INTERPERSONAL INFLUENCES ON YOUNG CHILDREN'S UNDERSTANDING OF MIND

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ABSTRACT

The thesis represents a critical examination of the theory-theory account of young children's understanding of mind, as explored through six empirical studies carried out on 661 children. Beginning with a critique of both experimental and naturalistic approaches to the study of mind, the thesis proceeds to establish a set of guiding research principles drawn from the philosophy of mind. Following a philosophical critique of the major psychological accounts of children's understanding of mind, it is suggested that the theory-theory comes closest to satisfying the proposed philosophical guidelines.

The empirical studies reported suggest that children as young as three have a clear understanding of representations, as well as a developing theory of mind. It is proposed that certain patterns of interpersonal relatedness facilitate young children's understanding of both mental and nonmental representations. In particular, it was found that an experimenter's reference to a deceptive interaction facilitated young children's understanding of false belief. The fluent knowledge of a second language was similarly found to facilitate young children's ability to remember their own previous false belief, as well as their ability to understand the appearance-reality distinction.

Although the present research is founded on the use of the false belief paradigm, a critical discussion of its limitations suggests that developmentalists need to explore the interpersonal cooperation surrounding young children's developing theories of mind. It is also argued that the false belief paradigm can no longer be the dominant research paradigm if progress is to continue to be made in this field. It is suggested that future research has much to gain by adopting the principle that an understanding of mind is primarily an understanding of interpersonal relations.

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CHAPTER ONE

REVIEW OF THE LITERATURE ON YOUNG CHILDREN'S UNDERSTANDING OF MIND

1.1 INTRODUCTION

A theory of cognitive development should in principle be able to give an account of how children could ever begin to understand phenomena that are highly complex and which could have multiple ways of being construed. One area of developmental psychology which faces this challenge concerns children's understanding of mind. What do children of different ages understand about the mind? How are we to conceptualize the origin of and the changes in children's knowledge of mental life?

The earliest ideas in this area of cognitive psychology have come from Piaget (1926a, 1926b, 1929), who suggested that a young child does not make a clear distinction between mind and body. Similarly, a young child is not always able to distinguish between the self and the external world. Dreams, for example, are experienced as a disturbance breaking in from without. Words are so closely linked to the objects they describe, that to speak is to act on the objects themselves; or objects are endowed with intentions and will. According to Piaget, a young child is both egocentric and animistic. That is, the child believes that everyone thinks like himself, and is also capable of attributing consciousness to objects.

Nevertheless, it is only in the most recent decade that these ideas have aroused great interest, leading to an increase in research in an area which is now referred to as **children's theories**

of mind. Wellman and Estes (1986), for example investigated whether children aged 3 to 5 years could distinguish between real and mental entities. Their findings indicated that even 3-year-olds were able to judge real and mental entities appropriately on the basis of 3 criteria: behavioural-sensory evidence, public existence and existence over time. These children were also aware that mental entities can be about physically impossible, non-existent things, such as a dog that can fly. But what exactly do developmentalists mean when they employ the phrase '**a child's theory of mind**'? It was Premack and Woodruff (1978) who popularized the expression and the reasons they gave for describing the attribution of mental states to others as a theory are twofold:

> In saying that an individual has a theory of mind, we mean that the individual imputes mental states to himself and to others (either to conspecifics or to others species as well). A system of inferences of this kind is properly viewed as a theory, first, because such states are not directly observable, and second, because the system can be used to make predictions, specifically about the behaviour of other organisms (p.515).

The theoretical stance taken by Premack and Woodruff (1978) is one that is widely accepted by developmentalists (Wimmer and Perner, 1983; Perner, Leekam and Wimmer, 1987; Gopnik and Astington, 1988; Moses and Flavell, 1990; Sodian, 1991) who claim that the development of a theory of mind has a powerful impact on the child's life in two major ways. First, it is a social tool that can be used in the explanation, prediction and eventual manipulation of the behaviour of others. If one understands social behaviour as consisting primarily of cooperation and competition, then the way that we construe belief, desire and

intention will play a central role in social life. For example, one competitive strategy would be deception and lying (Chandler, Fritz and Hala, 1989; Sodian, 1991; Wimmer and Perner, 1983). Also, in a world where both cooperation and competition are possible, the judgement of intention would be crucial. Second, acquiring a theory of mind would play a role in the development of certain forms of reasoning, such as metacognition (knowledge of the cognitive system) and metarepresentations. This would have consequences for the way in which a child construes the world, leading to the distinction between subjective and objective, appearance and reality, facts and values (Russell 1982). It would follow that an individual who failed to develop a theory of mind would be faced with insurmountable social and cognitive problems. There is evidence to suggest that autism may well represent a deficit of this kind (Baron-Cohen, Leslie and Frith, 1985; Baron-Cohen, 1995; Baron-Cohen, Tager-Flusberg and Cohen, 2000).

The research into children's theories of mind therefore promises to improve our understanding of the development both of social behaviours and cognitive abilities. There have also been important contributions from other disciplines relating to children's theories of mind, such as primate psychology (Premack and Woodruff, 1978; Byrne and Whiten, 1991; Cheney and Seyfarth, 1991), artificial intelligence (Schultz, 1991) and philosophy (Bennett, 1978; Dennett, 1978; Harman, 1978). Nevertheless, developmental psychologists have favoured one of two research methodologies: naturalistic studies that aim to observe young children in their immediate social environment or experimental methods that seek to test cognitive abilities not easily uncovered by observational methods. In this thesis, we will be attempting to combine both methods by placing our experimental methods within a narrative framework or with clear references to a deceptive context. But first, we review the

empirical evidence of children's understanding of mind, beginning with the information gathered from naturalistic studies of young children.

1.2 THEORY OF MIND AS SOCIAL UNDERSTANDING

From early infancy, babies are alert and responsive to the behaviour and emotional expressions of close family members. They are particularly interested in the characteristics of the human face and voice. At 2 months of age an infant can respond differently to a person who speaks to them directly and to one who speaks to someone else (Trevarthen, 1977). In a situation that arouses uncertainty, an infant will attend to the mother's emotional expressions and adapt her behaviour accordingly. The infant's understanding of the feelings, intentions and actions of significant others develops in parallel with their comprehension of the social relationships that surround them.

Naturalistic studies by Dunn (1988) have demonstrated that young children's understanding of the psychological states of others can be classified into 4 categories. First, there are the attempts that children make to alter the psychological state of another by teasing, comforting, expressions of concern, helping actions and jokes. Reddy (1991) has observed that teasing occurs in children from the first year onward and represents an attempt to annoy, disturb or amuse another person. For this behaviour to be successful, the child would need to understand what is capable of disturbing or amusing a particular person. Dunn's (1988) observations show that by 24 months the child has developed teasing into a precise strategy, and with differentiated forms of teasing for mother and sibling. Children's efforts to comfort another, as well as expressions of concern have been observed early in the second year (Radke-Yarrow, Zahn-Waxler and Chapman, 1983). These behaviours become increasingly

elaborate by the age of 4 years and are of interest because they demonstrate an attempt by the child to alleviate the distress of others, as well as an understanding of what constitutes fright and worry. Similarly, children's helping actions have also been observed early in the second year. These actions reveal that a young child is capable of understanding the goals, needs and intentions of others, as well as the frustration that follows the failure to reach one's goals. Dunn (1988) has suggested that jokes appear between the second and third years, and that joking demonstrates the child's ability to take account of another's beliefs. However, children's understanding of the distinction between teasing and deception involving higher-order mental states (A wants B to know) does not develop until the age of 4 (Leekam, 1991).

The second category includes explicit verbal discussions by children of another person's mental state. As yet, there is little research in this area of child behaviour, but Dunn, Bretherton and Munn (1987) have observed that children in their third year talk in an interested way about the feeling states of others; while Wellman (1990) has claimed that children of 3 refer to the intentions of others, using words such as **remembering, forgetting, knowing** and **meaning to**. There certainly is an increase in children's curiosity about the internal states of others between the ages of 2 and 3 (Dunn, 1988).

The third category of evidence for children's growing understanding of other minds comes from observations of children's excuses, deceit and attempts to evade disapproval or punishment (Leekam, 1991; Reddy, 1991). These phenomena were observed by Dunn (1988) in the second and third years. Most striking of all was the use that children made of references to other people's mental states, intentions, likes and dislikes. In some cases, these strategies were observed in children younger than two years.

The fourth category includes children's social pretence with other family members. Naturalistic observations of pretence are of interest for 3 reasons. First, they demonstrate that children are able to engage in shared pretence from as early as 18 months (Dunn and Dale, 1984). Second, in the course of pretend play children often make references to the inner state of the pretend character. Before the age of 3, these references centre around feeling states, but between the ages of 3 and 4 children are able to discuss the intentions of the pretend character (Dale, 1983; Dunn and Brown, 1989). Third, there appears to be a close connection between pretend and teasing (Reddy, 1991).

Naturalistic studies of children within their family environment therefore provide us with evidence that children begin to understand mind between the ages of 2 and 3 years. They also reveal the influence of family discourse. From an early age, children frequently experience family discussions and explanations about why people behave the way they do, about beliefs, feelings and intentions. Dunn and Brown (1989) have claimed that differences in children's exposure to family conversations about feeling states is directly related to their later ability to understand another's feelings. Another important observation made by Dunn and Brown (1989) is that children's understanding of mind frequently develops within an emotional setting. Children learn about mind when their self-interest is threatened, when they are engaged in pretending with a sibling, when they are amused, or when they become worried and anxious about another person. Of these four situations, it is the first which is most often observed during the second and third years. Dunn and Brown (1989) have proposed that it is precisely those situations of conflict and threatened self-interest that enhance a child's understanding of their social relationships. A similar conclusion has been reached by Wolf (1982) in her studies of children's understanding of agency during the second year. Although

Tizard and Hughes (1984) have demonstrated that older children's reflections on mental states are often conducted in conversation with their mothers in a calm setting, it would seem that at least in the very early years a child's understanding of mind develops within emotionally charged settings.

There are important reasons why naturalistic studies of children have a place in the current research into children's theories of mind. First, naturalistic observations provide the only source of evidence so far on the young child's abilities to tease and joke. Equally, it is only through these methods that the relation between teasing and pretend play has been investigated. Second, naturalistic methods allow us to gather important information concerning children's understanding of mind between the ages of 2 and 3 years. Experimental methods since Piaget have demonstrated that it is extremely difficult to carry out experiments with children of that age. Third, it is only through naturalistic methods that we are likely to increase our understanding of the contexts in which a theory of mind develops. The studies quoted above suggest that emotionally charged settings, such as threats to the child's self-interests play an important role in developing a theory of mind. Finally, naturalistic methods allow us to observe the precise situations that arouse a child's curiosity and interest.

Nevertheless, there are two serious limitations to the naturalistic methods of gathering data. First, there remains the difficulty of making inferences about children's understanding of mind from their behaviour. Second, there is no way to ensure that the behaviours that one is observing are a representative sample of children's abilities to understand the mental states of others. Experimental methods have attempted to overcome these limitations by the use of set tasks in carefully controlled situations. It is to the empirical evidence of children's

understanding of mind derived by experimental methods that we turn to next.

1.3 THEORY OF MIND AS REASONING

1.3.1 THE CHILD'S UNDERSTANDING OF FALSE BELIEF

Premack and Woodruff (1978) were the first to speculate about the possibility that chimpanzees may have a 'theory of mind' that is not very different from a human's. To determine whether or not a chimpanzee infers states of mind, Premack and Woodruff (1978) showed an adult chimpanzee a series of videotaped situations in which a human actor struggled with a variety of problems. Some of these problems were relatively simple to solve, requiring only the ability to understand physical causality. Other problems had more complex solutions, requiring an understanding of the human actor's intentions. With each videotape, the chimpanzee was shown several photographs, among which one of them represented the solution to the problem. From the chimpanzee's consistent choice of correct photographs, Premack and Woodruff (1978) concluded that the animal was able to solve the problems by imputing mental states to the human actor. Nevertheless, their study was unable to determine whether a chimpanzee can make the distinction between to **know** versus to **guess**; as well as the distinction between **truthfulness** and **deceit**. Later efforts to teach deceptive pointing to four chimpanzees gave inconclusive results. Two of the chimpanzees were able to learn a certain measure of deception but only after an intense training effort lasting 5 months. It was these studies that suggested that the natural acquisition of deceptive strategies is a human characteristic and stimulated developmental psychologists to explore children's understanding of false beliefs.

In a series of experiments, Wimmer and Perner (1983) tested the ability of 3 to 9-year-old

children to understand the function of a false belief within two versions of a story acted out with dolls and toys. The original false belief task had the following format: the puppet 'Maxi' puts some chocolate in a blue cupboard and goes away. While Maxi is gone, the chocolate is transferred from the blue cupboard to a green cupboard. Maxi returns very hungry and wanting his chocolate. In the second version of this story, Maxi's big brother is also looking for the chocolate and asks Maxi where the chocolate is. "Good grief", thinks Maxi, "now big brother wants to eat up all the chocolate. I will tell him something completely wrong so that he won't find it for sure". In both versions of the story the child was asked to indicate where the puppet would look for the chocolate on his return. None of the 3 to 4-year-olds were able to give correct responses to **both** sketches, whereas 57% of the 4 to 6-year-olds and 86% of the 6 to 9-year-olds were able to give correct responses to both versions of the story.

In the experiment outlined above, the children were explicitly told the goal of the protagonist (Maxi wants the chocolate), the protagonist's anticipation of his antagonist's conflicting goal (Maxi thinks that his big brother wants to eat the chocolate), and the protagonist's clear intention to deceive his antagonist. From these 3 bits of information, the children had to infer the utterance that would best satisfy the protagonist's intentions. This sketch contrasts in form with the deceptive fairy tales that children become acquainted with between the ages of 4 to 8 years. In these fairy tales, children are usually told the protagonist's goal, the antagonist's goal and the protagonist's utterance. From this information, the child has to infer the protagonist's deceitful plan. Wimmer and Perner (1983) assessed the ability of 4 to 6-year-olds to make such inferences by means of two stories in which the protagonist made a critical utterance, the truth of which the children were asked to judge. This utterance was preceded

by one of 3 contexts; two of which were deceptive, while the third was informative. Children between the ages of 4 and 5 years were able to correctly judge this utterance as a lie only 28% of the time, whereas the 4 to 6-year-olds did so in 94% of the cases. Wimmer and Perner (1983) concluded that the development of children's ability to understand another person's beliefs, as well as the process of deception, does not depend on an increase in memory and central processing capacity, but is a cognitive skill that develops independently between the ages of 4 to 6 years.

Perner, Leekam and Wimmer (1987) tested the hypothesis that 3-year-olds have a conceptual limitation in the attribution of false beliefs against 4 competing hypotheses. The first hypothesis stated that the failure of the 3-year-olds to make correct belief attributions was due to a memory failure for relevant story facts. This was tested by means of two memory questions at the end of the story. The results indicated that many of the younger children who understood and remembered the facts of the story correctly, still made consistent incorrect false belief attributions. The second hypothesis stated that the younger children failed to appreciate that the protagonist expected the object to stay in its old location. This idea was tested by comparing the results of the original story with an alternative version in which the protagonist's expectations were made explicit, but even in this condition the ability of younger children to make correct false belief attributions did not improve. The third hypothesis stated that 3-year-olds may have given the wrong answers to false belief questions because of a pragmatic misunderstanding. That is, it is possible that the younger children interpreted the test question 'Where **will** he look...?' as 'Where **should** he look...?'. This possibility was seen as unlikely after the attempt to block such a misinterpretation by using the word 'think' instead of 'look' did not improve the children's scores. The fourth

hypothesis stated that the success of the 4-year-olds on the original false belief task may have been due to their associating the protagonist with the correct-answer location; but when this association was broken, the 4-year-olds continued to produce near-perfect false belief attributions. Overall, the results indicated that the understanding of false belief develops between the ages of three and four. This developmental pattern has also been found in cross-cultural studies including Austrian children (Hogrefe, Wimmer and Perner, 1986), American children (Johnson and Maratsos, 1977) and English children (Baron-Cohen, Leslie and Frith, 1985).

The Wimmer-Perner false belief paradigm has been criticised on the grounds that it is computationally complex (Hobson, 1991). There is first of all the problem that subjects must begin the false belief task by inferring what the puppet Maxi does and does not have a right to know before their understanding of false beliefs is assessed. There may also be a difficulty in that the subjects must begin by processing a lengthy narrative concerning Maxi, which in fact continues throughout the task. Finally, it has been suggested that the Wimmer-Perner paradigm conflates the ability of young children to ascribe beliefs to another with their capacity to **tell** about these very same beliefs. Given these methodologic concerns, Chandler, Fritz and Hala (1989) devised a novel hide-and-seek board game with which to observe children's spontaneous use of deceptive strategies. The game involved a child in helping a puppet ("Tony") to hide a treasure in one of 5 plastic bins, so that a second experimenter would not find it. The puppet inevitably left footprints on a white board and the first experimenter made it clear to the child that the footprints were a reliable indicator of where the treasure was hidden. Once the child had understood this, he was asked to "think of something to do so that E2 will not be able to find where Tony hid the treasure". On

subsequent trials, the child was asked to find alternative ways of misleading the second experimenter. All children demonstrated a variety of deceptive strategies that included (in ascending order of complexity): withholding evidence, destroying evidence (footprints), lying, producing false trails without destroying evidence and destroying evidence as well as producing a false trail. Fifty children were tested, 30 of whom were younger than 3½ years old. The results indicated that even children as young as 2½ are able to successfully utilise a range of deceptive strategies that presuppose an understanding of false beliefs. Even if the strategy of destroying evidence is discounted as a reliable indicator of deception, the results still show that 90% of the 2½ and early 3-year-olds were able to take active steps to deceive the second experimenter.

The results just described differ significantly from the mainstream developmental findings, which suggest that children under the age of 4 lack a theory of mind. For this reason, Chandler, Fritz and Hala (1989) have been criticised in a number of ways. First, it has been suggested that their subjects deceptive strategies were simply attempts to manipulate the **behaviours** of the second experimenter but not her actual **beliefs**. That is, the children were merely trying to lure the second experimenter away from the actual hiding place that they had chosen for the treasure. There is also the possibility that many of the different things that the children could do with the experimental materials in the hide-and-seek task could inadvertently obscure the true location of the hidden treasure, thus creating the impression that they had acted deceptively when in fact it was never their intention to do so. A third line of argument states that there was no clear demonstration that the children intended to to manipulate the actual **thoughts** and not merely the likely **behaviourial choices** of E2.

With these criticisms in mind Sodian, Taylor, Harris and Perner (1991) attempted to replicate Chandler et al.'s (1989) findings. In their initial experiment, children's level of insight into deception was tested by questioning them on the ensuing thoughts and actions of the victim. Otherwise, this experiment represented a close replication of Chandler et al. (1989). The results confirmed the observation by Chandler et al. (1989) that children as young as 30 months are capable of deceptive strategies. However, a closer look at the data revealed clear age changes in both the spontaneity and frequency with which the deceptive ploys occured. Compared to younger children, 4-year-olds were more likely to remove evidence without prompting, to produce misleading words and gestures and to predict correctly where E2 would search. By contrast, although the younger children produced deceptive actions, these were significantly less frequent and less systematic than the older children, and then, only as a result of prompting. The questions put to the children indicated that the younger children had little insight into the impact of their actions. Thus, the 2- and 3-year-olds often adopted a reality-oriented strategy when answering questions that tested their understanding of deception. For example, a child might predict that E2 would both search in the correct cup and believe that the "treasure" was hidden there, even when they had removed all possible clues. This was sometimes the case even when the child had seen E2 search at an empty cup on previous trials.

Sodian et al. (1991) carried out a second experiment which introduced controls. This was accomplished by confronting the children with a collaborator (who handed over the "treasure") on some trials and a competitor (who stole the "treasure") on others. In this way, it was possible to ascertain whether deceptive behaviours were directed selectively at the competitor. The results from this second experiment showed that only a minority of 2- and

3-year-olds (17%) adjusted their strategies appropriately across the two pairs of trials. In contrast, when 4-year-olds were faced with a competitor, they removed the visible evidence that would lead him to the treasure, as well as using deceptive pointing or false trails to direct him to the empty box. When faced with the collaborator, the older children did not engage in deception. Sodian et al. (1991) concluded that an important cognitive change takes place at around 4 years of age, when children come to appreciate that both false beliefs and deception refer to a situation that in reality does not exist.

In an effort to support their earlier controversial findings, Hala, Chandler and Fritz (1991) tested more than 70 3- and 4-year-olds in a modified version of the hide-and-seek game which explicitly asked the children to predict E2's beliefs concerning the location of the hidden treasure. In addition, an 'unexpected change task' was carried out. This task involved a brief puppet show in which two puppets ("Katie and Sam") played with a toy car, which they then placed in a red opaque container that looked like a miniature dustbin. After both puppets had left the room in opposite directions, Katie returned and moved the toy from its location to an opaque yellow container. Sam was then seen returning and it was made clear to the children that he wanted to play with the toy car again. At this point, the children were asked the crucial false belief question: 'Where will Sam look for the car when he comes back?'. The children were also asked various memory questions that ensured that they had followed the narrative sequence and remembered all of the important details of the story. Hala et al. (1991) found no significant differences in the performance of the 3-, 3½- and 4-year-olds on both tasks. Even the youngest children were able to anticipate the likely outcome of their deceptive strategies on both the behaviours and beliefs of E2, as well as demonstrating how information could be managed so as to help E2 find the hidden treasure.

Thus, the findings reviewed in this section of the thesis show that we have still not arrived at a clear developmental picture of young children's understanding of false belief and deception. One possibility, which we will be exploring later in this chapter, is that the difficulties that 3-year-olds experience relative to 4-year-olds is a consequence of the experimental procedures themselves. The relevant research will be examined after a brief survey of the representational change hypothesis.

1.3.2 THE CHILD'S UNDERSTANDING OF REPRESENTATIONAL CHANGE

Gopnik and Astington (1988) have suggested that 3-year-old children have representations of the world and that they change these representations, but that they do not understand representational change itself. That is, young children do not know that their beliefs change. Gopnik and Astington (1988) tested this hypothesis by questioning children between the ages of 2 and 5 about two sets of materials. In the first set, the children were presented with Flavell et al.'s (1983) task with its deceptive object: a sponge that looked like a rock. The true nature of the object was then revealed by allowing the children to touch and squeeze the sponge. Children's understanding of representational change was tested by asking them what they had thought the object was when they first saw it. Their understanding of false belief was also tested by asking them to predict what another child would think the object was. Finally, children's understanding of the appearance-reality distinction was tested by asking them both what the object looked like and what it really was. In the second set of materials, children were shown a Smarties box which was opened to reveal a pencil inside. They were then asked questions that tested their understanding of representational change and false belief. The results indicated a clear development in the understanding of representational change between the ages of 3 and 5. The majority of the 3-year-olds answered the

representational change questions incorrectly. Very few of the 5-year-olds made this error. The 3-year-olds performed more poorly than the 4- and 5-year-olds on the false belief and appearance-reality questions. Children as a whole produced significantly lower scores on the representational change questions than on the false belief and appearance-reality questions. These results are unlike the data presented by Perner, Leekam and Wimmer (1987) which indicated that the understanding of false belief is more difficult for young children than understanding representational change. Nevertheless, both sets of data suggest that children begin to consider alternative representations of the same object at about the age of 4.

If the 'representational change hypothesis' outlined above is correct, young children should be able to understand changes in their own mental states that do not appear to require an understanding of the process of representation. Some mental states seem to be completely unrepresentational. An example of this kind of mental state would be a simple emotion such as surprise. Other mental states involve representations without necessarily requiring an understanding of the process of representation itself. In pretending or imagining, for example, we may have a representation without needing to consider the relation between that representation and the world. Desires and intentions are interesting in that their relation to an object may change without the object itself changing, although there are aspects of desire that seem to require a representational model of mind (e.g. changes in our notions of desirability). Beliefs, on the other hand, seem to depend on an understanding of the process of representation. Gopnik and Slaughter (1991) tested the 'representational change hypothesis' in a series of tasks in which children were placed in one mental state, which was subsequently changed and they were then asked to report their initial state. Nearly all of the 4-year-olds were able to report all their past mental states, including beliefs. Three-year-olds

scored well in their reports of past pretences, images and perceptions. However, they scored significantly poorer in their reports of past beliefs. Three-year-olds experienced reporting past desires and intentions as more difficult than reporting pretences, images and perceptions, and slightly less difficult than reporting a previous belief. Gopnik and Slaughter (1991) sugested that these results are evidence that 3-year-olds have difficulty in understanding the nature of mental representations.

In the same way that a 3-year-old child cannot understand that another person can hold a belief different from their own, 3-year-olds possess little or no grasp of the distinction between appearance and reality. This was the conclusion reached by Flavell, Flavell and Green (1983) in a series of experiments. In their study, both 3- and 4-year-olds were shown an object with a deceptive appearance, such as a sponge that appeared to be a rock. They were first shown the object from a distance, after which they were allowed to touch it. The children were asked questions pertaining to the appearance of the object, for example: 'When you look at this with your eyes right now, does it **look like** a rock or does it **look like** a sponge?'. They were also asked questions relating to the reality of the object, for example: 'What is this really and truly - is it **really** and **truly** a sponge or is it **really** and **truly** a rock?'. Older children replied that the object **looked like** a rock but that it **was truly** a sponge. The older children were also able to state that a person who had only **seen** the sponge would believe it was a rock, thus demonstrating that they could hold 2 different mental representations of the same object. In contrast, 3-year-olds tended to give the same answer to both sets of questions. Flavell, Flavell and Green (1983) also indicated that the ability to solve the appearance-reality tasks was highly correlated with the capacity to take different perspectives on an object. Flavell, Flavell and Green (1983) proposed that what

helps children finally understand the appearance-reality distinction is the knowledge that human beings are sentient, cognizing subjects whose mental representations of objects and events can differ, both within the same person and between persons.

In an attempt to uncover the 3-year-old's competence on the appearance-reality distinction Flavell (1986) as well as Flavell, Green and Flavell (1986) made use of 3 different research strategies. First, they ran a series of simplified colour tasks in which an object or a substance whose colour was well known to children was momentarily made to appear to be a colour that they would never see in reality. For example, milk was made to turn red by passing a coloured filter in front of it, in the hope that the younger children would remember the real colour of milk, while recognizing the red milk to be a mere appearance. Second, easier versions of the object-identity tasks were administered. In one example, the apparent identity of the object was conveyed by its sound, while its real identity was determined by its visual appearance. Thus, a small tin can sounded like a cow when turned over. Children were then asked if it sounded like a can or a cow, and whether it really and truly was a can or a cow. Finally, a group of 16 3-year-old children, who performed very poorly on the colour and object-identity tests, received intensive training for 5 to 7 minutes on the meaning of real versus apparent, and were then retested on the same tasks. None of the 3 research strategies outlined above helped to improve the performance of the younger children on the appearance-reality tasks, so that it seems reasonable to conclude that their difficulies are due to a conceptual deficit.

There has been considerable investigation into whether the difficulties that young children experience on false belief tasks might be a consequence of the experimental procedures

themselves. The question has been posed and tested in a number of different ways (Perner, Leekam and Wimmer, 1987; Gopnik and Astington, 1988). Moses and Flavell (1990) have suggested two reasons why the standard false belief tasks may be masking young children's competence. First, in the false belief tasks that we have reviewed so far, the only cue to belief is the protagonist's lack of perceptual access to a crucial event, which may not be a very salient cue for a young child. Second, the standard tasks require that a child makes behaviourial predictions from the causes of a belief (what a protagonist has or has not seen) to the protagonist's beliefs or actions. This may also be something that young children are not particularly skilled at. In two experiments, Moses and Flavell (1990) tested 3-year-olds on tasks where a main character's actions and reactions were made more salient. Also, the protagonist's actions and reactions presented the children with puzzles that could only be resolved by invoking a false belief. These puzzles are not a normal feature of the standard false belief tasks. In their first experiment, 48 children under 4 years of age were shown a short film in which a young woman ("Cathy") enters a room, places a box of crayons in a bag and immdediately leaves the room announcing that she is going to get some paper with which to draw a picture. While she is gone, a clown enters through a side door, removes the crayons from the bag and replaces them with rocks. The clown leaves and Cathy returns with some paper, clearly intending to make a drawing. A third of the children were asked to infer the protagonist's belief solely on the basis of Cathy's lack of perceptual access to the critical event (the perception condition). Another third were asked to infer the protagonist's beliefs while being presented with additional cues in the form of the protagonist's actions. That is, Cathy walks over to the bag and is seen about to open it (the action condition). The remainder of the children were given further belief cues in the form of the protagonist's reaction on looking into the bag (the surprise condition). In this experiment, a desirable

object was replaced by an undesirable one. In a control condition, an undesirable object (a broken toy) was replaced by a desireable one (a new toy truck), to account for the possibility that children might equate the protagonist's belief with her desire. The children scored 97% correct on the questions that tested their memory for the details of the story, but were correct only 25% on the belief questions. Although they did somewhat better in the action and surprise conditions than in the perception condition, their performance in all conditions was poor and not significantly different from what would be expected by chance. In the second experiment, Moses and Flavell (1990) tested children on a version of the surprise condition in which the demands of the task were considerably reduced. On this occasion, children were correct on 47% of the belief questions, but this also did not exceed what was expected by chance.

More recently, Sodian (1991) tested the ability of 3- to 5-year-olds to deceive a competitor in a hiding game similar to the one used by Premack and Woodruff (1978) in their study of deception in chimpanzees. There were 3 experiments, the first of which aimed to determine at what age children begin to intentionally deceive a competitor in a playful context. The child was first introduced to two puppets: a king and robber. The king was described as a 'nice man' who helped children and gave them a star whenever he found one. The robber was a 'nasty man' who teased children and kept anything he found for himself. The puppets then left the stage while the child had the time to hide a star in one of two boxes. One of the puppets would return and ask 'Where is the star?'. This procedure was repeated with the second puppet and each child received 4 test trials: two cooperative and two competitive. The object of the game was to obtain as many stars as possible. Sodian (1991) found that there was a significant age trend in deceptive action between the ages of 3 and 5, with the older

children performing significantly better than the younger. Only one of the nine children aged under 3½ indicated the empty location to the competitor on one of the trials, but it was only the 4- to 5-year-olds that consistently deceived the robber on both trials. In the second experiment, children watched a third puppet ("Susi") play the hiding game. Susi's intention to prevent the robber from obtaining a reward was made explicit. The children were asked to tell Susi which of the two locations she should point to. The aim of this experiment was to determine at what age children begin to communicate deceitfully. Twenty-five per cent of the children under 3½, 66% of the 3½- to 4-year-olds, 75% of the 4- to 4½-year-olds and 89% of the 4½- to 5-year-olds instructed Susi to point to the empty box in the competitive condition. Finally, experiment 3 investigated two other forms of deception: sabotage and lying (without pointing). In the sabotage condition, a child could prevent a competitor from getting the reward by locking the box in which it was located. In the lying condition, a child could prevent the robber from getting the reward by telling him that the box where the reward was hidden was locked, when in reality it was open. Both conditions were presented in a 'one-box' and 'two-box' setting. In the one-box task 73% of the subjects correctly locked the box for the competitor (robber) and left it open to the cooperator (king), whereas only 27% lied to the competitor in the parallel deception task. In the two-box task, 59% of the subjects gave correct responses in the sabotage condition, while only 29% were correct in the lying condition. Although the one-box task was easier than the two-box task, the difference was not significant. The majority of children who failed both deception tasks (lying and deceptive pointing), mastered at least one sabotage task (81%). Of the 14 children who were younger than 3½ years, nine passed at least one of the sabotage tasks. Thus, even the youngest children who failed at deception were partly sucessful at sabotage.

1.4 RECENT TRENDS IN THEORY OF MIND RESEARCH

It would appear from a review of the literature thus far that young children have a limited understanding of mind in the context of deception. However, the Sodian (1991) studies provide evidence that young children have some understanding of deceptive behaviours in the form of sabotage. Moreover, both the Chandler et al. (1989) and the Hala et al. (1991) studies allow for the possibility that under certain conditions young children demonstrate a clear understanding of false belief. In fact, in recent years there has been a growing body of evidence to suggest that 3-year-olds can show an understanding of deception, although under very specific circumstances.

It has been reported that 3-year-olds succeed on false belief tasks when these are framed in the context of a deceptive game (Sullivan and Winner, 1993; Chandler and Hala, 1994). It has also been shown that a small variation in the standard false belief procedure may lead to high success rates among 3-year-olds. Lewis (1994) has demonstrated that asking children to retell the a story before the experimenter asks the test question will facilitate the performance of 3-year-olds on a false belief task, although simply repeating the story to the children does not significantly improve the likelihood of correct responses. Similarly, Mitchell and Lacohee (1991) were able to improve young children's performance on a classic deceptive box task by having them select and then post a picture that represented their own false belief.

Even more recently, Appleton and Reddy (1996) have shown that explaining particular instances of deception on videotape to young children will aid them on false belief tasks, while Siegal and Peterson (1994) have demonstrated that 3-year-olds can correctly distinguish

between lies and mistakes. A related study of children's understanding of the appearance-reality distinction by Rice, Koinis, Sullivan, Tager-Flusberg and Winner (1997) showed that 3-year-olds will perform well on the appearance-reality test when their aim is to trick someone or when they do not need to simultaneously hold two conflicting object identities in mind. Finally, a more controversial example concerns the use of more explicit forms of test questions. Thus, Siegal and Beattie (1991) followed by Surian and Leslie (1999) have found that 3-year-olds performed significantly better on a false belief task following the inclusion of the word 'first' in the prediction question 'Where will Sally look **first** for her marble?', although Clements and Perner (1994) have failed to replicate these results. More recently, Bowler, Briskman and Grice (1999) have shown that children's performance on both a false drawing task and an unexpected transfer task improved significantly following an unexpected intervention by a naughty puppet.

Taken as a whole, these studies suggest that studies carried out using the standard false belief procedure have seriously underestimated young children's understanding of mind. Some of these more recent findings will be discussed in greater detail in subsequent chapters. But first, we proceed to consider other relevant aspects of children's understanding of mind. This will be followed by a review of the philosophical assumptions on which this research is based in chapter two.

1.5 OTHER ASPECTS OF CHILDREN'S UNDERSTANDING OF MIND

1.5.1 INFANCY

According to Scaife and Bruner (1975), an infant's ability to follow the mother's line of sight increases significantly around the age of 9 months. This finding was interpreted as

demonstrating in the infant a capacity for shared reference, an interpretation which is in accord with two other studies. Trevarthen (1980) has pointed out that before the age of 9 months, infants will either engage in social play with the mother **or** in non-social play with toys. But at 9 months, the infant begins to demonstrate the ability to coordinate these two forms of play. Bates, Camaioni and Volterra (1975) have shown that intentional communication also emerges at around 9 months. By 'communicative intent' these authors refer to the speaker's a priori awareness of the effect that the message is designed to produce in another. Such an intent is inferred from a combination of directed behaviours such as the infant's alternating gaze, the substitution of one communicative gesture for another and the ritualization of instrumental gestures (e.g. reaching for an object instead of taking or holding it).

Bretherton, McNew and Beeghly-Smith (1981) have indicated that the findings considered above implicitly ascribe a rudimentary theory of mind to infants, in the way that an older child will utilize grammatical rules that they cannot verbalize. The study by Bretherton et al. (1981) suggests that internal-state language emerges late in the second year. From a sample of 30 20-month-old children, it was found that 30% could use verbal labels for fatigue, pain, disgust, distress, affection and moral conformity in an appropriate context. More recently, Bretherton and Beeghly (1982) asked the mothers of 30 28-month-olds to report child utterances containing six categories of internal-state words. Of these, cognition words were the least common. Also, words referring to affect and moral obligation did not occur as frequently as labels referring to volition, perception and physiological states. The data reported by Bretherton and Beeghly (1982) suggest that the capacity to understand goals and motives is well developed in the third year. Their evidence indicated that at 28 months,

children can interpret the mental states of others as well as their own. Furthermore, they are able to comment on past experiences, either their own or those pertaining to others. Bretherton and Beeghly (1982) have also suggested that children learn to speak of their own mental states before they can label those of others, but that the lag is relatively small.

1.5.2 ONE TO THREE YEARS

It has been proposed that there are two developmental levels to children's knowledge concerning visual-perceptual acts and experiences that are directly relevant to the child's developing theory of mind. At Level 2, a child is able to represent the fact that an object can appear different to a person when viewed from a different position. At Level 1, the child is not able to represent a different perspective of an object, but only whether a person can see the whole object or not. Thus, Masangkay et al. (1974) claimed that many of the two- to three-year-olds that they tested were able to infer what object another person saw from a position different from their own, provided they were given strong cues. However, it was only the four- to five-year-olds who could correctly infer how an object looked from another's position.

Nevertheless, it was Lempers, Flavell and Flavell (1977) who investigated the early development of Level 1 type knowledge in one- to three-year-olds. A series of simple tasks were administered to children aged between one and three years in their homes. Most of these tasks involved showing and hiding objects under a variety of conditions. Children were required to infer what another person was looking at from the orientation of the eyes and/or head, to point to these objects and to look at what the person pointed to. Lempers et al. (1977) found that children aged 1 year could both produce and comprehend pointing, but did

little else. At 1½ years, children will show a picture by holding it flat so that both they and the other person can see it. This is considered to be a form of showing that is not purely egocentric and Lempers et al. (1977) made the observation that purely egocentric showing was almost completely absent from their data. At 2 years, children understand that what you see depends on where you are situated. However, it was only the children aged 3 that were at ceiling on all tasks. The ability to hide an object appears to be beyond the capability of young children and is not well established until the age of 3 years, even though the role of the eyes in seeing are understood by children aged 2 to 2½. On this basis, it would appear that young children are unlikely to understand deception except in terms of sabotage as proposed by Sodian (1991), an idea that was described in section 1.3.2.

Further support for this position has come from Wellman and Wooley (1990), who claimed that 3 years is the earliest age at which children can reason about beliefs. Until they reach this age, children understand action in terms of simple desires only. A simple desire psychology attributes a person with certain internal desires, gathers information about the external world while generating inferences about how actions in the world are the consequence of these desires. While such a framework has a certain explanatory potential, it is weaker than a belief-desire psychology, which posits a belief as a representational mental state interacting with, but essentially independent of desire.

Wellman and Wooley (1990) explored these ideas by testing 16 children between the ages of 31 and 37 months on their ability to make judgements about the actions and emotional reactions of small cardboard characters in various kinds of situations. The data indicated a performance average of 81% on both types of tasks, thus demonstrating that two-year-olds

can correctly predict the actions and emotional reactions of a character if they know its desires. Two-year-olds appreciated that desires were internal psychological states and judged a character's actions and reactions as object-specific (that is, as a desire rather than a drive). In a second experiment, Wellman and Wooley (1990) tested the reasoning abilities of 20 children aged between 33 and 39 months on both desire and belief reasoning tasks. On average, the children scored at chance on the belief reasoning tasks (61%), compared to the desire reasoning tasks (91%). Wellman and Wooley (1990) suggested that the data were consistent with their hypothesis that desire reasoning precedes the acquisition of a belief-desire psychology, and that the latter develops out of a naive psychology of desire.

