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CHILDREN'S UNDERSTANDING
OF MINDS IN A STORY

by

Richard Ian MacLaren

A Thesis submitted in conformity with the requirements for the Degree of Doctor of Philosophy, Graduate Department of Education, in the University of Toronto

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Children's understanding of minds in a story

Doctor of Philosophy, 1994

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ABSTRACT

A great deal of progress has been made recently in our understanding of how children go about ascribing beliefs, desires, intentions and emotions to themselves and others. These developments begin at about four years of age and continue into the early school years. The question then arises as to how they use this new knowledge in understanding the beliefs and emotions of characters in stories, especially when these characters undergo abrupt reversals of beliefs and emotions in story contexts. And how do they relate these beliefs and emotions to their own beliefs and emotions as readers or listeners to these stories?

Children age 3 to 8 were given stories and asked, as each story progressed, about the mental states of protagonist and antagonist before and after the occurrence of some critical event. In one non-ironic story modelled on a task first used by Wimmer and Perner (1983), "Maxi and the chocolate," the main character, Maxi, leaves chocolate in a blue cupboard and goes out to play. Children see that the chocolate has been moved to the green cupboard, but Maxi does not possess this knowledge. Maxi then returns. Young children fail to understand that Maxi will think that the chocolate is in the original location or predict that he will be surprised upon finding no chocolate in the blue cupboard.

In an ironic story, "Punch and Judy," the main character, Punch, intends to perform a nasty trick on Judy. But Judy discovers his plan and foils it. This results in Punch destroying a prized possession, his new coat. The mental states of Punch change from glee to gloom, whereas Judy's change from despair to glee. Young children mistakenly attributed sadness to Punch prior to his having knowledge that his coat was in the box; older children correctly noted his change in emotion.
from happiness to sadness at the time he acquires knowledge about his misdeed. Older children could understand that Judy is happy despite Punch’s unpleasant discovery.

Children’s ascriptions of mental states to characters bore little relation to their own reports of mental states while listening to stories. The majority reported being happy throughout the reading of the story, rather than surprised, sad or disappointed.

The research is directly relevant to the education enterprise because it sets up for educators the topology of competencies necessary for understanding stories. The use of stories in schools presupposes specific capacities necessary to understand stories, and it is these capacities that are outlined in the present research. The inability of young children to ascribe false beliefs to story characters may mark and characterise young children’s inability to coordinate what Bruner has called a landscape of action with a landscape of consciousness (see Bruner, 1986).
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CHAPTER 1

INTRODUCTION

1.1 Educational Problem

This honest creature doubtless sees and knows more, much more, than he unfolds.

(Othello, Act III, iii)

In understanding stories, be they stories of everyday events or those contained in texts, mental states such as curiosity, suspense and surprise are experienced not only by listeners but also by story characters. Stories written for children and adults employ these states, both in terms of the experience they provide listeners and in terms of affective and mental states ascribed to story characters.

Understanding stories involves predicting and explaining story events. People use a theory of mind to predict story events. People who know, for example, that Red Riding Hood is ignorant of Granny’s identity have a distinct advantage over those without such knowledge. They can predict that Red Riding Hood will be surprised upon discovering Granny’s true identity. They can cite Red’s lack of knowledge about the wolf’s identity to say she will experience surprise if she discovers Granny’s identity. People also use a theory of mind to explain story events. To explain a story like the Three Bears, for example, people take note that Goldilocks is unaware of the re-entry of the bears to their home, and that the three bears know nothing of Goldilocks. Hence, events in the story depend on false beliefs. Adults might explain their own experience of suspense while describing those of story characters as surprise when each discovers the other.

The use of mental state concepts gives the young child predictive and explanatory power over the actions of characters and listeners. Bruner (1986) recognised this interplay of physical and mental states in stories, and distinguished between two domains of understanding necessary for story
understanding: action and consciousness. Comprehending a story requires the successful integration of both a landscape of action and one of consciousness.

What follows from Bruner’s landscapes of action and consciousness is that the subjective mental life of story characters may be understood by the use of a “theory of mind” entailing the use of mental state concepts such as belief, desire, intention and emotion. The concepts are useful when people wish to predict and explain the world of human action. And since stories describe human or character action and belief, these terms are deployed in our talk about stories.

Understanding myths and stories requires this competence, and students of literature take note of the relation of these mental states. Frye (1967), for example, talked about stories in terms of four “generic plots”, each of which implicates character mental states. Story types may be differentiated, in very general terms, on the basis of the ways in which these mental states are depicted by authors and the corresponding mental states experienced by listeners.

In comic stories, the protagonist’s desires are primary to the listener. Listeners want the protagonist to satisfy these desires, which, Frye notes, are usually directed towards a woman. The protagonist must overcome obstacles, such as parental figures or suitors, and play a zero-sum game with his usurpers. In many cases, listeners take delight in protagonists’ overcoming antagonists via some plot twist, such as the conversion of antagonists to the protagonist’s camp or their expulsion from the story action. For Frye, the protagonist’s desires are primary in comedy: “The obstacles to the hero’s desire, then, form the action of the comedy, and the overcoming of them, the comic resolution” (p. 164). Listeners experience the greatest pleasure at the moment of “comic discovery”, that point in the story plot where listener and protagonist realise that the protagonist will get what he wants and shall continue to do so.

In romantic stories, the story plot depends, in part, on listeners bearing witness to the story character proceeding through conflict and struggle with antagonists to eventual discovery: “The central form of romance is dialectical: everything is focused on a conflict between the hero and his enemy, and all the reader’s values are bound up with the hero” (p. 187). The protagonist has a
unique quest which leads to an adventure for both he and the listener of the story. And regardless of the precise nature or outcome of the quest, story listeners take pleasure in the conflicts and struggles of the story protagonist.

In tragic stories, the protagonist is unable to fulfil his goals. Helpful Prometheus gives fire to needy humans but angers a god. The god retaliates by chaining him to a rock to have his liver devoured by a raven. Oedipus, despite his own efforts, fulfils prophecy and ends his life a ruined man; Othello, unaware of the machinations of Iago, is compelled to feel and act in a manner which ruins him. Frye illustrates: “The tragic hero has normally had an extraordinary . . . destiny almost within his grasp . . . while catastrophe is the normal end of tragedy” (p. 210). Tragic stories share a common plot. The fate of the protagonist is negative, despite his expectations and wishes, and he is the object of listener pity or disgust.

Finally, in ironic stories, characters may pursue incompatible goals and the plot proceeds with one character winning out over the other. Yet it is not a simple conflict: the plot shifts such that the plotter may reap the harm intended for the other, or, conversely, the buffoon may reap reward properly belonging to a more worthy counterpart. For Frye, anyone listening to an ironic story is concerned primarily with the ironist’s mental states: “. . . whenever a reader is not sure what the author’s attitude is or what his own is supposed to be, we have irony . . .” (p. 222). Frye notes that the ironic, like the tragic, ends with the hero not attaining his goals: “Ironic with little satire is the non-heroic residue of tragedy, centring on a theme of puzzled defeat” (p. 224). Listeners to ironic stories take delight as the story concludes with one character miserable and the other gleeful when the former is defeated. The description of the four canonical story types illustrates that listeners must understand and appreciate the disparate mental states of story characters in order to appreciate stories.

---

1 The ironist here is the speaker, and listeners are interested in the attitude of the speaker. Sometimes this is the author and at other times it is the story character.
The present study is not a practical educational study but is directly relevant to the educational enterprise because it sets up for educational researchers the topology of understandings necessary for understanding stories. Stories have been, since the time of oral fables and stories, valuable tools of education, and their utility has not diminished. The use of stories in schools presupposes specific capacities to understand, and it is these capacities that are of interest here. What competencies might educators of the young consider when thinking about developmentally based instruction in reading?

1.2 Summary of Educational Problem

Educators are concerned with how the mental states of listeners and characters may be traded off to evoke curiosity, suspense and, eventually, surprise in listeners. The characters and listeners may experience quite different states at key junctures in a story, and listeners may be aware of the importance of such discrepancies. If a story plays upon these states, and if younger children do not understand this interplay, then these children may be unable to comprehend or appreciate the story. Both its educational and entertainment value will thus be diminished. On the other hand, listening to and reading stories may be important to the development of those understandings.

Children's predictions of a protagonist's mental states and actions in relation to their own states as listeners may be related, but exactly how they are related remains to be tested. How well do children relate the realm of mental events to the realm of behaviour? Put in Bruner's (1986) terms, how do children relate a "landscape of consciousness" to a "landscape of action"? And how do they relate their own mental landscape to that of the character in a story?

Here I ask whether children understand that a character's knowledge of events and hence his emotional state will change as critical story events occur. Further, I wish to find out whether children's understanding of ironic utterances follows from their competence in understanding beliefs and desires. Young children have been shown to have problems at times understanding beliefs and desires. While many studies have examined the young child's comprehension of the intentions and
beliefs of others (see Astington, Harris and Olson, 1988), less is known about how the child’s understanding of the concepts of belief and emotion may relate to competence in understanding stories. The research described herein addresses these relations through two lines of research. The first to be discussed concerns story comprehension and appreciation and the second concerns children’s understanding of belief, emotion and utterance.
CHAPTER 2

THEORETICAL BACKGROUND

2.1 Defining a story

The term "story", and its synonym "narrative", seem to challenge attempts at a formal definition. Stein (1982) found 20 definitions of a story. Prince's (1973, in Stein, 1982) event-based account holds that all that is necessary for stories is some account of a change in the physical environment. Here the required properties of the narrative are simple criteria: event changes, regardless of their mental or non-mental status, constitute change; these changes need not be the product of goal-directed behaviour. The lack of attention paid to protagonist goals has been cited as grounds for rejecting these event-based accounts (Stein and Glenn, 1979).

2.1.1 Schema theory

Theories which hold goal directed behaviour as a necessary story element (Stein, 1982) argue for the inclusion of a protagonist, a goal directed action, and the attainment or non-attainment of the goal. In schema theories, the protagonist's goal and goal attainment states are primary. The only internal state changes of interest are those which are relevant to the protagonist's goal attainment; grammars which have protagonist goals, which may be blocked, are story grammars; stories which don't meet these criteria, which do not have goals, are not stories.

Stein provides empirical evidence suggesting children come to understand the importance of the protagonist's goals by early school years (Stein and Glenn, 1979), but reports that first grade children, after being told a story, refer more to known physical story outcomes in explaining story events than to the internal states of characters. After being given stories, first grade subjects could discuss story outcomes, but could not discuss the mental events giving rise to the outcomes,
neglecting to mention aspects of the grammar such as internal response, internal plans or the reactions of characters. The correct recall and sequencing of story events evidenced by first graders suggests that some understanding of stories is achieved by the first grade. Yet since young children do not invoke protagonist goals to explain stories, they cannot, according to Stein's schema theory, understand stories as such. Understanding the intentional aspects of stories is a late acquisition for children.

Story schema theories have focused on the action and goal states of story characters; yet no mention is made of listener interpretation or affect because the listener's response, for story schema theorists, is important and predictable only as much as the protagonists' response is predictable. A prediction of listener emotion, for example, might well be assumed to parallel the emotional state of the protagonist such that if the protagonist is surprised, the listener will also be surprised. if the protagonist is afraid, so too is the listener. These relations have not been made explicit by schema theory.

2.1.2 Structure-affect theory

In contrast to story schema theory, the premise of a structure-affect model of story comprehension is that an important function of stories is to entertain; it is the listener's emotional states which undergo change (e.g., in curiosity, suspense or surprise) in order for a story to be a story. In contrast to schema based accounts which hold that the protagonist's emotional states are critical determinants of stories, a structural affect based account holds that the listener's emotional states (e.g., beliefs, emotions and needs) are primary.

Human emotional reaction to narrative has been researched by investigators such as Brewer and colleagues (Brewer, 1987; Brewer and Lichtenstein, 1982; Dorfman and Brewer, 1989; Jose and Brewer, 1984; Dorfman, 1989) to investigate the relationship between narrative story structures and story liking, as well as children's understanding of the points of stories. Brewer's work is derived from two lines of inquiry. The first, the structural component, is derived from the structuralist

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tradition in literary theory as articulated in Russian formalism and the second, the affective component, from the field of experimental aesthetics. Narrative structures involving surprise, suspense, and curiosity, must entail an initiating event, which may, though not always, increase listener tension, and, following various episodes, a critical event resolves the tension.

Hypothetical story structures such as surprise are marked by an ‘arousal jag’ occurring with the onset of some critical event. The arousal is thus experienced by the listener. Note that the early information given does not increase arousal, and peak arousal occurs abruptly with the onset of the critical event. Hence, our listener does not receive crucial information pertaining to the critical event until it occurs.

**Surprise**

Surprise stories are characterized by an ‘arousal jag’ which is abrupt and is resolved with the listener’s belief being overthrown. In the popular *Goldilocks and the Three Bears*, for example, the bears experience suspense and then surprise. They know someone was in the house eating porridge, sitting, and napping, but the precise location and the identity of the intruder is unknown. They are surprised to actually find Goldilocks. But Goldilocks’ experience of surprise, most agree, exceeds that of the bears. Goldilocks experiences the most pronounced surprise because the surprise comes without clues that she recognises as clues. The listener to *Goldilocks* however, is surprised only because he might not know how precisely the story ends, but the listener does know, provided he understands mental states, that the protagonist and antagonist are about to meet and may therefore be said to experience suspense while anticipating their meeting. Only the protagonist and antagonist are markedly surprised.

To understand and therefore appreciate narratives of the *Goldilocks* variety, one must understand that one character is unaware of events the listener is informed about. It is this imbalance between belief states which provides the listener with tension.
Suspense

Suspense stories are characterized by events which themselves cause an increase in arousal and prompt curiosity and interest. An ‘arousal jag’ occurs with the onset of some critical event, and though this critical event may be known by the listener and not the protagonist, the protagonist is affected by its occurrence.

A typical suspense story, according to listener response based theories, is *Goldilocks and the Three Bears* because the listener experiences increasing arousal with the onset of various events and is held, after discovering clues, in a state of suspense; clues are information about story events, and they prompt listener anticipation and arousal. In suspense stories, arousal may be experienced by listeners of suspense stories and character(s) simultaneously, though for quite different reasons: for a character, surprise is the product of overthrown expectations whereas the listeners have no such expectations overthrown unless they themselves were drastically mistaken about relevant story events, like clues. Listeners may experience generalized arousal or suspense upon detecting a clue, followed by arousal decline.

Structural-affect theory provides a theoretical grounding for predicting and explaining listener response, its proponents might suggest. I argue that the theory may be extended to include story appreciation. It follows that since, according to structure affect theory, a listener’s arousal may be increased by the detection of relevant story events like clues, and since a listener’s arousal may be linked with their preference or liking for a story, structure affect theory may well be construed as a theory of preference linked to comprehension. In those cases where story clues are mental events, these clues must be detected and appreciated. Story tension may occur, I argue, when there is a clear trade off in the mental states of two characters or between the listener and character. And though studies have shown that adults understand and appreciate this trade off (Brewer and Lichtenstein, 1982), there is no empirical evidence of children’s understanding and appreciating this interplay of mental states.
Structural-affect theory needs to be supplemented by an account of how listener comprehension for story events depends upon a listener’s understanding of mental events, how listener emotional response is related to those of the story characters and how listener interpretations of speaker utterances depend on their understanding of the emotional state of the speaker. It is these understandings which are examined in the present thesis. However, the present thesis also must address children’s understanding and ascription of mental states. The present thesis asks: How can children’s understanding of minds in stories be characterized? How might their naive theories impact on their understanding of stories? and how does their understanding of beliefs and emotion affect their comprehension of irony?

2.2 Understanding mind in stories

2.2.1 Representation and misrepresentation

What is a theory of mind? Baldwin, Baldwin, Hilton and Lambert (1969) referred to young children’s inexplicit knowledge of how people may react, internally or externally, as a ‘naive theory’ and Piaget referred to young children’s inability to distinguish their own points of view from those of other’s as ‘egocentrism’. Early theorizing about children’s theories of mind was concerned with children’s ability to engage in social inference.

Early empirical study of children’s ability to make social inferences focused on their ability to take another’s visual perspective. In one early study, Piaget and Inhelder (1967) showed children a three-dimensional mountain scene and asked child subjects to say what a teddy on the far side of the model would see. Children six-years and younger described the scene from their own perspective, whereas older children described the scene from Teddy’s perspective. Piaget and Inhelder’s work prompted further study of children’s visual perspective-taking (Flavell, 1974; Selman, 1974), and moral judgement (Kohlberg, 1969). These studies of children’s understanding of another’s perspective were precursors to present day study of theory of mind.
Olson, Astington and Harris (1988) characterise a theory of mind as a set of metarepresentations—representations, the beliefs, desires and intentions comprising the "theory" whose referential domain is the representations, beliefs, desires and intentions, of the self and others. To have a theory of mind means these beliefs, desires and intentions are seen as such. The beliefs of the self and of others become the content for other beliefs.

