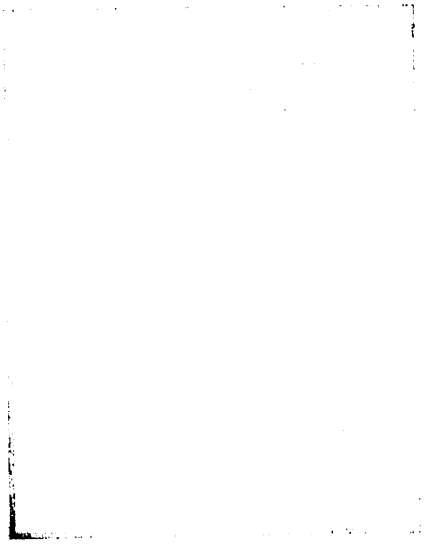


Realism and Representation in Children's Early Conception of Mind.

Thesis submitted in accordance with the requirements of the University of Wales for degree of Doctor in Philosophy by Rebecca Anne Saltmarsh.

October 1995

DECLARATION.

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Signed ..... (candidate)

Date ..... 27th October 1995 .....

STATEMENT 1.

This thesis is the result of my own investigations, except where otherwise stated. Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

Signed ..... (candidate)

Date ..... 27th October 1995 .....

STATEMENT 2.

I hereby give consent for my thesis, if accepted, to be available for photocopying and for inter-library loans, and for the title and summary to be made available to outside organisations.

Signed ..... (candidate)

Date ..... 27th October 1995 .....

The baby new to earth and sky,

What time his tender palm is prest

Against the circle of the breast,

Has never thought that 'this is I:'

But as he grows he gathers much,

And learns the use of 'I,' and 'me,'

And finds 'I am not what I see.

And other than the things I touch.'

So rounds he to a separate mind

From whence clear memory may begin,

As thro' the frame that binds him in

His isolation grows defined.

This use may lie in blood and breath,

Which else were fruitless of their due,

Had man to learn himself anew

Beyond the second birth of Death.

Tennyson *In Memoriam*

Acknowledgments

This thesis, which is the result of three years work, would not have been possible without the help of a great many people. Firstly, my deepest gratitude must go to my supervisor, Peter Mitchell to whom I am indebted, not only for his constant support, and guidance, but also for his belief in me. Without his initial encouragement, I would never have considered undertaking this research. Secondly I wish to express my thanks to Dave Oborne and the Department of Psychology at Swansea, who very generously agreed to fund me throughout the last three years.

The research itself would have been impossible without the friendly cooperation of the staff and pupils of the schools involved in the studies. I have learnt a great deal not only from the teaching staff, but also from the children. I am therefore very grateful to the following schools; Birchgrove Infant, Bishopston Primary, Brynmill Primary, Cadle Primary, Cilâ Primary, Clase Primary, Coedffranc Infant, Danygraig Primary, Gendros Primary, Griffin Manor, Grange Primary, Gwyrosydd Infant, Llangynwyd Primary, Llanrhidian Primary, Newton Primary, Parklands Primary, Pennard Primary, Margaret Street Nursery, Maytree Autistic Unit, Oystermouth Primary, Pentrepoeth Infant, St. Helen's Primary, Terrace Road Primary, The Lindens School, Whitefield Unit, Ysgol Pen-y-bont.

Finally I wish to thank my friends and family who have helped me throughout the past three years. I am especially grateful to; Ness for staring in the deception video; my Grandpa, Emma and Louise for their literary knowledge; My son, Jude, who has probably done more false belief tests than any other child in history and finally Jon, without whose support and understanding I would never have got this far.

Table of Contents

REALISM AND REPRESENTATION IN CHILDREN'S EARLY CONCEPTION OF MIND

Rebecca Saltmarsh

Abstract

The aim of this thesis was to investigate why young children fail false belief tests and to assess whether this failure could be caused by their propensity to attend to current reality.

In the first experiment (2:1) we found that inducing objective self-awareness in the child by allowing her to perform a deceptive box, false belief test in the presence of a mirror or a video monitor had no effect on her subsequent ability to acknowledge her prior false belief. In experiments 2:2, 2:3 and 3:1 we filmed the child carrying out the test and then replayed the initial part of the film back to her. Under this condition, the child was more likely to later acknowledge her false belief than when tested on a standard task. However, in experiments 2:2 and 3:1 this effect did not reach significance. In addition, we found (experiment 3:1) that if we replayed the entire video to the child (so that she actually heard her earlier self commenting on her belief), an even greater proportion of the children responded to the test question with their false belief. Experiments 3:2 and 3:3 confirmed that under this complete playback condition, children were not simply repeating what they had heard on the video, but were making genuine belief-based judgements.

In our second series of experiments we replicated Wimmer and Hartl's (1991) finding that children are more likely to give a correct response in the state change procedure than in the deceptive box procedure. In experiment 4:1 we discovered that this was true, not only for clinically normal preschool children, but also for children with autism. Wimmer and Hartl suggested that children gave the correct response by referring to the earlier situation rather than

to their prior belief. However, we found (experiment 5:1 and 5:2) that even when children were asked to identify a false belief within the state change procedure, children were significantly more likely to succeed than they were on a standard task. In addition, we discovered that on the true belief state change task, children could not have been giving the correct response simply by glossing the test question to one concerning reality. We demonstrated this in experiment 5:3 when on our deceptive box two contents task the majority of children referred to current (rather than prior) reality. In our final experiment (experiment 6:1) we found that facilitation within the state change task could not have been caused by its deceptive nature.

We discuss our findings within the framework of the reality masking hypothesis which suggests that current reality is more salient to young children than are beliefs. As such, young children are biased to attend to the world around them. Therefore although preschool children do understand something of the representational nature of beliefs, this knowledge is masked by their inclination to attend to reality. On a deceptive box task this means they will concentrate on the present content of the box and not on their earlier belief. However, if that belief is made more prominent, children will find it easier to divert their attention away from current reality. We suggest that for children, in whom the reality bias is strong, the belief can only be made to be more salient than reality if it is associated with a physical reality (as happens in the video complete playback condition and the state change procedure). However, in those children in whom the bias is diminishing, simply providing them with a stimulus that draws their attention away from the external world towards their mental realm might be sufficient to allow them to acknowledge a false belief.

Chapter One

"If there were a verb meaning 'to believe falsely',
it would not have any significant first person,
present indicative."

Ludwig Wittgenstein,

Example 1:1

Jon and Emma are playing hide and seek. Jon covers his eyes with his hands while Emma runs off to hide. As Emma is slipping behind a large rock, Jon opens his fingers, peeps through and sees where she is. Once he has finished counting he walks straight over to the far away rock, ignoring other more obvious hiding places on the way and finds her. An onlooker who failed to see Jon peeping may wonder why he behaved in this way as he would not know that Jon knew where Emma was. However, someone who had witnessed Jon's cheating would realise that Jon knew where Emma was and that that was why he behaved in the way he did.

1:1 Theory of Mind

If an individual has an understanding of another's mental states, she is in a position to infer or explain the other's subsequent behaviour. Consider example 1:1, if you know that Jon believes Emma is behind the rock, you will not be surprised to learn that he goes straight there when looking for her. If however you had no understanding of the way in which mental states govern behaviour, you would not be in a position to predict or explain anyone's behaviour in terms of what they believe. Individuals who possess such an understanding have been said by Premack and Woodruff (1978) to have a theory of mind. In their seminal paper which launched a great wave of research in the area, the authors defined a theory of mind as the ability to impute mental states to oneself or others. As such a theory of mind underlies the ability to think about and infer the thoughts of another individual. It therefore allows one to make a link between the

mind and behaviour.

Premack and Woodruff (1978) aimed to investigate whether chimpanzees possessed a theory of mind. To do this they showed Sarah, a chimpanzee, videotapes of a man struggling with a variety of problems. In order to give the correct solution, Sarah had to take account of the man's mental state. This she did, providing Premack and Woodruff (1978) with evidence which they suggested showed that chimpanzees were capable of imputing mental states. The publication of Premack and Woodruff's (1978) study lead to a flurry of interest in the topic, broadening out the investigation to young children's understanding of mind. Commentaries about Premack and Woodruff's study (eg. Dennett, 1978) suggested a seemingly foolproof method for assessing the possession of a theory of mind.

1:2 False Belief Tasks

To assess whether a child has an understanding of mental states, it would be logical to simply ask her to comment on her own or another's beliefs or desires. As such, if you want to know what a child knows about beliefs, then you could ask her what a character thinks about something. However, there is a fundamental problem with this method. In general, beliefs are true and as such reflect the way the world is. Beliefs and reality are therefore usually in accordance with one another. Consequently, if you ask a child to comment on an individual's belief within a situation, they could give you a correct response simply by commenting on the situation itself. For example if you show a child the Jon and Emma scenario (example 1:1) and ask her where Jon thinks Emma is, chances are she will answer, "Behind the rock." However, while the child's response is correct, we cannot be sure that she is really acknowledging Jon's belief. It may be that the child is simply commenting on reality. Not only does Jon think that Emma is behind the rock but she really is behind the rock. The response she gives would therefore be appropriate whether the child was asked "Where does Jon think Emma is?" or "Where is Emma?". The second can of course be answered correctly even if the child has no understanding of mental states.

To be credited with a theory of mind, the child must demonstrate that she understands that beliefs are distinct from world and therefore do not always reflect the way the world really is. Beliefs are not simple copies of reality but rather are representations of reality created by the mind. As such, reality can be misrepresented resulting in the individual holding a false belief.

Example 1:2

Imagine that after Jon has peeped through his fingers he closes his eyes again and finishes counting. During this brief period, Emma moves from behind the rock and instead hides behind a tree. Jon's belief that Emma is behind the rock is now false.

A true test of mental state understanding would be to ask the child where Jon (example 1:2) thinks Emma is now. As Jon's belief is now discrepant with reality, any correct answer she gives cannot simply be a reflection of how the child perceives the world, but must be a comment on Jon's belief. As such if a child can give the correct answer to this question (Jon thinks Emma is behind the tree), she has shown that she understands that beliefs are distinct from reality. A child who can demonstrate the acquisition of this concept has demonstrated an understanding of the mind's representational status.

1:3 The Unexpected Transfer Task

The unexpected transfer procedure, which was initially designed by Wimmer and Perner (1983), assesses a child's understanding of false belief and as such has been used to gauge whether or not she has a theory of mind. The task usually takes the form of a story acted out in front of the child using cutout characters or dolls. In the original story, Mum comes home from shopping and her son, Maxi, helps her put the things away. Mum has bought chocolate for a cake she is going to make and tells Maxi to put it in the blue cupboard. Maxi then goes out to play. In the meantime, Mum makes the cake using some of the chocolate. Once she has finished with it she puts the remaining chocolate away in the green cupboard. When Maxi comes

in from playing he is hungry and wants a piece of chocolate. The child is asked where he will look for the chocolate. The correct answer is of course, that he will look in the blue cupboard where he knew he had left the chocolate. However, the surprising thing is that when Wimmer and Perner (1983) presented young children with this puzzle, only 15% of the three to four-year-olds they tested were able to give the correct response. This result was in stark contrast with the 78% of the older four to five-year-olds who correctly acknowledged the protagonist's false belief. It seemed that unlike older children and adults, young children were unable to accurately report an individual's false belief (that Maxi thought the chocolate was in the blue cupboard) and instead answered according to current reality (that like the child, Maxi thought the chocolate was in the green cupboard).

Wimmer and Perner (1983) suggested that there was a fundamental difference in the way the older and younger children responded to the task. To correctly report a false belief, the older children must have created two different models of the world, one of the world as it is (with the chocolate in the green cupboard) and one of the world as it is represented by Maxi's thoughts (with the chocolate in the blue cupboard). In addition, the children must have represented the relation between the two. In contrast, the authors suggest that before this age, young children are unable to "represent the relationship between two or more persons' epistemic states" (p.126). The authors proposed that there is an "abrupt developmental step at the age of 4" suggesting that before that age children lack the "cognitive skill" needed to successfully acknowledge a false belief.

1:4 The Deceptive Box Task

Different tasks have since been devised which suggest that children below the age of about four years do have a general problem with understanding false belief, that is not specific to the narrative, unexpected transfer task. Perner et al. (1987) and Hogrefe et al. (1986) developed a procedure which not only simplified the task, but also enabled the experimenter to ask the child about her own prior false belief. In the deceptive box task, children were shown an

easily recognisable box such as a smarties tube and asked what they thought was inside. Once the child had answered "smarties", the experimenter opened the box and showed her that in fact she was mistaken and the box contained a pencil. The child's initial belief that the box contained smarties was therefore false. The experimenter replaced the pencil, closed the box and then asked the test question. This related either to the child's own false belief, "What did you think was inside?" or to the belief of a friend who had not been present when the box was opened and therefore did not know what it contained, "What will Jon think is in here?". (Throughout the thesis, the deceptive box procedure will always be discussed with the smarties tube and pencil as the content.)

In reviewing a number of experiments, Perner et al. (1987) found that there was a contrast between the performance of the older and younger children across the studies. The older children (four to five years) tended to correctly acknowledge the false belief (I thought there were smarties in it / he'll think there are smarties in it). However, a majority of the younger children (three to four years) failed to do this and gave incorrect reality responses, commenting on the way the world was at that time (I thought there was a pencil in it / he'll think there's a pencil in it). This pattern of results held for both the questions about the child's own false belief and that of another person, although in this particular study (Perner et al., 1987) children were significantly better at the former than the latter.

1:5 Artifactual Explanations

It seems therefore that young children have great difficulty in understanding that the beliefs that individuals hold may be markedly different from the way in which the world really is. Nonetheless, it is possible that young children do not have a specific problem with belief, but rather that some more peripheral factor is causing their failure. For instance, it may be that the younger children give realist responses on false belief tasks because their memory is not as efficient as that of older children. This may mean they simply lose track of the procedure and forget what the box originally contained. However, this explanation has been ruled out in a study

undertaken by Gopnik and Astington (1988). In the experiment children were involved in a procedure similar to the deceptive box task. However, instead of being asked about their prior belief, children were asked a simple memory question about the prior situation, ("What was inside?"). The authors found that when the young children were simply asked about a prior reality rather than a prior belief, even three-year-olds had no difficulty giving the correct response. As such incorrect responses on the deceptive box task cannot simply be attributed to poor memory.

Another possible explanation for the results is that perhaps young children did not want to admit they had initially been mistaken. It maybe that when children see the evidence of what is really inside the box, they feel they have been stupid and so resort to denying their initial belief. Wimmer and Hartl (1991) investigated this hypothesis by asking the young children to sit next to a puppet called Kasperl. Kasperl is a character from German television who is well known for his silliness and for getting things wrong. At the end of the deceptive box procedure, the experimenter asked the child what Kasperl had thought the box contained. Even if children did not want to appear stupid themselves, they were still in a position to attribute a false belief to Kasperl. However, Wimmer and Hartl found that three-year-old children gave a realist response as frequently for Kasperl as they did for themselves.

Perhaps the most convincing test of false belief comes from the Wimmer and Hartl (1991) state change task. The authors wanted to investigate whether children were failing the standard task, not because they lacked an understanding of belief, but because they were glossing the test question to be "What is inside the box" and therefore answering according to present reality. They presented children with a modified deceptive box procedure in which children were shown a box and asked what they thought it contained. Once the child had answered, the experimenter opened the box and showed the child that the box did indeed contain what she had anticipated. The experimenter then exchanged the typical content for an atypical content, closed the box and asked the child what she had initially thought the box contained. Under these conditions, young children successfully answered that they had thought the box contained its initial content. These

same children however failed a standard deceptive box test. Wimmer and Hartl concluded that young children had no problem with the procedure of the deceptive box task, their problem was with the concept of belief itself. They propose that on the state change task, while children were giving the correct answer, they were not in fact reporting their prior belief. Instead, the authors suggest that children were succeeding because they were commenting on the prior episode (during which the box did in fact contain the initial content) rather than to the initial belief itself. This would happen if children were glossing the test question "What did you think was inside?" as "What was inside?"

These findings therefore eliminate many artifactual accounts for young children's failure on false belief tasks. It seems that their problem with such tasks is robust and cannot be attributed to artifactual processes. Results from both the unexpected transfer and the deceptive box task suggest that young children's understanding of the mental realm is severely limited as they have difficulty dealing with mental states when they conflict with reality.

An important question facing developmental psychologists is therefore why young children fail the sort of tests described above. Any such explanation must not only account for why young children fail the tasks, but must also consider what happens during the early years of childhood which enables the four-year-old child to reach the correct solution.

1:6 The Representational Deficit Account

Many researchers, such as Gopnik (1988) and Perner (1991, 1992) ally themselves with the theory theory. These individuals suggest that young children's failure on tasks which require an understanding of false belief is symptomatic of a failure to engage in metarepresentation. They therefore consider the older children's success on the tasks to be demonstrative of their ability to metarepresent. Perner (1992) suggests that the shift in children's performance at around the age of four can be attributed to "a 'theoretical revolution' from a 'situation theory' to a 'representational theory of mind', a revolution centred around the concept of representation" (p. 148).

Perner (1991) outlines three stages of development through which the child must journey before she gains the ability to represent another's mind. He suggests that from birth until the age of 18 months the child entertains a single model of the world around them, which can be constantly updated. During the second year of life, the child develops the capacity to entertain multiple models and as such can compare past and present representations of a single situation. He has dubbed such children 'situation theorists'. Although these children can model two possibly conflicting situations, they are unable to model the relationship between the two. The child is not capable of this until she can metarepresent. Perner (1988) defines a metarepresentation as "a representation of a representation as a representation". When this is applied to mental states it refers to the ability to mentally represent your own or another's representation and as such, to hold beliefs about your own or another's beliefs.

Perner (1991) argues that if the child does not understand a representation as a representation she cannot distinguish between its referent (the situation the model represents) and its content (how the model represents the situation as being). In our example 1:2, Jon's belief that Emma is behind a rock is a misrepresentation and would be characterized by the divergence of the real situation it represents, (the referent) that Emma is behind the tree and the sense or content of the representation, that Emma is behind the rock. According to this theory, before a child can acknowledge a false belief, she must understand that while the referent of the belief will always be true in reality, the content of it may not be. The child who can be described as a representation theorist is therefore capable of understanding that the owner of the belief who is not privy to the discrepancy between referent and content will assume that her belief is a true representation of reality and will act accordingly.

The claim is therefore that without this capacity the younger situation-theorist is unable to conceive of her own or another's false belief. Consider once again, example 1:2, the child observer who is a situation theorist would be able to entertain both models of reality, that is; past reality; Emma is behind the rock and present reality; Emma is behind the tree. In addition, Perner states that while the situation theorist would be able to represent Jon as having different

attitudes to these situations in the past or in the hypothetical present, neither captures that Jon is thinking that Emma is behind the rock now. This is different from Jon thinking she was behind the rock or thinking about the possibility that she may be behind the rock. As such while the situation theorist can think of Jon as being associated with Emma behind the rock, she is unable to explicitly think of Jon mentally representing Emma as being behind the rock. It is not until the child can distinguish firstly which situation Jon's thoughts refer to (thinking of) and secondly the way in which his thoughts refer to the situation (thinking that) that she can conceive his present (or indeed her own past) false belief. According to Perner, this does not occur until the child makes the radical cognitive shift from situation-theorist to representation-theorist sometime around her fourth birthday. This shift is marked by the passing of false belief tests.

This idea that the child's problem is a general representational problem helps to explain data from the appearance-reality task. This task suggests that young children's difficulty is not limited simply to the recognition of beliefs, but seems to be rather more global.

1:7 The Appearance-Reality Task

In the appearance-reality task, which was designed by Flavell, Flavell & Green (1983), children are shown a misleading object, for example a sponge that has been realistically painted to look like a rock. They are then allowed to pick it up and as such find out what it really is. Finally children are asked an appearance question, "What does it look like? Does it look like a rock or does it look like a sponge?" and a reality question, "What is it really? Is it really a rock or is it really a sponge?" As in the false belief tasks, older children (over four years) tended to do well, this time answering that the object looks like a rock but really is a sponge. Three-year-olds, on the other hand not only answer that the object is a sponge, but also that it looks like a sponge.

Thus the young children were again making a realist error and were seemingly unable to report what the object appears to be. It seems likely that similar levels of understanding are required to solve both the false belief and the appearance-reality tests. In both tests, what the child now knows about the object conflicts with how she initially perceived it to be. The similarity

between the tasks was highlighted by Gopnik and Astington (1988). They contrasted children's performance on a deceptive box task with their performance on the appearance-reality task and found that the children who failed the appearance-reality task also tended to be those children who failed questions about both their own and another's false beliefs.

Such results do therefore support Perner's suggestion that the child does not have a specific problem with belief, but fails such tasks because she has a limited understanding of representation. Of course if the child cannot fully understand the mind's representational nature, she will have difficulty understanding that beliefs may be contradicted by reality.

1:8 The Information Processing Account

However, while this radical representational shift theory is perhaps the mainstream view, it is not universally accepted. One major critic of this approach is Alan Leslie. Leslie (1987) is not himself against the idea of a representational theory of mental state understanding. However, he opposes the concept of a representational revolution at the age of four and has proposed that from the age of eighteen to twenty-four months, young children are capable of metarepresentation. Young children's problem on false belief tasks is seen therefore not as a general representational deficit as proposed by Perner, but instead as being caused by the reasoning process the tasks require. He suggests that the concepts of pretending and believing are very closely related and that the emergence of pretence at about this time is demonstrative of this growing metarepresentational awareness in the very young child.

As such, Leslie leaves himself with the task of explaining why young children who demonstrate their capability of metarepresentation during pretence still fail tests of false belief understanding. Leslie (1987, 1994, & Thaiss 1992) suggests that although the underlying representational ability needed to solve false belief tasks is in place at an early age, it is not until sometime around the child's fourth birthday that she has the information processing capacity capable of the complex reasoning required. While Leslie agrees that the child must have a grasp of the nature of representation before she can understand a false belief, unlike theorists such as

Perner, he doesn't believe that this alone is sufficient.

He and his colleagues (Leslie, 1994; Leslie & Roth, 1993, Leslie & Thaiss, 1992) have produced a modular account which proposes the use of several different cognitive mechanisms in the solution of a false belief task. They hypothesise that the young normal child is endowed with a Theory of Mind Mechanism (ToMM) which matures over time. ToMM's job is to analyse and understand the behaviour of agents in terms of their underlying intentions. ToMM allows the young child to understand mental states intuitively and without reliance on any exhaustive computational reasoning process. To do this, it identifies the way the world is represented rather than the way the world really is. As such, it selects and processes representations. Alone, ToMM is sufficient to mediate both the production and the understanding of pretence. However, although ToMM is capable of dealing with the alternate realities of pretence, by itself, it cannot solve the puzzle of false belief.

The process of identifying the representation in the case of a mistaken belief is somewhat more complicated than it is in the case of pretence. According to Leslie (1987), in pretence the propositional attitude can be directly read off from the agent's behaviour. (The propositional attitude is the relationship between the agent and the proposition. For example John believes, but Mary hopes, it is raining [Leslie and Thaiss, 1992, p.230]). In the case of Mother's pretence, the child can read the propositional attitude, pretends, directly from Mother's behaviour which includes cues such as laughter and knowing smiles.

This is however, not the case for a false belief which must be inferred on the basis of the agent's past exposure history. Leslie provides us with a distinct mechanism to handle this task, the selection processor (SP). The SP takes account of the agent's knowledge and as such identifies and selects what is relevant from her past exposure, reconstructing the imaginary content of the propositional attitude. Therefore in the case of a deceptive box task, the SP must identify that John has not seen inside the smarties box and therefore does not know what it contains. On the basis of this evidence it must then construct the propositional attitude that John believes (falsely) that the box contains smarties. Leslie (1994) hypothesises that the SP performs

a type of executive function, inhibiting prepotent responses and selecting instead the correct premise upon which to base the belief. According to the account, the SP does not become fully functional until sometime around the child's fourth birthday. This is not a problem for the production or comprehension of pretence as the child only needs access to ToMM which is on line from an early age. However, it is not until the SP is up and running at about the age of four that the child can combine the two mechanisms and use them in tandem to infer the false belief.

According to Leslie, the existence of distinct cognitive mechanisms allows for the possibility of dissociable damage to one or another. He suggests that damage to ToMM may explain much of the data gathered demonstrating the difficulty shown by children with autism on tests of false belief (see chapter 4:4). Leslie sees results from both young normal children and children with autism on the Zaitchik (1991) false photo task as evidence for his model.

The task, which was closely modelled on existing false belief tests, was designed to see whether young children's difficulty with false belief generalised to a difficulty with representations per se. In the task, children were first trained in the use of a Polaroid camera. The experimenter then took a picture of an object in a certain position (eg. rubber duckie on the bed). Once the photo emerged from the camera it was placed face down so that the child could not see the picture developing. The object was then moved to a different position (eg. rubber duckie was put in the bath) and the child was asked where the object was located in the picture. To succeed on the task, the child must therefore put aside what she knows about the current location of the object and instead answer with reference to the pictorial representation. Young normal children tend to fail both a false belief test and a false photo task. However, older children with autism, while failing false belief tests, tend to succeed on the false photo task (Leekam & Perner, 1991: Leslie & Thaiss, 1992).

Leslie and Thaiss dispute Zaitchik's suggestion that young normal children's difficulty with the false photo task demonstrates their general inability to deal with metarepresentations and understand that representations can misrepresent a situation. They propose that their results from the children with autism testify to this. They believe that children from the two populations

are failing the false belief task for two completely different reasons. To succeed on a false belief task both ToMM and SP must be fully functioning. The young normal children are therefore performing badly because they lack an SP while the older children with autism are failing because they lack a ToMM. According to their analysis, the false photo task differs from the false belief task in that unlike the false belief task, it is not concerned with the representational state of an agent. Although a photograph is representational, it is a non-mental representation. Older children with autism, who have gained experience of pictures and photographs and have a fully functioning SP, have little or no trouble in understanding that although reality is updated, the picture remains the same. ToMM is not involved. Normal three-year-olds however are in a different position. They are unable to succeed on the false photo task as this requires a fully functioning SP.

Leslie and his colleagues therefore believe that although both children with autism and young normal children fail to impute false beliefs, they do so for entirely different reasons. Children with autism fail because without a ToMM, they do not possess the metarepresentational capacity needed to acknowledge a false belief. Young preschool children have difficultty with the tasks because they lack an SP and are therefore unable to draw together the correct information upon which to make a belief-based judgement.

1:9 The Simulation Account

The account of theory of mind development, which perhaps makes the most intuitive sense is the role-taking or simulation theory. Certain theorists including Harris (1989, 1991, 1992) and Johnson (1988), propose that the child comes to understand the mental states of others through a process of simulation. To appreciate what another person may be thinking about a certain situation, they imagine how they themself would think if put into an identical situation.

Harris (1993) suggests that children enter the world equipped with an innate mechanism the purpose of which is to establish joint attention and a joint attentional stance. During the

second year of life children begin to interpret other people's actions as having intentional relations with visible targets. To simulate another's mental state, the child must imagine intentional states in others that she herself does not currently entertain.

Harris (1991) suggests that the child has innate default settings which direct her to attend to her own current intentional stance. Therefore, in order to engage in pretence or to simulate the mental states of others she must change these default settings so that she can reason about other people without being distracted by her own current perceptions of the world. In certain cases, such as understanding what another person can see, what they know, what they expect or what they might want, this process is not complicated. First, the child must set aside her own default settings so that they are in line with the circumstances of the other individual. As such she will not assume that the other person will know, want, see or expect what she herself does. She is then in a position to appreciate what the other person knows, expects, sees or wants through a process of simulation. Such mental states are typically understood by children as young as three-years-old.

The understanding of more complex mental states, such as false beliefs, requires a more complicated process of simulation. The more simple mental states can be understood hypothetically. That is that the child has imagined the other knowing, seeing, expecting or wanting something in the world which is possible. However in order to understand that another person holds a false belief, the child must alter her default settings so much that she can temporarily overwrite what she knows about reality. It is no longer simply possible to consider hypothetical or possible events, now the child has to treat nonexistent events as though they were part of current reality. Once she has achieved this, she can then simulate how the other feels about the nonexistent state of affairs, substituting her own disbelief for the other's belief and as such understand the other's differing mental state. Harris suggests that the difficulty between these two levels of simulation is reflected by differences in the age at which children are capable of achieving them. As such, Harris proposes that if a child can acknowledge another's false belief through a process of simulation, a working grasp of metarepresentation is not a prerequisite for

success on the tasks.

However, it has been argued that if young children did use a process of simulation to infer another's thoughts, they should first be able to demonstrate an understanding of their own prior false belief. Astington & Gopnik suggest that the simulation theory would predict that "Children's understanding of their own minds, of their own beliefs, desires and so on, would consistently precede their understanding of the minds of others"(1991, p.24) Ideas of this kind stretch as far back in time as the seventeenth century. Descartes suggests that one's own mind is transparent to itself and so any understanding of another's mind is acquired through a process of reflection and introspection. Certain researchers believe that if it can be shown that not only do children have difficulty acknowledging other's false beliefs but also their own, the simulation account will be undermined. This has been demonstrated. While certain studies have shown that young children do have an understanding of their own prior false belief (Perner et al., 1987), others have found that using the standard deceptive box procedure, young children are unable to acknowledge that they had held a mistaken belief (Mitchell & Lacohee, 1991; Wimmer & Hartl, 1991). Indeed, Gopnik and Astington (1988) compared children's understanding of their own prior false belief and of another's potential false belief and found that understanding of another's false belief seems to precede the understanding of one's own.

However, this is not a valid criticism of simulation theory. As Harris (1991) points out, Cartesian transparency would apply only to the mind in its present state. As such, in order to acknowledge one's own prior false belief, a process of simulation would be necessary. As with understanding another's false belief, to reconstruct her own past belief, the child must change her default settings so that her present knowledge of a situation is temporarily overwritten with her previous false belief about the object. She must then set aside her present disbelief about the situation and instead simulate how she herself would have felt in the prior episode. As such a simulation account of the development of mental state understanding can be seen to apply not simply to another's possible false belief but also to one's own prior false belief.

1:10 Metarepresentation and Pretend Play

At the heart of the debate over the child's acquisition of a theory of mind is the concept of pretence. Unlike children with autism, from about the age of eighteen to twenty-four months, clinically normal children avidly engage in both individual and joint pretend play. There is ample evidence that young children gain the ability to act upon the world in a way that shows they can both imagine something to be other than it is (e.g. that a cup that is empty contains juice) and understand that another person may pretend that the world is something it is not (mother pretends that the banana is a telephone) (Harris & Kavanaugh, 1993).

Different theorist have used this aspect of children's development to provide evidence for their own theories regarding the development of mind.

1:11 Leslie

Leslie (1987) suggests that because children understand that while Mum is pretending the object is a telephone and at the same time realise that she knows it is really a banana, they must be able to metarepresent. If children were unable to do this, he believes they would be in danger of succumbing to the problem of 'representational abuse' in that they became confused as to whether an object belonged to the real world or to the realm of pretence.

Leslie (1987, 1994) distinguishes between the different types of representation which the child creates in order to avoid representational abuse. According to the model, the child must first entertain a 'primary representation' which is a direct copy of her perception of reality. In order to engage in pretence, she must then produce a 'decoupled' representation which is an opaque version of the primary representation. She does this by copying the primary representation into an opaque context. The decoupled representation is considered to be opaque as it is quarantined from the real world. The child cannot therefore treat it as if it were a reflection of the way the world is, but must instead consider it as a report of the world which has been filtered through the mind. As such, the decoupled representation is necessary for pretence as it can produce representations that explicitly contradict reality. Finally Leslie

suggests that the child must create a relational structure which represents the informational relation between the agent, the primary and decoupled representations. It is this entire structure which he terms the M-representation (He terms it the M-representation to distinguish it from Perner's different concept of metarepresentation).

Jarrold et al. (1994) point out that while Leslie's M-representation is undoubtably a metarepresentation as it is a representation of a representational relation, its definition differs from that of Perner in that it implies no conscious understanding in the child that mental states are representational. While Jarrold et al. (1994) do not dispute that Leslie's analysis of pretence adequately defines metarepresentation, they do not however agree that all pretence is necessarily metarepresentational. This is an important issue because if pretence is not metarepresentational, then Leslie's entire theory of cognitive development begins to look somewhat shaky. If pretence is metarepresentational then a child engaging in pretence must understand it in mentalistic terms. That is that before an individual can pretend to be a certain thing (for example a rabbit) they must first have knowledge of what a rabbit is and secondly have the intention to act in a way that is similar to a rabbit. Indeed the issue of whether or not pretence is metarepresentational and is understood by the young child as mentalistic is a decisive factor in mediating between the different theories of theory of mind acquisition.

1:12 Lillard and Perner

Perner's representational theory relies on the fact that before the age of four, young children do not have the capacity for metarepresentation. Leslie's analysis of pretence is therefore in direct contrast with this view. Both Lillard (1993) and Perner et al. (1994) were interested to investigate whether children who engaged in pretend play understand that pretence requires mental representation. Before an individual can engage in pretence, she must be able to mentally represent both reality as it is around her (the banana as a banana) as well as the pretend episode (the banana as a telephone). To do this they presented children with scenarios in which true pretence was either possible or impossible. For instance, Lillard showed young

children a troll and introduced him saying that although he was hopping around in a way that was like a rabbit, he did not know anything about rabbits. She then asked the children whether the troll was pretending to be a rabbit. The majority of four-year-olds and a substantial number of five-year-olds stated that even though the troll did not know what a rabbit was, they thought he was pretending to be one. Lillard takes these results to be evidence that young children have an activity-based rather than representationally-based understanding of pretence. That is, they understand pretence to be a special sort of acting, acting-as-if something were the case. According to her account, as this technique is adequate, they have no need to project mental states into the minds of their co-pretenders. Indeed her data suggests that children do not understand the representational nature of pretence until a point after they succeed on a standard false belief task (at around the age of six years). Lillard concludes from this that as their activity-based technique for understanding pretence is so proficient, even when they demonstrate an understanding of metarepresentation by passing a false belief test, children do not immediately take aboard mental representation into their conception of pretence.

Perner et al. (1994) also present persuasive evidence which suggests an activity rather than mentalistic understanding of pretence. In one of their experiments they showed children a toy rabbit in a box. In one condition the second experimenter was sent out of the room to fetch a carrot to feed to the toy rabbit. While he was away, the rabbit either stayed in the box or was removed by the first experimenter. In another condition the rabbit was removed from the box in the second experimenter's presence. Under both conditions the second experimenter then pushed the carrot through a hole in the box without looking inside. At the end of the trial the child was asked if the second experimenter had put the carrot in the box because he thought the rabbit was really inside or because he had just been pretending. Perner et al. found that while older four-year-olds were very good at distinguishing between whether the second experimenter thought the rabbit was in the box or was simply pretending he was, the younger four-year-olds and the three-year-olds failed to make the distinction correctly. As such Perner et al. concluded that the younger children did not take into account the mental attitude of the protagonist. They

seemed to be unable to distinguish between when an individual acted-as-if something were the case because they had a false belief and when they acted-as-if something were the case because they were pretending it was. Perner et al. suggest that young children do not distinguish between the two concepts, but instead have one umbrella concept of 'prelief' which can be used to understand all cases of acting-as-if. According to Perner's analysis of mental state development, this is within the abilities of a situation theorist for although she can understand how individual's are related to situations (propositions) she cannot understand that individuals relate differently to a situation depending on the how the situation is evaluated in terms of its truth status.

While Lillard (1993) and Perner et al. (1994) differ somewhat in their interpretation of the data, they do both provide strong evidence to counter Leslie's (1987) argument for a mentalistic understanding of pretence. If these very young children do not engage in pretence by understanding their own and other's mental states, it is very likely they have no conception of the mind as representational. If this is the case then Leslie's argument that children fail false belief tasks because of an informational processing problem rather than a metarepresentational deficit seems somewhat tenuous. At the same time such evidence supports the claim for a general metarepresentational deficit in young children.

However, Mitchell (1995) points out that simply because children in Lillard and Perner et al.'s studies use the word pretence in a situation in which a character's behaviour is not mapped onto an appropriate mental state, it does not necessarily mean that the child has no mentalistic understanding of pretence. He suggests that children may fail the tasks presented because of their linguistic naïvety rather than their metarepresentational deficit. Such a criticism is borne out by results from Gerow and Taylor (1995).

These authors circumvented young children's potential linguistic problem with Lillard (1993) and Perner et al.'s (1994) tasks by presenting their task in a pictorial form. The task was based on that of Lillard (1993) but instead of involving verbalisation, children were introduced to the concept of thought balloons. They learnt that the character was thinking about the object

within the balloon but not the object situated next to her. Following the training session, children were shown a series of pictures in which a character was performing the same action as two animals. One of the animals was depicted beside the character, while the other was contained in a thought balloon above her head. Children were asked which animal the character was pretending to be. Control questions were incorporated into the design to ensure that children did not select the animal contained in thought bubbles regardless of what question they were asked. As such the task mirrored that of Lillard except that it relied upon children's understanding that thought bubbles reflect the content of a character's mental state rather than their ability to label the content of a character's mental state. Under these conditions, children were markedly more successful with the majority of older three-year-olds successfully linking a character's pretend action with an appropriate mental state. Gerow and Taylor (1995) suggest that children's understanding of the mentalistic nature of pretence emerges at around the same time as their understanding that actions may be caused by false beliefs. Thus while these results do not support Leslie's view of early metarepresentational understanding, they do suggest that children understand the mentalistic nature of pretence at a period in development before they can verbally discuss the content of a pretend episode.

1:13 Jarrold, Carruthers, Smith and Boucher

Gerow and Taylor's (1995) suggestion that a mentalistic understanding of pretence emerges during the child's fourth year of life is supported by Jarrold, Carruthers, Smith and Boucher's (1994) analysis of pretend play. Jarrold et al. suggest that Leslie (1987) was wrong to equate individual pretend play and shared pretend play with others. They point out that it is unlikely (but not impossible) that a child who is involved in individual pretence will engage in metarepresentation (by representing herself as representing an object as representing another object). Jarrold et al. suggest that a hypothetical secondary representation such as, 'I am acting as if this object were another object' would be adequate for most occasions of individual pretence. Similarly they propose that for a substantial amount of shared pretend play again a

hypothetical 'acting as if' representation would suffice.

Jarrold et al. (1994) cite evidence from Howes and Matheson (1992) who distinguish between different forms of shared pretend play. The authors differentiate 'cooperative pretend play' in which children act out complementary roles within social pretence from 'complex social pretence' in which they observe children acting out complementary roles with the additional use of metacommunication. Howes and Matheson (1992) argue that while the more simplistic 'cooperative pretend play' emerges between nineteen and twenty-three months, the more advanced 'complex social pretend play' does not emerge until the child is at least thirty to thirty-five months or sometimes as late as between forty-two and forty-seven months.

Jarrold et al. (1994) suggest that 'cooperative pretend play', which relies on the child offering pretend scripts to her partner, does not necessitate metarepresentational understanding. However, they propose that 'complex social pretence' in which children not only adopt and negotiate different rôles but also use metacommunication to establish the play script and rôles undertaken, must be metarepresentational. The authors suggest that while it is possible that young children displaying the most rudimentary understandings of pretend play during their second year of life do have a metarepresentational understanding of the activity, compelling evidence for a mentalistic understanding of pretence is not apparent until the child engages in complex social pretence during her fourth year.

1:14 Harris

However, certain theorists would argue that even at this point in development, pretence is understood in terms of acting as if (or simulation) rather than in mentalistic terms. Harris (1994, & Kavanaugh 1993) hypothesises that as in the case of false belief reasoning, an understanding of its representational nature is not necessary either for the production or understanding of pretence. He suggests that young children simply need the ability to entertain hypothetical situations.

In Harris's model, the young child avoids representational abuse in pretence through a

system he terms 'flagging'. In pretend situations, the child does not confuse the pretence (the banana is a telephone) with reality (the banana is a banana) because she stipulates the pretend situation using a system of mental flagging. As such, if in the pretend situation the child is pretending that the banana is a telephone, she would store a flag for the banana that reads "This banana is a (make-believe) telephone". The flag is not attached to the primary representation of that prop, (and so that banana will not always be a telephone) but rather to the mental representation of the current pretend episode. Once the pretend episode is over, the flag is not overwritten but rather fades into the child's long-term memory within the context of that specific pretend episode. The banana is therefore still mentally represented as a banana, but if the pretend episode were to be retrieved and reentered, the banana would again be flagged as a telephone.

This analysis of pretence therefore supports a simulationist view of the development of mental state understanding in young children. As with pretence, Harris believes that no understanding of metarepresentation is necessary for an understanding of false belief (c.f. 1:9) and as such no representational revolution occurs during the preschool years. He must therefore explain why children, who are capable of manipulating a counterfactual situation during pretence at the age of two, are unable to engage in a similar activity during a false belief scenario until they have reached the age of four.

