DOES ACTING ON A FALSE BELIEF AID IN FALSE BELIEF RETRIEVAL IN 3-YEAR-OLDS?

by

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Abstract

Although previous studies have examined whether 3-year-old children can appeal to a false belief to explain another person's misguided action (e.g., Bartsch & Wellman, 1989; Wimmer & Weichbold, 1994; Wimmer & Mayringer, 1998), there exist no studies that have examined how children explain their own actions that were premised on a false belief. The goal of this dissertation is to determine whether 3-year-old children, who are typically unable to reason in terms of false belief, will appeal to a false belief to explain their own misguided actions.

In Experiment 1, 3-year-old children were given an action task in which they were required to act on the basis of a false belief. For instance, children were shown a crayon box and were asked to state what they thought was inside. After stating their belief, children went to get a piece of paper to draw on. The unexpected contents of the box were then revealed, and children were asked both a false belief question (i.e., "Before, when you first saw the box all closed up like this, what did you think was inside?") and an action explanation question (i.e., "Why did you go get the paper [then]?") Results revealed that children who answered the false belief question incorrectly were rarely able to explain their action in terms of a false belief. However, despite incorrect responses to both questions, the manner in which children answered the action explanation question differed in important respects from how they answered the false belief question. These differences are discussed with respect to both the "reality bias," and the theory-theory view of development.

In a second experiment, children's performance on the action task was directly compared to their performance on a standard unexpected contents task (e.g., Gopnik & Astington, 1988). In addition, a third task (planning + action task) was devised in which children planned and then acted on the basis of their false belief. Results indicated that children were able to retrieve their false belief significantly more often in the planning + action task, as compared to the standard unexpected contents task. Once again though, children who answered the false belief question incorrectly were similarly unable to appeal to a false belief to explain their action.

Consistent with previous research, the results of both Experiments 1 and 2 indicate that 3-year-old children have substantial difficulty reasoning in terms of false belief. However, results also indicated that planning and acting on a false belief may enable better retrieval. Finally, these studies highlight the fact that asking children to explain an action of theirs that was premised on a false belief, differs in many respects from simply asking children to retrieve a false belief.

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INTRODUCTION

A 3-year-old child is shown a crayon box and is asked to state what she thinks is inside. After she has stated "crayons," the box is opened to reveal candles. Once the box is closed up again, she is asked what she had initially thought was inside. Her response, like that of most typical 3-year-olds, is "candles," not crayons. However, consider what would happen if this procedure were modified in the following way: After the child has stated that she thinks the box contains crayons, she is asked to get a piece of paper to draw on. Upon returning with the paper, she is shown the candles. The box is closed up again and she is asked to state what she had initially believed it to contain. When she responds "candles," she is asked to explain why she went to get the paper. Will asking her to explain her previous action now allow her to access her false belief? The answer to this question is the focus of this thesis.

An understanding that our false beliefs can lie at the root of our actions is essential in acquiring a mature theory of how the mind works. This understanding encompasses both our ability to predict how someone with a false belief will behave, as well as explain behaviour that was premised on a false belief. Theory of mind research has traditionally focussed on the former (e.g., Wimmer & Perner, 1983; Perner, Leekam, & Wimmer, 1987; Perner & Wimmer, 1988; Clements & Perner, 1994; Wellman, Cross, & Watson, 2001). For example, in the now-classic change-in-location task, children are shown a character named Maxi who puts some chocolate in a cupboard and then goes outside to play. While he is outside,

Maxi's mother transfers his chocolate to the fridge. Upon Maxi's return, children are asked to predict where he will look for his chocolate. Results from this task have shown that 3-year-old children generally have difficulty predicting Maxi's action on the basis of his false belief, and instead predict that he will look for the chocolate where it currently resides (e.g., Wimmer & Perner, 1983; Perner, Leekam, & Wimmer, 1987). This finding has often been interpreted as indicative of a fundamental flaw in 3-year-olds' reasoning about false beliefs and the link between false belief and action (Perner, Leekam, & Wimmer, 1987).

However, such a conclusion may be premature without first considering how children perform when asked to explain an action that was premised on a false belief. For instance, do children find it any easier to reason in terms of false belief if they watch Maxi search for his chocolate in the empty cupboard, and are then asked to explain his action? In this case, children are in the position to witness a perplexing inconsistency between Maxi's behaviour and the true state of the world (Bartsch & Wellman, 1989; Moses, 1993). To correctly explain and make sense of Maxi's behaviour, they must appeal to Maxi's false belief (e.g., Maxi thinks the chocolate is in the cupboard). That is, although Maxi's behaviour is inconsistent with reality (i.e., chocolate in the fridge), it is consistent with his false belief. It is in this sense that Maxi's action serves as an important cue to his false belief (Moses & Flavell, 1990). In contrast, in predicting Maxi's action, the scenario is quite different. Here, children can make the perfectly consistent, but incorrect, claim that Maxi will look for his chocolate where it currently resides. Thus, in theory, there is reason to believe that children may find it easier to reason in terms

of false belief when they are asked to explain an action that was premised on a false belief, rather than to predict how someone with a false belief will behave. Such an argument has been put forth, and investigated, by researchers such as Bartsch & Wellman (1989) and Robinson & Mitchell (1995), and so I will begin by reviewing the results of these two studies.

Studies suggesting an earlier competence in explaining versus predicting an action premised on a false belief

Bartsch and Wellman (1989, Experiment 2) gave 3-year-old children a series of explanation and prediction tasks and compared their performance on each. An example of an explanation task was as follows. Children were shown a plain box, and a Band-Aid box, and were asked to choose the box that they thought contained Band-Aids. The majority of the children chose the Band-Aid box only to discover that it was empty, whereas the plain box contained Band-Aids. Children were then introduced to a puppet, Bill, who had a cut. Children watched as Bill searched in the Band-Aid box (which did not contain Band-Aids) and were then asked: "Why do you think he's looking in there?" If children did not respond, or responded by making reference to something other than Bill's belief, they were given the following prompt: "What does Bill think?" Children's answers to the explanation task were considered to be correct if they included reference to a false belief in response to either the initial question (i.e., "Why do you think he's looking in there?"), or to the prompt (i.e., "What does Bill think?"). Correct responses to the prompt were followed by the control question, "Are the Band-

Aids there really?" This control question was asked to ensure that children had not forgotten the actual contents of the container. Correct responses to the initial question included "Because he thinks there's Band-Aids in it," whereas correct responses to the prompt included "that there are Band-Aids in there."

An example of a prediction task, on the other hand, was as follows. Children were told "Look, here's Pam. Pam has a cut, see? And she wants a Band-Aid. Where do you think she will look for Band-Aids?" Children could respond either verbally, or by pointing. Children's performance on the prediction tasks (31% correct) was significantly lower than their performance on the explanation tasks (66% correct). These findings support the hypothesis that having children witness a character who behaves in a manner that is inconsistent with reality, results in a greater ability to reason in terms of false belief, than when children are asked to predict how a character with a false belief will behave.

However, this conclusion has not gone unchallenged (Moses & Flavell, 1990; Perner, 1991). Perner (1991) has argued that children who were classified as providing a correct response in Bartsch & Wellman's (1989) explanation tasks may have done so without genuinely appealing to a false belief. Perner argues that in the explanation tasks, children may have assumed that the puppet was acting "as-if" the Band-Aids were in the empty box, akin to the puppet "thinking-of" or "pretending" that they were in there. As such, Perner states that it is not clear whether children did indeed use the word "think" in their explanations to refer to the puppet's misrepresentation of the true situation (i.e., whether children genuinely acknowledged that the puppet held a false belief). Perner argues that

the prediction task, on the other hand, did not lead children to interpret the word "think" as "thinking-of" or "pretending," and thus may have accounted for why children did not perform as well on the prediction task. Based on the results of the Bartsch and Wellman (1989) study alone, it is unclear whether 3-year-olds are genuinely better at appealing to a false belief when they are asked to explain, rather than predict, a character's misguided action.

Using a different methodology, Robinson and Mitchell (1995) have also argued that 3-year-old children are better at explaining, rather than predicting, a character's misguided action. In their study, children were presented with a story that involved two identical twins. In this story, one of the twins knows the location of a ball while the other does not because he was outside when the ball was moved from its original, to its current, location. In the explanation condition, this unknowledgeable twin is then shown going to the original (and incorrect) location in response to his mother's query "Where's the ball?" while the other twin goes to the ball's current location. Children were then asked the following test question about the unknowledgeable twin: "So this one's gone to the wrong place hasn't he? Why's he gone to the wrong place; is it because he went outside or because he's stayed inside?" Another group of children was given the prediction condition in which they were asked the test question: "Now where will he go first of all to look for the ball, here or here?" Results indicated that children in the explanation condition correctly answered the test question 85% of the time which was significantly higher than children in the prediction condition who answered correctly only 30% of the time.

Yet again, it is unclear whether children's performance in the explanation condition was genuinely superior to their performance in the prediction condition. Specifically, Perner (1995) has pointed out that there exists an imbalance in baseline responding between Robinson and Mitchell's (1995) explanation and prediction conditions. Perner (1995) argues that in the prediction condition, children who do not have an understanding of false belief will make the classic error of predicting that the character will search for his ball in its current location (reality error), rather than where the character falsely believes it to be. On the other hand, this error does not apply to the explanation condition. Recall that in this case, children were asked "Why's he gone to the wrong place; is it because he went outside or because he stayed inside?" For a child with no understanding of false belief, either of these options is equally plausible, thus resulting in a 50% chance of answering correctly. Thus, without any understanding of false belief, children should already show superior performance in the explanation condition.

Although the data from Bartsch and Wellman (1989), and Robinson and Mitchell (1995), suggest that 3-year-olds are able to reason in terms of false belief when they can witness a character act in a manner that is inconsistent with reality, several methodological limitations have rendered these findings difficult to interpret. Moreover, as will be discussed next, there exist a number of studies that have found some striking limitations with respect to how 3-year-old children explain a character's action that was premised on a false belief (Moses & Flavell, 1990; Wimmer & Weichbold, 1994; Wimmer & Mayringer, 1998).

Studies suggesting that 3-year-olds have difficulty explaining an action premised on a false belief

Moses and Flavell (1990, Experiment 2) showed a group of 3-year-old children several videotaped false belief scenarios. In one such scenario, a character named Mary enters a room shaking her hand while saying "Ouch my finger hurts! I'm looking for a Band-Aid." Mary then spots a Band-Aid box on the table and says, "Ah, here are some Band-Aids." Mary opens the box to discover that it contains a toy car and exclaims, "Hey, there's a car in here! Where are the Band-Aids?" At this point in the protocol, the videotape was stopped and children were asked a series of questions. Included in this series were (1) a 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?"; (2) an action explanation question: "Why was Mary looking in the box?"; and (3) a goal question: "What was she looking for?" Despite having observed Mary's misguided action, children answered the false belief question correctly on only 47% of the trials which was not above the level that would be expected by chance. Children were equally unable to appeal to a false belief to explain Mary's action, despite being almost at ceiling in correctly answering the question about Mary's goal (e.g., she's looking for Band-Aids). That is, although children clearly understood that Mary's goal was to find Band-Aids, they were unable to understand that the direct cause of her action was her false belief that the box contained Band-Aids. Children's incorrect explanations to the question "Why was Mary looking in the box?" most often included references to the outcome of the

situation, (e.g., because there's a car in there), or to Mary's desire (e.g., because she wants Band-Aids).

A similar limitation on children's understanding of the link between false belief and action has also been reported in several subsequent studies. For example, Wimmer and Weichbold (1994) were interested in children's understanding of what leads to a character's (e.g., Maxi) misguided action in the change-in-location task. Thus, 3- and 4-year-old children were given a standard change-in-location task and were asked to predict where Maxi would search for his chocolate. If children correctly predicted that Maxi would look in the empty location, where he falsely believed his chocolate to be, they were asked to explain why Maxi would look there. If children incorrectly predicted that Maxi would look for his chocolate in its current location, they were first corrected (e.g., "No, look what Maxi does. He doesn't look here for his chocolate. He goes to this cupboard to get his chocolate"), and then were asked why Maxi would search in that (correct) location. Despite the fact that providing children with the correct location allowed them to witness Maxi's misguided action, none of the 28 3-year-olds in this study was able to correctly explain Maxi's action by appealing to Maxi's false belief.