It is widely held that the hallmark of this acquisition is an understanding of misrepresentation. Mindful primates or children equipped with a theory of mind understand that representations may be imperfect or false; in a word, they understand misrepresentation. In one of the first empirical studies of a theory of mind in primates, two comparative psychologists, Premack and Woodruff (1978), set out to define a criterion for the possession of a theory of mind and showed that the behaviour of some non-human primates met this criterion. To demonstrate that a subject has a theory of mind, a subject should be able to infer the mental states of others from observable events and should be able to use the inferred states to make predictions about behaviour. To test this ability, they showed a chimpanzee a series of videotaped scenes of a human actor coping with various problems. Simple problems involved inaccessible food—bananas vertically or horizontally out of reach or behind a box. Complex problems involved an actor unable to extricate himself from a locked cage, shivering because of the malfunctioning heater, etc. With each videotape the subject was given various photographs, one a solution to the problem, such as a stick for the inaccessible bananas, a key for the locked up actor, a lit wick for the malfunctioning heater. The results of these experiments were that chimpanzee subjects consistently chose the correct photographs. Chimpanzees chose, in the cooperative scenario, the stick for the bananas, the key for the lock and the wick for the heater. In the competitive scenario the chimpanzees did not select these items. Premack and Woodruff concluded that the animal recognised the videotape as representing a problem, understood the actors' intentions, and chose alternatives compatible with the intentions. Hence, according to Premack and Woodruff, chimpanzees have a theory of mind because they can recognise what another wanted or was trying to do.
In response to Premack and Woodruff's empirical demonstration, Dennett (1978), argued that a behaviourist description also fits the chimpanzee data: training may have given rise to expectancies and habits in chimpanzees, so the recognition of beliefs and desires need not be considered. Since chimpanzees do not possess language, researchers must train the chimpanzees, and training itself may foster particular habits and expectancies that could explain the behaviour of the chimpanzees, and the ascription of metabeliefs to chimpanzees is thus not the only way to account for their behaviour. Their actions may be explained in terms of conditioning without invoking mental states. In place of Premack and Woodruff's test, Dennett suggests an alternative. He asks whether chimpanzees will show the same excitement young children do at the sight of a Punch and Judy episode where Punch exhibits behaviour indicative of a false belief. The suggestion is that they could not.

Children may be asked questions such as "Why did Punch do such and such?", yet chimpanzees cannot be asked these questions. Prediction and explanation are necessary prerequisites to inferring that subjects use an explicit causal explanatory framework, and one way to test whether children or chimpanzees understand mental state theories is the false-belief task.

The procedure for the task is as follows (see Wimmer and Perner, 1983 and Tables 2 and 3 in this text). The child subject is witness to a story wherein some character, usually Maxi, puts some desired good in a blue cupboard. In his absence, the item is moved to a green cupboard. Maxi returns. At this time, children are asked "Where will Maxi look for the item?" Most 3-year-old children predict Maxi will look in the green cupboard; 4½-year-olds predict he will look in the blue cupboard. These older children understand Maxi's misrepresentation. The point of the task is that Maxi's predicted behaviour, to look in the falsely believed location rather than the true location, is a unique prediction characteristic of mental state reasoners. Maxi's behaviour cannot be explained without reference to what he thinks.

Experimental research on children's understanding of false belief suggest that it is not until about four years of age that young children understand false belief (e.g., Wimmer and Perner,
At this age, children understand that another's behaviour depends upon the other's beliefs about the world, whether true or false. This is counter to the ability of the 3-year-old, who can understand models of the world (DeLoache, 1988), but are unable to model a falsely modelled world. A vast literature now exists on this point (Austington, Harris and Olson, 1988; Frye and Moore, 1991; Perner, 1991).

Illustrative of the generality of these findings is the study by Baron-Cohen, Leslie and Frith (1985) which tested children's understanding of false beliefs in stories, comparing four-year-old normal children with groups of twelve-year-old autistic children and twelve-year-old Down's syndrome children on their comprehension of stories requiring an understanding of false belief. The autistic children failed to pass tests of false belief, whereas the four-year-old normal children and equal mental age Down's syndrome children could pass these tests.

2.2.2 Emotion

Related to studies of children's understanding of false belief are studies of understanding emotional states which depend on beliefs. Children's understanding of emotional states such as surprise follow shortly after understanding false belief (MacLaren, 1988; MacLaren and Olson, 1993; Hadwin and Perner, 1991). In our studies a developmental lag of some six months in children's understanding of surprise in relation to false belief was noted. The MacLaren and Olson (1993) study tested the hypothesis that an understanding of false belief would give rise to a change in young children's understanding of surprise. Children were asked to assess the knowledge of another person and to then choose an object which would surprise that person. Whereas 3-year-olds chose surprising objects on the basis of what seemed to be their 'desirable qualities, the 5-year-olds' choice of object varied with their assessment of the other's knowledge state. When the verbal requirements of the task were reduced and children were to match a schematized facial expression to the object, older children, unlike their younger counterparts, pointed out that surprised faces would result when another's expectations are violated. "In natural judgements" it was concluded "young children
employ a principle of desirability; older children employ principles of belief violation” (MacLaren and Olson, 1993, p.27). In Hadwin and Perner’s research, a similar finding was observed when young children viewed dramas and rated the protagonist’s reaction to a story outcome. The results of these studies of children’s understanding of surprise suggest that young children, though able to comprehend belief states, may be unable to comprehend related emotional states until some years following the acquisition of an understanding of false belief. Children’s understanding of other emotions like happiness and sadness might parallel their understanding of surprise, as the next studies suggest.

Further support for this developmental lag in understanding emotions related to false beliefs comes from Harris, Johnson, Hutton, Andrews and Cooke (1989). In their study, children were shown characters who liked either Coke or milk. In the character’s absence, the preferred drink was substituted for the non-preferred drink and children were asked how the character would feel upon her return. The results showed that four to six-year-olds adjusted their predictions depending on what the character preferred. The results suggest children can compare the likely outcome of an action with the character’s desires, ignoring their own desires and preferences in the process. More interesting was the fact that children who could ascribe a false belief still could not understand or predict the emotions of the protagonist prior to the critical event of actually seeing what was in the can. Only six-year-olds could say the character would be happy or sad depending on her beliefs about the contents of the can.

If children’s understanding of false belief is part of a general competence, it would follow that almost any mental state will be “representable” by children who have this ability. Thus, the representation of higher order mental states like suspense, mystery and surprise ought to be a simple matter of computing all of the possible belief states of listener, character and narrator. Understanding false belief, it could be argued, ought to enable this computation. But, as the Harris studies showed, this is not the case. However, false belief understanding may be a prerequisite to understanding certain emotions.
2.2.3 Communication

Understanding beliefs and emotions is not the only way in which young children's story comprehension abilities may be affected by the onset of an understanding of representation. Since an important feature of stories is the utterances made by story characters, and since these utterances come from mindful story characters, it follows that children's understanding of the communications of story characters may also be influenced by their understanding of mental states.

Olson and Hildyard (1981) found that kindergarteners', unlike second graders', memory for spoken utterances was influenced by the communicative intent of the speaker. Children heard a story in which a character who was not pleased with his share of popcorn remarks to a friend "You've got more than me". The younger children, when asked to recall the speaker's words, reported instead an intention they inferred from the speaker's words, saying that they heard "Give me some of your popcorn". Second graders, on the other hand, could report both the spoken words and the underlying intention of the speaker. The implication of this finding was that at some time between kindergarten and the second grade, children come to recognise that both the exact words of a message and its communicative intention must be attended to. More generally, young children fail to distinguish the public event, saying, from the mental event, intending.

The objective of these researchers was to discover the limits of children's understanding of communicative intention. In keeping with this objective, Beal and Flavell (1984) investigated children's ability to distinguish the literal meaning of a message from its communicative intent. These researchers wanted to know whether young children, when given an ambiguous message, could understand that the message was unclear. They presented first and second grade children with a referential communication task wherein subjects had to assess both the literal wording and the meaning intended by a speaker. The results showed that first graders, when informed of the intent of the message, could not understand that an ambiguous message could have referred to a referent not meant by the speaker. First graders not informed of the communicative intent could understand the double meaning of the message. Young children's ability to analyze the literal meaning of a
message is, it appears, affected by the accessibility of the speaker’s communicative intent. By the second grade, age 8 years, most children could recognize the ambiguity whether or not they knew the speaker’s intention.

The implications of these findings for children’s understanding of mind are relatively straightforward. Whereas false belief studies have shown that children begin to understand misrepresentation around four to six years of age, these studies indicate that they are able to understand misinterpretation of communication only somewhat later.

Is this performance simply one manifestation of a general ability to analyze the literal meaning of a message, as Beal and Flavell suggest? Torrance and Olson (1987) constructed stories in which a story character, Lucy, wants her new red shoes but asks only for her red shoes. A second character, Linus, not knowing her intention, brings her some red shoes, but on half the items, the red shoes were not the ones desired by Lucy. Child subjects were asked questions to assess their understanding of the message and the intention of the speaker. The results provided support for their model of textual understanding. The youngest subjects, senior kindergarteners, conflated the words said with the words intended by the utterance. The next oldest subjects recalled the exact text but they believed these words meant more than that specified by the wording. 70% of the oldest subjects, grade 2 children, could disentangle the words said from the intended meaning.

In Torrance and Olson’s framework, the youngest subjects see the speaker’s intentions as part of the text, whereas the oldest subjects see the possible disjunction between expression and intention. This understanding, though somewhat delayed, seems to parallel the development of understanding of mental representations as shown in the false-belief tasks. This understanding plays into children’s understanding of ambiguous remarks such as those made by Lucy in Torrance and Olson’s study, and it is this understanding which, it is hypothesised, is at least necessary for children rightly understanding ironic remarks.

Understanding the disparity between what Searle (1979) calls utterance meaning and sentence meaning appears to be one necessary competence for understanding some special uses of language.
Irony, for instance, requires that a listener at least detect the disjunction between utterance meaning (i.e., what the speaker means) and sentence meaning (i.e., what the words mean) and know they are opposite. The abilities tested by Beal and Flavell (1984) and Torrance and Olson (1987) bear on this early ability to detect the disparity between utterance and speaker meaning. In both studies the tasks require that subjects recognise two levels of meaning, utterance and speaker, in order to know the utterance was ambiguous.

Children's understanding of the disparity between utterance and sentence meaning appears to precede children's understanding of irony. Torrance and Olson's research suggests the former is acquired around seven years of age, but research by Demorest, Meyer, Phelps, Gardner and Winner (1984) suggest that it is not until age 8 years or older that children may note the falsehood in ironic utterances. In their study, children were given stories that ended with either sarcastic, metaphoric, understated, hyperbolic, ironic or literal utterances. Children were asked to say what the utterances meant and the reason the speaker might make the remark. Many 6-year-olds failed to detect the falsehood of the utterances and failed to explain the reason for the speaker's making the utterance. Further, 8-year-olds detected the falsehood in only about 50% of the utterances and could not in the main, say why the speaker said what was said. Only 11-year-olds could both detect the falsehood and explain its motivation. So given that previous research suggests emergence of the ability to understand this disjunct between utterance and sentence meaning happens by at least the second grade, why is an understanding of irony so late in coming?

One possibly necessary competence for children's understanding mind and mindful utterances like irony is the ability to make second-order interpretations of utterances. An early reference to this ability comes from Selman and Byrne (1974). In Selman and Byrne's model, Level 2 perspective taking involves, at minimum, a child subject representing that another thinks that another thinks such and such. Children acquire this ability, according to Selman and Byrne, at ages 8 to 10 years. The second embedding distinguishes Selman and Byrne's Level 2 perspective taking from understanding simply what another thinks. Winner and Leekam (1991) cite the ability to make
second-order interpretations (i.e., assessing what a speaker intends a recipient to believe) as a central component of a theory of mind:

We consider a second-order intention to be structurally similar to a second-order belief, i.e., a belief about another person's belief state (cf. Perner and Wimmer, 1985; Yuill and Perner, 1987). Both second-order intentions and second-order beliefs involve one person's mental state (either an intention or a belief) about another person's belief state. And both are central components of a full theory of mind.

For Winner and Leekam, the ability to grasp what a speaker wants a listener to believe is central not only to a fully fledged theory of mind, but also crucial to irony comprehension.

Winner and Leekam's (1991) study of irony comprehension tested children's ability to distinguish the ironist's attitude from that of a liar. Of interest for Winner was children's ability to detect second-order intentions of ironic speakers and distinguish these from the second-order intentions underlying a white lie. The results showed that children who failed to make second-order judgements about a character's intent also failed to distinguish "mean" (i.e., deceitful) from "nice" (i.e., white lying) speakers.

But whereas Winner and Leekam's (1991) study assessed children's understanding of a speaker's attitude behind a white lie or ironic comment about another, the study left unanswered the question of whether children can detect an ironic utterance arising from a situation the speaker himself finds ironic. In other words, whereas Winner and Leekam's study assessed children's understanding of ironic remarks about another, it did not address children's understanding of the remarks when a character makes them about the self in an ironic situation (i.e., proto-irony). If, for example, a speaker devises a plan which fails and his expectations are violated, he may say "Oh great!". The words "Oh great!" are ironic in relation to his foiled plan. It is this understanding of this relation which is addressed in the present study.

Winner (1988) suggested that there exist three underlying abilities necessary for the comprehension of irony:

to avoid taking irony as literally true, the child must detect incongruity or falsehood; to avoid taking irony as error, the child must correctly attribute beliefs to another mind; and to avoid taking irony as deception, the child must infer motivation and be able to
attribute second-order beliefs accurately. The concept of belief, so problematic for children, seems to be necessary for comprehending irony . . . (p. 182)

The following experiment tests Winner’s claims concerning the threefold requirements for irony comprehension. First, the experiment tests children’s understanding that some utterances, ironic and non-ironic, may not be literally true. Second, the experiment tests children’s ability to attribute sadness to a character while his utterance expresses happiness. Finally, the experiment tests children’s ability to correctly attribute second-order beliefs to a character, that is, what the character wants someone else to think.

2.2.4 Summary

The research proposed is an investigation into children’s understanding of the relation between mental events in stories. The research follows from early false-belief and surprise studies (Wimmer and Perner, 1983; MacLaren and Olson, 1993; Wellman and Bartsch, 1988) in that it explores how general metarepresentational competencies come to bear on story comprehension; it links the popular theory of mind research paradigm with the study of narrative comprehension in normal child subjects. Further, it tests how an understanding of representation bears on children’s comprehension of communications which are ironic.

The previous discussion notes that children understand beliefs at about age four years (Wimmer and Perner, 1983), belief-dependent emotion at about age five to six years (MacLaren and Olson, 1993; Hadwin and Perner, 1991 ), and intended meaning at about age six (Beal and Flavell, 1984; Torrance and Olson, 1987), it follows that since some forms of irony require an understanding of beliefs, emotion and utterance, children younger than age six may be expected to fail tasks requiring an understanding of irony.
2.3 Proposed Studies and Description of Stories

The proposed studies assess children's understanding of the relation between listener foreknowledge and character knowledge; their understanding of the discrepancies between the mental and emotional states of characters, and between the words a speaker utters and the meanings that may be assigned.

The stories were similar in many significant respects. The stories have the child subject knowing that a protagonist's goals will be thwarted, and have the protagonist believing the goal will not be thwarted. The result is an asymmetry between the knowledge states of the child subject and those of the character. It is the child subject's understanding of this asymmetry that is tested in the present study.
CHAPTER 3

HYPOTHESES AND PILOT RESEARCH

3.1 Hypotheses

3.1.1 Understanding knowledge, thoughts and false belief

The onset of children’s general metarepresentational ability should permit new understandings of stories. Children’s performance on a false-belief task will be related to their understanding of the beliefs of story characters. An understanding of false belief will be roughly concurrent with their understanding of the knowledge and thoughts of story characters.

3.1.2 Second-order belief

Children acquire the ability to ascribe beliefs to themselves and story characters at about age 4½ years; an understanding of second-order belief will lag behind an understanding of knowledge and false belief as an understanding of character beliefs is necessary for an understanding of their second-order belief.

3.1.3 False belief and belief-dependent emotions

Children’s understanding of another’s emotion improves with age. Children come to understand that character emotions may depend on the character’s beliefs rather than on the actual state of affairs in the world. Understanding belief-dependent emotion is premised on an understanding of false belief. Thus, understanding belief-dependent emotion follows an understanding of false belief. Children’s understanding of a story character’s change in emotion upon the discovery of his misbelief is premised on an understanding of false belief.
3.1.4 Irony

The onset of a general metarepresentational ability is necessary but not sufficient for children's understanding of ironic events and utterances in stories. Irony understanding is premised on understanding what the speaker believes, feels, and what the speaker wants the listener to believe. Thus, understanding irony is more difficult than understanding lying or unintentional actions.

Situated irony

Comprehension of ironic stories depends upon the metacognitive abilities for understanding character beliefs and emotions described in Hypothesis 3.1.1 and 3.1.2. Understanding the stories means, in this thesis, understanding relevant story events and story mental events. Complete understanding of situated irony occurs when subjects understand and can integrate story events with story mental events.

The relation of situated to spoken irony

Children's understanding of the mental or emotional happenings in stories may coincide with their understanding of ironic utterances in stories. Children's understanding of situated irony is necessary for an understanding of ironic utterances, but may not be sufficient for this understanding.