To account for this disparity, Harris proposes that once the child has got to grips with pretence, an additional step is necessary before she can understand false beliefs. In order to engage in pretend reasoning, the young child must have the ability to imagine a non-existent situation. She must be able to consider the hypothetical. In this respect the child who is capable of pretence is also capable of simulation, albeit in a rather rudimentary form. However to acknowledge a false belief a far more sophisticated version of simulation is necessary. Now the child cannot simply hypothesise, but must also set aside her own current disbelief which requires her to modify her current default settings. This is an ability which develops at a later point in childhood, beginning at some point during the fourth or fifth year of life.

1:15 Conclusion

Taking the evidence from pretend play into account, it is still difficult to arbitrate between the different theories of theory of mind acquisition. It is however probable that the emergence of pretend play in the young child between eighteen and twenty-four months is not the metarepresentational watershed that Leslie (1987) perceived it to be. Equally, the evidence from pretend play in young children does not fully support a theory theory model of a single step into the mentalistic domain at the age of four. Instead of seeing a revolution in children's ability to engage in metarepresentation, we see piecemeal development through which young children's ability to disengage from reality and project mental states into the minds of other people is constantly refined.

The simulation hypothesis is however alone unaffected by counterevidence. It makes eminent sense that before a young child is in a position to simulate another's mental state, she must first learn 'to act as if'. While Jarrold et al. (1994) suggest that complex social pretend play may have a metarepresentational component, this could be adequately taken care of by the child's growing ability to alter her default settings during simulation.

Indeed while the young child may not explicitly link mental states with pretend actions until their preschool year, evidence does suggest that pretence acts as a preparation for mental state understanding as would be suggested by a simulational view. Dunn (1994) reports work in which she and her colleagues investigated the relationship between young children's pretence and their ability to attribute mental states. She found that those children who engaged in the most role-enactment during their pretence were also the ones who were most able at assessing another's mental state during a false belief test.

Children's early appetite for pretend play may not as Leslie (1987) suggests herald the onset of the metarepresentational domain. Similarly their engagement in metarepresentational pretence during the fourth year of life at a point in development several months before usual success on a false belief task is at odds with the idea of a representational revolution. Rather

the evidence points towards a gentle progression in the understanding and production of 'acting as if', or pretend play. This gradual development reflects the child's growing capacity to simulate others' mental states within a context far less demanding than that required for the simulation of a false belief.

Chapter Two

"'First of all,' he said, 'If you can learn a simple trick, Scout, you'll get along a lot better with all kinds of folks. You never really understand a person until you consider things from his point of view -'

'Sir?'

'-until you climb into his skin and walk around in it.'"

Harper Lee, *To Kill a Mockingbird.*

2:1 An Understanding of Oneself

According to the Cartesian view of mind, an understanding of another's mind is presupposed by an understanding of one's own mind. To illustrate this point, Wimmer and Hartl (1991) quote Thomas Hobbes (1651/1968) "Whosoever looketh into himself, and consedereth what he doth, and when he does think, opine, reason, hope, feare, &c, and upon what grounds; he shall thereby read and know, what are the thoughts, and Passions of all men, upon the like occasions" (p.82). Therefore in order to understand what another person in a given situation may be feeling, you must reach inside yourself and imagine how you yourself would feel if faced with similar circumstances. This is known as a simulationist view of mind (c.f. 1:9).

If the simulationist hypothesis is to be believed, it must follow that before an individual can understand the mental state of another, she must have some understanding of her own mental states. As mentioned earlier (c.f. 1:9) it is not necessary for a young child to demonstrate knowledge of her own outdated mental states before she can consider those of another individual. According to Harris's (1989, 1991, 1992) model, a child will need to use a process of simulation to acknowledge her own prior belief states as well as the present mental states of

another. However, if the child is to engage in simulation of this type, it is of paramount importance that she first has access to an understanding of herself, her thoughts and beliefs in the present. Without such a facility, the child would have no database upon which to draw for information concerning other's mental states. If a simulationist view of mind is to be seriously considered, evidence must be provided which shows an understanding of the concept of the self and of the child's own mind at a stage before she begins to use this understanding to simulate the mental states in others.

In the previous chapter (c.f. 1:10-1:15) we considered the role of pretence in the development of an understanding of mind in young children. According to the existing simulation account, it is during pretend play that the young child first begins to hypothesise about possible states that are not true of current reality. As such pretence provides us with an understanding of how the child gradually builds up a system which will later allow her to consider states of the world which specifically contradict reality. However, while early pretend play illustrates that the child is becoming proficient with the process of simulation, it does not in itself demonstrate that she has a full understanding of the concept of herself as a person with a mind that is separate from those around her.

Yet, there is data from children's pretence which supports the idea that the child must first have an understanding of her own mental states before she can simulate those of another. Mitchell and Neal (1995) presented children aged between three and five years with tasks similar to those designed by Lillard (1993). These authors, however, were interested not only in children's understanding of pretence in others, but also in their understanding of their own pretence. They asked children whether they themselves or another person were pretending to be animals under two different conditions. Firstly when the child or the other person acted in an unintentional way and secondly when the child or a toy had no knowledge of the animal. They found that while the majority of young children understood their own pretence (that they had not been engaged in pretence when acting unintentionally), most of the children failed to understand another person's pretence. They judged that the other person had been pretending even if she

had explicitly stated that the action had been unintentional. It seems that while children have learnt to understand their own mental state of pretence at around the age of three, such knowledge for pretence in another is absent until a later date. It is likely that before children can understand what is happening to others internally during pretence, they must first have such knowledge for themselves. This could of course then be used to aid their simulation of the mental states entertained by others during pretence.

While such evidence from pretence is supportive of the simulationist view of mind, if such a model is to be accepted, it is crucial that not only is the presence of early pretence demonstrated, but also that an understanding of self is established in the young child.

2:2 Mirror Self Recognition

Perhaps the most fundamental indication of self-knowledge in the child, is the demonstration of mirror self recognition. As adults we are capable of self recognition. We know who we are, what we look like and as such can identify our own mirror image. This ability to recognise ourselves is something that we all take for granted. Its onset in young children (and the possibility that certain other species, such as the great apes, may also have the capacity to conceive of themself) has been a much researched topic throughout this century and before. Different methods for assessing whether or not an organism is able to recognise her own self-image have been tried, the most common being to place an organism in front of a mirror and watch for behavioural clues which might suggest recognition that the image is a reflection of the self.

Although this technique is widely used, different researchers suggest different criteria for crediting an individual with self recognition. Gallup (1970) offers the definition that for self-recognition to occur, "behaviour in which the self rather than the mirror is the referent" must be present. Anderson (1993) offers three behavioural criteria which he proposes are demonstrative of self-recognition; self-exploration in front of a mirror, experimenting with bodily and facial gestures and watching them in the mirror, and finally passing the mark test (see below). He

suggests that for an organism to be credited with the capacity to recognise its own reflection, at least two of the three behaviours must be present.

The mark test (Amsterdam, 1972; Gallup, 1970) has long been used as an indicator of an organism's ability to recognise itself in a mirror. In this procedure, a spot of dye or rouge is placed on the face, (either covertly in the case of a child or during sedation in the case of an animal) which is impossible to see without the aid of a mirror. The organism is then placed in front of a mirror and is said to be able to recognise itself if any behaviour directed to the mark is recorded (e.g.. inspecting, touching, wiping the mark). Animals who are unable to identify the mirror image as being of themself react as though seeing another conspecific organism. In the case of human infants (Amsterdam, 1972) and higher primates (Goodall, 1971) such behaviour includes searching behind the mirror for their playmate. Male macaques who show no evidence of self-recognition have been found to exhibit a facial gesture that is only seen when the animal is confronted by an unknown male conspecific (Gallup, 1977).

Experience and understanding of the nature of mirrors is not enough to pass the mark test. Some species who understand mirror correspondence and are able to use mirrors to manipulate objects are still unable to understand their own relationship with the mirror image and as such fail the mark test (Brown, McDowell & Robinson, 1965). Obviously as Gallup (1993) points out, success on just one of Anderson's criteria (even if that is from the mark test) can in no way be seen as providing conclusive evidence that an organism has true mirror self-recognition. Indeed in some cases while one or possibly two of the above criteria may be stably in place, others may not (Lewis & Brooks-Gunn, 1979; Lin, Bard, & Anderson, 1992). This suggests that to consider whether or not an organism has achieved self-recognition, one must look beyond one simple test to a wide range of behaviours. As Anderson (1993) proposes, with this in mind, the evidence clearly shows that only humans and certain great apes (chimpanzees and orangutans) can be credited with the capability for true self-recognition.

2:3 Mirror Self Recognition - Evidence of Self Awareness?

Gallup (1985) argues that such a variety of self directed behaviour is not merely evidence of the organism's ability to correctly infer the identity of its own reflection but is also evidence that it is self-aware. Gallup defines self-awareness as being aware of being aware and as having the ability to knowingly become the object of your own attention. He argues that it is because primates other than chimpanzees and orangutans lack a concept of the self, that they are unable to recognise their own image. "In order to correctly infer the identity of the reflection presupposed an identity on the part of the organism making that inference. If you did not know who you were, how could you possibly know who it was you were seeing when confronted by yourself in a mirror." (Gallup, 1985. p 633). His ideas are supported by those of Lewis (1986) who suggests that although an understanding of self is possible without the demonstration of self-recognition, self-recognition is not possible with no understanding of self. "self-recognition ..... and the general concept of self are not synonymous, because it is possible to have a concept of self and not be able to visually recognise oneself. Nevertheless, it is hardly possible to recognise oneself and not have a concept of self" (p.63).

According to Gallup's model, self-awareness is the critical test that distinguishes animals with conscience from those without. Adhering to a simulationist model, he goes on to suggest that individuals who are self-aware are able to use knowledge of their own mind and experience they have gained, to infer the conscious experience of others. Thus the acquisition of a concept of the self can be seen not only as indicative of an understanding by the individual of her own mind, but also as an indicator of the individual's ability to infer and predict the mental states held by others. "Organisms which are self-aware..... are in the unique position of being able to use their experience as a means of modelling the experience of others." (Gallup, 1985. p.633) He takes the argument one step further by suggesting that the presence of conscious experience in an organism can be inferred on the basis of her ability to use her own experience as a predictor of the experiences of another. Gallup (1982) proposes that as mirror self-recognition is possible only in those species that have a self-concept, those species who lack this ability are

incapable of reflecting on their own mental experience. Although Gallup's theory is highly contentious and many people question the relationship he proposes between mirror self-recognition and self-awareness (eg. Mitchell, 1993), it does provide a testable hypothesis. Without knowledge of one's own mind, an individual is incapable of simulating the states of her own or another's mind. Therefore, any species which fails to recognise it s own mirror image should not be capable of attributing mental states either to herself or to someone else.

While most of the work done in this area is centred largely around the understanding of mind in animals, it is of crucial importance to those who suggest that young children engage in simulation. If any species is found who can demonstrate an understanding of another's mind before she can show some vestige of self-awareness, the simulation model becomes suspect. However, evidence gathered over the last few years does seem to largely support Gallup's Cartesian stance. A major research programme headed by Daniel Povinelli has used the technique of comparing the performance on tasks likely to tap the ability to mentalise of those species which have been shown to be capable of mirror self recognition and those which have not. To date, only humans, chimpanzees, orangutans and a sign-using gorilla (Patterson, 1984) have shown clear evidence of mirror self recognition (Gallup, 1985; Gallup & Suarez, 1986). Povinelli et al (1990; 1991) investigated whether there was any difference between self recognising species and non-recognising species in their understanding that seeing leads to knowing. If an organism is capable of attributing knowledge to an individual in this way, some underlying understanding of mental states must exist. They found that while most of the chimpanzees tested consistently discriminated between someone who knew where the food was (who had visual access) and someone who did not know and was guessing (who had no visual access), the rhesus macaques made no such distinction. Povinelli et al (1992a; 1992b) explored whether there was a similar dissociation between species on a role reversal task. Again, most of the chimpanzees tested succeeded and immediately showed role reversal. On the other hand, none of the macaques transferred into their new roles until sufficient trials had elapsed to allow learning to take place.

Such evidence, lends support to Gallup's model. While no counter evidence is yet available, Povinelli is cautious not to over interpret his data. Taking a sceptical approach he suggests that it is eminently possibly that due to their greater intelligence, the chimpanzees are simply able to learn associations which are beyond the capabilities of the lesser species. Nonetheless until evidence is supplied to undermine the model, Gallup's simulational hypothesis is still tenable. In the species tested to date, there is no evidence to suggest that mental state understanding appears without the presupposition of self recognition.

2:4 The Development of Reflective Actions Within The Young Child

Although it would be precipitous to accept Gallup's model until more comprehensive data has been collected, Gallup has made an important link between the onset of mirror self recognition and the subsequent recognition of mental states in the self and others. Povinelli (1993) points out that although in young children, self-recognition typically appears a year or two before many other attributional processes (acknowledgement of false belief, understanding of appearance/reality, understanding that seeing leads to knowing), this does not undermine the model, but rather may be predicted by it, "the emergence of the self-attributional capacities that underpin self-recognition may set in motion ..... a series of cascading ontogenetic constructions related to an understanding of the mental world" (Povinelli, 1993, p.503).

Indeed, many other capacities which demonstrate some level of understanding of the self emerge along with mirror self recognition between eighteen and twenty-four months in human children. In some cases, this understanding is so comprehensive that the child can begin to draw upon it in her quest to simulate and understand the mind of another. As can be demonstrated from pretence, once the child gained some awareness of herself, she can then begin to hypothesise about the minds of others.

Hoffman (1975) and Zahn-Waxler and Radke-Yarrow (1982) demonstrate that in the human infant, this period is typically characterised by the appearance of pro-social behaviours such as hugging another crying child, offering a sought after toy or food as solace or going to get

help from an adult. The existence of behaviours such as these imply that these young children possess the ability to empathise. Kagan (1981) has also outlined many of the developments that infants in their second year undergo. These include becoming concerned with parental standards for behaviour, developing a sense of one's effectiveness in solving a task and importantly the emergence of the ability to distinguish between pretence and reality. Similarly, Novey (1975) and Lempers et al (1977) both supply data which suggests that at as early as two years, children are capable of engaging in role reversal. In addition, Zahn-Waxler et al. (1977) describe data which suggests that children of this age are already able to take account of another's preference when choosing food or a present for the other.

Indeed certain researchers have found strong correlational evidence between the emergence of mirror recognition in infants and the development of behaviours that are reliant upon some social attributional process. Asendorf and Baudonniere (1993) found a correlation between the emergence of mirror self-recognition and synchronic imitation in young children. Similarly, Bischof-Kohler (1988, 1991) demonstrated that a strong correlation existed (in children aged sixteen to twenty-four months) between mirror self-recognition and empathic responses to distressed victims. Although no causal links can be identified, the data does suggest that without the ability to self recognise one would be unlikely to engage in such deliberate, social behaviours.

Evidence from Chapman (1987) supports this idea more forcefully. In his longitudinal study 20 children between the ages of twelve and twenty-four months were tested for their understanding of agency in pretend play, their ability to mirror self recognise and their understanding of object permanence. In looking at the understanding of agency in pretend play, Chapman found that children proceeded through specific developmental steps. The understanding of self-as-agent (in which the child performs a modelled action for herself) appeared first. This was followed by an understanding of both passive-other-agent (in which the child performs the modelled action to a doll or another person) and substitute-other-agent (in which the child performs the modelled action to a non-symbolic object e.g. a block) which

emerged in tandem. Finally pretence was characterised by the use of active-other-agent (in which the child makes a doll perform the modelled action for itself).

Similarly on the self-recognition task, children proceeded through explicit developmental steps. Tactual exploration of the mirror emerged first. This was jointly followed by success on a task involving the child finding a toy situated behind her using the mirror to guide her and success on the mark test. The child's ability to name her own reflection emerged latest of all.

In line with predictions from a simulational model, Chapman found that, "There were no children showing active-other agency who did not also pass the self-recognition name task" (p.165). This result could be construed to suggest that without the self-knowledge demonstrated in mirror self-recognition, a child is not in a position to simulate an understanding of agency in another.

There are certain researchers who believe that like false belief reasoning, the ability to recognise oneself in a mirror requires a capacity for metarepresentation (Asendorpf and Baudonniere, 1993). These authors suggest that in order to identify a reflection as being of oneself, the individual must have already formed a mental model of oneself (secondary representation) that can be completely detached from current reality. She must then hold this representation of herself in such a way as to compare and coordinate it with the mirror image (primary representation) facing her. There will be those however, who dispute such an analysis of mirror self-recognition. While it is certain that to achieve self-recognition a child would need to create and manipulate a secondary representation of herself, it is less probable that she would need to represent herself as representing herself. The child would not therefore need to represent the relation between the two representations and as such the task cannot be seen as metarepresentational. In terms of Perner's (1991) model, mirror self-recognition would therefore be within the capability of a child that he would describe as a situation theorist.

It is likely that skills such as mirror self-recognition would be better understood within a simulationist framework. Throughout those early years of life, the child is building up her conception of the self. It is not until she has gained insight into her own mental states that she

can begin to simulate those of another person. Yet if this is the case, we must identify what changes in the child's understanding of her own mind which allows her to simulate that of another. As we see from the child's ability to pretend and empathise, she is already in a position to act as if something were the case as well as to understand something about other people's emotions. It does not seem to be a large step for the child to move from this position to one in which she can acknowledge false beliefs. The simulation account preferred by Harris (1989, 1991, 1992) suggests that as children develop, they become more adept at altering their default settings (c.f. 1:9). Perhaps if we take the simulation account one step further, we would see that early inflexibility with regard to the default settings, may be symptomatic of a more fundamental problem in young children; their inability to consistently become objectively self-aware.

2:5 The Theory of Objective Self-Awareness

Duval and Wicklund (1972) and Wicklund (1975) propose a theory of self-awareness which suggests that conscious attention can be focused in two directions; either outward towards the world or inward toward the self. When attention is directed away from the individual to the world around, she is in a state of subjective self-awareness. The individual is said to be subjectively self-aware because her attention is not focused on herself. As such, she is considered self-aware only in so far as she experiences herself through her own perceptions. When attention is directed internally towards the individual herself, she is said to be in a state of objective self-awareness. Her attention is now focused on herself and she has become the 'object' of her own consciousness. The individual who is objectively self-aware is not only aware of being aware but as such is able to introspect. She is therefore in a prime position to engage in simulation.

Directing attention externally or in Duval and Wicklund's terms, being subjectively aware is the usual state in which to be. The individual spends the majority of her time in this mode of awareness as she carries out her everyday life. It is when an individual directs her attention internally to herself and contemplates her mind, that she is considered to be in a state of

objective self-awareness. The authors suggest that when an individual is objectively self-aware she becomes more conscious of her own personal attributes, feelings and mental life. Such a consciousness is of course a pre-requisite for the ability to simulate these states in other people.

Wicklund (1975) suggests that while an individual is incapable of dividing her attention between the self and the environment and cannot be both objectively and subjectively self-aware at exactly the same moment, it is possible to say that an individual has increased or decreased objective self-awareness at any one time. Different levels of objective self-awareness are possible as one can oscillate one's attention between internal and external states at varying speeds. An increase in objective self-awareness is defined as an increment in the proportion of time spent focusing on the self.

2:6 The Development of Objective Self-Awareness in Children

Duval and Wicklund (1972) propose that babies are not born with a capacity for objective self-awareness. Before they become objectively self-aware, Duval and Wicklund hypothesise that children must first learn the objectlike nature of the self. This occurs as the child comes across "situations that cause him to examine dimensions of himself..... to build up a unified conception of himself, a comprehensive causal agent self..." (p.52). According to the authors these situations can involve interaction either with the environment or with social others. The nature of this interaction is important in that its crucial component must be discord. Until the child has an understanding of her 'causal agent self', she is unable to understand that her own perceptions of the world are not universal. Once this assumption of the universality of perceptions is quashed by evidence to the contrary, the child will come to the realisation that she is an individual in the world with thoughts and perceptions that differ from those around her. As such, she has become objectively self-aware. "The child will differentiate the causal agent self as a unique object in the world and become capable of self consciousness only when his assumption of the universality of perception is contradicted by a demonstration that perceptual, mediational and behavioral processes different from his own do exist, thus pointing out that each

person's perception is a bounded, object-like particular, and not a universal" (p.41).

This process occurs as the child experiences situations which either involve disagreements with other individuals or which provide evidence of a change in her own previous conception of reality. Duval and Wicklund give an example of a child and an adult's perceptions of a cat. A child approaching an ill tempered cat for the first time may initially perceive it to be a plaything. However, if she touches the cat and is immediately scratched, she will have a second, different perception of the cat as being vicious. While an adult in a similar situation can conclude that she was initially wrong in her perception of the cat, the subjectively self-aware child can do no such thing. Instead she assumes both perceptions to be correct and does not realise that her first perception differed from her later one.

Initially a child will be unable to profit from such experiences. Any contradictory perceptions which may have lead to an ability to attain a state of objective self-awareness in an older child will fail in a younger one. According to Duval and Wicklund, the child does not have the cognitive capacity to learn from such an experience. The young child will not recognize the contradiction inherent in the two perceptions but will "hold and even oscillate between the two contradictory perceptions without realizing the contradiction" (p.44). However, a cumulation of such contradictory experiences over time will allow the child to develop towards a point at which she has the ability to become objectively self-aware.

Duval and Wicklund do not specify an age at which the child becomes objectively self-aware and present no evidence concerning its development in young children. However, they seem to equate the child's state of subjective self-awareness with Piaget's concept of absolutism. Piaget suggests that children overcome this and other aspects of preoperational intelligence sometime around the age of seven years. Although Duval and Wicklund disagree with Piaget about the processes that precede and are causal in this occurrence, they seem to use this as the marker for the emergence of their concept of objective self-awareness. Considering the evidence presented in the previous chapter, this may be a somewhat overly cautious assessment. Research in the area of the child's theory of mind (Wimmer & Perner,

1983; Perner, 1991; Gopnik & Astington, 1988) and into different levels of perspective taking (Flavell et al., 1981) suggests that by the age of four, children have a fairly comprehensive knowledge of both their own mind and that of other people. Indeed the literature suggests that by the age of four the child is capable both of taking account of another's alternate view of the environment (Wimmer & Perner, 1983) as well as understanding that their original perception of an item was initially mistaken (Gopnik & Astington,1988). At least by the age of four, children do seem to be able to take account of more than one factor in a problem and so cannot be seen to subscribe to an absolute view.

As stated earlier, the authors believe that it is through exposure to discrepancies between what a child knows to be currently true of a situation and what she previously incorrectly thought was true of a situation that leads her to understand that her own thoughts are not necessarily universal. Therefore in showing she has an understanding of the nature of mind (when she passes a false belief test at about the age of four), she is without doubt demonstrating her ability to become objectively self-aware.

2:7 The Relationship Between a Child's Level of Self-Awareness and Her Ability to Attribute Mental States

However, even this assessment may be overly pessimistic. As suggested earlier (2:4), by the age of eighteen to twenty-four months, children not only have an emerging sense of self, but are also able to engage in simplistic simulation (in the form of pretence or empathy). This self-knowledge would be impossible without some ability to direct attention internally and as such be objectively self-aware. If the young child has a concept of the self she is capable of reflecting on her own present mental state and is therefore able to achieve a state of objective self awareness. However, perhaps at this stage in development, children spend a larger proportion of their time attending to external reality rather than to their own inner world. This would of course mean that they have a lower level of objective self awareness than their older counterparts.

According to this perspective, the default settings, proposed by Harris (c.f. 1:9), could be seen more simply as the direction in which the child is focusing her attention. If she is in a state of objective self-awareness and is focusing her attention internally, she would be able to use her own self-knowledge as a point from which to engage in simulation. However, if the child were in a state of subjective self-awareness, simulation would be impossible. As Wicklund (1975) points out, different levels of objective self-awareness are possible. Perhaps the main difference between the younger child who fails a false belief test and the older child who succeeds, is simply a difference in their levels of objective self-awareness when engaged on the task. While young children are capable of objective self-awareness, the level they have attained by their third and fourth year of life would only allow them to engage in simple simulational activities such as pretence and empathy. The more complex simulation required by false belief tasks would demand a level of objective self-awareness not yet achieved. Duval and Wicklund point out, that even in adults, objective self-awareness is not the default state of existence. Perhaps for the very young child, even though she is capable of achieving such a state, it is not natural for her to constantly switch her attention away from current reality to contemplate her own mind. It may be that before the child can attain the heightened sense of objective self-awareness needed to simulate another's false belief, she must learn the importance of contemplating her own inner world at the expense of the world around her.

Such an idea would be supported by Mitchell (1994) who proposes that developing an understanding of the world around her is of far greater urgency to the young child's survival than is understanding her own mental processes. As such, Mitchell proposes that the young child is programmed to contemplate the external environment at the expense of internal beliefs that may be in conflict with the way the world is at present. According to this argument, it is not that the child is unable to consider internal thoughts and feelings, but that when they are in conflict with present reality, the child's attention will be automatically focused on her external world. It is not until the child has a firm understanding of the nature of reality that she can begin to fully understand the importance of the mental world. Once this state is achieved, at around the age

of four years, the child's attention can vacillate at will between the two realms, mental and physical. This supposition in no way proposes that the child cannot contemplate her own mind, but rather that she is biased to contemplate reality instead. As such it follows that if the child can be shown the importance of mental experience, can be given cues that force her to focus on her own internal thoughts, she can be made to turn her attention away from reality and towards her own beliefs.

One way this theory has been tested was to present children with modified tests of false belief reasoning. Mitchell and Lachoee (1991) found that if young children were helped to focus their attention on their internal former false belief rather than present reality, many of those who failed standard tests of false belief could successfully report their prior false belief.

If young children are naturally subjectively self-aware and find it difficult to focus their attention internally, they will spend a large proportion of their time attending instead to external reality. On a traditional test of false belief they would therefore concentrate solely on the way the world is at present (i.e. that the box contains pencils). However if Mitchell is correct in his supposition that the child can be encouraged to overcome this natural bias towards external reality, her fledgling understanding of belief may be unmasked.

According to the theory of objective self-awareness, different environmental exposure over time would lead children's awareness of themselves to emerge, develop and mature. If a child, who already had a sense of self and as such the ability to become objectively self-aware were put in a situation in which her attention was focused internally, a development or heightening of the state may occur. Attempts to heighten the child's self-awareness may thus help her reach a level of maturity more advanced than that denoted by her mental or chronological age.

Duval and Wicklund's theory proposes that a state of objective self-awareness can be induced or heightened merely by presenting the individual with any stimulus that reminds her of herself. As such, much work has been conducted in which experimenters have tried to directly manipulate a subject's level of objective self-awareness by attempting to get her to focus her

attention internally.

2:8 Methods of Heightening Objective Self Awareness

Researchers have tried a variety of different techniques to focus the attention of their subjects internally and thus produce a state of objective self-awareness. Duval and Wicklund (1972) suggest that any stimuli that reminds the individual of herself will serve this purpose. The most common method used has been to ask subjects to perform a task in the presence of a contingent image of themself; a mirror (Beaman et al, 1979; Buss & Sceier, 1976; Carver 1974,1975; Carver & Schemer, 1978), a television camera (Duval & Wicklund, 1973), both (Gelder & Shaver, 1976).

Studies testing Duval and Wicklunds' theory lend it much support. Gelder and Shaver (1976) found that if subjects performed a modified version of the stroop task (Stroop, 1938) in the presence of a self-focusing stimuli, time taken to name the colour of self-relevant words decreased while colour naming time remained the same for other non-relevant words. There was no effect when no self-focusing stimuli was present. Gelder and Shaver suggest that the effect is due to the subject's self-relevant memory being triggered by their image in the mirror or camera, which then interfered with the colour naming when the word was self-relevant.

Davis and Brock (1975) demonstrated a difference between an experimental and a control group of subjects performing in the presence of a video camera or a mirror. Subjects were asked to determine the English personal pronouns which corresponded to those underlined in sentences written in foreign languages. The experimenters found that those in the camera and mirror conditions chose more first-person pronouns than those in the no-camera and no-mirror conditions. This was interpreted as demonstrating that the presence of the mirror and camera had heightened subjects' consciousness of themselves.

Carver and Schemer (1978) validated the above experiments. Subjects were asked to complete sentences on the Self-Focus Sentence Completion task (SFSC) (Exner, 1973). Half the subjects completed the sentences in the presence of a mirror while for the other half, no

mirror was present. The experimenters found that there was a greater tendency to make self-focused sentence completions in the mirror condition than in the no-mirror condition. The above evidence does indeed suggest that focusing an individual's attention on themself by means of a mirror or video camera heightens her self-awareness.

2:9 The Video Series of Experiments

Our aim in the following experiments was to see whether young children who fail a traditional test of false belief would succeed if they were assisted in becoming objectively self-aware. To do this we would have to help them to focus their attention internally. One of the techniques used in the past has been to present the subject with a stimulus that reminds her of herself. While a variety of stimuli have been successfully used in the past (photographs, mirrors, video cameras, tape recordings of voices and even of the heart beating), we decided to ask the children to look into either a mirror or a television monitor. It may be that allowing the young child to see her own contingent image would indeed heighten her self-awareness sufficiently to facilitate performance on a deceptive box, false belief task.

Evidence presented earlier suggests that young child have a certain amount of self-insight (2:2, 2:3, 2:4) as well as an ability to simulate the mental states of others (demonstrated in pretence). Success on a false belief task may therefore be possible to young children if their predisposition to focus their attention externally could be overcome. As the child has a bias to attend to reality and as such has low-levels of objective self awareness, the present task must induce her to focus her attention internally on her own mind. Inducing objective self-awareness in the child would therefore place her in the optimum situation from which to engage in simulation. As such, when asked the test question, she could effectively ignore present reality and make a correct response based on the simulation of the false belief. If her objective self-awareness was of a sufficient level for her to engage in the simulation, it need not matter whether she was asked to contemplate her own prior false belief or the present false belief of another. The same simulation process would be required for her to acknowledge either her own

previous false belief or that of another person.

Experiment 2:1

2:8 Introduction

The aim of the first experiment was to assess whether we could enable young children, who fail a standard test of false belief reasoning, to succeed on our modified task. We hypothesised that one way this might be achieved would be to induce objective self-awareness in the children. It is possible that if a child is made self-aware, she may be able to turn her thoughts away from the external world (the reality that the box contains pencils)and instead direct them towards her internal representation of her initial false belief (the belief that the box contains smarties). To induce objective self-awareness in the children we undertook to show them a contingent image of themselves either in a mirror or a video monitor. The children were shown the self-reminding stimuli during the beginning of the trial in which they registered their false belief.

Our intention in carrying out this study was to investigate young children's understanding of belief and to discover whether embedding a false belief task within a framework, designed to promote objective self-awareness in the child, would facilitate the child's judgements about her prior false belief. However, although we were interested in the children's belief judgements, we asked them a 'tell' (what did you tell...?) rather than a 'think" (what did you think...?) test question. In this respect our aim was to form an association in the child's mind between the test question and the point at the beginning of the procedure during which the child held the false belief. We wanted to direct the child's attention back to the period in which she was engaged with the self-focusing stimulus.

We felt justified in using a 'tell' rather than 'think' question as it has been suggested (Leslie & Thaiss, 1992) that even very young children automatically read off a character's beliefs from his or her utterance. This supposition has been supported by evidence from Wimmer and

Hartl (1991) who found no difference in children's judgements whether they were asked a 'say' or a 'think' question. This effect applied equally to judgements about the children's own belief as well as their judgements concerning a puppet's belief. Although we felt justified in using a 'tell' question in our series of experiments, we decided it was necessary to directly investigate the effect the two question forms might have on the child's subsequent belief judgements. This we did in experiment 3:3.

2:9 Method

Subjects

We tested 38 children (20 girls and 18 boys) whose ages ranged from 3-3 to 4-1 (mean 3-7). The subjects were drawn from the nursery class of a local primary school catering for children from varying socioeconomic backgrounds.

Materials

Three cardboard boxes were used in the investigation, all of which could be easily recognised by the young children due to the manufacturers packaging. Each box contained an atypical object. The model aeroplane box contained a wooden fish, the cornflakes box, a yo-yo and the toothpaste box, a wax crayon. Six (10 x 19 cm) picture cards were used, each of which had a simple colour drawing on it (an iron, a pair of glasses, a house, a spoon, a kettle and a pencil).

Also used in the experiment were a Daffy Duck glove puppet, a mirror on a stand (30 x 20 cm) and a small video camera. This stood on a tripod in the corner of the room. The camera was linked to a video walkman situated on the table in front of the child. The video walkman is a small video recorder / player, with a (6 x 7 cm) built-in LCD screen. When the camera was turned on, a contingent image of what it was recording could be seen on the screen. Some of the children seemed slightly confused by the fact that the camera rather than the screen was

recording their movements. To prevent this affecting the results, the two were lined up so that any movements made directly to the screen were filmed as though made to the camera itself. To ensure that the child understood when the camera was recording and when it was not, an opaque black cloth was used to cover the camera and a black bag to cover the walkman when not in use.

Design and Procedure

Before testing began, the experimenter spent a session with each of the two classes, helping in the nursery and playing with the children. Most of the children were therefore happy to accompany her to the separate room where the testing took place.

Each child spent an initial 5-10 minutes in a video training period. This involved the experimenter explaining in very simple terms, what the camera did. She told the children that when the camera was on it watched everything in front of it with its eye (the lens), heard everything with its ear (the microphone) and remembered it all on the videotape. The experimenter then filmed the child talking and waving to the camera. This footage was immediately replayed to the child. The experimenter made sure that the child could identify the image as herself and then engaged the child in conversation about how the camera had remembered what it had seen. If the child did not immediately identify herself, the experimenter prompted her (e.g. look she's wearing the same T-shirt as you...) until the child had voluntarily identified herself. (This proved a fairly lengthy process in the case of two sets of twins, all of whom insisted that the image on the screen was their brother or sister.) When the experimenter felt that the child understood that she was watching herself on the screen as the camera had recorded her moments earlier, she introduced the test by telling the child that they were going to play a game looking inside some boxes.

Each child was then tested over three trials, the order of which was fully counterbalanced.

In the experimental part of the trials, the child was asked to tell Daffy, a mirror and a

camera what she thought the box contains. As children are not usually expected to interact with mirrors and cameras we wanted to check they were comfortable doing this. Therefore, at the beginning of each trial we gave them the following warm-up task.

The experimenter produced two cards from her case. She asked the child to pick one, show it to Daffy / the mirror / the camera and tell him / it what the picture was. All the children did this without any difficulty, holding the card out facing Daffy, the mirror or the camera and identifying the object depicted. In the case of trials (ii) and (iii), the card was reflected back to the child in the mirror or relayed via the screen and the experimenter said, "Look, its showing it back to you." In trial (i), Daffy (operated by the experimenter) took an identical card from the case and showed it back to the child and the experimenter said, "Look he's showing it back to you." As all the children carried out the task easily and with no hint of amusement, we felt justified in asking them to interact with the mirror, camera and puppet in the experimental trials.

(i) Deceptive Box Trial (DB)

The experimenter took the Daffy Duck glove puppet from her bag and introduced him to the child. She told the child that he liked it when he was told things. The warm-up sequence described above was then carried out.

Once this was completed, the experimenter brought a box out of her bag and said to the child "Tell Daffy what is inside." When the child had answered correctly, according to the box's exterior, the experimenter made Daffy whisper in her ear and then put him back in the case saying that he was tired and was going to go to sleep. The experimenter then opened the box and showed the child the unexpected content expressing surprise at what she had found saying, "Oh look, it's a yo-yo / a fish / a crayon." Once the child had seen the content, she replaced it, closed the box returning it to its original state and asked the test-question, "When you first saw the box, before we opened it, what did you tell Daffy was inside?"

(ii) Mirror Trial (M)

The experimenter placed the mirror on the table in front of the child and asked her to look into it and identify her reflection. None of the children had any problem carrying this out. The experimenter then engaged the child in the warm-up session described above.

As soon as this was finished, the experimenter brought a box out from inside her case. She asked the child to tell the mirror what was inside. Once the child had done so, the experimenter turned the mirror around and covered it with an opaque black cloth. The trial continued as in trial (i) with the experimenter revealing the unexpected content to the child and then asking her the test question, "When you first saw the box, before we opened it, what did you tell the mirror was inside?"

(iii) Video, No Playback (VNP)

The experimenter removed the cloth and switched on the camera explaining to the child that it could now see and hear everything that went on in front of it. While the camera was recording, the child could see herself from the camera's perspective, on the screen. The child then undertook the warm-up session.

As in the previous trials, the experimenter then took a box from her bag and asked the child to tell the camera what she thought was inside. Once the child had answered, she switched off the camera and covered it with the opaque cloth explaining that it could no longer see or hear. The trial then proceeded as had trials (i) and (ii) as the experimenter revealed the box's unexpected content to the child. At the end of the trial, the experimenter asked the test question, "When you first saw the box before we opened it, what did you tell the camera was inside?"

2:10 Results

As table 2:1 suggests, there was little difference in performance on the three trials. Not surprisingly, McNemar chi square comparisons between all of the conditions proved to be non-significant; deceptive box and video no playback; McNemar chi square (corrected, $df=1$, $n=7$)=0

N.S., deceptive box and mirror; McNemar chi square (corrected, df=1, n=10)=0.1, N.S., mirror and video no playback; McNemar chi square (corrected, df=1, n=9)=0, N.S..

Table 2:1

The number of correct responses made on each trial

(i) DB	(ii) Mirror	(iii) VNP
18 (47.4%)	18 (47.4%)	19 (50%)

Indeed on each of the three trials, children performed at chance, (i) deceptive box; chi square (corrected, df=1, n= 38)=0.0263, N.S., (ii) mirror; chi square (corrected, df=1, n=38)=0.0263, N.S. and (iii) video no playback; chi square (corrected, df=1, n=38)=0.0263, N.S.. Children's acknowledgement of their former false belief was in no way facilitated either by registering their belief in a mirror or in a video camera with contingent image.

Table 2:2

A summary of the results of the hierarchical loglinear analyses assessing the effects of age, sex and order on children's performance on each trial

Trial	(i) DB	(ii) Mirror	(iii) VNP
Age	(df=1) 4.917 p<.026	(df=1) 2.959 N.S.	(df=1) 0.986 N.S.
Sex	(df=1) 0.238 N.S.	(df=1) 0.000 N.S.	(df=1) 0.085 N.S.
Order	(df=5) 5.186 N.S.	(df=5) 2.731 N.S.	(df=1) 10.807 N.S.

Three hierarchical loglinear analyses were carried out, in which age, sex and order were entered as factors in a saturated model. Three different analyses had to be undertaken as they are only able to assess the significance of between groups factors. As would be expected from this sort of study, no significant sex effects were found. Similarly, the order in which the trials were presented had no significant effect on children's performance. However, age did prove to

be significant. A summary of these results can be seen in table 2:2. No significant interactions were identified.

When the subjects were split according to age, young 3-3 to 3-7 (mean 3-5), old 3-8 to 4-1 (mean 3-10), the older children's performance could be seen to be significantly better on the deceptive box trial than that of the younger children. However, there proved to be no significant difference between the two age groups on the mirror or video playback trials. Although the age range of our subjects was small, consisting of three and young four-year-olds, we did find that on the standard task, the older children were more likely to successfully acknowledge a false belief than their younger counterparts. This finding is consistent with many other studies (see Perner et al., 1987, for a review) which suggest that children's ability to understand false belief develops at some time around the child's fourth birthday.

2:11 Discussion

Although there may well be a link between a child's conscious conception of herself and her understanding of mind in general, this is not borne out in the results from this experiment. Presenting children with a contingent image of themself did not facilitate their belief-based judgements. It is well documented (c.f. 2:6) that objective selfawareness can be promoted through the use of a medium such as a mirror or a contingent video image. However, we have yet to establish whether this will have any effect on a child's ability to acknowledge her prior false belief.

It may be that inducing a state of objective self-awareness in the child has no effect on her ability to understand false beliefs. This would certainly be one interpretation of the results of this experiment. However, while we have found no evidence to link objective self-awareness with belief-based reasoning so far, there are alternative explanations which may be applied to these data.

One possibility is that there is an association between the state of objective self-awareness in the child and her ability to acknowledge false beliefs, but we have yet to find it. It

is possible that while the child's awareness may have been directed internally, the effect was simply not great enough. It may be that the design of the experiment was too weak to bring out any link between self-awareness and false belief acknowledgement. It is conceivably too simplistic to expect self-awareness to be an all or nothing concept. It may be that different levels of awareness will be obtained if different focusing conditions prevail. Simply seeing oneself reflected in a mirror or on a video screen may not heighten a young child's self-awareness sufficiently to provide the additional insight needed to succeed on a false belief task. Perhaps if we could design a task in which the level of the child's self-awareness was heightened yet further, this would enable a child who had previously failed a false belief task, to gain sufficient insight into her own mind to allow her to successfully acknowledge a prior false belief. In the following experiment we attempt to do this. Instead of merely allowing the child to direct her attention internally by viewing an image of herself we aimed to focus the child on her internal state rather than reality.