In a similar study, Wimmer and Mayringer (1998) included a straightforward explanation-only condition, in which children were told a story about Ann who hides her book in a cloakroom cupboard before she goes outside to play. In her absence, her teacher moves the book from the cloakroom cupboard to a cupboard in the playroom. Ann then comes back inside and wants to get her

book. Ann is then shown going to the cloakroom to get her book, at which point children were asked: "Why then does Ann go to the cloakroom to get her book?" If children did not provide an explanation, or responded in an inadequate manner, the experimenter rephrased the question as one involving belief: "Ann goes into the cloakroom, because she thinks the book is in this cupboard. Why then does Ann think the book is in this cupboard?" Children's responses to the explanation question were coded as correct when a child provided an appropriate response to the explanation question itself (e.g., "because she doesn't know where the book is now"), or to the follow-up question involving belief (e.g, "because the book was in here"). Results indicated that barely a third of the children between 3 1/2 and 4 1/2 years of age appropriately explained Ann's misguided action. Children's inappropriate explanations were of several types. Among these was a tendency to refer to Ann's desire (e.g., "because she wants her book"), which explains why Ann went somewhere to get her book, but not why she chose to go to the empty location. The second type of explanation that children often provided was one which made reference to the present location of the book (e.g., "because it's in here [pointing to the playroom cupboard]"). Thus, even when directly questioned about Ann's misguided action, children were rarely able to make sense of it by appealing to Ann's false belief.

Thus, to date, the hypothesis that 3-year-old children are successful at invoking a false belief to explain a character's misguided action, has not received strong empirical support.

Re-evaluating the evidence to date

In light of the findings discussed in the previous section, should we simply accept the conclusion that 3-year-olds are unable to correctly explain an action that was premised on a false belief? Not necessarily. Instead, I argue that this hypothesis has never been tested in the most direct manner possible. Specifically, there exist several important reasons why it may have been difficult for the children in the previous studies to make sense of a character's misguided action by appealing to the character's false belief. First, it is possible that observing another person's misguided action is not a sufficiently salient cue to false belief. A more powerful manipulation would be to have children themselves perform an action that is premised upon their own false belief. When asked to explain their own misguided action, it may be clearer to children that their action was caused by their false belief. Indeed, this "intuitive" view has also been espoused by Moses (1993) who states the following: "Children's own feelings of volition and agency prior to acting, and energy expenditure while carrying out their actions, are presumably very salient at an early age. It is hard to imagine that very young children would not also have some sense of why they are doing what they are doing: that is, a sense of the goals driving their efforts" (p. 21). At a more theoretical level, such a claim is supported by simulation-theorists who argue that first-person psychological knowledge is especially powerful because it is direct, rather than being the result of inference or construction (Harris, 1992). Thus, there is reason to believe that the psychological causes of action (e.g., false belief) may be easier to access when the action is carried out by the self. However, it should be

noted that it is an ongoing debate whether an understanding of one's own mind should emerge prior to an understanding of the minds of others. For instance, there is evidence that children's ability to acknowledge their own prior false belief is not easier than acknowledging another's false belief (Gopnik & Astington, 1988; Wimmer & Hartl, 1991; Wellman, Cross, & Watson, 2001).

There exists no prior research, however, that has directly examined how children explain their own action that was premised on a false belief. However, related to this question, Riggs and Robinson (1995a) reasoned that if 3-year-old children could accurately recall an action of theirs that was premised on a false belief, this should in turn allow them to acknowledge that belief. In their study, children were seated at a table facing an egg box and a margarine tub. The experimenter then said: "I've got these boxes, can you get me an egg?" Children reached over and opened the egg box only to discover that it was empty. The experimenter then opened the margarine tub to reveal an egg. At this point, children were asked both an action question, "Let's remember, when you first saw these boxes, before we opened them, where did you go to get the egg?" and a belief question, "Let's remember, when you first saw these boxes, before we opened them, where did you think the egg was?" These questions were asked in counterbalanced order, such that half the children were first asked about their action and then about their belief, whereas the other half were first asked about their belief and then about their action. According to Riggs and Robinson, the ordering of these two questions was potentially important because children might find it easier to appeal to their false belief after having explicitly stated their

action, rather than the reverse. That is, Riggs and Robinson argued that it is nonsensical to claim that you opened the egg box to get an egg, and then to state that you believed the egg to be in the margarine tub. Interestingly, the results did not support this prediction: children provided no more correct responses to the belief question when the action question preceded, rather than followed, it. Overall, 87% of the children correctly remembered their action, whereas only 43% correctly remembered their belief.

However, what Riggs and Robinson's (1995a) study did not address, was how children would have reacted had they been asked to explain, rather than simply recall, their prior action. In order to address this question, one could ask children who incorrectly state that they initially believed the margarine tub to contain an egg, to immediately explain why they reached over to the egg box to retrieve it. In so doing, the inconsistency between children's incorrect reality-based response (i.e., margarine tub), and their prior action of searching for the egg in the egg box, would be clearly highlighted. Such a direct style of questioning may be crucial in giving children the insight that the cause of their action was their earlier belief about the contents of the box. Indeed, according to the theory-theory view of development, salient counterevidence is one way to provoke children to revise theories that are faulty (Astington & Gopnik, 1991; Gopnik & Wellman, 1992; Gopnik, 1996a; Gopnik, 1996b; Gopnik & Meltzoff, 1997). Thus, asking children to explain a previous action that was caused by their earlier belief may be an especially powerful means of providing counter-evidence to an incorrect, or incomplete, understanding of the role that false belief plays in determining action.

In sum, I argue that although previous studies have shown that 3-year-olds have difficulty explaining an action that was premised on a false belief, what remains unclear is whether this difficulty can be overridden by giving children a task which meets the following two criteria: (1) children themselves perform the misguided action, and (2) children's response to the false belief question is immediately followed up by asking them to explain their misguided action. Experiment 1 was designed to meet these two criteria.

EXPERIMENT 1

In Experiment 1, a novel paradigm adapted from the unexpected contents task (e.g., Gopnik & Astington, 1988) was developed. In a typical unexpected contents task, children are shown a familiar container, such as a crayon box, and are asked to state its contents. After children state "crayons," they are shown that the box actually contains candles. The box is then closed up and children are asked the following type of test question about their previous belief (i.e., false belief question): "Before, when you first saw the box, all closed up like this, what did you think was inside?" (Slaughter & Gopnik, 1996; Welch-Ross, 1997). Three-year-old children will typically respond "candles," thus failing to acknowledge their earlier belief. The procedure for the adapted unexpected contents task, referred to as the action task, was as follows. Children were shown a crayon box and were asked to state their belief about its contents. After stating "crayons," the experimenter pointed out to the children that there was a piece of paper on the floor, and suggested that they go get it to draw on with the crayons. When the children returned with the piece of paper, it was revealed that the box contained candles. Once the box was closed up, children were asked what they had initially believed it to contain. All children were then asked to explain their action. The advantage of this paradigm is that it allows one to ask children, who incorrectly reply that their initial belief was that the box contained candles, the following action explanation question: "Why did you go get the paper then?" In doing so, the inconsistency between children's incorrect reality-based response (i.e., candles)

and their prior action (i.e., going to get the paper) is made fully explicit (i.e., the only way to resolve this inconsistency is to appeal to a false belief). In addition to this crayon box trial, children were given a second action trial that was conceptually identical to the first, but that involved a juice box that unexpectedly contained sand (juice box trial). Prior to discovering the true contents of the juice box, children were asked to get a cup so that they could drink some juice.

One final unique feature of the design of this experiment was that children's understanding of false belief was assessed in two contexts that were familiar to them. That is, children are often asked to get paper to draw on or cups to drink out of. Consequently, it is likely that these actions carry special meaning to children because they serve to highlight the respective goals of drawing a picture and drinking some juice. In turn, discovering that these goals cannot be accomplished, because the crayon box unexpectedly contains candles, or the juice box unexpectedly contains sand, should further drive children to make sense of their action by appealing to their false belief.

Thus, the main question that I addressed in Experiment 1 was how 3-year-old children, who are typically unable to reason in terms of false belief, would explain an action of theirs that was consistent with their false belief, but inconsistent with reality.

Method

Participants

Participants included 63 children (30 boys, 33 girls; age range = 3;1 - 3;11 years, mean age = 3;6). Eight additional children were excluded from this final sample for either refusing to state their initial belief about the contents of the box, or for being unable to complete the procedure due to fussiness or an unwillingness to speak. Children were predominantly from White middle-class families, and were recruited through advertisements in local malls, daycare centers, and other public centres.

Materials

Stimuli included a crayon box that contained candles, an orange juice box that contained sand, a sheet of 8 1/2 x 11 in white paper, and a green plastic cup.

Design and Procedure

Children were tested individually in a laboratory playroom. Prior to the testing session, a piece of paper and a cup were placed alongside a wall adjacent to the table where the child and the experimenter would be seated during the testing session. None of the children appeared to notice either of these items until each was pointed out to them at the appropriate time during the experimental protocol. The order of the two action trials (crayon box and juice box) was counterbalanced, such that half of the children received the crayon box first and

the juice box second, and vice-versa. The procedure of these two trials preceding the administration of the test and control questions was very similar, and was as follows:

Crayon box trial. Children were shown a crayon box and were asked to state what they thought was inside. Once children had stated that they believed the box to contain crayons, the experimenter pointed out that there was a piece of paper on the floor, and suggested that they go get it to draw on with the crayons. After children had gone to get the paper and returned to the table, they were shown that the crayon box actually contained candles.

Juice box trial. Children were shown a juice box and were asked to state what they thought was inside. Once children had stated that they believed the box to contain juice, the experimenter pointed out that there was a cup on the floor, and suggested that they go get it so that they could drink some juice. After children had gone to get the cup and returned to the table, they were shown that the juice box actually contained sand. In six cases, children unexpectedly stated that they did not want to go get the cup because they were not thirsty.[1] These children were not included in the final sample (N = 63), as it was imperative to the design that children act on their false belief.

Test and control questions. In both trials, once children had seen the unexpected contents of the box, and the box had been closed up, they were asked the following false belief question: "Before, when you first saw the box all closed

[1] It is important to note that children's unwillingness to get the cup occurred equally often in Trial 1 as in Trial 2. Thus, it was not the case that after having discovered the unexpected contents of the box on Trial 1, children were hesitant to perform an action premised on their belief in Trial 2.

up like this, what did you think was inside?" If children responded "candles/sand," they were immediately asked the following action explanation question: "Why did you go get the paper/cup then?" For those children who correctly responded "crayons/juice," an ensuing reality control question was asked: "What is inside the box?" This question was asked to ensure that children were indeed differentiating between their false belief and the true contents of the box. These children were then asked the following modified action explanation question, "Why did you go get the paper/cup?" The wording of this question was changed slightly for this group of children for pragmatic reasons. That is, these children were not being asked to resolve the inconsistency between an incorrect reality-based response and a prior action, but rather, were being asked to simply recall why they had performed their action. In essence, the explanations of this group of children provided a comparison to the explanations of the group of children who incorrectly answered the false belief question (see Appendix A for Experiment 1 Protocol).

Coding

Responses to the false belief question were considered to be correct if children stated both their initial belief about the contents of the box, along with what was currently in the box (i.e., correctly answered the reality control question). All other responses were coded as incorrect.