1.5.3 THREE TO FOUR YEARS

Although three-year-olds show considerable difficulties in understanding the nature of representations, they are able to remember their previous pretend actions and perceptions, as well as being able to distinguish between real and mental entities. By the age of four, their understanding of representational processes has matured and they show themselves capable of belief-desire reasoning. These conclusions are drawn from three key studies, which we now proceed to review.

In a series of 3 experiments, Wellman and Estes (1986) tested the ability of 3 to 5-year-olds to make a distinction between real and mental entities. In their first study, 36 children aged between 39 and 71 months were asked to distinguish real versus mental entities according to 3 criteria. First, would the children understand that real entities, in contrast to mental entities, afford **behavioural-sensory contact**? Real entities also have a **public existence** that mental entities lack. The third crierion was **consistent existence**: mental phenomena, such

as dreams, do not exist over time in the way that everyday objects do. The children were also tested for their understanding of the words to **think**, **remember**, **pretend** and to **dream**. Although the number of correct judgements did increase with age, all age groups performed above chance (72% correct responses for the 3-year-olds, 86% for the 4-year-olds and 92% for the 5-year-olds, with chance at 50%). These findings demonstrated that even the youngest children did not mistakenly attribute real properties or status to mental entities. However, Wellman and Estes (1986) were initially concerned that the children's performance was either an artifact of the experimental situation or could be explained by some response strategy that the children were adopting. In particular, there was the serious possibility that children made sense of mental statements containing verbs such as to **think** or to **dream** as specifying only the absence of the real physical object. Wellman and Estes (1986) attempted to control for this possibility in their second study, and found an improved performance by all age groups. On average, the children scored 93% correct responses to all questions, with no effects of age. The third study aimed to determine whether young children can appreciate that mental entities can be about physically impossible, non-existent things (e.g. a dog that flies). In this final study, all age groups gave near-perfect scores (99%). The data presented by Wellman and Estes (1986), and more recently by Watson, Gelman and Wellman (1998), challenge Piaget's (1926a, 1926b, 1929) description of young children as animists and realists. Even the youngest children demonstrated that they were able to reason differently and appropriately about real and mental entities in their explanations, as well as accurately categorizing entities according to the criteria given above.

Wellman and Bartsch (1988) presented 3 studies of children's understanding of belief that demonstrated that 3-year-olds understand belief as internal states separate from but joined to

desires in a belief-desire system of reasoning. In their first experiment, Wellman and Bartsch (1988) tested 16 4-year-olds (the range was 4:2 to 5:0 with a median of 4:8) on their ability to understand surprise and happiness. The subjects were presented with a series of stories and asked for each one whether the protagonist would experience surprise or happiness given a certain outcome. The data indicated that the children were able to link happiness with desire (getting what you want), while surprise was linked to belief (unexpected outcome). However, in the stories where the protagonist thought that something would occur but did not desire it, the non-occurence of that event should have yielded surprise without happiness. However, subjects rated such stories as yielding happiness as well as surprise. This would indicate that the 4-year-olds did not fully appreciate the distinction between desires and beliefs. Wellman and Bartsch (1988) therefore devised an alternative form of the experiment in which each child was told stories that depicted a character's desire and belief. These stories formed 4 kinds of tasks. There were stories in which (1) the character's belief was explicitly mentioned (standard belief task), (2) the character's belief that an object was **not** in one location was clearly mentioned (not belief task), (3) the child's belief was first solicited, then the character was attributed as having the opposite belief (not own belief task) and finally (4) the character was seen to have an initial belief which changed to its opposite (changed belief task). Sixteen 3-year-olds were tested (3:5 to 3:11, M = 3:9), as well as 16 4-year-olds (4:1 to 4:9, M = 4:5). The researchers reasoned that a correct performance on any one task does not convincingly demonstrate belief-desire reasoning. That is, the individual tasks admit of alternative interpretations. But both groups of children performed well on all tasks, with the 3- and 4-year-olds averaging 85% and 89% correct responses respectively.

Nevertheless, Wellman and Bartsch (1988) admitted the possibility that their belief-desire

tasks could allow children to respond correctly without understanding belief. This would certainly be the case if a child were to use a **reality assessment strategy**. This strategy would involve translating belief statements into reality statements. For example, the statement "Sam believes his dog is in the garage" would become "Sam's dog is in the garage". The child would then reason as follows: "Sam wants his dog, it's in the garage, so Sam will look in the garage". This strategy would ensure a considerable measure of success on standard belief tasks. A third experiment was therefore carried out in which 3-, 4- and 4½-year-olds were tested for their understanding of false belief on a series of tasks. A primary finding was that, despite the ability of all age groups to demonstrate belief-desire reasoning skills, it was only the 4½-year-olds that performed above chance on the tasks where the protagonist's false belief was made explicit (86% correct responses, with chance at 50%). The 3- and 4-year-olds scored 16% and 31% correct responses respectively on the explicit false belief tasks. However, it should be pointed out that one should be careful not to confound assertions of chance at the group level. Thus, in the case of a single child who is tested over a series of false belief tasks and is found to perform at chance across tasks, it would be justified to conclude that the child has little understanding of false belief. But in the case of a group of young children who perform at chance on one or even several such tasks, it cannot be reliably concluded that young children do not therefore understand the concept of false belief. It may still be the case that some of these children will be found to have an understanding of false belief.

Gopnik and Slaughter (1991) investigated young children's ability to remember and report other types of past mental states over two experiments. In the first experiment, 22 3-year-olds and 21 4-year-olds were presented with an array of seven mental state tasks. The format

was as follows: a mental state was induced in the child, the mental state was changed, and then the child was asked to recall their past mental state. There was a **false belief** task as well as a **pretend** task, in which children were asked to recall their original pretend actions. There were also a **surprise** task, designed to induce a change in the child's emotions; a level 1 **perception** task; a **desire** task in which a child's formulated desire was satiated and therefore made to change; a **hunger** task and an **intention** task. The results of the surprise task could not be analyzed because children continued to say they were surprised when it was clear that they were not. Overall, there was a main effect for age, although all children performed perfectly on the pretend task. In contrast, only 38.9% passed the false belief task. Both groups of children also found the perception task easy, with their performance near ceiling. Performance on the perception task was not significantly different from performance on the pretence task, but it was found to be better than performance on the belief, intention and desire tasks. These results suggested a three-stage sequence in children's understanding of past mental states. Three-year-olds have little difficulty in reporting their own previous pretend actions or perceptions. However, they have some difficulty in reporting desires and intentions and considerable difficulties in reporting their own previous false belief.

One of the criticisms that can be levelled at this experiment concerns the pretend task. Since children did different things in two pretend situations, it was possible the children were not reporting their past mental state but simply remembering their past action. Moreover, the original pretend stimulus could still be seen by the child at the time of the test question. Gopnik and Slaughter (1991) therefore carried out a second study with a new **pretend** task that controlled for these weaknesses. They also added a mental **image** task and a level 2 **perception** task. Children's understanding of **surprise** was tested using a new set of

materials. Finally, as in the first experiment, children were tested for their understanding of **desire** and **false belief**. The results were similar to the first study. There was a main effect for age, with the older children performing significantly better overall, although all children performed near ceiling on both the pretend and image tasks. An unexpected finding was that 75% of the 3-year-olds passed the level 2 perception task, a result which was significantly different from their performance on the pretend task. In contrast, 3-year-olds once again showed considerable difficulty in understanding false belief.

The results of the second experiment thus supported the findings of the first study. Taken as a whole, these findings support the idea that 3-year-olds have difficulty in understanding representational processes. This would explain their poor performance on the false belief task. It would also explain their good performance on the pretend, image and level 1 perception tasks, as these tasks do not necessarily rely on understanding how representations are related to reality. Finally, these findings are in accord with those of Zaitchik (1990), to be reviewed in chapter three, who has argued that the difficulty that 3-year-olds experience in attributing a false belief to a deceived actor may not be specific to a child's theory of mind but may also appear in a child's reasoning about nonmental representations.

1.5.4 FOUR TO SIX YEARS

In this section we review those studies which suggest that by the age of five, children can both identify the source of their beliefs and remember those sources later. At that age, children are also beginning to understand the emotion of surprise and by age six are proficient at making surprise attributions, as well as understanding that beliefs determine emotions. There are three key studies to consider (Gopnik and Graf, 1988; O'Neill and

Gopnik, 1991; Hadwin and Perner, 1991) and which will be described in detail.

Gopnik and Graf (1988) tested the ability of 3-, 4- and 5-year-olds to identify the sources of their own beliefs as well as their ability to remember these sources at a slightly later time. Of a total of 59 children, 30 children were tested on the target task in which they were shown six drawers. All children were then given information about the contents of these drawers in each of three ways: they were either shown the contents, or told about the contents or were given a clue. The remaining 29 children received a training session before the target task. All children were tested in a delayed condition, to determine whether they could remember the source of their information. The results indicated a significant effect of age, with performance increasing across the age groups. The training session had no effect on the results, but an interaction of source and age showed that although 3-year-olds made errors on all types of sources, they made more errors when they were told about the objects than when they were shown the objects or given a clue. From the results of the delayed condition, it was found that even when 3-year-olds correctly identified the source of their information, nearly half of these children did not remember the source later. In contrast, when 5-year-olds correctly identified the source of their knowledge, they almost infallibly remembered the source. The results suggest that 3-year-olds have difficulty in both identifying the sources of their beliefs, as well as remembering the source of their knowledge. The almost perfect performance of the 5-year-olds supports the hypothesis that children learn about the causal links between world and mind between the ages of 3 and 5.

O'Neill and Gopnik (1991) have criticised Gopnik and Graf's (1988) findings on two counts. First, one of Gopnik and Graf's (1988) questions involved inference, which may have been

potentially confusing when contrasting inferences with other types of sources of knowledge. It is possible if that condition had been removed that young children might have been able to identify the sources that led to a belief. Second, the forced-choiced options were not counterbalanced, with the inference option always being presented last. O'Neill and Gopnik (1991) therefore carried out a series of three experiments to improve on these methodological weaknesses of the previous study.

In their first experiment, the researchers sought to investigate young children's understanding of the source of their beliefs, without using an inference condition which might be potentially confusing. The three types of sources chosen were **seeing**, **telling** and **feeling**. Overall, the 3-year-olds answered only 41.7% of the experimental questions correctly, in contrast to the 4- and 5-year-olds who obtained almost perfect scores. There were no significant differences between 4- and 5-year-olds, but 4-year-olds performed significantly better than 3-year-olds, who did equally poorly on all three conditions. This study, therefore, supported the original findings of Gopnik and Graf (1988).

Nevertheless, the problem of how to understand these findings still remained. O'Neill and Gopnik (1991) suggested that there were three steps involved in identifying a source of knowledge with a particular belief. First, an event in the world needs to be identified. Second, the event would need to be remembered. Finally, the memory of that event would have to be related to a later belief. O'Neill and Gopnik's (1991) second study included questions that would clearly determine the exact difficulty that children were experiencing in identifying the source of their beliefs. The results indicated that the problem stemmed from the last of these steps: that young children appear to be unable to relate their

experiences to a later belief.

The third of the studies carried out by O'Neill and Gopnik (1991) was designed to test the question of whether identifying inference as a source of knowledge is more difficult for young children than identifying other sources of information. Of five possible types of questions, it was discovered that children's performance on the see/infer condition (60.4% correct) was overall significantly worse than in the remaining four conditions. The children were correct on 76%, 85.2%, 88.5% and 88.5% of the feel/infer, tell/feel, see/tell and see/feel questions respectively. Four-year-olds also experienced difficulties on the see/infer questions, although their performance was significantly better than the 3-year-olds. The results of these studies are in agreement with the findings of Gopnik and Graf (1988), as well as with Wimmer, Hogrefe and Perner (1988), which suggest that young children have difficulty in identifying the sources of their belief. Furthermore, the results suggest that young children have particular difficulty in identifying inference as a source of knowledge, at least until the age of 5 years.

In addition to studies that have explored children's abilities to identify the source of their beliefs, an early study by Yuill (1984) showed that children at age three begin to understand that being pleased is a function of the match or mismatch between desire and reality. This idea was further explored by Hadwin and Perner (1991) in a series of four experiments. In the first experiment, 32 3-year-olds and 32 4-year-olds were given test stories in two conditions. In the pleased condition, a protagonist threw a ball over a wall. On the other side were two other characters. The protagonist was indicated as having a clear desire for the ball to caught by one of the characters and not the other. Children were required to show whether

the protagonist would be pleased or not pleased according to who caught the ball. They could do this by answering verbally or by pointing to a schematic face. In the surprise condition, the story consisted of a truly surprising event: a boy goes to collect eggs from his goose and either finds eggs or finds that the goose has laid an apple. Children were required to predict whether the protagonist would be surprised or not surprised by the event.

While both groups of children correctly predicted in the pleased condition, neither of the groups showed any reliable understanding of surprise. Hadwin and Perner (1991) argued that since 4-year-olds as a rule demonstrate a good understanding of belief, their difficulty with the emotion of surprise could not be attributed to a poor understanding of belief. One possibility would be that children do not as a rule understand the word 'surprise' to indicate a reaction to an unexpected event, but that the word has some other meaning to them. To account for this possibility Hadwin and Perner (1991) carried out a second experiment which relied solely on pictures of the facial expression of surprise, so that children did not have to use the word. Forty-eight children consisting of 5-, 6- and 7-year-olds were tested and results indicated that it is only by age 6 that children are able to make correct surprise attributions.

Since the study by Wellman and Bartsch (1988) indicated that even 4-year-olds could make reliable surprise judgements on the basis of the belief reality discrepancy, the differences between these studies need to be highlighted. Since Wellman and Bartsch (1988) used warm-up stories and gave their subjects feedback about how the protagonist would feel, it is possible that their subjects were **taught** about surprise. Thus, in their third experiment, Hadwin and Perner (1991) examined the possible effects of teaching on children's understanding of surprise. They found that there was an effect of teaching for the 5- and 6-

year-olds. With teaching, all of the 5- and 6-year-olds gave perfect answers, whereas without teaching, their performance was at chance level. These results indicate that there is a clear lag between understanding belief, which emerges at about age 4, and understanding its emotional consequences as regards surprise, which is not in place until about age six.

In a fourth experiment, Hadwin and Perner (1991) explored the possibility that this particular lag is the result of a more general problem. That is, that there is a developmental lag between understanding belief and understanding that emotions depend upon belief. To test this hypothesis, Hadwin and Perner (1991) looked at two other belief-dependent emotions that are understood early in life: happiness and sadness. They then tested 4-, 5- and 6-year-olds on their understanding of beliefs and their consequences for the emotions of happiness, sadness and surprise, using a misleading container paradigm. The researchers reported a large, statistically reliable gap between understanding belief and making belief-based attributions of emotions. These results suggest that children experience a general problem of understanding that belief determines emotions until they reach age five or six.

These studies demonstrate that even when young children show an understanding of false belief, there are other aspects of an understanding of mind that do not develop until later (Chandler and Helm, 1984; Taylor, 1988; Moore, Bryant and Furrow, 1989). This raises the question whether theory of mind ability continues to develop in later life.

1.5.5 THEORY OF MIND IN LATER YEARS

The ability to attribute mental states to self and others has been little explored in adulthood. One of the first studies of theory of mind in adults was carried out by Mitchell, Robinson,

Isaacs and Nye (1996), who investigated the possibility of a realist bias in adults' reasoning about false beliefs. In their first of two experiments, Mitchell et al. (1996) tested three groups. The first group consisted of 118 adults aged around 17 years; the second group consisted of 60 8- to 9-year-olds (mean = 8;9); while the third group was formed of 98 children aged between four to six years (mean = 5;9). Subjects in all age groups were shown two scenarios, one presented as a story supported by cartoon pictures, the other was a video. All scenarios were presented in one of three conditions. In the No belief, False message (NBFM) condition subjects were asked to judge whether a listener who had no prior belief would believe a false message. In the True belief, False message (TBFM) condition subjects were asked whether a listener protagonist who held a true belief about a situation (having seen the actual state of affairs) would believe a false message. Finally, in the False belief, True message (FBTM) condition subjects were again asked to judge whether a listener protagonist who held a false belief on the basis of seeing a previous state of affairs, would believe a true message.

The results indicated that all groups judged that the listener in the NBFM condition would believe a false message. The results also showed that both groups of children were significantly less likely to judge that a message would be believed in the TBFM than in NBFM condition. They were also significantly less likely to accept that an utterance would be believed in the FBTM than in the NBFM condition. This pattern of responding was also found among the adult group, except that a significant difference was found between TBFM and FBTM. That is, adults tended to judge that a listener protagonist who held a true belief was likely to ignore a false message (TBFM), but surprisingly, these subjects were more likely to judge that a listener protagonist would believe a true message even when they held

a false belief (FBTM). It was concluded from this that adult subjects' knowledge about the truth-value of a message that contradicted a protagonist's belief contaminated their judgements of whether the message would be believed or not.

Mitchell et al.'s (1996) second experiment tested 73 adults aged between 16 and 17 years on their ability to reason about the false belief of a listener protagonist. In this second study, subjects were randomly assigned to one of two conditions. In the video only condition, subjects were shown a video depicting two actors. The first actor ('Kevin') was shown to be in the kitchen looking into a jug, where he saw orange juice. Soon after, a second actor ('Rebecca') appeared and announced to Kevin that there was milk in the jug. Subjects in the additional information condition were shown exactly the same scenario, but were furthermore told that Rebecca had indeed filled the jug with milk before telling Kevin. In this way, subjects in the two conditions derived quite different beliefs about the true contents of the jug.

The essential point, however, was that the information made available to the listener protagonist (Kevin) was the same in both conditions. Thus, should subjects' judgements about the listener's belief vary across conditions, this could be interpreted as evidence that their reasoning about the listener's belief was contaminated by their knowledge of the true state of affairs. The results showed that subjects in the video only condition judged that Kevin would believe what he had seen and would discount Rebecca's comment about the contents of the jug. In contrast, in the additional information condition nearly half of the subjects judged that the listener protagonist would believe Rebecca's statement about the contents of the jug. Thus, subjects' knowledge about the true state of affairs contaminated their reasoning

about false belief. Mitchell et al. (1996) concluded that both studies indicated an instance of a realist bias in adults which was not present in children's reasoning about false beliefs.

More recently, Happé, Winner and Brownell (1998) have presented findings that suggest that theory of mind ability is preserved and may even be superior in normal old age. These researchers examined the abilities of 19 healthy elderly individuals (mean age = 73, range = 61 to 80 years) to answer questions on three kinds of texts: theory of mind stories, control stories and jumbled texts. Their performance was compared with two samples of young normal participants. The larger sample consisted of 52 young adults with ages ranging from 16 to 30 years (mean = 21). The smaller sample consisted of 15 U.S. participants with ages ranging from 21 to 30 years (mean = 22 years 6 months).

The theory of mind stories concerned deceptive acts, mistakes and persuasive interactions. Subjects were asked questions which required making inferences about the characters' thoughts and feelings. The only inferences which were required on the control stories concerned physical causation, while the jumbled passages required no inferencing of any kind. The jumbled passages contained no unifying story or theme, but questions pertaining to these texts tested subjects' memory.

The results indicated a significant interaction between age and story type, with the elderly group scoring more highly than the younger groups on the theory of mind stories, but not on the control stories. Since measures of subjects' IQ were not gathered, it is not possible to rule out the possibility that higher general intelligence in the elderly group was responsible for their superior performance on the theory of mind tasks. However, this explanation seems

an unlikely one given that there were no significant differences between groups on the control stories. These findings give support to a previous study by Hashtroudi, Johnson and Chrosniak (1990), who reported that a sample of elderly participants were better at remembering and reporting their thoughts and feelings than a sample of younger participants in relation to both real and imagined events.

1.6 SUMMARY AND CONCLUSIONS

This chapter began by examining the empirical evidence gathered from recent research on the young child's understanding of mental life. A review of naturalistic studies of children's understanding of intentions and other psychological states of mind suggested that young children's understanding of mind is closely linked to their understanding of social relationships. Thus, from early in life young children attempt to alter the psychological state of another, make verbal references to mental states, engage in deceptive behaviour and social pretence. However, the shortcomings in the naturalistic method of gathering data were noted and discussed.

This was followed by a review of the experimental evidence for children's understanding of false belief and deception, as well as the empirical work relating to the hypothesis that young children do not understand representational change. The adoption of the false belief paradigm by many developmentalists has led, until very recently, to the general conclusion that 3-year-olds do not on the whole understand deception in representational terms, although there is good evidence that they have a pragmatic understanding of it. However, a review of the most recent studies shows that there is a growing body of evidence that standard tests of false belief have underestimated young children's understanding of mind in the context of

deception.

We then considered other aspects of young children's understanding of mind from infancy onwards. The relevant research suggests that the capacity for shared reference, social play and intentional communication all emerge in the first year of life. By the end of the second year, children show some knowledge of internal state language. At that age children also exhibit the ability to reason about desires and later, about beliefs. While 3-year-olds have little difficulty in reporting their own pretend actions and perceptions, they have considerable difficulties in reporting their own previous false belief and in understanding representational processes.

In contrast, 4-year-olds show a clear ability to reason about beliefs, to report their own previous false belief and to understand that what one knows depends upon what one sees. By age five, children can identify the sources of their own beliefs and by age six they can understand that beliefs determine emotions. Finally, there is some evidence to suggest that theory of mind abilities continue to develop in adulthood.

This chapter thus completes the review of the literature that is relevant to the present thesis and provides us with a provisional outline of children's understanding of mind. Our next step will be to critically examine the key theoretical frameworks that have been developed to explain the empirical findings considered thus far. It will be argued that these major theories on young children's understanding of mind raise important philosophical questions that need to be discussed and it is to this purpose that we turn to our next chapter.

CHAPTER TWO

THEORIES OF MIND: A PHILOSOPHICAL CRITIQUE

2.1 INTRODUCTION

In chapter one we reviewed the recent research literature on young children's understanding of mind. In the present chapter we critically examine the methodological approaches to theory of mind research, as well as four major theoretical accounts of children's understanding of mind: the theory-theory, Hobson's (1991, 1993) theory of persons, the simulation hypothesis and the modularity approach to mind. It will be suggested that while the naturalistic approach to theory of mind research has not provided us with a clear criterion of what constitutes a mental phenomenon, the experimental approach has been constrained by its adoption of the false belief paradigm. Two philosophical perspectives to the study of mind will then be presented and the philosophical 'problem of other minds' described. One possible solution to this philosophical problem will be proposed which in turn will reveal and clarify the assumptions underlying the present research. The four psychological accounts of children's understanding of mind will then be reviewed according to these philosophical principles.

One may well question the value of adopting a philosophical perspective to the study of mind, given that the role of philosophy in psychology and the cognitive sciences has remained controversial. There are scientists who readily agree that an understanding of the classical problems of epistemology is both desirable and necessary to psychology (Putnam, 1975). Then, there are those who deem all philosophical projects as irrelevant or even

damaging to the efforts of a scientific psychology (Rorty, 1979). This thesis will immediately claim a position in this controversy by stating that philosophy is crucial to psychology in two ways. First, philosophy formulates sets of questions that are worthy of study. Second, there is a dialectic between the analysis put forth by philosophers and the empirical findings of psychology; a dialectic which is mutually enriching, as we have witnessed since the invention of the computer and the birth of cognitive science.

However, this is not to claim that the traditional questions of philosophy are essentially more important than those of psychology. Indeed, psychology formulates independent research projects. The point is that philosophy challenges psychology by its own research programs, its own general hypotheses, which psychology can only ignore at risk to its own development. Since this thesis concentrates on that particular area of research in developmental psychology known as **children's theories of mind**, the claim will be that for progress to be made in this field, developmentalists need to understand the dialectical relation between their empirical findings and the questions posed by the philosophy of mind. This idea will now be developed, beginning with a look at the way in which the philosopher's search for a criterion of mental phenomena elucidates the nature of psychological theories of mind.

2.2 SEARCHING FOR A CRITERION FOR MENTAL PHENOMENA

The question 'What is the nature of the mind?' is one that could be posed by either a psychologist or philosopher. But where the psychologist may confine the investigation to the human mind, it is a characteristic of philosophy that it seeks generality. A theory of mental phenomena should also apply to the minds of other animals. This may appear a trivial point,

but if the intended generality of the question is kept in mind, we will be less likely to accept an account of mental phenomena which will only explain the behaviour of one particular creature. Furthermore, it acts as a reminder to the developmentalist that there are important contributions to the field from other disciplines such as primate psychology (Premack and Woodruff, 1978; Byrne and Whiten, 1991; Cheney and Seyfarth, 1990) and artificial intelligence (Schultz, 1991).

The philosopher would also remind us that we should not be too quick to assume that the mind is a unified domain; that there is a single and clear criterion of what is a mental phenomenon. Now this is a much more important point, which will be returned to later when discussing the young child's understanding of representations. It will suffice for now if it can be clear what distinguishes the concerns of the philosophy of mind from those of psychology. The philosopher could be described as seeking to elucidate what is **essential** to all mental phenomena; that is, the necessary and sufficient conditions for a phenomenon to be termed 'mental'. The psychologist, on the other hand, will be concerned with the actual workings of a particular creature's mind.

When we examine the empirical evidence and explanatory theories put forward by psychologists on the child's understanding of mental life, we will find that researchers broadly fall into two groups. First, there are the naturalistic studies that have provided important observations of children's understanding of their social relationships. In chapter one of this thesis it was pointed out that these studies have been criticised on two accounts. First, there is the difficulty of making inferences about children's understanding of mind from their behaviour. Second, there is no way to ensure that the behaviours one is observing

are a representative sample of children's abilities. To these criticisms, it is now possible to add a third. Naturalistic studies of young children's understanding of mind do not provide us with an overview of what a theory of mind should look like. It is possible that this may be a consequence of the lack of an adequate set of criteria among naturalistic researchers of what constitutes a mental phenomenon.

The second group of researchers into children's theories of mind consists of those developmentalists who have used set tasks in carefully controlled situations in an attempt to overcome the limitations of the naturalistic approach. Premack and Woodruff (1978) were the first experimental researchers to speculate about theory of mind and proposed a definition which was important enough to quote in full in chapter one. In the ensuing debate that was generated by the Premack and Woodruff (1978) claims, the philosophers Bennett (1978), Dennett (1978) and Harman (1978) proposed a basic experimental paradigm that would fully demonstrate that someone possesses a theory of mind. In this paradigm, an individual is required to attribute a false belief to another. The reason for this is that to be certain that a child is able to attribute a belief to another, one must demonstrate that they are not simply assuming that the other person is sharing their own beliefs. Both the Premack and Woodruff (1978) definition of theory of mind as a system of inferences and the philosophers' paradigm have been widely adopted by developmentalists since the original false-belief task by Wimmer and Perner (1983).

Nevertheless, it is one of the assumptions underlying this research that the possession of a theory of mind cannot be identified with the child's successful performance on the Wimmer and Perner (1983) false-belief task/paradigm. While naturalistic studies have erred on the side

of not providing us with a clear criterion of what constitues a mental phenomenon, experimental studies since Wimmer and Perner (1983) have gone to the other extreme of defining theory of mind in an altogether rigid form. It is suggested that the Wimmer and Perner (1983) paradigm is also unable to provide us with an overview of what constitutes mental phenomena because it assumes that there is a single theory of mind that emerges at some point in the child's development. It also makes the assumption that before the acquisition of a theory of mind, the child is a behaviourist. In fact, it is very unlikely that there is ever a time in the child's development in which she is a behaviourist. Infants have been shown to demonstrate an ability to coordinate their actions with those of others in very sensitive ways almost since birth (Meltzoff and Gopnik, 1993). Infants also appear to have an understanding, albeit vague, of internal psychological states as evidenced in studies of infants' early interaction with faces.

2.3 TWO PHILOSOPHICAL PERSPECTIVES ON THE STUDY OF MIND

Returning once again to the philosophy of mind, we discover that the elucidation of mental concepts involves us in a special difficulty. The condition by which a phenomenon is deemed to be 'mental' can be given one of two ascriptions. We can refer to a mental concept either in its first- or third-person ascription. It would then appear, on a superficial analysis, that to find some unity in our mental concepts we would need to regard one perspective as better revealing the true nature of mental phenomena. Historically, views of the mind can be classified according to which perspective has been given preference. Cartesianism, for example, would claim that the essence of mind can only be revealed from the perspective of the subject. In contrast, phenomenology's claim has been that it is the world that reveals the mind to the self.

Before exploring one possible solution to this philosophical problem, let us examine the way in which psychology is presented with a similar dilemma. It would seem that researchers into children's theories of mind can also be classified accordingly. There are researchers in this field who approach the problem from the first-person perspective, such as Leslie (1987), Harris (1991) and Fodor (1992). Then, there are those developmentalists who give primacy to the third-person perspective, such as Piaget (1929), Vygotsky (1978) and Gopnik (1993). The first group of researchers begin from the premiss that a child first understands their own mind before discovering that others have a mind. The second group propose that it is at the social level that the child discovers the concept of mind and that subsequently the concept is applied to the self.

It is suggested that it is the second group of researchers who are in a better position to answer the question of how a child develops a theory of mind. The first reason for this is that there is evidence to indicate that young children have greater difficulty in understanding representational change than in understanding false beliefs (Gopnik and Astington, 1988). That is, young children find it more difficult to remember their own changing beliefs, than to attribute a false belief to another. The second reason derives from a philosophical analysis of the first-person perspective approach to the theory of mind (Merleau-Ponty, 1962, 1964a, 1964b). It is on the basis of this analysis that it will be argued that the first group of researchers have posed the 'problem of other minds' in terms that make it impossible to resolve. The argument for this now follows.

If I am aware of my own mind before I discover the mind of another, it can only be because my mind is given to me in a way that other minds are not. While my own thoughts are

transparent to me, those of another person are radically inaccessible. If the other does not communicate their mental state to me, I can only discover it indirectly, mediated by bodily appearances. The totality of the other's gestures and facial expressions present themselves to me to be decoded. Posed in this way, the problem would have four terms: (1) the set of mental states that I am experiencing; (2) the image and experience I have of my body; (3) the body of the other as seen by me and (4) the set of mental states of the other, which I can infer.

The problem of the experience of others posed in its four terms and described from the first-person perspective, would apparently be solved by means of projection and/or analogy. This is illustrated by the following quotes:

> The argument is that empathy is based on identifying (an)other's inner state as an emotion they are familiar with from their own inner experience of being distressed. Empathic reactions are possible because infants **project** that familiar state as a theoretical construct onto the other person for understanding what goes on in the other. (Perner, 1991).

> ...an infant's capacity to see other creatures who have the potential to adopt an emotional stance - of curiosity, interest or anxiety - towards an object, just as they themselves do...does not depend upon a perceptual mechanism but on an ability to simulate or imagine the emotional state of another person by **analogy** with the state of the self. (Harris, 1989).

The solution to the 'problem of other minds', when presented in its first-person perspective as just described, faces an immediate difficulty. Given that the perception and experience a child has of his own body is completely unlike what he perceives and experiences of that of another person, by what means is a point-for-point correspondence to be made between the two bodies? Given that a child is sensitive to facial expressions from very early in life, e.g. a smile, how could this sensitivity be possible if it had to engage in the complicated task of mapping its own bodily experience of a smile with the visual smile of another? At first, it might seem that the third-person perspective would encounter the same difficulty as the first-person perspective, given that there is no one-to-one correspondence between the experience of the other's body and one's own. But what needs to be remembered is that the experience of mind that one encounters at the social level is so much richer and more varied than that which could be discovered through introspection. In any case, the ability to introspect may well depend on an already developed concept of the self.

In the past, philosophers have concluded that if we want to solve the problem of the transfer of the other's conduct to the self, we can in no way rely on the supposed analogy between the other's body and that of the child. Merleau-Ponty (1964a, 1964b) has claimed that the problem:

> ... comes close to being solved only on condition that certain classical prejudices are renounced. We must abandon the fundamental prejudice according to which the pyche is that which is accessible to myself and cannot be seen from outside. My "psyche" is not a series of "states of consciousness" that are rigorously closed in on themselves and inaccessible to anyone but

> me... We must reject that prejudice which makes 'inner realities' out of love, hate, or anger, leaving them accesible to one single witness: the person who feels them. Anger, shame, hate and love are not psychic facts hidden at the bottom of another's consciousness. They are... visible from the outside. They exist **on** this face or **in** those gestures, not hidden behind them. (Merleau-Ponty, 1964a).

The view that the mind is the 'other side of the body', that is, that all psychological states are to find their reference point directly in the body will referred to as the **open view** of the mind from here on. However, it is suggested that Merleau-Ponty's philosophical solution to the 'problem of other minds' is insufficient as a full psychological account of mind because it cannot explain the phenomena of deception. On the other hand, an account of the mind that relies exclusively on a system of inferences ignores that there are aspects of mind that are directly observable. It also fails to consider what is known about very young children (2-year-olds), namely, that they already have some understanding of desires and perceptions (Wellman and Woolley, 1990).

2.4 THE THEORY-THEORY

It is proposed that only if we accept that there are aspects of mind that are directly observable **and** that there are aspects of mind that need to be inferred do we come close to a solution to the philosophical problem posed above. Thus, it could be argued that instead of a single theory of mind acquired by the child at some point in his development, there are a series of views of mind that the child needs to acquire, beginning with an open view and later culminating in an understanding of false beliefs and deception. Stated in another way,

there is a series of gradual transitions, whereby an early theory of mind is continually enriched and revised through experience. This is consistent with the third-person perspective outlined above; that is, with the idea that the concept of mind is discovered at the social level.

One could construe the child's developing understanding of mind as involving two basic positions. The first account of mind has already been described above and referred to as the **open view** of the mind. This view would include conceptions of mental states such as desires and perceptions, as well as a nonrepresentational account of beliefs. Later, the child comes to understand that there are aspects of mind that are not directly observable and that need to be both represented and inferred. What the child discovers is that there are mental states that cannot be directly related to the body, because the body itself is capable of either misleading the observer or of witholding information. This discovery, which represents both an enrichment and a revision of the open view, will be termed the **closed view** of the mind from here on.

It is, of course, possible to subdivide each of these basic views into stages. For example, in the open view of the mind, children may learn about simple emotions such as surprise, before understanding desires and intentions (Gopnik and Slaughter, 1991). In the closed view, it may be that children learn to hide objects from another before they fully understand deception (Lempers, Flavell and Flavell, 1977). Thus, the idea that a child's theory of mind begins with an 'open view,' which needs to be revised through experience to accommodate a 'closed view', is consistent with the views of other developmentalists in the field. It is compatible with the 'representational hypothesis' put forward by Gopnik and Astington

(1988); with the views of Wellman and Woolley (1990) on the child's transition from a simple desire psychology to belief-desire reasoning; and it is consistent with Perner's 'representational model of the mind' (1991). In fact, the idea that young children hold a series of hypotheses about mind that are gradually enriched and modified according to experience forms the very basis of the developmental account of children's understanding of mind known as the **theory-theory**.

The proposal is also compatible with a suggestion from the philosophy of mind which was mentioned at the beginning of this chapter: that there may not be a single criterion of what constitutes a mental phenomenon. Finally, the proposal is able to reconcile the seemingly contradictory evidence on the young child's ability to deceive. Chandler, Fritz and Hala (1989), as well as Hala, Chandler and Fritz (1991) have provided evidence to suggest that children as young as 2½ are capable of utilising a range of deceptive behaviours. These findings are not predicted by current theoretical views on false belief representation and therefore need to be addressed. Consistent with the views that have been outlined so far, it would be predicted that very young children are indeed capable of deception, but only as part of a repertoire of deceptive strategies. In the open view stage, the child who engages in deceptive behaviours is intent on manipulating another's behaviour, but we would not expect them to aim to manipulate another person's mental representations. Such a view has been put forward by Sodian (1991) in her studies of sabotage and deception.

But the proposal that children's understanding of mind develops from an open to a closed view differs from other researchers in one important respect. Advocates of the theory-theory or the representational model of the mind hold that in a fully developed theory of mind

almost all psychological functioning is mediated by representations. That is, all mental phenomena would share the same fundamental structure, which some would describe in terms of propositional attitudes. There is also the assumption that the child's late revisions of theory of mind radically replace all previous naive theories. It is an assumption of this research that the closed view of the mind represents a special case, an addition to the open view which continues to function throughout adult life. Thus, it is suggested that the open view is primary and the closed view is constructed by the child in response to the phenomena of deception. Nevertheless, the point still remains that the basic idea of the theory-theory comes close to conforming to the philosophical principles outlined earlier in this chapter.

2.5 HOBSON'S THEORY OF PERSONS

It may appear that the open/closed view of the mind that is being proposed is compatible with Hobson's (1991, 1993) account of a theory of mind as primarily a theory of persons. Among the similarities between Hobson's (1990, 1991, 1993) theoretical stance and my own views is the appeal to the philosophy of mind, primarily Merleau-Ponty (1962, 1964a, 1964b). Furthermore, he stresses that there is a great deal about mental life that is directly observable. Nevertheless, there are differences between Hobson's position (1993) and the theoretical formulations of this thesis which need to be clarified before proceeding to describe two of the major alternative accounts of chidren's understanding of mind.

Hobson (1991) argues against the view that children develop a theory that other people have minds, as well as opposing the idea that children's understanding of mental states is in any way theory-like. He also takes issue with the proposal that a child's understanding of mind takes the form of a system of inferences. What kind of evidence, asks Hobson (1991), would

persuade us that others did not have minds? He suggests that there is no such kind of evidence. Every interaction that a child perceives in the world of human relations points to the mind. In this case, a system of inferences is largely unnecessary because, in Hobson's view (1991), it is not that mental states are per se unobservable, but just that some are more observable than others. Hobson's (1991) view parallels that of Merleau-Ponty (1964) given above, in that the mind is construed as essentially open and directly observable.

It is suggested that neither Merleau-Ponty (1962, 1964a, 1964b) nor Hobson (1991, 1993) have supplied us with a satisfactory theoretical account of children's understanding of false belief and the phenomena of deception. Hobson's (1993) latest theoretical formulation proposes that children first of all learn about 'modes of relatedness'. From these forms of relation, the child derives the concept of 'person', while children's concepts of 'mind' are in turn derived from their understanding of persons. Presumably, deception would be one of the modes of relatedness that the child learns about. Thus, one possible reading of Hobson's (1993) position would be that the concepts of 'person' and 'mind' themselves contain the concept of deception. Hobson's (1993) account would then predict that children should demonstrate an understanding of false belief and deception from early on in life. In support of this interpretation of Hobson's (1993) latest work, it is interesting to note that he argues that the concept of belief must contain within it the concepts of 'truth' and 'falsity'. Thus, in his view an understanding of beliefs generally would account for an understanding of false beliefs.

In contrast to Hobson's views, the present thesis assumes that young children learn about persons before they understand deception. Moreover, the prediction which follows from

Hobson's theory of persons, that children would show an understanding of false belief and deception from an early age, has generally not been supported by contemporary research as was previously discussed in chapter one. We therefore move on to consider two other alternative accounts of children's understanding of mind: the simulation hypothesis and the innate module theory.

2.6 THE SIMULATION HYPOTHESIS

Johnson (1988) and Harris (1991) have proposed that the ability to understand another person's mental state is dependent on our ability to run a working model in our own minds of that person's situation. By imagining the mental state that we would experience in that situation, we would then project that state onto that person. Clearly, this is a first-person perspective of mind, which has already been criticised above. Nevertheless, it would be of interest to examine some of the consequences of the simulation hypothesis relation to the general approach that is being developed here.