Experiment 2:2

2:12 Introduction

In the previous experiment we presented children with a contingent image of themselves at the time they were registering their initial belief. Although evidence suggests that this should have helped them focus their attention internally, it had no effect on their performance on the false belief task. It could be concluded from these results that making a child more objectively self-aware does not effect her ability to acknowledge a false belief. However, it is possible that this technique could have facilitated false belief judgements were it structured somewhat differently. It may be that if an effect is to be found, the child must be made objectively aware at the retrieval stage of the process, rather than at the encoding stage. Perhaps if we were to induce the child to focus her attention internally immediately prior to asking her the test question, facilitation would occur.

As we had used a video set-up in the previous experiment, we decided to continue, using a slightly modified procedure. The child had previously registered her belief in a contingent image at the time the belief was formed. We now wanted her, not to see her contingent image, but instead to see a recorded image of herself at the time the belief was formed. Because of this we decided to abandon the mirror trials and instead concentrate solely on those using the video equipment.

We did not want the child to hear herself actually commenting on her belief as this may have led to simple repetition of what she had heard. Instead the video would be paused at the moment immediately before she said what she thought the box contained.

Not only would this procedure allow the child to focus her attention on herself at a point nearer the time of asking the test question, but we would also be showing the child an image of herself in her former belief state (ie. at a time when she still held the false belief as true). This may indeed direct her to focus not merely on her present internal state, but also on her previous internal state. As such, we will be giving the child the opportunity for introspection by presenting her with an image of herself in her previous belief state, at a crucial point just before the test-question. This may allow her to focus her thoughts internally and as such, deflect her from being subjectively aware of current reality allowing her to acknowledge her former false belief.

2:13 Method

Subjects

Subjects were, eighty-five children (forty-two boys and forty-three girls) with ages ranging from 2-7 to 4-10, (mean 3-11). The children were drawn from a state funded nursery school, situated in a predominantly working-class area.

Materials

As in experiment 1, three misleading boxes were used. Each box contained an

unexpected object. A model aeroplane box contained a yo-yo, the children's mug box contained a wooden fish and a toy postbox box contained a toy soldier. At the beginning of trials II and III, each child was videoed with the equipment used in the previous investigation.

Design and Procedure

Before testing began the experimenter spent a full session with each of the two classes becoming acquainted with the children. Prior to testing, the experimenter engaged the children in the video pretraining described in the previous investigation (2:9).

In the previous experiment we asked children to tell the puppet their initial belief. We felt this would act as a parallel to the trials in which they were asked to register their belief in a mirror or video monitor. In the present experiment we decided to instead present children with an unmodified deceptive box task. We felt this would allow us to assess, directly, whether false belief acknowledgement was facilitated in the self-focusing procedure when compared to a standard task.

Each child was tested over three trials, the order of which was fully counterbalanced.

(i) Deceptive Box Trial (DB)

The experimenter brought a box out of her bag and said to the child, "Have a look at this box and tell me what's inside." Once the child had answered according to the box's exterior, the experimenter opened the lid and showed the child the unexpected contents. She expressed surprise at what she had found, saying, "Oh look, its got a yo-yo / fish / soldier in it!" The contents were then replaced and the lid was closed, returning the box to its original state. The experimenter then asked the test question, "When you first saw the box, before we opened it, what did you tell me was inside?"

(ii) Video, No Playback Trial (VNP)

This trial was identical to trial (iii) Video No playback in Experiment 2:1.

(iii) Video Play-back Trial (VP)

The procedure was the same as that in trial (ii), however before the test question was asked the experimenter said, "Do you remember when the camera was watching you? Let's take a look at what it saw." She then rewound the tape to the beginning of the experiment and played it back to the child. The child and experimenter watched the film together. The experimenter paused the film and the image was frozen at a point immediately before the child told the camera her initial belief about what the box contained. Indicating to the image of the child on the screen, the experimenter asked the test question, "When you first saw the box, before we opened it, what did you tell the camera was inside?"

2:14 Results

A summary of the results can be seen in table 2:3. No significant difference in children's performance between any of the trials could be identified. Comparisons between performance on (i) deceptive box trial and (iii) video playback trial proved to be non-significant: McNemar Chi Sq (corrected, df=1, n=34)=2.382, N.S., as did those between the (ii) video no playback and (iii) video playback: McNemar Chi Sq (corrected, df=1, n=41)=1.561, N.S., and those between (i) deceptive box and (ii) video no playback: McNemar Chi Sq (corrected, df=1, n=17)=0, N.S..

Table 2:3

The overall number of correct responses made on each trial

(i) DB	(ii) VNP	(iii) VP
45 (52.9%)	46 (54.1%)	55 (64.7%)

On both trials (i) and (ii), children performed at chance; (i) deceptive box; chi square (corrected, df=1, n=85)=0.188, N.S., (ii) video no playback (corrected, df=1, n=85)=0.423, N.S.. On trial (iii) children's performance was significantly different from chance; (iii) video playback; chi square (corrected, df=1, n=85)=6.776, $p<.01$. On this trial, when confronted with a video of

themself about to articulate their initial belief, children were more likely to answer with what they initially thought the box contained than with its present content.

On finding no overall effect between any of the trials, as we had a large sample of children with a limited age range, our next step was to split the children into two age groups. The younger group consisted of 48 children (22 boys and 26 girls) aged 2-7 to 3-11 (mean 3-6). A summary of the findings from the younger children can be seen in table 2:4.

Table 2:4

The number of correct responses made by the younger children on each trial

(i) DB	(ii) VNP	(iii) VP
26 (54.2%)	23 (47.9%)	33 (68.8%)

When looking at the performance of only the younger children, we found a similar pattern of responding to that of the sample as a whole. Again, we found no significant difference between any of the trials; (i) deceptive box and (ii) video no playback; McNemar Chi Sq (corrected, df=1, n=21)=1.714, N.S.; (i) deceptive box and (iii) video playback; McNemar Chi Sq (corrected, df=1, n=7)=0.571, N.S.. The analysis between (ii) video no playback and (iii) video playback fell slightly short of significance; McNemar Chi Sq (corrected, df=1, n=24)=3.375, N.S..

In line with our overall findings, the young children performed at chance on both the first and second trials. (i) Deceptive box; chi square (corrected, df=1, n=48)=0.187, N.S. and (ii) video no playback; chi square (corrected, df=1, n=48)=0.021, N.S.. Again, as we found with the complete sample, the younger children were performing above chance on the third trial; (iii) video partial playback; chi square (corrected, df=1, n=48)=6.021, $p<.02$.

The older group was made up of 37 children (20 boys and 17 girls) aged 4-0 to 4-10 (mean 4-5). A summary of the findings from this group can be found in table 2:5.

Table 2:5

The number of correct responses made by the older children on each trial

(i) DB	(ii) VNP	(iii) VP
19 (51.4%)	23 (62.2%)	22 (59.5%)

There were again no significant differences between trials; (i) deceptive box and (ii) video no playback; McNemar Chi Sq (corrected, df=1, n=10)=0.9, N.S. and (ii) video playback and (iii) video no playback, McNemar Chi Sq (corrected, df=1, n=17)=0, N.S. (i) deceptive box and (iii) video playback, McNemar Chi Sq (corrected, df=1, n=13)=0.308, N.S.;

In contrast both to the sample as a whole and the group of younger children, subjects in the older group performed at chance on all trials. (i) Deceptive box; chi square (corrected, df=1, n=37)=0, N.S., (ii) video no playback; chi square (corrected, df=1, n=37)=1.73, N.S. and (iii) video partial playback; chi square (corrected, df=1, n=37)=0.973, N.S..

In experiment 1 we found that age was an important factor in children's performance on the deceptive box trial (and on the mirror trial). In this second investigation, we therefore tested a larger sample with a wider age range in order to test the robustness of this finding and to see whether it generalised to overall performance or to performance on any of the other trials. Our initial analysis looked at the effect of age on children's performance overall. We collapsed over the three trials, giving correct responses (referring to their initial comment) a score of 1, and incorrect responses (referring to the box's present content) a score of 0. A t-test was then computed looking at the relationship between age (young/old as described above) and score. We found that as would be predicted from the results above, age had no significant effect on the overall score, t(83)=-.09, N.S..

Although there was no overall effect of age on the children's scores, it is possible that there may be an age effect on an individual trial. We found in the previous experiment that children's performance on the deceptive box task improved with age. We therefore wanted to check the stability of this effect and see whether we could identify a similar effect on the (iii) video partial playback trial. At the same time we thought it would be interesting to check whether the

child's sex had any effect on performance. To do this we computed three hierarchical loglinear analyses (one for each trial), entering age, sex and order as factors into a saturated model. A summary of the results can be seen in table 2:6.

Table 2:6

A summary of the results from the hierarchical loglinear analyses assessing the effects of age, sex and order on children's performance in each trial

Trial	(i) DB	(ii) VNP	(iii) VP
Age	(df=1) 1.53, N.S.	(df=1) 2.158, N.S.	(df=1) 0.719, N.S.
Sex	(df=1) 0.306, N.S.	(df=1) 0.061, N.S.	(df=1) 0.019, N.S.
Order	(df=5) 4.981, N.S.	(df=5) 7.579, N.S.	(df=5) 0.909, N.S.

Even though we had set out to find an age effect and as such the age range of the sample was large (2-7 to 4-10), we found no significant age effects on any of the trials. As in the previous investigation, no effects of sex or order were identified. In addition, no interactions were found.

2:15 Discussion

The main question addressed by this experiment was whether children's ability to access false beliefs would be enhanced by seeing themselves forming the belief on film, prior to being asked what that belief was. We found that although children were marginally better on the video play back trial, than they were on either of the other two trials, their performance on the video playback trial was not significantly better than that on the deceptive box trial. However, when their performance on this trial was compared with chance, unlike performance on the video no playback and deceptive box trials, it proved to be significantly different. It seems therefore that either the act of enhancing the child's self-awareness has very little effect on her subsequent performance on a false belief task, or again we have failed to sufficiently augment her self-awareness.

In Experiment 2:1, children were asked to recall beliefs they now knew to be false which had been registered in a mirror or on a contingent screen. This failed to produce facilitation. We subsequently found in this experiment that when children registered their belief in a camera (without a contingent image), and saw themselves do so later, acknowledgement of false belief was again not significantly better than in the control condition. It might be that on both occasions we failed to augment the child's self awareness sufficiently to provide her with the extra insight needed to pass a false belief task. It may be that by combining the contingent image and the subsequent replay, we would provide the child with a more salient stimulus. This may compel her to ignore present reality and direct her attention internally which could improve her performance on the false belief task.

For the next investigation, we therefore aim to combine both factors. Children will see a contingent image of themself on the screen when encoding the initial belief and will also see a replay of themself forming the belief when trying to retrieve the false belief.

Experiment 2:3

2:16 Introduction

The previous two experiments investigated whether allowing the child to see a contingent image of herself at the beginning of the procedure or showing her a video of herself as she is stating her initial belief had any effect on her subsequent acknowledgement of that belief. We found that while sight of herself in a mirror or video screen at the time of belief formation gave the child no advantage, seeing a video replay may have marginally helped the child. The aim of this experiment was to investigate whether the two procedures may work in tandem to produce an effect. That is, whether allowing the child self-reminding stimuli both at the belief formation stage and at the belief retrieval stage of the procedure would induce the child to focus her attention internally so that she becomes objectively self-aware and as such be in a position to recall her prior false belief. It may be that while this effect could not be achieved merely by a

directive stimulus at one point of the procedure, this would occur if the child was given both cues.

The third experiment was therefore designed to investigate whether either manipulation (contingent image or an audio-visual reminder) or a combination of the two would facilitate the child's ability to acknowledge her prior belief.

2:17 Method

Subjects

46 children were tested (22 girls and 24 boys) whose ages ranged from 3-2 to 4-4 (mean 3-9). The subjects were drawn from the nursery classes of two West Glamorgan primary schools catering for children from a variety of socioeconomic backgrounds.

Materials

Children were videoed using the equipment described in experiment 2:1. Children were again shown the packaging of familiar objects containing atypical items (a toothpaste box containing a wax crayon and a small cornflakes box containing a wooden fish).

Design and Procedure

In the previous experiment we used an unmodified deceptive box task as a comparison to the video trials. However, in the present study, whether or not the child was provided with a contingent image of herself at the time she registered her initial belief was a factor under examination. We wanted children to register their belief in a way that was similar to the video trials, but did not provide them with a contingent image of themself. To this end, we reintroduced the puppet, deceptive box trial.

As in previous studies the experimenter spent a session with each class to ensure she had become familiar to the children. Again, all the children were tested individually in a room separated from the classroom. At the outset of the experiment, each child underwent the training video procedure described in the first experiment and met the Daffy Duck glove puppet. The

experimenter then told them that she had some boxes she wanted to show them.

The experiment was of mixed design. Children were alternately allocated to one of two groups; group 1, no playback; group 2, playback. Each child then participated in two trials described below. The order of the two trials was counterbalanced and mapped onto the presentation of the boxes (toothpaste first and cornflakes second).

Group 1, No playback

(i) Deceptive Box Trial (no screen) (DB)

The experimenter told each child that she had a box to show both her and Daffy Duck. She then showed the child the first box and said, "Take a look at this box and tell Daffy what's inside." Once the child had answered, the experimenter told her that Daffy was tired and was going to go back to sleep in the bag. Once Daffy had been put away, the experimenter said let's have a look in the box. The box was opened and the contents tipped out as the experimenter said, "Oh look, its a crayon / fish." She then replaced the content, closed the box and asked the child the test question, "When I first showed you the box, before we opened it, what did you tell Daffy was inside?"

(ii) Video, No Playback (with screen) (VNPS)

The experimenter turned on the camera and took a box from her bag saying to the child, "Take a look at this box and tell the camera what's inside." Once the child had answered, the experimenter turned off the camera covering up both it and the screen. She explained to the child that the camera could no longer see or hear them. She then opened the box and emptied the contents onto the table saying, "Oh look, its a crayon / a fish." The content was then returned to the box, the box was closed and the experimenter asked, "When I first showed you the box, before we opened it, what did you tell the camera was inside?"

Group 2 - Playback

(iii) Video playback (with screen) (VPS)

The procedure was almost identical to that in trial (ii). However, once the experimenter had returned the content and closed the box she said, "Let's have a look at what the camera saw." She then rewound the video tape and played it back to the child, pausing it at the moment immediately prior to the child stating her belief. She pointed to the image on the screen and said,"When I first showed you the box, before we opened it, what did you tell the camera was inside?"

(iv) Video playback (no screen) (VP)

The procedure was identical to that in trial (iii). However while the camera was recording, the screen was not turned on. The child therefore could not see her own contingent image.

2:18 Results

Table 2:7 shows the number of correct belief-based responses in each condition and for each trial. The data were initially analysed to assess the effect of the child's access to a contingent image of herself in the form of the video screen. Therefore the two trials (screen and no screen) for each group (playback and no playback) were compared. No effect could be found in either group; Group 1 - Deceptive box (no screen) and video no playback (with screen); chi square (corrected, df=1, n=4)=0.25, N.S.; Group 2 - Video playback (no screen) and video playback (with screen); chi square (corrected, df=1, n=4)=0, N.S.. The presence or absence of the screen therefore had little effect on the child's subsequent ability to acknowledge her prior false belief. In fact, while as may be expected, performance in the screen trial (44%) was superior to performance in the no screen trial (35%) for the no play back condition, in the playback condition, performance on the no screen trial (78%) was marginally better than it was on the screen trial (74%).

Table 2:7

The number and percentage of correct responses for each group on each trial

Group 1 : No playback		Group 2 : Playback	
DB (no screen)	VNP (screen)	VP (screen)	VP (no screen)
8 (35%)	10 (44%)	17 (74%)	18 (78%)

As there was no significant difference in the same condition between trials in the presence or absence of the screen, the data was collapsed over the trials within each condition. A t-test was then performed to assess whether allowing the child to see a video of herself forming her initial false belief caused facilitation to occur when she was later asked to acknowledge it. This proved to be significant, $t(44)=-3.05$, $p<.004$. with children being more likely to acknowledge their former false belief when shown video evidence of it than when not.

Children's performance within each condition, on each trial was then compared to chance. For group 1, in the no playback condition, performance on both screen and no screen trials did not differ significantly from chance; (i) deceptive box; chi square (corrected, df=1, n=23)=1.565, N.S.; (ii) video no playback with screen; chi square (corrected, df=1, n=23)=0.174, N.S.; However, children's performance on both trials in the playback group were significantly different from chance;(iii) video playback (no screen); chi square (corrected, df=1, n=23)=4.348, p<.05. (iv) video playback (screen); chi square (corrected, df=1, n=23)=6.261, p<.02. On both trials in this condition, children gave significantly more correct answers than could have been predicted if they were answering according to chance.

Finally the data was examined for age, sex and order effects. Two hierarchical loglinear analyses were carried out, one for each trial (screen; VNPS & VPS / no screen; DB & VP). Age, sex, order and condition (playback / no playback) were entered as factors in a saturated model. No significant interactions were identified. The results are summarised in table 2:8. As would be expected from the earlier analyses, there was a significant condition effect in both the screen and no screen conditions demonstrating children's superior performance in the playback as opposed to the no playback trials. No other significant effects emerged.

Table 2:8

A summary of the results from the hierarchical loglinear analyses assessing the effects of condition, age, sex and order on children's performance in each trial

	Screen	No Screen
Cond	(df=1) 4.461, p<.05	(df=1) 9.425, p<.01
Age	(df=1) 0.098, N.S.	(df=1) 0.394, N.S.
Sex	(df=1) 0.672, N.S.	(df=1) 0.394, N.S.
Order	(df=1) 0.028, N.S.	(df=1) 0.154, N.S.

2:19 Discussion

In experiment 2:1 we found that allowing the child to view her contingent image had little effect on her subsequent belief acknowledgement. This finding was replicated in the present experiment. In both the playback and no playback conditions, whether or not the child could see herself on the screen made no difference to her performance. This result throws up several different possible explanations. Firstly, it may be that our hypothesis is fundamentally incorrect.

Our initial hypothesis was that by heightening the child's level of objective self-awareness, we would enable the child to engage in a process of simulation in advance of her maturational level. It was suggested that this would facilitate her false belief judgements. It is possible that heightening the child's level of objective self-awareness has little or no effect on her ability to simulate her own prior mental state.

A second possibility is that while objective self-awareness may be linked with false belief understanding, we failed to change the child's level of awareness in any significant way. This finding initially seems difficult to fit into the objective self-awareness framework outlined in the introduction to this chapter. The studies cited above (Carver & Schemer, 1978; Davis & Brock, 1975; Gelder & Shaver, 1976) suggested that allowing the individual access to her a self-reminding stimulus did result in a state of objective self-awareness. The authors found that this manifested itself in many different ways (eg. an increase in the use of first-person pronouns,

more self-attributions). However, our study did differ significantly from those reported above, possibly in a way which prevented us from increasing the level of objective self-awareness in our subjects. The obvious difference between our subjects and those participating in the previous experiments is their age. The evidence of the young child's emerging sense of self makes it seem impossible that these children are incapable of attaining some state of objective self-awareness. However, it is possible that simply presenting young children with a mirror may not heighten awareness in the same way as it does in adults.

Evidence for such a hypothesis comes from a study by Beaman et al (1979). These authors tried to induce objective self-awareness in children (whose estimated ages ranged from one year to over thirteen years) and measure its subsequent effect on transgression rates. These Halloween trick-or-treaters were instructed to take only one sweet from a bowl. In the study, self-awareness levels were manipulated in the form of the presence or absence of a mirror. Children were either specifically told to take one sweet each or were told to help themself. With either of these instructions, children took fewer sweets in the mirror condition than in the no mirror condition. This effect was especially marked when children were specifically told how many to take. However, when looking at the effects of age, the authors found that the presence of the mirror was only significant for children who were nine years or older. The presence of the mirror had no significant effect on the younger children's behaviour. Perhaps we should therefore consider our results in the light of Beaman et al.'s findings. It may be that although children are capable of becoming objectively self-awareness, as would be suggested by their ability to self-recognise, it is not promoted through the presence of a self-focusing stimulus. Simply allowing a young child access to her contingent image does not seem to enhance her self-insight and as such has little effect on her state of objective self-awareness.

The results from the analysis looking at the effect of the playback may however complicate this picture. In experiment 2:2 we found that although allowing the child to see a replayed video of herself at the beginning of the trial did not make the child's performance significantly different from that on other trials, it was significantly above chance. This effect

seems to be have been replicated and extended in the present experiment. Here we found that regardless of which trial children underwent (screen or no screen), correct false belief judgements were significantly more likely for children in the playback than no playback condition.

If it is the case that it is impossible to induce objective self-awareness in the pre-school child, it seems difficult to explain why children are performing so well when they are allowed to see a replay of the video of the beginning of the trial. It may be that simply allowing the child to see her own self-image does not alter her state of awareness, but allowing her to witness her prior state through a video recording does. Such a proposal, while not denying that the child's objective self-awareness has been augmented, would explain both our results as well as those of Beaman et al. (1979).

This idea has some similarities with the reality masking hypothesis (Mitchell 1994). This suggests that while young children are capable of acknowledging a false belief, they do so only if their attention can be diverted from the world around them to consider their own internal mental state. One way this can be achieved is if the child is provided with physical evidence of her prior belief. These two possibilities (heightened self-awareness and reality masking) may be instrumental in belief facilitation, acting independently. However, it is also possible that the two theories are not as distinct as may initially be supposed and as such may facilitate belief-based reason by acting in conjunction with one another.

Chapter Three

Between the idea

And the reality

Between the motion

And the act

Falls the shadow.

T. S. Eliot, *The Hollow Man*

3:1 Heightened Self-Awareness

In the previous chapter we found that presenting children with their own contingent image, had no effect on their subsequent ability to acknowledge a prior false belief. However, allowing the children to view a video of themselves looking at the closed box initially, facilitated their later belief-judgements.

At the outset of the series of experiments, our hypothesis was that inducing objective self-awareness in the child may provide her with enough self-insight to engage in a process of simulation which would in turn enable her to acknowledge her false belief. However, we found that simply allowing her access to a contingent image of herself had no such effect. It seemed that heightening the child's objective self-awareness did not enhance her ability to reason about false beliefs. This evidence suggests that a simple relationship is unlikely to exist between the child's level of self-awareness and her ability to recognise mental states. What is however possible is that while the child's ability to conceive of herself is not independently responsible for facilitation of belief-based judgements, it is an important constituent of a larger process which results in greater mental state understanding.

While facilitation was not found on the trials in which the child was simply shown her own contingent image, it was when she was given access to a video of herself forming her initial

belief. It seemed that if the child was provided with this sort of evidence then her ability to acknowledge her prior belief was enhanced. While it is unlikely this could occur simply from a process of enhancing her self-awareness, perhaps objective self-awareness is instrumental in this facilitation. The major thread running through Duval and Wicklund's (1972) theory is that awareness can be directed in two ways, to the self or to the world around. Objective self-awareness is induced or augmented if an individual's attention is directed internally. It may be that heightening the child's self awareness does not cause facilitation because it affords increased insight into the self, but rather functions to direct the child's attention away from current reality towards her internal mental states. If this were the case, increasing the child's level of objective self-awareness would not provide her with more tools (self-knowledge) with which to carry out the simulation process. Instead it would simply alter the child's default settings to allow her the opportunity to engage in counterfactual simulation that under standard conditions would not occur.

3:2 The Reality Masking Hypothesis

Such an idea would not be at odds with the theory of objective self-awareness proposed by Duval and Wicklund (1972). Indeed echoes of their model can be heard in contemporary theory of mind literature. Certain researchers believe that neither the simulation approach nor the cognitive deficit approach can fully explain much of the data collected more recently. These workers propose that young children's fundamental problem in acknowledging alternate mental states is caused by a reality bias. In much the same way as Duval and Wicklund suggested twenty years ago, many workers now believe that children are failing to consider the mental world because their attention is being drawn to current physical reality.

Mitchell (1994) suggests that although young children have some metarepresentational competence, this is usually masked by an inability to deviate from perceived reality. When a child is asked to comment on a belief, she is faced with two different possibilities. One is to correctly comment on the content of her own or another's representational mind. The other

option is to simply comment on presumed reality. As beliefs and reality are in the most part identical, a child will usually successfully acknowledge a belief by simply commenting on reality. This in no way suggests that children are unable to contemplate beliefs as beliefs, but rather that for the young child, treating a belief as though it were reality is an efficient strategy. Of course, this strategy will not pay off if the child is asked to acknowledge a false belief. A young child who answers according to present reality when asked about a false belief, will give an incorrect response in a way that may be taken by others as a demonstration that she has no conception of the representational nature of beliefs.

Mitchell (1994) proposes that young children are biased to answer in this way when asked about false beliefs, not just because it can be a more efficient strategy for dealing with beliefs (when they happen to be true) but because they are innately programmed to do so. His analysis of the development of theory of mind understanding in young children centres around the phylogenetic and ontogenetic progression of our species. For the first few years of life, in order to survive, young children must explore and come to terms with the physical world around them. To do this they must focus on the external world of their environment making the understanding of physical reality a more dominant force than the understanding of mental states. During this time, children are constantly protected by their primary caregiver. Children rarely leave this safety to venture alone into the world of social others. According to Mitchell, individuals outside the genetic family have no special investment in the child's safety. As such, when during the fourth or fifth year of life she is expected to enter this realm, made up largely of strangers, she must understand that others with beliefs or desires which differ from her own may oppose or try to thwart her. Perner et al (1994) provide evidence that could be seen as support for this view. They show that young children brought up as singletons, develop an understanding of the representational nature of beliefs later than those brought up with siblings. The children growing up with brothers and sisters have to deal with conflict in the home over issues such as parental attention, perceived favouritism etc. long before only children come across similar disputes. Although the home is still a place of safety, young children with siblings are forced to quickly

learn how to manipulate others to get what they want.

Evidence that children are biased towards reality as opposed to suffering from a cognitive deficit comes from the hundreds of experiments conducted into young children's understanding of differing belief states. The young children who fail these tasks tend not to answer at chance as would be the case if they simply had no understanding of belief. Instead they consistently comment on present reality demonstrating their bias towards it. Russell et al. (1991) suggest this occurs because present physical knowledge is cognitively more salient to the child than is a conflicting mental representation.

Russell et al. (1991) provide evidence of this in the form of the windows task. In the experiment, young children have to compete against a second experimenter to gain a reward (a chocolate). On the table in front of the child are two boxes, each with a small window so that the child can see what the box contains. The principle of the game is to show the competitor where to look for the reward. Therefore, if the child is to win the reward herself, she must point to the empty box. The competitor will open the box to which she points and the child will be free to open the other box (containing the prize). Therefore to win the prize the child must refrain from pointing directly to it. Children learn this procedure by undergoing fifteen practice trials in which the second experimenter points in turn to one or other of the boxes and either wins the prize himself or allows the child to win the prize. Russell et al. found that the four-year-olds and the control group of children with Down's syndrome had no trouble understanding the game and consistently pointed to the empty box in order to win the prize. The three-year-olds and children with autism however perseverated in pointing to the box containing the reward. Indeed, 64.7% of the three-year-olds and 63.6% of the children with autism pointed to the baited box on every single trial. Russell and colleagues draw attention not, to the fact that these groups of children do not succeed on the task, but to the fact that they persistently fail to do so. Even if such children were incapable of understanding alternate mental states, surely they could learn through trial and error the simple rule that to win the reward you must point to the empty box. However, even after twenty trials the children do not seem to have learnt this rule.

Russell et al. (1991), have therefore concluded that the results demonstrate that in the face of reality (especially a reality as tempting as a chocolate button) young children (and in this case children with autism) are unable to deflect their attention from the object in question and consider an alternate model. The children are unable to prevent themselves from being drawn to reality and as such can be seen to suffer from a reality bias. The authors argue that, "in young children ..... physical knowledge is more salient than mental knowledge so that in some circumstances where the two are in competition the former wins out" (p.343).

It is possible that such a situation exists in a false belief task. Young children's knowledge of present reality will always induce them to refer to it when answering the test question. If this is indeed the case then by making the alternate scenario (the mental representation) cognitively more salient to the child, this may draw the child's attention away from reality. By doing this on a false belief task, we may find that young children, who do have an understanding of mental representation (albeit a fledgling one), but suffer from a bias towards reality, might successfully acknowledge their own or another's false belief.

This hypothesis has been successfully tested using a number of different procedures. Mitchell and Lacohee (1991) enhanced the physical salience of the child's former belief in a modified deceptive box task. After showing children a smarties tube and asking them what they thought it contained, the experimenters instructed the children to select a picture of their initial belief (smarties) and post it out of sight into a box. The authors suggest that associating the initial belief with a picture of itself, gives the belief a reality status. When the children were then asked the test question, those in the posting condition were more likely to acknowledge their former false belief than were those in the control condition. The authors propose that the picture posted in the box, acted as an enduring physical embodiment of the belief itself. If young children do indeed suffer from a reality bias, then associating the belief with an enduring reality would allow the child to consider the belief without being swayed by current reality.

Robinson and Goold (1992) unmasked false belief understanding in the three-year-olds they tested in a similar way. When asking children the test question at the end of the deceptive

box procedure, they alerted them to the picture on the outside of the box. As such, they were adding physical salience to the false belief. Under these conditions, children were better able to report their superseded belief than were those in a control group undergoing a standard task.

Experiments investigating the effect in reverse, have demonstrated another important role of physical reality in false belief reasoning. Such studies have not augmented the cognitive salience of the belief, but rather reduced the salience of current reality. Robinson et al (1995), using another modified deceptive box procedure, did not show the children the atypical contents of the box, but instead told them what it contained. As such, physical reality was not allowed to intrude into the child's belief-reasoning and again children were better able to acknowledge their initial false belief. A comparable study was carried out by Zaitchik (1991) who presented children with a modified version of the unexpected transfer task. She found that when young subjects were told but not shown the real location of the target object, their ability to acknowledge another's false belief was facilitated. The salience of reality was therefore reduced by denying the children visual access to the object's present location.

A similar phenomenon was demonstrated by Wellman and Bartsch (1988). Children were told that Sam's puppy might be under the porch or in the garage, and they then had to guess where he was. Once the children had guessed, the experimenter said that Sam thought his puppy was in the opposite place. (If the child had guessed garage, Sam would think it was under the porch and vice-versa.) Even though Sam's belief differed from the child's own belief, children rarely confused the two by attributing their own belief to Sam. Instead the young children generally correctly acknowledged Sam's alternate belief state. However, when Sam's belief contrasted with reality, rather than with the child's guess, young children judged incorrectly. Young children do have the ability to hold two contrasting beliefs in their mind at one time, but are unable to do this when present reality impinges on the situation. Therefore, according to the reality masking hypothesis, for early belief-based judgements to occur, it is important that either the belief is made cognitively more salient through a physical association, or alternatively that some physical element is removed from current reality to make it less salient.

Emma Steverson (1995), working with Peter Mitchell has demonstrated the importance of reality, not just to young children who fail false belief tasks, but also to older children who pass. She has shown how unstable the ability to pass a false belief test is. In initial experiments, Steverson took young children through the deceptive box procedure until she reached the test question. At this point she enhanced the salience of the children's belief by suggesting it back to them saying, "you thought there were smarties in the box didn't you". She found that many young children who failed a standard deceptive box task, could be induced to succeed on this modified task. Children in control conditions who have had something irrelevant suggested to them, e.g. "you thought there were jelly babies in there didn't you," did not accept this suggestion and continued to answer according to reality ("No, I thought there were pencils in there!")

Steverson has gone one step further. She has demonstrated that it is unlikely that passing a standard false belief test is indicative of a radical cognitive shift taking the child from a position of ignorance about the mind to a position of complete understanding. She identified a group of children who could pass a standard test of false belief (three, four and five year-olds) and presented them with another modified deceptive box procedure. This time upon reaching the test question, she placed emphasis on current reality by suggesting " You thought there were pencils in there didn't you." This time she found that many of these children who passed the standard task were accepting her reality suggestion (but again not accepting an irrelevant suggestion).

These results, suggest that an understanding that beliefs may conflict with reality is not an all or nothing revolution that occurs over night. It seems that young children must proceed through a gradual period of change. Perhaps not only is their understanding of mind increasing, but importantly their bias to look immediately toward reality may be decreasing. If this is true, it seems somewhat premature to credit children who succeed on one simple test (demonstrating some understanding of false belief) with a complete understanding of mind. On the other side of the coin, it may be overly stringent to suggest that a child who fails a similar test has absolutely no understanding of mind.

Indeed one body of research suggests that although the child's bias to reality is diminishing, we can see that at times, even adults ignore alternative options when reality affords an obvious and straightforward prediction. Mitchell, Robinson, Nye and Issacs (In Press) presented young children, older children and adults with stories in which the protagonist heard a message purporting to give factual information. In certain respects all the subjects performed in a similar way. When subjects knew that the protagonist did not hold a belief, subjects in all age groups were likely to judge that a protagonist would believe the message he had heard (regardless of whether the message was true or false). However, certain group differences did emerge. Unlike the children, the adults allowed their own knowledge of the situation to interfere with their judgements about another. These older subjects tended to judge that the listener would disregard a false message if his prior belief was true, but would believe a true message if his prior belief was false.

As such, the authors conclude that adults can be biased to base their judgements of another's actions according to their own perception of reality. What the adults know about the truth status of a message, contaminates their judgements of whether or not the individual will believe the message. The authors go on to argue that such evidence not only adds weight to the reality masking hypothesis, but may at the same time seriously undermine radical shift theories. Such a view would hold that on a false belief task, children default to a reality response in the absence of a representational theory of mind. However, Mitchell et al. point out that while we as adults are credited with having a theory of mind, "we might never rid ourselves of the realism apparent in early development". As such, it is no contradiction to suggest that young children could possess both a bias towards reality as well as have some level of understanding of mind.

Saltmarsh et al. (In Press) present the possibility of a weak and a strong version of the reality masking hypothesis. The strong version suggests that from a very early age children have a full understanding of the representational mind and this ability is masked by their reality bias. This account therefore has much in common with Leslie's informational processing model (Leslie

and Thaiss, 1992). However, a weaker version of the reality masking hypothesis does not go so far as to suggest that the only difference between those children who succeed on the theory of mind tasks and those who do not, is the diminishing bias towards reality. Instead, this account proposes a smooth cognitive development in which a growing awareness of mind is paralleled by a diminuation in the child's reliance upon reality.

3:3 Self Awareness and the Reality Masking Hypothesis

In some ways our results so far can be seen in the light of the reality masking hypothesis. In presenting the child with the video of herself, we may have enabled her to direct her attention away from the more salient reality (the smarties box containing pencils) by making her original belief (that the smarties box contains smarties) more salient. However, the crucial elements of the reality masking hypothesis are that for early false belief reasoning to take place, either the child's belief should be associated with something physical or alternatively the physical nature of current reality should be diminished. In our experiments however, the child is presented with evidence that could not be considered as physical. Here the child sees herself on the video but does not hear herself comment on the belief nor witness any tangible token (e.g. a picture or sample of smarties). As such we have found facilitation in acknowledgement of the belief even in the absence of a physical associate.

It seems unlikely therefore that, as it stands, the reality masking hypothesis can fully explain the data we have discussed so far. What seems more likely is that a combination of self-awareness, reality masking and simulation can be seen as factors in the facilitation of the child's belief judgements. Perhaps as Mitchell proposes, the young child is heavily biased to attend to current, physical reality. However, when we present the child with non-physical evidence of her belief, although we are not enhancing the salience of the belief by associating it with something physical, we are making the child self-aware in so far as we are directing her attention internally. As has been suggested, the reality bias gradually wanes throughout this developmental period. It may be that the child's reliance upon reality diminishes as her ability to enter a state of

objective self-awareness increases. Perhaps for those children in whom the reality bias is already somewhat diminished, it is sufficient simply to direct their attention away from reality. This would provide them with an opportunity to focus their attention internally either on prior or potential belief states. In simulational terms this could be considered as helping the child to alter her default settings.

However, for those children whose reliance upon reality is still very strong, non-physical evidence of this type would have little effect on their ability to accurately assess false beliefs. Duval and Wicklund (1972) suggest that in very young children, attempts to highlight evidence demonstrating the possibility of contradictory beliefs would not induce a state of objective self-awareness. According to their theory, for these children who are still predominantly, subjectively self-aware, it is unlikely that simply diverting attention away from current reality will enable them to engage in mental state reasoning. However, unlike Duval and Wicklund, we hypothesis that such children, who have some understanding of mind, may be helped to acknowledge a false belief if the salience of that belief is increased. According to the reality masking hypothesis, this would occur if the belief was associated with something physical. If this were to happen, the child would be provided with physical evidence which she could draw upon when inferring the false belief. It is likely that this inference would occur through a process of simulation.

In the following experiments (3:1, 3:2 & 3:3) our aim was to investigate this hypothesis. The reality masking model proposes that in associating the child's belief with an enduring physical reminder of it, one draws the child's attention towards that belief. If this supposition is correct, we should find increased facilitation when we present children with a task of this sort. We hypothesise that playing back the video to the child, this time allowing her to hear her earlier belief comment, will act in this way. Now, the video will not simply function as a reminder of an earlier state, but will provide the child with tangible, physical evidence of her earlier belief. Not only will children's attention be focused internally as a function of seeing her earlier self on the screen, but it will also be drawn specifically to the content of her earlier belief. The physicallity of the video will channel the child's attention directly to the initial belief, providing her with the

evidence she needs to successfully acknowledge her false belief.

Experiment 3:1

3:4 Introduction

In this experiment we wanted to give the child direct access to her initial belief by replaying the video and pausing it immediately after she had heard herself commenting on that belief. It was hypothesised that this would allow many of the children who were still heavily biased towards reality to demonstrate their understanding of mental states. It was proposed that this would occur because in allowing the child to hear herself on the video, the belief would be endowed with added physical salience. It is possible that such a procedure would therefore facilitate correct false belief judgements in many of the children who had made reality errors when only a small part of the video was replayed.

3:5 Method

Subjects

We tested 41 children (25 boys and 16 girls) whose ages ranged from 3-3 to 4-8 (mean 3-9). All the subjects attended the nursery class of a West Glamorgan Infant School in a low socioeconomic catchment area.

Materials

As in the previous experiments, children were shown familiar boxes. These were, a toy train box containing a wooden fish, a model aeroplane box containing a yo-yo and a toy teapot box that contained a small teddy-bear. The children were filmed using the video equipment described in experiment one. In both video trials, the video monitor was turned on so that the child could see her own contingent image.

Design and Procedure

Before testing began, the experimenter again spent a session with each class. All children were tested individually, in a room separated from the classroom. As in the previous investigations, each child was given the video training session described in experiment one, before undertaking the experimental trials. The experiment was a within subjects design and each child participated in all three trials. The order of presentation of the trials was fully counterbalanced.

In order to have a standard comparison for our video task, we decided not to use the Daffy Duck puppet anymore. As such, in the following three video experiments each of the deceptive box trials followed a standard, unmodified procedure.

(i) Deceptive Box Trial (DB)

This was identical to the deceptive box trial described in experiment 2:2. At the end of the trial, the experimenter asked each child, "When I first showed you the box, before we opened it, what did you tell me was inside?"

(ii) Video Partial Playback Trial (VPP)

Children participated in a trial identical to the partial play back procedure in the experiment 2:2. At the end of the trial, children were asked "When I first showed you the box, before we opened it, what did you tell the camera was inside?"

(iii) Video Complete Playback Trial (VCP)

The VCP trial was crucially different to the VPP trial in that the experimenter did not pause the video before the child uttered her original belief about the box's content. Instead, the video was played right through. The experimenter paused it at a point after the child had stated her belief. The child was therefore provided with firm evidence of what her previous belief had been. Children were then asked the test question, "When I first showed you the box, before we

opened it, what did you tell the camera was inside?"

3:6 Results

Although the children participating in the present study were of similar ages to those tested in the previous experiments, overall performance in this study was a great deal worse. On trial (i) deceptive box, children were performing well below chance, chi square (corrected, df=1, n=41)=14.049, p<.001. On the other two trials children were responding at chance; (ii) video partial playback, chi square (corrected, df=1, n=41)=0.878, N.S.; (iii) video complete playback, chi square (corrected, df=1, n=41)=0, N.S.. A summary of the number of correct responses given on each trial can be found in table 3:1.

Table 3:1

The number of correct responses made on each trial.

(i) DB	(ii) VPP	(iii) VCP
8 (20%)	17 (41%)	20 (49%)

Even though the overall level of performance was low, this did not obscure the difference between trials. Success was more common in (ii) the partial playback condition than it was in (i) the deceptive box condition although this difference did not quite reach significance; McNemar Chi Square (corrected, df=1, n=21)=3.048, N.S.. However, children were significantly more likely to succeed on (iii) the video complete playback trial when confronted with evidence of their former belief than on (i) the standard deceptive box trial; McNemar Chi Square (corrected, df=1, n=16)=7.563, p<.01. Although more children gave correct answers on (iii) the video complete playback trial than they did on (ii) the video partial playback trial, this difference was not significant; McNemar Chi Square (corrected, df=1, n=17)=0.235, N.S..