Following an initial inspection of the data, children's responses to the action explanation question were classified into the following four categories:

1. Pre-action: reference to a state which occurred prior to children performing the action. These states included: i) belief (e.g., because I thought it was crayons), ii) desire (e.g., because I wanted a drink), iii) goal (e.g., for drawing), and iv) physical (e.g., "because I was thirsty")
2. Post-action: reference to a state which occurred after children had performed the action. Within this category, the only state that children appealed to was the true contents of the box (e.g., "because there was sand in there")
3. Irrelevant: reference to an aspect of the situation that was not causally related to the child's action (e.g., "I got the paper" or, "Where's the cup?")
4. No response: the no response category included instances in which the child provided no response at all, or simply stated "I don't know," or "because"

All of the children's explanations were independently coded by myself and by an undergraduate psychology student who was blind to the purpose of the study. Interrater agreement was 96%, Cohen's kappa = 0.95. All disagreements were resolved through discussion (see Appendix B for examples of children's explanations).

Results

Across both trials, children answered the false belief question correctly 50% of the time, and incorrectly 50% of the time. There were no instances in which a

correct response to the false belief question was followed by an incorrect response to the reality control question. Analyses of the data indicated that children's responses to the false belief question were not affected either by Trial order, McNemar χ^2 (1, 62), p = .549, or by Trial type (i.e., crayon or juice box): Trial 1, χ^2 (1, 62) = .42, p = .516, Trial 2, χ^2 (1, 62) = .75, p = .387 (see Table 1).

Analyses of children's responses to the action explanation question were broken down as a function of their performance on the preceding false belief question. Responses that were coded as pre-action were considered to have correctly explained the child's action[2], whereas responses that were coded as post-action, irrelevant, and no response were not.

In those instances in which children passed the false belief question (n = 60)[3], 65% of their explanations were coded as pre-action, 5% as post-action, 10% as irrelevant, and 20% as no response. Among the pre-action explanations that children provided (n = 39), 15% appealed to a belief, 31% to a desire, 36% to a goal, and 18% to a physical state.

In those instances in which children failed the false belief question (n = 63), 19% of their responses to the action explanation question were coded as pre-action, 16% as post-action, 32% as irrelevant, and 33% as no response. Among the

[2] Given that pre-action explanations were at times provided by children who incorrectly answered the false belief question, one could argue that only belief-related explanations truly reflect children's understanding that their action was premised on a false belief. Although I agree that this is the case, it is important to distinguish pre-action explanations from those that do not in any way explain why children performed the action that they did.

[3] Because the experimental protocol did not initially entail asking children who passed the false belief question to explain their action, the total number of explanations provided in these cases was 60, rather than 63.

pre-action explanations that children provided (n = 12), 42% appealed to a belief, 25% to a desire, 25% to a goal, and 8% to a physical state.

In those instances in which the false belief question was answered correctly, children provided significantly more pre-action explanations than in those instances in which the false belief question was answered incorrectly: Trial 1, χ^2 (1, 62) = 6.22, p = .013, Trial 2, χ^2 (1, 61) = 22.89, p < .001.

Of the 63 children in the study, 41% passed the false belief question in both trials, 41% failed the false belief question in both trials, and 18% answered correctly in one trial and incorrectly in the other. Of this last group of children, four answered correctly on the first trial, but incorrectly on the second, whereas seven showed the opposite pattern. A breakdown of the action explanations for each of these 3 groups of children is shown in Figure 1.

Overall, results indicate that in those instances in which the false belief question was answered incorrectly, children were rarely able to appeal to their false belief in response to the follow-up action explanation question.

Nonverbal aspects of children's responses

During the coding of children's verbal responses to the false belief and action explanation questions, I noticed that there were nonverbal aspects of the children's responses that appeared to differ between these two questions. The difference between these two questions appeared to be especially marked in those instances in which children failed the false belief question. In these instances, children often responded to the false belief question quickly and with ease (albeit

incorrectly), whereas their responses to the action explanation question appeared to be fraught with more uncertainty and/or hesitation. This difference did not appear to be as pronounced in those instances in which children passed the false belief question. To examine whether these differences did indeed exist, a coding scheme for nonverbal behaviours was developed.

Coding Scheme. Children's responses to both the false belief and action explanation questions were coded along the following three dimensions:

1. Response latency. Response latency was measured from the time the experimenter finished asking the test question to the time that the child uttered the first word of his/her response that was not an interactional marker, such as "uh," and "hmm." For example, if a child gave the following explanation: "uh, because I wanted to draw," the timer was stopped at "because," and not "uh." Cases in which children failed to provide a verbal response were automatically assigned a latency time of 4 s. This procedure was only required for children's responses to the action explanation question, because there were no instances in which children failed to provide a response to the false belief question. A response latency of 4 s was chosen based on the finding that 97% (106/109) of all children's response latencies to the action explanation question were 4 s or less.[4] Agreement between the two coders' response latencies for each question was assessed using correlations. The Pearson r's for response latencies to the false belief and action

[4] The remaining three latency times to the action explanation question were: 4.87, 5.43, and 10.36 s. This last latency time was markedly longer than the others because the child's response contained several interactional markers. The results of the analyses do not differ whether these three latency times are included or not.

explanation questions ranged between $r = 0.92$ and 0.99, $p < .01$ (mean disagreement < 0.15 s).

2. Interactional markers and retracings. Interactional markers are defined as sounds that function as pauses (e.g., "uh"), or that reflect thinking/waiting (e.g., "hmm") (MacWhinney, 1995). If children's responses contained one, or more, of these markers, a score of 1 was given; otherwise, a score of 0 was assigned. Retracings captured both direct repetitions and changes in wording.[5] Within the latter, I distinguished between changes that involved (1) the contents of the box (e.g., because I thought there were candles, crayons in there), (2) a belief or knowledge state (e.g., because it was, I thought it was juice), and (3) other (e.g., because there's, because I wanted to colour). Percent agreement for children's use of interactional markers and retracings was 99.5% and 99% respectively. Cohen's kappa for interactional markers and retracings was 0.98 and 0.93 respectively.

3. Behavioural reactions. Examining children's behavioural reactions was intended to capture those instances in which children overtly displayed uncertainty and/or hesitation in response to the test questions. Behaviours that were identified as reflecting such a characterization included: getting up and leaving the table where the child and the experimenter were seated, changing the topic, fidgeting, and gaze aversion (i.e., looking away, down, or around, immediately after the test question was asked). If children's reaction to the question included one, or more, of these behaviours, a score of 1 was given,

[5] Although retracings are verbal devices, these were categorized as nonverbal, because their use was considered to reflect uncertainty and/or hesitation in the child, that was separable from the verbal meaning of the child's explanation.

otherwise, a score of 0 was assigned. Percent agreement for behavioural reactions in response to the false belief and action explanation questions was 96% and 89% respectively. Cohen's kappa for behavioural reactions to the false belief and action explanation questions was 0.82 and 0.77, respectively.

Response latency, interactional markers and retracings, and behavioural reactions were coded in exactly the same manner for children's responses to both the false belief and action explanation questions. This in turn enabled me to directly compare the nonverbal aspects of children's responses to each of these two questions.

Preliminary Analyses. Two-way repeated measures ANOVAs were conducted on the sample as a whole. The two within-subjects factors entered into these analyses were Trial order (first or second), and Question type (false belief or action explanation). The dependent measures of interest were response latency, interactional markers and retracings, and behavioural reactions.

Response latency. The analysis of response latency revealed a significant main effect of Trial order, $F(1, 59) = 15.49$, $p < .001$, and of Question type, $F(1, 59) = 19.17$, $p < .001$. Children responded significantly faster to both the false belief ($M = .92$, $SD = .75$) and action explanation ($M = 1.56$, $SD = 1.51$) questions on Trial 2, as compared to Trial 1 (false belief question, $M = 1.39$, $SD = 1.13$; action explanation question, $M = 2.21$, $SD = 1.28$). Children also responded more quickly to the false belief question, as compared to the action explanation question. There was no Trial order x Question type interaction, $F(1, 59) = .42$, $p = .518$.

Interactional markers and retracings. The number of interactional markers contained in children's responses was not significantly affected by Trial order, $F(1, 49) = 1.09$, $p = .302$, Question type, $F(1, 49) = 2.67$, $p = .109$, or a Trial order x Question type interaction, $F(1, 49) = .05$, $p = .821$. There was however, a significant main effect of Question type on the number of retracings in children's responses, $F(1, 49) = 10.60$, $p = .002$. Children's responses to the action explanation question contained significantly more retracings than their responses to the false belief question. There was no main effect of Trial order, $F(1, 49) = 1.32$, $p = .255$, nor a Trial order x Question type interaction, $F(1, 49) = 1.32$, $p = .255$.

Behavioural reactions. Finally, there was a significant main effect of Question type on the number of behavioural reactions contained in children's responses, $F(1, 59) = 60.26$, $p < .001$. Children's responses to the action explanation question contained significantly more behavioural reactions than their responses to the false belief question. There was no main effect of Trial order, $F(1, 59) = .14$, $p = .709$, nor a Trial order x Question type interaction, $F(1, 59) = .16$, $p = .687$.

Although an overall analysis of the data indicated that children's responses to the false belief and action explanation questions differed significantly on several dimensions, I was interested in determining whether this same relationship would hold within various sub-groups of cases. I was particularly interested in whether the pattern that was observed with the sample as a whole, would be the same in those instances in which children passed the false belief question, as well as in those instances in which children failed the false belief question.

Instances in which children failed the false belief question. I predicted that in these instances, children's responses to the action explanation question would have longer latencies, contain more interactional markers and retracings, and contain more behavioural reactions reflecting uncertainty and/or hesitation, as compared to their responses to the false belief question. To provide a more detailed analysis of children's responses to these two questions, the data were examined separately for Trials 1 and 2.

Response latency. Differences in response latency were examined using a one-way repeated-measures ANOVA with Question type (false belief or action explanation) as the within-subjects factor. In both Trials 1 and 2, there was a main effect of Question type, $F(1, 32) = 10.59$, $p = .003$, and $F(1, 29) = 6.78$, $p = .015$. For both Trials 1 and 2, response latencies were significantly longer to the action explanation question, as compared to the false belief question. Means and standard deviations for children's response latencies are shown in Table 2.

Interactional markers and retracings. In general, children's responses did not often contain interactional markers and retracings. Across trials, the percentage of children's responses that contained interactional markers was 12% to the false belief question and 4% to the action explanation question. Across trials, the percentage of children's responses that contained retracings was 2% to the false belief question and 15% to the action explanation question. Although retracings that involved either a mental state, or the contents of a box, were particularly interesting for theoretical reasons, as they signal that children are actively changing their minds (e.g., because I thought there was sand, juice in the

box), these rarely occurred in the data. Indeed, these types of retracings never occurred in children's responses to the false belief question, and only occurred twice in their responses to the action explanation question.

To examine whether there were significant differences in children's use of interactional markers and retracings in response to the false belief and action explanation questions, McNemar χ^2 tests were conducted. The McNemar χ^2 test is a nonparametric test that is employed in a design with categorical data from two dependent samples (Sheskin, 1997). In Trial 1 there were no significant differences in children's use of either interactional markers, McNemar χ^2 (1, 26), p = 1.000, or retracings, McNemar χ^2 (1, 26) p = .625, between the false belief and action explanation questions. In Trial 2, this same pattern held for children's use of interactional markers, McNemar χ^2 (1, 24), p = .375. However, it was not possible to conduct a McNemar χ^2 for children's use of retracings in Trial 2 because none of their responses to the false belief question contained any retracings, and so two of the cells in the contingency table were equal to zero.

Behavioural Reactions. Children displayed significantly more behavioural reactions that were coded as reflecting uncertainty and/or hesitation in response to the action explanation question than they did in response to the false belief question in both Trials 1 and 2, McNemar χ^2 (1, 32), $p < .001$, and McNemar χ^2 (1, 29), p = .001, respectively.

Instances in which children passed the false belief question and answered the action explanation question correctly. The current set of analyses was restricted to those instances in which children passed the false belief question and

correctly responded to the action explanation question (n = 39). I predicted that in these instances, in contrast to what was found in those instances in which children failed the false belief question, response latency, interactional markers and retracings, and behavioural reactions would not differ significantly between children's responses to the false belief and action explanation questions. I based this prediction on the fact that, for children who answered the false belief question correctly, asking them to explain their action did not highlight any inconsistency in their reasoning.