In the simulation account, the experience of one's own mind is direct and without inference. It would follow from this that it is impossible to be deceived about one's own mental state. In contrast, the view that children revise their understanding of mind allows for the possibility to make erroneous interpretations of one's own mental state. Furthermore, it is not at all clear what the consequence would be for further simulations if an incorrect mental state is attributed to the other person. The open/closed view hypothesis stipulates that it is precisely because of errors committed in the open view stage that the child constructs the closed view of mind. Furthermore, according to simulation hypothesis there is no reason why a particular mental state should be easier or harder to attribute than any other. For example,

beliefs and desires should be equally available to a child as states of his own mind and could therefore both be simulated with equal ease. The open/closed view hypothesis posits that some mental states are more difficult to understand than others and that this is why there can be more than one theory of mind. In this thesis, empirical findings will be presented which are not readily accounted for by this early version of the simulation hypothesis. However, the main criterion for not pursuing this particular line of thought at this point is that the simulation hypothesis does not conform to the philosophical guidelines already outlined: that there should be a clear but flexible set of criteria of mental phenomena, a preference for third-person descriptions of mind and a distinction between observable and non-observable states of mind.

Nevertheless, a more recent version of simulation theory, sometimes referred to as 'radical simulationism' has been advocated by Gordon (1996). According to Gordon (1996), simulation theory has clear advantages over other accounts of our understanding of mind because it is an example of a 'hot methodology'. That is, it is a system of making inferences about another person's mental state which simultaneously makes use of one's knowledge of motivational and emotional principles, as well as the capacity to reason in a practical form about human behaviours. The simulation theory, argues Gordon (1996), is also an account of how we make decisions in the role of another agent. It follows from this account of radical simulationism that competence in predicting the actions of another is less dependent on an understanding of mental states such as beliefs and desires, and more grounded in a practical understanding of persons.

Radical simulationism differs from earlier forms of the simulation hypothesis in that it does

not assume that an understanding of another person's mental state is necessarily grounded in an understanding of one's own mental states through similarity or analogy. Gordon (1995, 1996) has, in fact, argued against such a version of the simulation hypothesis. Instead, radical simulationism would contend that the ability to answer questions about mental states may be rooted in a procedure called an 'ascent routine'. In this procedure, a question about a mental state may be answered by first answering another related question given at a lower semantic level. For example, a person who is asked 'Do you believe that a single european currency is a good idea?' will first of all consider the question as 'Is the single european currency a good idea?'. If the answer that the person arrives at is 'no', they can then proceed to answer the original mental state question as 'No, I do not believe that having a single european currency is a good idea'.

What is radical about this particular form of the simulation approach is that it posits that an individual does not need to recognise their own mental state **as such** in order to engage in a simulation. Neither is it necessary that the simulator have an understanding of the appropriate mental state concept. However, in the final analysis, the use of ascent routines creates a logical space that enables an individual to think of facts or events as having a **mental location**, thus leading to an understanding of mind.

Heal (1996), however, has both defended the simulation approach and argued that there are limits to the understanding of mind that can achieved through simulation. According to Heal (1996), it is clear that we possess distinct knowledge about persons and their mental states, as well as the ability to assess the many influences acting on an individual's behaviour. However, this knowledge is generally of a practical kind and cannot be said to be strictly

theoretical in nature. Heal (1996) thus argues that simulation theory has an advantage over the theory-theory in that it better describes the kinds of processes at work in our everyday understanding of mind.

Nevertheless, it would appear, argues Heal (1996), that although the simulation approach is capable of explaining how we understand the content aspects of mind, it has considerable difficulties in accounting for the non-content aspects of mental states. Heal (1996) defines non-content as an aspect of a mental state which will differ from another mental state, but where the difference cannot be specified by a reference to the representational aspects of these mental states. An example given by Heal (1996) of a non-content aspect of mind is the phenomenon of craving. Craving can be considered to be different from desire, but the difference is not one that can be determined by the content aspect of these mental states. That craving and desire can be differentiated and are marked by distinct features, points to the non-content aspect of mental states. This dimension of our understanding of mental states has not, as yet, been developed by simulation theory, and has prompted some researchers to suggest that a fruitful way forward would be to consider an understanding of mind as involving both simulation and theory (Perner, 1996). This idea, that an understanding of mind involves both simulation and theory, would in principle conform to the philosophical arguments outlined in this chapter, but as this proposal has not as yet been fully developed, this line of inquiry will not be pursued in this thesis.

2.7 MODULARITY APPROACHES TO MIND

Another important rival hypothesis is that an understanding of mind is not constructed from evidence, but is the result of an innate module that has developed through evolution. Both

Fodor (1992) and Leslie (1987, 1994a, 1994b) have championed this view, with the latter proposing that there is a distinct theory of mind module which coincides with the onset of the ability to pretend at 18 months. We will consider each one in turn, beginning with Fodor's Very Simple Theory of Mind.

2.7.1 FODOR'S VERY SIMPLE THEORY OF MIND

According to Fodor (1992) a three-year-old's theory of mind is not fundamentally different from a four-year-old's or from an adult's, but the three-year-old does not have the same access to the computational resources required to solve problems involving a knowledge of mental states. As the child grows older, these computational resources become more readily available, so that it is possible to make behavioural predictions with increasing efficiency. Fodor refers to the primitive theory of mind that both 3- and 4- year olds share as the Very Simple Theory of Mind (VSTM). This theory of mind is 'simple' or 'primitive' because it recognizes fewer intentional psychological objects than an adult folk psychology would. In fact, it only recognizes beliefs and desires.

VSTM subscribes to two generalizations, which for Fodor form a **competence theory**:

(1) ceteris paribus (i.e., in normal circumstances), people act in a way that will satisfy their desires if their beliefs are true;

(2) ceteris paribus, people's beliefs are true.

Along with these covering laws of VSTM, both 3- and 4-year olds exploit two strategies to

make action predictions. These two heuristics comprise the **performance theory** of VSTM:

H1 Predict that the agent will act in a way that will satisfy his desires.

H2 Predict that the agent will act in a way that would satisfy his desires if his beliefs were true.

It is clear that H1 is a simpler but less reliable heuristic to use for making action predictions than H2 is. According to Fodor, this is the heuristic that 3-year-olds use **whenever it affords a unique behavioural prediction**. If this uniqueness condition is not satisfied, a 3-year-old child will resort to H2. Adults and 4-year-olds, in contrast, will use H1 if they think that the beliefs that the agent is acting on are true. If they are not sure of the agent's beliefs, or if they suspect that the agent's beliefs are false, they will then resort to H2. According to Fodor, people act out of true beliefs in the majority of cases, so predictions based on H1 are "generally reliable".

How does VSTM account for why 3-year-old children fail on false belief tasks? Consider the Wimmer and Perner (1983) experiment: Maxi the puppet and a child watch the experimenter place an object in container A. Maxi then leaves the scene and the experimenter removes the object from container A and places it in container B. The child, who has witnessed the manipulation, is asked where the puppet will look for the object. Three-year-olds usually give an incorrect answer (container B); whereas adults and 4-year-olds give the correct answer (container A). It is because this false belief paradigm yields a unique prediction that 3-year-olds will resort to the H1 heuristic: if the object is in container B, then searching in container

B will be the action that satisfies Maxi's desire.

Consider now the false belief explanation paradigm as tested by Bartsch and Wellman (1989): a child is told that Maxi is searching for his kitten under a piano, but that the kitten is hidden underneath a sofa. So why is Maxi looking under the piano? Children who fail the false belief task will often perform well on the false belief explanation task by correctly attributing a false belief to Maxi. Fodor concludes from this that a child's failure to make the correct prediction on the false belief task cannot be explained by attributing a deficient notion of false belief to the child. The reason why a 3-year-old may do well on the false belief explanation task, says Fodor, is because the child is clearly told by the experimenter that predictions made in accordance with H1 will fail. The child therefore resorts to the H2 heuristic to explain Maxi's behaviour, and thus correctly attributes a false belief to Maxi.

Fodor's VSTM has the merit that it is both developmentally plausible and that it readily lends itself to empirical assessment. A modification of the Wimmer and Perner (1983) false belief task, adapted so that there would not be a unique behavioural prediction should uncover whether a child of 3 years could make H2-type predictions. Nevertheless, since the critical approach adopted in chapter has been philosophical rather than empirical, it is suggested that Fodor's VSTM is flawed in that the covering laws do not guarantee H1-type predictions. The basic idea can be expressed as follows: the assumption that a person's beliefs are true cannot in and of itself validate the use of H1. There is no way that such an assumption could help one predict that an agent will engage in a specific action to satisfy their desires. For example, in the Wimmer and Perner (1983) study, the assumption that Maxi's beliefs are true, without reference to what these beliefs might be, cannot in and of itself determine that Maxi will look

in container B. To be able to predict that Maxi will act in a way that will satisfy his desires it becomes necessary to understand which specific actions Maxi considers will satisfy his wishes and why. Thus, it is necessary to make assumptions about the contents of another person's beliefs, and not simply about their truth. Therefore, Fodor's performance theory does not follow logically from the competence theory.

Stated in another way, the assumption that a person's beliefs are true in and of itself is insufficient to explain the systematic character of young children's errors. For an H1-type prediction to be endorsed in the false belief task, the child needs to assume that the agent possesses the true belief that the object is hidden in container B. This can only be so if the child were to assume that the object somehow causes the agent to have the corresponding true belief. In other words, the child makes the assumption of omniscience. This assumption can be expressed as a logical rule: if a proposition is true, then that proposition is believed by agents. But if it is the case that 3-year-olds make the omniscience assumption then we must conclude that the child has a gross misconception of the causal history of beliefs. This would mean that a 3-year-old's notion of belief is qualitatively different from an adult's or a 4-year-old's. But since this is precisely what Fodor argues against, we thus discover a logical contradiction within Fodor's VSTM. It is for this reason that we do not pursue this line of enquiry in this thesis.

2.7.2 LESLIE'S THEORY OF MIND MODULE

According to Leslie (1987) the fundamental forms of pretend play, which emerge together in a child between the ages of 18 and 24 months, appear to be of 3 kinds: object substitution, attribution of pretend properties and imaginary object pretence. Object substitution is about

identities or types so that one may, for example, pretend a postcard is a butterfly. An example of the attribution of pretend properties would be if one were to imagine that humans have wings and imaginary object pretence is the case where one pretends that an object exists where there is none.

Leslie's intuition is that it is not coincidental that there are 3 fundamental forms of pretence, as well as 3 kinds of semantic properties that propositions may have when expressing mental states. He posits that there must be a deep isomorphism between the semantics of mental state reports and the forms of pretence. This is illustrated by the following table:

LOGICAL PROPERTY	CORRESPONDING FORM OF PRETENCE
Violation of the existence condition	Imaginary object pretence
Violation of the uniqueness condition (referential opacity)	Object substitution
Violation of the predication condition	Attribution of pretend properties

Leslie's proposal is that underlying both cognitive phenomena, pretend play and reports of mental states, there is a common form of internal representation. It follows from this that pretending is a special case of the ability to understand pretence in others and is therefore to be considered an early manifestation of a theory of mind. In other words, the understanding of pretence in another is an elementary form of understanding their mental state. Leslie (1987) suggests that a child interprets pretence according to the following representational schema:

Agent - informational relation - "expression"

where the agent will usually represent persons and any primary representation can replace "expression". The quotation marks indicate that the primary representation's existence, uniqueness and predication conditions are temporarily suspended ("decoupled"). The informational relational part of the schema can be regarded as a computational function that relates the agent to both the decoupled expression and the primary representation. The informational relation can be expressed by a mental state term such as 'pretend', 'think' or 'believe'.

In this model there is the assumption that the primary representations cannot be used to generate pretence because their meaning would become distorted and it is important that they remain faithful copies of the world. It is in order to avoid this representational abuse that Leslie posits a decoupling mechanism which copies the primary representations that are to be used in pretence. In fact, Leslie subsumes all acts of pretence under a single decoupling mechanism and further proposes that this mechanism is innate. His claim is that it is unlikely that perceptual evidence alone could allow the child to arrive at the idea of unobservable mental states. Neither does he think it likely that language learning could lead the child to the concept of mental states because the meaning of the relevant linguistic expressions could not be grasped without first understanding the concept. We will see now that Leslie's model of pretence which has just been outlined has three consequences which make it difficult to support.

First, because the metarepresentations are decoupled from the primary representations with

no direct feedback, there are no limits to pretending. At least, no constraints have been built into the model and so in principle any object could substitute for any other in pretence. According to Vygotsky (1978), the properties of an object constrain pretend play because meaning for a child is closely linked to the visual field and to action. Nevertheless, since Vygotsky has not provided any data to support his view the question remains open and one possible test of Leslie's model would be determine if there are constraints on the pretend play of young children. Refering to play in general, the observational studies of children aged 3 to 5 by Sylva, Roy and Painter (1981) and Bruner (1981, 1985) have shown that there are four conditions which increase the richness and length of play. First, there is the presence of **one** other child as a play mate; not two or many or none, but simply one other child. Second, certain materials stimulate combinatorial exploration, especially if they have a clear-cut variable means-end structure, have some constraints on the nature of the material that can be deployed, and yield direct feedback that a child can interpret on her own without having to depend on authorities. Puzzles, building blocks, miniaturized versions of life activities meet these criteria; whereas water, sand, clay and fingerpaint do not. Third, there is the presence of an adult in the background, not engaged in play but providing the occasional comforting response ("Oh, what a nice monster!"); and finally, children who are exposed to other children playing, at play-groups and nurseries, are more likely to play longer and more elaborately than others when on their own. Bruner refers to this as modelling. These findings refer to play in general, and it remains to be established whether these four conditions would apply equally to pretend play.

Returning to Leslie's model of pretence, the second consequence of the lack of feedback from the meta-representations to the primary ones is that it should not be possible for a child

to learn about the real world whilst engaged in pretending. This raises the question of the evolutionary purpose of pretence. According to Leslie, it makes evolutionary sense to assume that that the primary representations are not in any way affected by the meta-representations. But on this view, pretend play would have no learning purpose of its own other than to serve as an early manifestation of a theory of mind.

We turn now to the third consequence of Leslie's model of pretence. As it has now been shown that children of 4 years of age can predict the behavioural consequences of someone having a false belief (Wimmer and Perner, 1983; Baron-Cohen et al., 1985), while children of 3 have clear difficulties doing so, how does the Leslie model of pretend play account for the difference? Leslie's explanation is that the causal view of the world, which is well developed in a child of 2 years of age, does not merge with the theory of mind view until the age of 4. This can be illustrated in the following manner:

SYSTEM OF UNDERSTANDING	REPRESENTATION GENERATED	TYPICAL APPLICATION
Causal View	A causes B	Behaviour of objects and persons
Theory of Mind	Agent-IR-"content"	Pretence and reports of knowledge

The table above demonstrates the independence of the causal view and theory of mind in 2- and 3- year olds, as posited by Leslie (1988). Obviously, this implies that their theory of mind is not a true theory but a proto-theory. Leslie's claim is that it is not until the age of

4 that a child links their proto-theory of mind to their causal view, and thus becoming a true theory of mind. Thus, in this model it is not until the age of 4 before a child can understand that a mental state can be the outcome of a particular event or social interaction. Nor would the child be able to understand that a mental state can be the cause of a particular behaviour. This raises the question of why it would take a child so long to apply the causal view to mental states. The answer lies in Leslie's proposal that basic mental concepts are not constructed from experience during the course of childhood development, but that an understanding of mind is the result of an innate Theory of Mind Module (ToMM).

Leslie (1994a) has refined this idea to argue that our understanding of agency is the result of three distinct modules, each with its own specialized form of information acquisition. The first of these processing devices is the Theory of Body mechanism (ToBy) which appears at age 3 or 4 months and allows the infant to understand the mechanical properties of objects and events. The Theory of Mind Module is divided into two distinct subcomponents. ToMM system1, which develops between 6 and 8 months, allows the infant to represent the actional properties of agents. ToMM system2, which emerges between 18 and 24 months allows the child to pretend and understand pretence in others. Although these three processing components are hierarchically organized, their development proceeds in parallel and unfold according to their own distinct character and purpose.

It is on this last point that a crucial difference arises between Leslie's (1987, 1988, 1994a) innate module theory and the assumptions underlying the present research, a difference that concerns the interplay between experience and mental state concepts. To claim that an understanding of mind is modular is not only to state that mental state concepts are innately

specified, but also that their processing is mandatory, encapsulated, perceptual, fast and **insensitive to revision through experience** (Fodor, 1983). According to this view of what constitutes a module, it is an assumption of this thesis that while there can be innate knowledge about the mind, it does not support the idea of a theory of mind module. More specifically, while there can certainly be an innate first theory of mind in the form of an open view, the closed view of the mind is a construction, a revision of an initial position about mind that is rooted in the child's experience of others.

It is worth highlighting that the fact that certain understandings of mind are universal can be interpreted as evidence for either the modular theory or the theory-theory. That is, these universal understandings of mind may either be innately specified or it may be that they are derived from experiences that are shared by all cultures. The fact that there is psychological knowledge in early infancy is also compatible with either view, as is the fact that in certain disorders such as autism, the child's theory of mind is seriously impaired. So, what kind of evidence would we need to differentiate between the innate module theory and the proposal that an initial first theory is revised through experience?

It is possible that cross-cultural investigations may provide one source of evidence. The few studies that have been carried out so far on young children's performance on appearance-reality and false belief tasks suggest that there are few cultural differences (Flavell, Zhang, Zou, Dong and Qi, 1983; Avis and Harris, 1991; Vinden, 1996; Tardif and Wellman, 1997). However, until recently there have been no cross-cultural studies of children older than 5, or even cross-cultural studies of adult theories of mind (Lillard, 1998). Another source of evidence may come from studies that examine the influence of different patterns of evidential

input on the timing of the development of mental concepts. There is already some evidence to suggest that there are such significant variations depending on diferences in the immediate social environment (Dunn, Brown, Slomkowski, Tesla and Youngblade, 1991; Perner, Ruffman and Leekam, 1994; Jenkins and Astington, 1996; Ruffman, Perner, Naito and Parkin, 1998). However, the most important kind of evidence would come from intervention studies that would determine whether children could develop a significantly different theory of mind given a different pattern of evidence. Such an experiment has never been attempted and would certainly be most difficult to conduct. Nevertheless, despite the difficulties of identifying the kind of data that would constitute evidence against the modular view of mind, it is claimed that some of the empirical findings to be presented throughout this thesis are not easily accounted for by modular approaches to the study of mind.

2.8 SUMMARY AND CONCLUSIONS

The purpose of this chapter was to present a philosophical critique of both the methodological approaches to theory of mind research in psychology and of four major theoretical accounts of children's understanding of mind: the theory-theory, Hobson's theory of persons, the simulation hypothesis and the modularity approach to mind. Starting from the premiss that developmentalists in theory of mind research need to understand the analyses put forward by the philosophy of mind, it examined the need for a clear criterion of what constitutes a mental phenomenon. It was suggested that while naturalistic studies have not provided us with a clear criterion of what constitutes a mental phenomenon, the experimental approach to theory of mind has adopted an overly rigid criterion in the form of the false belief paradigm.

By identifying two major philosophical approaches to mind, it was possible to classify psychological approaches to theory of mind accordingly. It is an assumption of this research that a third-person perspective to an understanding of mind is to be preferred on theoretical grounds. That is, that it is likely that children first discover the concept of mind at a social level and only later apply the concept to the self. It was also suggested that when considering the 'problem of other minds' the third-person perspective is more likely to lead to a philosophical solution.

A philosophical critique was then presented of four major approaches to theory of mind research: the theory-theory, Hobson's theory of persons, the simulation hypothesis, and the modular approaches of Fodor (1992) and Leslie (1987). It was suggested that the theory-theory comes closest both to satisfying the philosophical guidelines expounded in this chapter and to addressing the problems raised by the philosophy of mind. On these criteria, it is proposed that the remainder of the thesis be dedicated to a critical and empirical examination of the theory-theory. To this purpose, we turn now to the first empirical study of the theory-theory, concerning the role of young children's understanding of representations.

CHAPTER THREE

YOUNG CHILDREN'S UNDERSTANDING OF REPRESENTATIONS DO NOT PROVIDE THEM WITH A THEORY OF MIND

3.1 INTRODUCTION

In chapter one of this thesis we reviewed the work of Gopnik and Astington (1988) and Gopnik and Slaughter (1991), who have provided evidence that 3-year-olds do not understand that their representations of the world change over time. This is an important issue because there are researchers who have claimed that the problem lies exclusively with the child's theory of mind. Chandler and Boyes (1982), for example, have referred to the younger child as a 'copytheorist', in comparison to the older child or adult who is a 'constructivist'. A copytheorist, according to Chandler and Boyes (1982), would conceptualize a thought as a mental copy of the world. In this way, a copytheorist could claim a limited understanding of knowledge and ignorance, but would not be able to conceive of a false belief. Similarly, Wellman (1988) has suggested that the difficulty the younger child has in understanding false belief stems from the inability to conceive of the mind as an active information processor, instead of a repository into which representations (thoughts) are stored and not updated. In accordance with these views, Leslie (1987) has proposed that a young child's understanding of mental states is altogether divorced from the causal fabric of the world, such that there is no possible experience in the world that could lead a child to conclude that thoughts are immaterial and private. It would follow from these theories that a young child who has difficulties in reasoning about mental representations should not necessarily experience the same problems when reasoning about nonmental representations.

An altogether different view has been forward by Zaitchik (1990), who has suggested that the problems that young children encounter with false beliefs are due to the larger problem of understanding the nature of representations themselves. Thus, Zaitchik (1990) was able to demonstrate that for a young child, photographs are no easier to reason about than beliefs. In Zaitchik's (1990) experiment, an actor who took a photo of an object in location **x** later moved that same object to location **y**. A preschool subject would then be asked to predict what would be represented in the photo. A similar design was used to test the children's understanding of false belief. Both 3- and 4-year-olds scored better in the belief condition than in the camera condition. Only the 5-year-olds were, as a group, better than chance on the camera condition, although it is perhaps unfortunate that this group were not tested in the belief condition.

In subsequent studies, Zaitchik (1990) repeated variations of the experiment to address the following hypotheses: the possibility that the photo task made greater inferential demands on the child (expt. 2), that the critical information was insufficiently salient (expt. 3), that the difficulty in both tasks is a processing problem unrelated to the representational status of beliefs and photos (expt. 4), that the problem on both tasks is in the timing of the inference (expt. 5). In all experiments, the results indicated that photos were no easier to reason about than beliefs. In fact, younger children experienced greater difficulties reasoning about photos than about beliefs, although this difference was not significant. Zaitchik (1990) concluded from these findings that young children's failures on false belief tasks may not be due to an inadequate theory of mind, but point to a difficulty in understanding representations themselves.

In recent years, however, Zaitchik's (1990) results have come under increasing criticism (Leslie and Thaiss, 1992; Perner, Leekam, Myers, Davis and Odgers, 1993; Parkin and Perner, 1994). A careful examination of Zaitchik's experimental design shows that, indeed, it is open to criticism. We therefore propose the explanation that if children show difficulties in the photo-reasoning task, it is because preschoolers do not understand the mechanism of cameras. Furthermore, children's reasoning about photos may have been made more difficult by giving them 'training' on toy cameras that took 'pretend' photos. Zaitchik (1990) has argued that all that the child needs to know about cameras is that one aims the camera at an object, look through the window and push the button. In her view, for a child to succeed in the camera condition it is enough that he should know about photos. Specifically, the child would need to know that (1) the photo was a representation of whatever was in the viewfinder at the time the photo was taken, and that (2) the photo captures a moment in space and time which does not change later. The child would also (3) need to remember how the world was when the photo was taken.

Zaitchik (1990) has taken the view that young children's difficulties with photos lie exclusively with condition (2). She proposes that children perceive photos as automatically updating themselves to represent the true state of affairs in the world. While such an explanation is certainly plausible, it does not explain why there should be increased difficulties with the photo task as opposed to the belief task. We therefore proposed to test the Zaitchik hypothesis by means of a simplified version of her experimental design.

In this study, the use of a finished painting was preferred over the use of photos. The rationale for this choice comes from Charman and Baron-Cohen (1992), who have suggested

that drawings are simpler to understand in terms of their production. Furthermore, young children are not likely to have had experience with cameras, whereas drawings are known to them from an early age. Charman and Baron-Cohen (1992) tested 17 subjects with autism, 14 subjects with mental handicap but without autism, and 20 typically developing children aged three and four years. All groups were tested on a false drawing test as well as a false belief task. Although no significant differences in scores were found between the groups with autism, mental handicap and the typically developing 4-year-olds on the false dawing task, the typically developing 3-year-olds produced significantly lower scores than the 4-year-olds. In contrast, both the group with autism and the typically developing 3-year-olds produced significantly lower scores on the false belief task when compared to the mentally handicapped group and the 4-year-olds. Focusing on the 3-year-olds, these results supported Zaitchik's (1990) findings, given that the poor performance of this younger group on the false drawing task matched their poor performance on the false belief task.

Similar findings were reported by Robinson, Nye and Thomas (1994), who tested 3- and 4-year-olds' understanding of pictures and their referents by either introducing a change in the characteristics of the referent or a change in the picture. The results indicated that children tended to judge as if the picture changed along with its referent. Furthermore, children still made the mistake of attributing a visual feature to a picture that belonged to the real referent even when no transformation had taken place in the latter.

In Charman and Baron-Cohen's (1992) study the false drawing task required that the child and the experimenter each draw an object. In the Robinson et al. (1994) study the children persistently produced poor scores on the control memory questions. Thus, it could be argued

that in both of these studies the children were faced with high task demands. In the present study, matters were simplified by presenting children with a completed painting, as well as presenting the experiment within the framework of a narrative context. It was considered that with these manipulations it might be possible to come to a fuller understanding of young children's understanding of representations, both because they lessen task demands and because recent research has shown that narrative improves children's performance on tasks of a deceptive nature (Lewis, 1994).

3.2 THE EXPERIMENT

3.2.1 PARTICIPANTS

There were 60 participants in total, divided into three groups, as shown in table 3.1 below.

Table 3.1 Means, Standard Deviations and Range for All Age Groups

Group	**N**	**Mean Age (Months)**	**S.D. (Months)**	**Range**
3-year-olds	27	39.44	4.26	32 to 46 months
4-year-olds	18	53.56	3.15	48 to 58 months
5-year-olds	15	68.73	4.01	61 to 73 months

All children attended either a nursery or preschool centre in the central London area. There were approximately equal numbers of boys and girls in each group as follows: among the 3-year-olds there were 12 boys and 15 girls, while among the 4-year-olds there were 10 boys and 8 girls. Finally, the 5-year-olds were composed of 9 boys and 6 girls.

3.2.2 MATERIALS

Two puppets, a completed painting showing a horse on the left hand side of the canvas and an apple on the right, a brush, a small table and a cloth with which to cover the painting.

3.2.3 PROCEDURE

A child was taken to a room where she found a puppet (a lion) busy painting on a canvas. The painting was, in fact, already completed and the puppet simply moved a dry brush across the canvas, pretending to paint only. On the left-hand side of the canvas the puppet had 'painted' a horse, which represented a toy horse located to the left of the canvas. Similarly, the puppet was 'painting' an apple on the right-hand side of the canvas, which was a copy of a toy wooden apple situated to the right of the painting. The puppet was therefore apparently copying a scene from within the room. The experimenter and the child watched while the lion 'completed' his painting. Throughout the experiment, the sequence of events was supported by a narrative in which the experimenter explained to the child what the puppet was doing, as follows:

'Look, here's the lion. He's been painting all morning. On this side he's painting a horse [experimenter points to toy horse] and on this side he's painting an apple [experimenter points to toy apple. The procedure is repeated. Suddenly the lion begins to slow down]. Oh dear! I think the lion is feeling tired and sleepy. Let's help him cover up the painting.'

The experimenter took the brush away from the lion and together the child, the experimenter and the lion covered up the painting with a cloth that lay nearby. The lion then left the scene. Suddenly, a second puppet (a fox) appeared:

'Look, here's the fox. He's a naughty animal and he wants to play a trick on the lion. What's he doing? [The fox walks across the painting, takes the toy horse and moves it to a new location such that the relative positions of the two toys are now reversed. Before leaving, the fox looks in the direction of the lion and rubs his paws. The deed was done.] The fox has moved the horse and the lion didn't see that. But when the lion wakes up he'll be coming back to see his painting.'

The child's understanding of the outcome of events was then tested by means of the following questions.

3.2.4 THE QUESTIONS

Belief Probe: Does the lion **know** where the horse is now?

Belief Test: Where does the lion **think** that the horse is now?

Picture Probe: Where was the horse when the lion finished his painting?

Picture Test: In the painting, where is the horse?

The most common form of response to the test questions was to point to the intended location and this was considered sufficient for scoring purposes. However, on occasion a child would point in an ambiguous or unclear manner and if this response was not spontaneously corrected by the child, she was eliminated from the study. Following Zaitchik's (1990) study, participants were not given feedback to their responses to the probe questions, nor were these responses included included in the analysis. The order of presentation of the belief and picture test questions was counterbalanced.

3.3 RESULTS

A hierarchical 2 (belief) x 2 (picture) x 2 (order) loglinear analysis showed that there were no order effects either on the belief test (Likelihood Ratio Chisq = 1.41, df = 1, $p < 0.24$) or the picture test (L.R. Chisq = 3.19, df =1, $p < 0.08$).

The loglinear analysis also revealed a significant association between children's rates of success on the picture task and their performance on the false belief task (L.R. Chisq = 4.49, df = 1, $p < 0.04$). This finding is shown in table 3.2 below, inspection of which shows that of 8 children who failed the picture task, 7 also failed the false belief task. However, of 52 children who passed the picture task, only 24 succeeded on the false belief task. Furthermore, a McNemar test indicated a significant difference in children's rates of success between tasks, with the false belief task presenting as the more difficult one (Binomial, $p < 0.001$). This becomes clearer when we examine the column and row totals of table 3.2 below. While 52 children passed the picture task, only 25 gave correct responses to the false belief question.

Table 3.2 False Belief x Picture Crosstabulation

		PICTURE TASK	
		Fail	Pass
FALSE BELIEF	Fail	7	28
	Pass	1	24

A separate hierarchical 3 (age) x 2 (belief) x 2 (picture) loglinear analysis indicated that there was a significant association between age and children's scores on the false belief task (Likelihood Ratio Chisq = 17.55, df=2, $p < 0.0003$), with the older children reaching the better scores. This is illustrated in table 3.3 below, where it can be seen that it is the 5-year-olds who show a clear understanding of false belief.

Table 3.3 Age x False Belief Crosstabulation

		AGE		
		3-year-olds	4-year-olds	5-year-olds
FALSE BELIEF	Fail	20	13	2
	Pass	7	5	13

However, the loglinear analysis did not reveal a significant interaction between age and children's scores on the picture test (L.R. Chisq = 2.04, df = 2, $p < 0.36$). This is illustrated in table 3.4 below, which shows that all age groups were performing at near ceiling.

Table 3.4 Age x Picture Crosstabulation

PICTURE	AGE: 3-year-olds	4-year-olds	5-year-olds
Fail	4	2	2
Pass	23	16	13

Finally, the performance of all groups on the picture test was significantly above chance (L.R. Chisq = 36.06, df = 1, $p < 0.0001$).

3.4 DISCUSSION

The results of our study replicate earlier findings that 3-year-olds experience difficulties in attributing a false belief to another, whereas older children are able to do so. However, the level of accuracy of the younger children on the picture test is both surprising and not predicted by the hypothesis that children's understanding of false beliefs is linked to their general knowledge of representations. Indeed, when the 3-year-olds are divided into two groups, aged 2;8 to 3;4 and 3;6 to 3;10, as Zaitchik did, we discover that all of the older 3-year-olds performed without error on the picture task.

From these results we draw two conclusions. First, that the results obtained by Zaitchik (1990) were an artefact of her experimental design and/or the result of an incomplete understanding of the nature of cameras on the part of the younger children. We have already

presented our criticisms of Zaitchik's experimental design in the introduction to this chapter and do not repeat them here. Second, that a general understanding of representations is not a sufficient condition for a theory of mind in young children. We hypothesise that a general understanding of representations is still a necessary component of a theory of mind, but we propose that the theory-theory of mind would need to be revised to take into account our present findings.

A comparison with Zaitchik's (1990) study showed that although she examined the rates of success of children on both the unexpected transfer task and the camera task, she failed to provide a contingency analysis, so that it remained unclear from her study whether children's performance on one task was related to their scores on the other. This chapter, in contrast, has provided such a contingency analysis and the hypothesis that an understanding of representations is a necessary component of a developing theory of mind is supported by the analysis which revealed an association between children's scores on both the false belief task and the picture task. Even so, one must approach this finding with caution, given that all age groups were performing at near ceiling on the picture task.

It is of interest to compare our findings with the most recent research by Slaughter (1998), which was carried out after the present experiment. Slaughter (1998) was able to demonstrate across two studies a dissociation between children's understanding of representations in pictures and drawings, and their understanding of mental representations. In her first study, 37 three-year-olds (mean = 3;7.6 range = 3;2 to 4;4) were tested on five different tasks: false belief for the self, false belief for another, appearance-reality, false photograph and false drawing. The false photograph and the false drawing tasks were found to be

significantly easier than the false belief and appearance-reality tasks, thus supporting the hypothesis that children's understanding of pictorial and mental representations are not related in development.

This idea was further explored in Slaughter's (1998) second study, when 30 children who had failed a false belief pretest were randomly assigned to three training groups: a false belief training task, a false picture training task and a number conservation task (that acted as a control). If the understandings of pictorial and mental representations are both supported by a general concept of representations, then the effects of training on false belief would be expected to transfer to false picture tasks,and similarly in reverse. When the children were posttested on all three kinds of tasks, a differential pattern of performance was found, with the belief group scoring highest on the theory of mind posttest, the picture group performing best on the false picture posttest and the control group scoring highest on the number conservation posttest. The lack of transfer between the false belief and false picture tasks argues against the hypothesis of a general understanding of representations underlying children's performances on both tasks. This finding contrasts with previous studies in this area (DeLoache 1991; Marzolf and DeLoache 1994; Slaughter and Gopnik 1996), which have shown that false belief training is transferable to other theory of mind tasks.

The findings reported in this chapter are also consistent with an earlier series of three studies by Robinson, Riggs and Samuel (1996), who found that children were more accurate at recalling drawings than beliefs. In their first study, the researchers tested 80 children aged between 3;10 and 4;5 (mean =4 years) on two tasks: a standard deceptive box task and a draw task. In the draw task, children were shown a Smarties box and asked to draw on a

blackboard what they thought was inside. In the **enduring condition**, the blackboard was turned over but left unchanged. In the **erased condition**, the picture was erased before turning the blackboard over. There were two test questions to the draw task: a belief question and a draw question. Results indicated that children found it easier to recall what they had drawn than to remember their false belief on which the drawing was based or their false belief in the standard task.

In their second study, Robinson et al. (1996) used a similar procedure, testing 92 children aged between 3 years and 4 years 6 months, but on this occasion the expected and the real contents were of the same shape. By this means, children ended up producing drawings that were ambiguous. The researchers were interested to know if this ambiguity in the drawings would lead the children to misrecall their drawings. However, the results were similar to the first study, with all age groups performing more accurately on their draw judgements than in their belief judgements. Finally, Robinson et al. (1996) carried out a third study, testing 40 children aged between 3 years 9 months and 4 years 5 months (mean = 3 years 11 months), examining children's abilities to recall what another person with a false belief had drawn and thought. As with the previous studies, children found it significantly easier to recall what another person had drawn than what that person had thought.

The studies by Robinson et al. (1996) were based on a procedure first utilised by Mitchell and Lacohee (1991) in three experiments whereby 3-year-olds were asked to select a picture of whatever they had expected a box to contain and then to post that picture. In Mitchell and Lacohee's (1991) first study, 84 3-year-olds with a mean age of 3;6 were first given three warm-up trials in which they were presented with a box and asked to state what they thought

was inside. The box was changed at each trial and on every occasion represented a familiar product that was readily recognised by the manufacturer's packaging. In the first three trials the actual content of the box coincided with the packaging, but on the fourth trial the actual content (pencils) varied from the packaging (Smarties). In the **relevant posting condition**, children were asked to select the card that represented their response and then to post that card through a slot in a postbox. Children in this condition gave significantly more correct responses than children in both a control group and an **irrelevant posting condition** in which children were asked to post a picture of an irrelevant item, once they had stated what they initially thought was the test item.

In Mitchell and Lacohee's (1991) second experiment, the relevant posting procedure was repeated but children were not given feedback about their responses in the three warm-up trials. In this way, the link between the picture in the postbox and the test question was not made explicit. The researchers tested 26 children with a mean age of 3;10 who were assigned to one of two conditions. Once again, children in the relevant posting condition performed significantly better than the control condition. Finally, the researchers carried out a third study testing 36 children with a mean age of 3;10 in both a relevant and an irrelevant posting trial, using a within-subjects design. In this study, the warm-up trials were omitted and a final question was introduced to test children's understanding of the true content of the test item. The pattern of responses was similar to the previous two studies, with children in the relevant posting condition performing better than those in the irrelevant posting condition. Since the warm-up trials were omitted, it could not be argued that the results were due to training effects. The introduction of a final question revealed that all children who passed the belief question in the relevant posting condition were able to state the true content of the test

item, even when they failed the belief question in the irrelevant posting condition.

The present findings are also consistent with a recent unpublished study by Bowler and Strak (1999), who tested 68 children aged 36 to 56 months on the Sally Anne false belief task, as well as a false picture test and a number conservation task. In all three tasks a comparison was made between children's scores on the standard versions of these tasks, with their performance on modified versions using the sudden and unexpected appearance of a 'Naughty Cow' responsible for task transformations. The results indicated that the accidental appearance of the puppet improved the children's scores on the false belief task and the picture task, but not on the conservation task. It is of interest to note that children's understanding of the picture task was superior to their understanding of the false belief task, with a pattern of responding similar to the one reported in this chapter (54 passes, 6 fails). This finding would, in principle, support the argument that young children have a clear understanding of nonmental representations.

The studies described so far by Mitchell and Lacohee (1991), Robinson et al. (1996), Slaughter (1998) and Bowler and Strak (1999), along with the results presented in this chapter all argue against the idea that young children have a deficient understanding of representations. In this way, they also argue against the representational hypothesis which states that the development of a theory of mind depends on the more general understanding of representations. While it may still be possible that an understanding of representations is necessary to the development of a theory of mind, the data suggest that such knowledge is not sufficient. In terms of the theories which we discussed in chapter two, the data presented in this chapter are not easily accounted for by the simulation hypothesis (Harris, 1992), as

they would suggest that the processes involved in the simulation of false beliefs are distinct from the simulation of pictorial representations. Neither can they be accommodated by Leslie's modular approach to mind (Leslie, 1994b; Leslie and Roth, 1993; Leslie and Thaiss, 1992). According to Leslie, there is a specific cognitive mechanism which he termed the Selection Processor (SP) which is involved in understanding pictorial representations. This is independent of the cognitive mechanism involved in answering questions about false beliefs, which he termed the theory of mind module (TOMM). In his view, while 3-year-olds may have a TOMM, the Selection Processor does not develop until the age of 4 years. But on the basis of the results reported in this chapter, it would seem that 3-year-olds must have an SP. Such an argument would also be supported by the experimental findings of Mitchell and Lacohee (1991), Robinson et al. (1996), Slaughter (1998) and Bowler and Strak (1999) discussed above.

