ACTING UPON VERSUS TELLING ABOUT FALSE-BELIEFS:  
A COMPARISON OF TWO PROCEDURES FOR ACCESSING  
YOUNG CHILDREN'S EARLY THEORIES OF MIND

by
SUZANNE MARIE PAULINE HALA
B.A. (Psychology), University of Victoria, 1978

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Department of Psychology
The University of British Columbia
Vancouver, Canada

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ABSTRACT

This report is intended to help arbitrate the unsettled matter of when in the course of their early cognitive development children first evidence some "theory-like" understanding of their own and others' mental lives. To this end, this study directly compared results obtained through the administration of two competing assessment procedures, each of which has been used to support conflicting claims regarding the earliest age at which children first evidence an understanding of the possibility of false beliefs.

A substantial body of recent research has contributed to a growing, but perhaps premature consensus that children under 4 years of age do not recognize the possibility of counterfactual beliefs in others and consequently lack any early theory of mind. Much of the evidence in support of this late-onset view is based upon the use of an "unexpected change" task developed by Wimmer and Perner (1983) in which children are asked to predict where an inadequately informed story character will search for an object. In contrast to these findings results obtained using a recently developed hide-and-seek task, which directly assessed children's abilities to generate misleading clues in order to produce a false-belief in another, offered strong support for a much earlier-onset position (Chandler, Fritz & Hala, in press). Despite strong methodologic reasons in favour of accepting the results of this investigation the possibility remained that the 3-year-olds in the Chandler et al. study were a special
population that might also have succeeded in the unexpected change task had they been given it. To guard against this possibility the present study provided a within-subject comparison of both the unexpected change procedure and the newer hide-and-seek procedure based on the responses of 30 children ages 3.0, 3.5 and 4.0 years. A further test of false-belief understanding was provided by asking subjects to comment directly upon their opponent's belief based on subjects' own misleading actions. As predicted even young 3-year-olds demonstrated the ability to provide misleading clues to their opponent but when faced with the unexpected change task these youngest subjects performed poorly. When responding to the false-belief question based on their own deceptive actions, however, even these youngest subjects showed strong evidence of understanding the possibility of false beliefs in others.
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CHAPTER 1: INTRODUCTION

Statement of the Problem

This thesis is intended to help arbitrate the unsettled matter of when in the course of their early cognitive development children first evidence some theory-like understanding of their own and others' mental lives. To this end, this study directly compared the results of two competing assessment procedures, each of which has been used to support conflicting claims as to the earliest age at which children first evidence an understanding of the possibility of false beliefs.

While there exists general agreement among contributors to this literature that young children do in fact acquire some theory-like knowledge of mental events sometime during their preschool years (Olson, Astington & Harris, 1988), what continues to remain unsettled is just when in their early cognitive development such evidence is first in place. For the most part, advocates of these divergent views can be divided into one or the other of two opposing camps, one of which promotes an early- and the other a late-onset view.

A Synopsis of Competing Views of Emerging Theories of Mind

According to the first or early-onset position, children as young as 2 1/2 years of age are said to be capable of some preliminary understanding of the role of mental processes in determining their own and other's actions (eg. Chandler, Fritz & Hala, in press; Leslie, 1982; Wellman, 1985, 1988, in press). By
contrast, advocates of the delayed-onset view maintain that it is not until around 4 or 5 years of age that children first give evidence of understanding the possibility of false beliefs and, consequently, can be said to hold to some theory-like understanding of mind (e.g. Gopnik & Astington, 1988; Perner, Leekam, & Wimmer, 1987).

In support of the early-onset position investigators such as Bretherton (1984), for example, point to the fact that children as young as 2 or 2 1/2 years old spontaneously employ various mental state terms in their everyday speech. Similarly, 2- and 3-year olds also show considerable competence in representing alternative models of reality as demonstrated through their ability to engage in acts of pretend play (Leslie, 1988), their skill in contrasting belief states with reality (Shatz, Wellman & Silber, 1983), their spontaneous tendency to invoke false beliefs in accounting for anomalous behaviours (Wellman, in press) and their abilities to understand the difference between real and imaginary objects, all of which support the notion that young children already possess some basic theory of mind.

In contrast to this early onset position, others have held out for what is argued to be a more exacting standard of evidence. According to this view, evidence of any theory of mind is said to require the ability to recognize that others will act upon their beliefs even when these beliefs are objectively false. Advocates of this presumably tougher minded position have regularly reported a substantially later onset time for
children's first theories of mind. Using an ingenious but complicated measurement paradigm, Wimmer and Perner (1983) and their colleagues, for example, have presented evidence said to establish that children younger than approximately 4 years of age entirely lack any demonstrable theory of mind. The "unexpected change" procedure promoted by these authors has since become a widely accepted litmus test of young children's understanding of false belief and, consequently, their first theories of mind. In this procedure subjects are told a story while it is acted out with two doll figures, both of which initially have equal access to information about the true location of an object. One doll then leaves the room and in its absence, the object is moved (i.e., its location is unexpectedly changed) to a second location. Subjects are then required to predict where they think this ill informed doll will search for the concealed object. A subsequent series of minor modifications and simplifications in this procedure (e.g. Gopnik & Astington, 1988; Hogrefe, Wimmer & Perner, 1986; Perner, Leekam & Wimmer 1987; Wimmer, Gruber & Perner, 1984, 1985) have so far done nothing to substantially alter the original finding that children regularly fail this measure until they are approximately 4 years old (for a possible exception to this generalization see Lewis, in preparation).

**An Alternative to Standard False Belief Measures**

In a recent attempt to arbitrate between the early and late onset views Chandler, Fritz and Hala (in press) introduced a
novel measurement strategy that utilized a test of children's abilities to deceive others as a method of indexing their understanding of false beliefs. In this study children between the ages of 2 1/2 and 5 years took part in a hide-and-seek game in which they were asked to hide a "treasure" from a second experimenter. Complicating this task was the fact that subjects were required to complete this hiding operation using a doll which left a clear trail of footprints that immediately gave away its movements on the playing surface. The task confronting the subject was how to hide the treasure given the presence of tell-tale tracks indicating their chosen hiding location. The measure extracted from this procedure concerned the ability of subjects to take active steps to "disinform" their opponent. On the assumption that only subjects who understood the possibility of false belief could undertake to disinform others, clear evidence of such deceit was taken as a demonstration of some already present theory of mind. With the aid of this less passive, less hypothetical and less verbally encumbered assessment strategy Chandler et al. (in press) demonstrated that when operating on their own behalf children as young as 2 1/2 years of age did engage in acts of purposeful deceit, thus demonstrating a working understanding of the possibility of false belief.

A long list of potential reasons exist as to why these two false-belief measures may have generated such different results. As already alluded to above, Wimmer and Perner's unexpected change measure involves subjects as third party bystanders who
passively observe the unfolding of a long and hypothetical narrative about a sequence of events in which they have no personal stake. They are also required to process and remember the specific informational details made available to themselves and the various story characters and consequently infer exactly what beliefs each is legitimately entitled to. The possibility also exists that the relatively poor showing of young subjects on the unexpected change measure is in part traceable to the fact that this and similarly structured measures require, not only the ability to consider the possibility of false beliefs, but also those additional expository skills necessary to tell about or comment upon such an understanding. Finally, because both measures were not administered to the same sample, the possibility remains open that the subjects of the Chandler et al. study somehow constituted an unusually precocious sample, who also might have passed the Wimmer-Perner unexpected change measure had they been given the opportunity. The present study put this last possibility to the test by providing a direct within-subject comparison of the two measurement paradigms. To this end subjects ranging in age from 3.0 to 4.5 years were tested using both of these experimental procedures. On the strength of the assumption that young 3-year-olds do in fact understand the possibility of false beliefs, but continue to fail unexpected change measures for reasons having to do with their unnecessary procedural complexity it was hypothesized that even the youngest subjects of the present study would succeed on the
deception measure but still fail the unexpected change task.

A second and conceptually more weighty counter explanation for the divergent results produced by deception and unexpected change measures concerns the prospect that the subjects of the Chandler, Fritz and Hala study, while somehow able to manipulate the behaviour of their opponent in the hide-and-seek task, did not undertake the various disinforming strategies that they employed with any intent of actually manipulating the other's beliefs. Instead, it might be argued, the young subjects in the Chandler et al. study were attempting simply to lead others into wrong behavioral choices, without any serious knowledge of or interest in their potential for holding to false beliefs. One explicit test of this reductive interpretation is to wait until subjects had completed their attempt to hide the treasure and then ask them directly about what they thought their opponent would believe about the location of the treasure and where he or she could be expected to begin their search. Responses on the part of the subjects indicating that they expected their opponent to be taken in by their deceptive efforts and to search in a false location would indicate that they understand and can give voice to the fact that these deceptive actions will cause opponents to hold beliefs that they themselves know to be false. Because it was assumed that the subjects in the earlier Chandler, Fritz and Hala study had undertaken their hiding efforts with just such a clear expectation that they were first manipulating their opponent's beliefs and only as a consequence
their actions, rather than on the basis of some simpler behavioral strategy, it was hypothesized that even the young 3-year-olds of the present study would correctly respond to questions about opponents beliefs.

Finally, it could be argued that the youngest subjects in the Chandler, Fritz and Hala study simply forgot where they had hidden the treasure and so were never in a position to consider simultaneous but contrastive notions about its true location. Were this the case, then any failure on the part of the subjects of the present study to follow what has come to be called a "reality assessment strategy" (Wellman & Bartsch, in press) by indicating that their opponent would search where the treasure was actually hidden could indicate that they had ended up deceiving themselves as well as others. That is, responses of subjects to "belief" questions regarding their assumptions about the thoughts or likely search strategies of their opponents are only interpretable in relation to their own recollections regarding the true location of the treasure. The responses of subjects who may have lost track of where they have previously hidden the treasure would allow room for uncertainty as to what is actually meant when they indicate that their opponent is likely to search in a particular location. To guard against this possible source of interpretive confusion, the present study included memory control questions in the deception procedure to ensure that subjects recalled the actual location of the treasure. Here the hypothesis was that subjects of all ages
would successfully remember where they had hidden the treasure.

Summary of Hypotheses

In summary, then, the four hypotheses that guided the present study were as follows: 1) Like the children of the Chandler, Fritz and Hala study, subjects in all age groups to be tested will commonly take steps to disinform their opponents in the hide-and-seek task; 2) Subjects of all ages will accurately remember the true hiding location of the treasure in the hide-and-seek task; 3) The youngest subjects (3-year-olds) will fail a standard version of the Wimmer-Perner unexpected change measure; while 4) The same subjects will pass a comparable "belief" question in the deception task.

Before proceeding directly to the specific methods employed to test these hypotheses, it might prove useful to follow a more detailed summary of the research literature that guided the formulation of this inquiry. The literature review provided in Appendix A is meant to supply this supporting information.
CHAPTER 2: METHOD

Procedural Summary

Subjects

A total of 33 children between the ages of 3.0 and 4.5 years of age were recruited from a metropolitan preschool in a Western Canadian city. Children whose parents gave the necessary permission were excluded from the results only if they refused to participate in some aspect of the procedure, such as manipulating the doll figure or refusing to hide the treasure in the hide-and-seek task. On the basis of this criteria three subjects were dropped prior to analysis (two 3-year-olds and one 3.5-year-old). The remaining 30 children were divided into three age groups with 10 subjects comprising each group: young 3-year-olds (range= 3.0 - 3.4, mean= 3.2, 5 males and 5 females); 3.5-year-olds (range= 3.5 - 3.9, mean= 3.8, 4 males, 6 females) and young 4-year-olds (range= 4.0 - 4.4, mean= 4.2, 4 males, 6 females).

All subjects participated in both the unexpected change task and the deception task. The order of presentation of these two measures was counterbalanced with half of the subjects being administered the unexpected change task first. The procedures were carried out in two separate testing sessions to avoid subject fatigue and task demand spillover. What will be described later as the "false-belief test question" in the deception task was always asked immediately after each subject had completed his or her own hiding efforts and immediately
before their opponent reentered the room.

**Materials**

Both the unexpected change task and the deception task involved the use of a 92 cm x 82 cm white playing surface covered with a washable oil cloth material and 20 cm high opaque plastic containers with lids (5 containers for the deception task and 2 for the unexpected change task). The unexpected change task used two 33 cm high hand puppets and a small toy car (see Figure 1) while the deception task used a kitchen sponge, a "treasure" made up of chocolate coins and small trinkets and one 33 cm puppet mounted on a wheel with projecting feet attached which rotate leaving a set of inky footprints as the puppet is moved (see Figure 2).