The age effect we found on the first experiment (experiment 2:1) was not significant in the two subsequent studies. To see what influence the children's age had on their responses in this experiment, we initially collapsed over the three trials. Again, responses that referred to

the child's statement about what the box contained were scored as correct while responses commenting on the box's present content was scored as incorrect. These were then summed and each child was therefore given a final score of 0, 1, 2 or 3. The results showed that age did indeed have a significant effect on children's ability to respond, $t(39)=3.18$, $p<.003$.

The next step was therefore to discover whether the effect of age was universal to all trials or rather, resided in one specific trial. To do this we undertook a loglinear analysis entering age, sex and order as factors in a saturated design. A summary of the results can be seen in table 3:2.

Table 3:2

A summary of the results from the hierarchical loglinear analyses assessing the effect of age, sex and order on children's performance in each trial.

Trial	(i) DB	(ii) VPP	(iii) VCP
Age	(df=1) 4.770, p<.029	(df=1) 2.358, N.S.	(df=1) 8.221, p<.004
Sex	(df=1) 1.822, N.S.	(df=1) 0.383, N.S.	(df=1) 0.272, N.S.
Order	(df=5) 6.652, N.S.	(df=5) 1.333, N.S.	(df=5) 6.147, N.S.

We found that while age was not a significant factor in the partial playback trial, it was for both the deceptive box and complete playback trials. Strangely enough, the direction of the age effect proved to be counterintuitive. Replaying the complete video to the children seemed to help the younger children (aged 3-3 to 3-11, mean 3-6) more than it did the older ones (aged 4-0 to 4-8, mean 4-3). As in our previous experiments, we found that neither the child's sex nor the order of presentation, had any effect on performance.

3:7 Discussion

Providing the children with limited evidence of their initial belief formation (VPP) did lead to some facilitation in later false belief acknowledgement. However while a substantial minority of the children succeeded under these conditions, (as in experiment 2:2) no significant facilitation

was observable when the results were compared with those from the standard trial (DB). Playing the entire video back to the child (VCP) and allowing her to hear herself commenting on her false belief proved to have more facilitating effect. When the children saw and heard themselves asserting their initial belief, they were significantly more likely to acknowledge their own prior false belief than on the standard deceptive box trial.

This is the pattern of results that would be predicted by the hypothesis stated in the introduction. It was proposed that while partial playback of the video would enable some of the children to acknowledge their prior belief, complete playback would have a facilitative effect for a larger number of children

Although the results certainly speak against a radical shift view of development, we would also suggest that they provide positive evidence for a revised version of the reality masking account. While providing children with physical evidence of their prior belief allows a substantial number to correctly acknowledge their earlier false belief, some of the children were again helped in the task simply by being shown a small portion of the video. As this could in no way be seen as a physical token of the belief, the children must have been aided in their task in some other way. Possibly the shorter video acted by directing their attention away from current reality allowing them to contemplate their own mental states. For those children whose reality bias is weakening, this would provide them with the ideal environment in which to infer or simulate the false belief. This would of course not be sufficient to help those children whose bias towards reality is more substantial. It is possible that the difference between those children who succeed under both video conditions and those who succeed only under the complete playback condition is one of cognitive capacity. Perhaps a greater capacity was required to reason from the point in the video reached in the video partial playback trial to the memory for that belief than from that at which it was paused in the video complete playback trial. Therefore fewer children would benefit from the partial playback condition than would from the complete playback condition. However this explanation seems unlikely as the analysis of the age data showed that the older children (4-0 to 4-8) had more difficulty doing this than the younger ones (3-3 to 3-11).

Was it merely a case of increased cognitive load, it would be unlikely that the younger group would do better than the older one.

The one ideosyncracy to emerge from the data therefore was that the younger children's performance was superior to the elder children. The children were separated into different classes by age and perhaps this had some effect on their overall development. An alternative possibility is that the younger children may have been responding correctly more often because they were not thinking about the belief, but rather were simply repeating what they had heard on the video. This seems unlikely as the same age effect was observed for the deceptive box trail. However it does merit further investigation.

The overall level of responding on this experiment was low. In both the deceptive box and partial playback trial success levels were lower than in any of the previous experiments. The study was undertaken in a nursery school situated in a deprived area of Swansea and it is likely that this is responsible for the poor performance.

Experiment 3:2

3:8 Introduction

In the previous experiment, when children were provided with physical evidence of a false belief in the form of a video, subsequent belief-based judgements were facilitated. However, it is possible that these children were not in fact answering the question posed. Rather they may simply have been repeating the words they had heard themselves say in the film. Any correct responses they made would therefore not be demonstrative of their ability to reason about beliefs, but rather their ability to echo their own prior comment. If children did not attend to the question, then they would probably repeat what they had said on the video tape no matter what test question they were asked.

In this experiment, children were split into two groups. As in the previous study, all the children registered their initial belief on film and then watched as it was replayed. The video was

paused at the point following their comment regarding what they thought the box contained. The first group of children was then asked what they had told the camera was inside the box, while the second group was simply asked what was inside the box. If in the previous study children were mindlessly parroting back what they heard on the video, in this experiment they would respond with their initial belief no matter what question they had been asked. If however the children were using the video as a cue to aid their belief-based reasoning, we would expect the responses to differ depending upon which condition the children were in.

3:9 Method

Subjects

60 children were initially tested, however 2 children (1 girl and 1 boy) were excluded from the analysis as they failed to respond to any of the questions. The remaining sample (30 girls and 28 boys) were aged 3-2 to 4-9 (mean 3-9). The subjects were drawn from the nursery classes of three West Glamorgan infant schools all of which were located in mid to low socio-economic catchment areas.

Materials

The two boxes used in this experiment were a toy train box containing a wooden fish and a cornflakes box containing a wax crayon. The video set up was the same as in the previous experiments.

Design and Procedure

The day before testing began, the experimenter spent a session with each class. Each child was then tested individually away from the classroom. Before undertaking the experimental trials, each child was given the videotraining session described in experiment 2:1. The children were then alternately split into 2 groups; Group 1; Tell, Group 2; Was. Apart from the wording

of the test question, the procedure for both groups was identical. All children undertook two trials, (i) Deceptive box (ii) Video complete playback. The order of presentation of the trials was counterbalanced.

(i) Deceptive Box (DB)

This was identical to the deceptive box trial described in the previous experiments. When the trial was completed the experimenter asked those in the tell condition, "When I first showed you the box, before we opened it, what did you tell me was inside?" She asked those in the was condition, "When I first showed you the box, before we opened it, what was inside?"

(ii) Video Complete Playback (VCP)

This trial was identical to that described in experiment 3:1. When the trial was completed the experimenter asked those in the tell condition, "When I first showed you the box, before we opened it, what did you tell the camera was inside?" and asked those in the was condition, "When I first showed you the box, before we opened it, what was inside?"

3:10 Results

As can be seen from a glance at tables 3:3 and 3:4, children answered very differently depending on the condition to which they had been assigned.

Table 3:3

The number of children answering according to their initial belief in both groups on each trial

	DB	VCP
(i) Tell (n=30)	11 (37%)	22 (73%)
(ii) Was (n=28)	0 (0%)	1 (4%)

While twenty-two of the thirty children in the 'tell' condition correctly responded by commenting on their initial belief, only one child in the 'was' condition answered in this way (in the was condition, this would of course have been an incorrect response).

Table 3:4

The number of children answering according to the box's present content in both groups on each trial.

	DB	VCP
(i) Tell (n=30)	19 (63%)	8 (27%)
(ii) Was (n=28)	28 (100%)	27 (96%)

In both trials, the children who had been asked the tell question were significantly more likely to answer with reference to their earlier belief than were those who had been asked the neutral question; (i) deceptive box; chi square (corrected, df=1, n=58)=10.395, p<.01 and (ii) video complete playback; chi square (corrected, df=1, n=58)=26.611, p<.001. The children's responses were dependent upon the question they had been asked.

These data replicate the favourable effect of the video condition found in the previous experiment. In the 'tell' condition, children were more likely to correctly acknowledge their initial false belief in (ii) the video complete playback trial than they were in (i) the standard deceptive box trial ; McNemar Chi Square (corrected, df=1, n=13)=7.692, p<.01. However there was no significant difference between the two trials when children were asked the neutral 'was' question; McNemar Chi Square (corrected, df=1, n=1)=0, N.S.

Analysis of performance against chance told a similar story. In the 'tell' condition, children's performance was not significantly different from chance on (i) the deceptive box trial; chi square (corrected, df=1, n=30)=1.633, N.S.. On (ii) the video complete playback trial children's performance was significantly different from chance; chi square (corrected, df=1, n=30)=5.633, p<.02. Those children asked a 'was' question were significantly more likely to respond with the present content than with their previous belief on both trials; (i) deceptive box;

chi square (corrected, df=1, n=28)=26.036, p<.001 and (ii) video complete playback; chi square (corrected, df=1, n=28)=22.321, p<.001.

Table 3:5

A summary of the results from the hierarchical loglinear analyses assessing the effects of age, sex and order on children's performance in each trial.

	Deceptive box	Video Complete Playback
Condition	(df=1) 15.408, p<.001	(df=1) 33.872, p<.001.
Age	(df=1) 0.871, N.S.	(df=1) 0.44, N.S.
Sex	(df=1) 0.713, N.S.	(df=1) 0.617, N.S.
Order	(df=1) 0.732, N.S.	(df=1) 0, N.S.

We initially analysed the overall effect of age and found that within our sample it was not a significant factor; t(56)=.652 N.S. . We then computed two loglinear analyses to assess the effect of age, sex and order on each trial. We therefore entered condition, age, sex and order as factors in a saturated model. A summary of the results can be seen in table 3:5. As would be expected from the earlier analyses, the condition to which children had been assigned (tell / was) had a significant effect on their subsequent performance. In both conditions, children were more likely to refer to their earlier belief when asked a "tell" question than when asked a "was" question. No other effects were identified. No significant interactions were found

3:11 Discussion

The motivation behind the fifth experiment was to assess whether the effect found in experiment 3:1 was artifactual. Children may have been arriving at the correct answer by using a simple heuristic rather than using belief-based reasoning. If this were the case, the results would not provide evidence that young children who fail standard tests have any understanding of false beliefs. However the results from experiment 3:2 show that this is unlikely to have been what happened. The majority of children who were asked the neutral question "What was

inside?" interpreted it correctly and thus answered without reference to what they had said on the film. Only one child incorrectly repeated his previous belief from the film. Children were therefore not mindlessly repeating what they had previously stated but were processing the two questions differently. When the children were asked the *tell* question we can conclude that they generated a thoughtful response.

In addition we found that when asked a belief question, children treat it in a way that is different to the way they treat a question about present reality. It has previously been suggested (Wimmer & Hartl, 1991) that young pre-school children have no conception of belief. Thus children give realist responses to questions concerning beliefs because they would simply gloss the belief question to be one about reality. Obviously if this were the case, children would answer identically whether asked a belief or a reality question. This was not the case in this experiment. In the video condition, children tended to answer according to the belief when asked about it and according to reality when asked about that.

The results strongly suggest that given the right test situation young children can and do correctly acknowledge their own initial false belief. If children are provided with physical evidence of that original belief, it is much harder for them to deny it and take the option of present reality. Instead they use the evidence to help them correctly acknowledge their initial false belief.

However, before we can conclude this with any certainty, we have one final control to carry out. Throughout this series of experiments we have been asking the children the test question "What did you tell the camera was inside?" We used the tell wording as we wanted to explicitly link the video replay with the test question. Obviously we must check whether children's false belief acknowledgement is also facilitated if they are asked a question about belief. It may be that the video procedure only enables children to comment on what they had previously said rather than what they had previously thought. The final experiment in the series was designed to investigate this possibility.

Experiment 3:3

3:12 Introduction

It has often been presumed that children say what they believe. As such asking a child what she previously said in a false belief situation would be comparable to asking her what she had previously thought (Wimmer & Hartl, 1991). Wimmer and Hartl (1991) found that the young children they tested were equally bad at reporting their own previous belief as they were at reporting what they had previously said (when this was to comment on a belief they now had been shown was false). It was suggested that this was true of both their own beliefs and statements as well as those of other people. It has been proposed (Perner, 1991) that children act in this way because their problem on false belief tasks is specific to the metarepresentational component which exists both in what people believe and what they say. As such, children who have no conception that beliefs may be distinct from reality are unable to understand that a message too may represent something in a way that is different from the way the child presently represents it.

This position however is not supported by Leslie and Thaiss (1992) and Roth and Leslie (1991). They suggest that children have little or no problem in understanding such messages. In fact, the authors propose that these messages help the child to understand an individual's mental state. According to their model, the child infers the agent's mental state directly from his or her message and as such from an early age children understand that what other people believe is implicit in what they say.

However results recently reported, (Riggs and Robinson, 1994) show that although children find it as difficult to recall what they themself had previously said as what they had previously thought, they are better at reporting what another person with a false belief said than they are at judging what he or she thought. As such, perhaps the association in the child's mind between what is said and what is thought is not as clearcut as had previously been believed.

The aim of the present series of experiments was to assess the young child's ability to report her own prior false belief when confronted with physical evidence of that belief. From the

point of view of this study, at the time of asking the test question the child's thoughts needed to be drawn directly to the video we were showing her. As such it was crucial to ask a 'tell' question rather than a 'think' question. Taking the evidence cited above as given, it seemed reasonable to assume that in reporting what she had previously said, the child was also reporting what she had previously thought. However, it is still possible that the children's improved performance was not due to a facilitation in their judgements about their false belief, but rather due to their increased ability to report what they had previously said. Perhaps, although young children generally equate what they had previously said with what they had previously thought, this is not a hard and fast rule. Maybe when the child explicitly hears what she previously said (as happens in the video) she finds it easy to repeat. If this were the case, the results we have so far reported simply show that if you present children with evidence of what they previously said, they are subsequently better able to report their comment than if they have been given no such cue. If this were true, our data would have little bearing on children's ability to acknowledge false beliefs.

We therefore wanted to investigate whether children's judgements about what they had previously thought (think judgements) would be facilitated in the same way as their judgements about what they had previously said (tell judgements). It maybe that if we were to present the child with exactly the same procedure, but at the end ask her what she previously thought the box contained, realist errors would prevail. If it were the case that children were significantly better at "tell" judgements than they were at "think" judgements, we could not assume that our results demonstrated early false belief reasoning.

3:13 Method

Subjects

72 children (40 boys and 32 girls) were tested. The data for one child (a girl) was withdrawn from the analysis as she failed to answer either test question. The remaining children were aged between 3-1 and 4-6 (mean 4-0). It was difficult to recruit younger children as the testing was carried out late in the school year. However, as can be seen from the results,

including children who were older four-year-olds in no way detracted from our findings. The subjects were drawn from two West Glamorgan primary schools located in areas that are predominantly middle class.

Materials

The video equipment used was again that described in experiment 2:1. We used two boxes in this study. They were, a duplo helicopter box (containing a small plastic dinosaur) and a toothpaste box (containing a wax crayon).

Design and Procedure

Before testing began, the experimenter spent a session with each class to allow the children to feel at ease with her. Children were again tested individually in a room away from the classroom. Each child underwent the video training session described in experiment 2:1 before testing was started. The experiment was a factorial design with children being alternately split into two groups and then tested over two trials. The only difference in procedure between the two groups was the wording of the question.

Group 1 -Tell On both trials, children in group 1 were asked the test question, "When I first showed you the box, before we opened it, what did you tell me / the camera was inside?" The group consisted of 37 children (20 boys and 17 girls) who were aged from 3-3 to 4-6 (mean 4-0).

Group 2 - Think Children in group 2 were asked the test question,"When I first showed you the box, before we opened it, what did you think was inside?" at the end of each trial. The group was made up of 34 children (20 boys and 14 girls) who were aged from 3-1 to 4-6 (mean 4-0).

Each child underwent two trials, the order of presentation of which was counterbalanced. The helicopter box was always presented in the first trial and the toothpaste box in the second.

(i) Deceptive Box Trial (DB)

This was identical to the deceptive box procedure outlined in the previous experiment. At the end of the experiment children were asked the test question applicable to their group.

(ii) Video Complete Playback (VCP)

This was again identical to the procedure in the previous experiment and children were again asked the test question applicable to their group.

3:14 Results

As can be seen from table 3:6, children's performance on the video trials was far superior to that in the deceptive box trials under both conditions. Group 1(tell), deceptive box versus video; chi square (corrected, df=1, n=17)=11.529, p<.001; Group 2 (think), deceptive box versus video; chi square (corrected, df=1, n=20)=8.45, p<.01. We had therefore demonstrated that presenting young children with physical evidence of their prior false belief in the form of video evidence not only helped them to acknowledge their own prior statement but also their belief.

We then went on to assess whether there was any significant difference in the way children from the two groups responded on each trial. Firstly we collapsed the two trials giving one point for each correct answer. Children could therefore obtain a score of 0,1 or 2. We then carried out an independent t-test between the two groups. This showed that overall, there was no significant difference between the performance of the two groups; t(69)=1.08, N.S..

Table 3:6

The number of correct responses made in both groups, on each trial

	(i) DB	(ii) VCP
(1) Tell	7 (21%)	21 (62%)
(2) Think	11 (30%)	26 (70%)

While this result demonstrates that children's belief judgements were facilitated even when asked a 'think' question, we wanted to check whether there was any effect on either of the specific trials. To do this we calculated two chi square analyses. The first was between children's responses in groups 1 (tell) and 2 (think) on the deceptive box trial; Chi square (df=1, n=71)=0.3739, N.S. The second was between children in group 1 (tell) and group 2 (think) on the video trial; Chi square (df=1, n=71)=0.2558, N.S. Therefore although the above table shows us that children's performance was slightly better in the tell condition than in the think condition, this was no where near significance.

Finally, two hierarchical loglinear analyses were computed to check for any age, sex or order effects for each trial. A summary of the findings can be seen in table 3:8. No interactions were identified.

Table 3:7

A summary of the results from the hierarchical loglinear analyses assessing the effects of condition, age, sex and order on children's performance in each trial.

	Deceptive Box	Video Complete Playback
Condition	(df=1) 0.679, N.S.	(df=1) 0.062, N.S.
Age	(df=1) 7.792, p<.01	(df=1) 0.062, N.S.
Sex	(df=1) 0.005, N.S.	(df=1) 0.062, N.S.
Order	(df=1) 0.142, N.S.	(df=1) 6.023, p<.02

As would be expected from our earlier results, there was no significant effect associated with condition (tell / think). Again, consistent with some of our earlier results, we found that within this sample, when asked a 'think' question in the deceptive box trial, older children were more likely to respond with the correct answer than were the younger ones. In addition we found that on the video trial, children were more likely to succeed when it was presented first than when it was presented second.

3:15 Discussion

This study demonstrates that in the preceding series of experiments, children were not succeeding on our modified deceptive box task simply by acknowledging a prior statement. It seems that not only does the video procedure facilitate correct judgements about a child's own out of date statement but, also facilitates acknowledgements of the child's outdated belief. Although these results are in no way conclusive, they suggest that Wimmer & Hartl (1991) and Riggs and Robinson (1994) may well be correct in supposing that as far as judgements about the self are concerned, children seem to assume that an individual's beliefs can be directly read off from her statements. If this is the case, perhaps the video procedure alleviates the necessity of engaging in a process of either inference or simulation to reach a correct belief judgement.

Although there was some slight difference in children's judgements in the two conditions, this was not near significance. Indeed, a small difference between conditions is to be expected. When the child is asked the 'tell' question, the test question is being explicitly linked to the video evidence. The 'think' question is not however directly associated to the video the child has just seen. In this respect, the child will not be in as favourable a position to use the cue as she would if asked a 'tell' question. It may be that, as was suggested above, the child need not explicitly infer her belief from her statement. Rather, she may simply read the belief off the statement. However, whether or not this is what happens, by asking a 'think' question the child is not being automatically directed to the evidence in the same way as she is in the 'tell' condition.

3:16 Video Series General Discussion

In the preceding two chapters we assessed whether young children's acknowledgement of their own false belief could be facilitated if we presented them with a modified version of the deceptive box task. We initially hypothesised that inducing objective self-awareness in the child would enhance the child's sense of self and thereby improve her ability to simulate a prior belief. This was based on the assumption outlined by Gallup (1985) that before an organism is capable

of simulating the mental states of another an understanding of the self must be achieved.

However, in experiments 2:1 and 2:3, we found that simply allowing a child to see her contingent image did not help her subsequent judgements concerning her false belief. It seemed that either this technique, proposed initially by Duval and Wicklund (1972) fails to induce objective self-awareness in children as young as three and four years, or alternatively a heightened sense of self has little effect on a child's ability to acknowledge a false belief.

These results were contrasted by the finding that filming the child while she is initially looking at the deceptive box and subsequently replaying it to her, promotes facilitation when she is later asked to recall that false belief. Although the effect is small, children are helped by this technique when the video is paused directly before the child on the tape utters her belief concerning the content of the box.

These results are supported by those of German (1994), who also presented children video evidence during a false belief procedure. In his task, children hid a biscuit in one of two locations and then left the area to play a different game. In the meantime the biscuit was moved to the second location. The child then returned to the area to search for the biscuit. This procedure was then filmed. Once the biscuit had been located, children were shown a film, either of themself or another child hiding the biscuit. The film was paused at a point before the child returned to the room. Children were then asked a prediction question, "When you / the little boy came back to look for the biscuit in the film, where did you / he look for it?" The film was then restarted so that the child could witness the incorrect search after which they were asked an explanation question, "Why are you / is he looking in there?" and a belief question, "When you were / he was looking for the biscuit, where did you / he think it was?" The authors found that under these conditions the children had little difficulty acknowledging the false belief. Interestingly, children were significantly better at acknowledging their own false belief than that of another child.

At the point in German's procedure at which the prediction question was asked, children had not yet been provided with physical evidence of their prior belief. This is therefore similar

to our partial playback trial. However, by the time children were asked the explanation question, their belief had been provided with a physical counterpart through witnessing the false search on the film. This is comparable to the child hearing her self comment on her belief in our complete playback trial. In both studies facilitation was greater at this point.

German's results therefore support our revised reality masking hypothesis. This suggests that as children's bias towards reality diminishes, so too her need for physical evidence decreases. These children, who would still fail a standard false belief test are able to succeed if their attention is diverted away from current physical reality. As such it is sufficient to induce in them an increased level of objective self-awareness. However, as can be seen from the results of Beaman et al. (1972), to induce such a state in these young children, it is not sufficient to simply present them with a contingent image. Rather a stronger stimulus such as a replayed video of themself in their earlier state is required. For those children who are still heavily biased to attend to reality, such a stimulus would be inadequate. These children's attention would not only need to be averted from current reality, but also positively drawn towards the belief. The video complete playback procedure would serve this purpose.

This idea would therefore be at odds with the original version of the reality masking hypothesis proposed by Mitchell (1994, Mitchell & Lacohee, 1991, Robinson & Mitchell, 1994, 1995), which stresses the importance of either identifying the belief with a physical counterpart or de-emphasising the physical characteristics of current reality. Either way, the concept of a physical reality is at the heart of the model. The evidence presented here suggests however that while a physical counterpart of the belief is important for those children with a strong reality bias, it is of less importance to children who have already shed much of their reliance upon reality. While these children do seem to be drawn to the physical nature of current reality, simply encouraging them to focus their attention internally by showing them a small part of the video, is perhaps all they require to enable them to engage in belief rather than reality based reasoning.

Two different versions of the reality masking hypothesis have been proposed. The strong view holds that from an early age the child has an understanding of the representational nature

of belief and as such an ability to infer beliefs. It is therefore simply her reality bias which prevents her so doing on false belief tests. This account would be largely consistent with Leslie's (& Thaiss, 1992, Leslie 1994) model of cognitive development (c.f. 1:8) which suggests that ToMM is fully developed and on line at a very early age (about twenty-four months). However, a weaker version of the reality masking account suggests that the young child's understanding of belief is not absolute. Rather, as her reality bias diminishes, so too her understanding of belief increases. While our results illustrate the gradual decline of the child's bias towards reality, they can not arbitrate between these two versions of the model. More research would be needed to assess whether the child's understanding of belief is fully fledged at an early age or rather develops gradually throughout childhood.

Our results do however suggest in what way the child reasons when acknowledging a false belief. If allowing these children a heightened level of self-insight enables them to acknowledge a false belief, it seems likely that the reasoning they engage in is based upon a process of simulation. It is logical to suggest that deflecting the child's attention away from current reality so that she can instead focus upon her own mind, would increase her ability to simulate mental states both for herself and for other people. If such a process did not require that one reflected on one's own mental states, the simple act of focusing attention internally would be unlikely to affect subsequent performance.

Our initial hypothesis stated that allowing the child access to her contingent image would increase her level of objective self-awareness, thus enabling her to simulate her former false belief. While this was not borne out by the data, the more general hypothesis that increasing a child's self-insight by allowing her to turn her attention away from current reality to her inner self would facilitate false belief judgements was proved. However, we also demonstrated that such an effect is minimal if the child's reality bias is too pervasive. In such a case, presenting the child with a physical counterpart of the belief is essential before she can ignore the world around her and instead concentrate her attention upon inferring the false belief.

Chapter Four

> Doublethink means the power of holding two contradictory beliefs in one's mind simultaneously, and accepting both of them.
>
> George Orwell, *Nineteen Eighty Four*

Experiments 4:2, 4:3, 5:1, 5:2 and 5:3 can be found in Saltmarsh, Mitchell and Robinson (In Press, *Cognition*).

4:1 Physical Reality and Facilitation on False Belief Tests

In the series of experiments reported in the two previous chapters we were interested to discover whether enhancing a child's level of objective self-awareness had any effect on her ability to reason about false beliefs. Although we found that self-awareness and false belief seemed to be related to one another, the two concepts were not associated in the way we had initially anticipated. We concluded that allowing children to witness a video of themselves forming their initial belief (but not actually commenting upon it), enabled them to become objectively self-aware and as such focus internally rather than externally. This in turn helped them to overcome their reality bias and engage in belief-based reasoning. The cue had little effect on some of the children, which may be because their reliance on current reality was stronger. It seems that these children required tangible physical evidence of the initial belief. Such evidence not only deflected their attention from current reality, but by providing the initial belief with a physical counterpart, positively drew their attention towards the belief.

With this evidence in mind we suggested a revision of the reality masking hypothesis as

it is currently defined. This was as follows; owing to its physical status, young children are naturally biased to attend to current reality (and as such can be considered to be subjectively self-aware [c.f. 2:6]). They therefore fail tests of false belief reasoning, not solely because they lack an ability to reason about the mind, and default to reality judgements, but because they are instinctively drawn by physical reality. As with the development of mental state understanding, this reality bias is not a discrete concept; no revolution occurs following which the child is free to contemplate the mind. Rather the child's reality bias gradually diminishes as her understanding of the mental realm grows. For those children at a later point in this development, drawing their attention internally is sufficient to allow them to disengage themselves from current physical reality, thus enabling them to infer or simulate the prior belief. However, for those children in whom the bias is still stronger, simply focusing attention internally is not enough. The belief must be endowed with an enduring physical reality to actively attract their attention towards it. As such, the present account differs from previously stated models in that it allows for a decreased reliance upon a physical counterpart of the belief in older, more developed children.

The reality masking hypothesis, either in its original or revised form, explains much of the data gathered from false belief tests so far. On tests of false belief understanding, young children do not answer at chance as would be expected if they simply lacked a concept of belief. Generally their performance is consistently below chance (c.f. 3:3). If the child is actively drawn to reality these are the results one would expect to find. However, while such general findings do provide support for the model, more specific evidence is needed. Indeed, for the account to be valid, it must be capable of satisfactorily explaining evidence, which at least superficially seems to contradict it. Such evidence comes from the state change task (Wimmer & Hartl, 1991)

4:2 The State Change Task (Wimmer & Hartl, 1991)

The state change task was initially devised by Wimmer and Hartl (1991) to assess

whether young children's difficulty with false belief was symptomatic of linguistic immaturity rather than a specific cognitive deficit. They suggested that in the standard task young children may have been misconstruing the test question which asks "What did you think was in the box?" to be "What do you think is in the box?" However, the study's major finding is not that it sets aside artifactual explanations of the false belief effect. Rather, the results provide convincing evidence in support of the proposal that the young child's difficulty with the standard deceptive box task is specifically a problem with the representational nature of belief.

The state change procedure is an elegant modification of the deceptive box task. Children are shown an easily recognisable box (e.g. a smarties tube) and asked what they think it contains. The experimenter then opens the box and reveals the contents are as the child had anticipated (smarties). She removes this first content (smarties), replaces it with a second content (a pencil) and closes the box returning it to its initial state. The experimenter then asks the observing child what she initially thought was inside the box.

Wimmer and Hartl (1991) found that while only 38% of their sample of three and four-year-olds succeeded on a standard deceptive box task, 86% gave correct judgements on the state change task. The two procedures are identical except that while in the state change task, there are two successive contents (the initial content being that which the child expected), in the deceptive box task there is only one. If children were misunderstanding the test question in the standard deceptive box task, presumably they would do the same on the state change task and fail that as well. As such, the state change task seems to provide an irrefutable control demonstrating that young children's problem with the deceptive box task is not due to their misunderstanding of the wording of the test question.

However, the state change procedure addresses issues that are of more importance than the child's linguistic capability. The task seems to provide conclusive evidence that young children's difficulty centres around their inability to understand the representational nature of

belief.

Perner (1991) distinguishes between the sense and the reference of a belief (c.f. 1:6). He suggests that young children fail false belief tasks because they are unable to understand that while the referent (or represented situation) of a belief must always be true, its sense (way in which the referent is represented) may not be. He terms children who lack this concept, situation theorists. Results from the state change task seem to provide direct support for this supposition. In order to succeed on the standard deceptive box task the child must understand this distinction between sense and reference. While the reference of their initial belief was that the box contained pencils, its sense was that it contained smarties. This is however not the case on the state change task. Here, the initial belief was true (the child thought there were smarties in the box and indeed there were smarties in the box). As such the reference and the sense of their initial belief were identical; the box contained smarties. Success on such a task is therefore within the capability of a situation theorist.

Wimmer and Hartl (1991) suggest that it is this difference which accounts for the difference in the results from the two tasks. They point out that while the child must understand that beliefs can be distinct from reality to succeed on the deceptive box task, no such understanding is necessary to make a correct response on the state change task. In the state change task both the initial belief (smarties) and the initial reality (smarties) are the same. Wimmer and Hartl subscribe to the position that young children have no conception of belief. They suggest that when young children succeed on the task they do so not by reporting their initial belief (the belief that the box contains smarties), but rather by reporting the previous situation (the box contains smarties), "The child's answer to the expectation question is just the expression of a correctly apprehended prior state of affairs." (Wimmer and Hartl, 1991, p. 131)

The authors therefore suggest that as young children have no conception of belief, they are unable to process the test question as regarding that belief and instead take it to concern the

earlier period of time when they saw the box's initial content. If children have no understanding of belief, they will simply gloss the belief question, "What did you think was inside the box?" to be, "What was inside the box?" Young children, whose problem is specific to recalling beliefs and not to recalling reality, can therefore give a correct response on the state-change task by simply recalling the earlier reality. Consequently, correct judgements on the state-change task can not necessarily be seen as being demonstrative of an understanding of false belief. Note that Wimmer and Hartl were not arguing that children suffered from a superficial linguistic misunderstanding of the question. Rather, they propose that a conceptual limitation prevents understanding of belief and imposes a constraint on how children interpret the question.

As such, the state-change control seems to provide powerful support for a conceptual shift theory. Young children perform quite differently on two very similar tasks, the only difference being that to succeed on one an understanding of false belief is required while to succeed on the other no such understanding is necessary.

4:3 The reality masking account of the state change findings

Not only does the state change procedure support a conceptual shift account, but as suggested earlier, it could also be seen to undermine the reality masking hypothesis. If young children are biased to attend to reality ahead of belief, superficially it would seem likely that in the state change procedure, when asked the test question, the child would refer to the box's present content rather than the prior situation. As young children frequently give the correct response on the state change task, the procedure could be seen to provide convincing evidence against the reality masking account. The state change procedure therefore seems to be an impressive control supporting the idea that a concept of belief as representational is not available to children until they are seen to pass a standard test of false belief. A corollary is that a grasp of belief, and indeed a theory of mind, seems to emerge in a stage-like radical conceptual shift.

However, an alternative possibility exists. It may be that the prevalence of correct judgements on the state change task is not inconsistent with the reality masking hypothesis but rather offers powerful support for it. In the state change task, once the child has told the experimenter what she thinks the box contains, the box is opened and when the child sees the expected content her initial belief is confirmed. As such, the child's belief is given a physical counterpart. There is a clear parallel between this procedure and the Mitchell and Lacohee (1991) posting procedure (c.f. 3:3). In that task once the child has said what she thinks is inside the box, she posts a picture (a physical counterpart) of it. The picture helps the child resist the magnetism of current reality and as such allows many children who fail standard deceptive box tasks to correctly acknowledge their initial belief. We might therefore expect that seeing the expected contents in the state change task would serve a purpose similar to that of the posted picture.

In the state change task, once the child has informed the experimenter of her initial belief, the box is opened and the expected content revealed. At this point in the procedure, the child's belief is not simply confirmed, but is explicitly linked to a physical counterpart of itself. According to the reality masking hypothesis this would of course make the child's belief more salient to her. Once the contents have been exchanged and the box closed, the child is then asked to acknowledge that belief. While she would normally be biased to answer in accordance with current reality, now her attention is drawn towards the strengthened belief. As such, even a fairly young child would be in a position to engage in belief-based reasoning. The reality masking account would therefore hypothesise that children would find it easier to acknowledge their initial belief in the state change procedure than in the deceptive box procedure.

In our series of video experiments we suggested a modified version of the reality masking hypothesis. We proposed that those children who had a profound reality bias would not benefit from a procedure which simply directed attention internally but would need a stronger cue

(physical evidence of the belief) to positively attract their attention to the belief. In the state change procedure, we are looking at the false belief task from another angle. Here, unlike in the video experiments, at the time of questioning, the young children's attention is not being directed, either away from current reality nor towards the initial belief. Rather, we hypothesise that initially making the belief more salient to the child by associating it with a physical reality, will allow the child herself to direct attention internally and therefore focus it upon the belief without the aid of further cues.

Wimmer and Hartl's (1991) state change task can be seen to suffer from confounding two variables. Children could be succeeding on the test either by referring to the prior episode or because it has been made more salient, by referring to the belief. To investigate which of these possibilities is correct, we created a false belief state change task in which the belief was now false but was still endowed with a physical counterpart. To succeed on such a task, the child must be able to distinguish between the sense and the referent of the belief. Because the belief is now false, the child cannot give a correct response simply by glossing the question and commenting on the earlier situation. As such, if children's performance on state change is still significantly better than it is on the deceptive box trial, we would be able to conclude that facilitation is due to the child overcoming her bias towards current reality.

Experiment 4:1

4:4 Introduction

The previous section highlights the importance of Wimmer and Hartl's (1991) state change control condition. However, although the procedure can be seen to hold a critical position in the debate which surrounds the study of the young child's acquisition of mental state understanding, it's significance has gone largely unrecognised in the subsequent literature.

Indeed Wimmer and Hartl themselves seem to have overlooked just how crucial the procedure is. Having designated the procedure as being the second experiment in a series of three, they have afforded it a less than dominant position within the paper as a whole. Secondly, the authors discuss it primarily in terms of the artifactual issue of whether or not young children understand the language used in the test question. As such, they ignore the crucial issues that their results address.

Before any conclusions can be reached as to what factor may cause children's success on the state change task, we must set the task in the context it rightly deserves. There are several possible approaches we might take. Firstly it is important to replicate the state change procedure, but this time we will use a larger sample. From such a replication we would be able to assess whether or not the state change effect is robust and worthy of further investigation.

Secondly, it would be useful to compare young normal children's performance on the state change task with the performance of children with autism. Individuals interested in investigating the development of mental state understanding in young children have taken great interest in work being carried out with children with autism as it has been shown that a theory of mind does not develop normally in this subject population. Not only is this of interest to those wishing to investigate the nature and causes of autism, but it is also crucial to those charting the normal development of a theory of mind.

Autism has long provided researchers with a challenge. That is, the need to find a causal explanation which not only sheds light on the triad of core impairments (socialization, communication and imagination [Wing & Gould, 1978]) but also accounts for the more peripheral symptoms. Many competing theories have been put forward which try to causally explain autism, the most dominant, currently being the mind blindness account. This model stemmed from the finding that children with autism (with a mental age well in advance of 4) make realist errors on false belief tasks in a way that is similar to clinically normal preschool children. Baron-Cohen,

Leslie & Frith (1985) presented children with autism and a control sample of children with Down's syndrome the Sally-Ann task, a simplified version of Wimmer and Perner's (1983) unexpected transfer task. In the procedure, the child is shown two dolls, Sally who has a basket and Ann who has a box. Sally puts a marble in her basket and leaves the scene. While she is absent, Ann takes the marble from Sally's basket, puts it in her own box and leaves. When Sally returns, the child is asked where she will look for her marble. The authors found that 80% of the children with autism failed to acknowledge Sally's false belief and indicated that she would look in the box where the marble really was. In contrast, 85% of normal children (aged 3:5 to 5:9) and 86% of children with Down's Syndrome (who incidentally had a mental age lower than that of the children with autism) successfully acknowledged Sally's false belief.

This experiment was followed by a flurry of other studies which suggested that, even when tasks are specifically adapted to cater for this population, the substantial majority of children with autism are unable to demonstrate an understanding of the nature of mental states (Baron-Cohen, 1991, Leslie & Frith, 1988 and Perner, Frith, Leslie and Leekam, 1989). The deficiency seen in children with autism is not, however, simply restricted to their understanding of beliefs but can be seen more generally in tasks which require the ability to mentalise. Happé (1994) used a "fine cuts" technique to demonstrate how pronounced the distinction is between the performance of children with autism on tasks that require the ability to mentalise and similar tasks which do not. For instance, children with autism fail to order mentalistic pictures, but successfully order behavioural pictures (Baron-Cohen et al., 1986), they understand the concept of "see" but not of "know" (Perner et al. , 1989), they understand "sabotage" but not "deception" (Sodian & Frith, 1992) and they understand literal but not metaphorical expression (Happé, 1993). Such evidence points to a specific deficit in autism in understanding how mental states are formed and held.

How children with autism handle novel tasks is therefore of great interest to those

studying the normal development of mind. Not only does their performance tell us something about the nature of autism, but it also tell us something about the nature of the task. As such, how children with autism react when given the state change task will provide us with a certain amount of insight into whether or not the task requires the ability to mentalise.

Our intention in this series of studies is to outline the abilities necessary, to giving a correct response on the state change task. As such, it would be useful to compare children's performance on the state change task with their performance on other tasks which are thought to tap children's understanding of the mind and representational states. Wimmer and Hartl (1991) contrasted children's performance on the state change task with their performance on a standard deceptive box task. We would wish to replicate this, and in addition compare performance on the state change task with performance on the false photo task (Zaitchik, 1990).

The false photo task is a procedure which has assumed an importance in the theory of mind debate (c.f. 1:8). Young children's failure to acknowledge that a photograph (representation) does not update even though its subject does, was initially taken to be symptomatic of a general lack of representational understanding in young children. However, further evidence from both clinically normal preschool children as well as children with autism suggests otherwise. Leekam and Perner (1991) and Leslie and Thaiss (1992) found that while both subject populations tend to fail standard tests of false belief reasoning, the performance of children with autism on the false photo task is significantly better than that of the normal children. These results have also been replicated using a slightly different procedure in which the updated representation was a drawing rather than a photo (Charman & Baron-Cohen, 1992).

Leekam and Perner claim that these data do not affect the theory of a general representational deficit in young children, but simply demonstrates that an ability to metarepresent is not a prerequisite for success on the false photo task. Perner (1993) proposes that unlike the false belief task, success on the false photo task is within the ability of the

situation theorist which he suggests both preschoolers and children with autism are. As the children with autism tested on the task have a mean chronological age well in advance of the clinically normal sample, Perner suggests that their superior performance is due to their increased knowledge of cameras and photographs.

However, such an explanation seems unlikely. Firstly results from Charman and Baron-Cohen (1992) demonstrate the same effect on false drawing tasks. Obviously even children as young as three-years-old have a wealth of drawing experience. In addition, Charman and Baron-Cohen (1995) tested children with autism and mentally handicapped controls on a similar task that involved the understanding of pictures and models. Although the mentally handicapped group were on average older than the autistic group, the performance of the children with autism was better on the task than that of the mentally handicapped group (although this difference was not significant). In contrast the mentally handicapped group significantly out performed the autism group on the false belief task.