Note, however, that I did not include in these analyses instances in which children passed the false belief question, but were unable to provide a correct explanation for their action. My rationale for this choice was that, in these cases, the nature of children's understanding of false belief was unclear, given that they appeared unable to correctly reason about an action of theirs that was premised on a false belief. Instead, these children may have been in a stage that has been labeled as "transitional" with respect to false belief understanding (Clements, Rustin, & McCallum, 2000). Indeed, these authors found that within a group of children who were given a change-in-location task, there was a subset who could correctly judge where the character would look for his object (e.g., "Where is Maxi going to look?"), but were unable to justify their judgment (e.g., "Why will he look there?"). Consequently, I chose to include as a comparison only those instances in which children were able to correctly answer both the false belief and action explanation questions.

In addition, the current set of analyses provided a control for the possibility that the longer response latencies to the action explanation question, as compared to the false belief question, that were observed in the previous analyses, were merely due to differences in sentence structure between these two questions, thus making the action explanation question more difficult for children to answer. For instance, it is arguable that the "why" format of the action explanation question is an inherently difficult one for 3-year-old children to understand and thus may take them longer to answer than the false belief question. However, if this were the case, then one would expect all children to take significantly longer to respond to the action explanation question as compared to the false belief question.

Response latency. There were no significant differences in response latency between the false belief and action explanation questions for either Trial 1, $F(1, 15) = 2.15$, $p = .163$, or Trial 2, $F(1, 22) = 2.02$, $p = .170$. Response latency means and standard deviations are shown in Table 3.

Interactional markers and retracings. There were no significant differences in children's use of interactional markers for either Trial 1, McNemar $\chi^2 (1, 15)$, $p = 1.000$, or Trial 2, McNemar $\chi^2 (1, 22)$, $p = 1.000$, nor were there any significant differences in children's use of retracings for either Trial 1, McNemar $\chi^2 (1, 15)$, $p = .219$, or Trial 2, McNemar $\chi^2 (1, 22)$, $p = 1.000$.

Behavioural reactions. There were significantly more behavioural reactions that were coded as reflecting uncertainty and/or hesitation in response to the action explanation question, as compared to the false belief question in Trial 1,

McNemar χ^2 (1, 15), p = .031. However, this difference was only marginally significant in Trial 2, McNemar χ^2 (1, 22), p = .063.

Analyses between groups. The previous analyses established that response latencies to the action explanation question were significantly longer than those to the false belief question in those instances in which children answered the false belief question incorrectly. In contrast, response latencies did not differ significantly between the false belief and action explanation questions in those instances in which children answered both questions correctly. However, it was also important to establish that response latencies across these two groups were similar to the false belief question, yet differed to the action explanation question. As expected, such analyses revealed that response latencies to the false belief question did not differ significantly between groups for either Trial 1, $F(1, 49) < 1$, p = .985, or Trial 2, $F(1, 51)$ = .20, p = .657. For the action explanation question, response latencies did not differ significantly, for Trial 1, $F(1, 49)$ = 2.07, p = .157, though the trend was in the predicted direction. In Trial 2, this difference was marginally significant, $F(1, 51)$ = 3.84, p = .056 (see Tables 2 and 3 for response latency means). Thus, although response latencies to the false belief question were virtually identical for both groups, these differed to the action explanation question, significantly so in Trial 2.

Discussion

Verbal Responses

In Experiment 1, my goal was to determine whether children who respond incorrectly to a standard false belief question, might nevertheless appeal to their false belief if questioned about why they had performed an action that was premised on this belief. Results indicate that this was rarely the case. In those instances in which children incorrectly answered the false belief question, only 8% of their ensuing explanations made an explicit reference to their false belief. This finding supports previous results by Moses and Flavell (1990), Wimmer and Weichbold (1994), and Wimmer and Mayringer (1998).

However, what these previous studies did not address was how children explained their own misguided action. Although proponents of the theory-theory view argue that an understanding of the various aspects of mind should not emerge earlier with respect to self than with respect to others (e.g., Astington & Gopnik, 1991), such a hypothesis has never been tested in the realm of action explanation. Yet, intuitively, there is reason to believe that the actions and goals of the self should be more salient than those of others, and thus easier to make sense of. This view is nicely echoed in the following statement by Riggs and Robinson (1995b): "...children may have heightened awareness of their own intentions relative to those of other people and that this may mark an important difference between children's reasoning about own and others' minds" (p. 283). In addition, having children act on their own false belief created a very clear inconsistency

between what children incorrectly stated as their initial belief (i.e., candles/sand), and their earlier action (i.e., getting paper/cup), that could only be resolved by invoking a false belief. Nevertheless, the results of Experiment 1 clearly show that children were unable to appeal to their prior false belief to explain their action. This finding supports the claim that 3-year-old children may indeed suffer from a conceptual deficit in their understanding of false belief. I will return to a more detailed treatment of this issue in the General Discussion.

Nonverbal aspects of children's responses

The methodology of Experiment 1 involved asking children both to report an earlier belief about the contents of a box, as well as to explain an action of theirs that was premised on this earlier belief. As a result, it was possible to compare nonverbal aspects of children's responses to each of these two questions. The results of this comparison revealed an interesting pattern. Specifically, children who incorrectly answered the false belief question tended to do so quickly and easily, while their response to the ensuing action explanation question tended to reflect more uncertainty and hesitation, as evidenced primarily by response latency and behavioural reaction measures.

An explanation that I propose for this finding draws upon the notion of cognitive dissonance. In the adult literature, cognitive dissonance is defined as those instances in which we are aware that our thoughts and actions do not coincide (Myers, 1995). As a result, we experience tension, or, in other words, dissonance. It may not be that 3-year-old children are explicitly representing the

following, "If I thought that there were candles in the box, why did I go get the paper?" However, it is possible that at an implicit level, children are beginning to detect the inconsistency between their incorrect reality-based response (e.g., candles) and their prior action, which is reflected in a response pattern that is characterized by uncertainty and/or hesitation. The fact that the false belief question does not explicitly set up this same inconsistency might account for why a similar response pattern is not observed for this question.

A second, alternative, hypothesis is that the observed response pattern to the action explanation question was due to the fact that children had committed themselves to an incorrect response to the false belief question (e.g., "candles), in turn precluding the possibility of a correct response (e.g., "because I thought it was crayons") to the action explanation question. That is, after having denied, or failed to acknowledge, their prior false belief, it may have been difficult for children to then appeal to this belief to explain their action. According to this argument, children's uncertainty and/or hesitation in answering the action explanation question merely reflected the fact that they did not have an answer that was readily available. If this were the case, then there would be no need to characterize children as experiencing cognitive dissonance.

Although I cannot fully rule out this hypothesis, there are two reasons why I believe that it is less likely than the "dissonance hypothesis." First, it is not clear that an incorrect response to the false belief question precludes a correct response to the action explanation question. Whereas the false belief question provides no context for recall (i.e., children are simply asked to retrieve their initial belief), the

action explanation question reminds children about an earlier action of theirs that was premised on this belief. Thus, it is possible that a child may answer the false belief question incorrectly, yet, after having been reminded about her past action, be able to retrieve her false belief to explain this action. Indeed, part of the rationale for the action explanation question was to draw children's attention to their prior action to facilitate the retrieval of their prior belief.

Second, the fact that, in many cases, children did not have a response that was readily available (i.e., they took longer to answer the action explanation question), may in fact support the dissonance hypothesis. Because 3-year-old children have a firm grasp of desires and goals, it would seem that, in the absence of an understanding of false belief, they should be able to appeal to such concepts as an explanation for their action (e.g., Because I wanted to draw). The fact that children did not always readily provide such explanations, however, suggests that the action explanation question may have led them to begin to detect the inconsistency between their incorrect reality-based response (e.g., candles) and their prior action. Indeed, such an inconsistency can only be resolved by appealing to a false belief, and not to a desire or to a goal. This could perhaps explain why these children were "stuck" for a response; that is, they may have recognized that a desire- or goal-based explanation was unsatisfactory, yet a satisfactory belief-based explanation may not yet have been within their grasp.

The results of Experiment 1 indicated that the differences in response latency to the false belief and action explanation questions cannot be fully explained by arguing that the action explanation question is an inherently more

difficult one for children to answer than the false belief question. Specifically, my third set of analyses indicated that there were no significant differences between children's response latencies to the false belief and action explanation questions in those instances in which children answered both of these questions correctly. Although in these instances, children's responses to the action explanation question also tended to be characterized by more behavioural reactions reflecting uncertainty and/or hesitation, as compared to their responses to the false belief question, this difference was not as marked as it was in those instances in which children failed the false belief question.

Finally, across the sample as a whole, children responded to the false belief and action explanation questions significantly more quickly in Trial 2, as compared to Trial 1. However, this did not affect the relative differences in response latency that were observed between the action explanation and the false belief questions. Interestingly, these shorter response latencies to both the false belief and action explanation questions in Trial 2, did not result in significantly more correct responses to either of these two questions (false belief question: McNemar χ^2 (1, 62), p = .549; action explanation question: McNemar χ^2 (1, 59), p = .481).

EXPERIMENT 2

The results of Experiment 1 revealed that having children act on a false belief did not necessarily lead them to retrieve their false belief when asked to explain their action. However, might it be the case that giving children a task which provided them with even more evidence of their false belief would enhance their retrieval ability? This issue relates to the debate about whether children's failure to retrieve a false belief reflects a conceptual deficit (i.e., children lack the understanding that the mind can misrepresent reality), or whether there exist factors, unrelated to children's understanding of false belief, that might prevent them from retrieving a false belief. In one such account, the "reality-masking" hypothesis, children's difficulty in acknowledging a false belief is attributed to their inability to ignore what is currently true in the world (e.g., There are really candles in the box). Such a "reality bias" may in turn mask any early insight into the mind that children might possess (Mitchell & Lacohée, 1991; Freeman & Lacohée, 1995; Freeman, Lacohée, & Coulton, 1995; Robinson & Mitchell, 1995; Saltmarsh, Mitchell, & Robinson, 1995; Saltmarsh & Mitchell, 1998; 1999).

According to the conceptual deficit account, regardless of how facilitative a retrieval context might be, children will be unable to retrieve their false belief because "false belief" is not a notion that exists in their conceptual lexicon. In contrast, according to the "reality-masking" hypothesis, if the salience of a child's false belief can be heightened, then it is more likely that he, or she, will succeed in retrieving it.

One of the first studies to provide support for the reality-masking hypothesis was conducted by Mitchell and Lacohée (1991). In this study, children were given a standard unexpected contents task with the following modification. Once children had stated their initial belief about the contents of a Smarties box, for instance, they were shown a series of picture cards, and were asked to find the card that depicted Smarties. Children were then asked to "mail" this card through a slot in a mail-box. After doing so, children were asked the following false belief question: "When you posted your picture in the postbox, what did you think was in here?" Comparing children's performance on this task with one in which an irrelevant picture card (e.g., animal) was mailed, revealed a substantial difference in performance. Children were successful in retrieving their false belief 71% of the time when they mailed a picture of Smarties and only 36% of the time when they mailed an irrelevant picture card. The authors argued that because children's initial belief was given a physical counterpart (i.e., the picture of Smarties that they mailed) its salience was increased, thus allowing children to retrieve it.

An important aspect of the reality-masking hypothesis is that the manner in which a child's false belief is made more salient need not necessarily involve a concrete object, but can also take the form of an action. For instance, the results of the Robinson and Mitchell (1995) study discussed in the Introduction of this thesis, have been used to support the notion that a character's misguided action (e.g., going to the wrong location to search for an object) can also serve the role of heightening the salience of a false belief. Recall that in Robinson and Mitchell's (1995) study, children heard a story about two identically dressed twins, one of

whom was absent when the location of the ball that he had been playing with was moved. The authors found that 3-year-old children were below chance level when asked to predict where the "absent twin" would look for his ball. However, children were above chance level when asked an explanation question about whether the twin who went to the wrong location to search for his ball, was the twin who had been outside (or inside) when the ball was moved. The authors argued that, in this case, the twin's wrong search served as a physical counterpart to his false belief, thus resulting in an increase in the children's performance. However, given the objections that Perner (1995) has raised with respect to the methodology of the Robinson and Mitchell (1995) study, combined with the findings from Riggs and Robinson (1995a) (where an action cue did not necessarily lead children to retrieve their false belief), it remains unclear whether it is indeed the case that acting on a false belief enhances children's ability to retrieve their belief.