Spoken irony

Ironic utterances, if made by story characters, may be understood by young children provided they also have the competencies outlined in 3.1.1 and 3.1.2, as these competencies are held to be necessary prerequisites to understanding ironic utterance. A further competence necessary for understanding irony is the ability to distinguish what is said from what is meant.

Why irony is harder than false belief

Understanding false belief requires an understanding of the relation between what Bruner has termed a landscape of action and a landscape of consciousness. However, irony requires not only an understanding of the relation between action and consciousness, but also the ability to coordinate multiple aspects of each landscape simultaneously. Specifically, understanding irony requires that a listener keep in mind, for example, that a character may be happy holding a false belief and then
sad when the character discovers the falsity of his thoughts. Thus, understanding irony will follow and not precede an understanding of false belief.

3.1.5 The listener's emotional state

It is hypothesised that only once children have the competencies outlined in 3.1.1 to 3.1.4 that they may appreciate a story character's sadness in an ironic story. Children who understand and can integrate the beliefs and emotions of both story characters will report they are happy despite a character's sadness in an ironic story.

3.2 Pilot Experiment

3.2.1 Subjects

The subjects for the pilot experiment were children age 4 to 8 years old selected from the Ontario Science Centre and junior public schools in Toronto, Canada. In the pilot study, there were \( N = 37 \) subjects ranging in age from 4:6 to 12 years of age.

3.2.2 Materials

The objective of the pilot experiment was to determine the utility of the measuring instruments and the stories. The pilot experiment was conducted using the scripts contained in Appendix A. The basic outline of the stories and the follow-up questions were as follows. The "Maxi" false-belief task of Wimmer and Perner (1983) was used as a standard against which subject performance on the other story tasks could be compared. However, the story in the present experiment also allowed the experimenter to ask questions concerning the character's emotions, his surprise and happiness, following his discovery of the critical story event. Hypothesis 1 suggested the ability to pass the false-belief task may correlate with the ability to assess the protagonist's emotional states when the protagonist entertains a false belief. This task was given to all subjects. The "Maxi" story in this experiment differed from that of Wimmer and Perner (1983) in a number of significant respects.
First, the stories were briefer so that young subjects would be less likely to tire after the presentation. The interested reader may consult Appendix A for technical details. Second, the revised story, unlike the original, had a proper conflict and resolution to enable questions to be posed to subjects concerning the emotional states of characters and their interpretation of utterances. In the present story subjects asked, prior to Maxi's return, "When Maxi comes back from the playground and wants chocolate, what does he feel? Will he be surprised or not surprised?" and following his discovery of missing chocolate "What does he feel? Point to the face he'll make" The subject, in order to correctly assess Maxi's emotional state, was required to say the character was surprised despite the fact that the subject, given his own advanced knowledge of the character's situation, had no cause to be surprised.

The "Punch and Judy" story was intended to parallel that story structure described by Dennett (1978). Here, a character entertained a false belief and acts on this belief. The subject but not the protagonist knew the protagonist was entertaining a false belief. The story contains both situational irony and a verbal ironic comment. The situational component concerns the switch of emotions of characters as the story proceeds and the fact that the main character, despite his plan to make another character sad, ends the story with himself feeling sadness. The verbal ironic comment occurs following his discovery of his foiled plan, and expresses a sentiment in direct opposition to his true emotional state: the character concludes the story saying "Oh great!"

The "Sniddler's Gulch" story was presented to subjects for exploratory purposes. The purpose of its inclusion was to test the listener's comprehension of this natural text. The story is about a character named Cowboy X who disturbs people in a town with his marking up of the town with X's. The townspeople ask him to please stop making X's all over the town. The character complies, and proceeds to make O's all over the town instead. Following the cowboy's switch, one townsperson remarks "Oh great!" The text was presented in video format and was copied from the popular "Sesame Street" television series.
3.2.3 Procedure

The subjects were told "You are about to participate in an experiment. I will read you a story and ask you some questions about the story characters, o.k.?" The stories were then presented to subjects in random order. The experimenter presented subjects the stories and asked them questions about their own mental, emotional and communicative states and those of story characters as the story events progressed.²

The subjects were asked five kinds of questions for each story. The first question type, that for subject emotion {SE}, was identical to that given for characters except that the question was altered to apply to the subject. Subjects were thus asked questions such as "Are you happy or sad?", and "Are you surprised?". These questions were asked immediately before or immediately following identical questions for character emotion. The second question type tested children's memory {SM} for story events. Subjects were asked to recall those story events which were crucial for their understanding of character beliefs and emotions. The third question type concerned character beliefs {CB}. Subjects needed only state the character's likely course of action or to state what the character believed to be true at that time in the story. The fourth question type concerned character emotions {CE} and required that subjects identify character emotion. To facilitate identification of emotions without an exclusive reliance on linguistic labels, a pointing task was used. Subjects, once asked, for example, "Is the character happy?" or, on alternate trials, "Is the character sad?" were to point to one of four schematic pictures of faces while given an accompanying verbal label by the experimenter. Subjects were asked to choose between basic happy and sad faces or surprised and not-surprised faces. The final question type concerned character utterances {CU}. These were standard "say-mean" questions as used by Torrance and Olson (1987) and were asked following the protagonist's utterances. These questions were designed to tap children's ability to comprehend various aspects of an utterance. It addressed their understanding of the distinction between the

² The oldest group, the 11 year olds, read the stories themselves and answered the questions with pen and paper.
words in an utterance and their intended meaning, e.g., "Does Punch mean what he says?", as well as their understanding of the sentiment underlying the utterance, e.g., "When he said ... does he mean what he said?".

3.2.4 Results

For each of the critical questions the subjects were assigned a composite score for question items ranging from no correct responses out of 2 stories to 2 correct responses out of 2 stories. For the purpose of statistical analyses the subject responses were then collapsed into 2 groups. Scores from 0 to 1 were taken as failing the question while scores of 2 were taken as passing the question. This classification had the advantage that it met the requirement for minimum expected cell frequencies.

Subjects' responses to the false belief questions (e.g., "Where will Maxi look for the chocolate?" and "Does Punch know what is in the box?") were compared across each of the age groups to determine if performance on this question improved with age. The groups did not differ markedly, and the distribution of responses was decidedly negatively skewed. Most children of all ages passed these questions.

Subjects' responses to questions about the protagonist's emotions after his action and before his knowledge of the outcome of his act (e.g., "Is Maxi surprised?" and "Is Punch happy or sad?") were compared across each of the age groups to determine if performance on these questions improved with age. The groups differed considerably in how well they assessed the protagonist's emotion. Whereas only 1 out of 12 4-year-olds correctly said Maxi was not surprised and Punch happy, 9 of 13 7-year-olds and 7 of 12 11-year-olds correctly assessed their emotions. The reported differences were significant, $\chi^2(2, N = 20) = 10.4, p < 0.005$.

Subjects' responses to the utterance questions (e.g., "Does Maxi mean what he says?" and "Does Punch mean what he says?") were compared across each of the age groups to determine if performance on these questions improved with age. The groups did not differ. Only 4 four-year-olds, 1 seven-year-old, and 3 eleven-year-olds correctly said the protagonist did not mean what he
said; most said he meant what he said. While it is not clear why subject performance failed to improve with age, it is possible that children really meant the protagonist means what he says, but they are referring to speaker meaning. Indeed, one child age 6 said, when asked “Does Punch mean what he says?” responded, using falling intonation, “Yes, he means Oh great!” However, given the very small number of subjects tested, it is difficult to know if the response patterns are representative of the performance of each age group. To determine the utility of these questions and the possible cause of the response pattern, more subjects would need to be tested using a variety of metalinguistic measures.

3.2.5 Discussion

The pilot experiment served to validate our measure of false belief. Almost all subjects passed questions concerning the protagonists' beliefs across both stories, which, combined with the fact that subjects were age appropriate to pass the false-belief task, suggests that performance on Wimmer and Perner's false-belief task transfers to questions about Punch's false belief in the Punch and Judy story. Thus, in asking questions of Punch's false belief in future studies we expect to be testing children's understanding of false beliefs.

The pilot experiment demonstrated that although children may correctly assess another's false belief at the expected age, they may fail to correctly assess emotions premised on false belief until about 7 years of age. Only 1 four-year-old who passed the false-belief task also correctly assessed Maxi's and Punch's emotions. Thus, a developmental lag similar to that observed by MacLaren and Olson (1993) in children's understanding surprise was present in this replication. The 'lag' could be tested under different experimental conditions, which will be discussed later, so as to permit inferences about the generalizability of the finding.

The pilot experiment failed to show significant differences in subject performance on the mean-say utterance questions. The questions proved difficult for even the oldest subjects in the study. This may be because subjects may not understand the mean-say questions and are
pragmatically biased to answer "yes". However, it was conceivable that subjects actually detected
the distinction between what is said and what is meant, but the unitary "mean-say" question used
in the study might not be good measures of the abilities in question. To test this, alternative
utterance questions could be used in the major experiment.
CHAPTER 4

THE EXPERIMENT

4.1 Research Questions

The present thesis asks a number of research questions relevant to both story comprehension and appreciation, as well as to children’s theory of mind.

1. Does children’s reportable experience of happiness and surprise while listening to stories change with age?

2. Does children’s memory for story plans and events improve with age?

3. Does children’s understanding of false belief in stories improve with age?

4. Does children’s understanding of a character’s lack of knowledge or thoughts parallel their understanding of false belief?

5. What is the contingency between an understanding of a story character’s knowledge and an understanding of false belief, as measured by Wimmer and Perner’s (1983) task?

6. Does children’s understanding of character second-order beliefs follow a developmental pattern that coincides with their understanding of false belief, or does their understanding of second-order beliefs lag behind this understanding?

7. What is the relation between children’s understanding of another’s knowledge, false belief and their understanding of second-order belief?

8. Granting that there exist differences in children’s ascriptions of knowledge and false belief to story characters, is there any difference in the emotions younger and older children may ascribe to story characters?

9. Do even older children fail emotion questions when they are contingent on false belief?

10. Regarding subjects’ ascriptions of emotion to characters, how do the ascriptions of older subjects differ from those of their younger counterparts?

11. How precisely do children’s ascriptions of emotion to story characters become difficult? How well do children understand a ‘trade-off’ between the emotional states of characters?

12. What proportion of children score correctly on emotion change questions for most stories?

13. What factors give rise to an abrupt improvement in children’s understanding of character emotion? How is an understanding of false belief implicated in this understanding?
14. Could children understand that when the speaker uttered "Oh great!" that the speaker could be speaking ironically and that he thinks a bad thing has happened?

15. What is the relation between understanding emotion and ironic sentiment?

16. What is the relation between an understanding of character emotion and irony and a subject’s experience of emotion following irony? Put another way, do children understand the relation between a character’s emotion and their own emotion as listeners? (e.g., Do they recognize that Punch’s sadness makes them, as readers, happy?)

The questions will be addressed in the Results and Discussion chapter.

4.2 Method

4.2.1 Subjects

The subjects for the experiment include children age 3 to 8 years of age selected from the Ontario Science Centre and junior public schools in Thunder Bay and Toronto, Canada. In the experiment, there were 28 3 to 4-year-old children (Range = 2;7 through 4;9 years; Mdn=4;01), 29 5 to 6-year-old children (Range = 4;10 years through 6;8 years; Mdn=5;11) and 31 7 to 9-year-old children (Range = 6;9 through 9;11 years of age; Mdn=8;01). The age groups were split in this fashion in order to permit a large equal number of subjects to be tested in each age group. The age divisions as they stand are not obscuring known relevant cognitive milestones observed in the literature.

The age distributions of subjects were not markedly skewed. The distribution of 3 to 4-year-old subjects shows one child age 2;7 and approximately equal numbers of 3 and 4-year-old subjects. The distribution of 5 to 6-year-olds includes four older 4-year-olds and approximately equal numbers of 5- and 6-year-olds. Similarly, the distribution of 7 to 9-year-olds includes three children age 6;10 through 6;11, four children age 9;0 through 9;01, and almost equal numbers of 7- and 8-year-olds. See Figures 1-3.
Figure 1: Frequency histogram of 3 to 4-year-olds by year and month.

Figure 2: Frequency histogram of 5 to 6-year-olds by year and month.

Figure 3: Frequency histogram of 7 to 9-year-olds by year and month.
4.2.2 Materials

The recognition task materials included schematic drawings of happy, sad, surprised and neutral faces. There were two false-belief stories (‘Maxi and the Chocolate’ and ‘Pat and the Jellybeans’) and two ironic stories (‘Punch and Judy and the magic box trick’\textsuperscript{3} and ‘Dennis and Darlene’). Story emotion questions concerned two emotions, surprise and happiness. In the false-belief story ‘Maxi and the Chocolate’ questions were asked about character surprise, whereas in the other false-belief story, ‘Pat and the jellybeans’, questions were asked concerning character happiness. In the ironic story ‘Dennis and Darlene’ questions were asked about character surprise, whereas in the other ironic story, ‘Punch and Judy’, questions were asked concerning character happiness. Table 1 shows the story and emotion types and shows that the stories are counterbalanced for type and emotion question.

Table 1: The story titles, story types and emotion questions used in the experiment.

\begin{center}
\begin{tabular}{|l|c|c|}
\hline
\textbf{Emotion} & \textbf{False belief} & \textbf{Ironic} \\
\hline
\textbf{Surprise} & Maxi and the Chocolate & Dennis and Darlene \\
\hline
\textbf{Happy} & Pat and the Jellybeans & Punch and Judy \\
\hline
\end{tabular}
\end{center}

Table 2 shows schematic versions of the stories used in the present experiment. The false-belief script shows the story events. The character, Maxi or Pat, places some desired good, chocolate or jellybeans, in a cupboard and then leaves the room. In the character’s absence, the desired good is moved to some alternate location. The character then returns, looks in the incorrect location, falsely believing the desired good to be in the original location. The ironic script shows the story events for both protagonist and antagonist. The protagonist, Punch or Dennis, declares a plan to play

\textsuperscript{3} Hereafter ‘Punch and Judy’.
harmless tricks with the antagonist and, in an aside to the audience, he states he will play a nasty trick on the antagonist. The antagonist then swaps the cupboard contents. The protagonist then throws water or mud in the cupboard. Following this, he discovers the actual contents of the box and utters “Oh great!” upon discovery that his trick has backfired. The full scripts are presented in Table 3.

Table 2: Schematic stories used in the present experiment

<table>
<thead>
<tr>
<th>False belief</th>
<th>Ironic</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Character puts desired good into Cupboard A.</td>
<td>(1) Protagonist declares intent to play harmless trick.</td>
</tr>
<tr>
<td>(2) Character exits.</td>
<td>(2) Antagonist enters box.</td>
</tr>
<tr>
<td>(3) Contents of Cupboard A swapped to Cupboard B.</td>
<td>(3) Protagonist secretly plans to play nasty trick. (An aside informs.)</td>
</tr>
<tr>
<td>(4) Character enters. Desires goodies. Says “Oh boy!” in excitement.</td>
<td>(4) Antagonist is privy to the aside and knows about protagonist’s secret plan.</td>
</tr>
<tr>
<td>(5) Character looks in Cupboard A and sees nothing.</td>
<td>(5) The antagonist swaps herself for the protagonist’s prized object.</td>
</tr>
<tr>
<td>(6) Character says when he looks in the cupboard “Oh great!”</td>
<td>(6) The protagonist dumps water or mud in the box but the protagonist does not look in the box.</td>
</tr>
<tr>
<td></td>
<td>(7) Protagonist hears antagonist laughing.</td>
</tr>
<tr>
<td></td>
<td>(8) Protagonist looks inside, sees object.</td>
</tr>
<tr>
<td></td>
<td>(9) The protagonist says “Oh Great!”</td>
</tr>
</tbody>
</table>
Table 3: The false-belief and ironic scripts and questions used in the experiment

Maxi and the Chocolate

The following is a story about a person named Maxi. Maxi’s mother returns from her shopping trip. She bought chocolate for a cake. Maxi may help her put away some things. He asks her ‘Where should I put the chocolate?’ ‘In the BLUE cupboard,’ says the mother. ‘Wait I’ll lift you up there, because you are too small.’ Mother lifts him up.

Maxi puts the chocolate in the BLUE cupboard. Maxi remembers exactly where he put the chocolate so that he could come back and get some later. He loves chocolate. Then he leaves for the playground. Mother takes the chocolate out of the blue cupboard, uses it and puts it back not in the blue cupboard but in the GREEN cupboard. (So the subject sees it placed in the GREEN one) She then leaves the room.

Maxi then comes back from the playground, is hungry, and wants some chocolate. He says “Oh Boy!” because he really loves chocolate. Maxi remembers where he put the chocolate.

{FB} Where will Maxi look for the chocolate?
{CU} What did Maxi mean when he said “Oh Boy”? When he says this, does he mean what he says?
{CE} When Maxi comes back from the playground and wants chocolate, what does he feel? Does he think he will be surprised?
{SE} Are you surprised or not surprised?

Maxi then looks in the BLUE cupboard and sees nothing. Maxi says when he looks in the cupboard “Oh great!”