Leslie and Thaiss (1992) suggest that the results from the false photo task may reflect a profound difference between the two subject populations, not discernable on the standard task. While the children with autism may fail false belief tests because they lack an understanding of mind, such a deficit would have little effect on the false photo task which requires no ability to mentalise. Young normal children (whose ability to mentalise may be masked by task difficulties on false belief tasks) may face the same difficulties on the false photo task that they do on the standard task as both are structurally similar.

This model of the normal and abnormal development of a theory of mind is of course of interest when the state change task is considered. If children with autism, but not normal preschool children suffer from a mentalising deficit, significant differences may appear in their responses on the state change task. If an understanding of belief is necessary for success, Leslie and Thaiss may hypothesise that young normal children would succeed, while children

with autism may not. However, if as Wimmer and Hartl suggest, no such understanding is required for success on the state change task, both populations may give significantly more correct responses than they do on the false belief task. It may be that the state change procedure provides us with another task which demonstrates a dissociation in the performance of normal preschool children and children with autism. If this were the case, it would provide support for the supposition that while clinically normal preschoolers fail false belief tasks due to informational processing problems, children with autism fail because they suffer from a more fundamental deficit

4:5 Method

Subjects

The twenty-four children with autism (19 boys and 5 girls) who participated in the study were recruited from three units and three schools catering for children with autism situated in Wales and in London. Only those children who had already been diagnosed as autistic (not including those diagnosed as having Asperger's syndrome) according to established criteria (Rutter, 1978) were included. The group of children were aged between 7-0 and 17-4 (mean 12-2). Each child was assessed for verbal mental age using the British Picture Vocabulary Scale (B.P.V.S.; Dunn, Dunn, Whetton & Pintilie, 1982). Children whose mental ages were lower than 4-0 years were excluded from the study. The verbal mental ages of our subjects ranged from 4-1 to 9-3 (mean 5-11; S.D. 1-9).

The clinically normal group consisted of 41 children (21 girls and 20 boys) who were aged between 3-5 and 4-8 (mean 4-1). These children were not tested for verbal mental age as it was assumed that their mental age would roughly correspond to their chronological age. The children all attended the nursery class of a primary school in a largely middle class area of West

Glamorgan.

Materials

In the deceptive box, state change and memory control trials, children were presented with easily recognisable boxes. These were, a toy train box (containing either the train or a wooden fish) a toy tea set box (containing either the tea set or a baby shoe) and a cornflakes box (containing either cornflakes or a wax crayon.)

For the false photo condition a Polaroid camera was used, while for the false drawing condition plain white paper and a thick felt-tip pen were provided. Two different setups were used for the false drawing and photo trials. The first was the change of location setup. For this we used a playperson, a playperson's bed and a playperson's armchair. The second was the change of state setup in which a white teddy bear and a small teddy sized scarf and hat were used.

Design and Procedure

Before testing began, the experimenter spent some time with the children to allow them to feel more at ease with her. For the normal children this simply meant spending a session in each classroom, however it was necessary to spend several days in the company of the children with autism.

Each child in the autistic sample was tested on three separate occasions usually on consecutive days. In the first session, the children were assessed using the B.P.V.S. therefore allowing any children who did not meet the cut-off criteria of four years to be withdrawn from the sample. It could therefore be assumed that those autistic children who failed tests of false belief did not do so just because they were linguistically immature.

The children from both samples were then tested over two experimental sessions. There

were two independent levels of counterbalancing, the order of presentation of the sessions themselves, as well as the order of the trials within each session. The trials were mapped onto the presentation of the materials. The first box trial (whether state change, deceptive box or memory) used the train box, the second the tea set box and the last used the cornflakes box. The first false picture trial (whether false drawing or false photo) used the location materials while the second used the clothing. Session 1 consisted of the deceptive box trial, the state change trial and the false drawing trial. Session 2 consisted of the false photo trial and the memory control trial.

Session 1

(i) State change trial

The procedure in this trial was very similar to that in Wimmer and Hartl (1991). The experimenter took an easily recognisable box from her bag and said to the child, "Take a look at this box, what do you think is inside?" Once the child had responded, the experimenter said, "Let's take a look." She then opened the box and revealed to the child that the contents were as she had expected saying, "Oh look, its a train / tea set / cornflakes." She removed the contents from the box and took a second, atypical content (the fish / shoe / crayon) from her bag and said to the child, "Look what I've got here, what is it?" She held the atypical object up to the child and once the child had named it said, "I'm going to take the train / tea set / cornflakes out of here and put them in my bag and put the fish / shoe / crayon in the box instead." The experimenter carried out the action as she was talking. She then closed the box and asked the child the test questions,

Belief question; "When you first saw the box, before we opened it, what did you think was inside?"

Reality question; "What's inside the box now?"

The reality question was only asked if children gave a correct response to the belief question. If children reported current reality when asked the belief question the second question seemed superfluous.

(ii) Deceptive box trail

This trial began in the same way as the state change trial. However, once the child had commented on her present belief, the experimenter opened the box and revealed to the child that the contents were not as she had anticipated saying, "Oh look, a fish / shoe / crayon." The experimenter then returned the content to the box saying "I'm going to put this back in the box." Once she had closed the box, the experimenter asked the test questions which were the same as those posed in the state change trial.

(iii) False drawing trial (described using the change of location materials)

The experimenter set out the toy chair and bed on the table in front of the child. She then brought out the playperson, sat him on the chair and said to the child, "Here is Fred, where is he sitting?" Once the child had answered correctly, the experimenter said, "O.K., now I'm going to draw a picture of Fred sitting in the chair." The experimenter then drew a picture of Fred sitting on the chair and showed it to the child saying, "Look, I've drawn a picture of Fred sitting on the chair." She then put the picture aside, face down on the table and said, "Fred's tired, let's put him on the bed." As she said this she took Fred and sat him up on the bed and asked the test questions.

Representation question: "In the picture, where is Fred sitting?"

Reality question: "Where is Fred sitting now?"

Session 2

Regardless of which trial came first in session two, children were initially given a training period using the Polaroid camera. The experimenter showed the child the camera asking her if she knew what cameras did. She then explained to the child that this was a very special camera and showed her the viewing window, the button and the slot from which the picture would emerge. She then got the child to look through the window saying that what she saw would come out in the photo if she pressed the button. The experimenter then placed two soldier playpeople on the table and asked the child to take a photo of them. She helped the child to position the camera correctly making sure she was closing one of her eyes so that she could see the target. Once the child had pressed the button, the picture emerged and the experimenter explained that although the photo was dark now, it would get clearer and clearer until it would be possible to see the soldiers in the photo. The experimenter and child then talked about the photo until the picture was fully developed.

(iv) False Photo trial (described using the change of state materials)

The experimenter took Teddy out of her bag, introducing him to the child. Next she brought out the woolly hat and asked the child what it was. Once the child had identified the hat, the experimenter picked up the camera and said to the child, "Here's the camera again. I'm going to look through the window and take a picture of Teddy with his hat on." She looked through the viewing window and pressed the button saying, "There, I've taken a picture of Teddy with his hat on. Now we have to wait for the picture to get clearer and clearer." The experimenter then placed the picture face down on the table. Next, she took the scarf from her bag and asked the child what it was. Once the child had named the scarf, the experimenter took Teddy's hat off putting it out of sight in her bag and wound the scarf around Teddy's neck instead. She then pointed to the back of the picture and asked the child the test questions.

Representation question: "In the picture, what is Teddy wearing?"

Reality question: "What is Teddy wearing now?"

(v) Memory control trial

The procedure for this trial was identical to that in the state change procedure. However, once the contents had been swapped and the box closed the child was asked the test questions,

Memory question: "When you first saw the box, before we opened it, what was inside?"

Reality question: "What's inside the box now?"

4:6 Results

Clinically normal group

The initial aim of the study was to check the replicability of Wimmer and Hartl's (1991) state change effect. Our first analyses therefore focused on the data provided by the clinically normal children. Every child in the sample passed the memory control question and so no further analysis was undertaken in relation to this task.

Table 4:1

The number of correct responses made by the clinically normal children on each trial.

Deceptive Box	State Change	False Photo	False Drawing
16 (39%)	33 (80%)	20 (49%)	24 (59%)

As shown in table 4:1, children gave proportionately more correct responses on the state change trial than they did on any of the other three. As Wimmer and Hartl found, the difference between children's performance on the state change and their performance on the deceptive box task was highly significant as the children were more likely to succeed on the state change procedure than the deceptive box procedure; McNemar Chi square (corrected, $df=1$, $n=17)=15.059$, $p<.001$. When performance on the state change task was compared to

performance on the false photo task, children were again significantly more likely to succeed on the state change trial; McNemar Chi square (corrected, df=1, n=19)=7.579, p<.01. However, when results from the state change trial were compared to those on the false drawing trial, the difference fell slightly short of significance; McNemar Chi square (corrected, df=1, n=19)=3.368, N.S.. Not only have we replicated Wimmer and Hartl's state change effect in comparison with a deceptive box trial, but we have also extended it to demonstrate that children's state change performance is superior to their performance on a false photo and a false drawing task.

We then went on to compare children's performance on the deceptive box task with that on the false drawing and false photo task. In accordance with previous studies (Leslie & Thaiss, 1992; Leekam & Perner, 1991; Zaitchik, 1991), there was no significant difference between performance on the deceptive box and false photo trials; McNemar Chi square (corrected, df=1, n=16)=0.563, N.S.. Although children's performance was slightly better on the false drawing task than the deceptive box task, again in line with the literature, (Charman and Baron-Cohen, 1992) this was not significant; McNemar Chi square (corrected, df=1, n=18)=2.722, N.S..

Patterns of results found previously for false photo and false drawing tasks suggest that the two procedures are testing the same underlying mechanism and indeed we found no significant difference in children's performance on the two tasks; McNemar Chi square (corrected, df=1, n=14)=0.643, N.S.. In order to assess whether it is appropriate to equate the two procedures in this way, we compared children's performance on the two tasks using a contingency test. The contingency can be seen in table 4:2. While the result of the analysis did not reach significance; chi square (corrected, df=1, n=41)=3.15, N.S., the effect was in the right direction, suggesting that it was possible to equate the two tasks.

Table 4:2

The contingency between clinically normal children's responses on the false photo and false drawing trials.

		False Photo	
False Drawing		Pass	Fail
	Pass	15	9
	Fail	5	12

Children with autism

Next we turned our attention to the data obtained from the children with autism. As with the clinically normal group, all subjects in the autism group succeeded on the memory control trial. As such no further analysis of these data was undertaken.

Table 4:3

The number of correct responses made by the children with autism on each trial.

Deceptive Box	State Change	False Photo	False Drawing
7 (29%)	15 (63%)	20 (83%)	17 (71%)

Firstly we wanted to assess whether, as table 4:3 suggests, the performance of the children with autism, on the state change task would be different to that found on the deceptive box task. To do this we undertook a chi square analysis and found that as with the young normal children, the children with autism were significantly more successful on the state change task than they were on the deceptive box task; McNemar Chi square (corrected, $df=1$, $n=10$)$=4.9$, $p<.05$.

As with the young normal children, we next wanted to compare the autistic children's performance on the state change task with their performance on the false picture tasks. In line

with the results from the normal children, we found no significant difference in the comparison between the state change and false drawing trials; McNemar Chi square (corrected, df=1, n=10)=0.1, N.S.; and an effect which fell slightly short of significance in the state change and false photo trials; McNemar Chi Square (corrected, df=1, n=5)=3.2.

Previously reported studies suggest that the performance of children with autism on tests of false representation is superior to their performance on tests of false belief (Charman and Baron-Cohen, 1992; Leekam & Perner, 1991; Leslie & Thaiss, 1992). To check the replicability of this effect, we compared the children's performance between the tasks. As previous authors have reported, we found that the children's performance was significantly better on the false drawing trial than on the deceptive box trial; McNemar Chi square (corrected, df=1, n=10)=8.1, p<.01, and again was better on the false photo trial than the deceptive box trial; McNemar Chi square (corrected, df=1, n=15)=9.6, p<.01.

Finally, as with the sample of clinically normal children, we wanted to compare the children's performance between the two false representation trials. A contingency table illustrating performance on the two tasks can be seen in table 4:4.

Table 4:4

The contingency between responses of children with autism on the false photo and false drawing trials.

		False Photo	
False Drawing		Pass	Fail
	Pass	15	2
	Fail	5	2

As with the clinically normal group, we found no significant difference between children's performance on the false photo and false drawing trials; McNemar Chi square (corrected, df=1,

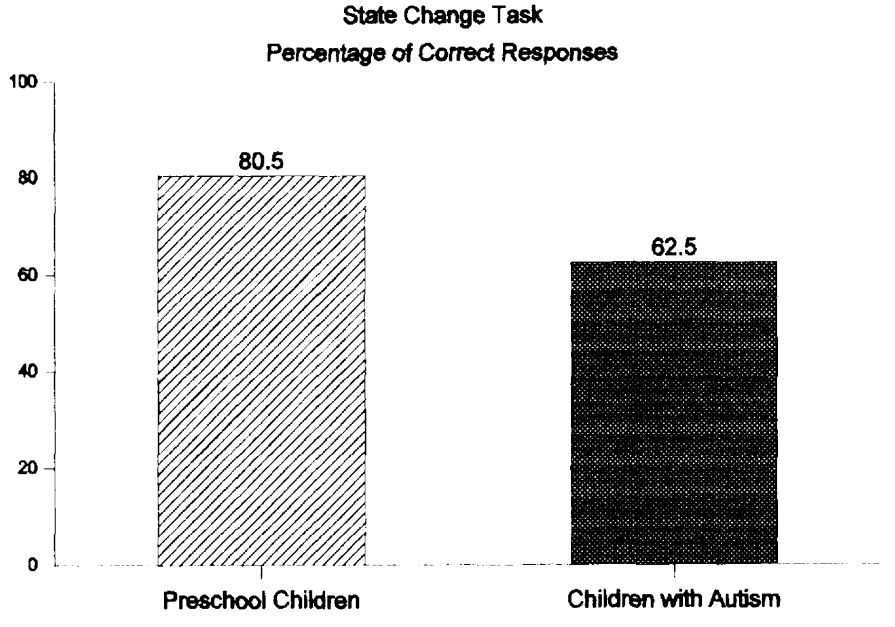
n=7)=0.571, N.S..

Comparisons between performance of the two groups on the different trials

Having looked at the results within both the clinically normal and autistic groups, we next wanted to compare results across the groups for each trial. To do this we carried out a chi square analysis between the two groups for each specific task.

Our first comparison was between performance of the clinically normal children and those with autism on the state change task. As figure 4:1 reveals, the normal preschool children were successful on the state change task more frequently than were the children with autism. This difference was not however significant; Chi Square (df=1, n=65)=2.536, N.S..

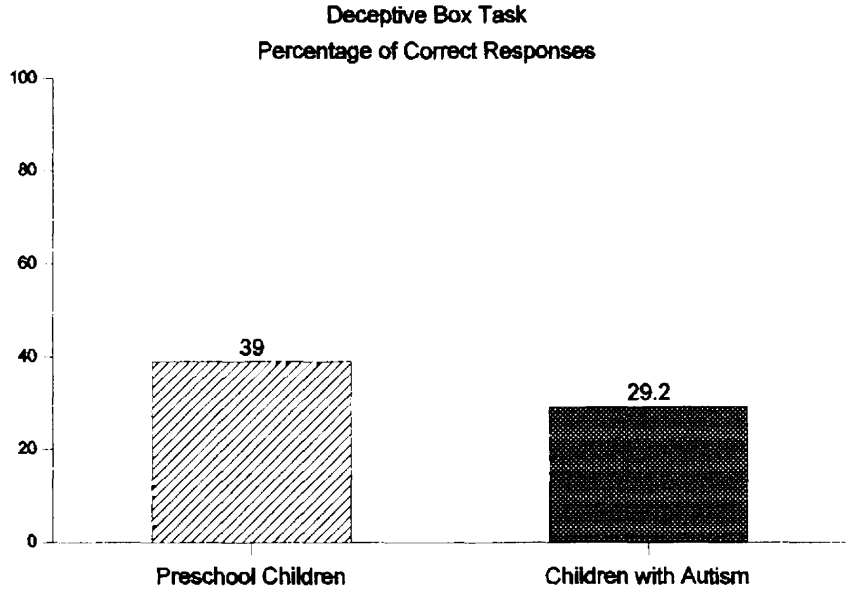
Figure 4:1



A similar pattern emerged when we looked at performance on the deceptive box trial.

Figure 4:2 shows the young normal children again out performing the children with autism, but as on the state change trial, this difference was not significant; Chi Square (df=1, n=65)=0.211, N.S. This finding replicates many others reported in the literature (Baron-Cohen, 1991).

Figure 4:2



However, when we turned our attention to the children's performance on the false representation tasks, a different pattern emerged as can be seen in figure 4:3. On the false photo task, we replicated the effect found in previous experiments (Leekam & Perner, 1991; Leslie & Thaiss, 1992), that the performance of able children with autism is better than that of normal young children. This difference proved to be significant; Chi square (df=1, n=65)=5.824, $p<.01$.

Figure 4:3

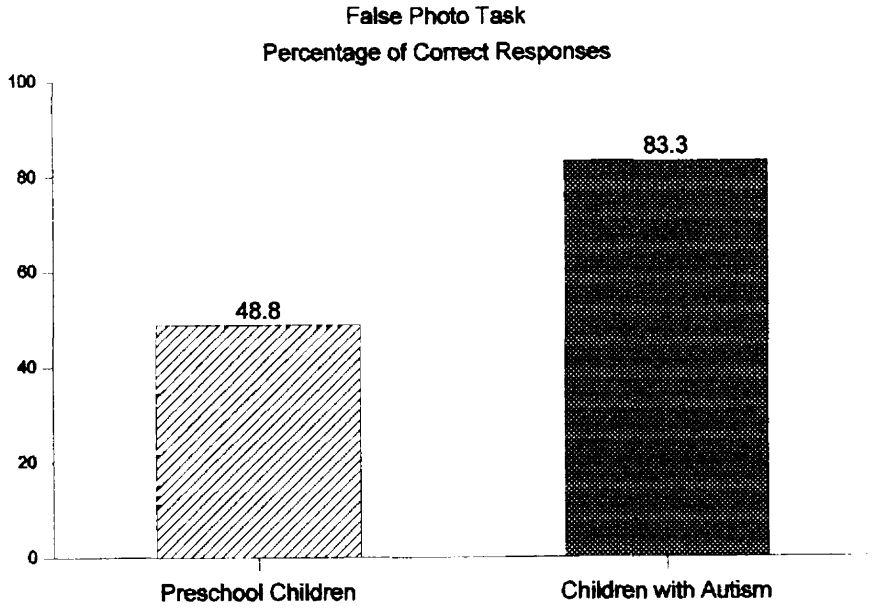
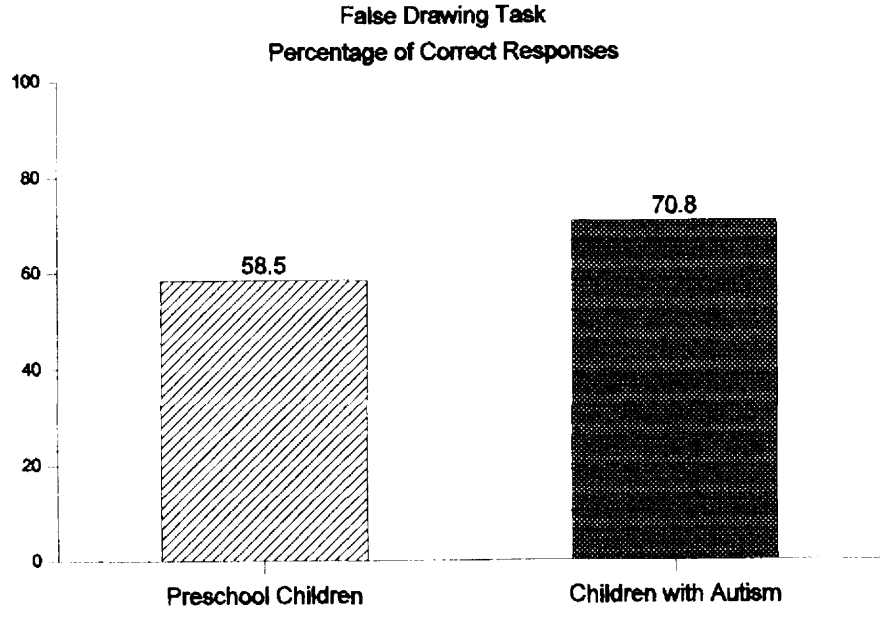


Figure 4:4



Although a similar pattern of responding can be seen in the results from the false drawing task, the dissociation is not as great. As can be seen from figure 4:4, although the children with autism are succeeding on the task more frequently, this effect is not as large as that found on the false photo task. Indeed when analysed, the difference proved to be non-significant; Chi square (df=1, n=65)=0.982, N.S.. This effect is in line with that reported by Charman and Baron-Cohen (1992) who also found the dissociation to be non-significant.

Having looked at the different levels of performance on each trial, we next wanted to assess whether there was a relationship between any of the trials. To do this we used a chi square analysis to check whether there was a significant contingency within either of the subject groups.

Contingency data in clinically normal children

In looking at the data from the pre-school children, we found only two significant contingencies. Firstly a significant contingency was found between children's performance on the state change task and their performance on the deceptive box task; Chi square (df=1, n=41)=6.361, p<.01. This suggests that there is a necessary but not sufficient relation between the two trials. While some children succeed on the state change trial alone, every child who succeeded on the deceptive box trial also passed the state change trial. These data could therefore be seen to suggest that while the state change procedure is easier than the false belief procedure, clinically normal children treat the two tasks in the same way. As it is assumed that the false belief procedure taps children's understanding of belief, it is possible that an understanding of belief also underlies children's success on the state change task.

Secondly, there was a significant contingency between children's performance on the false photo task and their performance on the false drawing task; Chi square (df=1, n=41)=4.391, p<.03. This suggests that although the children found the drawing task more difficult than the

photo task, previous authors (Charman & Baron-Cohen, 1992) are correct to equate the two.

There was no contingency between either the false drawing or false photo trial and the deceptive box trial. This may suggest that Leslie and Thaiss (1992) are correct to assume that the tasks draw upon fundamentally different capabilities.

Contingency data from children with autism

A radically different pattern of results emerged from our analysis of the performance of the children with autism. This time we found no relationship between the false photo and false drawing tasks or the state change and deceptive box tasks. Instead we found a significant contingency between the state change task between the false photo task; Chi square (df=1, n=24)=4.867, p<.02; in addition there was a significant contingency between the deceptive box task and the false drawing task; Chi square (df=1, n=24)=4.941, p<.02.

It is interesting that a significant contingency was found between the deceptive box task and the state change task in the young normal children, but not in the children with autism. It maybe that while the young normal children seem to answer the state change task in accordance with prior belief, the children with autism answer in accordance with prior reality. While the state change task is not significantly related to the deceptive box task in this population, it is significantly related to the false photo task, which requires the child to refer, not to a prior belief, but to the prior reality. However, we must be cautious in the assumptions we make from such data, especially as we found a significant contingency between the deceptive box task and the false drawing task where we would have hypothesised no relationship.

Our final set of analyses were undertaken to find out whether any peripheral effects may have been present. As the counterbalancing for the experiment was fairly complex, there were 24 possible combinations of trials. As such order effects were not investigated as there would be too few subjects in each cell.

Age and sex effects in clinically normal children

Four different hierarchical loglinear analyses were run in order to investigate the effects of age and sex for each trial. Age and sex were entered as within subject factors in a saturated model. A summary of the results can be seen in table 4:5. Neither age nor sex were significant factors in the deceptive box, state change or false photo trials. However, children's age was significant in the false drawing trial with the older children making more correct responses than the younger ones. No significant interactions were identified.

Table 4:5

A summary of the results from the hierarchical loglinear analyses assessing the effects of age and sex on the performance in each trial of the clinically normal children

Trial	(i) DB	(ii) SC	(iii) FD	(iv) FP
Age	(df=1) 0.488, N.S.	(df=1) 1.953, N.S.	(df=1) 0.338, N.S.	(df=1) 4.414, $p<.05$
Sex	(df=1) 0.4, N.S.	(df=1) 0.212, N.S.	(df=1) 3.266, N.S.	(df=1) 2.336, N.S.

Age and sex effects in children with autism

When the data for the children with autism was analysed, each child's verbal mental age (from B.P.V.S. scores) was used as well as her chronological age. However, as table 4:6 shows, neither chronological age, mental age nor sex proved to be a significant factor for our sample on any of the trials. In addition, no significant interactions were identified.

Table 4:6

A summary of the results from the hierarchical loglinear analyses assessing the effects of age and sex on the performance in each trial of the children with autism.

Trial	(i) DB	(ii) SC	(iii) FD	(iv) FP
CA	(df=1) 0.258, N.S.	(df=1) 1.007, N.S.	(df=1) 2.075, N.S.	(df=1) 1.941, N.S.
MA	(df=1) 0.002, N.S.	(df=1) 3.364, N.S.	(df=1) 1.233, N.S.	(df=1) 0.506, N.S.
Sex	(df=1) 3.313, N.S.	(df=1) 3.492, N.S.	(df=1) 3.061, N.S.	(df=1) 1.682, N.S.

4:7 Discussion

The primary aim of this initial state change experiment was to follow Wimmer and Hartl's procedure and attempt a replication of the effect using a larger sample of children. This we did, finding an effect of a very similar proportion to that found by the previous authors. Wimmer and Hartl report a success rate of 86% for their state change task (change-of-state) and of 38% for their deceptive box task (change-of-mind). We, similarly found that 80% of the normal preschool children gave correct responses on the state change task while only 39% did so on the deceptive box task. Both studies found the difference between the tasks to be significant at $p<.001$.

In addition to the replication with young normal children, we also found that the effect could be generalised to a clinical population, children with autism. Although this in itself tells us little about the state change task, it provides hints as to what factors may be underlying state change competence. Regardless of whether or not it is causal to the disorder, in autism, the understanding of representational mental states develops in a way that is atypical. That is, the majority of children with autism seem unable to attribute false beliefs to other individuals.

Therefore because this population of children succeed on the state change procedure, it may be deemed proof that success on the task does not require the ability to mentalize. This would suggest that Wimmer and Hartl (1991) are correct to suppose that to succeed on the state change task the child simply needs to gloss the question and refer to the prior content.

However, other aspects of the results suggest that it may be hasty to assume that because two distinct populations answer a single task in the same way, they do so for the same reasons. On false belief tasks both clinically normal preschool children and children with autism tend to give realist judgements. However, when asked about the outdated representation of a photograph, clinically normal children again incorrectly refer to current reality while children with autism successfully comment on the prior situation. Leslie and Thaiss (1992) suggest that while both populations fail tests of false belief reasoning, they do so for markedly different reasons. According to their model, the young normal children fail because they have not yet developed a capacity to select the correct premises from which to process the counterfactual answer. Children with autism, on the other hand, would fail because they are unable to deal with mental states which conflict with reality. The evidence from the contingency tests in the present study suggest that the reverse may be happening on the state change task, allowing both populations to succeed.

In the introduction to this chapter it was hypothesised that young children may have been succeeding on the state change task by engaging in belief-based reasoning. That is that because they had their initial belief supported by a physically salient reality, they were subsequently able to acknowledge that belief, even when it is in direct contrast with contemporary reality. It may be that while such a procedure helps young children to acknowledge their former belief it is of little use to children with autism. If these children are not biased towards reality, but rather have an underlying cognitive deficit that prevents them from understanding mental states (as suggested by Leslie and Thaiss, 1992) then even if their initial

belief is made more salient, they would answer according to the prior situation rather than the prior belief. Although on the state change task this would be a correct response, it would not be considered an acknowledgement of the prior belief. As such while the children with autism may succeed on the state change task by referring to the prior situation, it is possible that the clinically normal preschool children succeed by commenting on their outdated belief.

Such an idea would be supported by our findings on the false representation tasks. As with the state change trial, on both the false picture trials, children with autism were significantly more likely to give a correct response than they were on the deceptive box trial. This would be the pattern of results expected if children with autism, though unable to acknowledge mental representations, could process standard non-mental representations. On all three of these tasks children could succeed by referring to a prior reality (no understanding of belief would be required). This would of course not be possible in the case of the false belief task, and the low level of performance from the autism group can be seen as testament to this.

Although the data from the present experiment hint that the two samples may be answering the state change test question in markedly different ways, they provide *no proof* that young children are succeeding by referring to their prior belief. If young normal children are shown to be answering according to a prior belief, the state change procedure could no longer be seen as evidence against the reality masking hypothesis. Rather, it would provide direct evidence to support the idea that young children do have an understanding that beliefs are distinct from reality and that this ability can be unmasked if the target belief is made more salient. As suggested previously (c.f. 4:3), perhaps on the state change task, associating the prior belief with a physical counterpart allows the child to focus her attention internally. She would therefore be in a position to overcome her reality bias which in turn would allow her to engage in the simulational process required to acknowledge the outdated belief. To test this possibility we must devise a state change task in which the child is asked about a false rather than a true

belief. On such a task, if the child glossed the question as Wimmer and Hartl (1991) suggest, the child would make an incorrect response. Correct responses from such a task would therefore be reliant upon genuine belief-based reasoning. This possibility will be explored in chapter 5. However, before we can directly test this hypothesis two preliminary experiments must first be carried out.

Experiment 4:2

4:8 Introduction

In the previous experiment we replicated Wimmer and Hartl's (1991) state change effect. Both young clinically normal children and children with autism were significantly more likely to give a correct response on the state change trial than on the deceptive box trial. The results from our analysis of the contingencies between all the trials suggest that while the children with autism may have treated the state change question as one concerning the prior situation, the young preschoolers seemed to treat the two procedures in the same way. We hypothesised that although the children with autism may have been responding according to prior reality as Wimmer and Hartl suggest, the young normal children may have been giving a belief-based response. The aim of the following experiments was to directly assess in what way the young normal children treated the test question. They may have treated it as referring to the prior situation (as Wimmer and Hartl suggest) or otherwise as referring to their prior false belief. In order to investigate this possibility we therefore needed to dissociate the child's initial belief from the initial situation. The easiest way to do this would be to ask her about the current belief of another individual who had not witnessed the previous situation or the subsequent exchange of contents (this will be discussed fully later). However, before we can do this we first needed to check that the state change effect still held whether the child was asked to comment on her own

or another's outdated belief.

To do this, we asked children to judge the initial belief of another (a puppet) who saw the unopened container at the same time as the child, but then disappeared and did not see either the initial expected content of the box or indeed its updated atypical content. Both child and puppet therefore had the same initial belief but the child's belief had subsequently been updated. There is no obvious reason why the facilitation found when the child is asked about her own prior belief should not be generalised to a situation in which she is asked about another's outdated belief. However, we needed to check this before we could modify the procedure to a condition in which the puppet had a false belief.

4:9 Method

Subjects

30 children were tested (11 boys and 19 girls) who were aged between 3;2 and 4;0 (mean, 3;7). Children were alternately assigned to either (i) a 'true belief state change' group or (ii) a 'false belief deceptive box' group. Group 1 consisted of 14 children, aged 3;2 to 3;11 (mean, 3;7) while group 2 consisted of 16 children, aged 3;4 to 4;0 (mean, 3;8). Another child who failed to answer any questions was excluded from the study. All the children attended the nursery class of a West Glamorgan primary school situated in a largely working class area.

Materials

A Daffy Duck glove puppet, a small cornflakes box (containing either cornflakes or a wooden elephant) and a toothpaste box (containing either toothpaste or a wax crayon) were used in the study.

Design and Procedure

The experimenter spent a session with each class to allow the children to feel at ease with her before testing began. Each child was interviewed individually in a quiet and isolated corner of the classroom. The testing itself involved two trials based on the same procedure, but with a different box used for each trail. The experimenter brought the Daffy Duck glove puppet from her case and introduced him to the child asking if the child had seen him on television. Daffy then 'whispered' into the experimenter's ear and the experimenter explained to the child that Daffy was shy so he would tell the experimenter things who in turn would relay these to the child. The experimenter, Daffy and the child then spent some time in conversation. Once the child seemed comfortable the testing began. The experimenter told the child she had something to show the two of them and took the first box from her case saying, "Take a look at this box, what do you think is inside?" Once both the child and Daffy had answered (Daffy answered by whispering in the experimenter's ear who then announced, "Daffy thinks there's cornflakes/toothpaste inside."), Daffy whispered to the experimenter that he was tired and wanted to go to sleep in the case. The experimenter explained to the child that Daffy who was now shut inside the case was sleeping and could not see what was happening. She then gestured to the box and said, "Let's have a look inside." Thus far, the procedure was identical for both groups. However from this point on, the procedures for the two groups diverged.

Group 1 - true belief state change:

The experimenter opened the box to reveal to the child that the contents were as she had anticipated saying, "That's right, it's cornflakes / toothpaste." She then produced an atypical item (a wooden elephant / a wax crayon) and asked the child to identify it. Once the child had named the object, the experimenter removed the original content from the box and replaced it with the atypical content, commenting throughout on what she was doing. She then closed the box thus

returning its exterior to its initial state.

Group 2 - false belief deceptive box:

The experimenter opened the box and revealed to the child that the content was atypical and not as had been anticipated saying, "Oh look, its an elephant / crayon." She then closed the box thus returning it to its original state.

In both groups, the experimenter then stressed that Daffy was asleep and had not seen what was inside the box. At that point Daffy awoke and came out of the case whereupon the experimenter asked the test questions. Each child answered two questions for each trial, one referring to her own initial belief and the other concerning Daffy's. The order of the questions was counterbalanced over the two trials.

Question 1: "When you first saw the box, before we opened it, what did you think was inside?"

Question 2: "When Daffy first saw the box, before we opened it, what did he think was inside?"

4:10 Results

The data from each child consisted of four judgements, two about her own initial belief and two about Daffy's initial belief. A summary of the children's responses appears in table 4:5.

We computed an analysis of variance of the design, 2 (false belief deceptive box versus true belief state-change) X 2 (puppet belief versus own belief), the last factor being a repeated measure. This revealed no difference in children's judgements whether they concerned their own belief or the puppet's: $F(1,26)=0.93$, N.S. However, children were more likely to give a correct judgement in the true belief state-change procedure than in the false belief deceptive box procedure, $F(1,30):6.52$, $p<.05$. This finding replicates and extends Wimmer and Hartl's (1991) results. The interaction between the two factors was nonsignificant.

Table 4:5

The number of children making 0,1 and 2 correct judgements about their own and the puppet's initial belief.

	(1) Own belief			(2) Puppet's belief		
No. correct judgements	0	1	2	0	1	2
Deceptive box n=16	12 (75%)	0 (0%)	4 (25%)	12 (75%)	1 (6%)	3 (19%)
State-change n=14	3 (21%)	5 (36%)	6 (43%)	3 (21%)	5 (36%)	6 (43%)

Although we again successfully replicated Wimmer and Hartl's (1991) finding that children made more correct judgements on a true belief state change trial than they did on a false belief deceptive box trial, our effect fell somewhat short of both the original effect as well as that found in experiment 4:1. While Wimmer and Hartl found that children were correct on a true belief state change task 86 percent of the time, in this study we found that children were successful on the task only 61 percent of the time. Although the figure does not exceed chance expectancy, ($t(26)=1.44$, $p=.16$) this does not mean that children were necessarily judging randomly. At the very least we can say that the state change procedure enables the child to combat her excessive focus on current reality that leads to characteristic errors on the deceptive box task.

Having already found there to be no significant effects identified with sex or age in our initial analysis, our final tests checked whether there were any effects associated with the order in which the test questions were asked. To do this we carried out two McNemar Chi square tests, one for the questions regarding the child's own belief; McNemar chi square (corrected, $df=1$, $n=5)=0$, N.S. and the other for the questions concerning the puppet's beliefs; McNemar chi square (corrected, $df=1$, $n=6)=2.083$, N.S.. It made no significant difference whether the

questions about the child's own belief or that of the puppet came first or second.

4:10 Discussion

Although the effect we found was smaller than that identified by Wimmer and Hartl, we again demonstrated a significant difference between children's performance on the true belief state change task and their performance on the false belief deceptive box task. It is not obvious what has caused the discrepancy between our present results and those found in experiment 4:1 and by Wimmer and Hartl (1991) as we were careful to be faithful to the original procedure. The only real difference between the procedures was the presence of the Daffy puppet in our version. It seems implausible that the puppet would distract children to an extent that it caused them not to attend to the task. In fact, it is likely that the puppet would have made the task more interesting allowing the child to become more engaged.

Nonetheless, our findings do show that facilitation of true belief state change reasoning relative to false belief reasoning on the deceptive box task is a fairly robust finding that can be generalised to children's judgements concerning another individual. Having demonstrated that facilitation occurs even when children are asked about another's belief we can now proceed by modifying the procedure to analyse the locus of the facilitation. However, before doing this we wanted to check that the state change effect could not be attributed to an artifactual cause.

Experiment 4:3

4:11 Introduction

It is possible that on the state change task young children succeed uninsightfully. It may be that children do not answer in accordance with the outdated belief nor do they misconstrue the question to be one concerning prior reality. Rather they may simply lack the memory capacity

to follow the complexity of the state change task itself. Perhaps when the experimenter confirms the young child's belief by showing her the initial content of the box, this has such a great impact on the child that she forgets about the subsequent content as soon as the box is closed. If this were the case, children would not only respond that they initially thought the cornflakes box contained the first content (cornflakes) rather than the present content (a wooden elephant), but also that they currently think the box contains the first content (cornflakes). If children did respond in this way, a correct response on the task would not demonstrate early understanding of belief, nor would it illustrate preschooler's difficulty with the representational nature of belief. Rather it would simply document the limited capacity of young children's memory.

4:12 Method

Subjects

We tested 22 children (11 boys and 11 girls) aged 3;2 to 4;2 (mean 3;7). The children attended the nursery classes of two West Glamorgan primary schools both situated in low to middle socio-economic areas.

Materials

We presented children with the same boxes used in experiment 4:2 with the addition of a toy car box containing either the toy car itself or a wooden fish.

Design and Procedure

As in previous experiments, before testing began the experimenter spent a session with each class to allow the children to become acquainted with her. Each child was tested individually in a quiet room away from the classroom. All children were tested over three trials. The order of trials one and two was counterbalanced. The boxes were presented in a fixed

order.

(i) Deceptive box trial with a current reality question

Children were shown an easily recognisable box and asked, "Take a look at this box and tell me what you think is inside?" Once the child had responded, the experimenter opened the box revealing to the child that the contents were atypical "Oh look, there's an elephant/ a crayon/ a fish in there!" The experimenter then replaced the contents and closed the box returning it to its initial state and asked the child the reality test question, "What's inside the box now?"

(ii) True belief state change with a current reality question

The experimenter showed the child a box and again asked her to, "Take a look at this box and tell me what you think is inside" Once the child had answered, the experimenter opened the box to reveal that the contents were as the child had anticipated, saying, "Oh look, there's cornflakes / toothpaste / a car in there!" She then removed the contents from the box putting them out of sight and replaced them with an atypical item (eg. a crayon or a toy elephant), telling the child what she was doing. Once the box was closed, the experimenter asked the child the reality test question, "What's inside the box now?"

(iii) Deceptive box trial with other belief question

The trial proceeded in the same way as trial (i). However, once the child had been shown the atypical content and the box had been closed, Daffy appeared from the experimenter's bag. She said to the child, "Look here's Daffy. He didn't see what was inside the box," and asked the belief test question, "What does he think is inside the box now?"

4:13 Results

As can be seen in table 4:7, children had no difficulty following the state change procedure. No children gave incorrect responses to the reality question in the deceptive box reality trial and only one child did in the state change reality trial. As would be expected, there was no significant difference between children's performance on the two trials with reality test questions; (i) deceptive box - reality and (ii) state change - reality; chi square (corrected, df=1, n=1)=0, N.S.. There was however a significant difference between young children's performance on the two deceptive box trials; (i) deceptive box - reality and (iii) deceptive box - belief; chi square (corrected, df=1, n=19)=17.053, p<.001. Young children were significantly more likely to answer correctly when asked a reality question than when asked a belief question. Children were also significantly more likely to give a correct response on (ii) the state change with a reality question than on (iii) the deceptive box trial with a belief question; chi square (corrected, df=1, n=1)=16.056, p<.001. As such, children's performance was significantly better when asked a reality question than when asked a belief question.

Table 4:7

The number of correct responses made on each trial.

(i) Deceptive box - reality	(ii) State-change - reality	(iii) Deceptive box - belief
22 (100%)	21 (95.5%)	3 (13.6%)

On both trials (i) and (ii) involving reality questions children performed at ceiling, significantly above chance; (i) deceptive box with a reality question; chi square (corrected, df=1, n=22)=20.045, p<.001; (ii) state change with a reality question; chi square (corrected, df=1, n=22)=16.409, p<.001; On the third trial the majority of children made realist responses, answering significantly below chance; (iii) deceptive box with a belief question; chi square (corrected, df=1, n=22)=10.227, p<.01.