To determine whether this might be the case, Experiment 2 involved comparing children's performance on the action task to their performance on a standard unexpected contents task. In addition, I devised a third task that was intended to provide children with increased evidence of their false belief (thus making their belief more salient). In this task, referred to as the planning + action task, children were first asked to plan what they would do with the expected contents of the box, and were then asked to act on their false belief. For example, in the crayon box version of this task, children were asked what they intended to draw, and what colour they intended to use. Children then went to get the paper.

In sum, children were given the following three false belief tasks: (1) standard (unexpected contents), (2) action, and (3) planning + action. My prediction was that children would retrieve their belief most often in the planning + action task, and least often in the standard task. In addition, in the planning + action and the action tasks, I was interested in obtaining children's explanations for why they had performed their action. Recall that the logic in Experiment 1 was that children who incorrectly answered the false belief question might nevertheless appeal to their false belief when asked to explain their action. This is because, in this case, children's action (e.g., getting paper to draw on) is only consistent with their false belief (e.g., crayons) and not with reality (e.g., candles). Although the results of Experiment 1 did not support this finding (but see results from the analyses of the nonverbal aspects of children's responses), it is possible that providing children with increased evidence of their false belief, as with the planning + action task, may make the resulting inconsistency stronger, thus allowing children to retrieve their false belief to explain their action. In this case, it is not only children's action that is inconsistent with reality (as is the case in the action task), but also children's plan for what they would have done with the contents of the box. As such, it is possible that children will appeal to their false belief more often when asked to explain their action in the planning + action task, as compared to the action task.

Method

Participants

Participants included 48 children, 18 boys, 30 girls, age range = 3;1 - 3;11 years, mean age = 3;5. Seven additional children were excluded from the sample for either failing to state their initial belief about the contents of one of the boxes (4 children), not wanting to get the cup in a juice box trial (2 children), and experimenter error (1 child). However, because I was interested in determining children's relative performance across each of the three tasks, only those children who failed at least one of the tasks were included in the final sample. Twenty-four children fit this criterion, 9 boys, 15 girls, range = 3;1 – 3;11 years, mean age = 3;5. All children were predominantly from White middle-class families and were recruited from the University of Waterloo Early Childhood Education Centre and a local Daycare.

Materials

The materials in this experiment included three boxes with unexpected contents -- a crayon box that contained candles, a juice box that contained sand, and a Smarties box that contained string — and three objects that the children were asked to retrieve — a piece of paper to draw on with the crayons, a cup to drink the juice out of, and a bowl to put the Smarties in.

Design and Procedure

Children were tested individually in a quiet area in their respective Centre/Daycare. To reduce any carry-over effects, children were tested during two separate sessions that were no less than two days apart (e.g., Monday and Wednesday). The number of days intervening between the two sessions ranged from 2-9 (the time between sessions was determined by the child's schedule). Children were always given the planning + action and action tasks together in counterbalanced order during one session, and the standard task during the other. The order of these two sessions was counterbalanced, such that half the children were given the planning + action and action tasks first and the standard task second, and vice versa. In addition, the type of box was counterbalanced for each task, such that any box x task combination was possible. Children always received a different type of box for each of the three tasks (i.e., a child was never given the same box twice). The procedure of the tasks was as follows:

Standard. Children were shown one of the three boxes and were asked to state what they thought was inside. Children were then shown the unexpected contents of the box. The box was closed up and children were asked the false belief question, "Before, when you first saw the box all closed up like this, what did you think was inside?" Children who answered correctly were then asked the reality control question, "What is inside the box?"

Action. The procedure for the crayon and juice boxes was identical to the procedure in Experiment 1. For the Smarties box, children were asked to get a bowl to put the Smarties in. Recall that for those children who answered the false

belief question incorrectly, the action explanation question ("Why did you go get the bowl then?") was asked immediately afterwards. For those children who answered the false belief question correctly, the reality control question ("What is inside the box?") was asked, followed by the modified action explanation question ("Why did you go get the bowl?").

Planning + Action. The procedure for this task was identical to the procedure for the action task with the following exception: Prior to being asked to perform an action, children were asked to plan what they would do with the expected contents of the box. For the crayon box, children were asked "What are you going to draw?" and "What colour are you going to use to draw X?" For the juice box, children were asked "Can you show me how much you're going to drink?" (by pointing with their finger to the level on the box corresponding to how much they would drink), and "How many sips are you going to take?" Finally, for the Smarties box, children were asked "How many are you going to eat?" and "What colour are you going to eat first?" The administration of the test questions in this task was identical to their administration in the action task.

Coding. The verbal coding procedure for Experiment 2 was identical to that of Experiment 1. Inter-rater agreement for children's explanations was 100%.

Results

False belief questions

Children's responses to the false belief questions did not differ significantly as a function of task order: planning + action, χ^2 (1, 23) = 1.34, p = .247, action, χ^2 (1, 23) = .06, p = .813, and standard, χ^2 (1, 23) = .60, p = .439 (see Table 4).

Of particular interest was whether children's performance on the false belief questions differed as a function of task type. To address this issue, McNemar χ^2 tests were carried out. A one-tailed significance level was adopted for these tests because specific predictions about the children's performance had been made (e.g., children will answer the false belief question correctly significantly more often in the planning + action task, as compared to the standard task).

Analyses indicated that, as predicted, children answered the false belief question correctly significantly more often in the planning + action task, as compared to the standard task, McNemar χ^2 (corrected, 1, 23), p = .032. There were no other significant task differences that emerged. Overall, children answered the false belief question correctly 33% of the time in the planning + action task, 25% of the time in the action task, and 12.5% of the time in the standard task (see Figure 2).

Of the 24 children in the sample, 12 answered the false belief questions incorrectly across all three tasks. The pattern for the remaining 12 children was as follows: four answered the false belief question correctly in the action task only, three answered the false belief question correctly in the planning + action task

only, three answered the false belief question correctly in both the standard and planning + action tasks, and finally, two answered the false belief question correctly in both the action and planning + action tasks (see Table 5). Interestingly, it was never the case that children answered the false belief question correctly in the standard task, without also doing so in the planning + action task.

In three cases children responded to the false belief question correctly, but were unable to state what was currently inside the box (i.e., provided an incorrect response to the reality control question). These three cases were coded as incorrect responses to the false belief question.

Action explanation questions

Because children did not perform an action in the standard task, the following analyses are with respect to the action and planning + action tasks only. Recall from Experiment 1 that children's explanations were coded into four categories: (1) pre-action, (2) post-action, (3) irrelevant, and (4) no response. Once again, children's explanations were broken down as a function of their performance on the preceding false belief question (see Table 6).

In those instances in which children answered the false belief question incorrectly in the action task (n = 18), 3 (17%) of their explanations were coded as pre-action, 7 (39%) as post-action, 4 (22%) as irrelevant, and 4 (22%) as no response. Within the pre-action category, children either made reference to a goal, or to a physical state (e.g., there was crayons on here [pointing to the crayon box]). In those instances in which children answered the false belief question correctly (n

= 6), 3 (50%) of their explanations were coded as pre-action, 1 (17%) as irrelevant, and 2 (33%) as no response. None of children's explanations were coded as post-action. Within the pre-action category, there was one reference to false belief, one reference to a goal, and one reference to a physical state.

In those instances in which children answered the false belief question incorrectly in the planning + action task (n = 16), 3 (19%) of their explanations were coded as pre-action, 3 (19%) as post-action, 3 (19%) as irrelevant, and 7 (43%) as no response. None of children's pre-action explanations made appeal to a false belief, or to a desire. Rather, in two cases children made reference to their goal (e.g., to put the Smarties in), and in one case, to a physical state. In those cases in which children correctly answered the false belief question (n = 8), 3 (37.5%) of their explanations were coded as pre-action, 1 (12.5%) as post-action, and 4 (50%) as no response. Once again, children's pre-action explanations did not include reference to a false belief, or to a desire, but rather, included reference to either a goal or to a physical state .

There were no significant differences in the number of pre-action explanations that children provided in the planning + action task, versus the action task, McNemar χ^2 (1, 23), p = 1.00.

Discussion

As predicted, children's performance on the planning + action task was significantly better than their performance on the standard task. However, my predictions that children's performance on the action task would be significantly

better than their performance on the standard task, and likewise, that their performance on the planning + action task would be significantly better than their performance on the action task, were not confirmed. Also, it was not the case that the planning + action task led children to explain their action correctly significantly more often than in the action task. I will begin by discussing what might account for the significant difference between children's performance on the false belief question in the planning + action task and their performance on the false belief question in the standard task.

First, at a general level, this finding is consistent with the reality-masking hypothesis discussed earlier. Indeed, in the planning + action task, it is likely that having children act, as well as plan, on the basis of their false belief made this belief very salient to them. However, one wonders whether a more specific argument can be made about how the planning + action task served to make children's belief more salient. Although one of the merits of the reality-masking hypothesis may indeed be its generality, an accompanying drawback is that little is said about any specific processes that may be involved, above and beyond the manipulations succeeding because they increase the salience of children's belief. Thus, it is perhaps worthwhile to briefly outline the manipulations employed in these previous studies, and then to discuss how these may have differed in an important way from the planning + action manipulation in this study.

Recall that in the Mitchell and Lacohée (1991) study, (as well as Freeman et al. [1995] and Freeman & Lacohée [1995]), children's initial belief was made more salient by giving children a picture of Smarties to mail. The authors concluded that

the picture of Smarties served as a cue to the child's belief, thus allowing for successful retrieval: "...the cues we provided...enable 3-year-olds to succeed by direct recall instead of inferential reconstruction" (Freeman & Lacohée, 1995, p. 56). In Mitchell and Lacohée's study, children (mean age = 3;6) were correct 71% of the time in the mailing condition, compared to 14% of the time in a standard unexpected contents condition.

Although similar theoretically, the manipulation that Saltmarsh et al. (1995) and Saltmarsh and Mitchell (1998) employed was quite different. Children were given what was termed a false belief state change task (adapted from the state change task developed by Wimmer & Hartl [1991]). In this task, both the child and a puppet were shown a Smarties box, and both were asked to state what they thought was inside. After the child and the puppet had stated "Smarties," and prior to the contents of the box being revealed, the puppet left to take a nap. At this point, in contrast to the procedure in a standard unexpected contents task, the children were shown that the box did indeed contain Smarties. This manipulation was, of course, intended to make children's belief more salient. Then, with the child watching, the experimenter exchanged the Smarties for an atypical content (e.g., pencils). Thus, only the puppet, but not the child, now held a false belief about the contents of the box. To determine whether children could acknowledge the puppet's false belief, they were asked the following (false belief) question "What does Puppet think is inside the box now?" Children's performance on this task was compared to their performance on a standard unexpected contents task.

Results from both the Saltmarsh et al. (1995) and Saltmarsh and Mitchell (1998) studies indicated that children answered the false belief question correctly significantly more often in the false belief state change task, as compared to the standard unexpected contents task. Specifically, in Saltmarsh et al. (1995), children (mean age = 3;8) were correct 47% of the time in the false belief state change task, as compared to 24% of the time in the standard unexpected contents task. These numbers were comparable to those in the Saltmarsh and Mitchell (1998) study. Here, children (mean age = 3;11) were successful 58% of the time in the false belief state change task, and 29% of the time in the standard unexpected contents task. In each of these studies, the authors argued that "presenting a physical instantiation of a false belief helps children to a small but reliable extent to correctly report that belief" (Saltmarsh & Mitchell, 1998, p. 3).