**Procedure**

Unexpected Change Task

As the strongest and most conservative test of the several hypotheses presented here, the most recent revision of the unexpected change task (Perner, Leekam & Wimmer, 1987) was used. This variation differs marginally from these authors' own earlier versions of this procedure primarily in that memory and reality probes are used throughout in an effort to ensure that the subjects understand and recall the rather complicated story that unfolds. Again, following Perner, Leekam and Wimmer's suggestion, "stop-and-think" instructions were included in this procedure to help prevent impulsive guessing on the part of the younger subjects. The only substantial difference between the
present "unexpected change" procedure and that described by Perner et al. was that, in order to insure the closest possible match between this procedure and the hide-and-seek task described below, some of the same testing materials were used in both measures. That is, the same containers and similar puppets were used to guard against any possible preferences for one set of stimulus materials over another that might confound subjects' performance on the tasks.

Subjects were seen individually by a single experimenter with whom the children had gained some familiarity in the classroom. The task was introduced as a short puppet show which the children were asked to watch carefully because questions were to be asked at the end. Two puppets were shown to arrive at a room that contained two different coloured (one red, one yellow) opaque containers that look like miniature plastic garbage cans. One of the puppets was carrying a small toy car. The puppets were made to play together with the car and then together put it away in the red container. The puppets were then called away for snack time and both left the room in opposite directions saying they would meet after snack to play again. One puppet (Katie) returned first and removed the toy car from the red container, played with it for a few minutes, but after hearing her teacher call her back, left the room once more. This time, however, she put the toy car in the yellow container before she left the room. Soon the second puppet (Sam) was shown about to return and his desire to once again play with the toy car was explicitly
stated. At this point the following test questions were asked of the subject: "Does Sam know where the toy car is?", "Where will Sam look for the car?". In addition to the test questions other memory and reality probes were asked to insure that the subject followed the sequence of events and remembered all the important details. As well, all of the various strategies described by Perner et al. (1987) to assist their subjects in focusing on the relevant details were included. Finally, subjects were asked to provide justifications for their responses. The adequacy of these justifications did not influence subjects' scores on the ignorance and false-belief test questions as they have previously been found to underestimate young preschool children's performance on false-belief tasks (see Perner et al., 1987) but were included here as an aid to illuminating any difficulties such young subjects may have had with the task.

The hide-and-seek task

In the interests of making the hide-and-seek task match the unexpected change measure as closely as possible, the Chandler et al. procedure was modified in several minor ways. Most notably the procedure was shortened and a standardized number of trials (3) was used rather than requiring subjects to continue until they had exhausted their repertoire of deceptive strategies. This shortening was done with the aim of minimizing any effects that simple practice with the materials and procedures might have on children's performance on later trials.

In addition, reality and memory control procedures, which
were not a part of the original Chandler et al. deception study, were introduced to determine whether the subjects remembered where they hid the treasure. This procedure once again provided a better match to the unexpected change measure, and allowed for a more judicious comparison. Finally, following each of their separate hiding efforts subjects were asked exactly the same false-belief test questions which were used in the unexpected change procedure.

Subjects again were seen individually, this time by two experimenters, both of whom were familiar to the subject. The task was introduced as a hide-and-seek game that involved hiding a small treasure somewhere on the game board so that the opponent could not find it. One experimenter (E1) remained with the subject throughout the procedure to physically assist in the hiding operation, remind the subject of the rules of the game and to ask the requisite probes and test questions. The second experimenter (E2) acted as the opponent. To ensure subjects had a grasp of the basic concepts of the game a brief warm-up trial without the puppet was conducted in which the child took one turn as first finder then as hider. These trials were not included in the scoring and were used instead as a method of introducing the goals and rules of the game. After this short warm-up a puppet named Toni was introduced. It was explained that Toni was really the owner of the treasure and it was the child’s job to help Toni hide the treasure. The experimenter then demonstrated how Toni could be made to walk across the board, and attention
was drawn to the clear trail of inky footprints that the puppet left behind. At this point the tracks were wiped away with a damp kitchen sponge that was left available for later use. The subject and E1 took the first turn in the finders' role, leaving the room while E2 hid the treasure in one of the containers. When the subject reentered the room, a clear set of footprints marked the location of the treasure. This step served to ensure that subjects made the potential connection between the footprints and the location of the treasure. If the subject failed to make use of the footprints in the search for the treasure the footprints were explicitly pointed out and the trial repeated.

In the second and most critical part of the procedure it became the subject's turn to act in the role of hider, and this time E2 left the room. The first experimenter then reminded the subject of the rule that the puppet Toni must be used to hide the treasure and simply assisted in carrying out whatever tasks were initiated by the subject. Once the treasure was hidden, thereby leaving a trail of footprints on the board, E1 reminded the subject that the goal was to make it hard for E2 to find the treasure and asked the subject how that could be done. Reality probes akin to those used in the Perner et al. unexpected change paradigm were used throughout. When the subject had completed his or her hiding efforts E1 asked "Do you remember where you hid the treasure", "show me". Finally, the two critical test questions were asked before E2 was called back: (1) The
"ignorance" question, "Will E2 know where the treasure is?"; and
(2) The "false-belief" question, "Where will E2 look?".

When E2 returned, if the subject has acted strategically, E1 surreptitiously signaled the true location of the treasure to prevent E2's accidently finding it on the first attempt. After a first failed attempt E2 was given another chance. At this point the subject was provided further opportunity for deception by being asked "Where shall we tell E2 to look now". Subjects were asked to justify or explain their hiding strategies but as with the unexpected change task these justifications did not enter into the scoring of these strategies as deceptive or nondeceptive. A maximum of two more hiding trials were then repeated exactly as described above.

Scoring

Unexpected Change Task

As in the Perner et al. (1987) study a dichotomous scoring procedure was employed. Subjects were scored as passing the false-belief test question if they responded to the question, "Where will Sam look for the toy car when he returns?" by correctly pointing to the container in which the toy car had in fact been originally placed. Subjects who followed a "reality assessment strategy" by incorrectly pointing to the container in which the toy car actually was located were scored as having failed. Similarly, subjects who responded correctly that the uninformed puppet would not know where the toy car was were
scored as passing the ignorance test question.

While not used to determine pass/fail performance on this task, subjects also were asked to justify their answers. These responses were coded dichotomously as to their adequacy.

**Hide-and-Seek Task**

Scoring for this measure of false-belief understanding is somewhat more complex than for the unexpected change procedure as there exist several possible strategies subjects could employ in attempting to deceive their opponent. Chandler, Fritz and Hala (in press), set out a typology of deception strategies into which subjects' responses were reliably placed. This five level typology orders the various strategic actions available to the subjects in terms of the certainty they provide that deception has actually occurred but this order does not reflect any assumptions regarding hierarchical relations of increasing complexity of strategies. Once actions are assigned to a specific level within this typology a further dichotomous categorization can be made into deceptive-nondeceptive actions in order to facilitate comparison with results on the unexpected change task.

The first level in this typology, level 0, categorizes as nondeceptive both those actions that are totally devoid of any apparent attempt at deception (e.g. leaving clear footprints to the location of the treasure), and also any actions that might conceivably have had deceptive intent, but were too ambiguous to be unequivocally coded as deceptive. Responses assigned to this
latter category included such actions as: a) the simple withholding of evidence by making sure that any containers that had been moved were returned to their original location; b) efforts on the part of the subject to make sure that E2 was not peeking during the hiding procedure; c) not telling E2 the location of the treasure; and d) attempts at hiding the treasure that involved some sort of "smokescreen" of irrelevant but not obscuring clues.

The remaining levels of the deception typology concern responses which go beyond attempts at simple secret keeping, and instead evidently involve some deceptive intent and action. Level 1, destroying evidence, includes those attempts to remove any clues left during the hiding procedure by wiping up the puppet's tell-tale tracks. Level 2, lying, represents subjects' attempts to mislead their opponent by suggesting that they look for the treasure in an empty container. Level 3, producing false trails, includes all attempts on the part of the subject to lay one or more sets of additional trails to some empty container. The final level, level 4, destroying evidence and producing false trails, was used whenever subjects combined the strategy of producing false trails (no. 3) with the strategy of removal of the original set of tell-tale footprints (no. 2), resulting in leaving only misleading clues for the opponent to follow. For the purposes of the data analyses to be reported below levels 0 and 1 in this scoring scheme were coded as nondeceptive and only responses scored in levels 2, 3, and 4 were counted as evidence
of clear deception.

Scoring of the false-belief test question asked during the hide-and-seek procedure is also a somewhat more complex task than for the unexpected change procedure which simply requires the subject to indicate in which of two containers the only partially informed puppet will look for the concealed toy car. While exactly the same test question was asked in the hide-and-seek task, what counts as a correct response differs from subject to subject and even from trial to trial depending upon the type of hiding strategies employed. If, for example, a subject had left only one clear, but false, set of tracks leading to an empty container, then the most rational attribution the subject could make is the E2 would search in that single falsely nominated container. If, however, the subject has produced tracks to all of the remaining containers, then the most rational response would be that E2 would be obliged to look in each and every container. In fact, many subjects spontaneously appreciated this consequence of their hiding efforts and would counter by saying "But I will tell her to look in this one" indicating one of the falsely nominated containers. There also existed the real possibility that subjects might respond in any one of several ways that were all irrational in that they were unrelated to the available evidence (e.g. suggesting that E2 would look in a container that had no clues indicating that it contained the treasure). A special case of this larger class of irrational responses is provided by responses in which the subject indicates
that E2 would look in the container that actually concealed the treasure, despite the presence of available evidence indicating otherwise. Responses of this sort are referred to here as a reality assessment strategies because subjects employing them appear to be basing their assessment of another’s beliefs upon the state of the world as it really is rather than as the other might have reason to believe it to be. Note that while the term reality assessment might in some situations connote an achievement in cognitive development in this case it carries a more negative connotation and is meant to characterize failure on the part of children to distinguish what is really the case from what their opponent has a right to believe based on the evidence available. Responses based upon such reality assessment strategies are precisely those which young 3-year-olds are said to routinely make in the unexpected change task.

Given this range of possibilities the scoring of subjects’ responses involved placing them into a dichotomous categorization of reality assessment strategies versus rational assessment strategies. The term rational assessment strategies serves as a contrast to reality assessment strategies and draws attention to the fact that subjects employing such strategies attribute to their opponents courses of action that rationally follow on the basis of evidence available to them. Although, as indicated above, it was technically possible for subjects to generate "nonrational" responses other than those resulting from the application of a simple reality assessment strategy, such
choices were rare (n=2). Whatever else they might signal, they did not indicate that the subjects understood the likely impact of available evidence upon E2's search response and so were conservatively counted here as instances of reality assessment strategies.

A similar course of action was taken in those few instances (n=2) in which subjects failed to act deceptively. While a case might have been made to exclude these subjects on the grounds that since all of the available evidence pointed to where the treasure was actually located, no real opportunity was available for subjects to employ any strategy but a reality assessment strategy. Again, in an effort to choose a course of action that did not favour the hypotheses guiding this study, these cases were counted as true instances of a reality assessment strategy.
CHAPTER 3: RESULTS

The central question which this study was intended to answer is whether children younger than 4 years of age do in fact possess some theory-like understanding of their own and others' mental lives, as evidenced by their ability to engage in deceptive hiding practices and to anticipate the consequences of these deceptive acts on the beliefs of others. The following results, which are intended to answer these questions, are organized into three sections. The first of these summarizes the findings of an attempt to replicate the results of the earlier* Chandler, Fritz and Hala study (in press), upon which this investigation was predicated. Part two describes results from a concurrent attempt to evaluate the performance of the same subjects on an alternative false-belief task, the standard "unexpected change measure" originally introduced by Johnson and Maratsos (1977) and subsequently popularized by Wimmer and Perner and their colleagues (see Perner et al. 1987). Finally, and most importantly, Part three will present the results of a novel attempt to transport the key "belief" question, upon which the interpretation of results from standard unexpected change measures regularly hinge, into the deceptive hiding paradigm featured in this study. Here the key issue is whether children who are able to actively deceive also understand that their misleading actions actually promote false beliefs in others.
Order and Sex Effects

The appropriateness of this serial approach to the presentation of the results necessarily presupposes that the separate findings from the different false-belief measures are actually independent of the order in which they were collected. Based on a oneway analysis of variance, task order was not found to have any significant effect on the performance of subjects in any of these tasks. Parenthetically, a second oneway analysis of variance revealed no significant effect for sex of subject for any of the measures, warranting the combination of the data from both male and female subjects.