Table 4:8

A summary of the results of hierarchical loglinear analyses assessing the effect of age, sex and order on each trial.

Trial	(i) DB - reality	(ii) SC - reality	(iii) DB - belief
Age	(df=1) 0.000 N.S.	(df=1) 1.803 N.S.	(df=1) 0.275 N.S.
Sex	(df=1) 0.000 N.S.	(df=1) 1.803 N.S.	(df=1) 0.275 N.S.
Order	(df=1) 0.000 N.S.	(df=1) 2.206 N.S.	(df=1) 0.068 N.S.

Age, sex and order effects were again analysed using loglinear analysis the results of which can be seen in table 4:8. As may have been predicted by both the ceiling effect of the first two trials and the floor effect of the third, none of the comparisons proved to be significant. In addition, no significant interactions were identified.

4:14 Discussion

The children who participated in the study had no difficulty in answering the reality question posed after either the state change or the deceptive box procedure. As such, the state change effect found both by Wimmer and Hartl (1991) and by ourselves in the previous experiments cannot simply be attributed to this simple artifactual interpretation. Children correctly identified both what the box currently contained (deceptive box with a reality question) as well as what the box had previously contained (state change with a reality question). The impact of the initial content on the children could not have been so great that the child simply forgot what the box subsequently contained. The sample in the present experiment was comparable with that in the previous experiment as indicated by the prevalence of realist errors on the deceptive box task in which we asked a question about the puppet's present belief.

4:15 General discussion to experiments 4:1, 4:2 and 4:3

In the studies reported in the present chapter we have replicated Wimmer and Hartl's state change effect both with clinically normal children and those with autism. Results from experiment 4:1 suggest that although the majority of both normal preschool children and children with autism give correct responses on the state change task, they may do so for different reasons. We have also checked that the state change effect can be generalised to questions about another's belief. In addition, we have ruled out the competing explanation for the effect which is that children may have simply forgotten the box's final content. We have therefore reached a position from which we are able to directly test whether, when making a correct response on the state change task, young children are correctly acknowledging an outdated belief or are simply commenting on a prior situation. The studies reported in the following chapter aim to do just this.

Chapter Five

> The obvious truth is that the moment any matter has passed through the human mind it is finally and for ever spoilt for all purposes of science. It has become a thing incurably mysterious and infinite.
>
> G. K. Chesterton

5:1 A False Belief State Change Task

In chapter four we replicated Wimmer and Hartl's (1991) state change effect in young clinically normal children as well as children with autism. We ruled out the possibility that the effect could have been caused by children simply attending to the first and not the second content of the box and we also generalised the effect to situations in which children are asked about another's outdated belief. We were therefore in a strong position to investigate the reasoning behind children's correct judgements on the state change task.

In Wimmer and Hartl's standard state change procedure, children are asked about their own outdated belief. As in the deceptive box procedure, their initial belief is about the box's content. However, unlike the deceptive box procedure, in the state change task, at that specific point in time (when the box is first seen), the child's belief is true; she thinks the box contains smarties and it does. In the deceptive box task however, she thinks the box contains smarties, but in fact it contains pencils. In order to assess whether children who give a correct response on the state change task do indeed understand that beliefs are distinct from reality and can therefore be false, it is important to assess their ability to acknowledge a false belief within the state change procedure. If those children who fail standard tasks but succeed on the state change task are unable to give a correct response when asked to comment on a false belief, it

is likely that on the true belief state change task they are answering correctly simply by referring to the prior situation. If however these children continue to make correct responses even when asked about a false belief, it is probable that they are giving genuine belief-based judgements. In the following three experiments we attempt to explore this possibility.

Experiment 5:1

5:2 Introduction

In experiment 4:1, children in group one were asked about the puppet's true belief in the state-change procedure. The puppet appeared at the beginning of the trial and told the child what he thought the box contained at that moment. The puppet then went to sleep in the experimenter's bag and he could no longer see what the child and experimenter were doing. During this time the experimenter opened the box and showed the child that the box did contain what the child and puppet had anticipated. This content was then exchanged for an atypical content which was put into the box and the box was then closed. As such the child, but not the puppet was privy to the updating of the box's content. The child was then asked two past tense questions, "When you first saw the box, before we opened it, what did you think was inside? " and "When Daffy first saw the box, before we opened it, what did he think was inside?" As such, the child was being asked to comment on her own and the puppet's true (past) belief. If the child is asked to comment on the puppet's prior true belief, as in the standard state change task, she can of course still succeed by referring to the initial situation when the box contained the first content. To be sure that there was no way the child could give the correct response by referring to prior reality, we now asked the children to comment on the puppet's present false belief. This was achieved very simply by changing the tense of the test question. Instead of asking the past tense question used in experiment 4:2, we now asked the present tense question, "What does he think is inside?" As Daffy did not see what was inside the box or indeed what the contents had been exchanged for, the question refers to his present false belief rather than his earlier true

belief.

If Wimmer and Hartl (1991) are correct to suppose that children are giving the correct response by simply referring to the box's initial content then simply shifting the tense of the question from past to present should be sufficient to increase the frequency of realist errors. This would happen because if young children have no understanding of the concept of belief, they would ignore the word "think" and gloss the question as "What is inside the box?". This would of course result in children reporting the box's current content and therefore making realist errors.

However, the reality masking hypothesis would predict that as in Wimmer & Hartl's true belief state change task, children's belief judgements would still be facilitated in this false belief state change procedure. Even though the puppet's belief is false, it was initially endorsed with a physical counterpart. It would therefore have been made cognitively more salient to the child. When the time came for her to acknowledge Daffy's false belief she would therefore be in a position to direct her attention away from current reality and towards the belief.

5:3 Method

Subjects

We tested 46 children (27 boys and 19 girls) who were aged 3,2 to 4,0 (mean 3;7). 4 children were subsequently excluded from the analysis as they made inappropriate responses. The resulting sample consisted of 42 children (3 boys and 1 girl) aged between 3;2 and 4;0 (mean 3;8). The children were drawn from two West Glamorgan nursery schools one situated in a mid socioeconomic catchment area and the other in a low socioeconomic area.

Design and Procedure

Children were tested over two trials using the materials of Experiment 4:2. The order of presentation of the two trials was counterbalanced. At the end of each trial the children were asked the same test question regardless of whether it was a true belief state change or a false

belief deceptive box procedure.

(i) False belief state change trial

This followed the same procedure as that outlined in the previous experiment. The box initially contained an expected content which was subsequently exchanged for something atypical as the child (but not Daffy) watched. Finally Daffy appeared at the end of the trial and children were asked about Daffy's current false belief, "What does Daffy think is inside the box now?"

(ii) False belief deceptive box trial

This trial followed the same procedure as that described in the previous experiment. However, at the end of the trial children were asked about Daffy's current false belief, "What does Daffy think is inside the box now?"

5:4 Results

As table 5:1 reveals, the overall level of performance was low, with 20 out of the 42 children failing both the deceptive box and state change trials. Nonetheless, there were important differences between conditions, as significantly more children succeeded in acknowledging false belief in the false belief state change trial than in the deceptive box trial; McNemar Chi Square (corrected, $df=1$, $n=14$)$=5.79$, $p<.02$.

Table 5:1

The number of correct responses made on each trial.

(i) False belief state change	(ii) False belief deceptive box
20 (47.6%)	10 (23.8%)

Although in the state change condition children performed at chance; McNemar Chi

Square (corrected, df=1, n=42)=0.0238, N.S., in the deceptive box condition they performed significantly below chance; McNemar Chi Square (corrected, df=1, n=42)=10.5, p<.01.

Finally two hierarchical loglinear analyses were undertaken to assess the effect of children's age, sex and the order of presentation of the trials on performance. A summary of the results can be seen in table 5:2.

Table 5:2

Results from the loglinear analyses assessing the effects of age, sex and order

	Deceptive box	State change
Age	(df=1) 0.034, N.S.	(df=1) 0.119, N.S.
Sex	(df=1) 0.228, N.S.	(df=1) 0.671, N.S.
Order	(df=1) 0.242, N.S.	(df=1) 0.017, N.S.

As can be seen from the table, none of the factors tested proved to have a significant effect on children's performance on either trial. No significant interactions were identified.

5:5 Discussion

On the past tense state change trials in experiments 4:1, 4:2, and 4:3, children who gave the correct response could have been so doing simply by commenting on the prior situation rather than the prior belief. This would occur if, as Wimmer and Hartl (1991) suggest, children without a conception of belief gloss the test question by eliminating the word think. However, on the false belief state change task, such a strategy would not result in a correct response. Here, children who did give the correct response must have been referring to the puppet's current false belief. If they possessed no conception of belief and were therefore forced to gloss the question as Wimmer and Hartl suggest, they would have responded incorrectly, by reporting current reality.

The comparison between the two trials showed that children were significantly more likely

to acknowledge the puppet's present false belief in the state change condition than they were in the deceptive box condition. However, overall children's performance on both trials was low and realist judgements were fairly common in the false belief state change trial as well as the deceptive box trial. It may be that while the false belief state change task offers facilitation over the deceptive box task, it does not generate a level of facilitation comparable with the true belief state change procedure. The following investigation addresses this issue.

Experiment 5:2

5:6 Introduction

In the previous experiment, on the false belief state change task, those children giving correct responses must have been making genuine belief-based judgements rather than referring to prior reality. However, the aim of the present experiment is to check whether the frequency with which children give correct judgements on the false belief state change task is comparable to that on the true belief state change task. To achieve this, we presented two groups of children with identical state change tasks except that the tense of the test question differed between groups. One group was asked a present tense question (what does Daffy think is inside?) and the other was asked a past tense question (what did Daffy think was inside?). Accordingto Wimmer and Hartl (1991), the young child with no conception of belief would gloss out the belief reference in both questions. As such, the past tense (true belief) question would become, "When Daffy first saw the box, before we opened it, what was inside?" and the present tense (false belief) question would become, "Daffy didn't see us open the box, what is inside it now?" Therefore, a child who did not understand the belief-reality distinction would answer with the initial content when asked about the puppet's past belief and with the current content when asked about the puppet's present belief. As such, Wimmer and Hartl would predict correct judgments when the puppet's belief matches reality (past tense), but incorrect reality judgements when his belief conflicts with current reality (present tense).

The reality masking hypothesis however, would predict a distinctly different pattern of results. For both question wordings, the correct judgement is to report the stereotypical content of the box. In both cases this potential response has been supported by a reality counterpart as far as the child is concerned; she thought there was toothpaste in the box, she then saw toothpaste in the box which was subsequently exchanged for something atypical. As such the reality masking hypothesis would predict that correct judgements would be equally prevalent in both conditions. According to this hypothesis, it does not matter whether the belief being judged is true (past tense) or false (present tense). What is important is whether or not the correct belief response is supported with a reality counterpart.

5:7 Method

Subjects

We tested 90 children (50 girls and 40 boys) aged 3;0 to 4;10 (mean 3;9). The children were alternately assigned to either a 'true belief state change' group which consisted of 47 children (26 girls and 21 boys) aged 3;0 to 4;8 (mean 3;9) and a 'false belief state change group' which consisted of 43 children (24 girls and 19 boys) aged 3;1 to 4;10 (mean 3;10). The children were drawn from the nursery classes of four primary schools situated in a variety of catchment areas.

Materials

The materials were again those used in experiment 4:2

Design and Procedure

Each child participated in two trials, one state change trial and one deceptive box trail. The order of the two trials and the presentation of the boxes was counterbalanced. The trials were identical for children in both groups except that at the end they were asked different test

questions. In all trials the experimenter showed the child and Daffy an easily recognisable box and asked them what they thought it contained. Daffy then left the scene and went to sleep in the experimenter's bag. At this point the procedure for the state change and deceptive box trials diverged;

(i) State change trial

As in previous trials, the experimenter opened the box to reveal that the contents were as the child had anticipated. The experimenter then removed the initial content and replaced it with an atypical object. The box was closed, Daffy reappeared and the experimenter asked the child the test question appropriate to her group;

Group 1 were asked a question referring to Daffy's initial true belief; "When Daffy first saw the box, before we opened it, what did he think was inside?"

Group 2 were asked a question referring to Daffy's current false belief, "What does Daffy think is inside the box now?"

(ii) Deceptive box trial

As in the previous experiments, when the box was opened the contents were shown to be atypical. The experimenter closed the box and asked the child the question appropriate to her group. The questions were identical to those used in the state change trial

5:8 Results

As table 5:3 shows, on both trials and in both conditions children made many realist errors. In our first analysis we collapsed over conditions, and found that children's performance on the two trials differed greatly.

Table 5:3

The number of correct judgements made on both trials and in both conditions

	State change	Deceptive box
Group 1 Past tense (n=47)	25 (53%)	14 (30%)
Group 2 Present tense (n=43)	18 (42%)	7 (16%)
Total (n=90)	43 (48%)	21(23%)

As in the previous experiments we found that children gave significantly more correct judgements in the state change trials than in the deceptive box trials; McNemar chi square (corrected, df=1, n=22)=20.05, p<.001.

We then went on to compare judgements in the two state change procedures independently with performance on the respective deceptive box trial. In both conditions, correct judgements were more common in the state change trials than in the deceptive box trials. The advantage was identical for both state change forms in that eleven children in both groups performed better on state change than on deceptive box, while none were better on deceptive box than state change, McNemar chi square (corrected, df=1, n=11)=9.09, p<.01. Moreover, there was no significant difference in the frequency of correct judgements between the two kinds of state change task: chi square (corrected, df=1, n=90)=0.74, N.S.

When we compared children's performance with chance, we found they were giving the correct response significantly below chance on both deceptive box trials; deceptive box true belief; McNemar chi square (corrected, df=1, n=47)=6.892, p<.01; deceptive box false belief; McNemar chi square (corrected, df=1, n=43)=18.236, p<.001. However, performance was at chance level for both state change trials; state change true belief; McNemar chi square (corrected, df=1, n=47)=0.085, N.S.; state change false belief; McNemar chi square (corrected, df=1, n=43)=0.837, N.S.

Our final analyses assessed whether children's age or sex, or the order of presentation

of the trials affected subsequent performance in any way. Two loglinear analyses were computed in which condition, age, sex and order were entered as factors into a saturated model. A summary of the results can be seen in table 5:4. As we found earlier, children's responses did not differ depending upon which condition they were in. Children's age proved to be a significant factor in responses given in the state change procedure. The older children in the group were significantly more likely to give a correct response than were the younger children. No other significant effects or interactions were identified.

Table 5:4

A summary of the results of loglinear analyses assessing the effect of age sex and order on children's performance on each trial

	Deceptive box	State change
Condition	(df=1) 2.021, N.S.	(df=1) 0.192, N.S.
Age	(df=1) 0.074, N.S.	(df=1) 8.175, p<.01
Sex	(df=1) 0.074, N.S.	(df=1) 0.604, N.S.
Order	(df=1) 0.962, N.S.	(df=1) 0.192, N.S.

5:9 Discussion

Wimmer and Hartl (1991) attribute young children's success on the state change task to their glossing the belief question as one that concerns the initial (seen) reality. However, the results from both this and the previous experiment undermine this claim. Had children glossed the question when asked the present tense question "What does Daffy think is inside the box now?", they would have wrongly commented on the box's present content in the same way that they correctly comment on the box's initial content when asked the past tense question, "When he first saw the box, before we opened it, what did Daffy think was inside?" However, contrary to Wimmer and Hartl's expectation, children actually gave a correct belief judgement (which

corresponded with the box's first content in both versions of the state change task) as frequently in both conditions. It would be very unlikely that children would gloss one belief question (past tense) and not the other (present tense). If as Wimmer and Hartl suppose, the young child had no concept of belief, she would have no option but to gloss both questions.

The pattern of results found in this experiment was that predicted by the reality masking hypothesis. The prediction was that just as the true belief state change task offered facilitation over a deceptive box task, so the same would apply for the false belief state change procedure. It would make no difference whether the belief being judged was true or false. Under either condition, facilitation offered by state change results from the correct response option being supported with a reality counterpart. This stands in direct contrast not just to Wimmer and Hartl's (1991) account, but also to that presented by Wellman (1990). He suggests that young children have a specific problem with false belief but not with true belief. Presumably he would have viewed children's success on the true belief state change task as being caused by the fact that the belief being judged was true, rather than that it was supported by a reality counterpart.

Experiment 5:3

5:10 Introduction

In the two previous experiments we investigated whether children who gave a correct response on the true belief state change task would also succeed when asked to comment on a false belief. We found that children's performance was comparable on both state change tasks. When asked a present tense question on the false belief state change task, children could not have been succeeding by glossing the question as Wimmer and Hartl suggest. Had the children done so, realist errors rather than correct judgements would have resulted. However, while this would suggest that on Wimmer and Hartl's (1991) true belief state change task those children who give a correct response are making a belief-based judgement, it does not provide direct evidence that they are not glossing the question as Wimmer and Hartl suggest. The

present experiment will however directly test this claim. A true test of whether or not children are glossing the belief question to being one concerning reality comes in the form of the deceptive box two contents task, as explained below.

In this procedure children were shown a box which when opened was revealed to have an unexpected content. This was removed and replaced with a second unexpected content and the box was closed. The child's initial belief therefore contrasted with both the initial content and the second content. If children are glossing the past tense test question to be one referring to initial reality in the standard state change task, they will also do so on this modified version of the task. As such, Wimmer and Hartl would predict that those children who failed standard tests of false belief would answer the deceptive box two contents task by wrongly referring to the box's first content. The reality masking hypothesis, in contrast, predicts that children would report the current content, just as they do in the standard deceptive box task. As the child's initial belief has no reality counterpart (the belief and the first content are different),when asked what she first thought the box contained, the child's attention would be drawn to the current content of the box.

In designing the experiment, we also included a group of children who answered a reality question. If children were glossing the question "What did you think was inside" to be "What was inside", answers to the two questions (belief and reality) would be identical. If however, the child was answering the belief question as a belief question, responses to the two questions would differ.

5:11 Method

Subjects

We tested 70 children (34 boys and 36 girls) aged 3;5 to 5;2 (mean 4;4). As many of the children were considerably older than three years, we split the sample approximately in half to form a younger group (n=32, range 3;5 to 4;4, mean 3;10) and an older one (n=38, range 4;5 to 5;2, mean 4;9). Children were assigned alternately to either a prior belief question group or a

prior reality question group. The details of age for both groups were identical to those for the entire sample. The data from three children was excluded due to failure to respond in one case and experimental error in a further two. The children attended the nursery and reception classes in two West Glamorgan Primary Schools. Both schools were in mid to low socio-economic catchment areas.

Materials

A toy train box (containing either a watch or a wooden fish) and a small cornflakes box (containing either a lion or a wax crayon) were used.

Design and Procedure

All children participated in both a deceptive box single content trial and a deceptive box two contents trial. The order of trials was counterbalanced, but the boxes were presented in a fixed order (train box first).

(i) Deceptive box single content trial

This was identical to the deceptive box procedures outlined in the video series. It differed from other deceptive box trials in the state change series in that Daffy was not present.

(ii) Deceptive box two contents trial

As in the deceptive box single content trial, children were shown one of the boxes and asked what they thought was inside. Once the child had responded with the stereotypical content, the experimenter opened the box to reveal that the contents were not as the child had anticipated. Unlike on the deceptive box single content trial, the experimenter then removed the content and replaced it with a second atypical item. The box was then closed and the child was asked the test question. The test question was the same as the one the child was asked in the

deceptive box single content trial. The form of it depended upon the group to which the child had been assigned.

Group 1 (Belief question)

Children in this group were asked a question about their prior belief, "When I first showed you this box, what did you think was inside?" The correct response to this question was to report the initial belief both for the deceptive box single and two content trials.

Group 2 (Reality question)

Children in this group were asked a question about what the box had initially contained, "When I first showed you this box, what was inside?" The correct response to this question was to report the first content for both the deceptive box single and two content trials. (In the case of the deceptive box single content trial this was also the current content because the box's content never changed.)

5:12 Results

A summary of children's responses can be seen in table 5:5. We began by focusing on children's judgements in the deceptive box two contents trial (see the left half of table 5:5). A prediction made from Wimmer and Hartl's (1991) account would be that when asked a prior belief question, young children would gloss "What did you think was inside?" to be "What was inside". If children did this, their judgements would be identical whether asked a question about prior belief or prior reality.

To investigate whether children did gloss the test question, we computed a hierarchical loglinear analysis, entering question type and age as factors into a saturated model. The analyzed data were from children who either answered the question by referring to the first content or to the current content. We therefore excluded children who either referred to the

stereotypic content of the box or who made an unclassifiable response. Contrary to the expectation based on Wimmer and Hartl (1991), children were significantly less likely to refer to the first atypical content when asked a prior belief question than when asked a prior reality one: chi square (df=1, n=57)=9.03, p=.003. This was the only significant effect identified by the analysis.

Table 5:5

Children's responses to questions about prior belief or prior reality on the deceptive box single-content and deceptive box two-content trials.

Child's response	Deceptive box two content				Deceptive box one contents			
	Belief question		Reality question		Belief question		Reality question	
	Old	Young	Old	Young	Old	Young	Old	Young
stereotypic content	4 (22%)	5 (31%)	2 (10%)	1 (6%)	6 (33%)	4 (25%)	1 (5%)	0 (0%)
first content	6 (33%)	3 (19%)	14 (70%)	10 (63%)	-	-	-	-
current content	8 (44%)	8 (50%)	4 (20%)	4 (25%)	11 (61%)	12 (75%)	18 (90%)	16 (100%)
unclassified response	0 (0%)	0 (0%)	0 (0%)	1 (6%)	1 (5%)	0 (0%)	1 (5%)	0 (0%)

(old 4:5 to 5:2, young 3:5 to 4:4)

It maybe that we have not presented a fair test of Wimmer and Hartl's prediction because the statistical comparison involved different exclusion rates from the prior reality question group and the prior belief question group: collapsing over age (as no significant effects were associated with this variable), ten of the children who were asked the prior belief question correctly acknowledged their initial false belief by reporting the expected content of the box. In contrast,

only 3 of the children in the prior reality question group answered with the expected content. These are of course incorrect responses to a prior reality question. That is, the two groups differed in that an additional seven members of the prior belief question group were excluded from the analysis because they (correctly) referred to the stereotypic content. This raises the possibility that had an equivalent number of children been excluded from the prior reality question group, then perhaps the contrast between groups would not be significant. To eliminate this possibility we excluded from the prior reality question group a further seven children who answered according to the first atypical content, thus minimising the possibility of a significant contrast. Even with these exclusions, the effect still remains: chi square (corrected df=1, n=51)=3.93, p<.05. This suggests that the children really were treating the two questions in very different ways.

Having established a difference in children's judgements between the two question wordings on the deceptive box two contents task, we went on to compare performance on the deceptive box single content trial with that on the deceptive box two contents trial for the prior belief question. We defined a correct judgement as a reference to the stereotypic content of the box and all other responses as incorrect. No significant difference between trials was found, McNemar chi square (corrected df=1, n=9)=0.08, N.S.. This suggests that when asked a prior belief question, exchanging the atypical contents did not create any further difficulty than children already experience with a standard deceptive box task with a single content.

There was however a significant difference between trials for the group of children who were asked the prior reality question. This time, the correct response in the deceptive box two content trial was to refer to the first (atypical) content. In the deceptive box single content trial, the correct response was to refer to the current content (which was also of course the first content). All other responses were coded as incorrect. Children had significantly more difficulty with the deceptive box two content trial than they did with the deceptive box single content trial: McNemar chi square (corrected, df=1, n=10)=8.1, p<.01. This is not really surprising if one

considers that to succeed on the deceptive box single content trial, children need only comment on current reality while to give a correct response on the deceptive box two content trial, children had to ignore current reality and recall a previous reality.

Table 5:6

A summary of the results of loglinear analyses assessing the effect of age, sex and order on children's performance on each trial

	DB	SC
Condition	(df=1) 39.026, p<.001	(df=1) 11.624, p<.001
Age	(df=1) 0.56, N.S.	(df=1) 0.002, N.S.
Sex	(df=1) 0.149, N.S.	(df=1) 0.090, N.S.
Order	(df=1) 8.059, p<.01	(df=1) 0.828, N.S.

Our final analyses assessed whether children's performance on the tasks was affected by their age, sex or the order in which the trials were presented. We computed two loglinear analyses entering condition, age, sex and order as factors in a saturated model. A summary of the results can be found in table 5:6. As would be expected from the earlier analyses, a significant difference was found on both trials between the two conditions (belief / reality questions). The only other significant factor identified was that the order of presentation of the trials affected performance on the deceptive box trial. Children were more likely to succeed on the deceptive box task if it followed the state change trial. No significant interactions were identified.

5:13 Discussion

When asked the reality question about the prior content of the box in the deceptive box two contents trial, children had little difficulty giving a correct response. However, when they were asked the question concerning their initial belief "When I first showed you the box, what did you think was inside?" children tended to incorrectly report the present content of the box. From

Wimmer and Hartl's (1991) account of the state change procedure, one would predict that on this novel task, when children are asked a belief question, they would again gloss it as one concerning reality. This would of course result in young children answering both the prior belief and prior reality questions in the same way. Therefore, on the deceptive box two contents task, when children are asked what they first thought was inside the box, they should respond with the box's initial content (what was inside the box) as often as they do when asked a prior reality question. However, we found that this did not happen. Children were significantly more likely to refer to the box's present content than to the box's first content when asked about their own prior belief than when asked about the earlier situation. As such, children could not be considered to have treated the two questions in the same way as would have been predicted by Wimmer and Hartl.

These are however the results that would be predicted by the reality masking hypothesis. In the deceptive box two contents procedure, the belief about the initial content was not supported by a reality counterpart as it is in the standard state change procedure. As such, the child has been deprived of a reality basis to support her belief and so current reality will attract her attention. The masking hypothesis would therefore predict the prevalence of reality errors we found in both deceptive box trials in this experiment, errors that we do not see in the state change trials in earlier experiments.

5:14 General Discussion of experiments 5:1, 5:2 and 5:3

The three studies reported in this chapter provide evidence which strongly suggests that the state change procedure, designed by Wimmer and Hartl (1991), allows the young child who would normally fail a standard false belief test to correctly identify an out of date belief. On the standard state change task children are asked to comment on their earlier outdated, true belief. Under this condition, simply commenting on the earlier situation would therefore result in a correct response. As such, Wimmer and Hartl suggest that the significant difference in children's

performance on state change and deceptive box trials is caused by the fact that to succeed on the former the child needs no understanding of the distinct relationship between belief and reality while to succeed on the latter, such an understanding is essential.

However our data speaks against this claim as experiments 5:1 and 5:2 show that many young children still give the correct response even when asked to comment on another's current false belief rather than outdated true belief. In addition, our results show that it is very unlikely that, in the state change procedure, children treat the test question (What did you think was inside?) as a question about prior reality (What was inside?). If they did, when asked to comment on their earlier false belief in experiment 5:3, they would have answered by naming the initial content. This did not happen. Instead the majority of children incorrectly made realist responses naming the current content.

When seen as a whole, the data therefore allows us to make various assumptions about the development of an understanding of mind in young children. Firstly, the proposal that children below the age of four years have no understanding of the representational nature of mind has been undermined. If children were answering according to the prior reality in the standard true belief state change then by simply changing the tense of the test question we should induce them to answer with reference to the present reality. This did not happen; even when asked about a puppet's prior false belief, children answered according to the initial content. It may have been the case that children were reaching this end result by simply glossing the test question. However, if this had happened there would have been no dissociation in responses to the two question types in experiment 5:3. It seems that in experiments 5:1, 5:2 and 5:3, in the state change trials, children succeeded because they engaged in genuine belief-based reasoning.

These results not only threaten those researchers who refuse to credit young children with any representational understanding of mind. They also challenge those who suggest that young children's problem does not encompass beliefs per se, but is instead specific to false

beliefs (Wellman, 1990). Wellman argued that young children do understand that true beliefs are representations of reality rather than reality itself, but supposed that they have difficulty with false beliefs because they use a 'copy theory'. He suggests that young children do not understand that information must be interpreted as it enters the mind from the world around. As such, they assume that reality is faithfully copied from the world into the mind. However the results from experiments 5:1 and 5:2 undermine such a view of early theory of mind. The truth of the belief was immaterial to whether or not the child successfully acknowledged it.

Not only do the data discussed in these chapters speak against certain mainstream theories of theory of mind development, but they also positively support the reality masking hypothesis. This suggests that the understanding of mind is not an all encompassing, irreversible leap from ignorance to enlightenment. Instead it has been proposed that children's mental knowledge develops throughout the preschool years at least in part as a function of the diminution of their reliance upon reality (Mitchell, 1994; Mitchell & Lacohee, 1991; Mitchell et al., 1995; Mitchell & Saltmarsh, 1994; Robinson & Mitchell, 1995). In the experiments reported in chapters 2 and 3 we suggested that if children's attention is diverted from current reality at the time she is asked to comment on her initial, false belief, facilitation in acknowledging that belief is found. In addition, many of those children who are not helped by such a technique are able to engage in belief-based reasoning if their attention is actively drawn internally and directed towards the belief. This of course happens when the belief is supported by a physical counterpart. In the state change series of experiments we have found that in many of the children tested, if the initial belief is supported by a physical reality at the time it is held to be true, it is unnecessary to give cues later on in the procedure which direct the child's attention towards the belief.

However, while children's performance was significantly better on the state change trials than it was on the deceptive box trials, in none of the experiments did their performance approach ceiling. It may be that as with the video experiments, only those children in whom the

reality bias was waning were helped to engage in belief-based reasoning by the state change procedure. Perhaps those children in whom the bias is stronger do need to be directed towards the belief at the time when the test question is asked. Nonetheless we can conclude that tasks which offer children reality-based support in making judgements about belief do allow many of those tested to reveal a precocious competence in understanding mind (Mitchell & Lacohee, 1991; Robinson & Mitchell, 1995; Steverson, 1995).

As outlined earlier, it is possible that the facilitation found on the state change task occurs in a way similar to that found on the posting task (Mitchell and Lacohee, 1991). When the box is opened and the child sees the expected content, her belief is associated with and therefore supported by the physically tangible content. As such, when the time comes for the child to respond to the test question and make a choice between the current reality option and the belief option, her attention is not automatically drawn to current reality, but rather she is in a position to make a correct judgement about the belief.

However, a modified version of the posting experiment seems to provide evidence against such an interpretation of the state change results. In the study (Freeman and Lacohee, 1995) certain conditions were included in which the child posted either a drawing, a photograph, a model or a sample of her initial belief (eg. smarties). While children were significantly better in all conditions when they posted a relevant (eg a picture of smarties) rather than irrelevant (eg. a picture of crisps) cue, they gave correct belief judgements more frequently after posting a picture than after posting any of the other cues. This seems anomalous with the findings from the state change procedure. In the state change trial, the point in the procedure at which the child sees the initial content would seem to parallel that in the posting procedure when she posts the sample. According to the reality masking hypothesis posting a sample should therefore result in performance at least as good if not better than that seen in the picture condition.

We have suggested (Saltmarsh et al., 1995) that the children did not equate the two procedures. Perhaps when they posted a picture of the smarties they were posting a token of

what they believed the box contained. However, when they posted a sample (some smarties) the children may have assumed that as the box they were looking at was unopened, the smarties therefore could not have come from that specific tube. Hence although the smarties in the sample were similar to those in that specific tube, perhaps the children did not regard them as a token of what was inside. If the sample was not regarded as a token of their initial belief, it would be unlikely to significantly affect children's subsequent acknowledgement of that belief.

This explanation cannot however fully account for Freeman and Lacohee's findings. The authors point out that while the sample was the weakest cue they presented, when children posted a model of their initial belief, performance was again not greatly improved. However, this effect may have been caused by young children's difficulty in understanding models. Evidence suggests that until the age of three years, children do not fully understand that models are both objects in their own right and symbols of other things (DeLoache, 1987, 1991). In contrast, DeLoache suggests that children understand the symbolic properties of pictures a full six months earlier. Although the subjects in Freeman and Lacohee's studies were all three years or older this may have something to do with the lack of facilitation found on this trial. Perhaps while these young children did understand the dual nature of models, they did not possess the same level of experience in dealing with models in this way as they did with pictures. This may account for the difference found between the model and picture posting conditions. When considered in such a way Freeman and Lacohee's results no longer threaten our interpretation of the state change results.

If facilitation on the state change task is caused by the child seeing the initial belief, it would seem likely that in the same way the unexpected transfer task (Wimmer and Perner, 1983) should be easier for children than the deceptive box task. In the former, the child sees Maxi place the chocolate in the cupboard. Maxi's false belief that the chocolate is in the cupboard should be easier for children to acknowledge as it has previously been supported with a reality counterpart (the child has seen the chocolate placed in the cupboard). While there is no

systematic comparison between the two tasks in the published literature, Lewis, Freeman, Hagestadt and Douglas (1994) report data which seem to support this prediction. The authors suggest that children's difficulty with false belief tests is symptomatic of their more profound difficulty with narratives. They provide evidence which suggests that young three-year-olds can acknowledge a false belief on the unexpected transfer task if they are provided with help in following the narrative. This argument however seems implausible when applied to all such procedures as children have great difficulty with the deceptive box task which does not involve a narrative. However the possibility that the unexpected transfer task may be easier for children if their problem with narrative is overcome is consistent with the reality masking hypothesis. We would suggest that when the children's difficulty with the narrative is overcome, they are able to succeed on the task because the protagonist's initial belief has been grounded in reality (the child saw where the object was initially placed).

In the three experiments reported in this chapter we have demonstrated that children who give a correct response on the state change task are doing so by acknowledging the initial belief. Experiment 5:3 supports our hypothesis that facilitation on the task is caused by the association of the initial belief and a physical reality. In the deceptive box two contents task the child's initial belief was not physically supported as it is in the state change task. On this task as on standard deceptive box tasks realist errors prevailed. It seems therefore likely that the facilitative effect found in the state change procedure is caused by the physical confirmation of the child's belief. However, before this can be concluded one further possibility must be ruled out. That is that children may acknowledge the belief on the task because there is an deceptive quality inherent in the state change procedure.

Chapter Six

> Seldom, very seldom does complete truth belong to any human disclosure, seldom can it happen that something is not a little disguised, or a little mistaken.
>
> Jane Austen, *Emma*

6:1 Deception and the state change task

In the preceding experiments, we demonstrated facilitation in young children's judgement about either an outdated true belief or a false belief in the state change procedure. We discussed this within the framework of a modified version of the reality masking hypothesis. As such we suggested that when the child's initial belief was supported by its physical counterpart (in the form of the first content) the belief was made cognitively more salient to the child who was subsequently able to override her natural reality bias and thus acknowledge the initial belief. However, although this account is supported not just by the data presented here but also by many other studies (e.g. Mitchell & Lacohee, 1991), competing explanations must also be considered.

One such explanation came to light while the data were being collected. Many of the children who succeeded on the state change trials spontaneously seemed to turn it into a deceptive procedure. After the puppet (Daffy) had left the scene, the experimenter removed the initial content and replaced it with something discrepant. At this point in the procedure, the children displayed great pleasure in the fact that they were tricking Daffy. They made comments

such as "We've hidden it from him" and "He doesn't know that we've hidden it" while at the same time laughing and giggling. This suggests that the state change task might be inherently deceptive and that this might be at least partly causal in the child's heightened ability on the task. As such, one possible explanation for our previous findings is that children became more absorbed within the procedure because they saw it as a chance to deceive the puppet. Although it is possible that the deceptive overtones could be partially responsible for the facilitation found on the state change procedure, we could not attribute the entire effect to deception. In the standard state change task (Wimmer & Hartl, 1991; Experiment 4;1, 4:2) after the contents had been exchanged, children were asked to comment on their own initial belief rather than that of another person. The original state change procedure could not possibly be construed as being embedded within a deceptive framework because the child would have to deceive herself. However, we wanted to investigate the state change task more deeply to identify whether facilitation found regarding the acknowledgment of another's false belief was caused by deception, rather than by the initial belief being associated with a reality counterpart. The aim of the following experiment is to clarify this issue.

6:2 Evidence of early understanding of deception in young children

Evidence does exist within the literature which suggests that children understand deception developmentally before they demonstrate an understanding of false beliefs on standard tasks (Chandler, Fritz & Hala, 1989; Dalke, 1995; Hala, Chandler & Fritz, 1991; Hickling & Wellman, 1995; Sullivan & Winner, 1991, 1993). The mainstream account of the development of children's theory of mind proposes that it is not until around the time of the child's fourth birthday that she achieves an understanding of false beliefs. Demonstrations of an early understanding of deception therefore seem somewhat surprising. In order to have a complete grasp of deception, the child must understand that one individual is intentionally behaving in a way that will give rise to a false belief in another. As such if a child can demonstrate a real

understanding of deception, she must understand the relationship between mental states and behaviour and as such should be credited with possessing a theory of mind. Therefore, why such a dissociation exists in young children's performance on two tasks both of which are said to involve an understanding of mind must be investigated.

However, if, as the reality masking hypothesis suggests, many young children who fail standard false belief tasks do in fact have some understanding that beliefs are distinct from reality, the demonstration of an early understanding of deception would not necessarily be surprising. It maybe that some factor within the procedures used enables the child to withdraw her attention from current reality allowing her to contemplate the mental domain. This may be especially true if the revised version of the reality masking account (c.f. 3:16) is considered. This model suggests that any stimulus which draws the child's attention away from current reality may help her contemplate the mental world.

Evidence of early deception comes in different forms. Several authors present naturalistic evidence of deception in very young children. Dunn (1991) cites a situation in which one child of twenty-one months pretended to have soiled herself in order to be allowed to use the soap. Hoffman (1975) describes a situation in which a 20-month-old girl asked her sister if she could play with one of her toys. When her sister refused, the little girl went over to her sister's favourite toy, a rocking horse, climbed on and began shouting "Nice horsey!", watching her sister all the time. This action had the desired effect. The sister raced over to the rocking horse and the first girl immediately dismounted the horse, and ran straight for the toy she had initially desired. Examples such as this suggest that a child's deceptive actions may be the earliest indicators of a developing understanding of mind. Indeed, Chandler, Fritz and Hala (1989) hypothesised that children may be more successful on tasks that involve deception than those involving more straightforward false beliefs because the hide and seek tasks used, eliminate any problems children may have with the narrative structure of the standard tasks. The authors suggest that before children are able to reason hypothetically about a character's belief

embedded in a narrative, they may be able to actively manipulate another's beliefs. To investigate this possibility, the authors showed young children a puppet hiding a treasure in one of four boxes. As the puppet moved he left a trail behind him. The child was then given the task of obstructing a second puppet's search for the treasure. In order to do this she could either wipe out the mark, lay false trails or use a combination of the two methods. Chandler et al. found that children as young as two-and-a-half were able to wipe out the original trail. With some prompting the young children also showed that they were capable of laying new false tracks to the empty boxes as well as pointing deceptively when questioned about where the treasure was.

However, there is some doubt as to whether they were intentionally acting deceptively. In order to credit children with an understanding of mind, there must be no dispute as to whether or not the way they are acting is designed to deliberately alter the beliefs of another person. Sodian, Taylor, Harris and Perner (1991) point out that unless there is a cooperative condition as well as a competitive condition in a hide-and-seek task, it cannot be known whether the child is discriminating between different strategies (i.e. they must deceive a competitor but help a friend) or is simply enjoying the strategy of wiping away the trails. It maybe that rather than acting in a truly deceptive way, the participants in Chandler et al.'s study were simply altering the behavioural choices of the competitor noninsightfully. To investigate this possibility, Sodian et al. replicated Chandler et al.'s study but also included a cooperative condition in which the child was instructed to make the task easy for a friendly person to obtain the treasure. They found that while many of the three-year-olds did employ the seemingly deceptive acts of wiping away false trails, very few were selective about when they did this, doing so in both the cooperative and competitive conditions. On the other hand, a majority of the four-year-olds tested discriminated between the two different conditions. The investigators discovered that while most of the children over the age of four spontaneously laid false trails, few three-year-olds laid such trails until it had been modelled for them by the experimenter. Indeed, once they did begin laying the trails, the three-year-olds did not tend to discriminate between conditions. In direct contrast to

the Chandler et al. findings while the older children tended to correctly point deceptively when questioned by the competitor, the younger children seemed unable to do so spontaneously and did so only after extreme prompting from the experimenter. The results therefore do strengthen the claim that children as young as three-years-old can perform deceptive behaviours. In addition, the study highlights the fact that the presence of such behaviour does not necessarily imply an understanding that the manipulation of the others' beliefs is involved. Indeed Sodian et al.'s findings suggest that children below the age of four do not possess a mentalistic understanding deception.