Finally, in Saltmarsh & Mitchell (1999), children were videotaped while being administered the standard unexpected contents task. The videotaping began when the experimenter first showed children the box, and was stopped immediately after the children had uttered their initial belief about the contents of the box. The rest of the task proceeded in the typical manner, up until the administration of the false belief question. At that point, children were shown the videotape of themselves uttering their initial belief about the contents of the box and, only after seeing the videotape, were asked the false belief test question. Results indicated that children (mean age = 4;0) answered the false belief question correctly significantly more often in the standard unexpected contents task + video playback (62%) than in the standard unexpected contents task (21%). The

authors interpreted this finding as follows: "...the video procedure makes children's initial belief more salient, thus reducing the need to reconstruct the premises upon which the false belief will be based" (p. 145).

What is common to all of the studies just described, is that the performance of 3-year-old children, who are typically unable to retrieve a false belief, was significantly enhanced. Consequently, based on these findings, an important claim has been substantiated: in a standard unexpected contents task, the child's false belief (e.g., crayons) is not simply updated by the true contents of the box (e.g., candles) and lost, but rather, under the right conditions, can be retrieved. This, in itself, is an important contribution to the false belief literature.

What is less clear from this research, however, is the process involved in children's successful retrieval of their belief. For instance, it could be argued that the manipulations in these studies lacked "real-world" relevance, or "ecological validity." Indeed, how often are children videotaped while uttering an initial belief about the contents of a box, or asked to mail a picture depicting their belief about the contents of the box? As such, it is unclear what insight about false belief children in these studies may have had during the retrieval process.

In contrast, it is arguable that the planning + action manipulation in Experiment 2 made children's belief more relevant, and in the process more salient, because it involved goals that young children are familiar with (e.g., drawing a picture). As such, I would argue that the planning + action manipulation was one that was ecologically valid. That is, this task may provide a context in which children become aware of the relevance of past beliefs to explain

past behaviour. For instance, successful belief retrieval in the planning + action task may have involved children coming to the realization that, because they had just gone to get a piece of paper (action), and had intended to draw a blue snowman (plan), their earlier belief was necessarily that the box contained crayons. In contrast, it is unclear whether the manipulations in the "reality-masking" studies provided children with a similar sort of insight.

It is important to acknowledge that the difference in magnitude between children's correct performance in the planning + action task (33%), and their correct performance in the standard task (12.5%) was not quite as large as some reported in the studies discussed above. However, it is important to point out that the mean age of the children in Experiment 2 was slightly younger (3;5 years) than in these studies, and thus may have accounted for the relatively smaller difference in magnitude that was observed. One notable exception, however, is the Mitchell and Lacohée (1991) study, in which children's mean age was 3;6 years. In this study, the magnitude of the increase in children's performance in the mailing task, as compared to the standard task, was 54%. Although merely speculative, it is possible that this substantial difference in performance was in part due to the temporally explicit wording of the false belief test question. Rather than asking children a standard false belief question (e.g., Before when you first saw the box all closed up like this, what did you think was inside?), Mitchell and Lacohée (1991) asked children the following: "When you posted your picture in the post box, what did you think was inside?" Although, in Experiments 1 and 2, I contemplated asking children, "When you went to get the paper, what did you

think was inside the box?" I decided against this wording because I was worried that a portion of children's correct responses to the false belief question might reflect an associative bias (e.g., "paper" might automatically cue "crayons"), rather than genuine false belief retrieval.

Finally, my prediction that children might explain their action by appealing to a false belief in the planning + action task more often than in the action task was not confirmed. Indeed, perhaps the most striking finding from both Experiments 1 and 2 was children's inability to appeal to a false belief to explain their action. And so, it is this specific issue that I turn to first in the General Discussion.

GENERAL DISCUSSION

I began this thesis by asking the following question: Will asking children to perform an action premised on their false belief allow them to retrieve this belief, when asked to explain their action? The results from both Experiments 1 and 2 revealed that this was rarely the case. In those instances in which children responded incorrectly to the false belief question in Experiment 1, only 8% of their ensuing responses to the action explanation question included reference to a false belief. In Experiment 2, children's incorrect responses to the false belief question were never followed by a response to the action explanation question that included reference to a false belief.

Researchers who ascribe to the theory-theory view of development have argued about the importance of counter-evidence in promoting theory change. According to this view, one mechanism that is hypothesized to contribute to the shift from an incomplete (or incorrect) theory, to one that is complete (or correct), is an accumulation of counter-evidence to the initial theory. Moreover, it is argued that the beginnings of such a shift are apparent when counter-evidence to an incomplete theory is especially salient (Gopnik & Wellman, 1992; Gopnik, 1996a; Gopnik, Slaughter, & Meltzoff, 1994). In this account, the relationship between counter-evidence and theory change is viewed as progressing through the following steps: (1) counter-evidence may initially be treated as "noise," and thus is largely ignored or discounted, (2) ad-hoc auxiliary hypotheses are developed to

account for particularly salient instances of counter-evidence, and finally, (3) an alternative model to the original theory is developed.

The notion of counter-evidence is relevant to both Experiments 1 and 2 of the current thesis. Specifically, in Experiment 1, children acted on their belief in a goal-directed fashion. Thus, the action that children performed, provided them with evidence of their false belief. Children were then reminded of this evidence when asked to explain why they had performed their action. Stated alternatively, this task provided children with counter-evidence to a theory of belief which does not incorporate the notion that beliefs can be false. In Experiment 2, children were similarly exposed to counter-evidence by being questioned about their false belief after having planned, and then acted, on the basis of this belief. Was there any indication that children were aware of the counter-evidence that was provided to them in both Experiments 1 and 2?

The effects of counter-evidence in Experiment 1

Because 3-year-olds generally do not have a firm grasp that the mind can misrepresent reality, their responses to a standard false belief question tend to incorrectly appeal to current reality (e.g., candles), rather than to their earlier belief (e.g., crayons). In this case, children's "reality bias" is likely heightened because the structure of the standard false belief question does not motivate children, who lack an understanding of false belief, to contemplate their answer prior to providing it. Couched in the language of the theory-theory, the false belief question does not provide children with any counter-evidence to their incorrect

theory of belief. Rather, children can quickly respond to this question by appealing to the current contents of the box, without ever becoming aware that their reasoning is faulty. In contrast, the results of Experiment 1 indicated that this process differed when these same children were asked to explain an action of theirs that was premised, not on reality, but on their false belief. Although a majority of the children's responses were also incorrect, they were not characterized by this same reality bias.

Perhaps this argument is best illustrated as follows. A majority of the children who failed the false belief question in Experiment 1 tended to state quite confidently what was currently in the box (e.g., "candles/sand"). One would expect this same reality bias to reappear in children's ensuing responses to the action explanation question. That is, one would expect children to answer the action explanation question by stating, for instance, "because there were candles in the box." However, children displayed such a reality bias only 16% of the time in their responses to the action explanation question (i.e., only 16% of children's responses were coded as post-action). This finding suggests that children were processing the false belief and action explanation questions quite differently.

More specifically, as I stated in the discussion section for Experiment 1, I suggest that the action explanation question may have triggered the following type of processing in the children (though perhaps not formulated quite so explicitly): "If I thought that there were candles in the box, why did I go get the paper?" As such, I would argue that drawing children's attention to an earlier action of theirs that can only be explained in terms of their false belief provides

them with counter-evidence that strongly challenges a theory of belief that is incomplete (i.e., one that does not include the notion of false belief).

Although it was not the case that such counter-evidence was successful in leading a majority of the children to appeal to a belief when asked to explain their action, nonverbal aspects of children's responses suggested that this counter-evidence was not altogether ignored either. For instance, in Experiment 1, a comparison between the false belief and action explanation questions, in those instances in which children answered the false belief question incorrectly, revealed that the action explanation question took children significantly longer to respond to than the false belief question.

The results of Experiment 1 are relevant to how Gopnik and her colleagues have characterized the progressive relationship between counter-evidence and theory change. Recall that at the first level, children are described as often ignoring counter-evidence. The children in Experiment 1 who explained their action by appealing to reality (e.g., "because there was sand in there") could be characterized in this manner.

At the second level, children are described as developing "ad-hoc auxiliary hypotheses" to account for particularly salient instances of counter-evidence. This level would correspond with the few instances in Experiment 1 in which children answered the false belief question incorrectly (e.g., "candles"), but who then appealed to their false belief to explain their action (e.g., "because I thought it was crayons").

Finally, at level 3, children are said to develop an alternative theory to their incorrect, or incomplete, original one. The children in Experiment 1 who were able to both correctly retrieve their belief, and correctly explain their action would be characterized at this level.

However, one important transitional phase that I propose is lacking in the levels of change that Gopnik and her colleagues have formulated, may occur between levels 1 and 2. This stage would characterize a number of the children in Experiment 1 who did not ignore the counter-evidence (as was clear from the nonverbal aspects of their responses), but for whom developing auxiliary hypotheses to account for this counter-evidence was not yet within their grasp. Interestingly, it may only be possible to identify such children by examining nonverbal aspects of their responses.

To my knowledge, nonverbal aspects have not been examined in previous studies of children's explanations of misguided actions. However, this method has the potential to contribute much needed information to how children begin to develop an awareness that false beliefs can sometimes lie at the root of actions. Interestingly, there is one study that has examined an aspect of children's nonverbal responses in a change-in-location task (Clements & Perner, 1994). Results indicated that a substantial sub-set of children, between the ages of 2;11 and 4;6, who incorrectly predicted the location where a character with a false belief would search for his object, nevertheless displayed eye gaze to the correct location. The authors argued that the children's correct eye gaze was reflective of

an implicit knowledge or, "knowledge that is unverbalizable," of false belief (Clements & Perner, 1994).

Finally, Slaughter and Gopnik (1996) have reported informal observations of children's behaviour when faced with counter-evidence, that are consistent with how I have characterized children's reactions to the action explanation question in Experiment 1. In their study, 3-year-old children, who did not pass a standard false belief task, were given training on the concept of belief, and were provided with feedback on their performance. For instance, in one of the training tasks children were shown some golf balls and were asked "What do you think these things are?" Once children had stated "golf balls" it was revealed that the golf balls were really soap. Children were then asked a standard false belief question ("When you first saw these things, what did you think they were then?"). If children answered incorrectly, they were told "No you didn't, you thought they were golf balls." The authors noted that although some of the children tended to ignore this contradictory feedback, others appeared taken aback and even shocked upon receiving it.

Interestingly then, from a developmental perspective, early evidence of children's shift from what can be characterized as a non-representational, to a representational, understanding of belief may first be apparent in the nonverbal, rather than the verbal, realm.

The effects of counter-evidence in Experiment 2

In Experiment 2, children were given the following three false belief tasks: standard, action, and planning + action. I hypothesized that children's false belief would be encoded at the deepest level in the planning + action task, in which children planned, and then acted, on the basis of their false belief, and at the lowest level in the standard task, in which no belief-based planning or action were involved. In turn, I predicted that children would retrieve their false belief significantly more often in the planning + action task, as compared to the standard task. This prediction was confirmed.

Children's increased ability to retrieve their false belief in the planning + action task, as compared to the standard task, can also be interpreted within the framework of the theory-theory. In the planning + action task, children's belief was highlighted by having them plan, as well as act, on the basis of their belief in a goal-directed manner. Thus, when asked the false belief question, children may have been less prone to answer incorrectly given that, moments earlier, they had formulated a plan, and performed an action, that were both premised on their false belief. This amplified planning + action context may have succeeded in providing children with stronger counter-evidence to their incomplete theory of belief, which in turn deterred them from providing a reality-based response. The unavailability of such counter-evidence in the standard task, may have accounted for the significantly fewer correct responses observed in this task.

An alternative manner in which children's improved performance in the planning + action task may be interpreted is related to the notion of "relevance" as

described by Barreau and Morton (1999). These authors argue that in a standard unexpected contents task, children initially hold the belief that the box contains its expected contents (e.g., Smarties), but that this belief becomes unavailable upon their discovery of the true contents of the box (e.g., box contains pencils). However, it is important to note that the hypothesis is not that this belief is irretrievable, but merely inaccessible under standard testing conditions.