It could, however, be argued that there were certain methodological weaknesses to the present study. First, although the order of presentation of the belief and picture questions were counterbalanced, the belief probe always preceded the belief test question. Similarly, the picture probe always preceded the picture test question. It could therefore be argued that the probes alerted the children to the test questions to follow. Such an argument would be a serious criticism of this study only in the event of the picture probe enhancing performance on the picture test question, while the belief probe proved detrimental to the children's performance on the belief test question. A second possible criticism of this study would be that apart from the probes, there were no controls of the children's understanding of the experimental set-up and of the narrative structure surrounding the experimental manipulations. We will be returning to both of these criticisms in chapter eight of this thesis,

where we report on a similar experimental procedure with an improved methodology.

Finally, we make note of a curious feature of children's responses to the picture test question. There were six recorded instances of children changing their responses when answering the picture test question. Three of these children were 4-year-olds, while the remaining three were 5-year-olds. On four of these occasions, the children gave an incorrect answer, looked at the experimenter and after a very brief pause, they changed their response to the correct one. It was decided later to include the child's second response in the analysis. But what is of interest here is that on two of these six occasions the experimenter inquired why they had changed their mind. One child replied that he thought the experimenter was 'going to do magic', while the other child gave a similar reply: that he thought the experimenter was going to make the painting change. There were no recorded instances of 3-year-olds changing their responses, but there two recorded instances of 5-year-olds changing their responses from a correct to an incorrect one! These behaviours raise two important questions. First, while experimentalists are familiar with children changing their responses and must decide in which way to score the change, there are as yet no published studies investigating the reasons for children changing their mind. Second, it may well be that by studying the circumstances under which children change their responses we may learn about how they perceive experimental procedures. In the present case, it could well be that some of the older children made the assumption that the experimenter was carrying out the experimental manipulations as a prelude to performing a magic trick. This fascinating idea will be discussed further in chapter nine of the thesis.

3.5 SUMMARY AND CONCLUSIONS

Only the oldest group demonstrated a clear and significant understanding of false belief. In contrast, all groups demonstrated an understanding of the sample nonmental representation (the painting). This would suggest that the younger children's poor performance on the belief test cannot be attributed to an incomplete understanding of the nature of representations. It is concluded therefore that an understanding of representations is not a sufficient condition for a theory of mind in young children, although future research may yet establish that it is a necessary one. These findings were discussed with reference to three major theories. It was suggested that the results of this study cannot easily be accounted for either by the simulation hypothesis nor by Leslie's modular approach. Moreover, it was suggested that these data suggest the need for a revision of the theory-theory.

We now turn our attention to an important claim that was made in chapter two. It concerns the status of first-person versus third-person knowledge of mental states. In that chapter the claim was made that a third-person approach to studying mental concepts was to be given priority on the assumption that the experience of mind that is encountered at the social level is richer and more complex than the experience of mind achieved through introspection. One possible prediction that stems from this view is that the concept of false belief is similarly discovered at a social level. In consequence, young children should find it easier to remember another person's false belief than to recall a previous false belief of their own. It is to this hypothesis that we turn to next in chapter four.

CHAPTER FOUR

TO ATTRIBUTE A FALSE BELIEF TO ANOTHER IS EASIER THAN TO REMEMBER ONE'S OWN PREVIOUS FALSE BELIEF

4.1 INTRODUCTION

In chapter two, two philosophical perspectives on the study of mind were presented. It was argued that mental phenomena can be described from a first-person perspective or a third-person perspective. Furthermore, it was proposed that researchers into children's theories of mind could also be classified accordingly. Researchers who give preference to a first-person perspective would argue that a child discovers the concept of mind as it applies to the self and only later is applied to others. In contrast, researchers who support a third-person perspective would reason that a child discovers the concept of mind at the social level, which is only then applied to the self.

In this chapter we examine the status of first-person and third-person knowledge of mental states. The question is an important one, not only because we wish to test our philosophical foundations, but also because it is an aspect of theory of mind research which has been neglected. In chapter one we reviewed the work of Gopnik and Astington (1988) who have argued that young children hold representations of the world and that they change these representations, but that they do not understand the fact that these representations can change. Gopnik and Astington (1988) tested this hypothesis by questioning 3- to 5-year-olds on a cognitive task that forced a child to anticipate another child's false belief, as well as remembering and reporting their own previous false belief. The results indicated a clear

development in the understanding of representational change between the ages of 3 and 5. What is of interest here for the purposes of this chapter is that in the above study, all groups of children gave significantly lower scores on the representational change questions than on those pertaining to false belief. This finding thus supports the third-person perspective in the understanding of mind.

In contrast, Perner, Leekam and Wimmer (1987) tested 32 children with a mean age of 3 years 5 months (range = 3;1 to 3;9) where half of the children were given the standard smarties task, while the other half were assigned to the condition with a pencil **and** smarties in the box. The reason for having this second condition was to test the hypothesis that 3-year-olds fail the Smarties task because of a pragmatic difficulty; that is, that they find it hard to give the correct answer because it involves saying something false. However, the researchers were unable to find a significant difference in children's performance between conditions.

For the purposes of this chapter, it is of interest to examine the pattern of responding across the two test questions in the Perner et al. (1987) study. In the standard pencil only condition, 75% of the children gave the correct answer to the false belief for self question, while only 44% did so for the false belief for other question. In the pencil and smarties condition, 69% of the children answered the false belief for self question correctly, but only 46% gave the correct answer to the false belief for other question. This pattern of responding was shown to be statistically significant for both conditions. Indeed, of the 32 children tested, only one child showed a different pattern of responding.

Thus, there is as yet no agreement among theory of mind researchers as to whether children

find it more difficult to remember their own previous false belief or to attribute a false belief to another. In this chapter, we explore this question by adopting the experimental procedure used by Gopnik and Astington (1988). The criterion for adopting a well established procedure, in preference to using a method of our own, comes from a previous pilot study (Berguno, 1995) where no significant differences were found between 3- and 4-year-olds on a standard false belief task for both types of questions (false belief for self and false belief for other), with both groups of children exhibiting low rates of success. It was considered that these results might have been due to procedural effects, including the way test questions were phrased. Thus, it became necessary at this point to determine whether this finding would emerge again using a well known false belief task.

4.2 THE EXPERIMENT

4.2.1 PARTICIPANTS

Participants were 82 children from two under-five day nurseries in Central London. The subjects were divided into two age groups, as shown in table 4.1 below.

Table 4.1 Means, Standard Deviations and Range for Both Age Groups.

Group	N	Mean Age (Months)	S.D. (Months)	Range
3-year-olds	37	38.76	5.34	30 to 47 months
4-year-olds	45	52.93	3.25	48 to 59 months

Among the 3-year-olds there were 19 boys and 18 girls, while the 4-year-olds consisted of 25 boys and 20 girls. Children who took part in the previous study were not selected for the present experiment.

4.2.2 MATERIALS

All children were given a screening task in which they were shown a closed toy house. The roof of the house came off to reveal a toy wooden apple inside. The apple was removed, a toy pirate was placed in the house and the roof replaced. The child was then asked the following question: "When you first saw the house at the beginning, what was inside it?". For the main task, a Smarties container was used with a pencil hidden inside.

4.2.3 PROCEDURE

Children were tested in a separate area of an under-five day nursery. A child (C1) and a 'friend'(C2) were taken to the experimental room by two nursery workers. C1 was taken into the room by one of the workers who then introduced C1 to the experimenter. The door was closed, leaving C2 outside with the second worker, who was then told by that worker that "It seems it's not your turn yet" and returned to the nursery. C1 had no way of knowing that C2 had left. C1 was told "We're going to play a game where we show you some things and ask questions about them". The first nursery worker sat at the back of the east side of the room and remained quiet for the whole session. The experimenter sat on the floor of the south side of the room, facing the door at the north end. The child therefore had her back to the door. The 'game' consisted in allowing C1 to discover that a pencil lay inside a Smarties container. The pencil was returned to the Smarties tube, which was then sealed. The child being tested was then asked to say what was inside the Smarties box before proceeding with the test questions below.

4.2.4 THE QUESTIONS

False belief for self: When you first saw the box, all closed up like this, what did you think

was inside it?

False belief for other: X hasn't seen inside this box. When s/he first sees the box, all closed up like this, what will s/he think is inside?

To answer the screening question correctly ("apple"), the child needs to have understood the concept of one event occurring after another. The child also needs to have remembered the past event, as well as ignoring the present situation. The question therefore aims to ensure that the child understood the basic concepts involved in the false belief for self question. In fact, the only difference between the screening question and false belief for self question is the metarepresentational element. In the former, the child is asked about the original state of an object, while in the Smarties false belief for self question they are asked about their past representation of an object. To control for possible order effects, the test questions and the screening task were counterbalanced, with four different orders of presentation.

4.2.5 SCORING

The 82 children included in this study all passed the screening task. There were 4 additional children tested who either did not give the correct answer to the screening question, or who failed to reply to one or more of the main task questions.

4.3 RESULTS

Because of the relatively small sample size, it was decided to run separate analyses for each test question.

A hierarchical 2 (age) x 2 (false belief for other) x 4 (order) loglinear analysis revealed that there were no order effects on the false belief for other question (L.R. Chisq = 0.41, df = 3, $p < 0.94$). The loglinear analysis also revealed an association between age and performance on the false belief for other question (L.R. Chisq = 18.94, df = 1, $p < 0.0001$). This is illustrated in table 4.2 below, inspection of which shows that of 37 three-year-olds, 27 gave incorrect answers to this test question. In contrast, of a total of 45 four-year-olds, 34 answered the test question correctly.

Table 4.2 False Belief for Other x Age Crosstabulation

		AGE	
		3-year-olds	4-year-olds
FB OTHER	Fail	27	11
	Pass	10	34

A separate hierarchical 2 (age) x 2 (false belief for self) x 4 (order) loglinear analysis showed that there were no order effects on the false belief for self question for either age group

(L.R. Chisq = 1.19, df = 3, p < 0.76). However, the loglinear analysis also established that there was no significant association between age and children's performance on this test question (L.R. Chisq = 0.54, df = 1, p < 0.47). Children's pattern of responding to this question is shown in table 4.3 below, where it can be seen that although the older group performed marginally better than the younger group, both age groups showed poor rates of success on this question.

Table 4.3 False Belief for Self x Age Crosstabulation

	AGE	
FB SELF	3-year-olds	4-year-olds
Fail	24	25
Pass	13	20

A separate chi-square analysis showed that there was a significant association between participants' rates of success on both tasks (Chi^2 = 30.82, df = 1, p < 0.0001). This finding is illustrated in table 4.4 below, where it can be observed that of 33 children who passed the false belief for self question, 30 also passed the false belief for other task; and of 49 children who failed the false belief for self question, 14 still gave correct responses to the false belief for other question.

Table 4.4 FB for Self x FB for Other Crosstabulation

FB SELF	FB OTHER: Fail	FB OTHER: Pass
Fail	35	14
Pass	3	30

Finally, a McNemar test showed that there was a significant difference between participants' rates of success on both tasks (Binomial, $p < 0.02$). This finding relates to table 4.4, where it is possible to observe that children's scores on the false belief for other question consisted of 44 correct and 38 incorrect responses. In contrast, children gave 33 correct and 49 incorrect responses to the false belief for self question. Thus, children find remembering their own previous false belief significantly more difficult than attributing a false belief to another.

4.4 DISCUSSION

The present study found a significant difference in rates of succes between age groups on the false belief for other question, a finding which supports the study carried out by Gopnik and Astington (1988). From the developmental literature it seems reasonable to conclude that 3-year-olds demonstrate a conceptual deficit when compared to 4-year-olds on false belief tasks (Wimmer and Perner,1983; Perner, Leekam and Wimmer, 1987; Gopnik and Slaughter, 1991). Efforts to determine whether the competence of 3-year-olds in the false belief tasks has not been masked by the experimental procedures themselves have not, until very

recently, improved the performance of 3-year-olds (Moses and Flavell, 1990; Hala, Chandler and Fritz, 1991). It would seem then that the results of our experiment would support what has been termed the **representational-deficit** theories of children's understanding of mind, at least as far as the false belief for other task is concerned.

Nevertheless, we found no significant differences in performance between the two groups of children on the false belief for self question. It could be argued that this result supports one of Gopnik and Astington's (1988) basic findings: that young children find it significantly more difficult to remember their own previous false belief than to attribute a false belief to another. This argument is further supported by both the McNemar test relating to table 4.4 and the contingency analysis, which indicated that nearly all children who passed the false belief for self question also succeeded at the false belief for other task. Thus it could be argued that children's ability to understand false belief in another appears before their understanding of false belief for self, and that the emergence of an understanding of false belief for self consolidates their understanding of false belief for other. These findings conflict, therefore, with those of Perner et al. (1987) and it is perhaps possible that their results are due to procedural differences.

One possible explanation why both 3- and 4-year-olds found the false belief for self task especially difficult might be that children were exhibiting a reality bias (Mitchell, Robinson, Isaacs and Nye, 1996). In this case, it could be argued that children's knowledge of the true state of affairs contaminated their judgements when presented with the false belief for self test question, and that children proceeded to report current reality as opposed to their previous mistaken belief. However, this would not explain why the 4-year-olds were able to

give significantly better responses than the 3-year-olds to the false belief for other question. In order to support the hypothesis that children's low scores on the false belief for self question were due to a reality bias, one would have to explain why such a bias did not arise among the 4-year-olds on the false belief for other task.

Alternatively, it may have been the case that in the present study children failed the false belief for self question because they were embarrassed to admit that they had said something false. This possibility seems an unlikely one when we consider the findings of Wimmer and Hartl (1991). These researchers tested 3-, 4- and 5-year-olds on their understanding of both false belief for self and other. In their first of three experiments, the children were presented with a deceptive box task, and it was found that only 25% of the 3-year-olds were able to correctly attribute a false belief to another child. This contrasted unfavourably with the 4-year-olds who gave 78% correct responses to this test question, and with the 5-year-olds, who scored 87% correct responses. Children's pattern of responding to the false belief for self question was very similar, with the 3-year-olds giving 34% correct responses. This contrasted with the 73% correct responses given by the 4-year-olds and with the score of 100% correct responses achieved by the 5-year-olds. Thus, according to Wimmer and Hartl (1991), the task of identifying one's own previous false belief was not significantly more difficult than attributing a false belief to another child.

Having ruled out in their second experiment the possibility that the poor performance of the 3-year-olds was due to a memory problem or a failure to understand the test question, Wimmer and Hartl (1991) proceeded to test the hypothesis that the 3-year-olds' low scores on the false belief for self question was due to an embarrassment at having said something

false. This was achieved by contrasting the performance of 24 three-year-olds (median = 3;8) on an **own belief** task with their performance on an **own/other** task, where both the child and another person were simultaneously tricked, and where the other person, and not the child, was depicted as the victim of the trick. It was found that children's pattern of responding across tasks was similar, with the 3-year-olds giving 33% correct responses in both cases. Thus, on the basis of these findings it seems unlikely that young children find reporting their own previous false belief a difficult task because they are embarrassed to admit that they had been mistaken.

Nevertheless, the fact that in this study no significant differences between age groups were found on the false belief for self question is not entirely explained by the argument that this was the more difficult test question. We therefore make an assumption and provide an observation. The assumption is that, although we replicated the experimental design of Gopnik and Astington (1988) to every detail, there still remains the possibility that something in the general layout of the experiment masked the competence of the 4-year-olds. Indeed, we propose that our experiment, as it was run, did not provide a problem-solving **context** that facilitated children's performance. Furthermore, it could be argued that the experiment as carried out does not present the child with the necessary social motivation to impute mental states to his 'friend'. This would conflict with the principle that we outlined in chapter one, that one should attempt wherever possible to carry out an experiment in a way that reflects the natural environment of the child. It would therefore be of interest to present the Smarties false belief task as a game or social situation where cheating becomes a distinct possibility. It follows from this that there would have been something about Gopnik and Astington's (1988) experimental procedure that **did** facilitate the performance of the older

children on all tasks.

Gopnik and Astington (1988) did not give any indications as to the exact layout of the room, the positioning of the experimenter(s), the placing of the toys, the position of the second child. In the present experiment, the second child was not only out of sight and could not be heard, but the first child had his back to both the door and the nursery worker who remained within the room. None of the children who were tested ever turned around to look at the door when asked the false belief question. Nor did they ever look to the nursery worker for help. It is the experimenter's observation that most of the children attempted to extract the answer to the false belief question from observing the experimenter and the objects in front of him. That is, it appeared that the first child did not attempt to solve the false belief task by abstracting the situation, but insisted on looking for the answer in a concrete way, an observation which would be compatible with the reality masking hypothesis (Mitchell, 1994). It would therefore be of interest to test if children would perform differently on the Smarties false belief task when the second child is within sight, while obviously not in a position to know what the first child is experiencing. It is hypothesized that in the complete absence of C2, C1 will attempt to complete the false belief task without imputing mental states to C2. It is the presence of C2 that encourages C1 to solve the task by considering C2's mental state. This idea will be explored in our next chapter.

Returning then to Gopnik and Astington's (1988) original experiment, we may ask: was there then something in the way it was carried out that differs from our own? We find no differences in experimentation where procedures and content are concerned, but we suggest that Astington and Gopnik (1988) were able to provide a problem-solving context where we

failed to do so. The 'context' that we refer to was set by presenting the children with a variant of the Flavell et al (1983) "rock" task to test young children's understanding of the distinction between appearance and reality. That is, the children that Gopnik and Astington (1988) tested for their understanding of representational change, were the very same children who had been given the "rock" task. In contrast, the children we tested did not have the experience of engaging in any previous experiment with a deceptive content. In fact, apart from one child (aged 2;10!), none of our children had ever engaged in an experiment before.

It is also interesting to note that other researchers have at times been unable to find an age trend on false belief assessments (Robinson and Mitchell, 1995; Saltmarsh, Mitchell and Robinson, 1995; Dalke, 1995). Dalke (1995), for example, tested preschoolers' understanding of both the appearance-reality distinction and of false beliefs. Although an age difference was found on the appearance-reality distinction, there were no significant differences between 3- and 4-year-olds on the false belief task. Nevertheless, 3-year-olds performed **better** on a standard false belief task than on the appearance-reality task and the results indicated that task content affected the children's performance on both assessments.

Furthermore, in a second experiment Dalke (1995) found that explicit reference to deception was found to facilitate performance on the false belief task. In that study, two objects were placed in front of a child. One object was immediately visible while the second object was covered up. Once both objects had been pointed out to the child, she was asked the false belief for self question: 'If (another child) came in here and saw this table just like this, what would s/he think is on the table? Would she think there is a (visible object) or would she think there is an (invisible object)?' The experiment as described represented the **visual-**

access condition. In the **implied-deception** condition the child was subtly deceived before being asked the false belief question. Finally, in the **explicit-deception** condition the child was encouraged to pretend that he was going to play a trick on another child.

The performance of subjects in the explicit-deception condition was found to be better than subjects' performance in the visual-access condition. Performance in the implicit-deception condition, however, was significantly better than the visual access condition only if children had been exposed to the explicit-deception condition first. Now, according to Flavell (1988) and proponents of the theory-theory of mind (Gopnik and Astington, 1988; Perner, 1991), it is the limitations in their representational skills which prevent 3-year-olds from solving the false belief and appearance-reality tasks. However, the results cited above are not predicted by what Dalke (1995) has termed **representational-deficit theories**.

Dalke (1995) discussed her findings in terms of context-sensitive problem solving schemas. We prefer to refer to interpersonal factors, given that there is evidence to suggest that children's performance on theory of mind tasks is affected by the social context in which they are carried out. A recent example is provided by a study carried out by Brown, Donelan-McCall and Dunn (1996). These researchers analyzed natural language data from 38 47-month-olds which was gathered at home during unstructured observations. Comparisons were made of the use by children of mental state terms. It was found that significantly more references to mental states were made by the children in conversation with friends and siblings than with mothers. A significant proportion of the child-friend mental state talk ocurred in the context of pretend play. It was also found that a child's mental state talk was positively correlated with cooperative interactions with other children, as well as with two

false belief measures. These results support the view that a fruitful way forward for theory of mind research is to explore the implications for theory of mind of being a social human being.

4.5 SUMMARY

The present study tested 3- and 4-year-olds on their understanding of false belief for self and other, by adopting a procedure used by Gopnik and Astington (1988). The results indicated that young children find it easier to attribute a false belief to another than to remember their own previous false belief; a finding which is in line with the arguments presented in chapter two of this thesis, that third-person knowledge of mind has priority over first-person knowledge. In developmental terms, it would appear that young children learn about certain aspects of mind at a social level and only later apply the ideas to the self.

The present study, however, was unable to find a significant difference in performance between age groups on their ability to remember their own previous false belief. This aspect of the present study is at odds with the majority view in the developmental literature. A critical view of this study suggests that the experimenter was unable to provide a problem-solving context and/or a deceptive context that might have facilitated children's performance on this task. This idea forms the basis of the next chapter, which examines the effect of deceptive clues on young children's understanding of false belief.

CHAPTER FIVE

A DECEPTIVE CONTEXT FACILITATES AN UNDERSTANDING OF FALSE BELIEF

5.1 INTRODUCTION

In the last chapter we investigated two contradictory findings in the literature on young children's understanding of false belief. According to Gopnik and Astington (1988), both 3- and 4-year-olds find it easier to attribute a false belief to another than to remember their own previous false belief. In contrast, Perner et al (1987) found that young children find it easier to apply the concept of false belief to the self, than to attribute a false belief to another. Our findings support the former view, given that both 3- and 4-year-olds experienced difficulties in correctly reporting their own false belief in the study described in chapter four. Nevertheless, a critical look at our study suggested that the experiment as run did not present the child with a situation that resembled the kind of environment where the child is sufficiently motivated to apply their understanding of false belief to the full. We therefore proposed to repeat the same experiment but with two small modifications: (1) that the second child be brought into the visual field of the experimental child and (2) that the tasks be placed within a deceptive context. The rationale for the first of these modifications is based upon a number of studies that were reviewed in chapters one and four of this thesis and which suggested that young children are more likely to demonstrate their understanding of mind when in the presence of another child (Dunn and Brown, 1989; Reddy, 1991; Slomkowski and Dunn, 1996), especially if the second child is older (Dunn, Brown, Slomkowski, Tesla and Young, 1991). The basis for the second modification is based upon four key studies

which we now proceed to review.

In recent years, it has been well documented that in certain cases a small modification of a standard false belief task can dramatically alter young children's performance. Thus, Siegal and Beattie (1991) have proposed that young children can predict the consequences of having a false belief, but that this knowledge may not be revealed in standard theory of mind tasks if the child does not share or understand the experimenter's aim in questioning. Both speaker and listener must share the same conversational context if they are to be able to communicate. Refering to the Wellman and Bartsch (1988) study, Siegal and Beattie (1991) have suggested that young children's difficulties in answering the test question "Where will Jane look for the kitten?" is due to their interpreting it as "Where will Jane have to look for the kitten in order to find it?". Thus, it may be that young children simply do not share the conversational world of the adult.

To test this idea, Siegal and Beattie (1991) tested 40 3-year-olds with a mean age of 3 years 8 months and 40 4-year-olds with a mean age of 4 years 4 months on a false belief task similar to Wellman and Bartsch's (1988) study. Children were assigned to one of two conditions: a false belief condition or a question in which children were asked to say where a story character would **look first**. Both groups of children were able to make correct false belief judgements in the **look first** condition. In contrast, both groups of children performed poorly in the false belief condition. This is an interesting finding given the findings reported in chapter four of this thesis. Siegal and Beattie (1991) suggested that the poor performance of the 4-year-olds was due to being younger as a group than the 4-year-olds in Wellman and Bartsch's study, as well as the fact that they were from a mixed sample of working and

middle class families and not from a university preschool.

Nevertheless, it was possible that the use of the term **first** in the above study gave a clue to the children that they should give an answer that was contrary to the real location of the object. To test for this alternative hypothesis, Siegal and Beattie (1991) ran a second experiment with 24 3-year-olds with a mean age of 3 years 8 months. Children were randomly assigned to one of two groups. In one group, children were asked to make a prediction about a story character who held a true belief or a false belief. In the second group, the tasks were the same but involved predicting where a story character would **look first**. Most children gave correct answers to the questions involving true beliefs, as well as the **look first** false belief question. In contrast, children on the whole gave incorrect answers to the standard false belief question. The results did not thus support the alternative hypothesis described above, but did support the suggestion that 3-year-olds have some understanding of false belief. Siegal and Beattie (1991) concluded that the way to uncover children's knowledge of false beliefs is to study their understanding of context and everyday use of language.

Siegal and Beattie's (1991) findings are of interest because if young children's performance on a standard false belief task can be affected by a minimal modification in procedure, then this supports continuity theories. Clements and Perner (1994), however, were unable to replicate Siegal and Beattie's (1991) findings. This failure to replicate motivated Surian and Leslie (1999) to carry out a similar study, but using a standard Sally-Anne type task rather than Wellman and Bartsch's (1988) Explicit False Belief task. Surian and Leslie (1999) argued that before we can accept Siegal and Beattie's (1991) findings, there are two possible

explanations that need to be eliminated. The first is that the word **first** prompted children to interpret the test question as "Where marble first?". Such an interpretation would lead the child to give the correct answer without needing to consider the protagonist's belief. The second possibility is that the word **first** alerts the child to the fact that there will be later looks. The child's reasoning might be as follows: why are there later looks/ Because the first one will fail. Therefore, where can the protagonist make a failing look?

In their first experiment, Surian and Leslie (1999) tested seventy 3-year-olds with a mean age 3 years 9 months on the standard Sally-Anne task with two conditions. Approximately half of the children received the story in its standard format (not see condition), while the remaining children received the identical story except for the fact that Sally witnessed the marble being moved from its original location (see condition). In each condition, half of the children were asked the test question in its original format, while the remaining half were asked the test question in its modified form "Where will Sally look **first** for her marble?". The results showed that 83% of the children passed the look first question in the not see (false belief) condition, while only 30% passed the standard question. The possibility that children used some ad hoc strategy is ruled out by the fact that children performed at near ceiling level on the two forms of the question in the see (true belief) condition. These results are comparable to and lend support to Siegal and Beattie's (1991) findings.

In their second experiment Surian and Leslie (1999) compared the performances of 21 children with autism with a mean age of 13 years 8 months, with a group of 40 typically developing children with a mean age of 3 years 4 months. The experimenters tested subjects on the false belief story previously used in Leslie and Thaiss (1992), with the addition of a

look first question. The pattern of results supported the findings of their first experiment. Normal children proved significantly more likely to pass the **look first** question than the standard think question. The autistic group, in contrast, did not find the **look first** question easier than the standard question and compared to the normal group, the children with autism performed significantly poorer than the normal 3-year-olds.

Another relevant study is that of Sullivan and Winner (1993), who tested 51 children to determine under what circumstances 3-year-olds can understand false belief and to assess whether there are differences in young children's understanding of ignorance and false belief. Twenty-five of the children were 3-year-olds with a mean age of 3 years 4 months. The remaining twenty-six children were 'older' 3-year-olds with a mean age of 3 years 9 months. Children were assigned to one of two conditions: a standard and a trick condition. In the standard condition children were induced to have a false belief and then tested for their understanding of representational change. The children were then asked two further questions, to test their understanding of another's ignorance and their ability to attribute a false belief to another. In the trick condition, children were allowed to see another person model a correct response to the representational change question before being asked the test question themselves. Afterwards, the children were actively encouraged to trick one of the experimenters before being asked the ignorance and false belief questions.

The results indicated that the modelling procedure failed to improve the performance of either age group, but that the addition of the deceptive context had a facilitating effect on the ignorance question for both age groups. Furthermore, the trick context facilitated the performance of both age groups on the false belief question. However, a within-subjects

analysis did not reveal significant differences in children's responding to the ignorance and false belief questions; a finding which is consistent with Sullivan and Winner (1991), but which contradicts Hogrefe, Wimmer and Perner (1986). Taken together, these results suggest that 3-year-olds have some understanding of false beliefs, which becomes evident when mental state questions are posed within a deceptive context. Moreover, the ability to attribute ignorance emerges at the same time as their understanding of false belief. However, neither the modelling of a correct response, nor the use of a temporal marker had any effect on children's understanding of representational change.

Appleton and Reddy (1996) have pointed out that studies of the experimental scaffolding of the false belief task have shown that more than one type of intervention seems to work. This would suggest that it should be possible to train young children in a way that enhances their performance on the theory of mind tasks. Thus, Appleton and Reddy (1996) trained 23 three-year-olds (mean = 42 months) by showing them 4 different video sequences of an unexpected location task, followed by discussions with the children which emphasized supporting and expanding children's comments, but which did not emphasize errors. Later, children were given a misleading appearance task which tested their understanding of false belief for self and other. The training group performed significantly better than a control group of children of the same age. Thus, the training had clearly generalised across tasks, as well as across situations. Some weeks later, all children were given a follow-up test which included both a misleading appearance task, as well as a location task, and the training group continued to outperform the control group, thus demonstrating that it is possible to effectively train young children on theory of mind tasks through conversations and explanations, without the need to emphasize contradiction and counterevidence. These findings are in line with

those of Siegal and Peterson (1994) and Lewis (1994) in that they suggest that children's ideas about mind may well be acquired through conversations with adults.

The studies reported above provided the rationale for the present chapter. Given that the study reported in chapter four was unable to find a significant difference between age groups on their rates of success on the false belief for self task, the question then arose whether the introduction of deceptive clues would facilitate young children's understanding of false belief.

5.2 THE EXPERIMENT

5.2.1 PARTICIPANTS

The subjects were 130 children attending various under-five nurseries in North Kensington. The subjects were divided into two age groups, as shown in table 5.1 below.

Table 5.1 Means, Standard Deviations and Range for Both Age Groups

Group	**N**	**Mean Age (Months)**	**S.D (Months)**	**Range**
3-year-olds	66	40.42	3.3	34 to 47 months
4-year-olds	64	53.06	3.46	48 to 59 months

The 3-year-olds consisted of 36 boys and 30 girls, while among the 4-year-olds there were 33 boys and 31 girls.

5.2.2 MATERIALS

As in the previous experiment, all children were given a screening task in which they were

shown a toy house that was closed up. The experimenter removed the roof of the house to reveal a toy wooden apple inside. The apple was removed, a toy pirate was placed in the house and the roof replaced. The child was then asked the control question: "When you first saw the house at the beginning, what was inside it?". For the main task, a Smarties container was used with a pencil hidden inside.

5.2.3 PROCEDURE

Children were tested in a quiet and separate area of a nursery. A child (C1) and a 'friend'(C2) were taken to the experimental room by two nursery workers. C1 was taken into the room by one of the workers who then introduced C1 to the experimenter. The door was closed, leaving C2 momentarily outside with the second worker. In two of the 4 conditions, C2 was brought into the room at the apropriate moment. In the remaining two conditions, C2 remained outside. C1 was then told "We're going to play a game where we show you some things and ask questions about them". The nursery worker meanwhile sat at the back of the room and remained quiet for the whole session. The 'game' consisted in allowing C1 to discover that a pencil lay inside the Smarties container. The pencil was returned to the Smarties tube, which is then sealed. The child then had to indicate that they could remember the contents of the Smarties box before proceeding to the test questions given below.

5.2.4 THE QUESTIONS

Deceptive Clue (Self): Has anyone ever played a trick on you before?

False Belief for Self: When you first saw the box, all closed up like this, what did you think was inside it?

Deceptive Clue (Other): Have you ever played a trick on someone? Let's pretend that we're going to play a trick on your friend X. Let's take this pencil and hide it in this box.

False Belief for Other: X hasn't seen inside this box. When s/he first sees the box, all closed up like this, what will s/he think is inside?

Deceptive clues always preceded test questions, but to control for possible order effects, the test questions and the screening task were counterbalanced with four different orders of presentation. There were four conditions under which the children from both groups were questioned. In the first condition, C1 was asked the test questions but without deceptive clues. C2 remained outside throughout the procedure. This condition repeats the format used in experiment 1. In the second condition, C1 was asked all questions, preceded by the deceptive clues and C2 remained outside. In the third condition, C1 was asked the test questions, without the deceptive clues. C2 was brought into the room immediately before the false belief for other question. In the fourth condition, C1 was asked the test questions preceded by deceptive clues. C2 was then brought in immediately before the false belief for other question.

5.2.5 SCORING

The procedure used for scoring is the same as in chapter five: only those children who passed the screening task are included in this study.

5.3 RESULTS

A hierarchical 2 (age) x 2 (false belief for other) x 4 (order) loglinear analysis revealed that there were no order effects on the false belief for other question (L.R. Chisq = 1.35, df =

3, $p < 0.72$). Similarly, a separate 2 (age) x 2 (false belief for self) x 4 (order) loglinear analysis showed that there were no order effects on the false belief for self question (L.R. Chisq = 4.10, df = 3, $p < 0.26$). This allows us to focus on the main findings and it was decided to first test the effects of the deceptive clues on children's rates of success, along with the effects of the presence of another child.

A hierarchical 2 (context) x 2 (number of children) x 2 (false belief for self) x 2 (false belief for other) loglinear analysis revealed that children's performance on the false belief for other task was linked to context, with children as a whole performing better in those conditions with deceptive clues (L.R. Chisq = 17.88, df = 1, $p < 0.0001$). This is illustrated in table 5.2 below, which shows that of 65 children comprising the control group only 29 gave correct responses to the test question, while the remaining 36 responded incorrectly. In contrast, of 65 children who were given deceptive clues, 51 passed the test question while the remaining 14 responded incorrectly.

Table 5.2 False Belief for Other x Context Crosstabulation

		CONTEXT	
		With Clues	Without Clues
FB OTHER	Fail	14	36
	Pass	51	29

However, two separate chi-square tests showed that introducing a deceptive context into the false belief for other task improved the performance of the younger children ($Chi^2 = 17.52$, $df = 1$, $p < 0.0001$), but not of the older group ($Chi^2 = 2.00$, $df = 1$, $p < 0.17$). This means that the improved performance of those children on the false belief for other task who had been provided with deceptive clues was carried by the younger group, although it could be argued that the older group were already performing at ceiling. These results are shown in tables 5.3 and 5.4 below.

Table 5.3 shows that of 33 three-year-olds comprising the control group only eight passed the false belief for self question. In contrast, of 33 three-year-olds who were given deceptive clues 25 gave correct responses to this question.

Table 5.3 False Belief for Other x Context Crosstabulation (Three-Year-Olds)

		CONTEXT	
		With Clues	Without Clues
FB OTHER	Fail	8	25
	Pass	25	8

An inspection of table 5.4 shows that of 32 four-year-olds comprising the control group, 21

gave correct responses to the false belief for other question. And of 32 four-year-olds who were given deceptive clues, 26 responded correctly to the test question. Thus, in both conditions the pattern of responding was similar.

Table 5.4 False Belief for Other x Context Crosstabulation (Four-Year-Olds)

		CONTEXT	
		With Clues	Without Clues
FB OTHER	Fail	6	11
	Pass	26	21

The loglinear analysis also demonstrated that the introduction of deceptive clues did not improve children's scores on the false belief for self task (L.R. Chisq = 1.77, df = 1, $p < 0.19$). Similarly, the introduction of a second child into the experimental situation did not significantly affect children's performance on either the false belief for other task (L.R. Chisq = 1.29, df = 1, $p < 0.26$), nor on the false belief for self task (L.R. Chisq = 0.31, df = 1, $p < 0.58$).

The same loglinear analysis also revealed that scores on the false belief for other task were linked to performance on the false belief for self task (L.R. Chisq = 22.13, df = 1, $p < 0.0001$). This result is illustrated in table 5.5 below, a close inspection of which shows that

of 46 children who passed the false belief for self question, 40 also passed the false belief for other task. It may also be observed that of 84 children who failed the false belief for self test question, 40 still responded correctly to the false belief for other question.

Table 5.5 FB for Self x FB for Other Crosstabulation

FB SELF	FB FOR OTHER: Fail	FB FOR OTHER: Pass
Fail	44	40
Pass	6	40

Furthermore, a separate McNemar test revealed that there was a significant difference between children's scores on the test questions (Binomial, $p < 0.001$), with the false belief for self question proving to be more difficult. This can be observed by examining the column and row totals in table 5.5 which show that of 130 children, 80 passed the false belief for other task, while 50 responded incorrectly. In contrast, only 46 of these children gave correct responses to the false belief for self question, with 84 children failing this test question.

A separate hierarchical 2 (age) x 2 (context) x 2 (nokids) x 2 (false belief for other) loglinear analysis showed that there were clear significant differences in performance between age groups on the false belief for other task (L.R. Chisq = 8.91, df = 1, $p < 0.003$). Children's pattern of responding is shown in table 5.6 below, where it can be seen that of

66 three-year-olds only half gave correct responses to this test question. In contrast, of 64 four-year-olds, 47 were able to respond correctly to the false belief for other question.

Table 5.6 False Belief for Other x Age Crosstabulation

FB OTHER	AGE: 3-year-olds	AGE: 4-year-olds
Fail	33	17
Pass	33	47

Nevertheless, a separate hierarchical 2 (age) x 2 (context) x 2 (number of children) x 2 (false belief for self) loglinear analysis revealed that there were no significant differences between age groups on the false belief for self question (L.R. Chisq = 1.53, df = 1, $p < 0.22$). This result is illustrated in table 5.7, where it can be observed that of 66 three-year-olds only 20 passed the false belief for self question. And of 64 four-year-olds, only 26 responded correctly to this test question. Thus, the pattern of responding for both age groups was similar.

Table 5.7 False Belief for Self x Age Crosstabulation

FB SELF	AGE: 3-year-olds	AGE: 4-year-olds
Fail	46	38
Pass	20	26

5.4 DISCUSSION

Only one of the experimental modifications significantly affected children's performance on test questions. Contrary to expectations, the procedure by which a second child was brought into the visual field of the child being tested had no significant impact on children's performance. However, the introduction of deceptive clues prior to asking the test questions significantly improved the performance of the 3-year-olds on the false belief for other task. That the introduction of a deceptive context did not improve the performance of the 4-year-olds can be explained by a careful examination of the data, which indicated that the older children were already performing at ceiling level. But that the deceptive clues did not affect the younger children's scores on the false belief for self question is harder to explain and leads us to a critical examination of our experimental procedure.

When we review the exact phrasing of the deceptive clues, we notice an interesting feature. The deceptive clue which preceded the false belief for self question required the child to

remember a previous occasion when they had been tricked. It was also an indirect way of drawing the child's attention to the fact that the experimenter had just played a trick on the child. But when we look at the deceptive clue that preceded the false belief for other question, we notice that the child was required to remember a time when they had tricked another person **and** was furthermore encouraged to act in a deceptive way in relation to another child. This second clue then, is more likely to provide the child with the social motivation to apply their understanding of false belief. This difference in the structure of the deceptive clues may well explain why the introduction of a deceptive context had a significant effect on only one of the test questions. The imbalance also represents a weakness in our experimental procedure which will be addressed in the next chapter. This weakness also raises the very important question of what precisely is meant by the term **context**. It is suggested that there is as yet no agreement among theory of mind researchers as to the meaning of this term.