Part I: Replication of the Chandler, Fritz and Hala study

As described earlier, the Chandler et al. study demonstrated that children as young as three years of age took appropriate steps to deceive an opponent in a hide-and-seek game, both supporting the conclusions that they already had a working understanding of false belief and, consequently, some operative theory of mind.

Following the scoring conventions introduced in the Chandler et al. study and further described in Chapter 2 of this research report, an initial examination of the types of deceptive strategies employed across the three age groups studied (see table 1) provides a clear demonstration that even the youngest subjects of this study did actively undertake to deceive their
opponents. In line with the high scoring reliability found in the Chandler et al. study, based on approximately 26% of subjects' responses (a total of 8 subjects) perfect (100%) agreement was obtained between two independent raters in the present study. Before proceeding to a more detailed examination of the overall results using the hide-and-seek task, however, it is important to describe just how the subjects' individual hiding efforts were summarized and assigned to each of the several scoring categories outlined in this table. In brief, although a total of three trials was allowed, a sufficiently large number of subjects (27%) completed only two hiding trials. Consequently, the analyses to be reported were based only on trials one and two. Further, because there are no grounds for assuming that any given subject's best performance would occur on one or the other of these trials, and because the intention was to assess their capacity for acting deceptively, subjects were scored in terms of their best performance across these first two trials. This scoring convention also accommodated the fact that the strategy of destroying evidence by wiping up the puppet's tracks was the initial response of choice of half (50%) of the subjects. While this is an especially effective hiding technique, the fact that such responses are less clearly interpretable as attempts at deception than are lying or the laying of false tracks, such responses were cautiously excluded from the list of unambiguous
measures of deceit. Given this practice, relying upon trial one alone or averaging trials one and two would have created a misleading picture of subjects' abilities to actively disinform others.

As can be seen from a further examination of table 1, the various types of hiding strategies used by individual subjects are distributed relatively evenly across the three age groups. As in the Chandler, Fritz and Hala study, the best single measure of the overall ability of these young subjects to deceive comes from an examination of the proportions of children at each age who evidenced any hiding efforts that can be regarded as unambiguously deceptive. Consequently, for the purpose of this analysis, those actions that could be said to only serve as "security functions" by withholding or destroying tell-tale evidence were relegated to the category of nondeceptive responses. It is important to be clear about just how conservative this stringent definition of deception actually is. There is an active literature on deception regarding human and other species (e.g. Mitchell & Thompson, 1986) most of which is satisfied to count the withholding of evidence (e.g., in this measurement paradigm simply demonstrating caution in returning containers to their original position on the playing surface) as proof of deceptive intent. The actual wiping up of the puppet's tracks which is referred to here as a strategy for "destroying evidence", involves a much more active effort on the part of subjects to reach backwards in time and eliminate tell-tale
evidence of their earlier behaviour. As such, strategies of this sort might well have been argued to be a type of disinforming act and thus, excluding these highly efficient hiding practices from the category of deception clearly works against the present hypothesis that even young 3-year-olds already possess some theory of mind. Even using this stringent criteria, and dichotomizing responses into deceptive and nondeceptive acts,

Insert table 2 about here

as can be seen by an examination of this table, almost all subjects (93%) acted deceptively. Hierarchical loglinear analysis was applied to these data starting with a saturated model and using a backward iteration to find the model of best fit. The analysis reveals that the model that the two way effects of the interaction of age and task performance are zero cannot be rejected \( (G^2 = 1.692, 2, p = .59) \) and that the one way effect of task performance provides the best fitting model for the data \( (G^2 = 1.69, 4, p = .79) \). These results indicate that there is no significant effect of age and thus are in keeping with those obtained by Chandler et al. and again provide strong support for the claim that even when very conservative scoring criteria are employed children as young as 3 years of age are capable of acting deceptively.

Part II: Standard Unexpected Change Measure

A second focus of this research was upon the responses of
these same subjects to Wimmer and Perner's standard unexpected change task. The methods employed here closely conform to the revised version of the administration and scoring procedure recently introduced by Perner et al. (1987), which included several memory and reality probes enlisted to ensure that subjects actually follow the convoluted plots required by this task. Three such control questions were asked of subjects following the unexpected change: 1) "Where is the toy car now?"; 2) "Where did Katie and Sam (the two puppets) put the toy car at the beginning?"; and 3) "Did Sam see the toy car being moved?". These control questions were answered correctly by all subjects.

**Ignorance test question.**

Subjects responded to the first test question regarding whether the absent puppet knew where the toy car was either correctly by replying "no" or incorrectly by stating "yes". As shown in table 3 the results are in line with previous research (e.g., Hogrefe, Wimmer & Perner, 1986; Perner et al., 1987; Wimmer & Perner, 1983) with almost all of the young 3-year-olds having responded incorrectly while most of the 3.5-year-olds and all of the 4-year-olds responded correctly. Hierarchical loglinear analysis demonstrates that the best fitting model is one in which age and task success interact and that a test that the two way effects of age and task success are zero is rejected ($G^2 = 21.66, 2, p < .001$).

__Insert table 3 about here__
False-belief test question

Responses of subjects to the standard "false belief" performance question of "Where will Sam Look?" were scored as either pass, when subjects indicated that Sam would act appropriately by looking in the original container (i.e., where he had last seen the car put), or fail, when subjects mistakenly indicated that Sam would look in the container that now actually held the toy car. The results shown in table 4 show that, as predicted, when using this standard unexpected change measure of false-belief understanding, the findings were comparable with those recently obtained elsewhere (e.g. Perner et al., 1987) with 80% of 3-year-olds mistakenly choosing the actual location of the toy car as the place in which Sam would search. In contrast to this poor performance most of the 3.5- and 4-year-olds correctly indicated that Sam would search in the location where he and the other puppet figure had actually left it. Hierarchical loglinear analysis indicates that a model in which the two way effects of task performance and age provides the best fit and deletion of this interaction effect significantly alters the goodness of fit ($G^2 = 11.654, 2, p < .01$).

Ignorance "Versus" False-belief

Contrary to the findings of Hogrefe et al. (1986), in which a developmental lag was found to exist between the ability of
subjects to first pass the "ignorance" question, and their subsequent ability to pass the "false-belief" question, subjects at all ages in this study consistently tended to either pass or fail both of these tasks together, with the same numbers of subjects in each age group passing the false-belief question after failing the ignorance question as showing the reverse pattern. These findings, along with the results of a within-subject analysis using McNemar's test for correlated proportions which tests the equality of two proportions, are reported in table 5 (McNemar p=1) and indicate the high consistency found in subjects' responses to the two test questions.

Insert table 5 about here

Deception versus Unexpected Change Measure

In agreement with the results reported by Chandler et al., but in sharp contrast to other findings based upon various measures of unexpected change, the results of this study again demonstrate that children well under the age of 4 years are capable of actively leading another into false beliefs about the location of hidden objects. Figure 3 depicts a direct between-groups comparison of the performance of subjects on these two tasks. Consistent with the hypotheses that guided this study, the most striking difference to be observed in these data occurs in
the young 3-year-old age group. Whereas only 20% of these young subjects pass the unexpected change measure, 90% demonstrated the ability to act deceptively in the hide-and-seek task. A within-subject comparison provides an even stronger demonstration that the 3-year-olds in this study performed significantly better on the deception task than on the unexpected change task. Table 6 shows a two by two contingency table of performance on the two competing tasks. As can be seen by an examination of this table 10 of the subjects who failed the unexpected change measure of

Insert table 6 about here

false-belief were capable of taking deceptive action in the hide-and-seek task while no subjects showed the reverse pattern. An analysis using McNemar's test for correlated proportions reveals significant differences in performance on the two tasks \( p < .01 \) indicating that subjects had more difficulty in responding correctly during the unexpected change procedure.

Part III: Predicting False Belief in the Deception Task

In spite of the impressive performance of young 3-year-olds observed on the hide-and-seek task, the question may still remain as to whether acting in this apparently deceptive way can be interpreted unambiguously as proof that these young subjects actually appreciated that their misleading actions would result in generating false beliefs in their opponents. The inclusion within the new hide-and-seek task of a parallel version of the
standard "false-belief" test question that is so central to all unexpected change measures, was intended as a direct method of settling this uncertain matter.

Before proceeding to an examination of these results, however, it was necessary to determine whether subjects themselves actually remembered where they had hidden the treasure. Subsequent to any hiding strategy, whether deceptive or nondeceptive, subjects therefore were asked "Do you remember where you hid the treasure?", "Show me". Responses were scored as correct if subjects indicated the actual location of the treasure. Across all subjects and all trials only one subject (3 years old) on only one trial did not respond correctly and needed to be reminded of the true location of the treasure. Although this subject's actions on this trial had the effect of misleading the opponent, this single trial was not included in any of the analyses.

**Ignorance Question in Hide-and-Seek task**

Additionally, prior to turning to the more central issue of assessing the adequacy of subjects' responses to the "false-belief" questions, subjects' performance on the more peripheral "ignorance question" will be briefly examined. Subjects' performance on the ignorance question in the hide-and-seek task (i.e., "Will E2 know where the treasure is?") as can be seen in table 7, shows an increase in correct responses with age.

__________

Insert table 7 about here
Hierarchical loglinear analysis indicates that the best fitting model for these data is one in which age and task performance interact and that the model that the two way effect of these variables is zero must be rejected ($G^2 = 8.725, 2, p < .05$). In line with the results from the unexpected change task, but in contrast to previous results reported by Hogrefe et al. (1986), correctly answering the ignorance question did not appear to be generally easier, especially for the youngest subjects, two of whom actually found it more difficult. These findings leave considerable room for doubt as to precisely what question such young subjects understand themselves to be answering when asked whether E2 will know where the treasure is. Given the fact that E2 was generally allowed more than one attempt at finding the treasure on each trial and that this question is temporally not well marked it remains ambiguous how even an adult should answer this question.

**False Belief Question in Hide-and-Seek Task**

In contrast to those results obtained here and elsewhere with standard unexpected change measures, 80% of the subjects in this study responded correctly to the false-belief test question of "Where will E2 look?" when it was posed in the context of their own deceptive hiding efforts. As with the hiding responses, approximately 25% of subjects’ responses to this question were scored by an independent rater for reliability with 100% agreement once again being found. As can be seen in table 8, 70% of even the young 3-year-olds succeeded in providing a "rational"
as opposed to a "reality" based response to this test question on their best deceptive trial. Loglinear analysis indicates that the model that the two way effects of age and task performance are zero cannot be rejected ($G^2 = 1.30, 2, p = .53$). The best fitting model is found for only the one way effect of task performance ($G^2 = 1.30, 4, p = .86$). A more striking way to examine these findings and how they compare to results from standard unexpected change measures is provided by the use of prediction analyses (VonEye & Brandtstadter, 1988) which compared the fit of the observed data to two competing models. For comparison purposes the first of these competing models is labelled the "conceptual deficit hypothesis" in response to the strong claim put forth by Perner et al. (1987). According to this model children younger than 3.5 to 4 were said to suffer from some unspecified "cognitive deficit" which prevents them from understanding the possibility of false-belief in others. The second model, referred to here as the "conceptual competence hypothesis", follows from the earlier Chandler, Fritz and Hala (in press) study and holds out that subjects who take effective action to disinform others actually understand that their deceptive efforts will influence the beliefs as well as the behaviours of their opponents. The conceptual deficit hypothesis generates the prediction that the 3-year-olds in the present
study might succeed in the hide-and-seek task, but would still fail unexpected change tasks by following reality assessment strategies when asked to predict where their opponent would actually search for the hidden treasure (see table 9 for cell predictions). A somewhat more generous reading of this hypothesis, based upon the recent demonstration that some 3.5-year-olds may be capable of understanding the possibility of false beliefs (Perner et al. 1987), would make this same withholding prediction only for young 3-year-olds. By contrast, the conceptual competence hypothesis holds out that even children as young as 3 years should already follow a rational assessment strategy and predict that their opponent will believe and act upon the misleading cues made available to them (see table 10 for cell predictions).

Because both the conceptual deficit hypothesis and the conceptual competence models predict that 4-year-olds will succeed at this task, subjects in this age group were not included in the analyses. The expected frequencies were distributed equally (n = 5 in each cell), as age is not free to vary across the rows. A prediction analysis based upon these and the actual observed frequencies reported in table 11 failed to
find strong support for the conceptual deficit hypothesis (del = -.4, precision = .25, z = -1.03, p(z) = .24), indicating that subscribing to this model does not significantly reduce the error in the observed as compared to expected frequency distribution. The conceptual ability hypothesis, by contrast, received much stronger support (del = .5, precision = .5, z = 2.24, p(z) = .03). The precision value associated with predictions based upon this hypothesis, while relatively low, is higher than that obtained for the conceptual deficit hypothesis. When the dels of these two competing hypotheses are compared in terms of their overall predictive power, the difference between them was found to be significant (z = 3.83, p<.001) indicating that the conceptual ability hypothesis involves significantly more error reduction than the conceptual deficit hypothesis.