The authors argue that one factor that may contribute to whether or not the child's belief will be accessible is its relevance. With respect to the standard unexpected contents task, the authors' reasoning is as follows: The initial question requiring children to state their belief about the contents of the box (e.g., What do you think is inside the box?), sets up a "local goal" of finding out what is inside the box. Any additional information is then organized in relation to this goal, and information that is deemed relevant will be preserved. Thus, although children initially represent the Smarties box as containing Smarties, once the box is opened to reveal pencils, the child's initial representation (e.g., "Smarties") becomes irrelevant to their goal, and is thus updated. Although older children and adults are capable of holding both of these pieces of information in mind, it is argued that younger children cannot due, in part, to limitations on their memory capacity. However, Barreau and Morton argue that it is possible to overcome this difficulty if a "record" of children's initial belief is made, "...in order to help children remember what they had thought about the contents of the Smarties tube, their original belief representation had to be kept relevant to the current experience long enough for it to be transferred to LTM (long term memory)" (p. 77). Clearly,

one way to keep children's belief relevant to them is to have them plan, and then act, on the basis of their belief, as was the case in the planning + action task. Although my prediction was that children would also perform significantly better on the action task, as compared to the standard task, it could perhaps be argued that this manipulation was not quite powerful enough. However, it is also possible that this difference may have been detected had there been more than 12 children in Experiment 2 whose performance varied across the three tasks. Although a "plan only" (i.e., no action involved) task was not included in Experiment 2, it would be interesting to determine in future research whether planning on its own would also significantly bolster children's ability to retrieve a false belief.

Finally, it should be noted that the "relevance-based" account described above is not incompatible with the notion of counter-evidence. Indeed, any manipulation that serves to render a belief more relevant should, in turn, provide stronger counter-evidence to a theory of belief that does not include false belief as an explanatory construct.

How acknowledging a false belief may differ from explaining an action premised on a false belief

An interesting finding in Experiments 1 and 2 was that children who responded correctly to the false belief question did not necessarily go on to correctly explain their earlier action. A similar dissociation has recently been observed in a study by Clements et al. (2000). In their study, a lag was reported between children's ability to correctly predict the protagonist's action in a change-

in-location task (e.g., Where is Maxi going to look?), and their ability to correctly justify their prediction (e.g., Why will he look there?). On the basis of this finding, the authors have argued that an understanding of false belief cannot merely be reduced to correct responses on a standard false belief question. A similar claim can be made with respect to the findings from Experiments 1 and 2. That is, children who were successful in retrieving their earlier belief were not always successful in explaining their earlier action. For those instances in Experiment 1 in which children passed the false belief question, 35% (n = 21) of their ensuing explanations were not correct. In Experiment 2, this figure was 57% (n = 8).

This finding suggests that the false belief and action explanation questions may be tapping different aspects of children's understanding of false belief. This is an important point to highlight given that in the theory of mind literature children's understanding of false belief is often assessed on the basis of their one-word response to a standard false belief question. Children who respond correctly to this question are granted an understanding of false belief, whereas those who answer incorrectly are not. Yet, the results of Experiments 1 and 2 suggest that such an approach may not be fully warranted. That is, in these two studies, there existed a sub-group of children who answered the false belief question correctly, but were unable to correctly explain their action. Why then, might it be the case that children can correctly judge that they held a false belief, but be unable to explain an action of theirs that was premised on this belief?

Lee and Homer (1999) list three fundamental assumptions that we hold about the mind. First, we believe that the mind exists. Second, we believe that the

mind consists of various mental states, including intention, knowledge, and belief. Third, we believe that there exist causal links between the mind, external environments, and actions (the causality assumption). It is this last assumption that bears the most relevance to the current discussion. In terms of causality, it is possible to assess children's representation of another person's (or their own) false belief without requiring them to make any causal inferences about action. This would be the case when children are asked the false belief question in the context of a standard unexpected contents task. In such a context children need only represent their earlier belief without having to make any additional causal inferences about how a character will behave (Lee & Homer, 1999). However, in both the action and the planning + action tasks, the element of causality is introduced. To correctly explain their action, children must represent the causal link between an earlier mental, or physical, state, and their ensuing action.

There are a number of studies that have shown that, in the physical realm, children are sensitive to the fact that a cause must precede its effect (e.g., Bullock & Gelman, 1979; Gopnik, Sobel, Schulz, & Glymour, in press). However, a series of studies conducted by Povinelli and his colleagues (Povinelli, Landau, & Perilloux, 1996; Povinelli, Landry, Theall, Clark, & Castille, 1999) have revealed a striking limitation in an aspect of preschool children's understanding of causality. In these studies, 2-, 3-, and 4-year-old children were videotaped while playing a game with an experimenter. During the videotaping, unbeknownst to the child, the experimenter covertly placed a sticker on the child's head. Several minutes later, the child was shown a video playback of the previous events, including the

segment in which the experimenter placed the sticker on the child's head. The dependent measure of interest was whether children would reach up to remove the sticker. Although the researchers expected that even the youngest children would do this, results indicated otherwise. None of the 2-year-olds, and only about 25% of the 3-year-olds, responded in this way. It was only by 4 years of age that a substantial number of the children (75%) reached up to remove the sticker (Povinelli, Landau, & Perilloux, 1996).

Povinelli (2001) has argued that the findings from this delayed self-recognition task suggest that children do not understand how recent past events, that the self has experienced, are causally connected to the self's current experiences. That is, the 2- and 3-year-old children in the delayed self-recognition task seemed unable to understand how a past event (sticker being put on their head) bore any relation to their current self. Similarly, one could argue that the 3-year-old children in the present studies had difficulty conceptualizing how a past mental state (i.e., their false belief), that had become outdated, could have caused their action. Given this interpretation, should children's difficulty on the action explanation question be reduced to a specific difficulty in causal reasoning, apart from any sort of difficulty with false belief? Although it is perhaps tempting to do so, it may be that the relationship between children's understanding of false belief, and their understanding of the "temporal self" is not quite so simple.

Recently, Barresi (2001) has argued that children's performance on false belief tasks is related to an understanding of the concept that the self extends through time, and more specifically, that mental states of the self can change over

time. Barresi states that, "...to understand mental states as representational rather than as presentational states of the world, or of the organism, it may be necessary to conceive of the individual mind as existing outside of a particular time" (p. 157). Thus, part of what acquiring an understanding of false belief might entail is the ability to acknowledge how successive states of the self (physical or mental) are causally connected through time.

The fact that there existed a sub-group of children who responded correctly to the false belief question, but incorrectly to the action explanation question, may have been because the action explanation question provided a more stringent test of children's understanding that a past mental state, that has changed, is nevertheless causally connected to the present. Although children may be able to correctly acknowledge that they held a false belief, it may be more difficult for them to identify this outdated belief as the cause of their prior action. However, because the relationship between children's understanding of false belief and their understanding of the temporal self is not yet clear, this claim remains speculative. Indeed, I believe that a very fruitful direction for theory of mind research is one that takes into account concurrent developments in the child's understanding of the temporal self.

Children's false belief performance: Conceptual change or early competence?

Based on the results of a recent meta-analysis, Wellman et al. (2001) have argued that children's performance on false belief tasks reflects a process of conceptual change. By conceptual change, Wellman et al. (2001) mean that

changes in children's performance on false belief tasks reflect genuine changes in "children's conceptions of persons" (p. 671). In contrast, proponents of an early competence view argue that children do not lack the concept of false belief, but rather, that their poor performance on false belief tasks is attributable to "information-processing limits, unnecessarily demanding tasks, or confusing questions" (Wellman et al., 2001, p. 672). Given that there exist these two opposing views with respect to children's understanding of false belief, it is not surprising that in an ensuing commentary to Wellman et al. (2001), Scholl and Leslie (2001) argue that the results of the meta-analysis do not rule out early competence accounts. Clearly, this debate has not yet been settled.

I believe that the results of the present thesis can contribute to this debate, as well as raise further questions as to the nature of children's understanding of false belief. Three-year-old children's difficulty with false belief tasks is a striking one. In fact, I cannot help being mildly surprised each time I witness a 3-year-old child failing this task. I am evidently not the only one, given the number of studies which have sought to determine whether, under the right circumstances, 3-year-old children can achieve success on this task (e.g., Mitchell & Lacohée, 1991; Saltmarsh & Mitchell, 1998). Moreover, I cannot deny that part of my motivation for designing my thesis experiments stemmed from my belief that there existed a method that would allow a substantial number of 3-year-olds to pass a false belief task. However, in many ways, the results of Experiments 1 and 2 have shown that, in retrospect, my belief was false! In these studies children acted, and in some cases planned, and then acted, on the basis of their belief, yet, a majority of them

were unable to retrieve their belief, either when asked a standard false belief question, or when asked to explain their action. In the planning + action task, in which children received the most powerful dose of counter-evidence, I would argue that failure to appeal to a false belief reflected an incomplete concept of belief. Arguably, no amount of counter-evidence would have allowed these children to retrieve their false belief because the notion of "false belief" may not have been part of their conceptual lexicon. In other words, there was no "false belief" available for them to retrieve. In this sense, I would agree with the view that preschoolers' concept of belief shifts from one that does not include the notion that the mind can misrepresent reality, to one that does.

Although a number of studies have shown an earlier competence in children's understanding of false belief, it is not fully clear whether the manipulations used in these studies are assessing the same understanding of false belief that older children might possess. Indeed, even Freeman and Lacohée (1995) acknowledge the possibility that, "...the cues we provided do not turn 3-year-olds into 4-year-olds for the purposes of the test but enable 3-year-olds to succeed by direct recall instead of inferential reconstruction" (p. 56). Yet, it would seem important for the early competence view to show that the 3-year-old child's understanding of false belief is relatively similar to that of the 4-year-old, but that this understanding is masked because of task factors unrelated to false belief. Wellman et al. (2001) have voiced similar concerns about the manipulations intended to bolster the performance of 3-year-olds: "The manipulation may have resulted in a better, more sensitive test of young children's understanding, or it

may have resulted in an artifactually easy task that is prone to false positives" (p. 679).

However, one way in which it may be possible to circumvent this difficulty is to look at various aspects of false belief understanding within the same child. For instance, in Experiments 1 and 2, children were not only asked to retrieve their false belief, but were also asked to explain an action of theirs that was premised on this belief. As such, it was possible to obtain an additional measure of children's understanding of false belief. Thus, we can be relatively certain that children who were able to correctly respond to the false belief question, as well as appeal to a false belief to explain their action, had a well-grounded understanding of false belief. In contrast, children who responded incorrectly to the false belief question, and who were unable to appeal to a false belief to explain their action might be characterized as lacking the concept of false belief. Of course, it is more difficult to characterize the children who displayed other types of response patterns.

Despite this difficulty, I believe that future studies should aim to assess various aspects of children's understanding of false belief. In turn this would lead to a richer understanding of the developments that occur specifically within the child's understanding of this concept. Ultimately, such a method of research might lead to the conclusion that children's acquisition of false belief is a more gradual and multi-faceted process than the conceptual change view might suggest.

Limitations of the Current Research

From the outset, I have stressed the importance of devising a methodology that highlights the inconsistency between the child's action and the current state of the world. This inconsistency was hypothesized to motivate children to appeal to their false belief to explain their action. Although this general claim has also been put forth by other researchers (e.g., Moses and Flavell, 1990), it remains unclear how 3-year-old children generally react to inconsistencies that they may encounter in various domains. As such, one could argue that in Experiments 1 and 2, the low incidence of responses to the action explanation question that included a reference to a false belief was due to the fact that children are not generally good at detecting inconsistencies. As such, they are not motivated to resolve them. In essence, this would imply that attempting to bolster a 3-year-old child's performance in any domain by exposing them to inconsistency would be of little use.

However, an alternative argument that I propose, is that children begin to detect inconsistencies in a certain domain when they are in the midst of acquiring a new understanding, or theory, in that domain. Indeed, from the standpoint of the theory-theory, how children acquire an understanding of the mind hinges on their ability to detect inconsistencies, and to capitalize on these, in order to develop theories that provide more explanatory power. Indeed, what "counter-evidence" boils down to is evidence that is inconsistent with, or "counter" to, an existing theory. Implicit to the theory-theory then, is the assumption that children who are in the process of theory change are able to detect inconsistency.