However, these results can be seen to be in direct contrast to those reported by Hala et al. (1991). Taking on board criticism of the 1989 study, the authors also undertook a replication, this time including a cooperative condition. Unlike the results found by Sodian et al., Hala and colleagues reported that while the subjects, who were younger than four, failed the standard task with which they were presented, they correctly attributed a false belief when questioned on the hide-and-seek task. Not only did these young children demonstrate an understanding of how an individual's beliefs are manipulated by a deceptive action through verbal report, but they also successfully discriminated between the competitive and cooperative conditions when laying false tracks. From this evidence the authors felt vindicated in concluding that not only could young children act deceptively, but they could also demonstrate an understanding of the implications of that action on another's beliefs.

There are however possible explanations for the discrepancy between the two sets of data. Sodian et al. point out that in Hala et al.'s procedure, at the beginning of the competitive trial, but not at the beginning of the cooperative trial, a trail was in place leading to the location of the treasure. Not only would this provide the child with a cue to wipe out the informative trail, but, as the only informative trail had already been laid, it would also prompt her to lay false trails. Secondly, the experimenters explicitly told subjects not to tell the opponent where the treasure was in the competitive condition, but were silent in the cooperative condition. The young

subjects would therefore be more likely to direct attention to false locations if asked where the treasure was in the competitive condition than in the cooperative condition.

After considering the results from Sodian et al.'s study, it seems that while young children below the age of four can be seen to act deceptively, the evidence that these children really are trying to manipulate another's beliefs through the use of deception is tenuous. This position is supported by evidence from several other studies (Peskin, 1992; Ruffman, Olson, Ash & Keenan, 1993; Russell, Mauthner, Sharpe & Tidswell, 1991 and Sodian 1991). All four of these studies report data which suggests that young children below the age of four do not have a complete grasp of the processes underpinning deception.

Evidence from Ruffman et al. (1993) suggests that the understanding of deception and the ability to engage in deceptive acts does not emerge in young children until some time after they succeed on tests of false belief. The authors tested three and four-year-olds on tasks in which the child had to reason from a clue left at the scene, which character the protagonist would think had taken the prize. The results suggested that even the youngest children had little difficulty doing this in an uninformed condition when they had no knowledge of the situation. However, when a false belief (rather than a hypothetical belief) was involved, most of the young children were unsuccessful. The young children were able to predict the protagonist's different (from their own), but potentially true belief, yet were unable to predict their incorrect belief. The deceptive framework of the task did not facilitate their ability to acknowledge another's false belief.

In a more interactive study, Peskin (1992) engaged children in a game in which the child could win treasure (stickers). Children were introduced to two puppets, the bad, dark blue puppet and the good, light blue puppet. They were told that while the good puppet would never choose the sticker the child wanted, the bad puppet would take whichever sticker the child indicated she desired for herself. The puppets were then removed while the child told the experimenter which sticker she preferred. When the good puppet returned the child was asked

to tell him which sticker she wanted. The puppet then chose one of the less desirable stickers. However, when the bad puppet returned the child was asked to "think of what you can say or do so that he doesn't choose the one you want" (p.89). Therefore in order to obtain the sought after sticker for herself, the child had to indicate to the puppet that she desired a sticker other than the one she really did want. Peskin found that while most three-year-olds consistently failed to deceive the bad puppet, indicating to the sticker they really did desire, they frequently tried to physically exclude the puppet. This suggests that although the young children were unable to manipulate the puppet's mental state, this was not because they misunderstood the puppet's intentions. The three-year-olds' performance can be directly contrasted with that of the five-year-olds, the majority of whom gave correct concealing responses.

These findings are similar to those reported by Russell et al. (1991) (c.f. 3:3) who investigated young children's understanding of deception using their windows task. A sweet was placed in one of two boxes both of which contained a window facing the child. The child but not the opponent could therefore see the reward inside. In order to win the sweet, the child had to point to the empty box so that the opponent would search there, leaving the baited box for herself. The authors found that the three-year-old children were unable to prevent themselves from pointing to the baited box even after they had lost the treasure to the opponent time after time.

It does seem that while children become frustrated with constantly losing the prize to the competitor, they are unable to alter their behaviour in order to win the reward. Sodian (1991), like Peskin (1992), demonstrated that while young children do not have a problem with understanding the opponents' intention, they seem unable to understand how altering another's mental state can influence their subsequent behaviour. In her study children's ability to act deceptively was compared to their ability to engage in sabotage. In the deceit condition, children were told to indicate where the treasure (toy money) was, either to the king, a friendly character who returned the treasure to the child, or to the unfriendly robber, who kept any treasure he

found for himself. In the sabotage condition the child was instructed either to lock or not lock the box which contained the treasure (one box condition) dependant on who was going to look for it, or to lock the full or empty box (two box condition) again dependent on who the seeker was. Sodian found that while all the children she tested had little problem with the sabotage condition (i.e. locked the box or left it open depending on whether the robber or king was looking), the three-year-olds consistently told the robber where the treasure was in the deceit condition. As such, while in the sabotage condition the young children demonstrated they understood the purpose of the game, they seemed unable to manipulate the character's beliefs in order to gain the treasure for themself. These results are therefore consistent with the findings suggesting that before the age of four young children have no understanding of how beliefs and behaviour are linked (Gopnik & Astington, 1988; Perner, 1988).

These findings, which suggest that young children's difficulty with such tasks is specific to the mentalistic component of deception, are challenged by Russell, Jarrold and Potel (1994). In their study, Russell et al. gave young children different versions of the windows task (c.f. 3:3). In the standard task, children had an opponent who would open the box the child pointed to and if the sweet was inside, would keep it. In the new task, although there was no opponent, to obtain the sweet the child still had to point to the empty rather than full box. Under these conditions, while the executive demands of the task were the same (to succeed children had to inhibit the prepotent response of pointing to the baited box), children did not need to manipulate another's mental states to succeed. However, the three-year-olds still tended to fail this modified task. Russell et al. conclude that it is likely that it is the executive rather than the mentalistic demands of deception that make it difficult for young children.

However while the above studies find no evidence that children as young as three-years can engage in intentional deception on hide and seek type tasks, certain other studies (Avis & Harris, 1991; Hickling & Wellman, 1995 and Sullivan & Winner, 1993) suggest that children below the age of four possess a genuine understanding of deception (demonstrating both mentalistic

and executive abilities). Avis and Harris (1991) investigated whether the development of an understanding of the relationship between mind and behaviour was universal. To do this they studied the Baka children of southeast Cameroon. In their procedure, which was tailored to fit with the lifestyle of their subjects, one experimenter induced the child to deceive a second experimenter. The first experimenter cooked some kernels and placed them in a bowl saying that he was just going away for a while but would be back to eat them later. After E1 had left, E2 told the child they were going to play a game and hide the kernels from E1. Once the child had hidden the kernels (either spontaneously or with some prompting) she was asked the test questions; (i) where E1 would look for the kernels, (ii) whether E1 would be happy or sad before looking and (iii) whether E1 would be happy or sad after looking. Avis and Harris found that while children's ability to give correct responses did increase with age, a substantial proportion of the younger children (aged between 2-11 and 4-3) successfully answered that E1 would look where he had left the kernels, would be happy before looking but then would be sad when he found they were not there. These children not only engaged in deceptive acts, but also showed an understanding that their actions affected another's behaviour and emotions.

In the Avis and Harris study, the unexpected transfer task was embedded within a deceptive framework. Under these conditions, a number of the young children were able to demonstrate their understanding of mind. Hickling and Wellman (1995) undertook a study in which children were presented with a deceptive box task with deceptive overtones. They invited children to trick the second experimenter by exchanging the expected contents of a box for something atypical. Although they were considering data across two trials, the authors found that children were significantly better when asked a belief question in the trick scenario than in the standard condition.

Sullivan and Winner (1991, 1993) were also interested in looking at children's understanding of another's false belief within a deceptive context. They hypothesised that under certain conditions, children who would normally fail a standard task may be capable of

acknowledging a false belief. In their original study (1991) the deceptive box task was presented within a deception scenario in which the child watched the experimenter remove the original contents from a box and replace them with something atypical in order to trick another child. The results showed that embedding the false belief task within a deceptive context had no effect on young children's (2-11 to 3-7) ability to acknowledge another's false belief. However, they found that when older children (3-8 to 4-0) were presented with the deceptive task, they were better able to acknowledge false beliefs than they were on the standard task.

Results obtained from the later study (1993) were however more convincing. The authors suggested that while results from the hide-and-seek task (Hala et al., 1991; Sodian et al.,1991) were inconclusive, it was possible that as Chandler et al. (1989) proposed, allowing children to participate in a hide-and-seek task would facilitate their belief based reasoning, but only if that procedure was very simple. In this study, the deceptive box task was again embedded within a trick context, but this time children were asked to deceive another person. Sullivan and Winner (1993) hypothesised that participating within the deceptive situation maybe crucial, as it would allow children to conceptualize mental states and as such enable even young three-year-olds to grasp false beliefs. This was indeed what they found, "When mental state questions are embedded within a deceptive context, even young 3-year-olds give evidence of understanding false mental states" (Sullivan & Winner, 1993. p.146).

The authors put forward several suggestions as to why young children's performance should be facilitated in the trick condition over the standard condition. Firstly they proposed that the goal of tricking another, provides children with added motivation in that they want the other person to be ignorant of how the world has changed. Secondly, they suggested that the deceptive scenario provides the false belief task with a more naturalistic setting while at the same time making the child more involved in the task. Finally, the authors hypothesised that the deceptive context may help the children acknowledge a false belief because it highlights the initial belief allowing them to focus their attention upon it. This view would therefore assume that

the child is capable of understanding that beliefs can conflict with reality but for certain reasons fails to demonstrate this competence on standard tasks. This hypothesis can be seen to be similar to that proposed by the reality masking account, "The deceptive context disrupts children's overreliance on their default bias by making salient the other's state of mind - it 'marks' the other's mental state which allows the child to reason out the response" (Sullivan & Winner, 1993, p.145).

This proposal that deception may make the initial belief more salient to the child, is not dissimilar to the idea that exposure to a physical counterpart of the belief will make the belief more salient. Both assume that for very young children reality is the dominating factor in the resolution of the standard false belief task. Thus by highlighting the belief in some way, the child is able to divert her attention away from simply considering this one reality bound option and instead consider those based upon a mental state. The two suppositions differ solely in the way they consider the initial belief to be highlighted. Indeed, if we consider the revised reality masking hypothesis (c.f. 3:16), the parallel is yet more striking. In some children success on false belief tasks is not dependant on the belief option being supported by a physical counterpart. In this subset of children, simply diverting their attention away from current reality is sufficient to allow them to contemplate their mental state and thus acknowledge a false belief. Perhaps deception would work in this way, as Sullivan and Winner suggest. The behavioural cues that generally accompany deceptive behaviour may alert children to attend to internal as well as external events.

However, the similarity between Sullivan & Winner's (1993) task and the state change task highlights the possibility of an alternative explanation for the facilitation. Although there are studies which suggest a deceptive context may facilitate children's judgements about false belief, conflicting evidence does exist. In their trick procedure, but not their standard procedure, the child's initial belief was confirmed when she opened the box. As in the state change procedure, that belief was therefore supported by a physical counterpart. In their study, Sullivan and Winner

(1993) did not include a condition in which the task was not presented as a trick, but still included the initial association of the belief with a physical marker. They therefore confounded two variables, the deceptive framework of the task and the presence of a physical embodiment of the belief. As such, it is possible that the facilitation found in their trick condition was due, not to the deceptive overtone, but wholly or partly due to having already associated the child's initial belief with a physical counterpart in a way similar to that used on the state change procedure.

Experiment 6:1

6:3 Introduction

Considering Sullivan and Winner's (1993) claim that deception has caused the facilitation present in their trick condition, it is important to investigate the role of deception in a procedure similar to both Sullivan and Winner's (1993) trick task and Wimmer & Hartl's (1991) state change task. To do this, we decided to consider how deception may affect the procedure in two distinct ways. Firstly we wanted to investigate whether the state change task we had already presented to children was in any way inherently deceptive. The simplest way to do this seemed to be to ask the children whether or not they thought it was. As such, we presented children with a state change scenario and asked them whether they felt that the protagonist had tricked the other character. However, young children may be implicitly influenced by the deceptive nature of a procedure (reflected in their correct belief judgements), while at the same time be unable to explicitly conclude that it did involve playing a trick. We therefore decided to show the same scenarios to adults. We then asked the adults how deceptive they thought the protagonist was. We aimed to end up with data from both adults and children informing us of whether or not the state change procedure was deceptive. Adults not only saw the standard state change scenario but also witnessed a deceptive box procedure. They saw these in both their standard, non-deceptive form, as well as a new explicitly deceptive form.

Secondly we wanted to see whether making the state change situation overtly deceptive

facilitated children's performance any further. This was the method used by Winner and Sullivan. Whether or not the state change procedure is perceived as being inherently deceptive, it may be that presenting it in a deceptive context would further highlight the protagonist's false belief and as such increase the number of correct belief-based responses from young children. We hoped that in presenting the data to the adults we would be able to conclude whether or not the scenarios presented were indeed as deceptive as they were intended to be.

Sullivan and Winner (1993) postulated that the facilitating effect of deception on false belief reasoning may have been caused by the child becoming more involved in the procedure. It is possible that children may succeed more often on the deceptive trials than on the non-deceptive trials simply because they were more engaging. If there had been a difference, we would not have known whether to attribute children's success to the engaging nature of the video or to its deceptive overtones. To allow for clear interpretation, the non-deceptive videos were acted in an engaging manner with the hope that this would also draw the children's attention to the action.

As we wanted to minimise any variation in presentation between subjects, each of the scenarios was presented in the form of a short video. This mode of presentation may or may not have a direct effect on the way children reacted to it. The existing literature on the optimum way in which deception tasks should be presented is inconclusive. Sullivan and Winner (1993) suggest that in contrast to the lack of facilitation found in their earlier task (1991), children's success was due to their active involvement in the procedure. This idea is supported by the findings of Chandler and Hala (1994) whose data suggest that the deceptive framework is not the key to the facilitation they found, rather it is the level of the child's involvement both in the planning and carrying out of the task which is important. They found that when children simply watched one experimenter trick another, facilitation was no where near as high as when children were involved in the task themself. On the other hand, Ruffman et al. (1993) found no difference in children's ability to acknowledge the protagonist's false belief in a deceptive scenario whether

the child herself was actively involved or simply observing. In addition, in our previous state change procedures, we found facilitation even though young children only watched the experimenter exchange the contents.

6:4 Method

Subjects

We initially tested 60 children, but four had to be excluded from further analysis because they either responded with "don't know" throughout or gave answers that were not relevant to the question. The remaining sample consisted of 56 children (29 girls and 27 boys) aged 3-1 to 4-9 (mean 3-11). By chance all the children who were excluded came from the engaging group making the numbers in each group uneven. All the children attended the nursery classes of two West Glamorgan schools both situated in lower middle class catchment areas.

The videos were rated on a deceptiveness scale by a group of 46 adults. The sample consisted of 37 females and 9 males aged 17 to 47 years (mean=21). The adults were either attending an open day in the psychology department or were psychology undergraduates.

Materials

Children were shown two short video films. The films were played using the portable video recorder described in the first video experiment. Each film consisted of either a state change procedure or a deceptive box procedure, acted in either a deceptive or an engaging manner. Within those procedures a rice krispies box (containing either rice krispies or a banana) and a large smarties tube (containing either smarties or a spoon) were used.

Procedure

There was no scripted difference between the deceptive and non-deceptive videos. However, Ness, the protagonist was overtly deceptive (e.g. sniggering behind her hand and

looking around furtively) in the deceptive video and smiley and jolly in the non-deceptive, but engaging one. All the scenes took place in a kitchen. Ness stayed in the kitchen throughout the film but Jon entered and exited as seen below. The script of the videos were as follows:

(i) Deceptive box

Ness: Hello Jon.

Jon: Hello Ness.

The experimenter pauses the video and says pointing, "This is Ness, this is Jon."

Ness: I've got a box here, what do you think is inside?

Jon: I think there are rice krispies / smarties in there. I'm going to watch playbus now / I'm going to play outside now. Bye.

Ness: Bye.

Ness looks towards the camera, talking to the viewers

I'm going to look inside and see if there really are rice krispies / smarties inside.

Ness opens the box and takes out an unexpected content.

Oh look, a banana / a spoon.

Ness puts the content back and closes the box.

Jon can't see what I'm putting back in here can he. Here comes Jon, he didn't see what I just did.

Jon: Hello Ness.

Ness: Hello Jon.

The experimenter pauses the video and asks the test questions in the following order:

Belief question: Jon hasn't looked inside the box, what does he think is inside?

Reality question: What's inside the box really?

Trick question: Is Ness trying to trick Jon?

(ii) State Change

Ness: Hello Jon.

Jon: Hello Ness.

The experimenter pauses the video and says pointing, "This is Ness, this is Jon."

Ness: I've got a box here, what do you think is inside?

Jon: I think there are rice krispies / smarties in there. I'm going to watch playbus now / I'm going to play outside now. Bye.

Ness: Bye.

Ness looks towards the camera, talking to the viewers

I'm going to look inside and see if there really are rice krispies / smarties inside.

Ness opens the box and takes out the expected content.

Oh look, rice krispies / smarties.

Ness puts the content on the worktop behind her and covers it with a cloth. She then takes another object from the side, holds it up to the camera and names it.

A banana / a spoon.

Ness puts the atypical object into the box and closes it.

Jon can't see what I'm putting back in here can he. Here comes Jon, he didn't see what I just did.

Jon: Hello Ness.

Ness: Hello Jon.

The experimenter pauses the video and asks the test questions in the following order:

Belief question: Jon hasn't looked inside the box, what does he think is inside?

Reality question: What's inside the box really?

Trick question: Is Ness trying to trick Jon?

In order to assess firstly whether the engaging state change condition was inherently deceptive and secondly whether or not our new explicitly deceptive videos were deemed to be deceptive by independent raters, the videos were shown to adults. The adult subjects were alternately assigned to one of four groups. Group 1 (6 females, 3 males, aged 17 to 47, mean= 26) saw state change videos made to be explicitly deceptive. Group 2 (8 females, 1 male, aged 17 to 31, mean=20) watched non-deceptive deceptive box videos. Group 3 (14 females, 1 male, aged 17 to 38, mean =20) watched non-deceptive state change videos and Group 4 (9 females, 4 males, aged 17 to 32, mean = 21) saw deceptive box films that were made to be explicitly deceptive. Each adult watched two videos in total, one using the rice krispies box and the other the smarties box

At the end of each video the experimenter paused the tape and asked the subjects to rate how deceptive they felt the protagonist (Ness) had been. Subjects had to mark their answer on a scale ranging from 1 to 4 (1= definitely not deceptive, 2= not deceptive, 3=deceptive, 4=definitely deceptive).

Each child was tested individually in a quiet corner of the classroom. Upon entering the test room, children were alternately split into two groups; Group 1 saw deceptive videos (consisted of 30 children; 20 girls and 10 boys; aged 3-2 to 4-9; mean 3-11); Group 2 saw non-deceptive videos (consisted of 26 children; 17 boys and 9 girls; aged 3-1 to 4-8; mean 3-11). The children each watched two videos, one deceptive box and one state change, presented in counterbalanced order. At the end of each film, the video was paused and the children were asked the three test questions which were the same for both groups and on both trials. They were firstly asked the belief question (to assess whether the child could acknowledge the protagonist's false belief); *"Jon hasn't looked inside the box, what does he think is inside?"* Secondly they were asked the reality question (to assess whether the child had understood the workings of the procedure): *"What's inside really?"* Finally children were asked the trick question (to assess whether or not the child was sensitive to any deception inherent in the procedure): *"Is*

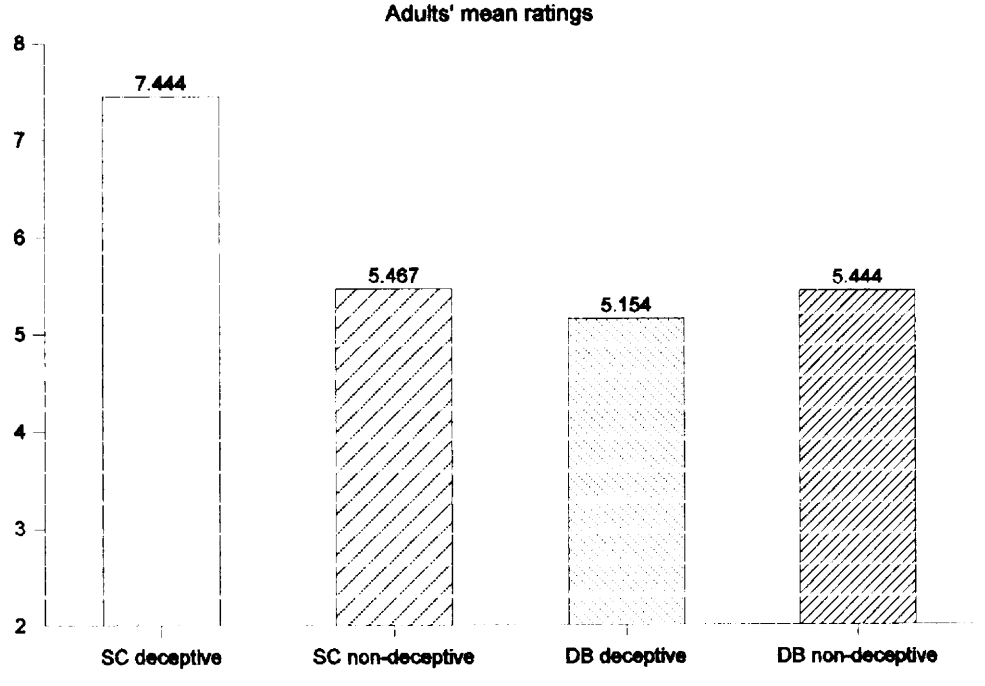
Ness trying to trick Jon?" The order of questioning was fixed because we did not want children's belief judgements to be contaminated by an explicit acknowledgement of deception as the goal. Had the trick question been asked first, this may have happened. Those who failed the reality question were excluded from subsequent analysis.

6:5 Results

Adult ratings

Our first aim was to investigate whether or not the state change procedure would be seen to be inherently deceptive and secondly, whether or not our new explicitly deceptive versions of the deceptive box and state change tasks were seen as more deceptive than the non-deceptive video. To do this we initially looked at the ratings provided by the adults. Their mean ratings for each video can be seen in figure 6:1.

Figure 6:1



Each adult saw two films, one involving a rice krispies box and the other a smarties tube. We found that there was no significant difference between their ratings for either trial, dependent on which box was seen in a specific video, $F(1,42)=0.28$, N.S.. We therefore collapsed over the two different boxes resulting in a possible score from each subject for each video of 2 to 8.

To assess whether adults rated any of the videos as more deceptive than any others we undertook a two-way analysis of variance entering the protagonist's manner (deceptive / non-deceptive) and procedure (deceptive box / state change) as factors. We found that while there was no significant main effect associated with the protagonist's manner (deceptive / non-deceptive) [$F(1,42)=2.517$, N.S.], there was a significant main effect associated with procedure (state change / deceptive box) [$F(1,42)=4.729$, $p<.05$]. This should however be interpreted in the context of the significant interaction between condition and trial; $F(1,42)=4.549$, $p<.05$.

A post hoc Newman-Keuls test was carried out to find the locus of the interaction (see figure 6:1 for adults' mean deception ratings). This revealed that adults were likely to rate the deceptive state change video as being more deceptive than all the other videos; SC deceptive / DB deceptive, $p<.05$; SC deceptive / DB non-deceptive; $p<.05$; SC deceptive / SC non-deceptive, $p<.01$.

This finding was supported when adults' mean rating for each video was compared with a hypothetical chance mean of 5. Using a one-tailed hypothesis, t-tests for the deceptive, deceptive box [$t(12)=0.26$, N.S.], non-deceptive, deceptive box [$t(8)=0.88$, N.S.] and non-deceptive, state change [$t(14)=1$, N.S.] videos all proved to be non-significant suggesting that adults did not consider the films to be deceptive. However, the t-test for the deceptive state change video was significant [$t(8)=6.49$, $p<.001$] demonstrating that adults rated this as deceptive significantly more often than would have happened according to chance.

Children's ratings

We next wanted to assess whether or not children were sensitive to any difference in the

deceptive nature of any of the films. This could manifest itself in two ways. Firstly it may be that the state change procedure is considered to be inherently deceptive (comparing state change with deceptive box). Secondly it may be that our new overtly deceptive procedure is considered to be more deceptive than the non-deceptive procedures (comparing deceptive films with engaging ones). To analyse the data, we gave all children who affirmed that Ness was trying to trick Jon (yes, she is trying to trick him), a score of 1 and all children who gave non-committal (I don't know) or negative responses (no, she's not trying to trick him) a score of 0.

Table 6:1

The number of children's 'yes' responses to the trick question

Deceptive Procedure		Non-deceptive Procedure	
Deceptive box	State change	Deceptive box	State change
25 (86%)	24 (83%)	16 (67%)	18 (75%)

As table 6:1 suggests, children did not demonstrate sensitivity to any deceptive overtones that may have been inherent to the standard, engaging state change video. In the non-deceptive condition, children were no more likely to report that they felt Ness had tricked Jon on the state change trial than on the deceptive box trial; McNemar chi square (corrected, df=1, n=4)=0.25, N.S. (see columns 3 & 4 of table 6:1). Similarly, within the deceptive condition there was no difference in children's judgements about the deceptiveness of the state change trial and the deceptive box trial; McNemar chi square (corrected, df=1, n=1)=0, N.S.. Even when we combined data from both conditions to assess children's sensitivity to trickery on state change trial compared with the deceptive box trial under both conditions, there was again no difference; McNemar chi square (corrected, df=1, n=5)=0, N.S.. On the face of it, it seems that unlike the adults the children are not sensitive to any deceptive overtones that are inherent in the state change procedure, ignoring whether or not it is presented in a deceptive framework.

Next we wanted to assess whether children were sensitive to the difference between our

new, overtly deceptive video and the non-deceptive video. As we had previously found no difference between children's judgements on state change and deceptive box trials, we collapsed over trial (state change and deceptive box) to look at the effect that the two conditions (deceptive video, engaging video) might have on children's trick judgements. Again, children's responses were coded giving each child a score of 1 for a positive response and a score of 0 for either a noncommittal response or a negative response. Each child could therefore achieve a score within the range 0 to 2. The subsequent t-test showed there to be no significant difference in children's responding dependant on whether they had seen a deceptive or a non-deceptive film, $t(38)=1.71$, N.S..

We then collapsed over condition to find out whether children showed a preference for 'yes' or 'no' answers. Testing children's ratings against a hypothetical mean, we found that children were significantly more likely to give a 'yes' response than a 'no' response [$t(49)=6.78$, $p<.001$], suggesting they were inclined to judge that Ness was trying to trick Jon.

We finally computed two hierarchical loglinear analyses to assess whether children's performance was effected by their age sex or the order in which the trials were presented. A summary of the findings can be seen in table 6:2.

Table 6:2

The results of the hierarchical loglinear analyses into the effect of age, sex, order and condition on children's responses to the trick question

	Deceptive box	State change
Condition	(df=1) 2.588, N.S.	(df=1) 0.468, N.S.
Age	(df=1) 1.511, N.S.	(df=1) 0.798, N.S.
Sex	(df=1) 0.082, N.S.	(df=1) 0.039, N.S.
Order	(df=1) 3.541, N.S.	(df=1) 2.600, N.S.

As table 6:2 shows, none of the factors significantly affected children's performance. In addition, no significant interactions were identified.

Children's responses to the belief questions

The second aim of our study was to investigate whether setting the state change and deceptive box procedures in an overtly deceptive framework facilitated their subsequent judgements concerning a false belief.

Table 6:3

The number of correct responses made on the belief question for each trial.

Deceptive		Non-deceptive	
State change	Deceptive box	State change	Deceptive box
12 (41%)	7 (24%)	14 (58%)	4 (17%)

As table 6:3 shows, children in both conditions were more likely to correctly acknowledge Jon's false belief in the state change trial, than they were in the deceptive box trial. When the data were collapsed over deceptive and non-deceptive conditions, this difference proved to be significant; McNemar chi square (corrected, $df=1$, $n=15$)=13.067, $p<.001$. When the data were analysed separately, for those children who were shown the non-deceptive video, the difference between trials proved to be significant; McNemar Chi Square (corrected, $df=1$, $n=10$)=8.1, $p<.01$. However, the difference between performance on the two trials for children who were shown the deceptive video did not reach significance; McNemar Chi Square (corrected, $df=1$, $n=5$)=3.2, N.S. While this effect was not significant, it should be pointed out that, not one of the children tested showed the pattern of succeeding on the deceptive box trial but failing the state change trial.

We then went on to consider whether there might be a difference in children's ability to acknowledge a false belief between the two conditions on each trial. To do this we undertook

two chi square analyses, one which considered the effect of condition (engaging or deceptive) on children's performance on the state change trial; chi square (df=1, n=53)=1.51, N.S.; and a second which looked at the effect of condition on performance on the deceptive box trial; chi square (df=1, n=53)=.446, N.S. On both the deceptive box trial and the state change trial, children's performance did not differ significantly whether the video they were shown was deceptive or engaging.

Next we wanted to assess whether or not there was a significant difference in children's overall performance dependant upon which condition they were in. To do this we gave each correct, belief acknowledgement a score of 1 and gave each incorrect judgement a score of 0. Each child's scores on the two trials were then summed to give an overall score (0, 1 or 2). An independent t-test showed there to be no significant difference between children's performance when shown the deceptive video and when shown the engaging video; t(51)=-0.43, N.S. Therefore children's ability to acknowledge another's false belief did not differ significantly whether it was shown within an engaging or a deceptive video.

We then went on to compare children's performance on each trial in each condition against chance. We found a pattern of results that was in concordance with those found in the previous state change experiments. On the deceptive box trials, children performed significantly below chance under both conditions; engaging condition; chi square (corrected, df=1, n=24)=9.375, p<.01; deceptive condition; chi square (corrected, df=1, n=29)=6.759, p<.01. On the state change trials children's performance did not differ significantly from chance in either condition; engaging; chi square (corrected, df=1, n=24)=0.375, N.S.; deceptive; chi square (corrected, df=1, n=29)=0.551, N.S..

Finally, two hierarchical loglinear analyses were computed in which condition, age, order and sex were entered as factors in a saturated model. A summary of the results can be seen in table 6:4.

Table 6:4

A summary of the results of the loglinear analyses regarding the effects of age, sex, order and condition on children's performance on the belief question in each trial.

	DB	SC
Condition	(df=1) 0.091, N.S.	(df=1) 1.950, N.S.
Age	(df=1) 1.058, N.S.	(df=1) 0.478, N.S.
Sex	(df=1) 1.360, N.S.	(df=1) 0.001, N.S.
Order	(df=1) 5.360, $p<.05$	(df=1) 9.027, $p<.01$

The only significant factor identified by the analysis was order. It seemed that children's performance was better on whichever trial they received first. It is likely that this was caused by children paying greatest attention to the first film they saw.

6:6 Discussion

Analysis of the adults' ratings data shows us that they felt the most deceptive video was the state change trial within the deceptive framework. They were not inclined to judge any of the other videos to be deceptive (including the state change non-deceptive video). Unlike the adults, the children did not differentiate between the deceptive nature of the various videos. However, they did generally tend to judge that the protagonist was trying to play a trick in all the videos.

Although children's responses to the trick questions did not differ over trials, their responses to the belief questions did. Facilitation in children's acknowledgment of false belief was found in the state change trial in both the non-deceptive and deceptive conditions (although it did not quite reach significance in the deception condition). Furthermore, no child showed a response pattern in which they succeeded on the deceptive box trial, but failed on the state change trial. In addition, in a comparison between conditions (deceptive / non-deceptive), no significant difference emerged. While children did not discriminate when asked the trick

question, they did when asked the belief question. Hence, the facilitation in acknowledging the belief found in the state change trial over that found in the deceptive box trial was independent of children's perception of the deceptiveness in the state change condition.

Our results are therefore fairly straightforward. In line with Sodian et al. (1991), Ruffman et al. (1993) and Peskin (1992) we found that presenting a false belief task in an overtly deceptive framework did not enhance the child's ability to later comment on the false belief. As such, we have provided further evidence to undermine Chandler et al. (1989) and Hala et al.'s (1991) claim that presenting the child with a deception task allows the child to demonstrate a previously hidden ability to attribute mental states to others.

However, one major difference between our study and the other's reported here is that in ours the child was a passive observer. In opting for greater ease of presentation, we may have allowed the child to take a step back from the action which prevented her from becoming involved. Although Ruffman et al. (1993) found no difference in performance when children participated in the deception and when they simply observed it, other researchers suggest it may effect subsequent success or failure on a task, (Chandler & Hala, 1994; Hala et al. 1991, Sullivan & Winner, 1991, 1993;). Indeed in our study the child was distanced even further from the action by virtue of the fact that the scenario was presented via a video monitor. In other studies in which the child was simply an observer, the procedure was acted out for her by the experimenter. Had our children joined in with the deception, perhaps the results would have been different.

Children were significantly more likely to correctly identify Jon's false belief when they saw the state change videos than when they saw the deceptive box videos. Comparisons between children's performance when shown the deceptive and non-deceptive videos demonstrated that our deceptive videos (which included many overtly deceptive cues) failed to further facilitate children's performance. Sullivan and Winner (1993) suggested that children's superior performance in the trick condition when compared with the standard condition was due to it being

presented within a deceptive framework. However, our results do not support this conclusion. It is more plausible that the facilitation found by Sullivan and Winner (1993) was not due to the deceptive framework in which the task was presented. It may be that the young children succeeded in their trick task because their initial belief was supported by a physical counterpart. The authors did not include a condition in which the child had her belief backed up by a physical counterpart but was not involved in an act of deception. As such the two factors, the presence of a physical counterpart to the belief and the deceptive framework were confounded. In our study where such a condition was undertaken (non-deceptive condition, state change trial), facilitation over the deceptive box trial was still found. In both this trial (non-deceptive condition, state change trial) and Sullivan and Winner's deception trial, facilitation could be attributed to the state change's possible inherent deception. However, earlier findings from own belief state change trials (Wimmer and Hartl, 1991; experiments 4:1 and 4:2) rule out this possibility. In the own belief state change trials, facilitation is found over standard deceptive box trials. While the initial belief is supported by a reality counterpart, no other individual is present, and as such there can be no inherent deceptiveness within the procedure.

In our study, presenting a false belief task in an overtly deceptive framework had no effect on children's subsequent ability to acknowledge a false belief. Facilitation occurred only in conditions in which the child's initial belief had been supported by a physical counterpart. In Sullivan and Winner's (1993) trick condition, but not in their standard condition, the child's initial belief was associated with a physical reality. It therefore seems likely that it was this, rather than the deceptive overtones which lead to the facilitation found in their trick, but not standard condition.

Chapter Seven

"Wait a moment," said Winnie-the-Pooh, holding up his paw.

He sat down and thought, in the most thoughtful way he could think. Then he fitted his paw into one of the tracks ... and then he scratched his nose twice and stood up.

"Yes," said Winnie-the-Pooh.

"I see now," said Winnie-the-Pooh.

"I have been Foolish and Deluded," said he.

A. A. Milne, *Winnie-the-Pooh.*

7:1 Summary

Having presented the data and discussed each individual experiment, I will now use the final chapter to discuss the thesis as a whole. I will begin by presenting a summary of the major findings from each of the thirteen experiments.

7:2 Summary of findings from the video series of experiments

Experiment 2:1

Children did not make significantly more correct judgements on a deceptive box task when tested either in the presence of a mirror or a video camera and monitor, than they did on the standard trial.

Interpretation

Simply allowing children to see their own contingent image did not promote objective self awareness in a way that would enable them to reason about their own prior false belief.

Experiment 2:2

In one trial, children were filmed looking at the deceptive box and forming their initial belief about its content. Children were no more likely to acknowledge their initial false belief when a small portion of this video (up to the point immediately before they comment on their belief) was replayed to them, than they were in a standard deceptive box task.

Interpretation

Simply playing back the first few minutes of the video did not heighten the child's self awareness sufficiently to allow her the self-insight needed to solve a false belief task.

Experiment 2:3

Again, children's ability to acknowledge a false belief did not improve when they were exposed to a contingent image. However, regardless of whether or not they saw their own contingent image on the video monitor, children's false belief judgements were facilitated when a small part of the video was replayed to them.

Interpretation

Showing the children a small part of the earlier video of themselves forming their initial belief allowed some of them enough self-insight to divert their attention from current reality. However, this only allowed a minority of young children to successfully acknowledge a false belief.

Experiment 3:1

Children were more likely to acknowledge their false belief if they were shown the complete video (including themself commenting on that belief), than they were on the standard task. As in experiment 2:2, the difference between the standard task and the partial playback task was not however significant.

Interpretation

Although the difference between children's performance in the partial playback and standard trials did not reach significance, more children acknowledged their belief when shown part of the

video than in the standard procedure. We suggest that partial playback of the video allowed some of the children to successfully acknowledge their false belief as it diverted their attention from current reality. Replaying the entire video to the children did not simply direct their attention away from current reality, but also actively drew it towards the false belief. This might have helped even those children with a strong reality bias to acknowledge their earlier false belief.

Experiment 3:2

When children were shown the entire video and asked "What was inside the box?" they correctly commented on the content rather than their false belief.

Interpretation

If children in the complete playback trials were simply repeating what they heard in the video rather than commenting on their false belief (using the evidence provided), they would also have done so when asked a reality question. This did not happen suggesting that in the complete playback condition, children were making genuine belief-based judgements.

Experiment 3:3

In the complete playback trials, children were as likely to give a correct response when asked a 'think' question as when asked a 'tell' question. When asked both questions, children's performance was significantly better in the video complete playback trials than it was in the standard deceptive box trials.

Interpretation

Children could use the video evidence to access their prior false belief ('think') as well as their earlier statement ('tell').

7:3 Summary of findings from the state change series of experiments

Experiment 4:1

Both clinically normal preschool children and children with autism gave significantly more correct

responses on the state change trial than on the deceptive box trial. We therefore successfully replicated Wimmer and Hartl's (1991) state change effect. In addition, while the children with autism tended to do well on the false picture tasks, the normal children's performance on these tasks was not significantly different to their performance on the deceptive box task.

Interpretation

Both groups of children gave more correct judgements on the state change trial than they did on the deceptive box trial. Evidence from the contingency tests between the trials lead us to speculate that while the children with autism may have been giving a correct response by commenting on the prior situation, the young normal children may have been succeeding through genuine belief-based reasoning.

Experiment 4:2

Young children gave correct responses when asked about a puppet's outdated belief within the state change task, as well as when asked about their own prior belief.

Interpretation

The state change effect generalised to children's judgements about another's prior true belief.

Experiment 4:3

Young children had no difficulty giving correct responses when asked about current reality within the deceptive box and state change tasks.

Interpretation

Children had no difficulty following the state change procedure. It is therefore unlikely that they give correct responses in the state change task when asked a belief question simply because they fail to attend to the second content.

Experiment 5:1

Children were significantly better at reporting a puppet's present false belief, within the state change procedure, than they were within the deceptive box procedure.

Interpretation

If children had glossed out the 'think' reference, they would have commented on current reality. Therefore, it seems that children must have been succeeding by acknowledging a false belief. This could have occurred because the child's belief response had been supported by a physical counterpart. This pattern of results would have been predicted by the reality masking hypothesis, but not by Wimmer and Hartl (1991).

Experiment 5:2

The level of success on the false belief state change task equalled that found on the true belief state change task.

Interpretation

Children were as adept on the false belief state change task as they were on the true belief version. As children did not respond to the present tense question by referring to the current situation, it is unlikely they were referring to the prior situation when responding to the true belief question in Wimmer and Hartl's state change task.

Experiment 5:3

On the deceptive box two contents task, children were significantly more likely to refer to the box's present content than to its first content when asked a prior belief question. Yet, when asked a prior reality question, they correctly reported the first content.

Interpretation

On the deceptive box two contents task, children could not have glossed the belief test question as one referring to the prior situation rather than the prior belief. Had they done so, they would have reported the box's initial content. Instead the results were as would be predicted by the

reality masking hypothesis. As the initial belief was not supported by a reality counterpart, young children had no choice but to refer to current reality.

Experiment 6:1

Children were no more likely to correctly acknowledge a protagonist's false belief in a deceptive scenario than in a non-deceptive scenario. However, they were again more likely to do so within a state change procedure than a deceptive box procedure.

Conclusion

Presenting a false belief task within a deceptive framework does not help young children acknowledge false beliefs. Previous studies which suggest such an effect (eg. Sullivan & Winner, 1993) may be confounding the effect of deception with that caused by supporting the child's belief judgement with a physical counterpart.

Interpretations of the findings

7:4 Implications of our results for the reality masking hypothesis

Our overall finding was that many young children who fail standard false belief tests do possess mentalising capacity required to succeed, but are usually unable to demonstrate this capability. We found that on a deceptive box task, if the child's initial belief was made more salient, she was subsequently more likely to acknowledge her own prior false belief (experiments 2:3, 3:1, 3:2 and 3:3), another's outdated true belief (experiments 4:1 and 4:2) as well as another's present false belief (experiment 5:1, 5:2 and 6:1) than if she had been tested using a standard task.