Justifications

In addition to their actual performance on the unexpected change and the hide-and-seek tasks, subjects were asked for justifications of their responses on both these measures. While these justifications were scored dichotomously in both cases, the exact nature of the questions posed and the appropriate responses were somewhat different in each task.

The Unexpected Change Task

After making their predictions about where Sam would look
for the car in the standard unexpected change task subjects were asked "Why will he look there?" and appropriate responses were held to be those that made some reference to Sam's likely and legitimate beliefs, or his lack of opportunity to have a more up to date opinion as to the car's new location. For example, if a subject answered "because that's where they put the car" the response was scored as correct even though it did not express other pertinent facts, such as that Sam did not see the car being moved. If, however, subjects responded with only some "desire" statement (e.g. "He wants to play with the car"), or said nothing at all, their justification was scored as inadequate. For this analysis all subjects were included and those that failed to correctly answer the false-belief test question necessarily were scored as offering no adequate justification for Sam's false belief. The results as shown in table 12 indicate that in this measurement context the adequacy of such justifications increases

Insert table 12 about here

with age. Hierarchical loglinear analysis reveals that the model that the two way effects of age and adequate justification of responses are zero is rejected ($G^2 = 15.38, 2, p < .001$) and that a model in which these two variables interact provides the best fit with the data. Much of the responsibility for this significant finding is traceable, however, to the fact that most of the young subjects had already failed to predict that Sam's belief would be mistaken and so could scarcely be expected to
justify beliefs that they did not hold.

The Hide-and-Seek Task

After E2 had searched for and failed to find the treasure in the hide-and-seek task subjects were asked to "Tell E2 how you made it hard for her to find the treasure". If subjects were able to explain their actions verbally or if they physically demonstrated their strategy to E2 they were judged as having adequately justified their deceptive actions. As with the unexpected change task, an adequate response to this question was dependent upon subjects having first somehow acted deceptively. The frequency of adequate justifications across age groups is reported in table 13. Hierarchical loglinear analysis was applied to these data producing the finding that the model in which the two way effects of age and proportion of adequate justifications are zero must be rejected ($G^2 = 6.56$, 2, $p < .05$) and that a model in which these two variables interact provides the best fit for the data.
CHAPTER 4: DISCUSSION

Details and Implications of the Research Findings

The central question addressed in this study was whether children as young as three years of age do already demonstrate an understanding of the possibility of false belief, and consequently to possess some real if fledgling theory of mind. The present results clearly replicated earlier findings reported by Chandler, Fritz and Hala (in press) by once again demonstrating that children as young as three years of age are able to take active steps to disinform others about some true state of affairs, further strengthening the earlier conclusion that, well before their fourth birthday, such young preschoolers are well aware that others are capable of holding false beliefs. Nevertheless, these same children typically continue to fail Wimmer and Perner's unexpected change measure. The different difficulty levels of these two measures was clearly demonstrated by the fact that while 90% of the 3-year-olds tested were able to provide solid evidence of their ability to disinform others, only 20% of this sample would have been judged capable of understanding the possibility of false belief had they been evaluated using only the Wimmer-Perner measure. This evidence provides stronger support for the conclusion that, contrary to popular opinion, the standard unexpected change measure does not provide a minimally complex method for estimating young children's earliest understanding of false beliefs. Other
features of these data also serve to counter various methodologic critiques to which the earlier Chandler et al. study remained open. For example, the findings of this study confirm that the children who served as subjects in this study did not differ in any important respect from other samples previously administered the unexpected change procedure, thus diffusing any argument that the success of subjects here or in the Chandler, Fritz and Hala study could be due to having stumbled upon some specially competent subject sample. Similarly, the finding that subjects of all ages actually remembered where they had hidden the treasure speaks strongly against the possibility that they somehow lost track of the treasure's true location and thus failed to understand the contrast between where the treasure was in fact and where E2 might mistakenly believe it to be.

Had this study ended with this replication effort the possibility would still have remained that, despite their demonstrated efforts to disinform their opponents, these 3-year-olds only imagined themselves to be manipulating the behaviour, but not the mental states or beliefs of others. That is, it might still have been argued that the deceptive efforts of these subjects simply represented some behavioral strategy carried out in total ignorance of the effect their actions might have upon the beliefs of their opponent. It is for just this reason that the Wimmer-Perner unexpected change measure of false-belief understanding has rested its case upon children's success or failure in predicting the search behaviour of an only partially
informed puppet character. The consistent argument has been that only subjects who have already mastered a conception of the possibility of false belief could anticipate that others will behave in ways that run contrary to events as they actually are by following courses of action consistent with the misleading information at their disposal.

When applied to children's own apparent attempts to mislead an opponent the false belief test question provides a useful check on whether such hiding efforts are in fact based on some comprehension of other's capacity for false belief. The fact that most of the 3-year-old children in this study accurately predicted their opponent's likely future actions based on the misleading clues that they themselves had left lends strong credence to the claim that their deceptive actions are based upon an understanding of and an attempt to influence the beliefs of others.

Despite the fact that between 70 and 90% of the subjects in all age groups tested appropriately responded to questions concerning where their opponent would search for the hidden treasure by indicating one or more of the locations indicated by the misleading cues they themselves had generated (i.e. followed what is referred to here as a "rational assessment strategy"), and did not predict others would search in the location where the treasure was actually hidden (i.e. a "reality assessment strategy"), as would have been the case if they actually were unaware of the possibility of false beliefs, these findings might
be still be challenged on the grounds that some of these results might be an artifact of the fact that in the present assessment context there are deceptive strategies that provide more ways of being "rational" than "realistic". That is, while the treasure is naturally always in a single hiding location and, consequently, there is only one response that could qualify as an instance of a "reality assessment strategy", the same is not true for responses that qualify as "rational". This follows because when children have left deceptive cues that nominate more than one possible hiding location, pointing to any or all of these locations as a likely place to search is equally "rational". In short, such a line of argument would attempt to minimize the significance of the observation that young subjects so frequently followed this rational course by pointing to the fact that these results might be a simple consequence of there being more opportunity for randomly generated responses to be coded as rational. While it is judged unlikely that the subjects of this study were responding in such a random fashion, a check on this possibility may be had by examining only those cases where subjects had falsely nominated a single container as the likely hiding place, either by laying a single set of false tracks or by some other means such as misaligning only one of the empty containers. Looking at every instance of such a single falsely nominated container across all subjects and all trials, a total of 23 such occurrences were found. Of these, 78% of the responses given were rational assessment strategies. Among the
four 3-year-olds who used such a single-false-track strategy 75% (3) similarly answered with a rational assessment strategy, indicating that E2 would look only in the container marked by the tracks. Clearly then, even when the possibility of a correct response by chance is maximally reduced, these young subjects continued to act in ways that suggest that their opponent would be led by available evidence to believe something which they themselves knew to be false.

A second argument that might be levelled against the claim put forth here that subjects' "rational responses" indicate an underlying concept of false-belief understanding is that when subjects were asked where E2 would look they simply misinterpreted such questions as something like "Where do the tracks lead?". A counter to this argument can be provided by an examination of only those cases where subjects took steps to eliminate all tell-tale tracks. While the hiding strategy of leaving no tracks does not qualify as unambiguously deceptive in the scoring typology used here, such a strategy does provide an opportunity to observe how subjects proceed in the absence of perceptual clues (i.e. footprints). That is, if it is to be argued that the subjects of this study succeeded in answering "belief" questions simply by noting where the available tracks led, then any subjects using such a primitive strategy should fail to respond in a seemingly "rational" way whenever all such cues were missing. As a test of this possibility all of the responses of subjects that resulted in the playing surface being
left empty of tracks was examined separately. Of the 24 hiding efforts that met this criterion 79% resulted in predictions indicating that E2 would need to look in all of the containers, or in some single false container because the subject would tell her to do so. Such appropriate responses speak against any suggestion that subjects simply based their predictions upon the availability of the perceptual cues provided by various false trails.

Taken together, all of these findings are seen to provide strong evidence in support of the conclusion that even young 3-year-olds already understand the possibility of false belief and consequently already possess some fledgling theory of mind.

Limitations and Suggestions for Future Research

Despite the clear abilities shown by the youngest subjects of this study numerous questions remain about just what specific features of the unexpected change task prevent 3-year-olds from adequately demonstrating their ability in that measurement context. As outlined earlier, some of the difficulties young persons experience with unexpected change measures of false belief may simply reflect the fact that these procedures are age inappropriate or unnecessarily complex. In the unexpected change task, for example, subjects are passive observers who must process, comprehend and remember a complex set of conditions that affect a story character's access to relevant information. In contrast, in the deception task subjects are active participants
who invent their own manner of instilling false beliefs in another. While such procedural differences might provide a sufficient explanation for the different results provided by these two tasks, this conclusion must await an empirical demonstration.

Another question that this study does not address is what might be considered the lower age boundary of possessing a rudimentary theory of mind. In this study young 3-year-old children were shown to be quite capable, not only of attempting to deceive another but of being able to comment upon what the deceived other would actually believe. While children younger than 3 years were not included here, Chandler et al. found that even 2 1/2-year-old children typically attempted to deceive the others in the same hide-and-seek game. These young subjects were not asked specifically about the likely false beliefs of their opponent, however, and given that 2 1/2-year-old children have very limited verbal abilities it is possible that these youngest subjects could not have adequately answered the false-belief question, despite their often successful hiding efforts. It would be imprudent however to conclude that such a failure would necessarily rule out an emerging understanding of false belief. Instead, such failure could simply indicate that children under the age of 3 years are unable to effectively follow such complex questions or lack the ability to comment upon the false beliefs of others, despite their ability to utilize such knowledge in their interpersonal interactions.
To tap the lower age boundary of this ability it may be necessary to look beyond even the present deception measure and to turn to an examination of the spontaneous attempts of toddlers to deceive others in everyday social settings. While naturalistic observations of this sort are likely to underestimate the presence of such deceptive actions, due to their relatively infrequent nature, it may be possible to access such actions through the use of various diary methods.

Over and above any future attempts to better establish the lower age boundary of young children’s first theories of mind, there remain numerous interesting and unanswered questions concerning the likely additional steps that young persons pass through in eventually arriving at an adult-like theory of mind. Studies aimed at better understanding this process are a necessary part of any agenda aimed at achieving an adequate understanding of children’s developing theories of mind.
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Table 1

Hiding Strategies by Age

<table>
<thead>
<tr>
<th>Hiding Strategy</th>
<th>3.0 yrs</th>
<th>3.5 yrs</th>
<th>4.0 yrs</th>
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<tr>
<td>Withholding</td>
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<td>1</td>
<td>0</td>
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<tr>
<td>Tampering</td>
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<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lying</td>
<td>0</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Disinforming</td>
<td>6</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Disinforming plus Tampering</td>
<td>3</td>
<td>6</td>
<td>5</td>
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</table>

\( a \ n = 10 \) each age group
Table 2

<table>
<thead>
<tr>
<th>Presence or Absence of Deceptive Strategy by Age</th>
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<tbody>
<tr>
<td>Hiding Strategy</td>
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<tr>
<td></td>
</tr>
<tr>
<td>Non-Deceptive</td>
</tr>
<tr>
<td>Deceptive</td>
</tr>
</tbody>
</table>

Note. Non-deceptive strategy included simple withholding and wiping up tracks.