The term **context** may refer to a particular communicative interaction between child and experimenter. Siegal and Peterson (1994), for example, have argued that 3-year-olds have an understanding of false belief, but that they fail standard false belief tasks because they do not share the adult's **conversational world**. In everyday conversations between adults, it is common to speak in ways that violate the principles of good communication, thus producing what are termed **conversational implicatures**. This is especially true of the false belief task given its brevity and the minimal use of narrative. Siegal and Peterson (1994) have also argued that the use of double-barrelled questions, as well as the use of incredible stories, makes it harder for young children to understand what is required of them. Furthermore, they suggest that since young children often do not share the experimenter's purpose in

questioning, 3-year-olds reinterpret test questions to their disadvantage.

Siegal and Peterson (1994) proposed that if the experimenter is careful to remove conversational implicatures, by avoiding repetitive and brief forms of questioning, while also ensuring that experimenter and child share the purpose of asking about deception, then 3-year-olds will be more likely to demonstrate what they know about false belief and deception. The researchers also suggested that the shift from an apparent failure on a theory of mind task at age three, to a clear success at age four can be accounted for by a change in the conversational environment of the home. Brown and Dunn (1991), for example, discovered that mothers of young children aged 30 to 36 months show an increase in the number of references to mental states. Similarly, Dunn, Brown, Slomkowski, Tesla and Young (1991) have shown that the frequency with which mothers engage children in conversations about feeling states and causality is a predictor of later success on false belief tasks. Cooperative interactions with an older sibling at age 2 has also been shown to be a predictor of later success on false belief tasks. Thus, Siegal and Peterson (1994) concluded, as did Dunn et al (1991), that an understanding of false belief is rooted in the conversational world of the family.

Another related meaning of the term **context**, along with further evidence that under certain conditions young children will display an understanding of false belief is provided by Lewis (1994), who has suggested that the problem facing the preschooler on a theory of mind task is one of understanding **narrative**. Lewis (1994) explored this idea by testing 3- and 4-year-olds (mean = 48 months, range = 36 to 60 months) on a standard false felief task using dolls. Two weeks later they were given a picture-book version of the task, with children

being allocated to one of two conditions. In the **one run** condition, children were simply read the false belief story and then asked the test question in the same manner as the standard task. In the **two runs** condition, children were first shown the story pictures and then asked to describe the pictures back to the experimenter before being asked the false belief question. The results showed that the children who passed the original standard false belief task were more likely to succeed at the book task. However, children in the two runs condition performed significantly better than those in the one run condition. Furthermore, older children in the two runs condition did not perform significantly better than the younger children.

Follow-up experiments (Lewis, 1994) demonstrated the limits of the effect: children will succeed on a false belief task if they are in control of the narrative. A more complex narrative presents difficulties to the younger children, but the addition of a benign detail does not necessarily confuse them. Interestingly, the experimenter reading the story twice did not in itself improve children's performance. These findings suggest that the problems that young children have on theory of mind tasks is related the more specific problem of reconstructing the narrative, which includes not only the causal fabric of the plot, but the protagonist's mental state. Finally, transcripts from three of Lewis' (1994) experiments were rated by independent judges as to the fluency of the children's narrative. A linear relationship was found between narrative fluency and success on the false belief task, such that poor narrators had little success on the false belief task, while good narrators were at ceiling.

Returning once again to Sullivan and Winner's (1993) study discussed in section 5.1 of this chapter, the phrase **deceptive context** there refered to a particular form of modelling

procedure whereby a child is able to watch another person model a correct response to a false belief question, as well as being encouraged to play a trick on someone else. Thus, the different shades of meanings of the term **context** suggest that it is important to arrive at a shared definition of the term which brings together its various meanings and uses, and can serve as a guiding principle in our own research. To this end, it is proposed that the term **context** should apply to a reference to a particular interaction. In this thesis, the phrase **deceptive context** will therefore apply to a **reference to a deceptive interaction**.

5.5 SUMMARY AND CONCLUSIONS

The present study repeated the procedure adopted in chapter five with a larger sample of 3- and 4-year-olds, as well as introducing a condition in which children were provided with deceptive clues. The results confirmed our previous finding that young children find it easier to attribute a false belief to another than to remember their own previous false belief. The introduction of deceptive clues improved the performance of the younger group on the false belief for other question, but had no effect on children's scores on the false belief for self question. Similarly, the attempt to improve children's scores overall by bringing a second child into the room did not affect children's performance on either task.

As was reported in chapter four, the present study was unable to find a significant difference in performance between age groups on the false belief for self question. A critical examination of the phrasing of the deceptive clues led to the conclusion that the deceptive clue for the false belief for other question was more salient and therefore more likely to affect children's scores than the clue used for the false belief for self question. This idea in turn led to a critical analysis of the term 'context' as used by theory of mind researchers. It

was proposed that the term should apply to a reference to a communicative interaction, and that the term 'deceptive context' be applied to a reference to deceptive interaction. This proposal forms the basis of the next chapter.

CHAPTER SIX

A REFERENCE TO A DECEPTIVE INTERACTION FACILITATES YOUNG CHILDREN'S UNDERSTANDING OF FALSE BELIEF

6.1 INTRODUCTION

In our last chapter, an attempt was made to improve the performance of young children on a classic false belief for self task. By introducing deceptive clues that immediately preceded test questions, we were able to improve the performance of the 3-year-olds on the false belief for other question. However, the use of a deceptive clue did not affect children's performance on the false belief for self question. In fact, in both chapters four and five of this thesis we have reported no significant differences between 3- and 4-year-olds on a standard false belief for self task. However, a critical examination of the types of deceptive clues used in the study reported in chapter five led to the conclusion that these clues were not carefully balanced for both test questions. The present chapter therefore reports on a similar type of study, but with an improved methodology.

Our review of the literature showed that it has now been repeatedly demonstrated that 3-year-olds perform poorly relative to 4-year-olds on tasks with a deceptive content. Nevertheless, in order to fully understand the poor performance of the 3-year-olds, one would need to account for those studies where a significant effect for age was not found on a false belief and/or an appearance-reality task. In chapter four we discussed the work of Dalke (1995) who tested preschoolers' understanding of both the appearance-reality distinction and of false beliefs. Although an age difference was found on the appearance-reality distinction, there

were no significant differences between 3- and 4-year-olds on the false belief task. Nevertheless, 3-year-olds performed **better** on the false belief task than on the appearance-reality task and the results indicated that task content affected the children's performance on both assessments. Furthermore, in a second experiment Dalke (1995) found that the explicit reference to deception was found to facilitate young children's understanding of false belief. In particular, it was the explicit use of the words **trick** and **hide** that greatly facilitated the performance of 3-year-olds on a standard false belief task. These findings led us to a discussion of the importance of social context on children's understanding of mind.

In chapter five, we also made a more detailed examination of the term **context**, as used by theory of mind researchers and noted its multiple meanings in the literature. It was suggested that there is as yet no agreement among researchers as to the meaning of the phrase **deceptive context**, and in an effort to synthesize the various meanings given to this phrase, as well as with a view to focusing our research methods, we proposed that this phrase should apply to a reference to a deceptive interaction. Dalke's (1995) explicit use of the words **trick** and **hide** would thus represent a good example of what we mean by deceptive context.

In this respect, it would be of interest to examine another recent study which claimed to make use of a 'deceptive context'. Rice, Koinis, Sullivan, Tager-Flusberg and Winner (1997) explored two possible reasons why 3-year-olds fail appearance-reality tasks. Their first hypothesis was that there could be a correspondence bias. This refers to a possible assumption that 3-year-olds might make regarding a deceptive object, namely, that an object's representation corresponds to the way the object really is. A second possibility is that young children may fail because of an information processing limitation, which makes it

difficult for them to simultaneously hold in their memory two conflicting object identities.

Rice et al. (1997) tested these ideas by testing 68 3-year-olds on a series of standard appearance-reality tasks. They also randomly assigned the children to one of two experimental conditions. In the reduced information processing condition, children were presented with two single identity objects to aid their memory, as well as being presented with a target deceptive object. In the trick condition, the experimenter introduced a complex trick manipulation which the researchers referred to as introducing a 'context of a deceptive game'. As will be discussed later, the experimenter manipulation included a reference to a deceptive interaction, a reference to the deceptive object in clue form and an invitation to deceive another child. The results indicated that 3-year-olds were able to make the appearance-reality in both experimental conditions, but not in the standard condition. That is, 3-year-olds can understand the distinction between appearance and reality when their goal is to trick someone or when the situation does not require them to hold conflicting object identities in mind at the same time.

Nevertheless, Rice et al. (1997) noted that the format of the trick condition was such that children succeeded if they were able to attribute the correct representation to themselves on the reality question and an incorrect representation to another child on the appearance question. It was therefore possible that the structure of the trick condition alerted the children to the fact that there were two ways of representing the situation, with one answer for the self and another for the second child. To eliminate this possible interpretation of results, it was therefore necessary to repeat the standard condition with a new sample of 28 3-year-olds but in which a control was introduced. This consisted in children answering the reality

question for themselves and the appearance question for another. But since the introduction of a control did not improve children's performance on the standard task, Rice et al. (1997) concluded that the improved performance of the 3-year-olds in the trick condition was due to the framing of the task in the context of a deceptive interaction.

The following study explored two other possibilities. First, we tested the hypothesis that the performance of young children on a theory of mind task might be improved by the presence of a second child of the same age to whom the experimenter could make reference. The rationale for this comes from Brown and Dunn (1992) who made the observation that young children's talk about internal states occurs more often with peers and siblings than with mother. Second, we tested the hypothesis that the experimenter's reference to a deceptive interaction that had either already ocurred or was about to occur would facilitate performance on the same task.

6.2 THE EXPERIMENT

6.2.1 PARTICIPANTS

The participants were 128 children gathered from four different under-five nurseries in the central London area. Children who participated in previous experiments were not selected for the present study. The subjects were divided into two age groups, as shown in table 6.1 below.

Table 6.1 Means, Standard Deviations and Range for Both Age Groups

Group	**N**	**Mean Age (Months)**	**S.D. (Months)**	**Range**
3-year-olds	64	41.47	3.76	34 to 47 months
4-year-olds	64	53.05	3.4	48 to 59 months

There were approximately equal numbers of boys and girls across both age groups and conditions, as shown in tables 6.2 and 6.3.

Table 6.2 Distribution of Gender Across Conditions (3-Year-Olds)

Condition	Number of Boys	Number of Girls
One Child, No Clues	8	8
One Child, With Clues	8	8
Two Children, No Clues	9	7
Two Children, With Clues	9	7

Table 6.3 Distribution of Gender Across Conditions (4-Year-Olds)

Condition	Number of Boys	Number of Girls
One Child, No Clues	6	9
One Child, With Clues	10	7
Two Children, No Clues	6	10
Two Children, With Clues	2	3

6.2.2 MATERIALS

For the language comprehension task, a toy house with a removable roof, a wooden apple and a plastic horse. For the main task, an emptied carton of milk was used with a toy person hidden inside.

6.2.3 SCREENING TASK

All children were given a screening task to test for language comprehension and their ability to recall a past state of affairs. At the beginning, a child was shown a toy house all closed up. The experimenter removed the roof of the house to reveal a toy wooden apple inside. The apple was removed, a toy horse was placed in the house and the roof replaced. The child was then asked the control question: "when you first saw the house at the beginning, what was inside it?"

6.2.4 FALSE BELIEF TASK

Children were tested in an area set apart from other childen. A child (C1) and a 'friend' (C2) were taken to the separated area by one of the workers who then introduced C1 to the experimenter. The second child was momentarily taken away and left on the other side of a partition. In two of the four conditions, C2 was brought in into the test area at the appropriate moment. In the remaining two conditions, C2 remained outside. C1 was then told "We're going to play a game where I show you some things and then ask questions about them". As in previous experiments, a nursery worker was required to be present during testing and sat at the back of the room, remaing quiet for the entire session. The 'game' in this case consisted in the experimenter pretending to pour out a glass of milk into a cup, but instead of milk a toy person would drop into the cup. The toy was then returned to the empty milk carton, which was then closed up. The child was then asked to indicate that they could correctly remember the contents of the milk carton before proceeding to the test questions. This represented a memory control question.

6.2.5 THE TEST QUESTIONS

All children were asked the following two test questions.

False Belief for Self: When you first saw the box, all closed up like this, what did you think was inside it?

False Belief for Another: (C2) hasn't seen inside this box. When s/he first sees the box, all closed up like this, what will s/he think is inside?

6.2.6 THE DECEPTIVE CLUES

Half of the children from both age groups were given the following clues.

Deceptive Clue preceding the false belief for self question: Has anyone ever played a trick on you? [Pause] You see, I played a trick on you. When you weren't looking I hid the toy in the box.

Deceptive Clue preceding the false belief for another question: Have you ever played a trick on someone? [Pause] Let's pretend that we're going to play a trick on your friend (C2). Let's take this toy and hide it in this box.

6.2.7 CONDITIONS

Subjects were allocated to one of four conditions: a control group without the presence of a second child in the test area and no deceptive clues; an experimental group with a second child present but with no deceptive clues; an experimental group with only one child present

but where test questions were preceded by deceptive clues; an experimental group with a second child present and where test questions were preceded by deceptive clues. To control for possible order effects, the language comprehension task and the test questions were presented in four different orders.

6.2.8 SCORING

The present data includes only those children who passed the screening task and correctly answered the memory question.

6.3 RESULTS

A hierarchical 2 (age) x 2 (false belief for other) x 4 (order) loglinear analysis revealed that there were no order effects on the false belief for other question (L.R. Chisq = 0.49, df = 3, $p < 0.93$). Similarly, a separate hierarchical 2 (age) x 2 (false belief for self) x 4 (order) loglinear analysis indicated that there were no order effects on the false belief for self question (L.R. Chisq = 4.59, df = 3, $p < 0.21$).

Examining the performance of all children as a whole, a hierarchical 2 (context) x 2 (number of children) x 2 (false belief for self) x 2 (false belief for other) loglinear analysis revealed a three-way interaction between the presence of a deceptive clue and an understanding of false belief both for self and false belief for other (Likelihood Ratio Chisq = 5.71, df = 1, $p < 0.02$), but since this loglinear analysis is one in a series of five, this finding does not survive Bonferroni correction and cannot be considered significant. Even so, this three-way interaction can be described as follows.

For those children who failed the false belief for other task, adding clues improved their performance on the false belief for self question. But for those children who passed the false belief for other task, adding clues did not affect their performance on the false belief for self question. Furthermore, for those children who failed the false belief for self question, adding clues improved their performance on the false belief for other task. But for those children who passed the false belief for self question, adding clues decreased their performance on the false belief for other task. This complex interaction is shown in table 6.4.

Table 6.4 Context x FB Self x FB Other Crosstabulation

	FB FOR OTHER Fail		FB FOR OTHER Pass	
	FB FOR SELF			
CONTEXT	Fail	Pass	Fail	Pass
Without Deceptive Clues	27	2	16	18
With Deceptive Clues	17	10	18	20

The presence of the second child was not found to influence results significantly (false belief for self: L.R. Chisq = 0.13, df = 1, $p < 0.72$; false belief for other: L.R. Chisq = 0.02, df = 1, $p < 0.91$). However, the loglinear analysis did indicate an association between

children's scores on the false belief for self and false belief for other questions (L.R. Chisq = 13.24, df = 1, p = 0.0003). This last result is illustrated in table 6.5, which shows that of 50 children who passed the false belief for self question, 38 also responded correctly to the false belief for other question. Furthermore, of 78 children who failed the false belief for self question, 34 still gave correct answers on the false belief for other task.

Table 6.5 FB for Self x FB for Other Crosstabulation

		FB FOR OTHER	
		Fail	Pass
FB SELF	Fail	44	34
	Pass	12	38

A separate McNemar test revealed that there was a significant difference between children's rates of success on both test questions (Binomial, $p < 0.002$), with the false belief for self question proving to be more difficult. By observing the column and row totals of table 6.5 it can be seen that of a total of 128 children, 72 passed the false belief for other question, while the remaining 56 answered this test question incorrectly. In contrast, only 50 children gave correct responses to the false belief for other question, with the remaining 78 failing this task.

A separate hierarchical 2 (age) x 2 (context) x 2 (number of children) x 2 (false belief for self) loglinear analysis indicated an interaction between age and children's scores on the false belief for self question (L.R. Chisq = 10.90, df = 1, p = 0.001), with the older group producing the better scores. This result is shown below in table 6.6, a close inspection of which shows that of 64 three-year-olds, only 16 answered the false belief for self question correctly. In contrast, of 64 four-year-olds, 34 passed this test question.

Table 6.6 False Belief for Self x Age Crosstabulation

		AGE	
		3-year-olds	4-year-olds
FB SELF	Fail	48	30
	Pass	16	34

Similarly, a hierarchical 2 (age) x 2 (context) x 2 (number of children) x 2 (false belief for other) revealed an interaction between age and children's scores on the false belief for other question (L.R. Chisq = 12.90, df = 1, p = 0.0003), with the 4-year-olds producing the better scores. Table 6.7 illustrates this finding, where one can observe that of 64 three-year-olds, only 26 passed the test question. This contrasts with the pattern of responding of the 64 four-year-olds, who gave 46 correct responses to this test question.

Table 6.7 False Belief for Other x Age Crosstabulation

FB OTHER	AGE: 3-year-olds	AGE: 4-year-olds
Fail	38	18
Pass	26	46

Separate chi-square analyses showed that although 4-year-olds' performance was significantly better than the 3-year-olds' on the false belief for self question across conditions with no deceptive clues ($Chi^2 = 7.80$, $df = 1$, $p < 0.006$), there were no significant differences in scores between groups when deceptive clues were used ($Chi^2 = 3.52$, $df = 1$, $p < 0.06$). These findings are shown in tables 6.8 and 6.9.

Table 6.8 shows that of 32 three-year-olds who comprised the control group, only five succeeded on the false belief for self task. This compares unfavourably with the performance of the 31 four-year-olds, who scored 15 correct responses to this test question.

Table 6.8 False Belief for Self x Age Crosstabulation (Without Deceptive Clues).

FB SELF	AGE: 3-year-olds	AGE: 4-year-olds
Fail	27	16
Pass	5	15

Table 6.9 shows the pattern of responding of the children who were given deceptive clues. It can be observed that of 32 three-year-olds, 11 gave correct responses to the false belief for self question. And of 33 four-year-olds in this condition, 19 passed the false belief for self task. Thus, although the introduction of deceptive clues improved the scores of children from both age groups, it was the three-year-olds who benefited the most from this experimental procedure.

Table 6.9 False Belief for Self x Age Crosstabulation (With Deceptive Clues)

FB SELF	AGE: 3-year-olds	AGE: 4-year-olds
Fail	21	14
Pass	11	19

Similarly, chi-square analyses indicated that although the performance of the 4-year-olds on the false belief for other question was significantly better than the 3-year-olds' in the conditions without deceptive clues ($Chi^2 = 13.51$, $df = 1$, $p < 0.0003$), there were no significant differences between groups when deceptive clues were present ($Chi^2 = 1.86$, $df = 1$, $p < 0.18$). Tables 6.10 and 6.11 illustrate these results.

Table 6.10 refers to the control group and shows that of 32 three-year-olds, only 10 gave correct responses to the false belief for other question. In contrast, of 31 four-year-olds, 24 passed this test question.

Table 6.10 False Belief for Other x Age Crosstabulation (Without Deceptive Clues).

FB OTHER	AGE: 3-year-olds	AGE: 4-year-olds
Fail	22	7
Pass	10	24

Table 6.11 illustrates the pattern of responding for those children who were provided with deceptive clues. It can be observed that of 32 three-year-olds, 16 passed the false belief for other question. This compares favourably with the performance of the 33 four-year-olds, who gave 22 correct responses to the same test question.

Table 6.11 False Belief for Other x Age Crosstabulation (With Deceptive Clues).

FB OTHER	AGE: 3-year-olds	AGE: 4-year-olds
Fail	16	11
Pass	16	22

If we now compare the patterns of children's responding as presented in table 6.11 with children's scores as illustrated in table 6.10, it would appear that the introduction of deceptive clues in the false belief for other task improved the performance of the three-year-olds, but not the four-year-olds.

6.4 DISCUSSION

As has been demonstrated in previous studies, the 3-year-olds performed overall more poorly than the older group of children on both false belief questions. However, it is interesting to note that the level of accuracy of the younger children in those conditions which used deceptive clues was comparable to the 4-year-olds. Indeed, there were no significant differences in performance between these age groups when the experiment was placed in a deceptive context. In contrast, the presence of a second child in the room to whom the experimenter could make reference did not significantly improve the performance of the 3-year-olds on the test questions.

The present finding that deceptive clues facilitated young children's understanding of false belief is at first glance in contrast with the findings of Hala and Chandler (1996), who have argued that the introduction of deceptive clues on their own are not sufficient to improve 3-year-olds performance on a false belief task. These researchers tested 64 three-year-olds (mean = 3;5) on an unexpected transfer task with four conditions. In the **deceptive planning** condition children were presented with deceptive clues, as well as allowed to strategically plan a deception. In the **observer-deceptive** condition, the children were presented with deceptive clues but it was the experimenter who planned the deception. In the **nondeceptive**

planning condition, children were allowed to take part in planning the deception, but deceptive cues were missing. Finally, the **observer-nondeceptive** condition represented the equivalent of a standard version of the unexpected transfer task. The results indicated that it was only in the deceptive planning condition that children showed significantly improved scores relative to the observer-nondeceptive condition. Hala and Chandler (1996) concluded from this that it was the opportunity to actvely engage in deception that facilitated the children's understanding of false belief, and not the use of deceptive clues alone.

In the present study, as indeed in the studies reported in chapters four and five, children were allowed to replace the deceptive in the target container. Although it could be argued that this experimental detail might have facilitated young children's performance in the studies reported in chapters five and six, this seems an unlikely explanation given that this manipulation was consistent across conditions. Furthermore, it would not explain why 3-year-olds' scores on the false belief for self task improved following the revised version of the deceptive clues introduced in the present study. A more cogent explanation would be that it is the very structure of the deceptive clue itself that made a difference, both in the present experiment and in the Hala and Chandler (1996) study. Thus, in the present study, deceptive clues consisted of references to a deceptive interaction **that involved the child**. But in the Hala and Chandler (1996) study, the deceptive cue given in the observer-deceptive condition consisted of an experimenter reference to hiding which made no reference to the child. This might explain why this particular cue was unable to improve children's scores on the false belief task. In contrast, in the deceptive planning condition the deceptive cue consisted in a reference to the child's deceptive interaction with the second experimenter. Thus, in the present study, as well as in the Hala and Chandler (1996) study, young children's

understanding of false belief was facilitated when a reference was made to the relationship aspect of a communicative interaction between child and experimenter; an idea which will be developed further in the final chapter of this thesis.

These observations would also apply to the study carried out by Saltmarsh and Mitchell (1998), who examined the conditions under which young children find it easier to correctly attribute a false belief to another. In their first of two experiments, 60 preschoolers (mean age = 47 months) watched two short movies featuring two protagonists, where one protagonist exchanged the contents of a box, thus inducing a false belief in the second character. In one movie, a typical content was exchanged for an atypical one (state change trials). In the second movie, the box contained a typical content from the beginning (standard trials). Half the children watched the movies enacted in a deceptive manner, while the remaining children watched the movies presented in a neutral, albeit engaging manner. The results showed that although children were more likely to attribute a false belief to the second protagonist in the state change than in the standard trials, the introduction of deceptive manners into the acting did not affect children's judgements of false belief. Saltmarsh and Mitchell (1998) concluded that it was the introduction of a reality counterpart of a belief that facilitated young children's ability at false belief attribution, but that there was no evidence that presenting the task in a deceptive manner helped children in understanding false belief. However, this thesis proposes that it is an experimenter reference to a deceptive interaction that facilitates young children's understanding of false belief. It could therefore be argued that merely presenting a task in a deceptive manner does not on its own help children with false belief attribution. Nevertheless, Saltmarsh and Mitchell (1998) were able to replicate their findings in a second experiment in which children were encouraged to take an active

part in deception. Thus, it would appear that the results of this second experiment are at odds with those reported in the present study. Even so, it must be highlighted that the present study found that the introduction of deceptive clues was facilitative in understanding false belief for other among the younger children only, with a reported mean age of 41 months. The younger group of children in the Saltmarsh and Mitchell (1998) study consisted of a much older group (mean = 50 months) and this may explain the lack of a facilitative effect in the use of deceptive cues. Although subsequently Saltmarsh and Mitchell (1998) carried out separate loglinear analyses to test for the effects of age on children's performance across conditions, and found that age was not related to success in acknowledging false belief, these analyses would have been carried out using small sample sizes for each age group relative to the present study.

Although the three-way interaction between the presence of deceptive clues and children's performance on both set tasks has been reported as not significant, it is worth noting that it only fell short of a very stringent Bonferroni correction ($p < 0.02$ with the significance level at 0.01). Moreover, it remains an interesting finding which deserves consideration. That the introduction of deceptive clues on one task might improve a child's performance on another may not be surprising, given that a strong association between children's rates of success on both tasks has been demonstrated. But that the introduction of clues might have been responsible for a decrease in the rates of success on the false belief for other question is unexpected and difficult to account for. Nevertheless, it needs to be pointed out that a similar pattern of responding was noted for the previous study reported in chapter five. In that experiment, it was observed that the older group had lower rates of success on the false belief for other question in the condition in which the deceptive clues were introduced, as

compared to the control condition.

It may also be possible to link this observation with the observation made in chapter three: that on occasion children change their responses. Chapter three reported six instances of older children changing their responses. The present study recorded three instances of 4-year-olds changing their mind. All three children changed their response on the false belief for other question from a correct one to an incorrect one. All three children had been given deceptive clues. If we now examine the experiment reported in chapter five, we note that there were two recorded instances of children changing their responses. Both children were 4-year-olds. However, on this occasion, one child changed their response on the false belief for self from a correct to an incorrect one. The second child changed their response on the false belief for other task from an incorrect to a correct one. But it is interesting to note that these two children had also been given deceptive clues. It is also worthy of note that in these three studies there were no recorded cases of 3-year-olds changing their responses.

Thus, it may well be that for reasons yet unknown the introduction of deceptive clues into the experimental situation may have the effect of negatively affecting the older children's understanding of what is required of them. This idea will be revisited in the final chapter of this thesis.

Three questions can now be raised in relation to these data: first, how does one explain that the presence of another child did not affect the performance of the younger children? Second, how are we to understand the improved performance of the 3-year-olds in those conditions where deceptive clues were given? Third, how are we to interpret these findings in relation

to previous studies of the effects of deceptive context on young children's understanding of mind? This last question will lead once again to a general discussion of the concept of 'deceptive context'.

The finding that the presence of a second child within the experimental situation did not improve the performance of the younger children would not have been predicted by those studies that have shown that young children's talk about internal states occurs more frequently in the presence of peers and siblings (Brown and Dunn 1991, Brown and Dunn 1992, Brown, Donelan-McCall and Dunn, 1996). Nevertheless, the present finding that the **mere presence** of another child did not affect children's scores on both tasks does not challenge these studies. It is to be noted that the experimental situation in this study was such that the child being tested did not have any opportunities to interact with the second child. This suggests that if young children are more likely to engage in mental state talk with a peer or sibling it is because of the opportunity to engage in a particular kind of **social interaction**. This idea links up to the suggestion made in chapter five, that the term **context** should refer to a particular kind of interaction. Having established that the mere presence of another child is insufficient to motivate the test child to apply their theory of mind, it would be of interest to examine whether young children's performance on a deceptive task can be improved by having them interact with another child. This idea is investigated in chapter seven of the thesis.

The finding that 3-year-olds' performance on a false belief task is significantly improved by the introduction of deceptive clues is at first glance in accord with the studies carried out by Dalke (1995) and Rice et al (1997). However, the explanations that these researchers give

as to why 3-year-olds are limited in their understanding of mind are cognitive in nature and fail to highlight the social factors at work in children's developing understanding of inner states. In contrast, we propose the following explanation to account for the data gathered in the present study. It is suggested that 3-year-olds have some understanding of the representational nature of mental states. However, at that age their conception of the representational nature of mind is still under construction and therefore will be limited to expressing itself **in certain social contexts only**. The introduction of deceptive clues, then, is likely to improve 3-year-olds' performance on a false belief task because it highlights the relationship aspect of the social interaction. Furthermore, it thus replicates the kind of social environment that encourages mental state talk in young children.

These observations lead us to repeat the suggestion made in chapter five: that there is no agreement as yet among developmentalists as to what constitutes a 'deceptive context'. In Dalke's (1995) study, a deceptive context is defined by the use of the words **trick** and **hide** on the part of the experimenter. In Rice et al. (1997) however, the concept of deceptive context is both more complex and less precisely defined. In this study, the experimenter manipulations in the trick condition included a reference to a deceptive interaction, a reference to the deceptive object in clue form and an invitation to deceive another child. The problem that this broad definition of deceptive context presents is that it is not at all clear whether the improved performance of the 3-year-olds on the appearance-reality task is due to all three manipulations or perhaps to only one these.

In contrast, the concept of deceptive context that is used in the present study is limited to the experimenter's reference to a deceptive interaction. Children were not given any clues that

might have facilitated their performance. Nevertheless, the study is open to criticism on the grounds that the experimenter's reference to a deceptive interaction was preceded by a memory question (Has anyone ever played a trick on you?/Have you ever played a trick on someone?). It could be argued that it was the memory component of the deceptive clues that alerted the children to the deceptive nature of the experiment. Nevertheless, since the children's most common response to the memory component of the deceptive clues was a negative one, we therefore suggest that it was precisely the experimenter's reference to a deceptive interaction that facilitated young children's understanding of false belief.

6.5 SUMMARY AND CONCLUSIONS

This study compared 3- and 4-year-olds on their understanding of false belief for self and other in four conditions: a control condition; an experimental condition in which the experimenter made a reference to a deceptive interaction; in which a second child of the same age was present to whom the experimenter made direct reference and finally, an experimental condition in which the experimenter gave deceptive clues in the presence of a second child. Although the older children performed significantly better than the younger group overall, it was found that there were no significant differences in performance between age groups in those conditions in which the experimenter made a reference to a deceptive manipulation. The presence of another child, however, did not significantly affect results. It was suggested that these findings support the idea that 3-year-olds have a clear understanding of false belief, albeit limited in that it expresses itself in certain social contexts only.

The present study also supports the findings reported in chapters four and five: that young

children find it easier to attribute a false belief to another than to remember their own previous false belief. A critical appraisal of the experimental setting suggested that bringing a second child into the visual field of another child was unlikely to motivate the test child to apply their understanding of false belief to the situation because of the lack of opportunities for interaction. The procedure also does not conform to the proposed definition of the term 'context'. Another possible criticism of this study concerns the memory component of the deceptive clues. In order to be entirely certain that it was the experimenter's reference to a deceptive interaction that affected children's performance on test questions, this aspect of the deceptive clues would need to be excluded in any future study. These criticisms are taken up in chapter seven.

CHAPTER SEVEN

THE FLUENT KNOWLEDGE OF A SECOND LANGUAGE FACILITATES AN UNDERSTANDING OF FALSE BELIEF

7.1 INTRODUCTION

In chapter six, it was observed that 3-year-olds' performance on a standard false belief task could be improved if the experimenter made a reference to a deceptive interaction. The main effect that this modification of the standard false belief task had was to facilitate young children's recall of a previous false belief of their own, although children's scores on the false belief for other question were also improved. However, the introduction of a second child into the experimental area and to whom the experimenter could make reference to did not affect children's scores. It was suggested that the mere presence of another child was insufficient to motivate them to apply their understanding of false belief.

The present study continues this line of enquiry by investigating the effect that a second child's **active participation** in the experimental manipulations had on another child's understanding of a deceptive object. Furthermore, the study also continues the debate raised in previous chapters, regarding the concept of context by examining the effects of different kinds of referencing. In particular, it examines the effect that an experimenter's reference to a deceptive object has on children's understanding of the appearance-reality distinction, as well as their ability to remember their own previous false belief. The possible effects of an experimenter's reference to a deceptive interaction are also investigated. Finally, this study also raises two questions that are new to this thesis. First, does having an older sibling

facilitate a young child's understanding of mind? Second, does the fluent knowledge of a second language provide a cognitive advantage on tasks that test a young child's understanding of representations?

The studies reported in previous chapters were completed in nurseries in central London, primarily in north Kensington, which is known to be a multi-ethnic area. The researcher had previously been struck by the relatively high numbers of bilinguals in the samples and had wondered what the effect might have been on young children's performance on theory of mind tasks. Since the line of enquiry pursued in this thesis has led to defining 'context' as a particular kind of communicative interaction, it becomes important to raise the question of the effects of bilingualism on children's understanding of mind. It could be argued that the bilingual will be more sensitive to context, given that the ability to speak a second language guarantees the ability to live in more than one social world. As yet, there have been few studies of the relationship between theory of mind ability and bilingualism, but the rationale for the present study comes from a number of sources. First, there is now some evidence to support a link between high levels of language proficiency and an understanding of false belief (Happé 1993, Happé 1995). Furthermore, a series of four recent studies by Doherty and Perner (1998) have provided evidence for a strong link between metalinguistic awareness and false belief understanding. Doherty and Perner (1998) have also suggested that, since their findings confirm that metalinguistic awareness can be demonstrated in four-year-olds, it may be that there is also a strong link between metalinguistic awareness and young children's understanding of representations. On the basis of this argument, one would expect to find an association between bilingualism and an understanding of the appearance-reality distinction in young children. Finally, Bialystock's (1997) argument, that bilinguals tend to

outperform monolinguals on tasks that require high levels of cognitive control, would also support a strong link between bilingualism and metarepresentational abilities. Thus, these studies provide the rationale for the present study, which examined the effects of bilingualism on both young children's understanding of false belief and their knowledge of the appearance-reality distinction. As to the possible effects of having an older sibling, this is a relatively new and controversial line of enquiry in theory of mind research, and there are three key studies which we now proceed to review.

Perner, Ruffman and Leekam (1994) were the first to investigate the relationship between family size and understanding of false belief in 3- and 4-year-olds across two experiments. In their first experiment a total of 76 children were tested, of whom 22 were only children, 42 were from a family of two children, 11 were from a family of three and one child came from a family of four. Half of the children were tested on Wimmer and Perner's (1983) unexpected transfer task, while the other half were tested on a story where one character misinformed another about the location of some chocolates. The children were also tested for memory, but the only significant finding, apart from a main effect for age, was family size, with children from larger families showing improved performances on both theory of mind tasks. The researchers also examined the effect of having older siblings only as compared to having younger siblings only, but this was not shown to have a significant effect.

In their second experiment, Perner et al. (1994) tested 42 children aged between 38 months to 69 months on a series of false belief stories. All children had only one sibling, so that it was possible to look at the differences in performances between children with an older sibling and those with a younger sibling. The results, however, did not reveal a significant difference

between these groups. Furthermore, neither the age of the child's siblings, nor the closeness in age between sibling and child made a difference.

Jenkins and Astington (1996) tested 68 3- to 5-year-olds on four standard false belief tasks with a view to examining the factors associated with individual variation in the understanding of false belief. In particular, the researchers were interested to study the effects of language and memory on false belief understanding, as well as to investigate the finding by Perner et al. (1994) that larger family size is associated with false belief understanding. General language abilities were assessed using the TELD (Test of Early Language Development), which looks at both syntactic and semantic abilities. Verbal memory was measured using the sentence memory test of the Stanford-Binet, while nonverbal memory was measured using the bead memory test of the Stanford-Binet. Finally, the ages of a child's siblings were requested from the parents.

The results indicated that children's ability to succeed at the false belief tasks was associated with general language ability. It was found that 98% of children who passed one or more false belief tasks demonstrated linguistic abilities expected of children aged 4;1 years and above. There was little evidence to support the hypothesis that performance on the false belief tasks was linked to memory. Nonverbal memory was not associated with false belief understanding once the effects of age had been accounted for; and although verbal memory was associated with false belief understanding, it did not account for more variance in performance than the measure of general language ability.

The results also indicated that there was a positive relation between false belief understanding

and the number of siblings a child had, thus confirming Perner et al.'s (1994) study. In a similar fashion to Perner et al. (1994), it did not seem to matter how old the siblings were, and importantly, the relationship between family size and false belief understanding was found to be independent of language ability.

In a series of four experiments Ruffman, Perner, Naito and Parkin (1998) examined the possible effects of both younger and older siblings on a child's understanding of false belief. Experiment 1 consisted in a reanalysis of Perner et al's (1994) data comprising 78 children. It was found that apart from a main effect for age, the only other finding was a significant effect of the number of older siblings on the understanding of false belief. In contrast, younger siblings had no significant effect on children's performance on the false belief task. However, one of the weakneses of this reanalysis, as pointed out by Ruffman et al (1998) was that there were no children with two younger siblings, whereas some children had two older siblings. Given that the number of siblings has been shown to be important by Jenkins and Astington (1996), it was possible that the effect of younger siblings was being underestimated.

To explore this possibility, Ruffman et al (1998) conducted a second experiment with 56 children aged between 4 and 6 years of age, but who were considered to be late developing in terms of false belief understanding. The choice of older children was the only way of ensuring a large enough sample of children with two younger siblings. The results indicated that, although there was a significant effect for older siblings, the number of younger siblings was not significantly related to false belief understanding.

In the third experiment, Ruffman et al (1998) investigated whether the ability of older siblings to enhance young children's understanding of false belief applied to children of all ages. In this experiment, a portion of the children were given a test of receptive vocabulary using the British Picture Vocabulary Scale, to test examine the possibility that the effect of older siblings was mediated by language ability. The participants were 116 children between the ages of 2;3 to 5;3 years. The initial findings indicated that there was neither a significant effect for older nor for younger children; a result in clear contradiction to the findings reported in the first two experiments. However, a closer look at the data showed an interaction between age and the older sibling effect. When only the 87 children who were aged 3;3 or above were considered, there was found a significant effect for older siblings, although the effect was not as striking as in the previous studies. An analysis of the control questions revealed that older siblings specifically enhance children's understanding of false belief and not memory for story details. Similarly, an analysis of the results of the 51 children who were tested on the BPVS indicated that older siblings did not help younger chidren with their overall language abilities.

Finally, in their fourth experiment Ruffman et al (1998) tested a sample of 214 3- to 5-year-old Japanese children on their understanding of false belief. The researchers had reason to expect that an older sibling effect would be found among Japanese children because of the emphasis in Japanese culture on socialization and cooperation from very early in life. Indeed, the results indicated a significant effect for older siblings that was more striking than that found among the samples of western children. As with the previous experiments, there was no effect found for younger siblings.

It would appear then that older, but not younger, siblings facilitate young children's understanding of false belief. However, the studies reviewed above have only examined the effect that having a sibling has on children's understanding of false belief for other. This study differs in this respect by focusing on the role of siblings in children's understanding of false belief for self, as well as the effect on their understanding of the appearance-reality distinction.

7.2 METHOD

7.2.1 PARTICIPANTS

A total of 197 children were tested, gathered from several nurseries in the Central London Area, of which 140 were monolingual and 57 bilingual. Tables 7.1 and 7.2 describe both these groups.