{CE} When he looks in the cupboard, what does he feel? Is he surprised or not surprised?
{CU} What did Maxi mean when he said “Oh great”? When he says this, is he saying this is a good thing? Does he mean what he says?
{CU} Maxi said “Oh great!” when he saw the empty cupboard and “Oh boy!” when he saw the cupboard. One of these times was funny. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?
{CU} Maxi said “Oh great!” when he saw the empty cupboard and “Oh boy!” when he saw the cupboard. One time, he did not mean what he said. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?
{SE} Are you surprised or not surprised?

Punch and Judy, and the magic box trick

The following is a story about a boy named Punch and a girl named Judy. Punch is a very, very, naughty little boy who always likes to play tricks on Judy. One day, Punch gets a new coat for his birthday. Punch is very proud of his new coat and he struts all over the place in his new coat. To celebrate his new present, Judy and Punch decide to spend the afternoon playing magic. Punch is the magician and Judy is his helper. Punch tells Judy “Judy, go in this box and I will show you something.” When she hears this, Judy steps inside the box and Punch closes the lid of the box. Now Judy is inside the box. Punch now says to himself “Oh boy!” Punch says “Now that Judy is inside the box I will take my pail of water and pour water all over her” Punch then goes away to get his bucket. But Judy hears Punch talking to himself. Judy can hear him saying he’s going to pour water on her.

{CB} Does Punch think that Judy knows about his plan?
{CB} Does Judy know Punch is planning to put water in the box?
How does Punch feel? Is he sad or happy?

How does Judy feel? Is she sad or happy?

What is Punch planning to do with the water?

Are you sad or happy?

What did Punch mean when he said “Oh Boy”? When he says “Oh boy”, does he mean what he says?

She steps quietly out of the box and tip toes over to the place where Punch keeps his new coat. She takes Punch’s new coat and puts it in the box and then hides behind a tree where she can watch the fun.

Does Punch know what is in the box?

What is in the box?

Are you sad or happy?

Punch returns with the bucket of water. Punch closes his eyes, lifts the bucket above his head, opens the lid to the box and dumps the bucket of water into the box! Remember, Punch does not look in the box.

What did Punch think was in the box?

Now that Punch spilled water in the box, what does he feel? Is he sad or happy?

Now that Judy saw Punch spill water in the box, how does she feel? Is she sad or happy?

Were you sad or happy when Punch dumped water on his coat?

After Punch pours the water inside the box, he hears Judy laughing. He then looks inside, sees his new coat is all wet.

When Punch looks into the box, what face does he make? Is he sad or happy?

How does Judy feel? When Punch looks into the box, is Judy sad or happy?

Were you sad or happy when Punch poured the water on his coat?

Punch then says “Oh Great!”

Was Punch sad or happy at the end of the story?

Was Ms. Judy sad or happy at the end of the story?

Does Punch mean what he says?

Does Punch think he did a good thing?

Punch said “Oh boy!” when Judy was in the box and “Oh great!” when he saw his coat. One of these times was funny. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?

Punch said “Oh boy!” when Judy was in the box and “Oh great!” when he saw his coat. One time he does not mean what he said. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?

Pat and the Jellybeans

The following is a story about a person named Pat. Pat’s mother returns from her shopping trip. She bought jellybeans for a cake. Pat helps her put away some things. He asks her ‘Where should I put the jellybeans?’ ‘In the WHITE jar,’ says the mother. ‘Wait I’ll lift you up there, because you are too small.’ Mother lifts him up.

Pat puts the jellybeans in the WHITE jar. Pat remembers exactly where he put the jellybeans so that he could come back and get some later. He loves jellybeans. Then he leaves for the playground.
Mother takes the jellybeans out of the WHITE jar, eats some and puts them back not in the WHITE jar but in the BLACK jar. (So the subject sees it placed in the BLACK jar.) She then leaves the room.

Pat then comes back from the playground, is hungry, and wants some jellybeans. He says “Oh Boy!” because he really loves jellybeans. Pat remembers where he put the jellybeans.

{FB} Where will Pat look for the jellybeans?

{CE} When Pat comes back from the playground and wants jellybeans, what does he feel? Does Pat think he will be sad or happy?

{SE} Are you sad or happy?

Pat then looks in the WHITE jar and sees nothing. Pat says when he looks in the jar “Oh great!”

{CE} When he looks in the cupboard, what does he feel? Is Pat sad or happy?

{CU} What did Pat mean when he said “Oh great”? When he says this, does he think this is a good thing? Does he mean what he says?

{CU} Pat said “Oh boy!” when he saw the jar and “Oh great!” when he saw the empty jar. One of these times was funny. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?

{CU} Pat said “Oh boy!” when he saw the cupboard and “Oh great!” when he saw the empty jar. One time, he did not mean what he said. Which one was it?

{SE} Are you sad or happy?

Dennis and Darlene

The following is a story about a boy named Dennis and a girl named Darlene. Dennis is a very, very, naughty little boy who always likes to play tricks on Darlene. One day, Dennis gets a new shoes for his birthday. Dennis is very proud of his new shoes and he walks all over the place in his new shoes. To celebrate his new present, Darlene and Dennis decide to spend the afternoon playing house. Dennis is the house and Darlene is his helper. Dennis tells Darlene “Darlene, go inside this cupboard and I will show you something.” When she hears this, Darlene steps inside the cupboard and Dennis closes the lid of the cupboard. Now Darlene is inside the cupboard. Dennis now says to himself “Oh boy!” Dennis says “Now that Darlene is inside the cupboard I will take my pail of mud and pour mud all over her.” Dennis then goes away to get his bucket. But Darlene hears Dennis talking to himself. Darlene can hear him saying he’s going to pour mud on her.

{CB} Does Dennis think that Darlene knows about his plan?

{CB} Does Darlene know Dennis is planning to put mud in the cupboard?

{CE} How does Dennis feel? Is Dennis surprised or not surprised?

{CE} How does Darlene feel? Is Darlene surprised or not surprised?

{SM} What is Dennis planning to do with the mud?

{SE} Are you surprised or not surprised?

{CU} What did Dennis mean when he said “Oh Boy”? When he says “Oh boy”, does he mean what he says?

She steps quietly out of the cupboard and tip toes over to the place where Dennis keeps his new shoes. She takes Dennis’s new shoes and puts it in the cupboard and then hides behind a tree where she can watch the fun.

{CB} Does Dennis know what is in the cupboard?

{SM} What is in the cupboard?
Are you surprised or not surprised?

Dennis returns with the bucket of mud. Dennis closes his eyes, lifts the bucket above his head, opens the lid to the cupboard and dumps the bucket of mud into the cupboard! Remember, Dennis does not look in the cupboard.

What did Dennis think was in the cupboard?
Now that Dennis spilled mud in the cupboard, what does he feel? Is Dennis surprised or not surprised?
Now that Darlene saw Dennis spill mud in the cupboard, how does she feel? Is Darlene surprised or not surprised?
Were you surprised or not surprised when Dennis dumped mud on his shoes?

After Dennis pours the mud inside the cupboard, he hears Darlene laughing. He then looks inside, sees his new shoes are all muddy.

What does Dennis feel? When Dennis looks into the cupboard, is Dennis surprised or not surprised?
What does Darlene feel? When Dennis looks into the cupboard, is Darlene surprised or not surprised?
Were you surprised or not surprised when Dennis poured the mud on his shoes?

Dennis then says “Oh Great!”

Was Dennis surprised or not surprised at the end of the story?
Was Ms. Darlene surprised or not surprised at the end of the story?
Does Dennis mean what he says?
Does Dennis think he did a good thing?
Dennis said “Oh boy!” when Darlene was in the cupboard and “Oh great!” when he saw his shoes. One of these times was funny. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?
Dennis said “Oh boy!” when Darlene was in the cupboard and “Oh great!” when he saw his shoes. One time he does not mean what he said. Which one was it? Was it when he said “Oh great!” or “Oh boy!”?

4.2.3 Procedures

The subjects were told “You are about to participate in an experiment. I will read you a story and ask you some questions about the story characters, o.k.?” Subjects were then given the recognition pre-task. The subjects were required to successfully complete the recognition pre-task prior to advancing to the next segment of the experiment. The recognition pre-task required that subjects point to a schematic facial expression appropriate to the verbal label. The faces were neutral, surprised, happy and sad. See Appendix B.

The four stories were presented to subjects in random order. Subjects were read stories by the experimenter and asked questions about character beliefs, emotions and utterances as the story
progressed. Subjects were also asked memory control questions and questions concerning their own story knowledge and emotions. In sum, there were five kinds of question for each story, namely, questions concerning subject experiences, memory questions, and questions for character beliefs, emotions and utterances. See Table 3.

The first question type, that for the subject's experience of emotion {SE} in Table 3, is identical to that given for characters except that the question was altered so that it applied to the subject himself (i.e., "Are you happy or sad?" or "Were you surprised or not surprised when Dennis dumped mud on his shoes?"). These questions were asked immediately before or following identical questions for character emotion.

The second question type tested children's memory {SM} for story events in the ironic stories. Subjects were asked to recall those story events which were crucial for their understanding of character plans (i.e., "What is Punch planning to do with the water?") and events (i.e., "What is in the box?"). The rationale for these questions was to permit inferences to be made about the children's understanding of beliefs in the absence of memory confounds.

The third question type, that concerning character beliefs {CB}, required only that subjects state what the character believed to be true at that time in the story. The belief questions were either direct questions about the contents of a character's mind (i.e., "What does Punch think is in the box?") or indirect questions about character action, as in Wimmer and Perner (1983) which implicate belief (i.e., "Where will Maxi look for the chocolate?" {FB}). In addition, subjects were asked second-order questions about the protagonist mental states (i.e., "Does Punch think that Judy knows about his plan?" {CB}) and for the story antagonists (i.e., "Does Judy know that Punch is planning to pour water in the box?" {CB}).

The fourth question type, that concerning character emotions {CE}, required that subjects identify basic character emotions. To facilitate the identification of character emotions without an exclusive reliance on linguistic labels, a pointing task was available for subjects. Once asked, for example, "Is the character happy or sad?" or, on alternate trials, "Is the character sad or happy?" the experimenter could, if he deemed they were having difficulty, point to one of faces while given
an accompanying verbal label. The emotion terms were reversed on alternate trials to counter spurious effects due to the order of the items.

The fifth question type, those concerning character utterances (CU), were of two varieties. The first were standard "mean-say" questions (i.e., "Does Punch mean what he says?" and "One time Punch said 'Oh boy!' and one time he said 'Oh great!'". One of these times Punch did not mean what he said. Which one was it? Was it when he said 'Oh boy!' or was it when he said 'Oh great!'?""). The second were questions about the speaker's evaluation of the story events (i.e., "When Punch says this, does he think a good thing has happened?"). These questions tapped children's ability to comprehend the distinction between the words in an utterance and their intended meaning, as well as the sentiment behind a speaker's utterance. The third tapped children's understanding that irony is a special use of language. To test if children could distinguish the differing uses of "Oh boy!" and "Oh great!" children were also told "One time Punch said 'Oh boy!' and one time he said 'Oh great!'". One of these times was funny. Which one was it? Was it when he said 'Oh boy!' or was it when he said 'Oh great!'?

4.2.4 Analysis

The primary independent variable for this design was subject age which, of course, was not manipulated directly. The dependent measures were subject responses to the questions concerning character beliefs, emotions and utterances. The subject's ascriptions of belief and emotion to story characters were treated as independent variables for questions pertaining to children's understanding of ironic utterances.

The design is cross-sectional: each subject is tested during a limited time period. Further, aside from story order the presentation was the same for all subjects. Finally, the inferences possible from this study ought to be generalizable to the general child population, as no special sampling procedures are used apart from those characteristic of studies within the paradigm. The study has each subject receiving multiple stories. The format was selected primarily because of the advantages of the repeated measures format (i.e., an increase in power resulting in fewer subjects being required per age group).
The data were subjected to both CHI-SQUARE tests and HILOGLINEAR analyses. The experimental hypotheses posits qualitative differences in children’s pass-fail performance on some questions. The CHI-SQUARE and HILOGLINEAR analyses are useful for testing hypotheses with dichotomous variables, and are commonly used when qualitative differences between age groups are posited.

4.2.5 Assumptions

The hypothesised causal model for the analysis entails a number of assumptions:

1. Subject age is a determinant of performance on the false-belief task.
2. Performance on the knowledge and false-belief tasks are determinants of performance on questions about belief-dependent emotions.
3. Performance on tests of understanding belief and belief-dependent emotion are co-determinants of children’s understanding of ironic utterances.

The model may be expected to account for the relevant responses given by subjects to these questions. The model tests, in causal terms, the role an understanding of false belief plays in children’s comprehension of emotion and utterance in story contexts.
CHAPTER 5

RESULTS AND DISCUSSION

5.1 Questions for Self

5.1.1 Subject experience

Does children’s reported experience of happiness and surprise while listening to stories change with age?

Recall that in each of the stories the subjects were asked questions about their own experience of happiness and surprise. In the Maxi and the chocolate story and the Dennis and Darlene story, subjects were asked “Are you surprised or not surprised?” at each critical juncture in the story. Similarly, subjects were asked in the Punch and Judy story and the Pat and the Jellybeans story “Are you sad or happy?” at each critical juncture. Subject’s assessments of their emotions were calculated for each of the groups. There were no significant age effects. See Figures 4 through 7.

Figure 4: Subject responses to questions about surprise for self during presentation of the Maxi and the Chocolate story before (Question 1) and after discovery of the critical event (Question 2).
Figure 5: Subject responses to questions about happiness for self during presentation of the Pat and the Jellybeans story before (Question 1) and after (Question 2) the discovery of the critical event.

In the Maxi false-belief story, a small majority of subjects say they are surprised both prior to and following his discovery of an empty cupboard. Similarly, in the Pat story, a small majority of subjects at all ages say they are happy prior to and following his unpleasant discovery.

Figure 6: Subject responses to questions about happiness for the self during presentation of the Punch and Judy story before (Question 1 & 2) and after (Questions 3 & 4) discovery of the critical event.
Figure 7: Subject responses to questions about surprise for self during presentation of the Dennis and Darlene story before (Questions 1, 2) and after (Questions 3, 4) discovery of the critical event.

In the Punch and Judy story, many subjects say they are happy throughout the story. Similarly, in the Dennis and Darlene story a small majority of subjects say they are surprised, then not surprised prior to and following the character’s discovery. Many subjects say they are surprised by the time of the fourth question. Overall performance was not as expected on these questions. The reasons will be discussed in the next chapter. For now it may be noted that a small majority of subjects report being surprised and happy throughout the stories.

5.2 Questions for the character

5.2.1 Scoring

Subjects could be asked comparable questions more than once in a story or over the course of the experiment. In this case the most parsimonious and efficient way to present subject performance is by the use of a single aggregate score rather than multiple independent scores. If subjects were asked, for example, comparable, or theoretically equivalent questions across two stories, then subject scores could range from no correct responses out of two stories to two correct responses out of two stories. For the purpose of statistical analyses the subject responses were collapsed into 2 groups. Scores from 0 to 1 were taken as failing the question while scores of 2 were taken as passing the question. Similarly, if subjects were asked four comparable questions in four stories, scores could range from no correct responses out of four stories to four correct responses out of four stories. For the purpose of statistical analyses the subject responses were then collapsed into 2 groups. Scores
from 0 to 2 were taken as failing the question while scores of 3 to 4 were taken as passing the question. The classification had the advantage that it met the requirement for minimum expected cell frequencies.

It should be noted that it was necessary to collapse some rows or columns. It is well known that collapsing tables may lead to the obscuring of potentially important effects, so the following procedures were used in collapsing rows or columns. First, observed row or column totals were examined and a temporary median split across rows was made. Second, cells above and/or below the median were inspected for potentially interesting row by column effects. Finally, if no useful information was concealed by the median split, it was accepted for use. If interesting, relevant information was evident with an alternative criterion, then that criterion was accepted for use. Exceptions to this are noted in the text where they occur. The three age groups established at the beginning of the experiment were never collapsed.

5.2.2 Children’s memory for story plans and events

Does children’s memory for story plans and events improve with age?

The memory questions for story plans and events were asked only in the irony stories as only the irony stories contained changing story plans and events. Subject responses to the various memory questions revealed no differences in the performance of younger and older children; all subjects performed at a high level. Recall that these questions require subjects to recall story plans and events at those junctures in the stories where the protagonist’s and subject’s knowledge differs.

Subject scores could range from no correct responses out of two stories to two correct responses out of two stories. Scores from 0 to 1 were taken as failing the question while scores of 2 were taken as passing the question. To the key plan question “What is Punch/Dennis planning to do with the water/mud?” all subjects age 5 through 9-years rightly made reference to the protagonist putting the water/mud “in the box” or “on Judy/Darlene”. All but 5 to 4-year-olds said the character was going to put water/mud in the box or on Judy/Darlene, and those 5 gave no statement of the character’s plan on one or more of the questions.
Another key memory question was "What is in the cupboard/box?" to which the subject would have to reply 'coat' and 'shoes' respectively to score correct. Most subjects scored correctly on these event questions. Twenty-seven of 29 3 to 4-year-olds passed these questions, as did 27 of 29 5 to 6-year-olds and 30 of 31 7 to 9-year-olds. The response pattern was non-significant, by inspection. There is no evidence to suggest that subject performance on this question improved markedly during this age span from 3 to 7; all subjects performed at a high level.