Deceptive strategy included lying in conjunction with other strategy, providing false clues, providing false clues and destroying actual evidence.

\[ n = 10 \] each age group
Table 3

Performance on Ignorance Question in Unexpected Change Task by Age

<table>
<thead>
<tr>
<th>Ignorance question</th>
<th>3.0 yrs</th>
<th>3.5 yrs</th>
<th>4.0 yrs</th>
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<tr>
<td>Fail</td>
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<tr>
<td>Pass</td>
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<td>7</td>
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\( \text{a } n = 10 \text{ each age group} \)
<table>
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<tr>
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<th>Age a</th>
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<td>Pass</td>
<td>2</td>
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</table>

\textsuperscript{a} n = 10 each age group
Table 5
Ignorance by False Belief in Unexpected Change Task

<table>
<thead>
<tr>
<th>False Belief question</th>
<th>Ignorance Question</th>
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<th></th>
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<td>1</td>
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<tr>
<td>Fail</td>
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<td></td>
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<tr>
<td>Pass</td>
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<td>22</td>
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</table>

McNemar (N = 30), p = 1.0
Table 6

Within Subject Comparison of Hide-and-Seek and Unexpected Change Tasks

<table>
<thead>
<tr>
<th>False Belief Task</th>
<th>Deception</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>No</td>
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<tr>
<td>Fail</td>
<td>2</td>
</tr>
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<td>Pass</td>
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</tbody>
</table>

McNemar \((N = 30)\), \(p < 0.1\)
Table 7

Performance on Ignorance Question in Hide-and-Seek Task by Age

<table>
<thead>
<tr>
<th>Ignorance question</th>
<th>Age ³</th>
<th>3.0 yrs</th>
<th>3.5 yrs</th>
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<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Pass</td>
<td>5</td>
<td>8</td>
<td>10</td>
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</table>

a n = 10 each age group
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<thead>
<tr>
<th>Strategy</th>
<th>Age 3.0 yrs</th>
<th>Age 3.5 yrs</th>
<th>Age 4.0 yrs</th>
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<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rational</td>
<td>7</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Assessment</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) n = 10 each age group
### Table 9
Predicted Cells for Conceptual Deficit Hypothesis

<table>
<thead>
<tr>
<th>Age</th>
<th>Reality Assessment</th>
<th>Rational Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 yrs</td>
<td>P&lt;sup&gt;b&lt;/sup&gt;</td>
<td>NP&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.5 yrs</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>4.0 yrs</td>
<td>NP</td>
<td>P</td>
</tr>
</tbody>
</table>

<sup>a</sup> n = 10 each age group  
<sup>b</sup> P = Permitted Cells  
<sup>c</sup> NP = Non-permitted Cells
Table 10

Predicted Cells for Conceptual Competence Hypothesis

<table>
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<th>Rational Assessment</th>
</tr>
</thead>
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<td>P&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.5 yrs</td>
<td>NP</td>
<td>P</td>
</tr>
<tr>
<td>4.0 yrs</td>
<td>NP</td>
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</tbody>
</table>

<sup>a</sup> n = 10 each age group  
<sup>b</sup> P = Permitted Cells  
<sup>c</sup> NP = Non-permitted Cells
### Table 11

**Observed Frequencies for False Belief Question in Hide-and-Seek Task**

Response to False Belief test question

<table>
<thead>
<tr>
<th>Age</th>
<th>Reality Assessment</th>
<th>Rational Assessment</th>
</tr>
</thead>
<tbody>
<tr>
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<td>3</td>
<td>7</td>
</tr>
<tr>
<td>3.5 yrs</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

*a n = 10 each age group*
### Table 12

**Justification of Responses on Unexpected Change Task by Age**

<table>
<thead>
<tr>
<th>Justification</th>
<th>3.0 yrs</th>
<th>3.5 yrs</th>
<th>4.0 yrs</th>
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<tr>
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<tr>
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<td>0</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

\( n = 10 \) each age group
Table 13

Justification of Responses on Hide-and-Seek Task by Age

<table>
<thead>
<tr>
<th>Justification</th>
<th>3.0 yrs</th>
<th>3.5 yrs</th>
<th>4.0 yrs</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>Yes</td>
<td>6</td>
<td>8</td>
<td>8</td>
</tr>
</tbody>
</table>

\( n = 10 \) each age group
FIGURE 1

Experimental Setup for Unexpected Change Procedure
FIGURE 2

Experimental Setup for Hide-and-Seek Procedure
FIGURE 3

Comparison of Performance
Between Unexpected Change Task and Hide-and-Seek Task
Figure 3

Comparison of Performance Between Unexpected Change Task and Hide-and-Seek Task

<table>
<thead>
<tr>
<th>Years</th>
<th>Unexpected Change Task</th>
<th>Hide-and-Seek Task</th>
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</thead>
<tbody>
<tr>
<td>3 yrs</td>
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</tr>
<tr>
<td>3.5 yrs</td>
<td>75</td>
<td>50</td>
</tr>
<tr>
<td>4 yrs</td>
<td>100</td>
<td>75</td>
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APPENDIX A

REVIEW OF THE LITERATURE

Evidence Supporting Early- Versus Late-Onset Positions

The Early-Onset View

According to the early onset view there are converging lines of evidence, all of which suggest children considerably younger than 4 years of age already show evidence of possessing a rudimentary intentional-state psychology or theory of mind (e.g. Wellman, 1985). From this perspective interlocking lines of evidence are seen to converge which suggest that children as young as 2 or 2 1/2 years understand the distinction between beliefs and the real world events to which those beliefs refer.

One line of evidence in support of this early-onset view comes from the literature concerning young children’s abilities to engage in acts of pretense. According to Leslie (1982; 1988) pretend play requires not only a representation of the world as it is, but also a metarepresentation of these same events that allows for a "decoupling" of such primary representations from their normal referents. From this perspective the emergence of pretend play constitutes a dramatic shift in the child’s metarepresentational abilities (McCune-Nicolich, 1981) of the sort usually associated with the emergence of some early theory of mind. While the first such pretend gestures emerge around 12 months of age, a literature review carried out by Fein (1981)
suggests that these alternative representations of reality continue to be private and idiosyncratic until some time around 15 to 20 months. It is this emergence of social pretend play that appears to mark the developmental place at which children first come to understand that others can represent representations, thus laying the groundwork for the emergence of a fledgling theory of mind. That is, while non-social pretense would appear to require some metarepresentations (Leslie, 1988), social pretend play would seem to necessarily require the ability both to hold to such a metarepresentation and also to clearly understand that such a metarepresentation is simultaneously held by others. Depending upon the context, social pretend play has been demonstrated to be a part of the repertoire of children as young as 2 years of age. Lucariello (1987), for example, found that in a familiar play context 24 to 29 month-olds initiated pretend play with their mothers. Similarly, in a naturalistic context involving preschool peers, Howes (1985) found that all children over 30 months, 67% at 27-28 months and 50% at 21-23 months engaged in cooperative social pretend play. Dunn and Dale (1984) also found that in sibling interaction 2-year olds and even some 18-month olds shared in pretend games with older siblings. Clearly then, by around 2 to 3 years of age children seem capable of engaging in pretend play with another thus demonstrating their ability to represent that the other was also pretending.

A second line of evidence in support of the claim that
children younger than 4 years of age already possess some initial theory of mind is provided by studies into children's spontaneous use of mental state terms. At around 2 1/2 years, for example, children have been shown to spontaneously employ a variety of mental state verbs such as think, remember, know, wish, hope and want (Bretherton 1984; Bretherton & Beeghly, 1982; Bretherton, McNew & Beeghly-Smith, 1981; Shatz, Wellman and Silber, 1983; Wellman 1985). Referencing such evidence, Bretherton and Beeghly (1982) have argued that having some beginning theory of mind is an essential prerequisite for being able to express a knowledge of internal states.

While simply parroting such intentional state terms obviously is insufficient evidence for concluding the presence of a theory of mind, there also is evidence that strongly suggests these children have a basic if not fully elaborated grasp of the conventional meaning of these terms. In a longitudinal study of the naturally occurring speech of children aged 2 to 3 1/2 Hood and Bloom (1979), for example, found that their young subjects made frequent and appropriate references to psychological causation. Similarly, Johnson and Wellman (1980) have demonstrated that their 2 1/2 to 3-year olds bracket together such mental terms and understand them as belonging to categories different from the actions and events to which they refer. Further evidence against the possibility that such young children simply parrot mental terms comes from Wellman (1985) and Shatz, Wellman and Silber (1983) who found that by around 2
1/2 years children seem to use at least the more salient of these mental state verbs in contrastive ways that clearly distinguish them from their external referents. In a more recent study Wellman and Estes (1986) found that the majority of 3 year old subjects could correctly answer questions concerning criteria for distinguishing mental and nonmental events and made very few errors when sorting real and nonreal events. These findings taken together strongly suggest that by three years of age children can understand not only that a mental world exists apart from reality, but also that the beliefs that populate their world have no counterpart in, or otherwise diverge from, things as they actually are.

Related research into children's understanding of their own and others' emotional lives makes a similar point and indicates that even very young preschoolers make appropriate connections between various mental entities and the affectively charged actions to which they are linked. Stein and Levine (1985), for example, found that 3-year olds are able to anticipate the appropriate emotional responses called for when either a match or mismatch occurs between someone's desires and the actual outcomes that ensue. Similarly, Poulin-Dubois and Shultz (1988) found that by 2 1/2 to 3 years of age children were able to attribute intention to others and to view various actions in relation to the intentions that prompt them. That preschool children readily make such connections strongly suggests that their use of mental terms goes beyond mere mouthing of the words and again implies a
basic understanding of how such mental entities might affect actions.

Very young children have also demonstrated that they have some conception of just where mental entities originate from and some basic notions of how they are governed. In a study of children's understanding of the brain and the mind (Johnson & Wellman, 1982) 3-year olds, although somewhat inconsistent, were found, for example, to treat the brain very much like the mind in that the brain was seen to control mental processes but not other physical processes. That is, these young children saw the brain and by association the mind and mental entities as something distinct from behaviors and responsible for mental actions such as thinking, dreaming, and remembering. While this concept of brain and mind is limited, it does show evidence for some theory-like understanding of what a mind is and what it might control.

On the basis of all the studies cited above, it seems clear that by 2 1/2 to 3 years of age children already have some access to and knowledge of the workings of the mental world, and understand this mental domain not only as distinct from the external world, but also as a determinant of the action, thoughts and emotions of others.

A third major source of evidence in support of the early emergence of children's theories of mind derives from research into visual perspective taking abilities. In response to Piaget's assertion that preschool children remain unable to
understand that others may view the same object differently (Piaget & Inhelder, 1969), Flavell (1978) proposed that there is in fact more than one level of perspective taking, and that the first of these levels is achieved a great deal earlier than Piaget proposed. Flavell maintains that at level 1 children first come to understand that if another's visual access to an object or event is restricted or obscured in any way, then that other will not see the object. The limitation of this level 1 ability, according to Flavell, is that although young 2- and 3-year old children seem capable of determining what another may or may not see, it is not until they are 4 or more that they achieve the level 2 ability to understand how others may differently construe the same content. The now classic and widely replicated visual perspective taking study of Lempers and Flavell (1977) can be used to illustrate this distinction. In this study subjects were exposed to a picture of a turtle which appeared to be lying on its back to one observer and resting on its own four feet to another. In this procedure, 3-year old children demonstrated an understanding that when the other has absolutely no visual access to the turtle they see nothing at all, but still fail to understand that from their different viewing positions they and the other will see the turtle in different orientations. Somewhat older children (4 years old), who are said to have achieved a level 2 understanding, were able not only to understand who could or could not see the turtle at all, but also how they and others see it. While level 2 perspective taking is
decidedly more mature than its precursor, achieving level 1 is no insignificant feat for the young child. Flavell (1978) maintains that for a child to achieve full level 1 competence he or she must understand that in order for another person to see an object four conditions must hold:

1) at a minimum one of the other's eyes must be open and unencumbered;
2) the other's eyes must be oriented in the direction of the object;
3) there must not be any physical obstructions obscuring the object from the other's vision; and
4) what the child has visual access to is independent from what the other sees.

By 3 years of age most children clearly evidence a full understanding of all of these aspects of level 1 visual perspective taking (Flavell, 1977, in press; Flavell, Flavell, Green & Wilcox, 1980; Lempers & Flavell, 1977; Hughes and Donaldson, 1979). Some research suggests an even younger onset age on simplified level 1 tasks. Flavell, Shipstead and Croft (1978), for example, using a research design that tested Level 1 visual perspective taking in terms of children's ability to hide an object from another, found that even 2 1/2 year olds knew how to deprive another of visual access to an object by placing it behind an opaque screen, thus demonstrating that they could distinguish between what they and others saw.

While proponents of the late-onset view (e.g. Hogrefe,
Wimmer & Perner, 1986) do not accept level 1 perspective taking as evidence for the existence of a theory of mind, there are reasons to consider this achievement as indirect support for an earlier onset view. Particularly relevant is the more recent work that connects level 1 perspective taking with children's early understanding that perception is a source of knowledge (e.g. Pillow, 1987). In this study, where differential access to a stimulus array was provided for subjects and puppets, Pillow found that even 3-year-olds could correctly infer the presence or absence of knowledge based on someone's perceptual experience. That is, these young children could correctly attribute knowledge of the colour of an object to whoever had seen the object, but understood that those who had not seen it would be ignorant of its colour. Thus, children seem to understand that a person's knowledge or belief is a result of perceptual access to information in the real world and, as such, believe that perceptual experience determines one's mental representation of an event.