Table 7.1 Descriptives for Monolinguals

Group	N	Mean Age (Months)	S.D. (Months)	Range
3-year-olds	80	41.79	2.75	37 to 47 months
4-year-olds	60	52.97	2.96	48 to 58 months

Table 7.2 Descriptives for Bilinguals

Group	N	Mean Age (Months)	S.D. (Months)	Range
3-year-olds	31	43.23	1.86	40 to 47 months
4-year-olds	26	52.5	3.01	49 to 58 months

There were approximately equal number of girls and boys across both age groups and

conditions, as illustrated in tables 7.3 and 7.4.

Table 7.3 Distribution of Gender Across Conditions (3-Year-Olds)

Condition	Number of Boys	Number of Girls
Control	13	15
Context	16	12
Older Peer	14	14
Interaction	14	13

Table 7.4 Distribution of Gender Across Conditions (4-Year-Olds)

Condition	Number of Boys	Number of Girls
Control	13	12
Context	10	10
Older Peer	11	9
Interaction	13	8

All of the children were tested individually in a separate, quiet area of a nursery.

7.2.2 MATERIALS

A small transparent, plastic container filled with water and thus serving as an aquarium; with sea shells, pebbles and seaweed placed inside. A bright pen in the shape of a fish, with round eyes, shiny red and yellow scales, and a removable tail.

7.2.3 DEFINITION OF BILINGUALISM

There is as yet no generally accepted definition of the phenomenon of bilingualism (Romaine, 1989; Hoffman, 1991). There are a large number of definitions which have been proposed without any real sense of progress being made in this field, and the list of definitions grows every year (Smith, 1999). Nevertheless, it is possible to refer to **ambilingualism** to describe the person who is capable of functioning in two languages equally well in all domains of activity. On this definition, very few individuals can be said to be ambilingual. A person who has learned two languages by force of circumstance and without any specific training can be said to be a **natural bilingual**. In this case, there is usually a preferred language, or they may be used selectively, but it is unlikely that they will show themselves to be equally fluent in both languages. If one language has clearly been acquired before another it is usual to refer to this as **additive or secondary bilingualism**. For the purposes of this study, no distinction has been made between ambilingualism and natural bilingualism. Instead, a child was considered bilingual if the nursery staff could confirm that she spoke competent english at the nursery **and** if the parents could confirm that the child preferred to speak another language at home. This method of defining bilingualism is in accord with recent research in this field (Bialystok, 1999).

7.2.4 PROCEDURE

Each child was randomly assigned within age groups to one of four conditions: the deceptive context condition (n = 48), the older peer condition (n = 48), the deceptive interaction condition (n = 48) or the control condition (n = 53).

In the **control** condition, a child would be taken to a separate room and shown the aquarium

filled with water and containing the target object: a pen that looked like a bright red fish. The experimenter pointed to the tricky object and said: "Look at this. What does this look like to you?". If the child replied by saying it looked like a fish, the experimenter responded with "Yes, it looks like a fish. If the child did not know what it looked like or did not respond, the question was repeated: "Look again. Look very closely. What does this look like to you?". The child was required to say what the target object looked like before the experiment could continue.

When the child had given the correct answer, the experimenter continued the study by taking the 'fish' out of the water, pulling its tail off to reveal a pen. The experimenter then proceeded to write a word or two on a pad of paper lying on the table nearby. This was followed by offering the pen to the child and saying: "Did you see what I did? Here, you try. Try and write something with this." After the child had written something, the experimenter asked: "So, what is it really and truly?". The child now had to correctly identify the deceptive object before the experiment could continue. If the child did not respond the question was repeated, but an incorrect answer meant that the testing was discontinued and the child was not included in the study.

Next, the experimenter replaced the tail onto the pen, once again making it look like a fish. The 'fish' was then returned to the aquarium and the child was asked the three test questions.

7.2.5 THE QUESTIONS

Reality question: "Now, for real, what is this really and truly?"

Appearance question: "Now, when you look at this, what does it look like?"

False belief for self question: "When I first showed this to you, what did you think it was?"

Questions were counterbalanced with six different orders of presentation, but children were not presented the questions in forced choice format, as the order of response choices would also have had to be counterbalanced across questions.

In the **deceptive context condition** the task was exactly as described above, with the exception that the test questions were preceded by the experimenter making a reference to the trick object and the situation as a whole: "This is a tricky situation and this is a tricky object because it looks like one thing but it really is another."

In the **older peer condition** the task was exactly as described for the control condition with the exception that all the manipulations were accomplished by a 5-year-old child, while the questions were asked by the experimenter. This set-up allowed the experimenter the opportunity to ask the false belief question in reference to the child's older peer: "When Danielle first showed this to you, what did you think it was?".

In the **deceptive interaction** condition: "You see, I'm a tricky person, because when you came in I played a trick on you, showing you this toy which looks like one thing but it really is another."

7.3 RESULTS

A hierarchical 4 (condition) x 2 (false belief for self) x 2 (appearance-reality) x 6 (order) loglinear analysis indicated that there were no order effects on either the false belief for self task (L.R. Chisq = 2.54, df = 5, $p < 0.77$) or the appearance-reality task (L.R. Chisq =

1.35, df = 5, p < 0.93).

The loglinear analysis also showed that there was a significant association between children's performance on the false belief for self task and on the appearance-reality task (L.R. Chisq = 49.312, df = 1, p < 0.0001). This result is illustrated in table 7.5 below, a close inspection of which reveals that of 114 children who passed the appearance-reality task, 92 also responded correctly to the false belief for self task. Moreover, of 83 children who failed the appearance-reality task, 57 also failed the false belief for self task.

Table 7.5 False Belief for Self x Appearance-Reality Crosstabulation

		APPEARANCE-REALITY	
		Fail	Pass
FB SELF	Fail	57	22
	Pass	26	92

A hierarchical 4 (condition) x 2 ((age) x 2 (false belief for self) x 2 (language) loglinear analysis revealed an interaction between age and performance on the false belief for self question (L.R. Chisq = 7.85, df = 1, p < 0.006), with the older group performing better than the younger one. This finding is illustrated in table 7.6 below, which shows that of 111 three-year-olds, only 57 passed the false belief for self task. In contrast, of 86 four-year-olds,

61 responded correctly to this test question.

Table 7.6 False Belief for Self x Age Crosstabulation

FB SELF	AGE: 3-year-olds	AGE: 4-year-olds
Fail	54	25
Pass	57	61

The loglinear analysis also revealed an interaction between language and performance on the false belief for self task (L.R. Chisq = 6.57, df = 1, p = 0.01), with the bilinguals outperforming the monolinguals. This result is shown in table 7.7, which shows that of 140 monolinguals, 76 passed the false belief for self question. The 57 bilinguals, in contrast, showed a better pattern of responding with 42 children giving correct responses to the false belief for self task. Described as percentages, while the monolinguals gave 54% correct responses to the false belief for self task, the pass rate among the bilinguals was 74%.

Table 7.7 False Belief for Self x Language Crosstabulation

FB SELF	LANGUAGE: Monolinguals	LANGUAGE: Bilinguals
Fail	64	15
Pass	76	42

There were no significant differences across conditions for all children on the false belief for self task (L.R. Chisq = 4.28, df = 3, $p < 0.24$). However, a separate 2x4 chi-square for the 3-year-olds revealed a significant interaction between condition and performance on the false belief for self question ($Chi^2 = 9.83616$, df = 3, $p < 0.03$), with children in the **deceptive interaction** condition showing the best scores. A careful look at the data showed that although children in all three experimental conditions showed improved scores relative to the control condition, children's understanding of false belief for self was best facilitated by an experimenter's reference to a deceptive interaction. Table 7.8 shows these results, and it can be observed that of 28 children in the control, only 8 gave correct responses to this test question. In contrast, of 27 children in the deceptive interaction condition, 19 responded correctly.

Table 7.8 Condition x False Belief for Self Crosstabulation (Three-Year-Olds)

FB SELF	CONDITION: Control	Context	Older Peer	Interaction
Fail	20	13	13	8
Pass	8	15	15	19

However, a 2x4 chi-square test for the 4-year-olds did not reveal a significant interaction between condition and performance on the false belief for self question ($Chi^2 = 0.66$, df = 3, $p < 0.89$). This is illustrated in table 7.9 below, where it can be seen that overall the older children were performing at ceiling.

Table 7.9 Condition x False Belief for Self Crosstabulation (Four-Year-Olds)

FB SELF	CONDITION: Control	Context	Older Peer	Interaction
Fail	6	6	7	6
Pass	19	14	13	15

A hierarchical 4 (condition) x 2 (age) x 2 (appearance-reality) x 2 (language) loglinear analysis revealed an interaction between age and performance on the appearance-reality task (L.R. Chisq = 7.31, df = 1, $p < 0.007$), with the older group performing better than the younger one. This result is shown in table 7.10 below, where it can be observed that of 111 three-year-olds only 55 passed the appearance-reality task. This contrasts with the performance of the 86 four-year-olds, of whom 59 responded correctly to this task.

Table 7.10 Appearance-Reality x Age Crosstabulation

		AGE	
		3-year-olds	4-year-olds
APPEARANCE-REALITY	Fail	56	27
	Pass	55	59

The loglinear analysis also revealed an interaction between language and children's scores on the appearance-reality task (L.R. Chisq = 6.715, df = 1, $p < 0.01$), with the bilinguals performing better than the monolinguals. This finding is shown in table 7.11, where it can be seen that of 140 monolinguals, 73 passed the appearance-reality task. The pass rate for the 57 bilinguals, however, consisted of 41 passes. Expressed as percentages, only 52% of the monolinguals responded correctly to these test questions, as compared to the bilinguals' 72% correct responses.

Table 7.11 Appearance-Reality x Language Crosstabulation

APPEARANCE-REALITY	LANGUAGE: Monolinguals	LANGUAGE: Bilinguals
Fail	67	16
Pass	73	41

There were no significant differences across conditions for all children on the appearance-reality task (L.R. Chisq = 2.35, df = 3, $p < 0.51$). A separate 2x4 chi-square for the 3-year-olds did not reveal an interaction between condition and performance on the appearance-reality task ($Chi^2 = 3.35$, df = 3, $p < 0.35$). A further 2x4 chi-square examining the performance of the 4-year-olds similarly did not reveal a significant interaction between condition and performance on the appearance-reality task ($Chi^2 = 1.44$, df = 3, $p < 0.70$). These findings are illustrated in tables 7.12 and 7.13.

Table 7.12 shows the pattern of responding of the three-year-olds across conditions, examination of which shows that children's rates of success were marginally better in the three experimental conditions as compared to the control group, with children in the deceptive interaction condition showing the best scores. In this latter condition, 16 out of a total of 27 children responded correctly to the appearance-reality questions. This compares favourably with the control group of 28 children, of whom only 10 gave correct responses to this task, although this difference did not reach significance.

Table 7.12 Condition x Appearance-Reality Crosstabulation (Three-Year-Olds)

	CONDITION			
	Control	Context	Older Peer	Interaction
APPEARANCE-REALITY				
Fail	18	13	14	11
Pass	10	15	14	16

Table 7.13 illustrates the pattern of responding of the four-year-olds and shows that overall this group of children were responding nearly at ceiling across all conditions.

Table 7.13 Condition x Appearance-Reality Crosstabulation (Four-Year-Olds)

	CONDITION			
	Control	Context	Older Peer	Interaction
APPEARANCE-REALITY				
Fail	9	5	5	8
Pass	16	15	15	13

In order to test for a possible sibling effect on both tasks it was decided to divide the participants into three age groups: 37 to 42 months, 43 to 50 months, and 51 to 58 months.

The rationale for this is based on Ruffman et al.'s (1998) observation that the sibling effect has only been noted among children aged 3 years 3 months and above. Thus, a hierarchical 3 (age) x 4 (condition) x 2 (false belief for self) x 2 (siblings) loglinear analysis did not reveal a sibling effect on the false belief for self task (L.R. Chisq = 1.40, df = 1, $p < 0.24$).

A separate hierarchical 3 (age) x 4 (condition) x 2 (appearance-reality) x 2 (siblings) loglinear analysis originally indicated a sibling effect for the appearance-reality task (L.R. Chisq = 4.83, df = 1, $p < 0.03$), but since this analysis is one in a series of six loglinear analyses it does not survive Bonferroni correction and cannot therefore be considered significant.

7.4 DISCUSSION

In line with previous research, the present study found significant differences in performance between age groups on both the appearance-reality and the false belief for self tasks, with the older children obtaining better scores than the younger ones. However, the introduction of a second child, who actively participated in the experimental manipulations, did not improve the scores of the children tested. The five-year-old child who was used in this condition had been trained by the researcher to carry out the experimental manipulations described in the control condition. It must be remarked that it is perhaps not surprising that the introduction of a second child in this manner had only a small and non-significant effect on test children's scores, given that there were no spontaneous interactions between children in the older peer condition. Furthermore, a setting where one child plays at being an experimenter is an unusual one, which does not in any way resemble the interactive patterns

to be found in children's natural play environment. This highlights the difficulties of putting into practice the principle expounded in chapter one of this thesis: that an experimental setting should strive, wherever possible, to resemble the child's natural play environment.

Similarly, in this study it was found that the experimenter's reference to a deceptive object did not significantly improve children's scores on either the appearance-reality or the false belief for self questions. Nor did the experimenter's reference to a deceptive interaction facilitate children's understanding of the appearance-reality distinction. Nevertheless, the experimenter's reference to a deceptive interaction significantly improved the performance of the **3-year-olds on the false belief for self question**. This finding is consistent with the results reported in chapter six, and supports the ideas developed thus far regarding the role of context in young children's understanding of mind. It was proposed that if certain kinds of 'context' improve young children's understanding of false belief, it is because they allow certain kinds of communicative interactions. Similarly, a reference to a deceptive interaction, which has been the definition of the phrase 'deceptive context' in this thesis, enhances young children's performance on theory of mind tasks by highlighting a particular aspect of a communicative interaction. This line of reasoning is supported by studies that we have reviewed throughout this thesis (Chandler, Fritz and Hala, 1989; Lewis, 1994; Siegal and Peterson, 1994; Dalke, 1995;). Furthermore, it lends support to the argument presented in chapter six, that 3-year-olds have a developing understanding of false belief, but one which shows itself in certain contexts only.

The finding that neither a reference to a deceptive object, nor a reference to deceptive interaction improved the three-year-olds' understanding of the appearance-reality distinction

would appear to be in conflict with the findings reported by Rice et al. (1997). However, as was argued in chapter six of this thesis, the 'deceptive context' that Rice et al. (1997) introduced into their experiment was a complex interaction of a reference to a deceptive interaction, a reference to a deceptive object and an encouragement to the test child to deceive another child. It is therefore not at all clear which aspect or combination of these aspects were responsible for the improved scores of the three-year-olds on their appearance-reality task. Our results suggest that a reference to a deceptive interaction is insufficient on its own to improve young children's performance on this task.

Similarly, the present finding that there was no sibling effect for either the false belief task or the appearance-reality task would seem to be in contradiction with previous research (Perner et al., 1994; Jenkins and Astington, 1996; Ruffman et al., 1998). Nevertheless, the present findings should be seen as preliminary in status, given that they represent a first attempt to establish whether there can be a sibling effect on a false belief for **self** task and on children's understanding of representations in general. The research studies cited above have so far only examined the sibling effect for false belief for other. Perner (1999) has highlighted that the sibling effect is a difficult one to measure and that we do not as yet know the limiting factors of this phenomenon. This observation will lead us to a critical examination of the concept of a 'sibling effect' in our final chapter. Moreover, it should also be pointed out that a recent study by Cutting and Dunn (1999) exploring the effects of language and family background on children's understanding of mind and emotion seriously challenges the idea of a sibling effect. These researchers tested 128 children with a mean age of 4.16 years (the range was 3.49 to 4.8 years) on a total of eight false belief tasks and found that there was no interaction between number of siblings and false belief understanding.

Similarly, when examining the effect of younger and older siblings, these researchers found no significant interactions with false belief or emotion understanding.

Perhaps the most interesting finding to have come out of this study was that the fluent knowledge of a second language made a significant difference to children's performances on both the appearance-reality and the false belief for self tasks. This finding is consistent with the developmental literature on bilingualism, which suggests that there are definite cognitive advantages to learning two languages at an early age. It has been reported that bilinguals score higher than monolinguals on tests of language proficiency, concept formation and nonverbal intelligence (Diaz, 1985; Bialystock, 1986, 1988). More recently, it has emerged that bilinguals outperform monolinguals on tests of metalinguistic abilities (Galambos and Goldin-Meadow, 1990; Bialystock, 1997). Bialystock has pointed out that a consistent finding throughout recent research on bilingualism is that bilinguals perform better than monolinguals of the same age on tasks that demand high levels of control (executive function), but that there is no advantage to being bilingual on tasks that simply require an analysis of representational structures. At first sight then, it would appear that there is no reason why the bilinguals in our study should have performed better than the monolinguals, until we remember that both the appearance-reality and the false belief for self task require metarepresentational abilities. According to our findings, it would appear that bilinguals' metacognitive abilities extend beyond the domain of linguistic processing. Precisely why bilinguals are better able to resist distraction has yet to be determined (Bialystock, 1999); and exactly why bilinguals should be better at theory of mind tasks is a question to be resolved by future research. It could be argued that being bilingual confers the advantage of having at least two linguistic representations to every referent, and that this metalinguistic ability

affects theory of mind abilities (Charman and Schmueli-Goetz, 1998; Doherty and Perner, 1998). Or it could be argued that to be a fluent speaker of two languages allows one to participate in two social worlds. The bilingual child could then be expected to be more attuned and sensitive to subleties of communicative interactions.

Since there is now evidence to suggest that there is a link between linguistic proficiency and an understanding of false belief (Happé 1993; Happé 1995), the high rates of success among the bilinguals on the false belief for self task might have been due to high levels of language proficiency rather than bilingualism per se. However, an alternative explanation has been provided by Doherty and Perner (1998), who were able to provide evidence across four studies that it is metalinguistic awareness, rather than general language proficiency, that is related to the ability to understand the representational nature of mind. In their first experiment, Doherty and Perner (1998) tested 12 three-year-olds (mean = 42 months) and 12 four-year-olds (mean = 48 months) on a standard version of the unexpected transfer task, as well as a synonym judgement task. The results indicated that children's performance on the two tasks was highly correlated, with the understanding of false belief and metalinguistic abilities emerging at about age four. However, since it was clearly possible that the two tasks were strongly associated because of an underlying dependency on general verbal intelligence, the researchers proceeded to run a second experiment in which 12 three-year-olds (mean = 37 months) and 13 four-year-olds (mean = 50 months) were given the British Picture Vocabulary Test along with the standard false belief task and the synonym judgement task. This second experiment replicated the essential findings of experiment one, and demonstrated that there was a strong association between success on the false belief and synonym tasks, even after performance on the British Picture Verbal Test had been partialled out. Thus the

association between the two tasks could not be explained by general verbal intelligence.

In their third experiment, Doherty and Perner (1998) explored the possibility that an early metalinguistic understanding might have been obscured by the demands of the synonym task. The researchers therefore devised a simplified version of this task. Even so, children's ability to produce synonyms and to understand false belief were strongly correlated. In experiment four, Doherty and Perner (1998) examined the possibility that young children's poor performance on the synonym task was simply due to an unwillingness on the part of the children to think of a different answer to the target word. This idea was tested by introducing a control task where children were required to misname a target object by pretending it was something else. However, children's performance on this pretend control task was significantly better than their performance on the synonym judgement task, thus demonstrating that children's difficulties on the latter task were not simply due to a reluctance to provide an alternative description of an object. Furthermore, children's rates of success on the synonym and false belief tasks were strongly associated. Thus, Doherty and Perner (1998) were able to show across four experiments that there is a close relationship between metalinguistic awareness and false belief understanding; an association that cannot be explained by an appeal to general verbal intelligence. The findings reported in the present chapter are consistent with Doherty and Perner's (1998) idea that there is an underlying conceptual basis to metalinguistic awareness and false belief understanding, given that the improved performance of the bilingual children extended to the appearance-reality task and that there was a strong association between children's performance on the two tasks, as was discussed above.

It is the intention of the present researcher to pursue the questions raised in this section as part of a separate research project, given that the findings regarding the bilingual sample represent the most interesting and fruitful approach forwards. But for the purposes of this thesis, it is decided to immediately pursue another important line of enquiry, relating to the findings presented in chapter three of this thesis. In that chapter, which represented the first of our empirical studies of the theory-theory account of young children's understanding of mind, it was concluded that young children's understanding of representations was insufficient on its own to provide them with a theory of mind. However, the findings reported in chapters five to seven provide a new possible interpretation to the data presented in chapter three. It may be that the dissociation in young children's understanding of representations and their understanding of false belief, as presented in chapter three, was more apparent than real. That is, it may have been that the theory of mind component of the task was not as salient as the representational component. Perhaps if the false belief aspects of the task had been highlighted by an experimenter reference to a deceptive interaction, young children's performance on the false belief question might have been improved upon. In that event, the conclusions reached in chapter three would need to be modified.

7.5 SUMMARY AND CONCLUSIONS

A number of questions motivated the present study. First, there was the question of whether the active participation of another child would facilitate children's understanding of false belief or their understanding of the appearance-reality distinction. Second, there was the very important question of what kinds of referencing might improve children's performance on the false belief for self and appearance-reality tasks. In this study, we examined two kinds of referencing: one was an experimenter reference to a deceptive object, the other was an

experimenter reference to a deceptive interaction. Third, there was the question of whether having an older sibling might facilitate a young child's understanding of mind or their understanding of representations. Finally, would the fluent knowledge of a second language provide a cognitive advantage on a test of false belief for self and the appearance-reality distinction?

The results indicated that the active participation of a second child did not affect children's performance on the two set tasks. With respect to the different kinds of referencing, only an experimenter reference to a deceptive interaction facilitated 3-year-olds' understanding of false belief for self. This finding is consistent with the results reported in chapters five and six, and was discussed in relation to key ideas concerning the role of context on children's understanding of mind. Although children with an older sibling achieved better scores on the appearance-reality task, this finding did not reach significance. The fluent knowledge of a second language, however, significantly improved children's understanding of both mental and nonmental representations.

Given that the last three chapters have shown that an experimenter reference to a deceptive interaction significantly facilitates children's understanding of mind, the question now arises whether the poor performance of the younger children on the false belief task reported in chapter three might have been an artefact of the experimental design. It is to this question that we turn to next in chapter eight.

CHAPTER EIGHT

YOUNG CHILDREN'S UNDERSTANDING OF REPRESENTATIONS ARE NECESSARY TO THEIR DEVELOPING THEORY OF MIND

8.1 INTRODUCTION

The results of the study presented in chapter three of the thesis indicated that while young children have a clear understanding of the nature of pictorial representations, they experience particular difficulties in understanding mental representations. This finding was presented as evidence against Zaitchik's (1990) proposal that the difficulty 3-year-olds experience on the unexpected transfer task is a measure of their poor understanding of representations in general. At a first glance, this points to the need for a revision of the theory-theory, given that this particular account of the development of young children's theories of mind argues that children's revision of their understanding of mind is dependent upon their understanding of representations as a whole. It has also been argued that the findings reported in chapter three supported Slaughter's (1998) hypothesis, that there is a dissociation between young children's understanding of pictorial and mental representations. It was therefore concluded, tentatively, that young children's understanding of representations is not itself sufficient to provide them with a theory of mind, although it was suggested that it was probable that it was still a necessary condition.

Nevertheless, the results of the study reported in chapter seven present a serious difficulty to the interpretation given in chapter three. In chapter seven, a strong association was found between children's scores on an appearance-reality task and their performance on a false

belief for self task. This raises the possibility that what appeared in chapter three to be a dissociation between children's understanding of pictorial representations and their understanding of false belief was simply an artifact of the experimental procedure. That is, it may have been that the task as presented to the child was not sufficiently sensitive to reveal their understanding of false belief.

At first glance, this explanation seems an unlikely one, given that special efforts were made in chapter three to present the task in the context of a story narrative. Nevertheless, the problem of designing theory of mind tasks with procedures that are both understood by 3-year-olds, as well as being likely to motivate them to apply their understanding of mind, is a key theme that runs throughout this thesis. Also, chapters four to six testify to the fact that experimenter interventions that would be expected to improve children's performance on a false belief task may not do so, even when they appear to replicate children's natural play environment. In the case of the chapters just referred to, it became evident that the introduction of a second child into the experimental set-ups reported in chapters four to six did not improve children's scores on the false belief tasks. It thus becomes possible to question the facilitative effects of the narrative presented in chapter three on children's understanding of mental representations.

Moreover, the study in chapter three was criticised on two grounds. First, it was pointed out that the probe questions always preceding the test questions, thus introducing the possibility that children's scores on the picture task were enhanced by this procedure and/or that children's understanding of false belief was inhibited thereby. Second, there were no strict controls of the children's understanding of the experimental set-up. In this chapter, both these

criticisms are addressed. This chapter thus represents both a methodological improvement of the study reported in chapter three, as well as an investigation into a new possible interpretation of the findings reported in that chapter.

8.2 THE EXPERIMENT

8.2.1 PARTICIPANTS

64 children participated in total, divided into two groups as shown in table 8.1 below.

Table 8.1 Means, Standard Deviations and Range of Children Across Conditions (Expressed in Months)

Group	N	Mean Age (Months)	S.D. (Months)	Range
Control	32	42.44	2.86	39 to 47 months
Experimental	32	43.38	2.43	39 to 47 months

All children were tested in one of two nurseries in the central London area. The control group consisted of 16 boys and 16 girls, while the experimental group consisted of 15 boys and 17 girls.

8.2.2 MATERIALS

Similarly to the first experiment, two puppets were used as protagonists in a story-like situation: a cat and a squirrel. There was a completed painting already framed and with a glass covering, showing a clock on the left hand side of the canvas and a chinese tea cup on the right. Other materials included a brush, small plastic 'paint pots'(empty yoghurt containers), a small table and a cloth with which to cover the painting.

8.2.3 PROCEDURE

A child was taken to a room where she found a puppet (the cat) busy putting the paints away and getting ready to leave. The experimenter explained that the cat had just finished a painting and was about to leave. The cat was then called on to explain to the child what the painting was all about. Picking up his brush the cat pointed to the left side of the painting and asked the child to identify the clock. If the child responded with the correct answer, the cat pointed to the real clock located to the left hand side of the canvas and asked the child to identify the object. This procedure was then repeated for the tea cup. In this way it was established that the painting represented a copy of two real objects placed on the table. Thus far, the experimental procedure is similar to experiment 1, with all events supported by a narrative structure in which the experimenter or the puppet explained to the child what was taking place. In contrast to experiment 1, these questions served to control the child's understanding of the situation. It was necessary for the child to correctly identify both test objects for the experiment to continue.

Once the cat had explained the painting to the child, the canvas was covered up with a cloth and the cat left the room. At this point, the second puppet (the squirrel) appeared who then proceeded to move the clock from its original position to a new location to the right of the tea cup. Similarly to experiment 1, the puppet was described as a 'naughty squirrel' who was 'playing a trick on the cat'. The child's understanding of these events was then tested by means of the following questions.

8.2.4 THE QUESTIONS

Both groups of children were asked the following questions:

Belief Probe: Does the cat **know** where the clock is now?

Belief Test: Where does the cat **think** that the clock is now?

Picture Probe: Where was the clock when the cat left the room?

Picture Test: In the painting, where is the clock?

The order of presentation of the probe and test questions were counterbalanced with four orders of presentation. Children in the experimental condition, however, were given a deceptive clue prior to the belief test question, consisting of a reference to the squirrel's deceptive manipulations:

Deceptive Clue: You see, the squirrel played a trick on the cat. When the cat wasn't looking, the squirrel moved the clock.

8.3 RESULTS

A hierarchical 2 (belief) x 2 (picture) x 4 (order) loglinear analysis showed that there were no significant order effects on either the false belief task (L.R. Chisq = 1.47, df = 3, $p < 0.69$) or the picture task (L.R. Chisq = 4.04, df = 3, $p < 0.26$).

A separate hierarchical 2 (condition) x 2 (false belief) x 2 (picture) loglinear analysis revealed a significant interaction between the presence of deceptive clues and children's scores on the false belief task (L.R. Chisq = 5.14, df = 1, $p < 0.03$), with the children who had been given deceptive clues producing the better scores. This is illustrated in table 8.2 below, which shows that of 32 children in the control group, only 10 gave correct responses to the false belief question. But of 32 children who were given deceptive clues, 18

responded correctly to this test question.

Table 8.2 Condition x False Belief Crostabulation

		FALSE BELIEF	
		Fail	Pass
CONDITION	Control Group	22	10
	With Deceptive Clues	14	18

The loglinear analysis also revealed a significant association between children's scores on the false belief and picture tasks (L.R. Chisq = 9.75, df = 1, $p < 0.002$). The pattern of responding across these two tasks is shown in table 8.3, which reveals that the 28 children who passed the false belief task also passed the picture task, although it must be remembered that the children were performing at ceiling level on the picture task. Table 8.3 also shows that of 36 children who failed the false belief task, 29 still passed the picture task.

Furthermore, a McNemar test indicated that there was a significant difference between children's rates of success across tasks, with the false belief task presenting as the more difficult one (Binomial, $p < 0.001$). Returning to table 8.3, it can be observed that of a total of 64 children, 57 passed the picture task. In contrast, only 36 children gave correct responses to the false belief question.

Table 8.3 Picture x False Belief Crosstabulation

		FALSE BELIEF: Fail	FALSE BELIEF: Pass
PICTURE	Fail	7	0
	Pass	29	28

However, the loglinear analysis indicated that there was no significant interaction between condition and children's scores on the picture task (L.R. Chisq = 1.19, df = 1, $p < 0.28$), as illustrated in table 8.4, although it is clear from the table that children were performing at ceiling on this task.

Table 8.4 Condition x Picture Crosstabulation

		PICTURE: Fail	PICTURE: Pass
CONDITION	Control Group	3	29
	With Deceptive Clues	4	28

8.4 DISCUSSION

The results of the present study confirmed the findings reported in chapter three of this thesis: the level of accuracy of 3-year-olds on the picture task suggests that they have a well-established understanding of the nature of representations in general. This finding is not one that would be predicted by proponents of the theory-theory, which points once again to the need for a revision of the theory-theory. However, the present findings are in direct contrast to those reported by Slaughter (1998), who over two experiments was able to demonstrate a dissociation between children's understanding of representations as shown in pictures and drawings, and their understanding of mental representations.

In chapter three of this thesis it was reported that even those children who performed well on the picture task experienced difficulties on the false belief task. The present study, however, has shown that if deceptive clues are introduced into the experimental situation, then even the younger children will show improved scores on the false belief task. Thus, the poor performance of the 3-year-olds, as reported in chapter three, can now be given a new interpretation. It is now proposed that the initial results, which suggested a dissociation between children's understanding of mental and pictorial representations, were an artefact of the experimental procedure. Despite the fact that the experimental set-up reported in chapter three appeared to engage the children, and that the experiment was placed within a narrative context, it is now suggested that this experiment did not, in effect, motivate the children to apply their understanding of mind.

This conclusion is indirectly supported by the results of the studies reported in chapters four to six of the thesis, which have demonstrated the difficulty of creating experimental

environments that are sensitive enough to measure young children's understanding of false beliefs. More directly, the results of the present study indicated a clear dependent relationship between children's scores on the false belief and picture tasks. A careful examination of table 9.2 shows that all children who failed the picture task also failed the false belief task. However, it is also evident that a pass on the picture task does not guarantee a pass on the false belief task. Thus, the pattern of children's scores suggests that an understanding of representations is a necessary but not a sufficient condition to be able to respond correctly to the false belief question.

This interpretation is only made problematic by the fact that children were performing at ceiling on the picture task. The absence of a significant interaction between condition and children's scores on the picture task can similarly be attributed to this ceiling effect. Nevertheless, the present interpretation is also supported by the results reported in chapter seven, where it was found that young children's scores on an appearance-reality task were associated with their scores on a false belief for self task. It is also consistent with the results reported in chapter three.

A recent study which lends support to the interpretation which is being advanced here was conducted by Bowler, Briskman and Grice (1999). In their first of two experiments, 39 children aged between 36 and 49 months (mean = 46 months) were given a false drawing test embedded within a story, as well as the Sally Anne and the Smarties false belief tasks. In one of the two conditions for the false drawing test, a glove puppet know as Naughty Snakey appeared and was intent on spoiling the proceedings. It was found that this accidental appearance of the glove puppet significantly improved children's scores on this task. The

finding that is of interest to the present discusion is that, although in the standard condition children's scores on the false belief tasks were not significantly different from their scores on the false drawing task, it was found that in the condition in which the glove puppet made its appearance, children found the false drawing task easier than either of the false belief tasks.

However, Bowler et al. (1999) argued that before concluding that the false belief and the false drawing tasks measure different abilities, it would have to be shown that the sudden intervention of a glove puppet on a false belief task did not improve children's performance. This question was addressed in their second experiment, where 50 children aged between 43 and 49 months (mean = 45.96 months) were tested on two unexpected transfer tasks, one of which included an accidental intervention by Naughty Snakey. The results indicated that the appearance of the naughty puppet improved children's scores on the unexpected transfer task.

If we now reexamine Slaughter's (1998) two experiments where she was able to apparently demonstrate a dissociation between children's understanding of pictorial and mental representations, we observe the following methodological details. In her first study, a group of 3-year-olds were tested on a false belief for self task, as well as a false belief for other task. These two tasks were of the standard variety, without deceptive clues or a deceptive context. Neither were the tasks placed within a narrative context, although a puppet made a brief appearance on the false belief for other task. It could therefore be argued that the poor performance of the 3-year-olds on the false belief tasks in Slaughter's (1998) first study was simply due to a characteristic of the standard false belief task which has been noted in

chapters four to six of this thesis: that such a task is a poor measure of young children's understanding of false beliefs.

This idea will be explored further in the last chapter of this thesis, but for now it is interesting to note that in Slaughter's (1998) study, the children's pattern of performance on an appearance-reality task was very similar to that on the false belief tasks, which would suggest a possible underlying association between children's understanding of false belief and the appearance-reality distinction. However, since Slaughter (1998) did not test for contingencies betwen these tasks, this possibility must remain at the level of a suggestion.

Turning now to Slaughter's (1998) second study, we find that a group of children who had failed a false belief pretest were given training on either a false belief training task or a false picture training task or a number conservation task which acted as a control. Those children who were given false belief training performed highest on a theory of mind posttest, but the training did not transfer to the false picture task. Similarly, those children who received training in understanding false pictures scored highest on the false picture posttest, but their learning did not transfer to the false belief task. On this basis, Slaughter (1998) argued once again for a dissociation between children's understanding of pictorial and mental representations. Nevertheless, on the basis of the findings reported in this chapter it is proposed that the lack of transfer between the false belief and false picture tasks can be given a new interpretation.

It is worth remembering at this point that the theory-theory account of children's understanding of mind gives emphasis to learning from experience, as well as children's

ability to revise their conceptions of mind. Thus, it could be argued that although children may show an understanding of representations in general at a very young age, they may not always be able to draw upon it to understand situations that require an inference to be made about another person's mental state. Stated in another way, it is proposed that young children learn about mind and about representations in very specific contexts which are not as yet generalisable. Thus, a young child may come to understand false belief in certain contexts, but may not be able to extract the principle that would allow her to apply this understanding to all contexts. This would explain why young children's performance on a standard false belief task can be improved by the introduction of a deceptive context or a narrative structure which to some extent mirrors the kind of environment where they might have learned about false belief. This would also explain why the standard false belief task may not always be a sensitive measure of young children's understanding of mind, an idea which will be discussed further in the next chapter.

It is worth highlighting that the findings reported in the present study are at odds with those presented by Riggs, Peterson, Robinson and Mitchell (1998), who have suggested that the difficulties that children encounter in understanding false belief are due to the more general difficulty of reasoning about counterfactual situations. In their first of four experiments, 32 children aged between 41 and 52 months (mean = 48 months) were given two stories in two forms: a false belief and a physical state variant. The results indicated that children tended to make realist errors with equal frequency on both the false belief and the physical variants of the stories, with children's performance on the two tasks significantly correlated. However, since it was possible that the association between performance on the two tasks might have been due to the fact that the same verbal abilities were required in each case, the

researchers carried out a second study where children's receptive verbal abilities were assessed. In this second study, 28 children with a mean age of 53 months were tested on two false belief tasks, as well as two physical state tasks. The results were consistent with experiment one, in that children's ability to reason about counterfactual physical states was a better predictor of children's performance on the false belief tests than chronological age or receptive verbal ability.

Riggs et al. (1998) then reasoned that perhaps the relation between children's performance on both types of tasks was due to their shared narrative format. Thus, in their third experiment Riggs et al. (1998) created new tasks in both false belief and physical state variants, but which did not require the children to listen to a story. In this study, 34 children with a mean age of 46 months were tested, and the results showed a significant correlation between performance on the two tasks, thus ruling out the possibility that the findings reported on experiments one and two were due to children's engagement in the narrative structures. Finally, a fourth experiment testing 28 children with a mean age of 53 months showed that children were able to avoid making realist errors when asked to reason about a future situation if certain conditions were in place. This finding was consistent with those of the previous experiments, which demonstrated that children's realist errors were due to their difficulties in reasoning about counterfactual situations and not with reasoning conditionally. However, according to this argument we would expect young children to experience difficulties in reasoning about the picture task, given that the experimental manipulations pertaining to this task presented the child with a counterfactual situation. However, the level of accuracy of the three-year-olds on the picture tasks reported in chapters three and eight do not support this view. Furthermore, it must be remembered that the results reported in

chapter three suggest that not all narrative structures facilitate children's understanding of false belief. In this regard, the story formats used by Riggs et al. (1998) do not conform to the kinds of interventions, as described in chapters five and six, that would be expected to facilitate young children's understanding of false belief. Given that a strong association was found in the present study between children's performance on both the false belief and picture tasks, but that it was not until deceptive clues had been introduced that the three-year-olds' scores on the false belief task matched their scores on the picture task, it is argued that three-year-olds' emergent understanding of false belief is context specific, an idea which will be developed further in chapter nine.

8.5 SUMMARY AND CONCLUSIONS

This brief chapter represents the last of six empirical studies investigating the theory-theory account of young children's understanding of mind. The motivation for the present study was twofold. First, to reconcile the contradictory findings of chapters three and seven. Second, to improve upon the methodological procedures of the study reported in chapter three.

The results of the present study confirmed the findings reported in chapter three, that young children show a clear understanding of pictorial representations, while demonstrating difficulties in understanding false belief. Nevertheless, when children were given a deceptive clue prior to the false belief question, their scores on that task improved significantly. On the basis of these results, it was proposed that young children do indeed have an understanding of false belief, albeit in limited contexts. Furthermore, it was suggested that the apparent dissociation between children's understanding of pictorial and mental representations, as reported in chapter three, was an artefact of the experimental procedure.

The present study showed a clear association between children's scores on the picture and false belief tasks. Although the results of chapter three indicated that young children's understanding of representations may not provide them with a theory of mind, the present study suggests that young children's understanding of representations in general is still a necessary component to their developing theories of mind.

As this study represents the last in a series, two important issues now emerge. First, there is the question of the extent to which the empirical findings presented so far support the philosophical analysis presented in chapter two of the thesis. Second, and perhaps most importantly, to what extent do the empirical studies presented in chapters three to eight support the theory-theory account of young children's understanding of mind? It is to these issues that we turn to in the next and final chapter.