5.2.3 Children's understanding of belief

Subjects' responses to the various belief questions (e.g., "Where will Maxi/Pat look for the chocolate?", "Does Punch/Dennis know what is in the box?" and "What does Punch/Dennis think is in the box?") were compared across each of the age groups to determine if performance on these questions improved with age.

Does children's understanding of false belief in stories improve with age?

Wimmer and Perner's (1983) false-belief questions (e.g., "Where will Maxi look for the chocolate?") were asked only in the false-belief stories, and the distribution of responses correspond to those reported by Wimmer and Perner (1983) in that 3 to 4-year-olds fail to respond correctly to questions about Maxi's and Pat's false beliefs. The same pass-fail criteria used for the false-belief questions were used for this analysis. Scores from 0 to 1 were taken as failing the false-belief questions while scores of 2 were taken as passing the question. Only 10 of 29 3 to 4-year-old children passed these questions, whereas 27 of 29 5 to 6-year-olds and 30 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 38.6, p < 0.0001$. The 3 to 4-year-olds fail questions about a character's false belief whereas most 5 to 6-year-olds pass these questions.

Does children's understanding of a character's lack of knowledge or thoughts parallel their understanding of false belief?

The knowledge questions were variants of the false-belief questions and were direct questions about the protagonist's knowledge. These questions were asked only in the ironic stories. Subject scores could range from no correct responses out of two stories to two correct responses out of two stories. Scores from 0 to 1 were taken as failing the knowledge questions while scores of 2 were
taken as passing the questions. To the question "Does Punch/Dennis know what's in the box?" only 14 of 28 3 to 4-year-olds said Punch did not know what was in the box. In contrast, 26 of 29 5 to 6-year-olds and 31 of 31 7 to 9-year-olds could ascribe Punch or Dennis ignorance, $\chi^2(2, N = 89) = 32.3, p < 0.0001$. The performance of children on the knowledge questions paralleled their performance on the false-belief questions. Further, when asked the question "What did Punch/Dennis think was in the box?" only 4 of 28 3 to 4-year-olds said Punch falsely thought Judy was in the box. In contrast, 28 of 29 5 to 6-year-olds and 31 of 31 7 to 9-year-olds could ascribe Punch or Dennis this false belief, $\chi^2(2, N = 89) = 66.4, p < 0.0001$. Most 3 to 4-year-olds falsely believed Punch/Dennis thought the box contained a coat/shoes. See Figure 8.

The results for these questions show that a parallel pattern of results is attained for these knowledge and thought questions as those obtained for questions concerning Maxi's and Pat's false belief. However, it may be noted that 4's appear to perform somewhat worse on the thoughts questions than knowledge or false-belief questions.

The belief questions across all four stories were failed by the majority of 3 to 4-year-olds and passed by the majority of 5 to 6-year-olds. Figure 8 shows subject performance on the knowledge and false-belief questions. The findings of Wimmer and Perner (1983) are thus confirmed and extended to the knowledge and thoughts questions in the story scenario.

Knowledge and false belief

*What is the relation between an understanding of another's knowledge and an understanding of false belief, as measured by Wimmer and Perner's (1983) task?*

Subject performance on the knowledge and false-belief questions was positively correlated. Of the 18 subjects who failed the knowledge question, 13 of these also failed the false-belief questions; 62 of 71 subjects who pass the knowledge question passed the false-belief question. The contingency was significant, $\chi^2(2, N = 89) = 27.4, p < 0.0001$. Only 9 children passed the knowledge question while failing the false-belief question, and only 5 children passed the false-belief questions and failed the knowledge question, $p = 0.211$, binomial. The questions appear comparable.
Second-order-belief questions

*Does children's understanding of character second-order beliefs follow a developmental pattern that correspond to their understanding of false belief, or does their understanding of second-order beliefs lag behind this understanding?*

The age groups differed markedly in their understanding of Punch's and Dennis's beliefs about another's beliefs. When asked "Does Punch/Dennis think that Judy/Darlene knows about his plan?" only 9 of 28 3 to 4-year-olds correctly said Punch/Dennis did not think Judy/Darlene knew about his plan. There were 15 of 29 5 to 6-year-olds and 29 of 31 7 to 9-year-olds who could correctly ascribe this second-order belief, $\chi^2(2, N = 89) = 25.4, p < 0.0001$. As Figure 8 shows, most 3 to 4-year-olds fail the second-order belief questions, whereas these questions are passed by most 7 to 9-year-old subjects.

The age groups also differed in their understanding of Judy's and Darlene's understanding of Punch's and Dennis's plans. When asked "Does Judy/Darlene know that Punch/Dennis is planning to put water/mud in the box?", only 15 of 29 3 to 4-year-olds and 26 of 29 5 to 6-year-olds gave the correct answer, as did 30 of 31 7 to 9-year-olds, $\chi^2(2, N = 89) = 21, p < 0.0001$. This understanding is parallel to their understanding of character knowledge.

The results suggest that the developmental time-course for understanding second-order belief is far from equivalent to that of understanding false belief. An understanding of second-order belief appears to lag behind an understanding of false belief.

**Knowledge, thoughts, false belief and second-order belief**

*What is the contingency between children's understanding of another's knowledge, thought, false belief and their understanding of second-order belief?*

The next analysis compares children's performance on the two false-belief questions (i.e., "Where will Maxi/Pat look for the chocolate/jellybeans?") in the Maxi and Pat stories with their performance on the two critical second-order belief questions (i.e., "Does Punch/Dennis think that Judy/Darlene knows about his plan?") in the Punch and Dennis ironic stories.

Older 8-year-old subjects, in the main, passed both the false-belief questions and the second-order-belief questions. The scores of these older subjects were excluded from these analyses as their responses were at ceiling. Thus, only the scores of the transitional 3 to 6-year-old subjects were
used in this analysis. Fifteen of 21 subjects who fail the false-belief questions also fail the second-order belief questions, and 18 of 37 subjects who pass the false-belief questions also pass the second-order belief questions. The contingency was not significant, $\chi^2(1, N = 58) = 2.2, p < 0.13$. Fully 19 of 34 subjects who pass the false-belief questions fail the second-order belief questions, and only 6 subjects pass the second-order belief question and fail the false-belief questions, $p < 0.05$, binomial. Understanding false belief precedes an understanding of second-order belief, yet many of the subjects who passed the false-belief question still failed the second-order belief question suggesting that the second-order belief question is more complex.
Table 4: Contingency table of 3 to 4 and 5 to 6-year-old subject pass-fail scores on the false belief, knowledge, thought and second-order belief questions

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<table>
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<table>
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<th>Fail</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fail</td>
<td>20</td>
<td>6</td>
</tr>
<tr>
<td>Pass</td>
<td>14</td>
<td>18</td>
</tr>
</tbody>
</table>

The contingency between an understanding of what a character knows and an understanding of second-order belief is even more obvious. An examination of the same 3 to 6-year-old subjects revealed that 16 of 18 subjects who fail the knowledge questions also fail the second-order belief questions, and 22 of 40 subjects who pass the knowledge questions also pass the second-order belief questions. The contingency was significant, $\chi^2(1, N = 58) = 9.8, p < 0.002$. Despite this strong contingency between performance on the knowledge and second-order belief questions, fully 18 of 40 subjects who pass the knowledge questions fail the second-order belief questions, yet few subjects, 2 of 18, failed the knowledge question and passed the second-order belief question. Binominal $p < 0.05$, one-tail. Understanding a character’s knowledge precedes an understanding of second-order belief.

The contingency between an understanding of what a character thinks (i.e., the thoughts question) and an understanding second-order belief was tested. Examination of the transitional 3 to 6-year-old subjects shows 20 of 26 subjects who fail these questions also fail the second-order belief questions, and 18 of 32 subjects who pass these questions also pass the second-order belief questions. The contingency was significant, $\chi^2(1, N = 58) = 6.5, p < 0.01$. Again, despite this strong contingency between performance on these thoughts questions and second-order belief questions,
14 of 32 subjects who pass the thoughts questions fail the second-order belief questions, yet only 6 of 26 subjects who fail the thoughts question pass the second-order belief question, binomial $p < 0.05$, one-tail. The second-order belief question is more complex than the thoughts question.

To check which of the knowledge and false-belief questions best predict performance on the second-order belief questions for the transitional age groups, HILOGLINEAR analyses were performed using two models describing the relationships among the variables age, knowledge, false belief, possible thoughts and second-order belief to help determine the best model to fit the data. The first model tested, for 3 to 6-year-old subjects, the relation among age, an understanding of false belief, and an understanding of second-order belief. The resulting model showed age predicts an understanding of false belief, $L^2(1, N = 58) = 24, p < 0.00001$. No effect was noted between understanding false belief and understanding second-order belief. In contrast, the second model, which tested the relation among age, knowledge questions and second-order belief questions showed significant age by knowledge contingencies, $L^2(1, N = 58) = 12.4, p = 0.0004$ and knowledge predicts performance on second-order belief questions, $L^2(1, N = 58) = 11.1, p = 0.0009$. No three-way effects were noted. Finally, the third model tested the relation among age, an understanding of another’s possible thoughts and their understanding of second-order belief. The analysis showed significant age by thoughts contingencies, $L^2(1, N = 58) = 47.8, p = 0.0001$ and thoughts predicts performance on second-order belief questions, $L^2(1, N = 58) = 6.7, p = 0.009$. No three-way effects were noted. Thus, children’s understanding what a character thinks another knows depends on children’s understanding of a character’s knowledge and possible thoughts.

5.2.4 Children’s understanding of emotion

Granting there exist differences in children’s ascriptions of knowledge, thoughts and false belief to story characters, is there any difference in the emotions younger and older children may ascribe to story characters?

To help answer this question, two types of analyses were employed. The first used the aggregate scores across stories for various measures of children’s understanding of emotion whereas the second examined the emotion questions individually.
Consider first the aggregate scores. To test subjects' understanding of the emotions of the protagonist before and after discovery, subjects were scored on their ascriptions of emotion to the story protagonist prior to and following his discovery of the actual contents of the boxes across the four stories. There was one question asked prior to the protagonist's discovery and one question asked following his discovery of the actual contents of the boxes in each story. Thus, eight of these questions were used across the four stories in this analysis. Aggregate scores could therefore range from no correct responses out of eight questions to eight correct responses out of eight questions. For the purpose of statistical analyses the subject responses were then collapsed into 2 groups and a conservative criterion adopted. Scores from 0 to 5 were taken as failing these questions while scores of 6 through 8 were taken as passing these questions.

Four of 29 3 to 4-year-olds, 7 of 29 5 to 6-year-olds and 15 of 31 7 to 9-year-olds passed the combined emotion questions. The difference was significant, \( \chi^2(2, N = 89) = 9.2, p = 0.01 \). The questions which appear to be difficult for even some older subjects are those questions asking children to predict a character's surprise, as will be shown in the next section.

*Why did so many older children fail these emotion questions?*

Recall that the emotion questions concerned both happiness and surprise. It was postulated that since surprise questions prove difficult for children because they often equate surprise with pleasantness (MacLaren and Olson, 1993), some children might equate surprise with pleasantness and still answer the surprise questions correctly. For example, if asked "Does Maxi think he will be surprised?" young children could equate surprise with pleasantness and reply "No, Maxi thinks he won't be surprised" because of the unpleasantness of the outcome. In responding "No" to the question "Does Maxi think he will be surprised" child subjects may mean "No Maxi thinks he won't be happy". If this is true, then it is expected that subject answers to surprise questions may be affected by the desirability of the outcome. To test for the presence of this effect a series of tests was performed on various emotion questions for each story. The results of these analyses are given below.
The false-belief stories

The "Maxi and the chocolate" and "Pat and the Jellybeans" false-belief scripts required that subjects assess character's emotions prior to and following his discovery. See Table 5 for details. Consider first children's assessments of the character's feelings prior to his unpleasant discovery of an empty container in the false-belief scripts. In these scripts, two emotion questions assess the character's belief about his future emotional state prior to his discovery of missing contents. Children were asked "Does Maxi/Pat think he will be surprised/happy?" In these false-belief stories the question concerning Maxi's anticipated surprise and Pat's happiness yielded quite different response patterns.

The questions for Maxi's surprise prior to his discovery of the critical change in cupboard contents yielded no significant differences across the age groups, as 11 of 29 3 to 4-year-olds, 6 of 29 5 to 6-year-olds and 12 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 2.8$, $p = 0.24$. See Table 5. In contrast, comparable questions for Pat's happiness and sadness were passed by 15 of 29 3 to 4-year-olds, 21 of 29 5 to 6-year-olds and 26 of 29 7 to 9-year-olds $\chi^2(2, N = 89) = 7.5$, $p = 0.02$. It is remarkable to note that about $\frac{1}{2}$ of 5 to 6-year-olds pass these emotion questions when the emotion assessed was happiness whereas $\frac{1}{2}$ of subjects did so when it pertained to surprise.
Table 5: Number of children in each age group ascribing (a) surprise to Maxi and (b) happiness to Pat prior to and following the unpleasant discovery.

(a) Surprise

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| N | 29 | 29 | 31 |

(b) Happiness

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<td>(2) Post-discovery</td>
<td>Sad</td>
<td>24</td>
<td>29</td>
<td>31</td>
</tr>
</tbody>
</table>

| N | 29 | 29 | 31 |

Next, consider children’s understanding of emotions after the critical event is revealed and the character discovers his misfortune. The special difficulty children display with understanding a protagonist’s surprise is revealed when their understanding of surprise is tested across age groups following the protagonist’s discovery of the critical event. In the Maxi and the Chocolate story, children were asked, following Maxi’s discovery of missing chocolate, an unpleasant event, “Is Maxi surprised?”. To this question, 12 of 29 3 to 4-year-olds, 9 of 29 5 to 6-year-olds and 22 of 31 7 to 9-year-olds correctly responded “Yes, Maxi is surprised” $\chi^2(2, N = 89) = 10.4, p = 0.006$. The 3 to 6-year-olds fail to understand Maxi’s surprise. Only 7 to 9-year-olds understand Maxi’s surprise. On the other hand, in the Pat and the Jellybeans story, children were asked, following Pat’s discovery of missing jellybeans (i.e., another unpleasant event), “Is Pat happy or sad?”. To this question, 24 of 29 3 to 4-year-olds, 29 of 29 5 to 6-year-olds and 31 of 31 7 to 9-year-olds responded Pat was sad, $\chi^2(2, N = 89) = 11, p = 0.004$. Most children understand Pat’s sadness.
The ironic stories

Responses by question

Recall next the “Punch and Judy” and “Dennis and Darlene” ironic scripts (details are given in Table 3). In these stories, unlike the false-belief stories, the protagonist and antagonist play out a competitive “zero-sum” game with one another. Subjects were asked to predict each character’s emotions as the story progressed. The next discussion presents results for the protagonist and antagonist emotions. The results for the protagonist are given first, followed by results for the antagonist.

Two emotion questions, one per story, assessed children’s understanding of the protagonist’s emotion prior to his discovery of the unpleasant outcome. In the “Punch and Judy” story and “Dennis and Darlene” story, the question concerning Punch’s happiness and the question for Dennis’s surprise yielded different response patterns. The results for the first emotion question are given in Table 6 (a)(1) and 6 (b)(1). For the happiness question, only 16 of 29 3 to 4-year-olds pass this question, whereas 29 of 29 5 to 6-year-olds and 31 of 31 7 to 9-year-olds pass these questions. The results show a sharp improvement in performance on these questions between the ages of 4 and 5 years, by inspection. However, the results for the surprise question were that 14 of 29 3 to 4-year-olds, 12 of 29 5 to 6-year-olds and 16 of 31 7 to 9-year-olds pass these questions. The results for the surprise question are non-significant, by inspection.

Consider next the second emotion questions. The questions for Punch’s happiness immediately prior to his discovery of a wet coat yielded no significant differences across the age groups, as 14 of 29 3 to 4-year-olds, 17 of 29 5 to 6-year-olds and 21 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 2.3, p = 0.31$. See Table 6 (a)(2). The majority of 3 to 4-year-olds fail to understand Punch could be happy while entertaining his false-belief; older children fare little better. In contrast, the performance of children on comparable questions for Dennis’s surprise were that 23 of 29 3 to 4-year-olds, 18 of 29 5 to 6-year-olds and 13 of 29 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 8.8, p = 0.01$. See Table 6 (b)(2). Young children here more often answer correctly than older children! The reasons for this may again be that very young children equate “no surprise” with unpleasantness, and may actually be ascribing sadness to Dennis prior to
Dennis's having knowledge of his misdeed. Minimally, it seems inappropriate to treat the two emotion questions as equivalent.

Table 6: Number of children in each age group ascribing (a) happiness to Punch and (b) surprise to Dennis prior to and following the unpleasant discovery.