In general then, it is clear and largely undisputed that by 2 1/2 to 3 years of age children demonstrate the use of a variety of social cognitive capacities which indicate at least some understanding of the mental world. Very early on children engage in pretense and somewhat later, but still prior to 3 years, join in cooperative social pretend play, demonstrating an understanding that others can represent a contrary-to-fact situation. Use and understanding of mental state terms and the
parameters of mental entities also emerge around this same time, as does level 1 visual perspective taking. In addition to possessing these candidate elements of a theory of mind there is some evidence suggesting that children as young as 3 years are also capable of combining these elements to predict another's action (Wellman & Bartsch, in press). In spite of this impressive list of accomplishments, however, there are many contributors to this literature who are still unwilling to credit a legitimate theory of mind to children under the age of 4. It is to this late-onset view that attention will now be turned.

The Late-Onset View

In contrast to those supporters of the early-onset view who credit children as young as 2 1/2 with holding to some basic theory of mind, those who support the notion of a later onset claim instead that 4 or 5 years of age marks the crucial turning point in this aspect of young children's early cognitive development. This debate between the competing claims of advocates of the early- versus late-onset view has as its essential pivot what one is willing to take as evidence for such a theory. Supporters of the late-onset view, while acknowledging that 3-year olds can in fact do all that others claim for them, argue that all such evidence is still not enough to warrant the label "theory of mind".

Perhaps the most central and certainly among the most prolific critics of the early-onset view are Wimmer and Perner (1983) and their colleagues. These authors see the ability of
children to understand opposing or false beliefs as the real litmus test for any theory of mind. There are a number of important and convincing reasons why the ability to understand that another may hold beliefs which differ from one's own should stand as a crucial test of whether one adheres to a theory of mind but the debate remains open as to when in the lives of children this occurs.

In the main, supporters of the late-onset view agree that it is insufficient to show that young children know that they and others have intentional states which differ from the real world, and hold out instead for evidence that such children have some working understanding of those intentional states to which such beliefs actually correspond. Understanding beliefs which are based on mutual knowledge cannot be shown to require any authentic understanding of beliefs in others (Newman, 1986) and while the understanding of false beliefs may occur simultaneously, it is only when differential access to information occurs that it is necessary for one to know that another may not share one's belief. Thus tests of children's understanding of beliefs in others must go beyond mutual knowledge to demonstrate a cohesive theory of mind.

One dimension of belief understanding that has been examined recently is the question of whether young children connect beliefs with the sources from which they originate. For example, Gopnik and Graf (1989) found that 3-year-olds did not accurately identify the source of their own beliefs. These results appear
inconsistent with those obtained by Pillow (1987) in which 3-year-olds correctly inferred the presence or absence of knowledge based on another's perceptual experience. These two studies, however, differ in some other important aspects. In Pillow's study subjects were required to predict what another would know on the basis of the availability of perceptual information. The Gopnik and Graf study in contrast required subjects to explain after-the-fact where their own knowledge or beliefs originated from, a task which requires a potentially more complex ability to comment upon how one comes to know a thing rather than what one has the right to know. The difficulty experience by the 3-year-olds in the Gopnik and Graf study does not preclude the possibility that these young subjects have some understanding of the nature of beliefs but may reflect their lack of expertise in accurately choosing among three plausible alternative sources for a given belief.

Much of the current research on children's developing theories of mind stands in some direct lineage to the now classic work of the ethologists Premack and Woodruff (1978) in which they attempted to illustrate that chimpanzees could demonstrate an understanding of the false beliefs of others and consequently some theory of mind through their use of various deceptive strategies. While arguing that Premack and Woodruff's work falls short of its intended mark, Dennett (1978) leaves open the possibility that possession of some theory of mind might be demonstrated by using what he proposes as the "minimal
experiment" for attributing deception to an organism. It is Dennett's minimal experiment on which Wimmer and Perner's (1983) test of false-belief understanding is based.

Before taking up a discussion of this procedure and the several different uses to which it has been put, some attention needs to be paid to the question of why authors such as Wimmer and Perner remain unimpressed by the results of other procedures. According to Perner, Leekam and Wimmer (1987) the test of the presence of a theory of mind lies in the child's ability to understand that persons may hold beliefs with conflicting truth values. At least to date, none of the methods used by supporters of the early-onset view (with the possible exception of the recent Chandler, Fritz & Hala, in press) appear to satisfy this task. What children at this earlier age can do, according to Perner et al, is to represent alternative models and assign appropriate truth values to these models, what they cannot yet do, according to these authors, is assign conflicting truth values to the models. Mental state terms even when used appropriately and when adequately distinguished from their real-world referents provide no such evidence. For example if a 3-year old child refers to a dream there is no question that another might believe that dream to be reality. Similarly, social pretend play while clearly involving claims at variance with the truth, need not involve an awareness of conflicting truth values for the reason that no one in such interactions assumes the pretense to be true. What is required in the case of
conflicting truth values according to Perner et al, is that not only does the child understand that a proposition or model is at variance with what he or she takes to be true but also that another person simultaneously deems this false model to be true.

The ability to assign such conflicting truth values, which is said to occur around 4 years of age, is assumed by Perner and his colleagues to be responsible for success on a number of tasks including the unexpected change procedure, appearance-reality measures, and level 2 perspective taking. This follows, according to these authors, because Flavell's level 2 of visual perspective taking involves not only the ability to understand whether another person with differential visual access could see an object but also how they saw that object. That is, children must hold in mind what they themselves see but understand that the other may perceive the object in some way which conflicts with their own view.

Similarly, the appearance-reality distinction (e.g. Flavell, in press; Flavell, Flavell & Green, 1983, 1987; Flavell, Green & Flavell, 1986; Taylor & Flavell, 1984) also requires that the child hold two different models of reality in mind at once, the model of the object as it appears and the model of the object as it truly is. An object may, for example, look like a rock but upon closer examination and handling may be shown to be really a sponge. At 3 years of age (Taylor & Flavell, 1984) children can separate the real from the apparent but cannot understand that the same object could be represented either as a rock or a sponge.
depending on the observer's point of view. In a similar study using variations of standard appearance-reality and false-belief tasks, Gopnik and Astington (1988) found that over half of their 3-year old subjects were unable to succeed and tended to treat their current representation of a thing as the only representation possible in both types of tasks. These authors further found that the appearance-reality tasks were more difficult for the children than the false-belief tasks lending support to Flavell's assertion (Flavell, Flavell, & Green, 1983) that understanding false belief is necessary for understanding the appearance-reality distinction because children must grasp the notion that another can believe something which they themselves know to be false. In view of the fact that the understanding of false belief is said to form a basis for many other related cognitive abilities it seems particularly important to have a measurement procedure that adequately gauges its emergence in young children. The following section describes in detail this standard Wimmer-Perner unexpected change measure.

The Unexpected Change Paradigm

The basic feature of Wimmer and Perner's original unexpected change task and its many variations is that it creates a context in which the subject and another have differential access to information. Subjects are told a story in which they are made privy to an unexpected turn of events about which the story protagonist (a doll figure) has no knowledge. In one such variation upon this procedure (Wimmer and Perner, 1983) the child
watches a scene enacted by a mother and son doll figure in a playhouse containing two cupboards. The mother and the boy, Maxi, have just returned from shopping and, among other items, some chocolate has been purchased. The chocolate is placed in cupboard A in Maxi's presence. Then Maxi leaves the house to play. During Maxi's absence the mother removes the chocolate from cupboard A, grates a little to make a cake, and places the chocolate, not back in cupboard A, but in cupboard B. In more recent "explicit" versions of this task the subject is reminded that Maxi does not see this unexpected transfer. The subject is then told that upon his return, Maxi will want some chocolate. The test questions asked of the subject at this point are "Will Maxi know where the chocolate is" and more importantly "Where will Maxi look for the chocolate". If subjects answer correctly with the original location of the chocolate (i.e. cupboard A) then they are credited with understanding false beliefs and assumed to possess some operative theory of mind. If, by contrast, they respond with the actual new location of the chocolate (i.e. Cupboard B), they are said to lack an understanding of the counterfactual nature of false beliefs and other forms of evidence, of the sort promoted by advocates of the early-onset view are discounted as having no status.

Wimmer and Perner's original unexpected change paradigm proved to be a powerful impetus to other research into children's thoughts about the mental lives of other persons, and while locating the threshold for such an understanding relatively late,
as compared to the claims of those discussed in the preceding section, it does in fact place the emergence of this ability at a younger age than has been suggested by many studies based upon still earlier measures of conceptual perspective taking (e.g. Selman, 1980; Shultz & Cloghesy, 1981). In particular, there are two major advantages of the Wimmer-Perner paradigm over previous research in this area. The first concerns the fact that these investigators successfully designed an assessment procedure which is not, in the main, dependent upon or confounded with young children’s abilities to verbally articulate what they are thinking. Much of the previous research in this area clearly was over reliant upon children’s explicit verbal reports. Wimmer and Perner achieve this procedural advance by having their subjects simply point to the cupboard in which they think Maxi will look for the chocolate. This paradigm also avoids the recursive, often noninterpretable nature of many earlier role-taking assessment procedures based on competitive game strategies (Selman, 1980; Shultz & Cloghesy, 1981), in which both lower level and higher level strategies were manifest in the very same action.

Since 1983 the original Wimmer and Perner unexpected change assessment paradigm has been used with numerous variations by these authors and their colleagues, in order to both replicate these earlier findings and in an effort to determine what it is that makes the understanding of false belief so apparently difficult for children younger than 4 years. What follows is a
synopsis of the findings from these several studies.

The original set of studies which introduced this standard unexpected change paradigm (Wimmer & Perner, 1983) involved an attempt to locate children’s first understanding of the beliefs of others at a younger age than had been proposed previously. Consequently, in response to earlier findings that placed such understanding in the middle school years, the ages examined in the first experiment ranged from 4 years to 9 years. The results of this study clearly showed that while the 6- to 9-year olds correctly answered the test questions, the majority of 4- to 5-year olds failed to do so. In a second experiment involving 3- and 4-year olds, the authors attempted to make the task easier by including "stop-and-think" instructions to guard against the impetuous responses given by very young children. A "disappear" condition was also included in which the chocolate was not simply displaced while Maxi was out of the room but was removed from the scene entirely. Wimmer and Perner found that only the disappear condition facilitated improvement in the performance on unexpected change tasks and then only for the 4 year olds, with the majority (76%) passing the disappear condition but only a minority (41%) passing the standard unexpected change paradigm. The 3-year olds performed poorly and below chance on all conditions, with their best performance (30% correct) occurring on the disappear condition.

In a number of related experiments Wimmer, Perner and their colleagues also have utilized correct responses on their
unexpected change task as a criterial measure with which to exclude subjects said to be lacking any theory of mind from further participation in studies of other related cognitive abilities such as the understanding of lying (Wimmer, Gruber & Perner, 1984; 1985) or the understanding of the mind as an active processor of information (Leekam & Perner, 1987). In these screening procedures the youngest subjects included were 4 years of age, a lower age limit arrived at on the basis of the earlier study which suggested children under 4-years old could not comprehend false belief. In the studies on lying the performance of 4 1/2-year olds on a standard unexpected change test, while substantially better than that found in the original Wimmer and Perner article, still remains far from perfect, ranging from 57% in the earlier study to 68% in the more recent experiment (Wimmer, Gruber and Perner, 1984, 1985). The more recent Leekam and Perner study (1987) found a dramatic increase in the number of 4 1/2-year olds passing the unexpected change measure of false-belief understanding (91%) but still only 66% of 4-year olds. No 3-year olds were included in any of these screening studies.

Additional studies in which understanding of false beliefs resulting from an unexpected change was among the central topics addressed have shown fair to good performance for 4-year olds, but performance by 3-year olds remains poor across all the studies. Hogrefe, Wimmer and Perner (1986), for example, found that 56% of their 4-year olds passed the false-belief questions
while only 17% of the 3-year olds did so. Based on Austrian and English samples Perner and Wimmer (1987) found that 65% of 4-year olds passed the test questions compared with only 38% of the 3-year olds. Wellman and Bartsch (in press), using simplified false-belief measures in which subjects were not required to infer the protagonists beliefs, also found continued poor performance for 3-year olds and chance performance for 4-year olds, with only the 4 1/2-year olds regularly performing significantly above chance. Similarly, in a variation of the standard unexpected change measure which required subjects to comment upon their own previously-held false beliefs rather than the false beliefs held by another, Gopnik and Astington (1988) found the majority of their 3-year olds failed to accurately state what their original belief had been subsequent to a demonstration that this belief was false.