CHAPTER NINE

A THEORY OF MIND IS A THEORY OF COMMUNICATION

9.1 IN SEARCH OF A NEW APPROACH TO THE STUDY OF MIND

We began this thesis by reviewing the empirical evidence relating to children's understanding of mind. It was noted that developmentalists favoured one of two methodological approaches to the subject. One such approach is the method of naturalistic observation of young children in their natural social environments (Dunn and Brown, 1989; Reddy, 1991; Dunn, Brown, Slomkowski, Tesla and Youngblade, 1991; Slomkowski and Dunn, 1996). A second approach is to test young children's cognitive abilities in a carefully controlled environment (Wimmer and Perner, 1983; Sodian, 1991; Sullivan and Winner, 1993; Lewis, 1994; Rice et al., 1997; Surian and Leslie, 1999). We have highlighted the advantages and disadvantages of both approaches. Although in this research we have adopted the experimental method to studying young children's understanding of mind, it was suggested that there was the possibility of combining both methods by modifying the experimental approach to include a narrative framework or by incorporating references to a deceptive context. In other words, by attempting to secure that the experimental set-up reflects characteristics of the young child's natural play environments. This guiding principle of our research is illustrated in the studies reported in chapters three and eight of the thesis, while chapters four to seven have explored the role of a deceptive context on young children' understanding of false belief.

However, our critique of these two methodologies goes deeper than simply describing their respective disadvantages. We have argued that each approach is rooted in a particular

conception of mind. The experimentalist will very likely adopt the suggestion proposed by the philosophers Bennett (1978), Dennett (1978) and Harman (1978), that a child can be said to possess a theory of mind if they are able to attribute a false belief to another. However, we have argued that a theory of mind, defined as the ability to make inferences about another's mental state, cannot be equated with an **understanding of mind**. That is, we have argued that there are aspects of mind that are directly observable and that therefore, to equate mind with the hidden or inaccesible aspects of another person represents an unnecessarily limiting definition of this concept. Furthermore, although theory of mind researchers are agreed that the ability to make inferences about another's mental state confers a social advantage, the emphasis on the mind as a private domain of experience obscures the fact that this ability is embedded within an ongoing pattern of human interactions.

Naturalistic studies of young children's understanding of mind, in contrast, have not provided us with a clear set of criteria of what constitutes a mental phenomenon. These studies have assumed that observations of children teasing each other, their attempts at comforting and expressions of concern, as well as jokes, pretence and deceptive actions necessarily reveal a young child's understanding of mind. While it appears to us that there are good grounds for making this assumption, the lack of a set of criteria for mental phenomena means that researchers adopting this approach have not provided us with a clear description of the development of the concept of mind in young children. Using the terms introduced in chapter two, it would appear that neither approach to the subject has addressed the question of how the closed view of mind arises from the open view. That is, how a conception of mind as a private domain of experience develops within and out of social interactions.Thus, our emphasis on the need for a new methodological approach arises from a conception of mind

as having two aspects. First, there are those aspects of mind that are directly observable and second, there are aspects of mind which, because they cannot be directly observed, need to be inferred.

This approach has parallels with Vygotsky's (1978) view that cognitive processes can be construed as occurring on either an interpersonal or an intrapersonal plane. Vygotsky argued that our first experiences of the higher cognitive processes are social, but that these experiences are gradually internalised to become an intrapsychological category. The methodological principle advocated in this thesis is also rooted in Vygotsky's tenet that all cognitive processes must be investigated within the social context in which they occur. This is not to suggest that the experimental approach had no place in Vygotsky's research, but that the experimental paradigm that Vygotsky supported was the 'method of double stimulation'. In Vygotsky's method, a child is presented with two sets of stimuli. The first set of stimuli become the objects of her activity, while the second allow the child to organize that activity. This use of a second set of stimuli, by which a child could organize her activity was meant to mirror the social processes by which we internalise that activity. Given a situation where the child is presented with an altogether new problem, one would expect her to look to the social context for clues. Our own approach is thus similar to Vygotsky's method, although in this research the focus has been on establishing the effect of particular kinds of context on children's understanding of mind.

Most of the research studies reviewed in chapter one of the thesis do not conform to the principle we have outlined above. Among the exceptions, it is possible to highlight the classic study by Chandler, Fritz and Hala (1989), where children's understanding of deception was

tested in the context of an original hide-and-seek game. This observation also applies to their follow-up study (Hala, Chandler and Fritz, 1991), as well as to the studies by Sodian, Taylor, Harris and Perner (1991) and Sodian (1991). The fact that the most recent trend in theory of mind research has been to examine 3-year-olds' understanding of deception on modified versions of the standard false belief task lends support to the approach advocated in this thesis (Siegal and Beattie, 1991; Sullivan and Wimmer, 1993; Chandler and Hala, 1994; Appleton and Reddy, 1996; Surian and Leslie, 1999).

Chapter two presented a philosophical critique of the major theoretical approaches to theory of mind research. It was argued that developmentalists need to understand the relation between their empirical findings and the questions posed by the philosophy of mind. One such question is the 'problem of other minds'. In philosophical terms, the question is: how can we be certain that another person has a mind? But stated in psychological terms, the question becomes: in what manner and at what point in their development does a child discover that another has a mind? In that chapter, it was argued that from a philosophical perspective, the 'problem of other minds' cannot be solved as long as we adhere to a conception of mind as a private domain of experience. Lillard (1998) has argued that this particular view of mind is one that is shared by most cultures in the Western hemisphere, which she terms the European American social science model of folk psychology (EASSM). Lillard (1998) does point out that this model is not shared by all cultures the world over, but fails to observe that there are, in fact, western philosophical traditions that present an altogether different approach to mind (Merleau-Ponty, 1964). The philosophical assumptions underlying this thesis have come from the phenomenological tradition and it is proposed that this philosophical approach provides us with an alternative model of mind, which we will

refer to as the **phenomenological model**. To understand how this model has guided this thesis, a brief comparison with the EASSM of mind will now be provided.

It is one of the assumptions underlying the EASSM that primacy must be given to cognition. The EASSM is a cognitive model, concerned with the way that knowledge is acquired, stored and processed. It is thus possible to express this model using a computer metaphor of mind. Furthermore, in the EASSM there is an emphasis on mental representations. One consequence of this is that the role of the body is de-emphasized or ignored altogether. As Lillard (1998) has pointed out, the EASSM is based on the Cartesian split, which posits that mind and body are considered to be separate realms of experience. Finally, the model emphasises the mind as a private domain of experience and a conception of self that emphasises that each one of us is a unique individual with clear boundaries.

In contrast, the alternative model of mind which has been termed the phenomenological model in this chapter would give primacy to **embodied perception** (Merleau-Ponty, 1964). It would also argue that there is an irreducible bodily element which cannot be explained by appealing to mental representations. Finally, it would argue that before there is a clear sense of self and other there is the experience of intersubjectivity. These ideas gave expression to the distinction made in chapter two between open and closed positions of mind and it is this phenomenological approach which has allowed us to argue that the 'problem of other minds' comes close to a philosophical solution when we accept that there are both aspects of mind which are directly observable and mental states which need to be inferred. In this respect, Hobson's (1991, 1993) 'theory of persons' came close to the mark when he argued that some mental states are more observable than others. Once this view is accepted, the implication

for developmental psychology is clear: a child's understanding of mind cannot be reduced to a child's performance on a standard false belief task (Bradmetz and Schneider, 1999). Thus, it is proposed that the Wimmer and Perner (1983) false belief paradigm, which has motivated a vast amount of research into children's understanding of mind, **can no longer be the dominant research paradigm** if progress is to be made in this field.

Returning once again to the philosophical 'problem of other minds', chapter two also argued that the problem comes close to solution if one gives preference to third-person descriptions of mental phenomena. This is not to imply that first-person descriptions do not play a role in development, but the principle that has been adopted in this thesis has been that we discover the concept of mind at a social level and only later apply it to the self. The empirical evidence presented in chapters four to six of this thesis provided support for the idea that the concept of mind, as a private domain of experience, is first discovered in social interaction. The studies presented in these three chapters have shown that young children find it easier to attribute a false belief to another than to remember their own previous false belief. Furthermore, the empirical evidence presented in chapters five to seven indicated that an experimenter's reference to a deceptive interaction primarily facilitated young children's understanding of false belief for self. Since other kinds of interventions were found to be less effective, it could be argued that young children's developing concept of mind as it applies to the self is dependent on certain kinds of experiences. In particular, we would argue that the young child has need of experiences of **communicative patterns of interaction that highlight the private aspects of mind**.

9.2 A CRITICAL EXAMINATION OF THE THEORY-THEORY

Having clarified the philosophical foundations of our research, we then proceeded to review three major approaches to the study of children's understanding of mind: the simulation hypothesis, modularity approaches to mind (including Fodor's Very Simple Theory of Mind and Leslie's Theory of Mind Module) and the theory-theory. It was argued that both the simulation hypothesis and the modularity approaches to mind did not satisfy our philosophical and research criteria. These criteria are threefold: that there needs to be a set of criteria for identifying mental phenomena that are both clear and flexible; that preference is to be given to third-person descriptions of mind on the basis that the experience of mind one encounters at a social level is always richer than that which is encountered through introspection; and finally, that there needs to be a distinction between mental phenomena that can be directly observed and those that need to be inferred. It was further argued that only the theory-theory was in a position to satisfy these criteria, given that theory-theorists have argued that young children do not simply hold one view of mind, but are constantly revising their understanding of mind through experience (Gopnik and Wellman, 1994). Also, proponents of the theory-theory have provided evidence that suggests that some mental states are more observable than others (Gopnik and Slaughter, 1991), as well as presenting findings that suggest that the concept of mind is discovered at the social level. It was on this basis that it was decided that this research should focus on an empirical evaluation of the theory-theory.

One of the tenets of the theory-theory is that young children have, not one theory of mind, but a series of hypotheses about the nature of mind that are tested and revised through experience (Gopnik and Wellman, 1994). The ability to revise one's hypotheses about mind is assumed to be dependent on some other cognitive ability and in chapter four, we examined

the suggestion by theory-theorists that young children's understanding of mind is dependent on their general understanding of representations. The initial findings suggested that even when young children show a clear understanding of representations they continue to have difficulties in understanding false belief. It was concluded tentatively that young children's understanding of representations does not provide them with a theory of mind.

Nevertheless, a subsequent study reported in chapter seven of the thesis indicated that there was a clear association between children's scores on a false belief for self question and their scores on an appearance-reality task. Perhaps the apparent dissociation reported in chapter three, between children's understanding of false belief and their understanding of nonmental representations, was possibly due to the task not being a sensitive measure of their false belief understanding. This question was investigated in chapter eight of the thesis, where a similar experiment was carried out, but where in one condition children were given an experimenter clue in the form of a reference to deceptive interaction. The results indicated that children in the condition with the deceptive clue performed better than those in the control condition. This result supports the findings reported in chapters six and seven, that a reference to a deceptive interaction facilitates young children's understanding of false belief. It also supports the suggestion that the experimental set-up reported in chapter three did not 'tap into' children's understanding of false belief, despite the fact that the task was embedded within a narrative structure designed to capture children's interest.

Nevertheless, the conclusion reached in chapter eight of this thesis, that young children's understanding of representations are necessary to their understanding of mind does not change the assessment made in chapter three: that while young children's understanding of

representations may be necessary to their understanding of mind, it is not in itself a sufficient condition for a theory of mind.

The difficulty of designing an experimental set-up that is sensitive enough to reveal young children's understanding of false belief is a theme that runs throughout this thesis. Chapter four reported on the use of a standard false belief procedure (Gopnik and Astington, 1988) to determine whether young children find it easier to remember their own previous false belief or to attribute a false belief to another. The motivation for this study was twofold. On the one hand, this is an empirical question with consequences for understanding the development of young children's theories of mind. But also, the study aimed to test one of the philosophical principles of this research: that third-person descriptions of mind have priority over first-person descriptions. The results indicated that young children find it easier to attribute a false belief to another than to remember their own experience of having been deceived. We have interpreted this finding as supporting a Vygotskian view of the development of the understanding of mind: that young children discover the concept of mind at a social level and only later apply the idea to the self.

However, in chapter four it was reported that there were no significant differences between 3- and 4-year-olds on a standard false belief for self task. Since a significant difference in performance between these age groups has been repeatedly reported in the developmental literature, the initial reaction of the researcher was to wonder in what way the experiment described in chapter four might have differed from the Gopnik and Astington (1988) experiment. In retrospect, however, it would appear that the lesson to be learned regarding the difficulties in finding a significant difference in performance between age groups on that

task highlight the difficulties in the use of the standard false belief task itself as the methodological tool.

It could be argued that chapter five of the thesis represented a turning point in the research and that a number of important results were achieved, both practically and theoretically. The study reported in chapter five repeated the procedure adopted in chapter four, but with two modifications. First, the study in chapter five used a much larger sample of 3- and 4-year-olds. Second, some children were provided with deceptive clues. This study confirmed the finding reported in chapter four: that children find it easier to attribute a false belief to another than to remember their own previous false belief. This result gave additional support to both the philosophical principles motivating the research, as well as to the Vygotskian account of the development of young children's understanding of mind. Once again, there were no significant differences between age groups on the false belief for self question. The introduction of deceptive clues facilitated young children's understanding of false belief for other, but not for self. However, a critical examination of the precise phrasing of the deceptive clues suggested an imbalance between the two types of clues and it was decided to repeat the experiment with an improved methodology, as reported in chapter six.

Chapter six confirmed the findings of the previous study, that a reference to a deceptive interaction improved young children's understanding of false belief. This chapter also provided additional support to another finding presented in chapter five, that the mere presence of another child in the experimental situation was not sufficient to motivate the children to apply their understanding of mind. Perhaps this should not have been surprising, given that the second child played no major interactive role in the proceedings and this was

then explored further in chapter seven, although even then the active participation of a second child did not affect children's rates of success on the two set tasks. Nevertheless, chapter six also opened up the possibility that under certain circumstances the introduction of deceptive clues might have been responsible for a **decrease** in children's performance on the false belief tasks, especially among the older children. This idea was given additional support by the observation that, on occasion, older children will change their correct response to an incorrect one. This phenomenon was observed in the studies reported in chapters three, five, six, seven and eight. Furthermore, a small but similar decrease in performance was noted in chapter five. This was observed among the 4-year-olds who had been given deceptive clues on the false belief for other task.

Having described chapter five as a turning point in the research, it is perhaps possible that the **theoretical** advance made in chapter five of the thesis is even more worthy of note. A critical analysis of the term 'context' as used by theory of mind researchers led to the conclusion that there is as yet no agreement among theory of mind researchers as to the meaning of the term. Among the possible meanings of this term highlighted in chapter five were: context as a conversational world (Siegal and Peterson 1994), as narrative (Lewis 1994), as a modelling procedure (Sullivan and Winner 1993), as a certain use of language (Siegal and Beattie 1991, Surian and Leslie 1999). It was suggested that the different shades of meaning of the term 'context', as used by theory of mind researchers, could be synthesized to refer to a reference to a particular interaction. Furthermore, it was proposed that the phrase 'deceptive context' be applied exclusively to a reference to a deceptive interaction. By adopting an operational definition of the term 'deceptive context' it was possible to critically examine our experimental procedures, as well as the experimental

procedures of other researchers. Perhaps more importantly, the emphasis of context as referring to a particular communicative interaction opens up yet another possible avenue for interdisciplinary work between developmentalists and researchers in the field of communications theory.

9.3 THEORY OF MIND AS AN UNDERSTANDING OF PERSONS

9.3.1 TWO ASPECTS TO COMMUNICATION

The relevance of communication theory to the study of interpersonal interactions has long been recognized (Watzlawick, Bavelas, Jackson 1967). It is thus surprising that there has been little interest in applying the insights of communication theory to children's understanding of mind or to understanding their behaviour in experimental contexts. Thus, communication theorists have proposed that all behaviour is communication, and that furthermore all communication has two aspects: content and relationship. The content aspect of a communication refers to the the information conveyed by a particular message or behaviour. The relationship aspect of a communication refers to the (usually unspoken) definition of a relationship. According to communication theorists, relationships are rarely defined in a conscious or deliberate way, but the suggestion is that every communication is always both a conveying of information and a defining of a relationship. Since the relationship aspect of a communication clarifies the content aspect, it therefore has the status of a metacommunication.

The relevance of these ideas to theory of mind research becomes apparent if we consider once again the phenomena reported in chapter three of the thesis. That chapter described how a small number of older children changed their answers to the picture question. In most

cases, the child changed their correct response to an incorrect one. All children who were asked why they had changed their response to the test question replied that they had expected the experimenter to perform a magic trick. Thus they had interpreted the relationship aspect of the experimenter's communications as signifying that here was a deceptive situation, where the experimenter might be expected to perform a sleight of hand. This aspect of children's understanding and interpretation of experimental procedures has as yet been little explored.

9.3.2 A NOTE ON CHANGING ONE'S MIND

For the sake of completeness, a description of the phenomenon of children changing their responses is as follows. In chapter three there were six recorded instances of children changing their responses on the picture test. Three four-year-olds changed their incorrect responses to a correct one. One five-year-old did the same, but the two remaining five year-olds changed their responses from a correct to an incorrect one. It is interesting to note that these last two children were among the oldest (69 and 70 months). There were no recorded instances of children changing their responses in the study reported in chapter four, which featured the use of the standard Smarties task. In chapter five there were two recorded cases of 4-year-olds changing their responses when provided with deceptive clues. In chapter six there were three instances of 4-year-olds changing their correct responses to incorrect ones when given deceptive clues. In all of these studies there were no examples of 3-year-olds changing their responses, but in chapter seven there were two recorded instances of 3-year-olds changing their responses from an incorrect to a correct one in the condition where the experimenter made a reference to a deceptive object. Finally, in chapter eight there was one recorded instance of a child (aged 43 months) who, having been provided with a deceptive clue, changed an incorrect response to a correct one.

In summary, in all those experiments where deceptive clues were introduced it was observed that occasionally children would change their responses. Out of fourteen recorded instances of children changing their responses three were three-year-olds, eight were 4-year-olds and three were five-year-olds. It can also be noted that among the older children the tendency was to change a correct response to an incorrect one. Although no concise explanation of this phenomenon has been given in this thesis, these findings have been reported to highlight how interesting it would be to conduct a study in future, examining children's reasoning behind their decision to change their responses to test questions.

9.3.3 CONTEXT AS A DEFINING FEATURE OF RELATIONSHIP

Approaching theory of mind research from a communications theory perspective allows us to refine the proposed definition of context once again. It could be argued that the term 'context' as used by most theory of mind researchers refers to the relationship aspect of a communication. A deceptive clue, in the form of a reference to a deceptive interaction, could also be construed as a reference to the relationship aspect of a communication. In this case, such an intervention has the effect of changing the relationship aspect of a communication from an unspoken and background phenomenon, to an explicit one. It is suggested that this explains the improved performance of young children on deceptive tasks. A young child who fails a standard false belief task may do so because they have failed to perceive or understand the experimenter's intentions, and not necessarily because they do not understand false beliefs. A reference to a deceptive interaction, by highlighting the relationship aspect of the experimental procedure, clearly communicates that here is a situation that must be construed as deceptive, thus motivating the child to apply their developing theory of mind.

These ideas are supported by the results of the study reported in chapter seven. The most notable finding was that the fluent knowledge of a second language facilitated young children's understanding of false belief for self and the appearance-reality distinction. This would suggest some kind of association between linguistic and representational abilities. Perhaps the fluent knowledge of a second language, because it provides the child with a new set of representations for the same or similar referents, also influences the development of metarepresentational abilities. One would need to examine bilinguals' understanding of mind across a range of theory of mind tasks. It would also be necessary to examine the effects of different kinds of bilingualism on young children's developing theories of mind.

Nevertheless, the most important suggestion to be made here is that what we require are comparative studies that look at the **interpersonal world** of the bilingual child. The question being raised is, what kind of patterns of communicative interactions are to be found in the bilingual child's social environments that facilitate an early understanding of mind? There has been a tendency in contemporary theory of mind research to neglect the **interpersonal cooperation** that surrounds the child's developing understanding of mind although there have been exceptions to this trend (Brown and Dunn, 1991; Brown and Dunn, 1992; Brown, Donelan-McCall and Dunn, 1996; Dunn, 1988; Dunn, Bretherton and Munn, 1987). In this respect, the use of the Wimmer and Perner (1983) false belief paradigm does not conform to the approach that has been advocated in this thesis, whereby cognitive abilities are studied in their interpersonal context.

Similarly, the search for a 'sibling effect' in chapter seven of the thesis can be criticised along the same lines. Instead of testing to establish what kind of effect the presence of an

older sibling might have on a young child's understanding of mind or their understanding of representations, a more fruitful line of inquiry would be to examine the kinds of communicative patterns between siblings that facilitate a young child's developing cognitive abilities. The principle that is being advocated is that an understanding of mind is primarily an understanding of how communication can achieved between persons; **that is, it is an understanding of interpersonal relations**.

In this respect, it is interesting to examine the work of Meins, Fernyhough, Russell and Clark-Carter (1998) who tested the symbolic and mentalising abilities of 33 children who had been assessed on the strange situations test as part of an earlier study. These researchers found that securely attached children achieved higher executive capacity scores than their insecurely attached peers, as well as being more likely to incorporate the verbal suggestions of another person into their pretend play. Furthermore, it was found that mothers of secuurely attached three-year-olds made more sensitive tutoring interventions and were more likely to describe their children in terms of mental characteristics than were mothers of insecurely attached children. Perhaps most importantly, it was also shown that children who were securely attached in infancy were more likely to pass a version of Wimmer and Perner's (1983) unexpected transfer task at age four, as well as showing a greater understanding of informational access at age five. According to Meins et al. (1998), the evidence suggests that mothers of securely attached children are more sensitive and consistent in their care-giving, which includes treating their children as individuals with minds, a pattern of interaction referred to as 'mind-mindedness'.

An interpersonal approach to the study of children's developing theories of mind would

require a new set of principles. First, it would require a re-examination of the way that we conceive of cognitive abilities as being the personal possession of a child. An interpersonal approach to theory of mind would conceive of a child's growing understanding of mind in terms of the child's gradual coming to share certain social experiences. This view is consistent with Vygotsky's (1978) assertion that the higher mental functions are first discovered at the social level and only later become internalised. In effect, what is being proposed is that researchers in this field need to critically examine how they construe mental phenomena. Chapter two of this thesis represents an attempt at such a critical analysis.

Second, the interpersonal approach would require a new set of methodological procedures. Chapter one reviewed the strengths and weaknesses of both the experimental and naturalistic approaches to the study of children's understanding of mind. One of the proposals made in this thesis has been that experimental approaches to children's understanding of mind need to have ecological validity, that is, that they should whenever possible reflect important aspects of the child's social environment. Apart from the experiment reported in chapter four, the studies that are described in this thesis have attempted to present children with tasks that make 'human sense' (Donaldson, 1978).

Finally, an interpersonal approach to theory of mind would need to be an interdisciplinary endeavour. In chapter two it was argued that for progress to be made in the field of children's understanding of mind, psychologists need to examine the fundamental ideas of the philosophy of mind. Our final thought on this matter is that developmentalists would also need to examine the theoretical work of clinicians. From the psychoanalytic perspective, Winnicott (1971, 1987, 1990) has provided a model of how an infant comes to know itself

and the world through the interpersonal cooperation between mother and child, a relationship that is based on a reciprocity of needs. According to Winnicott (1987, 1990), cognitive development is intimately linked to emotional experiences of reliability and continued care on the part of the primary caregiver. Within the first year of life, the infant discovers the primary caregiver is an independent agent and then begins to become preoccupied with the caregiver's behaviour and mental states in a way that could be described as an early theory of mind. Similarly, from a phenomenological perspective, Sullivan (1953) has provided us with a a model of how the child develops the ability to understand interpersonal relationships. In particular, he has been concerned with describing how cognitive development depends upon interpersonal security early in life and also upon the satisfaction of intimacy needs in middle childhood. In a similar way to Winnicott, Sullivan has argued that both cognitive and emotional development require interpersonal cooperation. Indeed, for Sullivan (1953) interpersonal relationships are the very basis of human development.

9.4 RECAPITULATION

With this chapter we conclude the thesis, which represents a critical examination of the theory-theory, achieved through six empirical studies involving 661 children. Beginning with a critique of both experimental and naturalistic approaches to the study of mind, as well as a critical review of four major theoretical approaches, the thesis began by establishing a set of guiding research principles. This chapter has argued that the empirical evidence gathered over the six studies give support to the philosophical arguments presented in chapter two. In particular, it would appear that young children learn about the concept of mind as it applies to others, before applying the concept to the self.

The present chapter has also argued that the empirical studies reported in this thesis have yielded findings that can be accommodated within the theory-theory account of children's understanding of mind. It would appear that children as young as three years have a clear understanding of the nature of representations and that this understanding is necessary to their developing theory of mind. Another consistent finding has been that an experimenter reference to a deceptive interaction facilitates young children's understanding of false belief. But perhaps the most notable finding reported in this thesis has been that the fluent knowledge of a second language significantly affected children's understanding of both mental and nonmental representations.

Finally, this chapter has discussed the findings of these studies with reference to possible future avenues of research. In particular, it has highlighted the limitations of the use of the standard false belief task and argued that the false belief paradigm can no longer be the dominant research paradigm if progress is to be made in this field. This concluding chapter has suggested that a more fruitful way forward would be to consider theory of mind as a theory of communication, and that much may be gained by studying the patterns of interpersonal relatedness that surround young children's developing understanding of mind.

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APPENDIX ONE

Data set for experiment one as reported in chapter three.

	age	belprobe	beltest	picprobe	pictest	order	months
1	3-year-olds	fail	fail	fail	fail	order2	32.00
2	3-year-olds	fail	fail	pass	pass	order2	32.00
3	3-year-olds	fail	fail	fail	fail	order1	33.00
4	3-year-olds	fail	fail	fail	fail	order2	34.00
5	3-year-olds	fail	fail	fail	fail	order1	36.00
6	3-year-olds	fail	fail	fail	pass	order1	36.00
7	3-year-olds	pass	pass	pass	pass	order1	37.00
8	3-year-olds	fail	fail	fail	pass	order2	37.00
9	3-year-olds	fail	fail	fail	pass	order2	37.00
10	3-year-olds	pass	pass	pass	pass	order1	38.00
11	3-year-olds	fail	fail	fail	pass	order2	38.00
12	3-year-olds	fail	fail	fail	pass	order1	39.00
13	3-year-olds	pass	pass	pass	pass	order2	39.00
14	3-year-olds	fail	fail	fail	pass	order2	39.00
15	3-year-olds	pass	pass	pass	pass	order1	39.00
16	3-year-olds	fail	fail	pass	pass	order1	40.00
17	3-year-olds	fail	fail	fail	pass	order2	40.00
18	3-year-olds	fail	fail	pass	pass	order1	40.00
19	3-year-olds	pass	pass	pass	pass	order2	42.00
20	3-year-olds	fail	fail	fail	pass	order2	42.00
21	3-year-olds	fail	fail	pass	pass	order1	42.00
22	3-year-olds	pass	fail	pass	pass	order2	44.00
23	3-year-olds	pass	fail	pass	pass	order1	45.00
24	3-year-olds	pass	pass	pass	pass	order1	46.00
25	3-year-olds	pass	pass	pass	pass	order2	46.00
26	3-year-olds	fail	fail	pass	pass	order2	46.00
27	3-year-olds	fail	fail	pass	pass	order1	46.00
28	4-year-olds	fail	fail	fail	pass	order2	48.00
29	4-year-olds	pass	fail	pass	pass	order1	49.00
30	4-year-olds	fail	fail	pass	pass	order2	49.00

	age	belprobe	beltest	picprobe	pictest	order	months
31	4-year-olds	fail	fail	fail	pass	order1	50.00
32	4-year-olds	fail	fail	pass	pass	order2	52.00
33	4-year-olds	pass	fail	pass	fail	order1	52.00
34	4-year-olds	pass	fail	pass	pass	order2	52.00
35	4-year-olds	pass	fail	fail	fail	order1	52.00
36	4-year-olds	pass	fail	pass	pass	order2	54.00
37	4-year-olds	pass	pass	pass	pass	order2	55.00
38	4-year-olds	pass	pass	pass	pass	order1	55.00
39	4-year-olds	pass	fail	pass	pass	order2	56.00
40	4-year-olds	pass	pass	pass	pass	order1	56.00
41	4-year-olds	fail	fail	pass	pass	order1	56.00
42	4-year-olds	pass	pass	pass	pass	order2	56.00
43	4-year-olds	pass	pass	pass	pass	order1	56.00
44	4-year-olds	pass	fail	fail	pass	order2	58.00
45	4-year-olds	pass	fail	pass	pass	order1	58.00
46	5-year-olds	pass	pass	fail	pass	order1	61.00
47	5-year-olds	pass	pass	pass	pass	order1	61.00
48	5-year-olds	pass	pass	pass	pass	order2	66.00
49	5-year-olds	pass	pass	pass	pass	order1	66.00
50	5-year-olds	pass	fail	fail	pass	order2	67.00
51	5-year-olds	pass	pass	pass	pass	order2	68.00
52	5-year-olds	pass	pass	pass	fail	order1	69.00
53	5-year-olds	pass	pass	pass	pass	order2	69.00
54	5-year-olds	pass	fail	pass	fail	order1	70.00
55	5-year-olds	pass	pass	pass	pass	order1	70.00
56	5-year-olds	pass	pass	pass	pass	order2	72.00
57	5-year-olds	pass	pass	pass	pass	order2	73.00
58	5-year-olds	pass	pass	pass	pass	order1	73.00
59	5-year-olds	pass	pass	pass	pass	order1	73.00
60	5-year-olds	pass	pass	pass	pass	order2	73.00

APPENDIX TWO

Data set for experiment two as reported in chapter four.

	age	self	other	order	months
1	three-year-	.00	.00	1.00	33.00
2	three-year-	1.00	1.00	1.00	33.00
3	three-year-	.00	.00	1.00	34.00
4	three-year-	.00	.00	1.00	34.00
5	three-year-	.00	.00	1.00	36.00
6	three-year-	.00	.00	1.00	36.00
7	three-year-	1.00	1.00	1.00	38.00
8	three-year-	.00	.00	1.00	39.00
9	three-year-	.00	.00	2.00	30.00
10	three-year-	1.00	1.00	2.00	30.00
11	three-year-	1.00	.00	2.00	31.00
12	three-year-	.00	.00	2.00	33.00
13	three-year-	.00	.00	2.00	34.00
14	three-year-	.00	.00	2.00	36.00
15	three-year-	1.00	1.00	2.00	36.00
16	three-year-	.00	.00	2.00	39.00
17	three-year-	.00	.00	1.00	44.00
18	three-year-	1.00	.00	1.00	44.00
19	three-year-	.00	.00	1.00	46.00
20	three-year-	.00	.00	1.00	46.00
21	three-year-	.00	.00	1.00	46.00
22	four-year-ol	.00	1.00	1.00	48.00
23	four-year-ol	.00	1.00	1.00	52.00
24	four-year-ol	.00	.00	1.00	53.00
25	three-year-	1.00	1.00	2.00	44.00
26	three-year-	1.00	1.00	2.00	45.00
27	three-year-	.00	.00	2.00	47.00
28	four-year-ol	1.00	1.00	2.00	48.00
29	four-year-ol	.00	.00	2.00	49.00
30	four-year-ol	1.00	1.00	2.00	51.00

	age	self	other	order	months
31	four-year-ol	.00	.00	2.00	52.00
32	four-year-ol	.00	1.00	2.00	54.00
33	four-year-ol	1.00	1.00	1.00	50.00
34	four-year-ol	.00	.00	1.00	51.00
35	four-year-ol	.00	1.00	1.00	53.00
36	four-year-ol	.00	1.00	1.00	54.00
37	four-year-ol	1.00	1.00	1.00	55.00
38	four-year-ol	1.00	1.00	1.00	57.00
39	four-year-ol	1.00	1.00	1.00	59.00
40	four-year-ol	.00	.00	2.00	50.00
41	four-year-ol	1.00	1.00	2.00	52.00
42	four-year-ol	.00	1.00	2.00	52.00
43	four-year-ol	1.00	1.00	2.00	54.00
44	four-year-ol	.00	1.00	2.00	54.00
45	four-year-ol	1.00	1.00	2.00	59.00
46	three-year-	.00	.00	3.00	36.00
47	three-year-	.00	.00	3.00	36.00
48	three-year-	1.00	1.00	3.00	38.00
49	three-year-	.00	.00	3.00	39.00
50	three-year-	.00	.00	4.00	34.00
51	three-year-	.00	.00	4.00	36.00
52	three-year-	1.00	1.00	4.00	36.00
53	three-year-	.00	.00	4.00	39.00
54	three-year-	1.00	.00	3.00	44.00
55	three-year-	.00	.00	3.00	46.00
56	four-year-ol	.00	1.00	3.00	48.00
57	four-year-ol	.00	1.00	3.00	52.00
58	four-year-ol	.00	.00	3.00	53.00
59	three-year-	1.00	1.00	4.00	44.00
60	three-year-	1.00	1.00	4.00	45.00

	age	self	other	order	months
61	three-year-	.00	.00	4.00	47.00
62	four-year-ol	1.00	1.00	4.00	48.00
63	four-year-ol	.00	.00	4.00	49.00
64	four-year-ol	1.00	1.00	4.00	51.00
65	four-year-ol	.00	.00	4.00	52.00
66	four-year-ol	.00	1.00	4.00	54.00
67	four-year-ol	1.00	1.00	3.00	50.00
68	four-year-ol	.00	.00	3.00	51.00
69	four-year-ol	.00	1.00	3.00	53.00
70	four-year-ol	.00	1.00	3.00	54.00
71	four-year-ol	1.00	1.00	3.00	55.00
72	four-year-ol	1.00	1.00	3.00	57.00
73	four-year-ol	1.00	1.00	3.00	59.00
74	four-year-ol	1.00	1.00	3.00	59.00
75	four-year-ol	.00	.00	4.00	50.00
76	four-year-ol	.00	.00	4.00	50.00
77	four-year-ol	1.00	1.00	4.00	52.00
78	four-year-ol	.00	1.00	4.00	52.00
79	four-year-ol	1.00	1.00	4.00	54.00
80	four-year-ol	.00	1.00	4.00	54.00
81	four-year-ol	1.00	1.00	4.00	59.00
82	four-year-ol	1.00	1.00	4.00	59.00

APPENDIX THREE

Data set for experiment three as reported in chapter five.