(a) Happiness

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<td>28</td>
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N 29 29 31

(b) Surprise

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<td>Surprised</td>
<td>11</td>
<td>11</td>
<td>20</td>
</tr>
</tbody>
</table>

N 29 29 31

Consider next children's assessments of protagonist emotions following the protagonist discovering the critical unpleasant event. In these stories, two emotion questions, one per story, assessed the protagonist's emotion following his discovery of this unpleasantness.
In the “Punch and Judy” story and “Dennis and Darlene” story, the question concerning Punch’s happiness and the question for Dennis’s surprise again yielded different response patterns. When asked comparable questions about happiness and sadness following Punch’s discovery of the fruits of his misdeed in the Punch and Judy ironic story, most of the children predicted the appropriate emotion. Twenty-five of 29 3 to 4-year-olds, 29 of 29 5 to 6-year-olds predict Punch is sad and 31 of 31 7 to 9-year-olds predict his sadness; this was not significant by inspection. See Table 6 (a)(3). In contrast, regarding surprise, following Dennis’s discovery of mud on his shoes, 8 of 29 3 to 4-year-olds, 10 of 29 5 to 6-year-olds and 21 of 31 7 to 9-year-olds predict the correct emotion, \( \chi^2(2, N = 89) = 11.3, p = 0.003 \). See Table 6 (b)(3). Young children fail to say that Dennis is surprised to find mud on his shoes. Older children say Dennis may be surprised to find mud on his shoes.

The results for the final emotion questions show steady improvements in children’s ability to understand character emotion. Table 6 (a)(4) shows 18 of 29 3 to 4-year-olds, 28 of 29 5 to 6-year-olds and 31 of 31 7 to 9-year-olds pass these questions for Punch’s sadness. By age 5 years, most children correctly assess Punch’s emotion at the conclusion of the story. Table 6 (b)(4) shows that 11 of 29 3 to 4-year-olds, 11 of 29 5 to 6-year-olds and 20 of 31 7 to 9-year-olds pass the surprise questions. By age 7 to 9 years most children correctly assess the Dennis’s surprise at the conclusion of the story, by inspection.

In sum, these comparisons of subject ascriptions of emotions across the stories yielded few very stable patterns. One pattern which emerged was that children’s ascriptions of happiness and sadness following the protagonist’s discovery improved significantly between age 4 and 5 years, with a steady improvement to age 7 to 9 years. Another pattern which emerged was that children’s ascriptions of surprise following the protagonist’s discovery of unpleasant contents in the Dennis story improved with age but more slowly. A third was that the two emotion types, happiness and surprise, yield quite different response patterns.

Next, consider children’s ascriptions of emotion to the antagonist. Two emotion questions assessed children’s understanding of the antagonist’s emotion prior to the protagonist’s discovery of some unpleasant outcome in each story. In the “Punch and Judy” story and “Darlene and
Darlene” story, the question concerning Judy’s happiness and the question for Darlene’s surprise again yielded different response patterns. Recall the adult pattern of ascription: Judy may be happy prior to Punch’s discovery—Punch is acting in accord with beliefs Judy knows to be false. Judy is happy because Punch’s plan has been foiled and she is not unwittingly soaked. If children understand, for example, Judy’s knowledge of Punch’s ignorance of her revised plan, they may well appreciate her happiness as he acts out his plan. Further, adults and older 7 to 9-year-olds understand that Darlene is not surprised at Dennis’s pouring mud on his shoes.

The questions for Judy’s happiness prior to Punch’s discovery of a wet coat yielded no significant differences across the age groups. For the first emotion question, shown in Table 7 (a)(1), 17 of 29 3 to 4-year-olds, 26 of 29 5 to 6-year-olds and 28 of 31 7 to 9-year-olds passed these questions. Similarly, for the second emotion question, 22 of 29 3 to 4-year-olds, 28 of 29 5 to 6-year-olds and 30 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 9.1, p = 0.01$. See Table 7 (a)(2). The statistical significance reached here is due in the main to 50% of cells having expected values less than 5. Almost ¾ of the 3 to 4-year-olds understand that Judy will be happy at Punch’s pouring mud on his shoes. The performance of children on comparable questions for Darlene’s surprise on the first emotion question were that 12 of 29 3 to 4-year-olds, 13 of 29 5 to 6-year-olds and 17 of 29 7 to 9-year-olds passed these questions. See Table 7 (b)(1). Similarly, for the second emotion question, 11 of 29 3 to 4-year-olds, 5 of 29 5 to 6-year-olds and 12 of 29 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 4, p = 0.13$. See Table 7 (b)(2). As with similar surprise questions for the protagonist, the pattern of results is mixed across age groups. The reasons for this may again be that very young children equate “no surprise” with unpleasantness, and may actually be ascribing happiness to Darlene prior to Dennis’s misdeed.
Table 7: Number of children in each age group ascribing (a) happiness and (b) surprise to Judy and Darlene prior to and following Punch and Dennis’s unpleasant discoveries.

(a) Happiness

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<th>7 - 9</th>
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<td>26</td>
<td>28</td>
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<tr>
<td>(2) Pre-discovery</td>
<td>Happy</td>
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<td>28</td>
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<td>(4) Post-discovery</td>
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<td>18</td>
<td>28</td>
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N 29 29 31

(b) Surprise

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<td>13</td>
<td>17</td>
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<tr>
<td>(2) Pre-discovery</td>
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<td>5</td>
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<td>6</td>
<td>19</td>
</tr>
<tr>
<td>(4) Post-discovery</td>
<td>Not surprised</td>
<td>9</td>
<td>8</td>
<td>21</td>
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</tbody>
</table>

N 29 29 31

Consider next children’s assessments of antagonist emotions following the protagonist discovering the critical unpleasant event. In these stories, two emotion questions assess the antagonist’s emotion following his discovery of this unpleasantness.

In the “Judy and Judy” story and “Darlene and Darlene” story, the questions concerning Judy’s happiness and Darlene’s non-surprise again yielded different response patterns.
When asked comparable questions following Punch’s discovery of the fruits of his misdeed in the Punch and Judy ironic story, most of the children predicted the appropriate emotion for Judy. Twenty-four of 29 3 to 4-year-olds, 28 of 29 5 to 6-year-olds predict Judy is happy and 29 of 31 7 to 9-year-olds predict her happiness. These differences are not significant, \( \chi^2(2, N = 89) = 3.7, p = 0.15 \). See Table 7 (a)(3). Similarly, for the final emotion question a parallel pattern of results emerged, as 18 of 29 3 to 4-year-olds, 28 of 29 5 to 6-year-olds predict Judy is happy and 29 of 31 7 to 9-year-olds predict her happiness. See Table 7 (a)(4). In contrast, following the fulfilment of Darlene’s plan, 15 of 29 3 to 4-year-olds, 6 of 29 5 to 6-year-olds and 19 of 31 7 to 9-year-olds predict happiness, the correct emotion, \( \chi^2(2, N = 89) = 10.8, p = 0.005 \). Similarly, 9 of 29 3 to 4-year-olds, 8 of 29 5 to 6-year-olds and 21 of 31 7 to 9-year-olds predict the Darlene is not surprised. See Table 7 (b)(4). Young children say that Darlene is surprised to see Dennis discover mud on his shoes. Older children know that Darlene is not surprised to find Dennis find mud on his shoes, as Darlene fully expects Dennis to attempt to fulfil his plan.

As with the assessments of the protagonist’s emotions, these comparisons of subject ascriptions of antagonist emotions across the stories yielded few very stable patterns. A repeated pattern was that children’s ascriptions of happiness and sadness improved significantly between age 4 and 5 years, with a steady improvement to age 7 years. Ascriptions of surprise were less systematic.

**The distribution of emotion responses**

*Regarding subjects’ ascriptions of emotion to characters, how do the distributions of older subjects differ from those of their younger counterparts?*

The results of previous analyses suggested there is no clear difference in the ascriptions of surprise young and older subjects make to story characters, and a clear difference in the ascriptions of happiness and sadness. These preliminary analyses did little to reveal any very general statements to be made about the distributions of subject responses for the story session.

In the Punch and Judy story, the distribution of subject responses to questions about Punch’s happiness yielded significant age effects. The distribution of responses for 3 to 4-year-olds is normally distributed, whereas for 5 and 7 to 9-year-olds the distribution of responses is negatively skewed. The pattern of responses was significant, \( \chi^2(2, N = 89) = 40.4, p = 0.00001 \). This indicates
that whereas younger subjects fell in the midrange older subjects tended to get these questions correct. See Table 8.

Table 8: Subject correct ascriptions of emotion to the protagonist, Punch, across all emotion questions.

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In the Dennis and Darlene story, the distribution of subject responses to questions about Dennis's surprise also yielded significant age effects. The distribution of responses for 3 to 4-year-olds is normally distributed, as is the response pattern for 5 and 7 to 9-year-olds. Despite the similarity in the shape of the distributions, the pattern of responses was significant, $\chi^2(2, N = 89) = 6.8, p = 0.03$. See Table 9.

Table 9: Subject correct ascriptions of emotion to the protagonist, Dennis, across all emotion questions.

<table>
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</table>

In the Punch and Judy story, the distribution of subject responses to questions about the Judy's happiness also yielded significant age effects. The distribution of responses for 3 to 4-year-olds is negatively skewed, as is the response pattern for 5 to 6 and 7 to 9-year-olds. The response pattern for 7 to 9-year-olds is platykurtic. Again, despite the similarity in the shapes of the distributions, the pattern of responses was significant, $\chi^2(2, N = 89) = 16.1, p = 0.0003$. See Table 10.
Table 10: Subject correct ascriptions of emotion to the antagonist, Judy, across all emotion questions.

<table>
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Finally, in the Dennis and Darlene story, the distribution of subject responses to questions about the Darlene’s surprise yielded significant age effects. The distribution of responses for 3 to 4-year-olds is normal, the response pattern for 5 to 6-year-olds slightly positively skewed and that for 7 to 9-year-olds slightly negatively skewed. The pattern of responses was significant, \(\chi^2(2, N = 89) = 7, p = 0.03\). See Table 11.

Table 11: Subject correct ascriptions of emotion to the antagonist, Darlene, across all emotion questions.

<table>
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In response to the question concerning the distribution of ascriptions of emotion to story characters by older and younger subjects, it may be said that older subjects are far more likely to consistently ascribe the correct emotions to a story character. Combining these results with those of the previous analyses, it may be said that although young children are likely to make errors ascribing either happiness or surprise to story characters, older children are better able to correctly ascribe happiness and surprise to story characters. Happiness is easier for children than surprise.
The results suggest little differences exist between children's ascriptions of protagonist and antagonist emotion. The distribution of responses of subjects ascriptions of happiness to Punch and Judy don't differ markedly across age groups. Similar results were achieved in the Dennis and Darlene story: fewer subjects made correct ascriptions of surprise, regardless of the character.

Coordinating the emotions of characters

Why are ascriptions of emotion to story characters difficult for young children? How well do children understand a 'trade-off' between the emotional states of characters?

The previous analyses was useful in that it demonstrated that young subjects fail to consistently ascribe emotions like surprise to story protagonists and antagonists. However, the previous analyses did little to tell us what kind of ascriptions young children have difficulty making.

The next analyses test children's performance at those critical junctures in a story where a character's emotion changes. It was hypothesised that it would be at those key junctures that children would err in ascribing emotion to story characters.

Recall that in the ironic stories the protagonist's emotions undergo change only when the protagonist gains access to the critical information about the contents of the box. Two questions assess the protagonist's emotion: one before his discovery of the box's altered contents and one after. Subject performance on these questions could thus range from 0 to 2 responses correct out of 2 assessments. However, given that the variable of interest in this case was that subjects score correct on questions preceding and following the protagonist's discovery, only 2 correct responses out of 2 were scored as passing the questions, and scores of 0 and 1 were scored as failing the questions.

Consider first children's ascriptions of emotion to the protagonists. In the Punch story, the happy/sad questions again proved easier for all age groups than the surprise questions, although significant differences were observed between the age groups. Only 11 of 29 3 to 4-year-olds passed these questions, saying Punch was happy prior to dumping water in the box and sad following his discovery of the contents of the box, whereas 17 of 29 5 to 6-year-olds and 21 of 31 7 to 9-year-olds pass these questions, \( \chi^2(2, N = 89) = 5.6, p = 0.06 \). In the Dennis story, only 3 of 29 3 to 4-year-olds and 4 of 29 5 to 6-year-olds passed both of these questions, saying Dennis thought he
would be not surprised prior to discovery and surprised following his discovery of the contents of the box, whereas 11 of 29 7 to 9-year-olds pass these questions, $\chi^2(2, N = 89) = 7, p = 0.03$. See Figure 9.

To summarize, the ascriptions of happiness and surprise to story protagonists do change with age. Subjects may equate surprise with pleasantness, causing them to wrongly say a protagonist is not surprised because he obtained some unpleasant outcome. The 3 to 4 and 5 to 6-year-old subjects are prone to these kinds of error.

Figure 9: Percent of children making correct ascriptions of happiness and surprise to the protagonist prior to and following his discovery in the irony stories.

The ascriptions of happiness and sadness to story protagonists clearly improved with age: 3 to 4-year-olds fail to ascribe happiness to a story protagonist when the child knows some unpleasant outcome awaits the protagonist. But 3 to 4-year-old children don’t make errors in ascribing the
correct emotion, sadness, when she and the protagonist share knowledge of some unpleasant event. The 3 to 4-year-old’s ascription of sadness to the protagonist are congruent with those of older children when the protagonist and the child subject possess knowledge of the unpleasant outcome. It is at these moments that 3 to 4-year-olds appear most like adults.

Recall next the critical questions for the story antagonists, Judy and Darlene. Here, the critical emotion questions occur prior to and following that time when the contents of the box are switched. When Judy swaps Punch’s coat for herself, and when Darlene swaps Dennis’s shoes for herself, their emotions may switch from sad to happy, and from surprised to not-surprised. It is these moments surrounding these critical junctures that are of interest here. Unlike the protagonist the antagonist’s emotions do not change following the protagonist’s discovery of the critical contents, instead, the antagonists’ emotions change following their change of plan.

In the Punch story, the happy/sad questions again proved easier for all age groups than the surprise questions. Twelve of 29 3 to 4-year-olds passed the happy/sad questions, saying Judy was sad to hear of Punch’s plan and happy following her switch of the box’s contents. In contrast, 25 of 29 5 to 6-year-olds and 27 of 31 7 to 9-year-olds pass these questions, \( \chi^2(2, N = 89) = 19.9, p = 0.00005 \).
Figure 10: Percent of children making correct ascriptions of happiness and surprise to the antagonist prior to and following her switch in the irony stories.

In the Dennis story, only 2 of 29 3 to 4-year-olds, 3 of 29 5 to 6-year-olds and 9 of 31 7 to 9-year-olds passed both of these questions, saying Darlene was surprised to hear of Dennis’s plan prior to the switch and not surprised following her switch, \( \chi^2(2, N = 89) = 6.5, p = 0.04 \). See Figure 10.

To summarize, the ascriptions of happiness and surprise to story antagonists do change with age. Subjects likely equate surprise with pleasantness, causing them to wrongly say an antagonist is surprised because she may feel good about some turn of events. The 4 and 5 to 6-year-old subjects make these kinds of error.
What proportion of children score correctly on emotion change questions for most stories?

To address this question, aggregate scores for the four stories were computed by summing the emotion change scores for the four stories for each subject such that subject aggregate scores could range from 0 to 4 correct out of 4 stories. For the purpose of statistical analyses the subject responses were then collapsed into 2 groups. Scores from 0 to 2 were taken as failing the question while scores of 3 to 4 were taken as passing the question. Subject performance on these questions varied significantly with age. Only 9 of 29 3 to 4-year-olds passed these questions whereas 15 of 29 5 to 6-year-olds and 24 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 13.1, p = 0.002$. About 30% of 3 to 4-year-olds correctly assess the character’s emotional change across stories. In contrast, almost 80% of 7 to 9-year-olds correctly assess the character’s emotional changes across stories.

Belief and emotion

What factors give rise to an abrupt improvement in children’s understanding of character emotion? How is an understanding of false belief implicated in this understanding?

To help address this question, direct tests of the contingencies hypothesised between an understanding of knowledge, false belief and emotion were performed. Children’s understanding of belief is correlated with their understanding of a character’s emotion in most stories. Recall that the results of previous analyses were consistent with the hypothesis that young children equate surprise with pleasantness. The previous analysis left unaddressed the relationship between understanding false belief and understanding emotion. The false-belief stories, held to be structurally similar to one another, were used in the next analyses to test the relation between belief and the emotions of surprise and happiness.

In the Maxi story, where subjects ascribe surprise or no surprise to Maxi, 18 of 19 subjects who failed the false-belief question failed the emotion questions, and 12 of 70 subjects who passed the false-belief question passed the emotion questions, $\chi^2(1, N = 89) = 1.7, p = 0.19$. See Table 12. The number of children who pass both surprise questions is quite low. This is due to the fact that
very few subjects overall passed the first surprise question. While passing false-belief is no sure indication that a child will succeed on the surprise question, failing false-belief questions is an almost certain indication that a child will fail the surprise questions.

Table 12: Contingency table of subject pass/fail false belief scores and ascriptions of surprise and happiness for all protagonist emotion questions.

<table>
<thead>
<tr>
<th>False belief</th>
<th>Fail</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxi</td>
<td>18</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Happiness</th>
<th>Fail</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pat</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>54</td>
</tr>
</tbody>
</table>

In the Pat story, where subjects ascribe happiness or sadness to Pat, 13 of 16 subjects who failed the false-belief question failed the emotion questions, and 54 of 73 subjects who passed the false-belief question passed the emotion questions, $\chi^2(1, N = 89) = 17.4, p = 0.00001$. Thus, for happiness, there is a strong relationship to understanding false belief.