These results are therefore consistent with our initial hypothesis that many young children have the potential to succeed on false belief tasks, but do not do so because they naturally direct their attention to the world around them and as such fail to contemplate mental states. We originally suggested that children may be helped to succeed on these tasks if they were made objectively self-aware. In its most simplistic form, this theory was unproven. However, evidence

from our video experiments did suggest that in one specific way heightening a child's objective self-awareness may enable children to acknowledge a false belief. Duval and Wicklund (1972) suggested that merely showing an individual a stimulus that reminds her of herself would induce the child to focus her attention internally and as such become objectively self-aware. While simply exposing the child to her own contingent image had no effect on her subsequent performance, we found that replaying part of the video to her, did. We propose that both the video and state change procedures enhance the child's objective self-awareness in that they provoke her to alter the direction of her attention from its default state, regarding the external world, to an alternate state examining her own mental state. We suggested that showing the child the video of her earlier belief state induced her to attend to her own mental world rather than the external physical one. Similarly, in the state change experiments, when the child's initial belief was made physically more salient, it was easier for her to draw her attention away from current reality and instead contemplate an alternate mental state.

In many ways these results can also be seen to be consistent with the reality masking hypothesis as it has previously been stated (Mitchell, 1994; Mitchell & Lacohee, 1991; Robinson, 1994). This suggests that young children are naturally biased to attend to the physical world around them rather than to internal mental states (c.f. 3:3). On a false belief task, the child's attention will therefore be drawn to current reality and she will comment on the world as it is (the box containing pencils and the chocolate in the cupboard). However, this account does not propose that these young children lack the metarepresentational understanding required to acknowledge a false belief. Therefore if the child's initial belief is made cognitively more salient, she will be in a better position to withdraw her attention from current reality and instead contemplate her own and other's mental state. It has been hypothesised (Mitchell and Lacohee, 1991) that as the child is programmed to attend to the physical world, the most effective way to ensaliate the belief is to associate it with a physical reality. This we did when the child both saw and heard herself commenting on her initial belief in the complete playback video trials and when her belief was confirmed by the content in the state change trials. As such, these results fit very

neatly into the existing masking hypothesis.

However, the facilitation we found on the video partial playback trials make the picture appear less clear cut. In these trials children saw a small portion of the video of themself forming their initial belief. The film was paused at a point prior to the child stating what she thought the box contained. This evidence of her earlier belief could not therefore be considered to be physical as the child neither saw nor heard physical evidence of the belief itself. In experiment 2:2 and 3:1 this procedure resulted in more correct belief judgements than the standard deceptive box procedure, but the effect was not significant. However in experiment 3:2, showing the child only part of the video in this way resulted in significantly more belief-based responses than the standard trial. Although the effect was not large, children's judgements about their own prior belief were sometimes facilitated in the absence of any physical evidence.

Consequently, our findings suggest that the existing reality masking hypothesis be updated. The data do not dispute the supposition that current reality is more salient to the child than an outdated belief. However, they do suggest that providing false belief failers with physical evidence of their prior belief is not essential for subsequent belief-based responses to result. It may be that rather than the reality bias being a discrete concept, the child's reliance on reality gradually diminishes overtime. (This would of course not be evident in children's responses on the false belief task which have no permeations but correct and incorrect.) If this were true it may be that while all those children who fail standard false belief tests are biased to attend to current reality, differences may exist in the extent to which each child relies upon reality. As such, some children may require strong evidence of their prior belief in order to divert their attention from reality and acknowledge the false belief, while others will not require as much. In terms of our studies, those children who require the stronger evidence would be those who fail on the partial playback but succeed on the complete playback trial while those requiring weaker evidence would succeed in both procedures. The strong evidence is provided by the physical counterpart which draws the child's attention away from reality and directs it towards the prior belief. For those children in whom the reality bias has diminished, simply deflecting attention

away from current reality would be all the help they would require before they could contemplate a false belief. Our results therefore suggest that for the majority of children who fail standard false belief tasks, physical evidence is essential before a false belief can be acknowledged. This is consistent with the existing reality masking hypothesis. However, our results also imply that for a subset of children, whose reliance upon reality has decreased, physical evidence is not imperative. Simply deflecting the child's attention away from current reality may enable her to engage in belief-based reasoning.

7:5 The implications of our results for a representational deficit account

Our findings overall, provide evidence that is inconsistent with a representational deficit account, akin to that of Perner (1991) and Gopnik (1988) (c.f. 1:6). The basic principle proposed by this account is that children move from a 'situation theory' to a 'representation theory' of mind in one revolutionary shift sometime around the age of four years. This progression is of course marked by young children's success on standard false belief tests which has been taken to demonstrate a lack of understanding of the representational nature of mind. However, post hoc analyses of the effect of age in each experiment undermines one of the fundamental tenets of the representational theory of mind account, that is that a conceptual revolution occurs in children at the age of four. Some authors (eg, Sullivan and Winner, 1991) have tried to pinpoint the exact age at which children pass the task. However, we found that many three year-olds passed our standard task while a substantial number of four-year-olds often failed. Although the age ranges of our samples did differ from experiment to experiment, we found no consistent age effect. Significant age effects were present in the deceptive box trial in only three of the thirteen experiments.

However, the major findings from all our studies were even more condemnatory for the representational deficit account. On both our tasks (video and state change), many young children successfully acknowledged a false or outdated belief. They therefore demonstrated an understanding of belief at a point in their development before they could succeed on a standard

deceptive box task. This seems to suggest that standard false belief tests are not sensitive to the child's growing awareness of her own and other's minds. In addition it implies that an understanding of mind is not achieved in one revolutionary stage, but rather is the product of a cumulative process. This idea is further stressed by the results from the different video experiments. We found that while some children who failed the standard deceptive box task could succeed on a modified version when presented with a rather weak cue (video partial playback), other children needed stronger, more tangible evidence of their prior belief before they could successfully acknowledge their prior false belief. This finding seems to suggest a gradual development in children's ability to reason about the mind during a period preceding success on standard theory of mind tasks.

Not only does the evidence presented here stand in direct opposition to the view of a representational revolution, but it also brings into question the value of the standard false belief tests. Tasks such as the unexpected transfer and deceptive box procedures are used to label children as false belief passers or failers. That is, the false belief task is seen as the 'litmus test' (Wellman, 1990) of whether or not children understand that beliefs are distinct from reality. However, false belief tasks offer no gradations of answer; children either succeed or they fail. We have demonstrated that many of the children who fail the standard task, can acknowledge a false belief either in themself or another person and as such should be credited with at least some semblance of a theory of mind. If nothing else, the results presented here demonstrate the need for a re-evaluation, of the overreliance placed upon the standard false belief tasks as classification tools assessing whether children understand the representational nature of belief.

This proposal is supported by evidence from a study undertaken by Clements and Perner (1994) who told children unexpected transfer stories during which the child's eye movements were constantly video taped. In one version, Sam the mouse left his cheese in the blue box and went off to sleep. In the meantime, his friend Katie moved the cheese to the red box and went out. Sam then woke up and wanted his cheese. At this point in the procedure, the experimenter wondered out loud where Sam would look for his cheese. Before asking the child to predict

where he would look, the experimenter paused for a moment while the video camera recorded the direction of the child's gaze. The authors found that while most of their sample gave reality responses (red box) when asked to anticipate where the protagonist would look for the target object, before making a response, a large proportion of the children over the age of two years, eleven months, looked towards the correct location (blue box). Clements and Perner suggest that their results demonstrate that there is an implicit understanding of belief in young children before they demonstrate an explicit understanding by referring to the correct location when asked a prediction question.

These results are crucial as they suggest that children do understand something about the representational mind before they succeed on a false belief test. The study is especially important as it demonstrates this early understanding on an unmodified task in which no cues or evidence of the earlier belief are provided to the children. It is plausible that the knowledge Clements and Perner's procedure uncovers, is not simply an implicit rather than explicit understanding of belief. Rather their results may demonstrate an understanding of the representational nature of belief which is concealed when children are tested in the standard way. It may be that their data support the reality masking hypothesis in that the children's eye movements show they are considering both responses (the belief and the reality based response). However, when they are questioned in a concrete, physical way, the child is forced to make a firm decision and as reality is most salient to her, it is this option she chooses.

7:6 Implications of our findings for other accounts of the development of an understanding of mind

While our results support a modified version of the reality masking hypothesis, they could equally be seen to strengthen other accounts which attempt to explain young children's failure on standard false belief tests. Indeed several different models exist which suggest that young children who fail false belief tasks do not do so because they lack a metarepresentational understanding of belief. While these theories differ in their account of the exact nature of

children's problems with the task, in many respects they have much in common both with the reality masking hypothesis and with each other.

Perhaps the most well known of these account is that put forward by Alan Leslie (Leslie & Thaiss, 1992; Leslie, 1994) (c.f. 1:8). He suggests that by a very early age (about 18 months) young children are capable of the metarepresentational understanding required to solve a false belief task. However, they fail such tasks because they have difficulty inferring the false belief on the basis of the agent's past exposure. As such what is difficult to the young child is not acknowledging that an individual's belief may differ from reality, but attending to the correct aspects of what has happened and then using these premises to infer the belief.

Similarly, Russell and colleagues (Moore, Jarrold, Russell, Lumb, Sapp & MacCallum, 1995; Russell, Mauthner, Sharpe & Tidswell, 1991, Russell, Jarrold & Potel, 1994) have also proposed an account of theory of mind development which includes the possibility of early mentalistic understanding. In looking for the reason behind young children's failure on the tasks, they highlight the possible difficulty caused by the executive component of the task. Executive function is an umbrella term which includes behaviours such as; "planning, impulsive control, inhibition of prepotent but irrelevant responses, set maintenance, organized search and flexibility of thought and action" (Ozonoff et al. 1991). They suggest that young children have problems inhibiting the prepotent response which in the case of the false belief task would be to refer to the content of the child's own current belief (presumed reality). Moore et al. suggest that this is a problem general to the executive demands placed on the child when she is required to reason about any mental state which conflicts with her own current mental state. As such the problem is not confined to the acknowledgement of a false belief. In their study, Moore et al. (1995) demonstrate children have difficulty reasoning about another's desire when it conflicts with their own in the same way that they have difficulty reasoning about another's conflicting belief. In one of their experiments, they presented children with both an unexpected transfer false belief task and a conflicting desire task. In the conflicting desire task, children played a game, similar to Beetle Drive against a toy called Fat Cat. The aim of the game was to complete a frog jig-saw

puzzle by turning over cards specifying the pieces needed. Each card stipulated a different part of the frog. The puzzle had to be completed in a specific order so, for instance, the eyes could not be put on until the head had been gained. Initially both the child and Fat Cat wanted a red card that would allow them to take the head. However, the child always drew the red card before Fat Cat. While Fat Cat's desire therefore remained constant (he still wanted the red card) the child's desire had changed. She now wanted to draw the blue card to allow her to obtain the frog's eyes. Moore et al. found that the number of children failing the false belief test was comparable with that failing the conflicting desire test. They suggest that while the task of acknowledging a desire that conflicts with one's own present desire does not have a metarepresentational component, it places the same executive demands upon the child as acknowledging a false belief. That is that to succeed, the child must put aside her own mental state and instead contemplate that of another. As such they propose that children fail standard false belief tests because they fail to inhibit the prepotent response which is the content of their own mental state.

This component of the task is reminiscent of Harris's (1991) account of the simulational processes required to solve a false belief task (c.f. 1:9). Harris suggests that in order to simulate another's mental state, the child must first alter her default settings which would reflect her own current intentional stance. As such she would have to turn her attention away from her own current view of the world and instead contemplate the world according to another's (or her own prior) intentional stance. Taking account of the other's informational access, the child is then in a position to simulate the other's mental state. Harris suggests that children's difficulty with false belief (as opposed to pretence) is caused by the need to alter their default settings so much that their own current intentional stance is actually overwritten. According to the account, young children who are capable of pretence demonstrate their ability to engage in simulation and as such contemplate an alternate mental state. This suggests that it is not an inability to simulate that prevents young children from succeeding on false belief tasks, rather it is due to their difficulty with the process of altering their current default settings.

This argument is not dissimilar to that proposed by Peterson and Riggs (1995). These authors also suggest that young children's primary problem with false belief tasks is not a lack of understanding of the representational nature of mental states. They propose instead that young children have difficulty reasoning counterfactually. The authors presented children with several different stories. In one John and Mary put some chocolate in the fridge. John went out and Mary took the chocolate out of the fridge and used some of it to make a cake. She then ate the cake and put the remaining chocolate away in the cupboard. John came in and wanted to eat some chocolate. Children were then asked both a counterfactual reasoning question, "If Mary had not baked the cake, where would the chocolate be?" and a false belief question, "Where does John think the chocolate is?" The authors found that even when mental age was partialled out, responses to the two questions correlated. While the ability to reason counterfactually is necessary for success on both questions, children do not need to correctly identify a false belief when asked a counterfactual reasoning question. However young children failed to give a correct response for both questions. The authors hypothesise that it is the young child's inability to reason counterfactually which prevents her from succeeding on false belief tests.

All five of these accounts therefore have much in common. The overwhelming similarity is that each of the models suggest that what the child knows of current reality (or 'the rebutting answer' in the case of Peterson and Riggs) is more salient to her than the belief of another (or her own past belief). In addition, all the accounts stress that what is difficult for the young child is not the metarepresentational component of the false belief task, but rather its executive demands. That is suppressing what they currently believe about reality and instead reasoning about a mental state produced by a knowledge state that directly contradicts their own. Indeed the principle difference between the accounts is the terminology used to describe the different components which make up the process by which a child infers a false belief.

These accounts are similar in that they propose that children's paramount difficulty with the standard false belief task is their inability to reason past their own knowledge of the situation.

This separates them from Fodor's (1992) account of young children's failure, which may superficially appear comparable. He suggests that young children make realist errors on the tasks because although both older and younger children can follow both of the simple heuristics;

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.

younger children use H1 whenever it results in a "unique behavioural prediction" and use H2 only when this condition is not satisfied. Older children, on the other hand, use H1 when they think the protagonist's beliefs are true and H2 when they believe the protagonist to hold a false belief. Although this account therefore predicts positive, rather than default realist errors in young children (as would be anticipated by the representational deficit account), it does not imply an understanding of the representational nature of belief masked by the child's inability to inhibit a realist response. This crucial point separates Fodor's account from the others outlined above.

As all the accounts presuppose an ability to engage in the process of reasoning about another's belief, it seems likely that in each case, were the child presented with a modified version of the task, she may be able to demonstrate her underlying understanding of mind. While such evidence has already been provided within the framework of the reality masking hypothesis (Mitchell & Lacohee, 1991; Steverson, 1995), it would not be antagonistic to the other accounts. Leslie's modular account suggests that if the relevant aspects of the other's exposure history are made clear to the child, correct belief-based reasoning will follow. Such a procedure has been undertaken by Lewis et al. (1994), who made the relevant parts of the story in an unexpected transfer procedure more salient to the child. Under this condition, children's subsequent judgements about the protagonist's beliefs were facilitated (We did hypothesise that while the narrative may make the unexpected transfer more difficult for the child and once this obstacle is removed children can then succeed on the task because the protagonist's initial belief has been associated with a physical counterpart, [c.f. 5:11]). Similarly, Peterson and Riggs's account suggests that, suppression of the 'rebutting answer' (the information that is not known by the

protagonist) is necessary before a child can reason about a false belief. In theory, were the rebutting answer made less salient or the default answer (the initial belief) made more salient, the task of reasoning beyond the rebutting answer to the false belief should be less problematic. Considering Russell's account in a similar way, it could be hypothesised that belief-based judgements would be facilitated if the executive demands of the task were reduced. If the initial belief were made more salient to the child this may help the child inhibit the prepotent response of referring to her own current belief (or desire). A similar hypothesis could be made if the simulational account were contemplated. Here, providing the child with evidence of the false belief would make altering her default settings that much easier. As long as the child had already attained a certain level of self-awareness, she would then be in a perfect position to simulate another's mental state.

If the five different accounts are considered as a whole several different issues emerge. While the reality masking hypothesis initially suggested that young children's problem with the standard false belief tasks was specific to belief, the results from Moore et al. (1995) suggest that their difficulty is not so narrow. According to their account, young children's problems are not confined to false beliefs but are associated with all situations in which the child's current mental state conflicts with that to be considered. The results from Peterson and Riggs's study suggests that the problems associated with young children's performance on false belief tasks may be yet more far reaching. They found that when the young children had to disregard additional information they knew that was relevant to the story but irrelevant to the question, they were as bad at reasoning about a hypothetical situation as they were a false belief. This suggests that children's problem is not even limited to reasoning about mental states but is in fact a more general difficulty in suppressing information. These results are supported by Zaitchik's (1990) false photo task (c.f. 1:8). She found that in the task, similar in structure to the unexpected transfer task but without the element of belief, three-year-old children were unable to report the content of the photo (which differed from current reality). Instead they reported the present (updated) situation. Although Zaitchik concludes that the results support the idea of a general

representational deficit, they could equally be seen as evidence of a reasoning problem akin to that proposed by Peterson and Riggs. Even though the task does not involve reasoning about a mental state, young children still have difficulty reasoning past what they now know about the current situation.

The evidence we have presented fits very neatly with the accounts mentioned above. Our findings demonstrate that young children's primary problem with false belief tasks is not the inability to understand the representational nature of belief, but rather is caused by a difficulty with the executive demands placed upon the child. More specifically, they seem to be unable to inhibit the reality response. In this respect, our findings can also be seen to be consistent with the self-awareness account mentioned earlier (c.f. 2:7). Duval and Wicklund (1972) suggested that the young child is naturally subjectively self-aware and as such attends to the world around her. It is not until she achieves a state of objective self-awareness that she can contemplate her own mind. We suggest that this idea is similar to the child being biased to attend to current reality. Put another way, the child has great difficulty in acknowledging a false belief as she is inclined to focus her attention on the external world as it appears at that present time. As such, when asked to acknowledge a false belief she is very likely to make a realist error. Until she is made objectively self-aware, the young child will find it difficult to inhibit this prepotent response. What our present results tell us is that this difficulty can be overcome if the task is presented in a way which induces the child to attend to her own internal state. In both series of experiments we have shown that if the child's initial belief is made more salient, her attention can be drawn away from presumed reality Such a process would allow her to inhibit a prepotent, realist response and therefore enable her to instead contemplate the mental world. As such, we could consider that by being made objectively self-aware, the child is able to alter her default settings allowing her to simulate how she may feel were her intentional stance towards the current situation different.

7:7 Conclusion

Our results stress that while the most effective way to facilitate a child's belief judgements may be to associate the belief with a physical counterpart, this is not the only strategy which will result in success. Simply directing the child's attention away from presumed reality will allow a substantial number of children to succeed on the task. This would certainly be the result expected if one is to consider a more general account of young children's failure on the task that would incorporate many of the findings discussed above. The act of directing the child's attention away from reality would be seen as working in different ways depending upon the account considered. In general, it would lessen the child's adherence to her own current intentional stance (presumed reality), thus reducing the likelihood that she would make the prepotent response of referring to current reality and as such allow her to demonstrate her awareness of the representational nature of mental states.

References

Amsterdam, B.(1972). Mirror self-image reactions before age two. *Developmental Psychobiology,* **5** (4), 297-305.

Anderson, J.R. (1993). To see ourselves as others see us: A response to Mitchell. *New Ideas in Psychology,* **11** (3), 339-346.

Asendorpf, J. B. and Baudonniere, P. (1993). Self-awareness and other-awareness: Mirror self-recognition and synchronic imitation among unfamiliar peers. *Developmental Psychology,* **29** (1), 88-95.

Astington, J. W. and Gopnik, A. (1991). Knowing you've changed your mind: Children's understanding of representational change. In J.W. Astington, P.L. Harris and D.R. Olson (Eds.), D*eveloping Theories of mind.* Cambridge: Cambridge University Press.

Avis, J. and Harris, P.L. (1991). Belief-desire reasoning among Baka children: Evidence for a universal conception of mind. *Child Development,* **62**, 460-467.

Baron-Cohen, S. (1991). The development of a theory of mind in autism: Deviance or delay? *Pervasive Developmental Disorders,* **14** (1), 33-51.

Baron-Cohen, S., Leslie, A.M. and Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition,* **21**, 37-46.

Baron-Cohen, S., Leslie, A.M. Frith, U. (1986). Mechanical, behavioural and intentional understanding of picture stories in autistic children. *British Journal of Developmental Psychology,* **4**, 113-125.

Beaman, A.L., Klentz, B., Diener, E. and Svanum, S. (1979). Self-awareness and transgression in children: Two field studies. *Journal of Personality and Social Psychology,* **37** (10), 1835-1846.

Bischof-Köhler, D. (1988). Über den Zusammenhang von Empathie und der Fähigkeit, sich im Spiegel zu erkennen [The relationship between empathy and mirror self-recognition]. *Schweizerische Zeitschrift für Psychologie,* **47,** 147-159.

Bischof-Köhler, D. (1991). The development of empathy in infants. In M. E. Lamb and H. Keller (Eds.), *Infant development: Perspectives from German-speaking countries*. Hillsdale, NJ: Erlbaum.

Brown, J. R. and Dunn, J. (1992). Talk with your mother or sibling? Developmental changes in early family conversations about feelings. *Child Development,* **63**, 336-349.

Brown, W. L., McDowell, A. A. and Robinson, E. M. (1965). Discrimination learning of mirrored cues by rhesus monkeys. *Journal of Genetic Psychology,* **106**, 123-128.

Buss, D. M. and Scheier, M.F. (1976). Self-consciousness, self-awareness, and self-attribution. *Journal of Research in Personality,* **10**, 463-468.

Carver, C.S. (1974). Facilitation of physical aggression through objective self-awareness. *Journal of Experimental Social Psychology,* **10**, 365-370.

Carver, C.S. (1975). Physical aggression as a function of objective self-awareness and attitudes toward punishment. *Journal of Experimental Social Psychology,* **11**, 510-519.

Carver, C.S. and Scheier, M.F. (1978). Self-focusing effects of dispositional self-conciousness, mirror presence, and audience presence. *Journal of Personality and Social Psychology,* **36** (3), 324-332.

Chandler, M.J., Fritz, A.S. and Hala, S. (1989). Small scale deceit: Deception as a marker of 2-3- and 4-year-old's theories of mind. *Child Development,* **60**, 1263-1277.

Chandler, M.J., and Hala,S. (1994). The role of personal involvement in the assessment of early false belief skills. In C. Lewis and P. Mitchell (Eds.), *Children's early understanding of mind.* Hillsdale, NJ:Erlbaum.

Chapman, M. (1987). A Longitudinal study of cognitive representation in symbolic play, self-recognition, and object permanence during the second year. *International Journal of Behavioural Development,* **10** (2), 151-170.

Charman, T. and Baron-Cohen, S. (1992). Understanding drawings and beliefs: A further test of the metarepresentation theory of autism: A research note. *Journal of Child Psychology and Psychiatry,* **33** (6), 1105-1112.

Charman, T. and Baron-Cohen, S. (1995). Understanding photos, models, and beliefs: A test of the modularity thesis of theory of mind. *Cognitive Development,* **10**, 287-298.

Clements, W. A. and Perner, J. (1994). Implicit understanding of belief. *Cognitive Development,* **9**, 377-395.

Dalke, D.E. (1995). Explaining young children's difficulty in the false belief task: Representational deficits or context sensitive knowledge. *British Journal of Developmental Psychology,* **13**, 209-222.

Davis, D. and Brock, T.C. (1975). Use of first person pronouns as a function of increased objective self-awareness and performance feedback. *Journal of Experimental Social Psychology,* **11**, 381-388.

DeLoache, J.S. (1987). Rapid change in the symbolic functioning of very young children. *Science*, **238**, 1556-1557.

DeLoache, J.S. (1991). Symbolic functioning in very young children: Understanding models and pictures. *Child Development,* **62**, 736-752.

Dennett, D. C. (1978). *Brainstorms.* Montgomery, VT: Bradford.

Dunn, J. (1991). Understanding others: Evidence from naturalistic studies of children. In A. Whiten (Ed.), *Natural theories of mind.* Oxford: Basil Blackwell.

Dunn, J. (1994). Changing Minds and Changing Relationships. In C. Lewis and P. Mitchell (Eds.) *Children's early understanding of mind.* Hillsdale, NJ:Erlbaum.

Dunn, L. M., Dunn, L.M., Whetton, C., and Pintilie, D, (1982). *British Picture Vocabulary Scale.* London: NFER-Nelson.

Duval, S. and Wicklund, R.A. (1972). *A theory of objective self-awareness.* New York: Academic Press.

Exner, J.E. (1973). The self-focus sentence completion: A study of egocentrism. *Journal of Personality Assessment,* **37**, 437-455.

Flavell, J.H., Everett, B.A., Croft, K. and Flavell, E.R. (1981). Young children's knowledge about visual perception: Further evidence for the Level 1- Level 2 distinction.

Developmental Psychology, **17**, 99-103.

Flavell, J.H., Flavell, E.R. and Green, F.L. (1983). Development of the appearance-reality distinction. *Cognitive Psychology,* **15**, 95-120.

Fodor, J.A. (1992). A theory of the child's theory of mind. *Cognition,* **44**, 283-296.

Freeman, N. H. and Lacohee, H. (1995). Making explicit 3-year-olds' implicit competence with their own false belief. *Cognition,* **56**, 31-60.

Gallup, G. G., Jr. (1970). Chimpanzees: Self-recognition. *Science,* **167**, 86-87.

Gallup, G. G. Jr. (1977). Absence of self recognition in a monkey [Macaca fascicularis] following prolonged exposure to a mirror. *Developmental Psychobiology,* **10**, 281-284.

Gallup, G. G., Jr. (1982). Self-awareness and the emergence of mind in primates. *American Journal of Primatology,* **2**, 237-248.

Gallup, G.G., Jr. (1985). Do minds exist in species other than our own. *Neuroscience and Biobehavioural Reviews*, **9**, 631-641.

Gallup, G. G. Jr. and Povinelli, D. J. (1993). Mirror, mirror on the wall which is the most heuristic theory of them all? A response to Mitchell. *New Ideas in Psychology,* **11** (3), 327-335.

Gallup, G. G., Jr. and Suarez, S. D. (1986). Self-awareness and the emergence of mind in humans and other primates, In J. Suls and A. G. Greenwald (Eds.), *Psychological perspectives on the self,* (volume 3), Hillsdale, NJ: Erlbaum.

Geller, V., and Shaver, P. (1976). Cognitive consequences of self-awareness. *Journal of Experimental Social Psychology,* **12**, 99-108.

German, T. (Nov. 1994). Video evidence in false belief: Do actions speak louder than words? Paper presented at Children's Early Conception of Mind Workshop, University of Birmingham, UK.

Gerow, L. E. and Taylor, M. (1995). Children's understanding that pretense is based on mental representation. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Indianapolis.

Goodall, J. (1971). *In the shadow of man.* NY: Dell.

Gopnik, A. (1988). Conceptual and semantic development as theory change. *Mind and Language,* **3** (3), 197-217.

Gopnik, A. and Astington, J. W. (1988). Children's understanding of representational change and its relation to the understanding of false belief and the appearance-reality distinction. *Child Development,* **59**, 26-37.

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

Happé, F. G. E. (1993). Communicative competence and theory of mind in autism: A test of Relevance theory. *Cognition*, **48**, 101-19.

Happé, F. G. E. (1994). *Autism, an introduction to psychological theory,* London: UCL Press.

Harris, P. L. (1989). *Children and emotion: The development of psychological understanding.* Oxford: Blackwell.

Harris, P. L. (1991). The work of the imagination. In A. Whiten (Ed.) *Natural theories of mind.* Oxford: Blackwell.

Harris, P. L. (1992). From simulation to folk psychology: The case for development. *Mind and Language,* **7** (1,2), 120-144.

Harris, P. L. (1993). Pretending and planning. In S. Baron-Cohen, H. Tager-Flusberg, and D.J. Cohen (Eds.), *Understanding other minds: Perspectives from autism.* Oxford: Oxford University Press.

Harris, P. L. (1994). Understanding Pretence. In C. Lewis and P. Mitchell (Eds.), *Children's early understanding of mind.* Hillsdale, NJ:Erlbaum.

Harris, P. L. and Kavanaugh, R. D. (1993). Young children's understanding of pretense. *Society for Research in Child Development Monographs.* Serial No. 231.

Hickling, A. K. and Wellman, H. M. (1995, March). Preschoolers' understanding of others' mental attitudes toward pretend happenings. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Indianapolis.

Hoffman, M. L. (1975). Developmental synthasis of affect and cognition and its implications for altruistic motivation. *Developmental Psychology*, **11**, 607-622.

Hogrefe, G.J., Wimmer, H. and Perner, J. (1986). Ignorance versus false belief: A developmental lag in attribution of epistemic states. *Child Development,* **57**, 567-582.

Howes, C. and Matheson, C. C. (1992). Sequences in the development of competent play with peers: Social and pretend play. *Developmental Psychology,* **28**, 961-974.

Jarrold, C, Carruthers, P, Smith, P. K. and Boucher, J. (1994). Pretend play: Is it metarepresentational? *Mind and Language,* **9** (4), 445-468.

Johnson, C. N. (1988). Theory of mind and the structure of conscious experience. In J. W. Astington, P. L. Harris and D. R. Olson (Eds.), *Developing Theories of Mind.* New York: Cambridge University Press.

Kagan, J. (1981). *The second year.* Cambridge, MA: Harvard University Press.

Leekam, S. and Perner, J. (1991). Does the autistic child have a "metarepresentational" deficit? *Cognition,* **40**, 203-218.

Lempers, J. D., Flavell, E.R. and Flavell, J. H. (1977). The development in very young children of tacit knowledge concerning visual perception. *Genetic Psychology Monographs,* **95**, 3-53.

Leslie, A. M. (1987). Pretense and representation: The origins of "theory of mind". *Psychological Review,* **94** (4), 412-426.

Leslie, A. M. (1994). Pretending and believing: Issues in the theory of ToMM. *Cognition,* **50**, 211-238.

Leslie, A. M. and Frith, U. (1988). Autistic children's understanding of seeing, knowing and believing. *British Journal of Developmental Psychology,* **6**, 315-324.

Leslie, A. M. and Roth, D. (1993). What autism teaches us about metarepresentation. In S. Baron-Cohen, H. Tager-Flusberg and D. J. Cohen (Eds.), *Understanding other's minds: Perspectives from autism.* Oxford: Oxford University Press.

Leslie, A. M. and Thaiss, L. (1992). Domain specificity in conceptual development:

Neuropsychological evidence from autism. *Cognition,* **43**, 225-251.

Lewis, M. (1986). Origins of self-knowledge and individual differences in early self-recognition. In J. Suls and A. G. Greenwld (Eds.) *Psychological perspectives on the self,* (volume 3), Hillsdale, NJ:Erlbaum.

Lewis, M. and Brooks-Gunn, J. (1979). *Social cognition and the acquisition of self.* New York: Plenum Press.

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

Lillard, A. S. (1993). Young children's conceptualization of pretense: Action or mental representational state? *Child Development,* **64**, 372-386.

Lin, A. C., Bard, K. A. and Anderson, J. R. (1992). Development of self-recognition in chimpanzees. *Journal of Comparative Psychology,* **106** (2), 120-127.

Mitchell, P. (1994). Realism and early conception of mind: A synthesis of phylogenetic and ontogenetic issues. In C. Lewis and P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development.* Hillsdale, NJ:Erlbaum.

Mitchell, P. (1995) *Acquiring a conception of mind: Children, autism and apes.* Hillsdale, NJ: Erlbaum (forthcoming).

Mitchell, P. and Lachoee, H. (1991). Children's early understanding of false belief. *Cognition,* **39**, 107-127.

Mitchell, P., Robinson, E. J., Issacs, J. E. and Nye, R. M. (In Press). Contamination in reasoning about false belief: An instance of realist bias in adults but not children, (*Cognition*).

Mitchell, P. and Saltmarsh, R. (1994). Communicating, reading one's own mind and resisting reality. Commentary on "Cognitive mechanisms in mindreading" (S. Baron-Cohen). *Cahiers de Psychologie Cognitive,* **13** (5), 652- 660.

Mitchell, R. W. (1993). Mental models of mirror-self-recognition: Two theories. *New Ideas in Psychology,* **11** (3), 295-325.

Mitchell, R. W. and Neal, M. (1995, March). Children understand their own pretense before they

understand another's pretense. Poster presented at the Biennial Meeting of the Society for Research in Child Development, Indianapolis.

Moore, C., Jarrold, C., Russell, J., Lumb, A., Sapp, F. and MacCallum, F. (In Press). Conflicting desire and the child's theory of mind, (*Cognitive Development*).

Novey, M. S. (1975). *The development of knowledge of other's ability to see*. Unpublished doctoral dissertation, Harvard University.

Ozonoff, S., Pennington, B. F. and Rogers, S. J. (1991). Executive function deficits in high-functioning autistic individuals: Relationship to theory of mind. *Journal of Child Psychology and Psychiatry,* **32** (7), 1081-1105.

Patterson, F. (1984). Self-recognition by *Gorilla gorilla gorilla.* Gorilla [Newsletter published by the Gorilla Foundation], **7**, 2-3.

Perner, J. (1988). Developing semantics for theories of mind: From propositional attitudes to mental representation. In J. W. Astington, P. L. Harris and D. R. Olson (Eds.), *Developing theories of mind.* New York: Cambridge University Press.

Perner, J. (1991). *Understanding the representational mind.* Cambridge, MA: MIT Press.

Perner, J. (1992). Grasping the concept of representation: Its impact on 4-year-olds' theory of mind and beyond. *Human Development,* **35**, 146-155.

Perner, J. (1993). The theory of mind deficit in autism: Rethiinking the metarepresentation theory. In S. Baron-Cohen, H. Tager-Flusberg and D. J. Cohen (Eds.), *Understanding other's minds: Perspectives from autism.* Oxford: Oxford University Press.

Perner, J., Baker, S. and Hutton, D. (1994). *Prelief:* The conceptual origins of belief and pretence. In C. Lewis and P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development.* Hillsdale, NJ:Erlbaum.

Perner, J., Frith, U., Leslie, A M. and Leekam, S. J. (1989). Exploration of the autistic child's theory of mind: Knowledge, belief and commuunication. *Child Development,* **60**, 689-700.

Perner, J. and Howes, D. (1992). 'He thinks he knows': And more developmental evidence against the simulation (role taking) theory. *Mind and Language,* **1-2**, 72-86.

Perner, J., Leekam, S. R. and Wimmer, H. (1987). Three-year-olds difficulty with false belief: The case for a conceptual deficit. *British Journal of Developmental Psychology,* **5**, 125-137.

Perner, J., Ruffman, T. and Leekam, S. R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development*, **65**, 1228-1238.

Peskin, J. (1992). Ruse and representations: On children's ability to conceal information. *Developmental Psychology,* **28** (1), 84-89.

Peterson, D. and Riggs, K. J. (1995). Subtractive reasoning and false belief task: an inferential account of chidren's realist errors, (Unpublished manuscript, University of Birmingham, UK).

Povinelli, D. J. (1993). Reconstructing the evolution of mind. *American Psychologist,* **48** (5), 493-509.

Povinelli, D. J., Nelson, K. E. and Boysen, S. T. (1990). Inferences about guessing and knowing by chimpanzees. *Journal of Comparative Psychology,* **104** (3), 203-210.

Povinelli, D. J., Nelson, K. E. and Boysen, S. T. (1992b). Comprehension of role reversal in chimpanzees: Evidence of empathy? *Animal Behaviour,* **43**, 633-640.

Povinelli, D. J., Parks, K. A. and Novak, M. A. (1992a). Role reversal by rhesus monkeys, but no evidence of empathy. *Animal Behaviour,* **44**, 269-281.

Premack, D. and Woodruff, G. (1978). Does the chimpanzee have a theory of mind? *The Behavioural and Brain Sciences,* **4**, 515-526.

Riggs. K. J. and Robinson. E. J. (In Press). What people say and what they think: Children's judgements of false belief in relation to their recall of false mesages. *British Journal of Psychology.*

Robinson. E. J. (1994). What people say, what hey think, and what is really the case: Children's understanding of utterances as sources of knowledge. In C. Lewis and P. Mitchell (Eds.), *Children's early understanding of mind: Origins and development.* Hillsdale, NJ:Erlbaum.

Robinson. E. J. and Goold. J. (1992). Young children's ability to report their own superseded beliefs: Facilitation via physical embodiment, (Unpublished manuscript, University of

Birmingham, U.K.).

Robinson. E. J., Mitchell. P. and Nye, R. M. (In Press). Young children's treating of utterances as unreliable sources of knowledge. *Child Language.*

Robinson. E. J. and Mitchell. P. (1994). Young children's false-belief reasoning: Interpretation of messages is no easier than the classic task. *Developmental Psychology,* **30** (1), 67-72.

Robinson, E. J. and Mitchell, P. (1995). Masking of children's early understanding of the representational mind: Backwards explanation versus prediction. *Child Development,* **66**, 1022-1039.

Roth, D. and Leslie, A. M. (1991). The recognition of attitude conveyed by utterance: A study of preschool and autistic children. *British Journal of Developmental Psychology,* **9**, 315-330.

Ruffman, T., Olson, D. R., Ash, T. and Keenan, T. (1993). The ABCs of deception: Do young children understand deception in the same way as adults. *Developmental Psychology,* **29** (1), 74-87.

Russell, J., Jarrold, C. and Potel, D. (1994). What makes strategic deception difficult for children- the deception or the strategy? *British Journal of Developmental Psychology,* **12**, 301-314.

Russell, J., Mauthner, N., Sharpe, S. and Tidswell, T. (1991). The 'windows task' as a measure of strategic deception in preschoolers and autistic subjects. *British Journal of Developmental Psychology,* **9**, 331-349.

Rutter. M. (1978). Diagnosis and definition. In M. Rutter and E. Schopler (Eds.), *Autism: A reappraisal of concepts of treatment.* New York: Plenum.

Saltmarsh, R., Mitchell, P. and Robinson, E.J. (In Press). Realism and children's early grasp of mental representation: belief-based judgements in the state change task. *Cognition.*

Steverson. E. J. (1995). The malleability of the developing representational mind. Unpublished doctoral dissertation, University of Wales, Swansea, UK.

Sodian, B. (1991). The development of deception in young children. *British Journal of Developmental Psychology,* **9**, 173-188.

Sodian, B. and Frith, U. (1992). Deception and sabotage in autistic, retarded, and normal

children, *Journal of Child Psychology and Psychiatry,* **33**, 591-605.

Sodian, B., Taylor, C., Harris, P.L. and Perner. J. (1991). Early deception and the child's theory of mind: False trails and genuine markers. *Child Development,* **62**, 468-483.

Stroop. J. R. (1938). Factors affecting speed in serial verbal reactions. *Psychological Monographs,* **50** (5), 38-48

Sullivan, K. and Winner, E. (1991). When 3-year-olds understand ignorance, false belief and representational change. *British Journal of Developmental psychology,* **9**, 159-171.

Sullivan, K. and Winner, E. (1993). Three-year-olds' understanding of mental states: The influence of trickery. *Journal of Experimental Child Psychology,* **56**, 135-148.

Wellman, H. M. (1990). *The child's theory of mind.* MIT Press, Cambridge, Mass.

Wellman, H. M. and Bartsch, K. (1988). Young children's reasoning about beliefs. *Cognition,* **30**, 239-277.

Wicklund, R. A. (1975). Objective self-awareness. *Advances in Experimental Social Psychology,* **8**, 233-277.

Wimmer, H. and Hartl, M. (1991). Against the Cartesian view on mind: Young children's difficulty with own false belief. *British Journal of Developmental Psychology,* **9**, 125-138.

Wimmer, H. and Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition,* **13**, 103-128.

Wimmer, H. and Weichbold, V. (1994). Children's theory of mind: Fodor's heuristics examined. *Cognition,* **53**, 45-57.

Wing, L. and Gould, J. (1978). Systematic recording of behaviours and skills of retarded and psychotic children. *Journal of Autism and Childhood Schizophrenia,* **8**, 79-97.

Zahn-Waxler, C. and Radke-Yarrow, M. (1982). The development of altruism: Alternative research strategies. In N. Eisenberg (Ed.), *The development of prosocial behaviour.* NY: Academic Press.

Zahn-Waxler, C., Radke-Yarrow, M. and Brady-Smith, J. (1977). Perspective-taking and pro-

social behaviour. *Developmental Psychology,* **13**, 87-88.

Zaitchik, D. (1990). When representations conflict with reality: The preschooler's problem with false beliefs and "false" photographs. *Cognition*, **35**, 41-68.

Zaitchik, D. (1991). Is only seeing really believing?: Sources of the true belief in the false belief task. *Cognitive Development,* **6**, 91-103.