	conditio	age	self	other	decep	nokids	months
1	1without	3-year-olds	.00	.00	no deceptiv	without chil	34.00
2	1without	3-year-olds	.00	.00	no deceptiv	without chil	34.00
3	1without	3-year-olds	.00	.00	no deceptiv	without chil	35.00
4	1without	3-year-olds	.00	.00	no deceptiv	without chil	37.00
5	1without	3-year-olds	.00	.00	no deceptiv	without chil	38.00
6	1without	3-year-olds	.00	.00	no deceptiv	without chil	38.00
7	1without	3-year-olds	.00	.00	no deceptiv	without chil	39.00
8	1without	3-year-olds	1.00	.00	no deceptiv	without chil	39.00
9	1without	3-year-olds	.00	.00	no deceptiv	without chil	39.00
10	1without	3-year-olds	.00	.00	no deceptiv	without chil	41.00
11	1without	3-year-olds	.00	.00	no deceptiv	without chil	42.00
12	1without	3-year-olds	1.00	.00	no deceptiv	without chil	43.00
13	1without	3-year-olds	.00	1.00	no deceptiv	without chil	43.00
14	1without	3-year-olds	1.00	1.00	no deceptiv	without chil	44.00
15	1without	3-year-olds	.00	1.00	no deceptiv	without chil	44.00
16	1without	3-year-olds	1.00	1.00	no deceptiv	without chil	45.00
17	1with	3-year-olds	.00	.00	with decepti	without chil	34.00
18	1with	3-year-olds	.00	1.00	with decepti	without chil	35.00
19	1with	3-year-olds	.00	.00	with decepti	without chil	37.00
20	1with	3-year-olds	.00	1.00	with decepti	without chil	38.00
21	1with	3-year-olds	.00	1.00	with decepti	without chil	39.00
22	1with	3-year-olds	.00	1.00	with decepti	without chil	39.00
23	1with	3-year-olds	.00	1.00	with decepti	without chil	39.00
24	1with	3-year-olds	.00	1.00	with decepti	without chil	40.00
25	1with	3-year-olds	.00	1.00	with decepti	without chil	40.00
26	1with	3-year-olds	.00	1.00	with decepti	without chil	41.00
27	1with	3-year-olds	1.00	1.00	with decepti	without chil	42.00
28	1with	3-year-olds	1.00	1.00	with decepti	without chil	42.00
29	1with	3-year-olds	1.00	1.00	with decepti	without chil	43.00
30	1with	3-year-olds	.00	1.00	with decepti	without chil	43.00

	order
1	3
2	2
3	1
4	4
5	4
6	2
7	3
8	1
9	1
10	2
11	4
12	3
13	3
14	4
15	1
16	2
17	2
18	4
19	1
20	3
21	3
22	1
23	4
24	2
25	4
26	4
27	1
28	2
29	3
30	1

	conditio	age	self	other	decep	nokids	months
31	1with	3-year-olds	1.00	1.00	with decepti	without chil	44.00
32	1with	3-year-olds	1.00	1.00	with decepti	without chil	44.00
33	1with	3-year-olds	1.00	1.00	with decepti	without chil	45.00
34	2without	3-year-olds	.00	.00	no deceptiv	with child	35.00
35	2without	3-year-olds	.00	.00	no deceptiv	with child	35.00
36	2without	3-year-olds	.00	.00	no deceptiv	with child	36.00
37	2without	3-year-olds	.00	.00	no deceptiv	with child	37.00
38	2without	3-year-olds	.00	.00	no deceptiv	with child	38.00
39	2without	3-year-olds	.00	.00	no deceptiv	with child	39.00
40	2without	3-year-olds	.00	.00	no deceptiv	with child	40.00
41	2without	3-year-olds	.00	.00	no deceptiv	with child	40.00
42	2without	3-year-olds	.00	.00	no deceptiv	with child	40.00
43	2without	3-year-olds	1.00	.00	no deceptiv	with child	40.00
44	2without	3-year-olds	1.00	.00	no deceptiv	with child	41.00
45	2without	3-year-olds	1.00	.00	no deceptiv	with child	42.00
46	2without	3-year-olds	.00	.00	no deceptiv	with child	42.00
47	2without	3-year-olds	.00	1.00	no deceptiv	with child	43.00
48	2without	3-year-olds	.00	1.00	no deceptiv	with child	44.00
49	2without	3-year-olds	1.00	1.00	no deceptiv	with child	44.00
50	2without	3-year-olds	.00	1.00	no deceptiv	with child	45.00
51	2with	3-year-olds	.00	.00	with decepti	with child	36.00
52	2with	3-year-olds	.00	.00	with decepti	with child	37.00
53	2with	3-year-olds	.00	.00	with decepti	with child	37.00
54	2with	3-year-olds	.00	.00	with decepti	with child	39.00
55	2with	3-year-olds	.00	1.00	with decepti	with child	40.00
56	2with	3-year-olds	.00	.00	with decepti	with child	41.00
57	2with	3-year-olds	1.00	1.00	with decepti	with child	41.00
58	2with	3-year-olds	1.00	1.00	with decepti	with child	42.00
59	2with	3-year-olds	1.00	1.00	with decepti	with child	42.00
60	2with	3-year-olds	.00	.00	with decepti	with child	43.00

	order
31	4
32	3
33	2
34	2
35	2
36	1
37	3
38	4
39	1
40	4
41	2
42	3
43	3
44	2
45	4
46	1
47	1
48	2
49	4
50	3
51	2
52	3
53	1
54	4
55	4
56	3
57	2
58	4
59	1
60	2

	conditio	age	self	other	decep	nokids	months
61	2with	3-year-olds	.00	1.00	with decepti	with child	43.00
62	2with	3-year-olds	.00	1.00	with decepti	with child	44.00
63	2with	3-year-olds	1.00	1.00	with decepti	with child	44.00
64	2with	3-year-olds	1.00	1.00	with decepti	with child	45.00
65	2with	3-year-olds	1.00	1.00	with decepti	with child	46.00
66	2with	3-year-olds	.00	1.00	with decepti	with child	47.00
67	1without	4-year-olds	.00	.00	no deceptiv	without chil	48.00
68	1without	4-year-olds	.00	.00	no deceptiv	without chil	49.00
69	1without	4-year-olds	.00	.00	no deceptiv	without chil	50.00
70	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	51.00
71	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	51.00
72	1without	4-year-olds	.00	1.00	no deceptiv	without chil	51.00
73	1without	4-year-olds	.00	.00	no deceptiv	without chil	51.00
74	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	52.00
75	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	54.00
76	1without	4-year-olds	.00	1.00	no deceptiv	without chil	54.00
77	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	54.00
78	1without	4-year-olds	1.00	.00	no deceptiv	without chil	55.00
79	1without	4-year-olds	.00	1.00	no deceptiv	without chil	56.00
80	1without	4-year-olds	.00	1.00	no deceptiv	without chil	57.00
81	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	57.00
82	1without	4-year-olds	1.00	1.00	no deceptiv	without chil	59.00
83	1with	4-year-olds	1.00	1.00	with decepti	without chil	48.00
84	1with	4-year-olds	.00	.00	with decepti	without chil	49.00
85	1with	4-year-olds	.00	1.00	with decepti	without chil	49.00
86	1with	4-year-olds	.00	1.00	with decepti	without chil	50.00
87	1with	4-year-olds	.00	1.00	with decepti	without chil	50.00
88	1with	4-year-olds	1.00	1.00	with decepti	without chil	51.00
89	1with	4-year-olds	.00	1.00	with decepti	without chil	52.00
90	1with	4-year-olds	.00	.00	with decepti	without chil	52.00

	order
61	2
62	1
63	3
64	4
65	2
66	1
67	1
68	2
69	4
70	3
71	2
72	4
73	1
74	3
75	2
76	3
77	4
78	1
79	3
80	2
81	1
82	4
83	3
84	2
85	4
86	1
87	4
88	3
89	1
90	2

	conditio	age	self	other	decep	nokids	months
91	1with	4-year-olds	1.00	1.00	with decepti	without chil	54.00
92	1with	4-year-olds	1.00	1.00	with decepti	without chil	55.00
93	1with	4-year-olds	.00	1.00	with decepti	without chil	55.00
94	1with	4-year-olds	1.00	1.00	with decepti	without chil	56.00
95	1with	4-year-olds	1.00	1.00	with decepti	without chil	57.00
96	1with	4-year-olds	.00	1.00	with decepti	without chil	57.00
97	1with	4-year-olds	1.00	1.00	with decepti	without chil	58.00
98	1with	4-year-olds	1.00	1.00	with decepti	without chil	59.00
99	2without	4-year-olds	.00	.00	no deceptiv	with child	49.00
100	2without	4-year-olds	.00	.00	no deceptiv	with child	49.00
101	2without	4-year-olds	1.00	1.00	no deceptiv	with child	49.00
102	2without	4-year-olds	.00	.00	no deceptiv	with child	50.00
103	2without	4-year-olds	.00	.00	no deceptiv	with child	50.00
104	2without	4-year-olds	.00	.00	no deceptiv	with child	51.00
105	2without	4-year-olds	.00	1.00	no deceptiv	with child	51.00
106	2without	4-year-olds	1.00	1.00	no deceptiv	with child	51.00
107	2without	4-year-olds	.00	.00	no deceptiv	with child	52.00
108	2without	4-year-olds	1.00	1.00	no deceptiv	with child	54.00
109	2without	4-year-olds	.00	1.00	no deceptiv	with child	55.00
110	2without	4-year-olds	.00	1.00	no deceptiv	with child	55.00
111	2without	4-year-olds	.00	1.00	no deceptiv	with child	56.00
112	2without	4-year-olds	1.00	1.00	no deceptiv	with child	57.00
113	2without	4-year-olds	1.00	1.00	no deceptiv	with child	58.00
114	2without	4-year-olds	1.00	1.00	no deceptiv	with child	59.00
115	2with	4-year-olds	.00	.00	with decepti	with child	48.00
116	2with	4-year-olds	.00	.00	with decepti	with child	48.00
117	2with	4-year-olds	.00	1.00	with decepti	with child	49.00
118	2with	4-year-olds	.00	1.00	with decepti	with child	49.00
119	2with	4-year-olds	1.00	1.00	with decepti	with child	50.00
120	2with	4-year-olds	.00	.00	with decepti	with child	50.00

	order
91	2
92	1
93	3
94	4
95	3
96	1
97	2
98	4
99	3
100	4
101	2
102	1
103	1
104	3
105	4
106	2
107	2
108	4
109	3
110	1
111	1
112	2
113	2
114	4
115	3
116	3
117	2
118	3
119	4
120	1

	conditio	age	self	other	decep	nokids	months
121	2with	4-year-olds	.00	1.00	with decepti	with child	51.00
122	2with	4-year-olds	.00	1.00	with decepti	with child	52.00
123	2with	4-year-olds	.00	.00	with decepti	with child	53.00
124	2with	4-year-olds	1.00	1.00	with decepti	with child	54.00
125	2with	4-year-olds	.00	1.00	with decepti	with child	56.00
126	2with	4-year-olds	.00	1.00	with decepti	with child	56.00
127	2with	4-year-olds	.00	1.00	with decepti	with child	57.00
128	2with	4-year-olds	.00	1.00	with decepti	with child	58.00
129	2with	4-year-olds	1.00	1.00	with decepti	with child	59.00
130	2with	4-year-olds	1.00	1.00	with decepti	with child	59.00

	order
121	2
122	1
123	4
124	3
125	3
126	4
127	2
128	1
129	1
130	2

APPENDIX FOUR

Data set for experiment four as reported in chapter six.

	conditio	age	self	other	decep	nokids	order
1	1without	3-year-olds	.00	.00	.00	.00	1.00
2	1without	3-year-olds	.00	.00	.00	.00	3.00
3	1without	3-year-olds	.00	.00	.00	.00	2.00
4	1without	3-year-olds	1.00	.00	.00	.00	4.00
5	1without	3-year-olds	.00	1.00	.00	.00	1.00
6	1without	3-year-olds	.00	.00	.00	.00	2.00
7	1without	3-year-olds	.00	.00	.00	.00	4.00
8	1without	3-year-olds	.00	.00	.00	.00	3.00
9	1without	3-year-olds	.00	1.00	.00	.00	4.00
10	1without	3-year-olds	.00	.00	.00	.00	1.00
11	1without	3-year-olds	.00	.00	.00	.00	2.00
12	1without	3-year-olds	1.00	1.00	.00	.00	3.00
13	1without	3-year-olds	.00	1.00	.00	.00	3.00
14	1without	3-year-olds	1.00	1.00	.00	.00	4.00
15	1without	3-year-olds	.00	.00	.00	.00	1.00
16	1without	3-year-olds	.00	.00	.00	.00	2.00
17	1with	3-year-olds	.00	.00	1.00	.00	2.00
18	1with	3-year-olds	.00	.00	1.00	.00	4.00
19	1with	3-year-olds	.00	1.00	1.00	.00	1.00
20	1with	3-year-olds	.00	1.00	1.00	.00	3.00
21	1with	3-year-olds	.00	1.00	1.00	.00	4.00
22	1with	3-year-olds	.00	.00	1.00	.00	4.00
23	1with	3-year-olds	.00	.00	1.00	.00	1.00
24	1with	3-year-olds	.00	.00	1.00	.00	2.00
25	1with	3-year-olds	.00	1.00	1.00	.00	3.00
26	1with	3-year-olds	1.00	.00	1.00	.00	1.00
27	1with	3-year-olds	.00	1.00	1.00	.00	4.00
28	1with	3-year-olds	.00	1.00	1.00	.00	3.00
29	1with	3-year-olds	.00	1.00	1.00	.00	3.00
30	1with	3-year-olds	1.00	1.00	1.00	.00	1.00

	months
1	35.00
2	37.00
3	37.00
4	38.00
5	40.00
6	40.00
7	40.00
8	41.00
9	41.00
10	43.00
11	44.00
12	44.00
13	45.00
14	45.00
15	45.00
16	46.00
17	34.00
18	34.00
19	37.00
20	37.00
21	38.00
22	40.00
23	41.00
24	42.00
25	42.00
26	44.00
27	45.00
28	45.00
29	46.00
30	46.00

	conditio	age	self	other	decep	nokids	order
31	1with	3-year-olds	1.00	1.00	1.00	.00	4.00
32	1with	3-year-olds	1.00	.00	1.00	.00	2.00
33	2without	3-year-olds	.00	.00	.00	1.00	4.00
34	2without	3-year-olds	.00	.00	.00	1.00	1.00
35	2without	3-year-olds	.00	1.00	.00	1.00	2.00
36	2without	3-year-olds	.00	.00	.00	1.00	3.00
37	2without	3-year-olds	.00	.00	.00	1.00	1.00
38	2without	3-year-olds	.00	1.00	.00	1.00	2.00
39	2without	3-year-olds	.00	.00	.00	1.00	4.00
40	2without	3-year-olds	.00	1.00	.00	1.00	2.00
41	2without	3-year-olds	1.00	.00	.00	1.00	2.00
42	2without	3-year-olds	.00	.00	.00	1.00	3.00
43	2without	3-year-olds	.00	.00	.00	1.00	3.00
44	2without	3-year-olds	.00	1.00	.00	1.00	2.00
45	2without	3-year-olds	.00	.00	.00	1.00	4.00
46	2without	3-year-olds	1.00	1.00	.00	1.00	1.00
47	2without	3-year-olds	.00	.00	.00	1.00	1.00
48	2without	3-year-olds	.00	.00	.00	1.00	2.00
49	2with	3-year-olds	.00	.00	1.00	1.00	3.00
50	2with	3-year-olds	.00	.00	1.00	1.00	4.00
51	2with	3-year-olds	.00	.00	1.00	1.00	4.00
52	2with	3-year-olds	1.00	.00	1.00	1.00	1.00
53	2with	3-year-olds	.00	1.00	1.00	1.00	3.00
54	2with	3-year-olds	1.00	1.00	1.00	1.00	2.00
55	2with	3-year-olds	.00	.00	1.00	1.00	1.00
56	2with	3-year-olds	.00	1.00	1.00	1.00	4.00
57	2with	3-year-olds	1.00	1.00	1.00	1.00	2.00
58	2with	3-year-olds	.00	.00	1.00	1.00	4.00
59	2with	3-year-olds	1.00	1.00	1.00	1.00	1.00
60	2with	3-year-olds	1.00	.00	1.00	1.00	2.00

	months
31	47.00
32	47.00
33	35.00
34	36.00
35	37.00
36	38.00
37	38.00
38	38.00
39	40.00
40	40.00
41	41.00
42	43.00
43	44.00
44	44.00
45	45.00
46	46.00
47	47.00
48	47.00
49	37.00
50	37.00
51	38.00
52	39.00
53	39.00
54	40.00
55	41.00
56	41.00
57	42.00
58	42.00
59	44.00
60	44.00

	conditio	age	self	other	decep	nokids	order
61	2with	3-year-olds	1.00	1.00	1.00	1.00	1.00
62	2with	3-year-olds	.00	.00	1.00	1.00	3.00
63	2with	3-year-olds	.00	1.00	1.00	1.00	4.00
64	2with	3-year-olds	1.00	.00	1.00	1.00	4.00
65	1without	4-year-olds	.00	.00	.00	.00	2.00
66	1without	4-year-olds	.00	1.00	.00	.00	3.00
67	1without	4-year-olds	.00	.00	.00	.00	4.00
68	1without	4-year-olds	.00	.00	.00	.00	1.00
69	1without	4-year-olds	.00	.00	.00	.00	3.00
70	1without	4-year-olds	1.00	1.00	.00	.00	2.00
71	1without	4-year-olds	1.00	1.00	.00	.00	3.00
72	1without	4-year-olds	1.00	1.00	.00	.00	2.00
73	1without	4-year-olds	.00	1.00	.00	.00	1.00
74	1without	4-year-olds	.00	1.00	.00	.00	1.00
75	1without	4-year-olds	1.00	1.00	.00	.00	2.00
76	1without	4-year-olds	1.00	1.00	.00	.00	4.00
77	1without	4-year-olds	1.00	1.00	.00	.00	1.00
78	1without	4-year-olds	1.00	1.00	.00	.00	3.00
79	1without	4-year-olds	1.00	1.00	.00	.00	2.00
80	1with	4-year-olds	.00	1.00	1.00	.00	3.00
81	1with	4-year-olds	.00	.00	1.00	.00	3.00
82	1with	4-year-olds	.00	1.00	1.00	.00	4.00
83	1with	4-year-olds	.00	.00	1.00	.00	1.00
84	1with	4-year-olds	1.00	1.00	1.00	.00	4.00
85	1with	4-year-olds	1.00	1.00	1.00	.00	2.00
86	1with	4-year-olds	1.00	1.00	1.00	.00	3.00
87	1with	4-year-olds	.00	.00	1.00	.00	4.00
88	1with	4-year-olds	1.00	1.00	1.00	.00	1.00
89	1with	4-year-olds	1.00	.00	1.00	.00	3.00
90	1with	4-year-olds	1.00	.00	1.00	.00	4.00

	months
61	45.00
62	46.00
63	47.00
64	47.00
65	49.00
66	49.00
67	50.00
68	50.00
69	51.00
70	52.00
71	53.00
72	54.00
73	54.00
74	55.00
75	56.00
76	57.00
77	58.00
78	59.00
79	59.00
80	49.00
81	49.00
82	50.00
83	50.00
84	51.00
85	51.00
86	51.00
87	52.00
88	52.00
89	53.00
90	53.00

	conditio	age	self	other	decep	nokids	order
91	1with	4-year-olds	.00	1.00	1.00	.00	3.00
92	1with	4-year-olds	1.00	.00	1.00	.00	1.00
93	1with	4-year-olds	1.00	1.00	1.00	.00	2.00
94	1with	4-year-olds	1.00	1.00	1.00	.00	1.00
95	1with	4-year-olds	1.00	1.00	1.00	.00	2.00
96	1with	4-year-olds	1.00	1.00	1.00	.00	1.00
97	2without	4-year-olds	.00	1.00	.00	1.00	3.00
98	2without	4-year-olds	.00	1.00	.00	1.00	1.00
99	2without	4-year-olds	.00	.00	.00	1.00	1.00
100	2without	4-year-olds	.00	.00	.00	1.00	2.00
101	2without	4-year-olds	.00	1.00	.00	1.00	4.00
102	2without	4-year-olds	1.00	1.00	.00	1.00	3.00
103	2without	4-year-olds	.00	.00	.00	1.00	4.00
104	2without	4-year-olds	.00	1.00	.00	1.00	2.00
105	2without	4-year-olds	.00	1.00	.00	1.00	2.00
106	2without	4-year-olds	1.00	1.00	.00	1.00	1.00
107	2without	4-year-olds	1.00	1.00	.00	1.00	1.00
108	2without	4-year-olds	.00	1.00	.00	1.00	3.00
109	2without	4-year-olds	1.00	1.00	.00	1.00	4.00
110	2without	4-year-olds	1.00	1.00	.00	1.00	2.00
111	2without	4-year-olds	1.00	1.00	.00	1.00	2.00
112	2without	4-year-olds	1.00	1.00	.00	1.00	4.00
113	2with	4-year-olds	.00	1.00	1.00	1.00	4.00
114	2with	4-year-olds	.00	.00	1.00	1.00	2.00
115	2with	4-year-olds	.00	.00	1.00	1.00	3.00
116	2with	4-year-olds	.00	.00	1.00	1.00	3.00
117	2with	4-year-olds	1.00	.00	1.00	1.00	3.00
118	2with	4-year-olds	.00	1.00	1.00	1.00	2.00
119	2with	4-year-olds	1.00	1.00	1.00	1.00	4.00
120	2with	4-year-olds	.00	1.00	1.00	1.00	1.00

	months
91	54.00
92	55.00
93	56.00
94	57.00
95	58.00
96	58.00
97	48.00
98	48.00
99	49.00
100	49.00
101	49.00
102	51.00
103	51.00
104	52.00
105	53.00
106	54.00
107	55.00
108	56.00
109	56.00
110	58.00
111	59.00
112	59.00
113	49.00
114	49.00
115	49.00
116	50.00
117	50.00
118	50.00
119	50.00
120	53.00

	conditio	age	self	other	decep	nokids	order
121	2with	4-year-olds	1.00	1.00	1.00	1.00	1.00
122	2with	4-year-olds	.00	1.00	1.00	1.00	2.00
123	2with	4-year-olds	.00	1.00	1.00	1.00	3.00
124	2with	4-year-olds	1.00	.00	1.00	1.00	4.00
125	2with	4-year-olds	1.00	1.00	1.00	1.00	4.00
126	2with	4-year-olds	1.00	1.00	1.00	1.00	3.00
127	2with	4-year-olds	1.00	1.00	1.00	1.00	1.00
128	2with	4-year-olds	1.00	1.00	1.00	1.00	2.00

	months
121	53.00
122	53.00
123	53.00
124	54.00
125	55.00
126	58.00
127	58.00
128	59.00

APPENDIX FIVE

Data set for experiment five as reported in chapter seven.

	conditio	age	appear	fbelief	language	siblings	newmonth
1	social	3-year-olds	1.00	1.00	monolingua	with older si	1.00
2	social	3-year-olds	.00	.00	monolingua	with older si	1.00
3	social	3-year-olds	1.00	1.00	monolingua	with older si	1.00
4	social	3-year-olds	1.00	1.00	bilingual	with older si	1.00
5	social	3-year-olds	1.00	1.00	bilingual	no older sib	1.00
6	social	3-year-olds	.00	.00	monolingua	no older sib	1.00
7	social	3-year-olds	.00	.00	monolingua	with older si	2.00
8	social	3-year-olds	.00	.00	bilingual	no older sib	2.00
9	social	3-year-olds	.00	.00	bilingual	no older sib	2.00
10	social	3-year-olds	1.00	1.00	monolingua	with older si	2.00
11	social	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
12	social	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
13	social	4-year-olds	.00	.00	monolingua	no older sib	2.00
14	social	4-year-olds	.00	.00	monolingua	no older sib	3.00
15	social	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
16	social	4-year-olds	.00	.00	bilingual	with older si	3.00
17	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
18	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
19	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
20	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
21	social	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
22	social	4-year-olds	1.00	1.00	bilingual	with older si	3.00
23	social	4-year-olds	1.00	.00	monolingua	no older sib	3.00
24	social	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
25	deceptive	3-year-olds	1.00	.00	monolingua	with older si	1.00
26	deceptive	3-year-olds	1.00	1.00	monolingua	no older sib	1.00
27	deceptive	3-year-olds	1.00	1.00	monolingua	no older sib	1.00
28	deceptive	3-year-olds	1.00	.00	monolingua	with older si	1.00
29	deceptive	3-year-olds	.00	.00	monolingua	with older si	2.00
30	deceptive	3-year-olds	.00	.00	monolingua	with older si	2.00

	months	order
1	37.0	3.00
2	41.0	6.00
3	41.0	1.00
4	41.0	3.00
5	41.0	6.00
6	42.0	3.00
7	43.0	2.00
8	45.0	5.00
9	45.0	1.00
10	45.0	4.00
11	46.0	2.00
12	46.0	2.00
13	49.0	1.00
14	52.0	4.00
15	52.0	5.00
16	52.0	2.00
17	53.0	4.00
18	53.0	3.00
19	53.0	5.00
20	53.0	6.00
21	54.0	5.00
22	54.0	4.00
23	58.0	1.00
24	58.0	6.00
25	40.0	5.00
26	40.0	6.00
27	40.0	5.00
28	42.0	3.00
29	43.0	3.00
30	43.0	6.00

	conditio	age	appear	fbelief	language	siblings	newmonth
31	deceptive	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
32	deceptive	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
33	deceptive	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
34	deceptive	3-year-olds	.00	.00	monolingua	no older sib	2.00
35	deceptive	3-year-olds	1.00	1.00	monolingua	with older si	2.00
36	deceptive	3-year-olds	1.00	1.00	bilingual	with older si	2.00
37	deceptive	4-year-olds	.00	.00	monolingua	with older si	2.00
38	deceptive	4-year-olds	1.00	1.00	monolingua	no older sib	2.00
39	deceptive	4-year-olds	1.00	1.00	bilingual	with older si	2.00
40	deceptive	4-year-olds	1.00	1.00	monolingua	with older si	2.00
41	deceptive	4-year-olds	1.00	1.00	bilingual	with older si	2.00
42	deceptive	4-year-olds	1.00	1.00	monolingua	with older si	2.00
43	deceptive	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
44	deceptive	4-year-olds	.00	.00	monolingua	no older sib	3.00
45	deceptive	4-year-olds	.00	1.00	monolingua	with older si	3.00
46	deceptive	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
47	deceptive	4-year-olds	1.00	.00	monolingua	no older sib	3.00
48	deceptive	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
49	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
50	control	3-year-olds	.00	.00	monolingua	with older si	1.00
51	control	3-year-olds	1.00	1.00	bilingual	with older si	1.00
52	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
53	control	3-year-olds	.00	.00	monolingua	with older si	1.00
54	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
55	control	3-year-olds	.00	1.00	bilingual	no older sib	2.00
56	control	3-year-olds	1.00	.00	bilingual	no older sib	2.00
57	control	3-year-olds	1.00	.00	monolingua	with older si	2.00
58	control	3-year-olds	1.00	.00	bilingual	with older si	2.00
59	control	3-year-olds	1.00	.00	monolingua	no older sib	2.00
60	control	3-year-olds	1.00	1.00	monolingua	with older si	2.00

	months	order
31	43.0	1.00
32	43.0	3.00
33	43.0	6.00
34	44.0	4.00
35	44.0	1.00
36	45.0	1.00
37	48.0	2.00
38	48.0	5.00
39	49.0	1.00
40	49.0	5.00
41	49.0	2.00
42	50.0	4.00
43	52.0	3.00
44	53.0	6.00
45	56.0	4.00
46	57.0	4.00
47	57.0	2.00
48	57.0	2.00
49	37.0	6.00
50	39.0	2.00
51	40.0	3.00
52	40.0	1.00
53	41.0	5.00
54	41.0	6.00
55	44.0	2.00
56	44.0	5.00
57	44.0	1.00
58	44.0	4.00
59	45.0	3.00
60	47.0	4.00

	conditio	age	appear	fbelief	language	siblings	newmonth
61	control	4-year-olds	.00	1.00	monolingua	with older si	2.00
62	control	4-year-olds	1.00	1.00	bilingual	with older si	2.00
63	control	4-year-olds	1.00	1.00	monolingua	with older si	2.00
64	control	4-year-olds	.00	1.00	monolingua	no older sib	2.00
65	control	4-year-olds	1.00	1.00	monolingua	no older sib	2.00
66	control	4-year-olds	.00	.00	monolingua	no older sib	3.00
67	control	4-year-olds	.00	.00	monolingua	no older sib	3.00
68	control	4-year-olds	.00	.00	bilingual	with older si	3.00
69	control	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
70	control	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
71	control	4-year-olds	1.00	.00	monolingua	with older si	3.00
72	control	4-year-olds	1.00	1.00	bilingual	with older si	3.00
73	control	4-year-olds	1.00	1.00	bilingual	with older si	3.00
74	control	4-year-olds	1.00	1.00	monolingua	with older si	3.00
75	social	3-year-olds	1.00	1.00	bilingual	with older si	1.00
76	social	3-year-olds	1.00	1.00	bilingual	no older sib	1.00
77	social	3-year-olds	.00	.00	monolingua	no older sib	1.00
78	social	3-year-olds	.00	.00	monolingua	with older si	2.00
79	social	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
80	social	4-year-olds	.00	.00	bilingual	with older si	3.00
81	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
82	social	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
83	deceptive	3-year-olds	.00	.00	monolingua	with older si	2.00
84	deceptive	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
85	deceptive	3-year-olds	.00	.00	monolingua	no older sib	2.00
86	deceptive	3-year-olds	1.00	1.00	monolingua	with older si	2.00
87	deceptive	4-year-olds	1.00	1.00	bilingual	with older si	2.00
88	deceptive	4-year-olds	1.00	1.00	monolingua	with older si	2.00
89	deceptive	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
90	deceptive	4-year-olds	.00	.00	monolingua	no older sib	3.00

	months	order
61	48.0	5.00
62	49.0	6.00
63	49.0	4.00
64	50.0	2.00
65	50.0	2.00
66	51.0	3.00
67	51.0	6.00
68	51.0	1.00
69	54.0	5.00
70	54.0	3.00
71	54.0	4.00
72	55.0	1.00
73	56.0	1.00
74	58.0	5.00
75	41.0	4.00
76	41.0	1.00
77	42.0	2.00
78	43.0	4.00
79	52.0	5.00
80	52.0	6.00
81	53.0	1.00
82	54.0	5.00
83	43.0	4.00
84	43.0	6.00
85	44.0	2.00
86	44.0	6.00
87	49.0	5.00
88	50.0	3.00
89	52.0	6.00
90	53.0	3.00

	conditio	age	appear	fbelief	language	siblings	newmonth
91	control	3-year-olds	1.00	1.00	bilingual	with older si	1.00
92	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
93	control	3-year-olds	.00	.00	monolingua	with older si	1.00
94	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
95	control	4-year-olds	.00	1.00	monolingua	with older si	2.00
96	control	4-year-olds	1.00	.00	monolingua	no older sib	3.00
97	social	3-year-olds	.00	.00	monolingua	with older si	1.00
98	social	3-year-olds	1.00	1.00	monolingua	with older si	1.00
99	social	3-year-olds	.00	.00	bilingual	no older sib	2.00
100	social	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
101	social	4-year-olds	.00	.00	monolingua	no older sib	3.00
102	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
103	social	4-year-olds	1.00	1.00	monolingua	with older si	3.00
104	social	4-year-olds	1.00	.00	monolingua	no older sib	3.00
105	deceptive	3-year-olds	1.00	.00	monolingua	with older si	1.00
106	deceptive	3-year-olds	.00	.00	monolingua	with older si	2.00
107	deceptive	3-year-olds	1.00	.00	bilingual	no older sib	2.00
108	deceptive	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
109	deceptive	4-year-olds	.00	.00	bilingual	with older si	2.00
110	deceptive	4-year-olds	1.00	1.00	monolingua	with older si	2.00
111	deceptive	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
112	deceptive	4-year-olds	1.00	.00	monolingua	no older sib	3.00
113	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
114	control	3-year-olds	.00	.00	monolingua	with older si	1.00
115	control	3-year-olds	.00	1.00	bilingual	no older sib	2.00
116	control	3-year-olds	1.00	.00	bilingual	no older sib	2.00
117	control	4-year-olds	.00	1.00	monolingua	no older sib	2.00
118	control	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
119	control	4-year-olds	1.00	.00	monolingua	with older si	3.00
120	control	4-year-olds	1.00	1.00	bilingual	with older si	3.00

	months	order
91	40.0	2.00
92	40.0	4.00
93	41.0	3.00
94	41.0	1.00
95	49.0	2.00
96	51.0	3.00
97	41.0	2.00
98	41.0	6.00
99	45.0	1.00
100	46.0	5.00
101	52.0	2.00
102	53.0	4.00
103	53.0	5.00
104	58.0	4.00
105	42.0	6.00
106	43.0	1.00
107	43.0	6.00
108	43.0	3.00
109	49.0	5.00
110	49.0	4.00
111	57.0	6.00
112	57.0	1.00
113	37.0	3.00
114	39.0	3.00
115	44.0	3.00
116	44.0	2.00
117	50.0	2.00
118	54.0	4.00
119	54.0	5.00
120	55.0	1.00

	conditio	age	appear	fbelief	language	siblings	newmonth
121	social	3-year-olds	.00	.00	monolingua	with older si	1.00
122	social	3-year-olds	.00	.00	monolingua	no older sib	1.00
123	social	3-year-olds	.00	1.00	bilingual	with older si	1.00
124	social	3-year-olds	1.00	.00	monolingua	no older sib	1.00
125	social	3-year-olds	.00	1.00	monolingua	no older sib	1.00
126	social	3-year-olds	.00	.00	monolingua	with older si	1.00
127	social	3-year-olds	1.00	1.00	monolingua	with older si	2.00
128	social	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
129	deceptive	3-year-olds	.00	1.00	monolingua	with older si	1.00
130	deceptive	3-year-olds	.00	.00	monolingua	no older sib	1.00
131	deceptive	3-year-olds	.00	.00	monolingua	with older si	1.00
132	deceptive	3-year-olds	.00	.00	monolingua	with older si	1.00
133	deceptive	3-year-olds	.00	1.00	monolingua	with older si	2.00
134	deceptive	3-year-olds	.00	1.00	monolingua	no older sib	2.00
135	deceptive	3-year-olds	.00	1.00	bilingual	no older sib	2.00
136	deceptive	3-year-olds	1.00	1.00	monolingua	with older si	2.00
137	control	3-year-olds	.00	.00	monolingua	with older si	1.00
138	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
139	control	3-year-olds	.00	.00	monolingua	no older sib	1.00
140	control	3-year-olds	.00	.00	bilingual	with older si	1.00
141	control	3-year-olds	1.00	1.00	monolingua	with older si	2.00
142	control	3-year-olds	.00	1.00	monolingua	no older sib	2.00
143	control	3-year-olds	.00	.00	monolingua	no older sib	2.00
144	control	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
145	control	4-year-olds	1.00	1.00	bilingual	with older si	2.00
146	control	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
147	control	4-year-olds	.00	1.00	monolingua	no older sib	3.00
148	control	4-year-olds	1.00	1.00	bilingual	no older sib	3.00
149	control	4-year-olds	.00	1.00	monolingua	no older sib	3.00
150	interaction	3-year-olds	.00	.00	monolingua	with older si	1.00

	months	order
121	37.0	1.00
122	39.0	3.00
123	40.0	5.00
124	41.0	2.00
125	41.0	6.00
126	42.0	4.00
127	45.0	3.00
128	46.0	4.00
129	37.0	4.00
130	39.0	5.00
131	41.0	4.00
132	42.0	6.00
133	43.0	2.00
134	44.0	5.00
135	45.0	3.00
136	47.0	1.00
137	37.0	6.00
138	39.0	6.00
139	40.0	5.00
140	42.0	3.00
141	43.0	2.00
142	43.0	1.00
143	45.0	2.00
144	45.0	1.00
145	50.0	1.00
146	51.0	2.00
147	53.0	4.00
148	55.0	3.00
149	57.0	4.00
150	37.0	5.00

	conditio	age	appear	fbelief	language	siblings	newmonth
151	interaction	3-year-olds	.00	.00	monolingua	no older sib	1.00
152	interaction	3-year-olds	.00	.00	monolingua	with older si	1.00
153	interaction	3-year-olds	.00	1.00	monolingua	with older si	1.00
154	interaction	3-year-olds	1.00	.00	monolingua	no older sib	1.00
155	interaction	3-year-olds	1.00	1.00	monolingua	no older sib	1.00
156	interaction	3-year-olds	.00	1.00	monolingua	no older sib	1.00
157	interaction	3-year-olds	1.00	1.00	monolingua	no older sib	1.00
158	interaction	3-year-olds	1.00	1.00	bilingual	with older si	1.00
159	interaction	3-year-olds	.00	.00	monolingua	no older sib	1.00
160	interaction	3-year-olds	1.00	1.00	monolingua	with older si	2.00
161	interaction	3-year-olds	.00	1.00	bilingual	no older sib	2.00
162	interaction	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
163	interaction	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
164	interaction	3-year-olds	1.00	1.00	bilingual	with older si	2.00
165	interaction	3-year-olds	.00	1.00	monolingua	no older sib	2.00
166	interaction	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
167	interaction	4-year-olds	1.00	.00	bilingual	with older si	2.00
168	interaction	4-year-olds	.00	.00	bilingual	no older sib	2.00
169	interaction	4-year-olds	1.00	.00	monolingua	with older si	2.00
170	interaction	4-year-olds	.00	.00	monolingua	no older sib	2.00
171	interaction	4-year-olds	1.00	1.00	bilingual	with older si	3.00
172	interaction	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
173	interaction	4-year-olds	1.00	1.00	monolingua	with older si	3.00
174	interaction	4-year-olds	.00	.00	monolingua	no older sib	3.00
175	interaction	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
176	interaction	4-year-olds	.00	1.00	bilingual	no older sib	3.00
177	interaction	4-year-olds	.00	1.00	monolingua	with older si	3.00
178	interaction	4-year-olds	1.00	.00	bilingual	no older sib	3.00
179	interaction	4-year-olds	.00	1.00	monolingua	no older sib	3.00
180	interaction	4-year-olds	1.00	1.00	monolingua	with older si	3.00

	months	order
151	37.0	3.00
152	38.0	1.00
153	39.0	6.00
154	39.0	6.00
155	40.0	3.00
156	41.0	5.00
157	41.0	6.00
158	42.0	2.00
159	42.0	6.00
160	44.0	5.00
161	44.0	4.00
162	45.0	2.00
163	46.0	5.00
164	47.0	4.00
165	47.0	1.00
166	47.0	2.00
167	49.0	1.00
168	49.0	3.00
169	50.0	6.00
170	50.0	1.00
171	51.0	3.00
172	51.0	1.00
173	51.0	2.00
174	52.0	3.00
175	52.0	3.00
176	53.0	4.00
177	53.0	6.00
178	54.0	5.00
179	55.0	5.00
180	56.0	5.00

	conditio	age	appear	fbelief	language	siblings	newmonth
181	interaction	4-year-olds	1.00	1.00	monolingua	no older sib	3.00
182	interaction	4-year-olds	1.00	1.00	monolingua	with older si	3.00
183	interaction	4-year-olds	1.00	1.00	monolingua	with older si	3.00
184	interaction	3-year-olds	1.00	.00	monolingua	with older si	1.00
185	interaction	3-year-olds	1.00	1.00	monolingua	with older si	1.00
186	interaction	3-year-olds	.00	.00	monolingua	no older sib	1.00
187	interaction	3-year-olds	1.00	1.00	monolingua	no older sib	1.00
188	interaction	3-year-olds	1.00	1.00	bilingual	with older si	1.00
189	interaction	3-year-olds	.00	.00	monolingua	no older sib	1.00
190	interaction	3-year-olds	1.00	1.00	monolingua	with older si	2.00
191	interaction	3-year-olds	.00	1.00	bilingual	no older sib	2.00
192	interaction	3-year-olds	1.00	1.00	monolingua	no older sib	2.00
193	interaction	3-year-olds	1.00	1.00	bilingual	no older sib	2.00
194	interaction	4-year-olds	.00	1.00	monolingua	no older sib	3.00
195	interaction	4-year-olds	.00	1.00	monolingua	no older sib	3.00
196	interaction	4-year-olds	1.00	1.00	monolingua	with older si	3.00
197	interaction	4-year-olds	1.00	1.00	monolingua	with older si	3.00

	months	order
181	57.0	4.00
182	58.0	1.00
183	58.0	6.00
184	39.0	2.00
185	40.0	2.00
186	41.0	2.00
187	41.0	4.00
188	42.0	1.00
189	42.0	4.00
190	44.0	3.00
191	44.0	6.00
192	45.0	5.00
193	46.0	6.00
194	55.0	1.00
195	56.0	2.00
196	57.0	3.00
197	58.0	4.00

APPENDIX SIX

Data set for experiment six as reported in chapter eight.

	conditio	age	belief	picture	order
1	control	39.00	fail	pass	4.00
2	control	39.00	pass	pass	2.00
3	control	39.00	fail	pass	4.00
4	control	39.00	pass	pass	1.00
5	control	40.00	fail	pass	4.00
6	control	40.00	fail	pass	4.00
7	control	40.00	fail	pass	3.00
8	control	40.00	fail	fail	4.00
9	control	40.00	pass	pass	3.00
10	control	40.00	fail	pass	3.00
11	control	40.00	pass	pass	1.00
12	control	41.00	fail	pass	2.00
13	control	41.00	fail	pass	4.00
14	control	41.00	fail	pass	3.00
15	control	41.00	pass	pass	1.00
16	control	41.00	fail	fail	2.00
17	control	41.00	fail	pass	3.00
18	control	42.00	pass	pass	2.00
19	control	42.00	fail	fail	2.00
20	control	42.00	fail	pass	2.00
21	control	44.00	fail	pass	1.00
22	control	44.00	fail	pass	3.00
23	control	45.00	fail	pass	1.00
24	control	45.00	fail	pass	2.00
25	control	46.00	pass	pass	4.00
26	control	46.00	pass	pass	1.00
27	control	46.00	fail	pass	2.00
28	control	46.00	fail	pass	2.00
29	control	47.00	pass	pass	3.00
30	control	47.00	pass	pass	4.00

	conditio	age	belief	picture	order
31	control	47.00	fail	pass	1.00
32	control	47.00	fail	pass	3.00
33	with decepti	39.00	pass	pass	1.00
34	with decepti	40.00	pass	pass	2.00
35	with decepti	40.00	fail	fail	4.00
36	with decepti	40.00	pass	pass	3.00
37	with decepti	41.00	pass	pass	1.00
38	with decepti	41.00	pass	pass	3.00
39	with decepti	41.00	fail	pass	1.00
40	with decepti	41.00	fail	fail	1.00
41	with decepti	41.00	fail	fail	1.00
42	with decepti	42.00	pass	pass	4.00
43	with decepti	42.00	pass	pass	3.00
44	with decepti	42.00	pass	pass	3.00
45	with decepti	42.00	fail	pass	2.00
46	with decepti	43.00	fail	fail	4.00
47	with decepti	43.00	pass	pass	4.00
48	with decepti	43.00	fail	pass	2.00
49	with decepti	43.00	pass	pass	3.00
50	with decepti	43.00	fail	pass	1.00
51	with decepti	44.00	pass	pass	2.00
52	with decepti	44.00	pass	pass	4.00
53	with decepti	45.00	fail	pass	1.00
54	with decepti	45.00	pass	pass	4.00
55	with decepti	46.00	fail	pass	3.00
56	with decepti	46.00	pass	pass	2.00
57	with decepti	46.00	fail	pass	1.00
58	with decepti	46.00	fail	pass	2.00
59	with decepti	46.00	pass	pass	3.00
60	with decepti	46.00	fail	pass	4.00

	conditio	age	belief	picture	order
61	with decepti	46.00	pass	pass	4.00
62	with decepti	47.00	pass	pass	3.00
63	with decepti	47.00	fail	pass	2.00
64	with decepti	47.00	pass	pass	1.00

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