The correlational evidence from these false-belief stories, in conjunction with the distributions of protagonist and antagonist ascriptions of the emotion of surprise mutually support the claim that children ascribe surprise on principles of desirability and later employ principles of belief violation. On the other hand, an understanding of false belief is highly correlated with children's understanding of happiness. The next analysis illustrates this point nicely with the knowledge questions.

The present analysis tests the relationship between an understanding of knowledge and emotion. The irony stories, held to be structurally similar to one another, were used in this analysis to test the relationship between understanding another's knowledge and understanding another's
emotion. In the Punch and Judy story, subjects ascribe happiness or sadness to Punch. Here, 8 of 13 subjects who failed the knowledge questions failed the emotion questions, and 68 of 76 subjects who passed the knowledge questions passed the emotion questions, $\chi^2(1, N = 89) = 19.6, p = 0.00001$. See Table 13. Subjects understanding of another’s knowledge appears to be related to their understanding of happiness.

**Table 13:** Contingency table of subject pass/fail knowledge scores and ascriptions of surprise and happiness for all protagonist emotion questions.

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Happiness</th>
<th>Fail</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punch</td>
<td>Fail</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Pass</td>
<td>5</td>
<td>68</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Knowledge</th>
<th>Surprise</th>
<th>Fail</th>
<th>Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dennis</td>
<td>Fail</td>
<td>14</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Pass</td>
<td>2</td>
<td>22</td>
</tr>
</tbody>
</table>

In the Dennis and Darlene story, subjects ascribe surprise to Dennis. Here, 14 of 16 subjects who failed the knowledge questions failed the emotion questions, and only 22 of 73 subjects who passed the knowledge questions passed the emotion questions, $\chi^2(1, N = 89) = 2.1, p = 0.14$. There is no significant relationship between understanding what another knows and performance on these surprise questions, although, again, success ascribing knowledge appears to precede success in ascribing surprise.

**5.2.5 Children’s understanding of ironic utterance**

**Speaker sentiment**

*Could children understand that when the speaker uttered “Oh great!” that the speaker thinks a bad thing has happened?*
Subjects’ responses to the questions about the speaker’s expressed sentiment following the critical disappointing event (e.g., “When Maxi said ‘Oh Great!’ does he think a good thing has happened?”) were compared across each of the age groups to determine if performance on these questions improved with age.

The distribution of responses to the sentiment questions across the various stories is not uniform across age groups. The subject scores for the final irony questions across all stories were summed to yield scores ranging from 0 to 4 correct out of 4 stories. The distribution of responses for the 3 to 4-year-olds is bimodal (6 scored 0 correct, 1 scored 1 correct, 5 scored 2 correct, 7 scored 3 correct and 10 scored 4 correct). The distribution of responses for the 5 to 6-year-olds is negatively skewed (0 scored 0 or 1 correct, 2 scored 2 correct, 4 scored 3 correct and 23 scored 4 correct). Similarly, the distribution of responses for the 7 to 9-year-olds is negatively skewed (0 scored 0 or 1 correct, 1 scored 2 correct, 2 scored 3 correct and 28 scored 4 correct). Thus, only for 5 to 9-year-olds do a majority score correct on all sentiment questions. The scores for individual stories are presented in Figure 11 below. These data show that the same trends occur across stories, by inspection.

Table cells were collapsed and a conservative criterion, 4 of 4 stories correct, was adopted. The groups were significantly different. Only 10 of 29 3 to 4-year-olds said the character did not think a good thing had happened, compared with 23 of 29 5 to 6-year-olds and 28 of 31 7 to 9-year-olds, $\chi^2(2, N = 89) = 24, p < 0.0001$. Young children generally said the protagonist uttered “Oh great!” thinking a good thing had happened. Older children recognised that his words were at variance with his sentiment.

Emotion and ironic sentiment

What is the relation between understanding emotion and ironic sentiment?

It was hypothesised that understanding a character’s happiness or sadness may contribute to their understanding of the sentiment prompting an ironic remark. The next analysis tests the contingency between children’s understanding of the character’s emotion and their understanding of the sentiment behind a character’s ironic remark. For the Punch and Judy story, the subject scores for the emotion questions were summed to yield values ranging from 0 to 4 correct out of 4
Figure 11: Number of children making correct ascriptions of sentiment to the story protagonist following his uttering “Oh great!”

questions. If subjects scored between 0 and 2 correct they were assigned a failing score, and if they scored between 3 and 4 correct they were assigned a passing score. For the Pat and the Jellybeans story, these scores were summed to yield values ranging from 0 to 2 correct out of 2 questions. If subjects scored between 0 and 1 correct they were assigned a failing score, and if they scored 2 correct they were assigned a passing score.

In the Punch story, 6 of 16 children who failed the emotion questions failed the sentiment questions, whereas 66 of 73 subjects who passed the emotion questions passed the sentiment questions, \( \chi^2(1, N = 89) = 8.2, p = 0.004 \). In the Pat story, only 9 of 32 children who failed the emotion questions failed the sentiment questions, whereas 53 of 57 subjects who passed the emotion questions passed the sentiment questions, \( \chi^2(1, N = 89) = 7.3, p = 0.006 \). Thus, most subjects who passed the emotion questions passed the sentiment questions. The findings of this analysis support
the case for a contingency between an understanding of emotion and an understanding of ironic sentiment.

**False belief and ironic sentiment**

Children's understanding of belief is also correlated with their understanding of that aspect of ironic utterances which concerns the character's attitude toward the situation, namely, their response to the question "Does he think a good thing has happened?". A significant contingency was found to exist between performance on both the false-belief, the second-order belief questions and performance on the 'good thing' sentiment questions. Specifically, a strong contingency was found to exist between subject performance on false-belief questions and their performance on sentiment questions. Of the 22 subjects who failed the false-belief questions, 14 also failed the sentiment questions. Of the 72 who passed false-belief questions, fully 61 of these subjects passed the sentiment questions, $\chi^2(1, N = 89) = 28.4 \ p = 0.00001$.

The moderate contingency between an understanding of second-order belief and children's understanding of character sentiment was also significant. 13 subjects who failed the second-order belief question failed the sentiment question and 46 subjects who passed the second-order belief question also passed the sentiment question, $\chi^2(1, N = 89) = 6.5 \ p = 0.01$.

Clearly, children's understanding that beliefs may be false bears on their understanding that a character's expressed utterance may be a false representation of his true sentiment. The contingency between performance on belief questions and performance on sentiment questions was greater for false-belief questions than second-order belief questions. By inspection, many people fail the second-order belief question and pass the sentiment question. In contrast, few people who fail the false-belief question pass the sentiment question.

**Ascriptions of emotion, subject experience and ironic sentiment**

*What is the relation between an understanding of emotion and irony and a subject's experience of emotion following irony? Put another way, do children understand the relation between a character's emotion and their own emotion as listeners? (e.g., Do they recognize that Punch's sadness makes them, as readers, happy?)*

It was hypothesised that an appreciation of irony may be achieved when a listener understands that an ironic utterance expresses a sentiment not shared by the listener. For this reason, the
following criteria were used to assess children’s understanding and experience of irony. If a subject said the protagonist did not think a good thing happened when the protagonist said “Oh great!”, and rightly said the protagonist was sad while they themselves as listeners reported feeling happy, subjects were assigned a passing score, and any other response pattern yielded a failing score.

Recall that the Punch story and the Pat story have the subjects assessing the character’s happiness and sadness, hence, only these stories were analyzed. These stories were the only stories wherein the emotional state of the character, happy or sad, could be equated with the sentiment, good or bad, of the character’s utterance.

In the Punch story, only 10 of 29 3 to 4-year-olds passed the questions concerning happiness or sadness. In contrast, 19 of 29 5 to 6-year-olds and 21 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 8.3, p = 0.02$. Similarly, in the Pat story, only 11 of 29 3 to 4-year-olds passed these questions whereas 24 of 29 5 to 6-year-olds and 18 of 31 7 to 9-year-olds passed these questions, $\chi^2(2, N = 89) = 12.1 p = 0.002$. In sum, the fact that a significant number of older children report feeling happy while ascribing sadness to the protagonist lends support to the claim that at about age (8+) years child subjects understand and appreciate the protagonist’s ironic remarks.

Metalinguistic questions

Recall that the experiment contained three metalinguistic questions. These questions were employed to test the hypothesis that an understanding of an ironic situation occurs at roughly the same time as an understanding that ironic utterances in that both involve a disparity between what is said and what is meant. Three questions were used to test this understanding, namely, a mean/say question (e.g., “When Punch says this, does he mean what he says?”), an opposition question (e.g., “... Punch said ‘Oh boy!’ and another time ‘Oh great!’, One time he did not mean what he said. Which time was it? Was it when he said ...?”) and a “funny” question worded like the opposition question but asking the subject to identify the “funny” utterance. The first and second mean/say questions both require that the subject identify the disparity between what is said and meant by the speaker’s utterance. The first mean/say question concerned the speaker’s “Oh boy!” remark.
Subjects were asked “Does the speaker mean what he says?” The question was repeated for the “Oh great!” remark.

The adult correct response to the first question was “Yes, Punch does mean what he says” and to the second question “No, Punch does not mean what he says.” Subjects scoring correctly on both these questions were assigned a score of 1, and subjects failing either of these questions a score of 0. Subject responses to the question concerning whether the speaker meant what he said while being ironic varied slightly with age but never reached a high level. HILOGLINEAR analyses were performed using subject age, performance on the two false-belief questions and performance on the mean/say questions as the variables of interest. The results of the analyses show significant age by false-belief effects, $L^2(2, N = 89) = 39, p = 0.00001$, and false-belief by mean/say effects, $L^2(2, N = 89) = 6.2, p = 0.01$. No three-way effects were detected by this analysis.

Finally, subjects’ responses to the questions concerning the unusualness or special use of “Oh great” behind the speaker’s utterances (e.g., “Maxi said ‘Oh boy’ when . . . and ‘Oh great’ when . . . One time was funny. Which one was it?”) were compared across each of the age groups to determine if performance on these questions improved with age. Few children succeeded and the groups were not significantly different. Six of 29 3 to 4-year-olds passed these questions, as did 9 of 29 5 to 6-year-olds and 12 of 31 7 to 9-year-olds, $\chi^2(2, N = 89) = 2.3, p = 0.31$. An understanding of which remark, “Oh boy!” or “Oh great!” was funny, was not displayed by any of the age groups. The younger subjects response patterns were well below chance, with most saying “Oh boy!” was funny, $p < 0.05$ binomial; those of older subjects were random, $p = 0.28$ binomial.

To summarize the results for the utterance questions, it appears that situated irony as measured by “Did he think a good thing had happened” was grasped before linguistic irony—“Did he mean what he said?”. Whereas the question for situated irony is easy for 5 to 6-year-olds, the questions for metalinguistic judgements of irony were extremely difficult. A good example of the limitation of this measure of mean/say opposition comes from the case example cited earlier. When asked “Does Punch mean what he says?” following his pouring water on his coat, children remarked, for example, that he meant what he said, and he meant “Oh great!” (intonation falling).
I began this study with four main questions in mind. First, while it was well known that children begin to understand their own mental states and the mental states of others when they are about 3 to 4-years-old, it was not known how they exploited this understanding in the comprehension of stories which involved one or more shifts in beliefs and feelings. Could children successfully coordinate character consciousness and action in stories?

Second, although the literature suggested an understanding of happiness and surprise may be traced to their understanding of false belief (Harris et al., 1989; MacLaren and Olson, 1993), it was not evident in the literature that broad generalizations about an understanding of emotion applied across emotions. How is an understanding of happiness similar to an understanding of surprise?

Third, it was not obvious how their understanding of the feelings of characters in stories was related to their understandings of their own feelings and beliefs as listeners or audience to these stories. How, for example, did children relate the surprise or happiness of protagonists and antagonists in stories to their own surprise and happiness as the story unfolded?

Finally, while the literature shows that children understand irony only after they understand false belief (Winner and Leekam, 1991; Wimmer and Perner, 1983), the relation between understanding mental states and understanding the irony of a situation (i.e., situational irony or metacognitive irony) has not been shown. What fluency with mental states is necessary in order to understand the mental state “backdrop” for ironic utterances in ironic situations?

Let the discussion begin with an examination of whether children successfully coordinate character consciousness and action in stories. The memory questions yielded two important facts which bear on the present findings. First, subjects' memory for story plans was consistently high from an early age. Despite a fairly difficult open question about the protagonist’s plans, most children readily announced it. Second, their memory for story events was also fairly good. Most
children, regardless of age, could state the present contents of the box or cupboard. Thus, our tests of children's understanding of character false belief and knowledge are unlikely to be confounded by children's forgetting the relevant story plans and events.

The questions across the stories suggested there exist significant differences in the abilities of younger and older children to understand another's belief. The false-belief questions across the two false-belief stories confirms the findings of Wimmer and Perner (1983). Further, the knowledge and probable thoughts questions across the two ironic stories extend Wimmer and Perner's findings to these ironic situations. Children at age 5 years could pass the false-belief task and also could rightly ascribe ignorance to the story protagonist or assess that character's possible thoughts. If asked whether a character who holds a false belief knows some story fact, few of the 3 to 4-year-olds can successfully state that the character does not know. Nearly all of the 5 to 6-year-olds can state whether the character knows. Further, if asked what a character who holds a false belief thinks, few of the 3 to 4-year-olds can successfully state what the character thinks. Nearly all of the 5 to 6-year-olds can state what the character thinks. An understanding of the false beliefs of story characters is well established by about age 5 years.

The results of the second-order-belief questions in the two ironic stories show that children can understand them by about age 7 to 9 years. Recall that Winner and Leekam's (1991) study demonstrated a relatively late onset of children's understanding of second-order intention. If understanding second-order belief is structurally identical to understanding second-order intention, then the present findings are parallel to Winner and Leekam's. Both studies show children may understand second-order representation by about age 7 to 9 years. In the present thesis, few 3 to 4-year-old and 5 to 6-year-old subjects could understand a character's second-order beliefs, although 5 to 6-year-olds could understand both another's knowledge and false belief. Only 7 to 9-year-olds could say what a character might believe about another character's thoughts or knowledge. Since very few subjects who failed the knowledge questions could pass the second-order-belief questions, and since there were a sizable number of subjects who passed the knowledge questions but failed the second-order-belief questions, it was concluded that an understanding of another's knowledge was necessary though not a sufficient condition for an understanding of second-order belief.
In the present study, the results showed understanding false belief to be an early precursor to an understanding of second-order belief, as an understanding of the former precedes an understanding of the latter. Further, the contingency analysis suggested understanding false belief was a predictor of understanding of second-order belief. However, the link between an understanding of false belief and second-order belief was unclear, since the hierarchical loglinear analyses partialled out this variable. In the present study, children were required to understand terms like 'think', 'know' and the like to answer the questions correctly. Studies of children's use of mental state language suggest that understanding of these terms emerges in the years 2½ to 6-years of age (Johnson and Wellman, 1980). Yet an understanding of second-order belief is evident only in 7 to 9-year-olds. An understanding of mental state terms like 'think' and 'know' is accomplished prior to age 7 to 9-years, suggesting a lag between the onset of understanding mental state terms like know and think and the coordination of these terms in second-order representation.

Given the present findings, it may be concluded that an understanding of false belief precedes an understanding of second-order belief, but a clear contingency between the two remains to be demonstrated. Independent contingency analyses show contingencies between understanding false belief, knowledge and second-order belief, but only performance on the knowledge questions impacts on performance on the second-order-belief questions in both the independent contingency analyses and the loglinear analysis. Understanding another's knowledge is clearly related to understanding what another knows about another's knowledge. Relative to understanding false belief, knowledge and thoughts questions, understanding second-order belief is a late development, coming at around 7 to 9-years of age.

Let the discussion now turn to children's understanding of the emotions of happiness and surprise. The results of the emotion questions replicate those observed in the literature to date for happiness (Harris et al., 1989) and for surprise (MacLaren and Olson, 1993; Hadwin and Perner, 1992; Wellman and Banerjee, 1992) and extend these findings to complex story contexts. However, the two emotions, happiness and surprise, revealed very different patterns of response.

In this study, the results for the happiness questions were consonant with the original predictions and with the results obtained by Harris et al. (1989). Examination of subject
performance on the simple happiness questions suggests 3 to 4-year-olds know that Punch's plan makes Punch happy and Judy sad, suggesting 3 to 4-year-olds understand simple happiness. Children's understanding of character happiness premised on mental states seems well established by age 5 years, examination of the distributions of responses for happiness questions shows. Five-year-old and older subjects were able to predict a character's happiness for individual happiness questions and were able to understand a character's shift in emotion from happy to sad both when a character changed plans and when a character's belief was overturned. The contingency analysis showed that an understanding of belief dependent happiness follows and is contingent upon an understanding of another's knowledge and another's false belief. Understanding false belief and ignorance are necessary to understanding another's belief-dependent happiness.