Possibly the most generous picture that can be painted of young children's understanding of false-belief based on the Wimmer-Perner paradigm appears in an article in which Perner, Leekam and Wimmer (1987) removed some of the potential stumbling blocks to correct performance. In this study, in addition to "stop-and-think" instructions, probes were used throughout to remind children of who had access to what information. With these methodological refinements a substantial improvement was found for the older age groups with 4 to 4 1/2-year olds performing almost at ceiling (96%) and 3 1/2 to 4-year olds now 75% correct. In spite of these improvements, the youngest group
of 3 to 3 1/2-year olds continued to perform poorly (24% correct). Based on these recent results the authors have modified their earlier position in which they held that only children who are 4-years of age or older understand false beliefs, currently allowing that 3 1/2 to 4 years may represent a transition period during which understanding about beliefs begins to emerge. Despite then what appears to be a great deal of back and fill regarding exact ages, these authors confidently maintain that children 3 years of age or younger definitely do not understand the nature of false beliefs in others. In fact, in their 1987 article Perner, Leekam and Wimmer go so far as to suggest that there may be some as yet unspecified cognitive deficit that wholly blocks children younger that 3 1/2 from holding to any sort of belief about beliefs.

All things considered, the available evidence on children's early theories of mind could hardly be more contradictory. On the one side there are those advocates of the early onset view who see evidence of these abilities in a broad variety of performances common to 2- and 3-year olds. On the other are those proponents of various false-belief measures who have an impressive body of evidence that speaks against that possibility. Two possible solutions to this dilemma suggest themselves. Either children younger than 3 1/2 or 4 really are unable to understand the nature of beliefs, specifically false beliefs in others, as Perner et al. maintain, or there exist some methodological insufficiencies or confounds that prevent standard
unexpected change measures of false-belief from properly bringing such abilities to light (Chandler, Fritz & Hala, in press).

Proponents of the delayed onset view (Hogrefe, Wimmer & Perner, 1986; Perner, in press; Perner & Wimmer, 1987; Wimmer & Perner, 1983) claim that what separates children who correctly respond to standard unexpected change measures of false belief attribution from those who do not is the ability to assign incompatible truth values to the same proposition. According to these authors, 3-year olds quite simply cannot understand that those who hold to objectively false beliefs actually mistakenly judge such false beliefs to be true. It is this understanding of the possibility that another might deem true a proposition which they themselves know to be false that is claimed to separate those subjects with a proper understanding of false belief, from those without (Hogrefe et al. 1986). Both the data and the arguments in support of this tough-minded view are very persuasive and even some who otherwise endorse the early-onset view concede that children may be doing something fundamentally different when they pass the unexpected change tasks. That is, while insisting that even 2-year olds who can engage in pretend play must in some sense represent certain situations as counterfactual, Leslie (in press), for example, suggests that pretense involves a decoupled expression which is neither true nor false, in that all participants in the pretense are meant to understand that the pretense is not real. Even if such decoupling represents an accomplishment that is logically
different from understanding counterfactuals in others it does not, however, necessarily follow that these cognitive accomplishments are totally divorced from one another, with understanding false beliefs arriving on the scene at a much later date. It is entirely possible that a concept of counterfactuals is arrived at simultaneously or at least very closely on the heels of the ability to engage in pretend play.

Quite apart from any claims for or against this notion of incompatible truth values, however, there exists a number of other more mundane reasons as to why young children might experience difficulty in responding correctly to the standard Wimmer-Perner procedure. One of those complexities is the role that inference plays in understanding the unexpected change task. Leslie (1988) suggests that children as young as 3 years can represent a false belief and that it is false but are unable to infer from a situation to a false belief. In the standard unexpected change paradigm (Wimmer & Perner, 1983; Perner, Leekam & Wimmer, 1987) subjects must infer where Maxi has a right to believe the chocolate is, based on the information available to him. A number of investigators (Leslie, in press; Perner & Wimmer, 1987; and Wellman & Bartsch, in press) have suggested that some of the difficulty 3-year olds have with the standard unexpected change measure of false belief may be in managing this incidental inference problem. In order to test this possibility Perner and Wimmer (1987) added a "misinformation story" which minimized inferential complexity for false-belief attribution.
These authors found that while 3-year olds performed somewhat better than in previous studies their correct responses were still well below chance (37%). Similarly, Wellman and Bartsch (in press) have also introduced a variation upon the standard false-belief paradigm that is intended to eliminate this inferential step by providing subjects with an explicit statement of the protagonists beliefs. Even in this inferentially less complex form, however, 3-year olds continued to have difficulty correctly answering the false-belief test questions. Although these findings are not definitive, they do suggest the heavy inferential demands of the original Wimmer-Perner measure may not be the source of any special difficulties occasioned by this procedure.

Alternatively, Chandler, Fritz and Hala (in press) have suggested that there were enough unnecessary procedural complexities inherent in the Wimmer-Perner procedure to cast doubt upon its standing as an optimal assessment of children's understanding of counterfactual beliefs. The first such candidate possibility is the high degree of verbal competence demanded by the unexpected change procedure. Wimmer and Perner (1983) point to this very same limitation in the work of others and it was in an effort to minimize this problem that they attempted to remove verbal fluency as a possible confound by having subjects express their belief about the protagonist's belief by simply pointing to the location where they thought Maxi would look. Despite this otherwise useful arrangement, the
rather complex narrative of the story problems used nevertheless continue to make heavy demands upon children's story comprehension abilities. Consequently, even when explicit probes are used throughout the narrative, it cannot be established with certainty that young subjects can successfully combine all the story elements into one cohesive unit. Obviously, any failings on the part of subjects in this quarter would dramatically reduce their performance on this test.

Second, subjects in the standard Wimmer-Perner paradigm may fail to demonstrate their best understanding of the possibility of false beliefs simply because they are personally removed from the action of the third party story problems used and are required instead to be passive observers to a tale which is acted out for them using doll figures.

On these and related grounds, Chandler et al. (in press) have argued that the unexpected change paradigm is a less than optimal assessment tool for determining the earliest point at which children evidence such a theory of mind. In its place they promoted an alternative paradigm involving the study of deception in children. The rationale for this choice is detailed in the section that follows.

Deception - Prerequisites and Criteria
Consider the following scenes:

In the fairytale of Hansel and Gretel the wicked witch is trying to fatten Hansel up to make a tasty meal.

Everyday she asks him to stick his finger out of the
cage so she may feel how fat he is becoming. Everyday, Hansel, knowing the witch to be short-sighted, substitutes a bone for his finger in order that the witch will believe him to be too thin to make much of a meal. In doing so Hansel achieves the desired effect of prolonging his demise.

"Sam" has a spelling test today for which he is unprepared. Sam refuses to get out of bed when his mother calls him in the morning and, although in truth he feels fine, he complains that he aches all over and his stomach is upset. His mother, not knowing that he has a spelling test decides that Sam should stay home in bed. Sam, like Hansel, thus postpones an unpleasant event.

The Black-necked Stilt (a member of the shorebird family) notices a predator nearby which could threaten its eggs but which the bird cannot drive away. The Stilt commences a distraction display in the form of "wing-flagging" which produces the impression of an injured bird. The predator follows the seemingly easy prey and the nest is left safe (Sordahl, 1986).

A female Photuris firefly mimics the mating signals of the female Photinus firefly resulting in the attraction of a Photinus male. When the male lands and approaches
her the Photuris female attacks and devours him (Lloyd, 1986).

What all of the preceding behavioral sequences have in common is that some target (person, witch, animal, insect) was persuaded to act upon some piece of "misinformation". The wicked witch acted as if Hansel's finger really was too thin. Sam's mother based her decision to keep Sam at home on the evidence at hand, false though it was. The would be predator went off on a wild bird chase and the Photinus firefly instead of mating with a female was eaten by one. All were deceived but do the actions of the one doing the misleading constitute deception? In the context of a very broad definition whereby deception is simply the carrying out of misleading behaviour we might accept these as instances of true deceit. To do so, however, would be to render the concept of deception all but devoid of any useful meaning.

There exists throughout the deception literature in general a widespread confusion over proper criteria for deception with the result that the simple, seemingly automatic, "genetically preprogrammed" behaviour (Mitchell, 1986), such as the feints and ruses as apparent in the broken-wing displays of ground nesting birds, are often lumped together with the premeditated actions of children and perhaps higher primates who attempt to avoid unpleasantries by manipulating the beliefs of others. Given this confusion of criteria it would seem to be impossible to use deceptive acts on the part of a child as a way of illustrating
that he or she has a theory of mind as the previous section argues we are warranted to do. Consequently, the first step in any plan to make use of a measure of deception as a marker of young children's knowledge of belief states in others is to clearly outline what should be required of any action before it can be classified as truly deceptive.

The first of these features is that in order to qualify as truly deceptive such actions must occur within a social context requiring the active participation of both deceivers and the targets of their deceit (Mitchell & Thompson, 1986). Deception can be said to occur as a result of a such dynamic interactions whenever the deceiver somehow manipulates the beliefs of the other in such a way as to produce in them a representation of reality that does not correspond with the state of the world as the deceiver believes it to be. Consequently, to be successful deception, like other types of communication, must occur within a system of shared meaning (Mawby & Mitchell, 1986) where both the deceiver and the target must share a common understanding of what given signs are normally taken to signify.

If Sally's father tells her to brush her teeth before going out to play, but Sally is in a hurry to be with her friends and doesn't want to take the time, she might try to deceive her father by simply wetting her toothbrush, demonstrating her belief that her father shares her understanding that in the normal course of events, a wet tooth-brush signifies recently brushed teeth. Without such a shared meaning this deception could not
take place. Imagine further that a Martian, on whose planet there is no water and so for whom a wet toothbrush is not a sign for clean teeth, is given the responsibility for ensuring that Sally has brushed her teeth. In this case Sally’s toothbrush wetting would then be futile as a deceptive strategy because Sally and the Martian would lack a common ground of shared meaning. Sally would have no Martian folk-psychology (Dennett, 1985, 1987) with which to predict and to manipulate the Martian’s thoughts and actions.

On similar grounds it could be argued for each of our examples at the beginning of this section (Hansel and Witch; Sam and mother; bird and predator; fireflies) that some sort of dynamic interaction took place. All involve some initiation of interaction or dialogue by one party and a response by the other. What is less than clear, however, is whether all of these examples involve a system of shared meaning. In the case of the fireflies, for example, one might reasonably contend that while the message the female is sending may hold the clear meaning of a mating call to the male, it might hold the entirely different but equally clear meaning to the female that dinner is in sight without implying any understanding on her part that the signal will be misinterpreted as a mating message by the male of the other genus.

In addition to being embedded within a social interaction and based on a system of shared meaning, a third prerequisite for deception is that there must exist between the two participants
some condition of differential access to relevant information which the potential deceiver recognizes. That is, you are not likely to be able to deceive me if all of the information I need in deciding how to act is already available to me. Just as importantly the deceiver needs also to recognize and be prepared to capitalize on this differential distribution of relevant facts. On the strength of this requirement it would seem that the ability to deceive requires as a prerequisite Flavell's (1978) level 1 visual perspective taking ability in which the child understands that other persons who have access to fewer or different facts will arrive at a different understanding. It is only when this recognition of differential access is present that the actor has the opportunity to inform, not to inform, or to misinform others (Vasek, 1986). Dennett (1987) illustrates the difficulties involved in assessing such knowledge in a potential deceiver by using as an example the problems that might be encountered in attempting to set up a situation in which a vervet monkey is afforded the opportunity to withhold information about an approaching python from a rival vervet monkey. The major difficulties involved in this instance are two-fold. The observer cannot be certain that the first vervet has actually seen the python nor can the observer be certain that the vervet thinks that its rival hasn't seen it. In this case simple failure to inform on the part of the first vervet can always be excused by the claim of ignorance. On these grounds Dennett argues that a minimally complex experimental paradigm for
determining whether deception has taken place would need to include evidence that the deceiver has actually undertaken to actively misinform his rival in some way.