In the present studies, children who explained their action by referring to the current contents of the box (e.g., "because there was sand in there") could be characterized as not having detected an inconsistency between their incorrect reality-based response and their action. That is, these children were willing to explain their action in a manner that was inconsistent with their belief. However, it would be interesting to assess how these same children would react to an inconsistent scenario which retained the same structure as the action task, but that was removed from the realm of false belief.

Although there does not exist any research that has examined children's ability to detect inconsistency in a way that parallels the inconsistency that children are faced with in the action and the planning + action tasks, it would be possible to set up such a scenario. For instance, given that 3-year-old children reason well about desires, one could set up the following task. Children see a cookie on a snack table and are told, "Oh, look at that yummy cookie, do you want to eat it?" Once children respond that they would, they are told that they can go get it. However, once they reach the table, they find out that the cookie is made of plastic. If asked to explain why they went to the table, I suspect that children would respond "because I wanted to eat the cookie," and not, "because I wanted to eat the plastic." Such a finding would allow us to conclude that children can detect inconsistencies, but only in those domains in which they have at least a rudimentary understanding of the concept (e.g., desire) that is being tested. However, this claim is merely speculative as the results of Experiments 1 and 2 cannot address whether this would indeed be the case.

A methodological issue that arises from Experiments 1 and 2 is whether children's responses would have differed had they been asked the action explanation question first, and the false belief question second. For instance, in the crayon box task, after the candles are revealed, children would be asked to explain why they went to get the paper. In this case, an inconsistency also arises, but here, it is between the child's action and the true contents of the box (e.g., candles). In Experiments 1 and 2 (in which children were asked the action explanation question second), the inconsistency that arose was between the child's action, and the child's incorrectly stated belief about the contents of the box (e.g., candles). Both of these question orders (i.e., action explanation question first or action explanation question second), create an inconsistency, and as such, I would expect that the action explanation question would take longer for children to answer than the false belief question, even if it were asked first. However, it would perhaps be interesting to examine whether children's responses would indeed differ if they were asked the test questions in the reversed order.

A related issue is whether the methodology of Experiments 1 and 2 pointed out the inconsistency clearly enough to the children. For instance, one could argue that an alternative manner to structure the false belief question would have been to include an explicit temporal reference to the child's prior action (e.g., When you went to get the paper, what did you think was inside the box?). However, a concern with this format, is whether it truly requires children to access their earlier belief, rather than simply make an association between "paper," and "crayons." Nevertheless, it would be interesting to see whether a "temporally explicit"

wording such as this, would increase children's correct responses to the false belief question.

Finally, it is important to acknowledge that the children in these studies were only exposed to a few instances of counter-evidence. However, it is likely that to observe a significant change in behaviour, children would need to witness a number of these instances over a more prolonged period of time.

Conclusions

The present studies have made an important contribution to the current research on children's understanding of false belief. First, they have shown that 3-year-old children do not readily appeal to a false belief, even in those instances in which they are asked to explain an action of theirs that was premised on a false belief. However, in this same context, nonverbal aspects of children's responses suggest that children may be gaining an awareness of false belief as a possible explanatory construct. Interestingly, merely asking children about an earlier false belief (i.e., asking them a standard false belief question) does not appear to foster such an awareness. However, the results of these studies have also revealed that the relationship between false belief and action is a complicated one, as was highlighted in the discussion of children's understanding of the temporal self. Thus, in some cases, children's difficulty in explaining an action by appealing to a false belief may be affected by an incomplete understanding of how past states of the self are related to the self's current experiences. This issue has not been raised in previous studies which have examined how children explain an action that was

premised on a false belief, but is a relevant one. Indeed, it is an issue that future research should address.

Second, these studies have highlighted the difficulty in categorizing children as either having, or not having, an understanding of false belief. Rather than viewing children's acquisition of false belief as an all-or-none process, I believe that there exists a continuum along which children's understanding must be situated. In turn, this suggests the need to assess children's understanding of false belief by employing methods that tap different aspects of such an understanding. As such, I find it difficult to fully ascribe to either the conceptual change or early competence views of children's acquisition of false belief. In support of the conceptual change view, I believe that my results have shown that 3-year-old children do not fully understand the concept of false belief. Moreover, for many of these children, even the most facilitative contexts will not likely enable them to reason in terms of false belief, because this concept is one that they do not appear to possess. However, I also believe that my results have shown that a finer-grained distinction must be made with respect to children's understanding of false belief. Ultimately, I believe that doing so may reveal that the concept of false belief is made up of various components that are not all acquired simultaneously, and are not all a function of the same underlying skill.

Appendix A

Experiment 1 Protocol

Crayon box

What do you think is inside the box? (crayons). You know what, there's some paper over there. Why don't you get it to draw on with the crayons. Okay, let's open the box and look inside (show candles, and then close up box). Before, when you first saw the box all closed up like this, what did you think was inside?

If incorrect: Why did you go get the paper then?

If correct: What is inside the box? Why did you go get the paper?

Juice box

What do you think is inside the box? (juice). You know what, there's a cup over there. Why don't you get it so that you can drink some juice. Okay, let's pour. Oh look, there's sand in here (show sand, and then put back in carton). Before, when you first saw the box all closed up like this, what did you think was inside?

If incorrect: Why did you go get the cup then?

If correct: What is inside the box? Why did you go get the cup?

Appendix B

Children's action explanations

Examples from the Crayon box Trial

Children who failed the False Belief Question

Explanation	**Code**
'Cause I thought it was crayons	Belief
Um, uh, let me think, 'cause I thought there was crayons inside	Belief
Because I...Because I wanted to colour	Desire
Because I wanted to draw	Desire
To use the crayons	Goal
It says crayon box	Physical
There was some candles	Post-action
Because there was no crayons	Post-action
Where's the paper?	Irrelevant
Well, what's this on there? (pointing to the edge of the paper)	Irrelevant

Children who passed the False Belief Question

Explanation	**Code**
Because there – I thought there was crayons	Belief
I think there were crayons in there	Belief
Because I wanted to draw	Desire
Um, because I wanted to draw	Desire
So I could colour	Goal
To colour with crayons	Goal
To see what there is	Irrelevant
Because I got it over there	Irrelevant

Examples from the Juice box Trial

Children who failed the False Belief Question

Explanation	**Code**
'Cause I thought it was juice	Belief
Because there was san...I thought there was orange juice in there	Belief
'Cause to drink it	Goal
Because I was thirsty	Physical
Because I wanted to put some sand in it	Post-action
Because there – there's no juice in here before	Post-action
Wow, because I knew it was there	Irrelevant
The – there, it was on the floor	Irrelevant

Children who passed the False Belief Question

Explanation	**Code**
Probably because I thought it was juice	Belief
Because I thought it was a drink	Belief
Because I wanted a drink	Desire
'Cause me wanted orange juice	Desire
For orange juice	Goal
For drinking	Goal
Bec(ause) – to put the sand in	Post-action
Because there was sand in there	Post-action
To see what it is	Irrelevant
From there	Irrelevant

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Table 1

Responses to the False Belief Question (n = 126) broken down by Trial order and by Trial type in Experiment 1

	Trial order	
Trial Type	First	Second
Correct responses		
Crayon box	17	14
Juice box	13	19
Incorrect responses		
Crayon box	16	16
Juice box	17	14

Table 2

Response latency Means (M) and Standard Deviations (SD) for instances in which children failed the False Belief Question in Experiment 1

	M (s)	SD (s)
Trial 1		
False Belief Question	1.42	1.21
Action Explanation Question	2.47	1.30
Trial 2		
False Belief Question	0.93	0.77
Action Explanation Question	1.97	1.97

Table 3

Response latency Means (M) and Standard Deviations (SD) for instances in which children passed the False Belief Question and correctly responded to the Action Explanation Question in Experiment 1

	M (s)	SD (s)
Trial 1		
False Belief Question	1.42	1.10
Action Explanation Question	1.90	1.19
Trial 2		
False Belief Question	0.84	0.66
Action Explanation Question	1.13	0.67

Table 4

Number of correct responses (n = 17) to the false belief questions broken down by task order and by task type in Experiment 2

	Task type		
Task order	Planning + Action	Action	Standard
P+A; A; S	2	1	1
A; P + A; S	1	2	0
S; P + A; A	3	1	1
S; A; P + A	2	2	1

Note. P + A = Planning + action task; A = Action task; S = Standard task

Table 5

Pattern of children's (n = 12) correct responses to the false belief question for the Standard, Action, and Planning + Action tasks in Experiment 2

Task	Number of Children
Standard only	0
Action only	4
Planning + Action only	3
Standard and Action	0
Standard and Planning + Action	3
Action and Planning + Action	2

Table 6

Breakdown of children's responses to the Action Explanation Question (in %) in Experiment 2

Explanation type	Task	
	Action	Planning + Action
	False Belief Question Failers	
	(n = 18)	(n = 16)
Pre-action	17	19
Post-action	39	19
Irrelevant	22	19
No response	22	43
	False Belief Question Passers	
	(n = 6)	(n = 8)
Pre-action	50	37.5
Post-action	0	12.5
Irrelevant	17	0
No response	33	50

Figure 1

Percentage of correct versus incorrect responses to the Action Explanation Question in Experiment 1

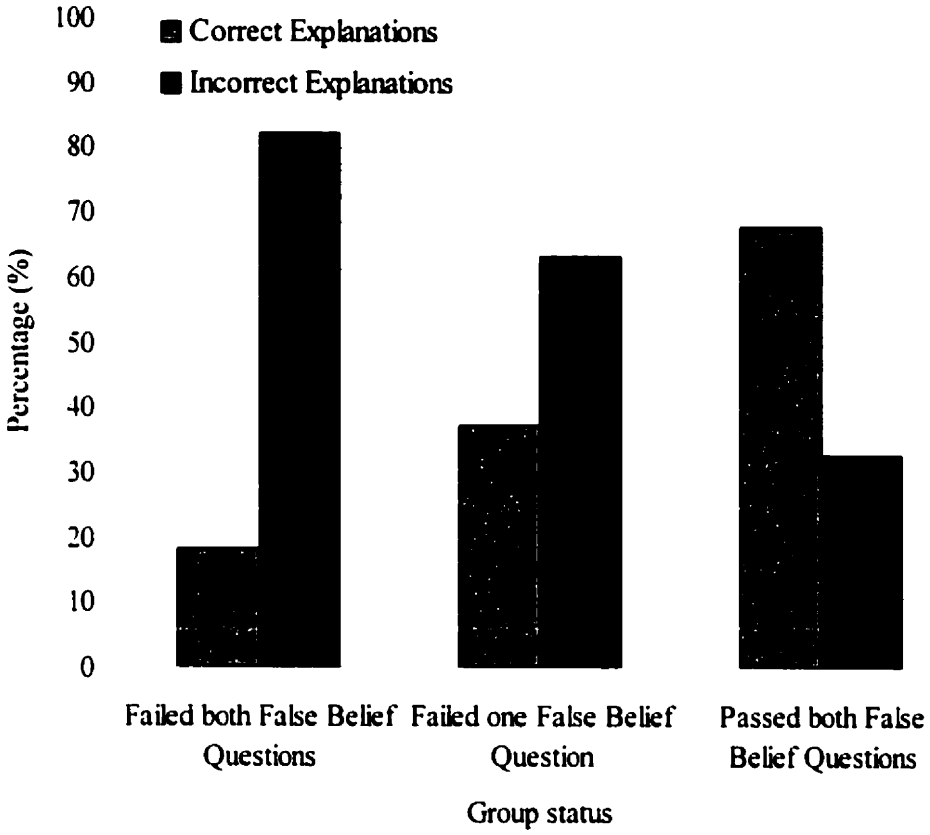

Figure 2

Percentage of children who answered the false belief question correctly for each of the three tasks in Experiment 2