Finally, given all of the above mentioned prerequisite conditions, the final leavening ingredient necessary to turn such a mixture into a deceptive act is the definite intention to misinform. An actor’s understanding that he or she exists in some interaction with a common language partner who has differential access to essential information simply provides him or her with the opportunity to deceive or not to deceive. It is this requirement that deceptive acts must be carried out purposefully that constitutes the central criteria that separates many more primitive types of misleading messages such as that of the femme-fatale fireflies, from what are generally agreed upon as truly deceptive acts (Anderson, 1986; Chevalier-Skolnikoff, 1986; Mitchell, 1986; Russow, 1986). This inclusion of intentionality in the criteria of deception has the clarifying consequence of allowing us to exclude those cases which appear to involve only innate or characteristic ways of responding behaviorally in a set stereotypic way in a specific situation. While the Stilt's "broken-wing" display may be effective in leading the predator away from the nest and as such is certainly misleading, the fact that the same behaviour occurs in the same sorts of situations across many species of ground nesting birds suggests that it is unlikely that the individual birds are acting with any plan or intention in mind. Rather one might say that
this sort of automatic behaviour which has the result of causing another to have a false belief is in some sense preprogrammed into the organism's response repertoire and consequently cannot be considered intentional.

This simple notion of intentionality as planful action on the part of a deceiver still remains insufficient, however, for any fully satisfactory definition of deception. Dennett's well known example of the dog who runs to the door so that its master will leave its favorite chair is illustrative of what is lacking in this unelaborated notion of intentionality. The dog may be acting intentionally by going to the door. It may have planned its actions with the understanding that if it went to the door its master would vacate its favorite chair. But was the dog operating intentionally with reference to its master's beliefs? Did the dog intentionally try to seduce its master into holding the false belief that he, the dog, wished to go outside, thereby causing its master to go to the door to let it out? Dennett suggests that although the dog's actions were misleading as interpreted by the master, unless we can clearly show that the dog's action was carried out with the intention of manipulating its master's belief, that is with deceptive intent, it cannot be considered truly deceptive.

Thus a further codicil to the requirement that a potential deceiver must be acting intentionally is that he or she must also intend for the target to take as true a message that he or she believes to be false (Vasek, 1986). Without this addition to our
inclusion criteria it would be impossible to exclude those cases where an actor may intentionally send a message which has the result of misleading another but which was based on the actor's own mistaken belief rather than any intent to deceive.

Finally, it is necessary to add to all the criteria already listed the requirement that the perpetrator of any candidate act of deception must also recognize that he or she is deceiving the other. Consider the original radio broadcast of Orson Wells' "War of the Worlds". Although the broadcasting station announced a disclaimer at the beginning of the program that what people were about to hear was in fact purely fictional, the broadcast was so realistic in its format and delivery that a great number of people who tuned in part-way through actually believed that the Martians had landed and panic ensued. In spite of the great number of people who were deceived by this radio account no real deception can be claimed. Although the producers of the show clearly intended for their audience to hear the realistic account of Martians landing on Earth they did not intend for the audience to hold a false belief about the broadcast being true as they had provided a clear marker that the program was fiction and only an "as-if" scenario. It is the presence of just such disclamatory markers that separates fictional works, humour and indeed pretend social play in young children from deception. The young child who says to an adult (or another child) "let's pretend that these rocks are cookies" is often quick to add "but they're not really cookies" in case the other person hasn't heard or may not
understand the marker "let's pretend".

Thus in order for a child to provide evidence that he or she could make use of deceptive strategies not only is it necessary to instill false belief in another but the child has to intend that the other will mistakenly believe to be true what the child believes to be false. That is, a potential deceiver must appreciate that he or she intends for the potential victim of the deceit to mistakenly judge the false message as a depiction of the true state of affairs.

Given all that has been said above, acts of deception, then, can be defined as actions that take place in the context of social interactions and systems of shared meaning and when the deceiver and his or her intended victim have differential access to the facts. Given these conditions, deception can be characterized as a planful action which is carried out with the intention of manipulating another's beliefs so that the other takes to be true what the self believes to be false.

The usefulness of deception as a way of indexing the presence of some theory of mind was suggested by Premack and Woodruff (1978) in their efforts to determine whether chimpanzees impute mental states to themselves and others. Based on this work and the responses it generated (e.g. Dennett, 1978) Wimmer and Perner (1983) have also maintained that deceptive action is a good index of the possession of a theory of mind due to the fact that inherent in the plan for deceit is the realization that another may be misled to believe something which is false. Thus
these authors and others (Chevalier-Skolnikoff, 1986; Vasek, 1986) suggest that deception requires the presence of second order beliefs and consequently some theory of mind.

In spite of its potential utility as an index of children's beliefs about the beliefs of others, the few measurement procedures which have been based on deceptive practices typically have shown a late emergence. Wimmer and Perner (1983) point out that while the natural occurrence of deception would strongly indicate metarepresentation abilities, they also maintained that relying upon deception as a measure of false-belief understanding would underestimate this ability due to the additional planning steps which, according to these authors, make the carrying-out of deception a more difficult endeavour than the passive understanding of false belief.

While there are few relevant studies of deception in children, most that have been carried out fall into one of two major areas: the passive reporting of an understanding of deceit in others; or the production of deceit within the context of a competitive game. Neither of these types of tasks are performed successfully by subjects younger than 5 years of age. In those studies where subjects are required to comprehend deceptive ploys or to predict the consequent beliefs of story characters who had been lied to by another, most children do not succeed until approximately 5 to 6 years of age or older (e.g. Vasek, 1986; Wimmer, Gruber & Perner, 1984, 1985; Wimmer & Perner, 1983). Similarly studies using competitive game procedures (e.g. Selman,
in which children must anticipate their opponent's beliefs, not only about the information at hand but also their opponent's beliefs about their beliefs about their opponent's beliefs, it has been demonstrated the subjects do not successfully use deceptive strategies on a consistent basis until they are older than 5 years of age.

More recently there have been two studies carried out independently that examine young children's ability to deceive. In a study of deception in preschool children carried out by LaFreniere (1988) subjects were instructed to "try to fool" an experimenter about the location of an object. Rather than relying upon children's own strategies for deception, however, children were expected to verbally lie while being faced with an adult experimenter who interrogated them while staring straight in their eyes. Under these somewhat intimidating circumstances 3-year-olds were not proficient at concealing the true location of the object. In contrast, Lewis, Stranger and Sullivan (1989) found that when 3-year-olds violated a prohibition, 38% spontaneously lied about their actions and a further 24% refused to answer the experimenter. While if is encouraging that 62% of these young subjects at a minimum withheld information without any inducement to do so, it remains difficult to unambiguously interpret the responses of those subjects who simply remained silent. As Dennett (1978) points out what is needed is a procedure which requires subjects to actively take steps to deceive. Such a procedural paradigm will be presented in the
following section.

The Deception Paradigm

Given the series of potential advantages of using deception as a marker of false beliefs Chandler, Fritz and Hala (in press) recently turned to the use of deception as a way of determining the earliest age at which young children first entertain beliefs about the beliefs of others. This research paradigm was developed in response to what was considered by the authors to be the systematic underappreciation of 3-year olds' abilities in understanding the nature of counterfactual beliefs in others resulting from standard unexpected change measures (e.g., Perner, Leekam & Wimmer, 1987; Wimmer & Perner, 1983). Consequently, their "deception" paradigm was designed to circumvent a number of the procedural shortcomings inherent in more familiar unexpected change tasks while incorporating the essential feature of these by holding to some demonstration of children's understanding of counterfactuals in other persons as essential evidence for an emerging theory of mind. In particular, the deception paradigm employed by Chandler et al. differs from the standard Wimmer-Perner unexpected change paradigm along several important dimensions concerning the complexity of the task and role of the subjects. Rather than being asked to respond to test questions after passively listening to a complicated narrative, subjects in this deception procedure were involved in a hide-and-seek game which left them opportunities to attempt to induce false beliefs in another. The verbal instructions required by this procedure
are minimal, participants are real persons rather than doll figures, and subjects play an active role in manipulating the beliefs of another.

More specifically, the subjects of this procedure are introduced to a hide-and-seek board game involving the child and two adult experimenters. One experimenter (E1) remains with the child throughout the procedure to remind him or her of the goals and rules of the game, to physically assist with hiding attempts and to probe for justifications following the child's actions. The second experimenter (E2) essentially acts as an opponent to the subject and E1. The game consists of several hiding and finding trials involving a small "treasure" which is to be hidden in one of five closed opaque containers lined up along one end of the board. The board itself is covered with oil cloth providing a smooth washable playing surface. The initial trials involve an attempt to familiarize subjects with the materials and to see if they can make use of or at least understand tell-tale clues such as misaligned containers or lids in their search for the treasure, and whether they take steps to avoid leaving such clues in their own hiding efforts. Once subjects seem reasonably comfortable with the game they are introduced to a puppet named Toni whose feet are mounted on a revolving wheel and who can be manipulated by a handle to move across the board. The treasure is said to belong to Toni and the goal of the task as one in which the subject is asked to help Toni hide the treasure so that E2 will not find it. This is not easy as Toni's feet secrete
paint leaving inky footprints wherever Toni walks. Subjects are then encouraged to hide the treasure in as many different ways as they can think of to make it difficult for E2 to find. When E2 returns to the room after each trial, if the subject had attempted any type of manipulation of the evidence regarding the location of the treasure E2 was signalled not to find it on the first trial. Subjects were also given the opportunity to tell the truth or lie about the location of the treasure when E2 failed to find it on the first try.

Using this deception paradigm Chandler et al. found that even 2 1/2 -year old children were capable of deceiving others, clearly supporting the early-onset view that before 3 years of age children are capable of entertaining beliefs about the false beliefs of others. On the basis of these results it would appear that it may not be the ability to understand false beliefs per se that has evaded most 3-year old subjects in the standard Wimmer-Perner paradigm, but rather their ability to comment upon such higher order beliefs when queried about third party story characters engaged in a computationally complex narrative sequence. Testing this prospect was the main purpose of the study discussed in the attached research report.

Before attempting to determine exactly which of the dimensions which separate the Chandler et al. deception measure from the Wimmer-Perner test of false beliefs additional questions must be asked as to the actual magnitude of differences found. Specifically what needs to be determined is whether the results
of the Chandler et al. study are not due to their having tested a special population who, had they been given the unexpected change measure of false belief understanding, might have performed adequately on that task as well. Most of the work using the unexpected change paradigm has been carried out using samples of Austrian and English children. Some minor differences have been found between the two countries with English children performing somewhat better than Austrian (Perner, Leekam & Wimmer, 1987). Consequently, the question remains as to whether Canadian children might exhibit even higher performance levels on the task. In order to test for the possibility that such sample differences may have caused the disparity between findings based on these two paradigms what is required is to provide a direct within-subject comparison of the deception and the unexpected change paradigms across the same three age groups.

The proposed study will assess children's understanding of false belief using both the standard unexpected change task and the newly developed deception task. Subjects will range in age from 3.0 years to 4.5 years to include the age which is considered by Perner et al. (1987) to be the lower age boundary for understanding false belief. It is expected that, in line with the findings of Perner et al. (1987), performance on the unexpected change task will improve with age but with the majority of children who are less than 3 1/2 years still demonstrating an inability to correctly answer the false-belief test questions. By contrast, even the youngest subjects to be
tested are expected to make use of deceptive strategies in the
Chandler et al. task. Any discrepancy found between the results
of these two testing procedures is expected to favour the
deception task which is hypothesized to be easier than the
unexpected change task for these young subjects.
APPENDIX B

PROTOCOL FOR UNEXPECTED CHANGE TASK

Subjects are brought into the testing room where the puppets and materials are set up as shown in figure 1. The procedure is introduced by the experimenter:

"Today you are going to see a short puppet show. Watch carefully because I am going to ask you some questions after it is over."

The two puppets are introduced:

"This is Katie and this is Sam. They are friends at school and like to play together. Right now they are playing with a toy car. They take turns playing with this car."

The puppets are shown to play with the car.

"Then they hear their teacher calling them "Katie, Sam, time to clean up and come to snack." Katie and Sam look around for a place to put the toy car so they can come back to play with it later. Sometimes they put it in the red container and sometimes they put it in the yellow container. Right now they put it in the yellow one."

The puppets are shown together putting the toy car in the yellow container.

"Then both Katie and Sam leave for snack."

The puppets are shown to leave the room in opposite directions.

"Katie finishes her snack first and comes back to play with the toy car. She takes it out of the yellow container and starts to play with it again. But then she hears her teacher calling again, "Katie, you didn't clean up your snack things, please come back." Katie then puts the toy car away again but this time she puts it in the red container. Sam doesn't see her put it there. Katie leaves the room again. Before Katie comes back, Sam is about to come back. He wants to play with the toy car again."
The experimenter then asks the test questions and the control questions as follows:

**Test questions**

"Does Sam know where the toy car is?"

"Where will Sam look for the car?"

**Control questions**

"Where is the toy car now?"

"Where did Katie and Sam first put the toy car?"

"Did Sam see Katie move the toy car?"