In this study, as in Harris et al.'s (1989) studies of happiness and sadness, 3 to 4 and 5 to 6-year-old children fail to understand that, prior to a character's discovery of the actual contents of a concealed box or container, the character does not know the contents of the container, and will have emotional states consonant with what he believes to be the contents of the container. For example, 3 to 4-year-old children fail to understand in the Punch and Judy story that Punch does not know the contents of the box, that he has not yet discovered that his coat is wet, and that he must be happy prior to discovering the contents of the box. Only older 7 to 9-year-old children understand a character's happiness may undergo change only following his discovery of the contents of a container, and that his happiness will be consonant with what he believes to be the contents. Younger children, unlike older children, fail to successfully coordinate the character's beliefs with the character's emotional state, and therefore ascribe happiness or sadness on the basis of their own knowledge of story facts rather than on the character's belief. We may generalize this to say young children may fail to integrate these story events with story mental events.

The results for the surprise questions were less straightforward. Recall that in MacLaren and Olson's (1993) study of children's understanding of surprise, young 3 to 4-year-old children equated surprise with pleasantness, and older children displayed no such outcome bias. The same finding was observed in the present study. In the present study, both 3 to 4 and 5 to 6-year-olds said the character was surprised provided the character also obtained some pleasant outcome. The
performance of these children on individual surprise questions suggested this outcome dependency. Only 7 to 9-year-olds consistently predicted a character’s surprise upon finding an outcome that was unexpected and unpleasant. Finally, the contingency analyses between false belief, knowledge and surprise showed there was no contingency between an understanding of false belief and surprise or between knowledge and surprise.

The results obtained in the present study differed from those obtained by MacLaren and Olson (1993) in that in the present study an understanding of surprise emerged much later. The relatively late onset of understanding surprise (i.e., 7 to 9 years), shown by the distributions of subject responses to the surprise questions, is explained by noting the question format used in this experiment and contrasting it with that used by MacLaren and Olson (1993). In that study, subjects predicted which item, an unexpected treat or a disappointing trick, would surprise the puppet, and children age 5 to 6 years could say the puppet would be surprised at a disappointing trick. In the present study, children were asked to state the character’s emotion prior to and following his discovery of a disappointing trick. It is suggested that the present study required more of subjects than the MacLaren and Olson (1993) study in two respects. First, the present study required that subjects assess correctly the character’s surprise prior to and following the critical event, thus making the criterion for passing the present task more stringent. Second, the nature of the questioning in the present study was that subjects had to choose the character’s emotion both before and following the character’s actual discovery, whereas in MacLaren and Olson (1993) subjects could point to the character’s facial expression in the absence of the character’s being privy to the contents of the box and prior to his viewing its contents.

No clear contingency was present between an understanding of belief and an understanding of surprise. The reason for this may be that, as mentioned, these surprise questions are very difficult for children given that, once the unpleasant event is revealed to the child, she must totally disregard the unpleasantness of the event and base her decision totally on the prior expectations of the protagonist. MacLaren and Olson (1993) introduced the notion that younger children judge surprise on Principles of Desirability and older children operate on Principles of Belief Violation. The suggestion was that very young children may base their judgements of surprise on the desirability
of the outcome, and only later come to base their judgements for another's surprise on the basis of whether beliefs had been violated. The pattern of responses given by children to questions about character surprise confirm this hypothesis. When scores both prior to and following the critical event are considered, an improvement in children's understanding across surprise questions was noted.

Combining these results with those obtained for children's understanding of happiness, it may be said that children's understanding of these emotions improved with age. But aside from this similarity, young children's understanding of a character's belief-dependent happiness differs dramatically from understanding a character's belief-dependent surprise. Performance on these happiness questions exceeded performance on surprise questions across most analyses of emotion understanding. For example, although a fully fledged understanding of a change from happiness to sadness is evident in 5 to 6-year-olds, only 40% of 7 to 9-year-olds understand the character's emotion shifting from not surprised to surprised. Thus, it may be inappropriate to treat children's understanding of happiness and surprise as two examples of the same thing.

It has been suggested in this thesis that young children fail belief-dependent emotion questions because they fail to coordinate character belief and character emotion. The results of the present thesis support this claim. One occasion which clearly demonstrates a failure to integrate story events with story mental events was the water dumping episode. Here, Punch dumps water on his own coat, but does not yet know this fact. The 3 to 4-year-olds say Punch is sad as they don't understand what he does not know, but older 7 to 9-year-olds understand he does not know the contents of the box, and say he is happy. But most relevant to our case is the performance of 5 to 6-year-olds. The 5 to 6-year-olds like the 8-year-olds do not fail to ascribe ignorance to Punch. Rather, 5 to 6-year-olds can rightly ascribe false beliefs and plans but they often fail to use what they know about Punch's plan, Judy's swap and Punch's false belief to predict "He's happy!"

Next, let us consider how children's understandings of the feelings of characters in stories was related to their understandings of their own feelings and beliefs as listeners or audience to these stories. The majority of subjects in the present study reported being happy throughout the telling of these stories. Regarding the emotion of surprise, subjects were not uniform in their reports of
surprise. In general, subjects were divided in that about 50% said they were surprised and 50% said they were not surprised. Subject assessments of their own emotion did not vary with the occurrence of story events.

The stories and measures used in the present study may not have been the most useful for the task of evaluating children's story experience. First, it is possible that children were happy that they were being told a story, and their reports of happiness across story events reflects this overall happiness and obscures variations in subject happiness which may occur as stories progress. Second, it was possible that the reason for children's divided reports of surprise was that the stories were not sufficiently evocative to bring about surprise in listeners. Finally, the present measures were verbal reports of affective states, and these reports may or may not represent the subject's experience. Subjects may well experience glee or happiness when the story's critical event occurs, but their reports of this experience may be confounded by their vocabulary and by their understanding of mental states. The questions for the self I have adopted for use in this study tap children's self-ascriptions of emotion. Ascriptions for the self may well be susceptible to at least some of the problems encountered in ascribing emotion to others. Thus, the measures of emotion are limited in this regard, and ought not be interpreted as measures of subject experience per se. Rather, these are measures of subject's self-ascriptions of experience and say more about their understanding of emotion than their experience of emotion.

Regarding the relation between their ascriptions of emotion to the self and to the character, it is at those moments surrounding the "Oh great!" utterance that children's reported experience of emotion bears on the irony comprehension hypothesis. The results show older children are more likely to say they are happy while a character is sad. Younger children seldom show this response pattern.

Finally, what fluency with mental states is necessary in order to understand the mental state "backdrop" for ironic utterances in ironic situations? The majority of the irony questions failed to reveal any differences between younger and older subjects. Recall that the irony questions were of two types. One may be described as metacognitive, as it taps children's understanding of the mental
states underlying ironic utterances, and the other as metalinguistic, as it taps children’s ability to comment upon both sentence and speaker meaning explicitly.

The metacognitive question “When Punch says ‘Oh great!’ does Punch think a good thing has happened” is a question that is not primarily metalinguistic in nature. Instead, the subject need only consider whether the utterance “Oh great!” means Punch thinks a good thing has happened, and most subjects know that Punch does not think a good thing has happened. Most 5 to 9-year-old subjects pass the questions about the speaker’s sentiment behind his utterance. The question measures what I have called “situated” irony. The child who understands the relations between the mental states of characters in a story effectively understands the mentalistic backdrop or context wherein an ironic utterance takes place. It is this understanding which, along with an understanding of false belief, is at least necessary for understanding irony.

The fact that it is not until about 5 years of age that children come to understand this irony question augments the findings of Winner and Leekham (1991). Recall that in their study it was not until about 7 years of age that children come to understand the distinction between irony and white lies—and this development is strongly correlated with their understanding of second-order intention. In the present thesis, children did not need to understand second-order intention in order to correctly predict the character’s sentiment. But just as children in Winner and Leekam’s study needed to understand mental states prior to understand irony, children in the present thesis had to understand the character’s false belief prior to understanding that when the character says “Oh great!” he does not think a good thing had happened.

The ‘mean/say’ and the ‘funny’ metalinguistic questions required that the subject be able to think about upon the utterances themselves. These questions proved difficult for even the oldest 7 to 9-year-old subjects in this study. The mean/say question was most influenced by an understanding of false belief, although the very low number of even 7 to 9-year-olds who pass the mean/say questions prevents interpreting these findings as fully representing children’s competencies in understanding irony. Rather, the present findings support the case that the ability to detect mean/say opposition is at least developing at age 5 to 9 years. The children in Winner and Leekham’s study failed to make this distinction before they understood second-order intention, children in our
own study failed to understand the mean/say opposition in Punch's remark until they understood false belief. The loglinear analyses showed a direct relationship between age and an understanding of false belief, and a further relationship between understanding false belief and an understanding of mean/say opposition. Age effects were partialled out of this analysis. Understanding false-order belief is an early necessary precursor to understanding mean/say opposition in irony.

The findings of the experiment showed that even the oldest children find the "funny" questions unusually difficult. Recall that the performance of the youngest subjects was well below chance, with most young subjects saying "Oh boy!" was funny and the performance of older subjects was at chance.

In sum, the present thesis addressed a number of issues relevant to children's understanding of character's minds in stories. First, children successfully coordinate character consciousness and action in stories only following an understanding of false belief. Second, children's understanding of character happiness precedes an understanding of character surprise in stories, and the two may be considered distinct accomplishments. Third, although children may like stories from the earliest of ages, and understand stories following an understanding of both a landscape of action and a landscape of consciousness, their appreciation of stories, marked by the successful coordination of their own experience as listeners and their understanding of the mental states of others, is a relatively late accomplishment. Children first enjoy stories, then understand them, and later come to appreciate them. Fourth, to understand utterances in ironic stories, children have to be adept in coordinating the variety of mental states that underlie ironic stories and ironic comments. It may be said that children's understanding of minds permits their understanding and appreciation of even ironic stories. Understanding and appreciating stories is not only relevant to entertainment but also to the developing ability to benefit from the sort of texts involved in education. Although the exact nature of this benefit remains to be explored by educators, it is suggested that if educators honour these capabilities and children are thought of as thinkers about mental states, children may come to think of themselves and others as folk who think about texts, and may generate new possible beliefs for themselves, others and authors.
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APPENDIX A: PILOT STORIES

The False-belief Task Script

The following is a story about a person named Maxi. Maxi's mother returns from her shopping trip. She bought chocolate for a cake. Maxi may help her put away some things. He asks her 'Where should I put the chocolate?' 'In the BLUE cupboard,' says the mother. 'Wait I'll lift you up there, because you are too small.' Mother lifts him up.

Maxi puts the chocolate in the BLUE cupboard. Maxi remembers exactly where he put the chocolate so that he could come back and get some later. He loves chocolate. Then he leaves for the playground. Mother takes the chocolate out of the blue cupboard, uses it and puts it back not in the blue cupboard but in the GREEN cupboard. (So the subject sees it placed in the GREEN one.) She then leaves the room.

Maxi then comes back from the playground, is hungry, and wants some chocolate. He says "Oh Boy!" because he really loves chocolate. Maxi remembers where he put the chocolate.

{FB} [Belief question] Where will Maxi look for the chocolate?

Subject must indicate B or G.

{CU} [Char. utterance] What did Maxi mean when he said "Oh Boy"? Does he mean what he says? Y or N.
{CE} [Char. emotion] When Maxi comes back from the playground and wants chocolate, what does he feel? Point to the face he'll make. S or NOT S.
{SE} [S. Emotion] Are you surprised? Y or N.

Maxi then looks in the cupboard and sees nothing. Maxi says when he looks in the cupboard "Oh great!"

{CE} [Char. emotion] When he looks in the cupboard, what does he feel? Point to the face he'll make. S or NOT S.
{CU} [Char. utterance] What did Maxi mean when he said "Oh great"? Does he think he did a good thing? Y or N. Does he mean what he says? Y or N.
{CU} [Char. utterance] Maxi said "Oh boy!" when he saw the cupboard and "Oh great!" when he saw the empty cupboard. One of these times was funny. Which one was it? Was it when he said "Oh boy!" or "Oh great!"?
{SE} [S. Emotion] Are you surprised? Y or N.

The Punch and Judy task script

The following is a story about a boy named Punch and a girl named Judy. Punch is a very, very, very naughty little boy who always likes to play tricks on Judy. One day, Punch gets a new coat for his birthday. Punch is very proud of his new coat and he struts all over the place in his new coat. To celebrate his new present, Judy and Punch decide to spend the afternoon playing magician. Punch is the magician and Judy is his assistant. Punch tells Judy "Judy, would you please go inside this box and I will show you something." Upon hearing this, Judy steps inside the box and Punch closes the lid of the box. Now Judy is inside the box. Punch now says to himself "Oh boy!" Punch says "Now that Judy is inside the box I will take my pail of water and pour water all over her" Punch then goes away to get his bucket. But Judy hears Punch talking to himself. Judy can hear him saying he's going to pour water on her.
{CB} [Char. belief] Does Punch think that Judy knows about his plan?
{CB} [Char. belief] Does Judy know Punch is planning to put water in the box?
{CE} [Char. emotion] How happy is Punch? Please point to the face he’ll make.
{CE} [Char. emotion] How happy is Judy? Please point to the face she’ll make.
{SM} [Subject memory] What is Punch planning to do with the water?
{SE} [Subject emotion] Are you happy or sad?
{CU} [Char. utterance] What did Punch mean when he said “Oh Boy”? Does he mean what he says? Y or N.

She steps quietly out of the box and tip toes over to the place where Punch keeps his new coat. She takes Punch’s new coat and puts it in the box and then hides behind a tree where she can watch the fun.

{CB} [Char. belief] Does Punch know what is in the box?
{SM} [Memory] What is in the box?
{SE} [Subject emotion] Are you happy or sad?

Punch returns with the bucket of water. Punch closes his eyes, lifts the bucket above his head, opens the lid to the box and dumps the bucket of water into the box! Remember, Punch does not look in the box.

{CB} [Char. belief] What did Punch think was in the box?
{CE} [Char. emotion] Now that Punch spilled water in the box, how happy is he? Point to the face he’ll make.
{CE} [Char. emotion] Now that Judy saw Punch spill water in the box, how happy is Judy? Point to the face she’ll make.
{SE} [Subject emotion] Were you happy or sad when Punch dumped water on his coat?

After Punch pours the water inside the box, he hears Judy laughing. He then looks inside, sees his new coat is ruined.

{CE} [Char. emotion] How happy is Punch? When Punch looks into the box, what face does he make? H or S.
{SE} [Subject emotion] Were you happy or sad when Punch poured the water on his coat?

Punch then says “Oh Great!”

{CE} [Char. emotion] Was Punch happy at the end of the story? H or S.
{CE} [Char. emotion] Was Ms. Judy happy at the end of the story? H or S.
{CU} [Prot. utterance] Does Punch mean what he says?
{CU} [Prot. evaluation] Does Punch think he did a good thing?
{CU} [Char. utterance] Punch said “Oh boy!” when Judy was in the box and “Oh great!” when he saw his coat. One of these times was funny. Which one was it? Was it when he said “Oh boy!” or “Oh great!”?

The Sniddler’s Gulch task script

Narrator: “In the early days of the West the peaceful town of Sniddler’s Gulch was threatened by one of the meanest desperados of all time, Cowboy X, a man who left his mark everywhere.”

He gallops in and a citizen remarks “It’s Cowboy X”.

Cowboy X hollers “Letter x, whoa, letter x, yippee!”
Narrator: “Cowboy X left x’s everywhere: on the houses, on the streets, in the schoolhouse, on the horses, x’s on the townhall... even on the good citizens of Sniddler’s Gulch. The citizen’s finally decided that Cowboy X had to be stopped.”

[SE] [Subject emotion] Are you happy or sad?
{CE} [Char. emotion] How happy is the little cowboy happy when he sees what Cowboy X has done? Point to the . see he’ll make. H or S.
{CE} [Char. emotion] How happy is Cowboy X? Point to the face he’ll make. H or S.

They said “Throw him in jail! Run him out of town”

The little cowboy said “Wait, why don’t we just ask Cowboy X to please stop marking up our town with x’s”. “The kid’s got an idea!” one man remarked, “It’s so crazy it just might work” said another.

Then a lady says “Here come’s Cowboy X now”

Then cowboy “X” rides into town “x, yippee x” and marks an ‘x’ on the little boy’s head. who says “Cowboy X, would you please stop marking x’s all over our town?”

{CE} [Char. emotion] How happy is the little cowboy now that he has asked Cowboy X to please stop making x’s all over? Point . . . H or S.
{CE} [Char. emotion] How happy is Cowboy X? Point . . . H or S.
{CU} [Prot. utterance] Did the little cowboy ask cowboy X to stop making x’s all over the town?
{SE} [Subject emotion] Are you happy or sad?

Cowboy X says “Why, sure I’ll stop.”

{CB} [Char. belief] Does Cowboy X know what the little cowboy wants him to do?
{CE} [Char. emotion] How happy is the little cowboy when he sees what Cowboy X has done? Point . . . H or S.
{CE} [Char. emotion] How happy is Cowboy X? Point . . . H or S.
{CU} [Prot. utterance] What did the little cowboy say he wanted Cowboy X to do?
{CU} [Prot. intent] What does the little cowboy want Cowboy X to do?
{CU} [Prot. utterance] Did Cowboy X do everything the little boy wanted him to do?
{SE} [Subject emotion] Are you happy or sad?

“From now on, I’ll be known as Cowboy O, yippee!” and he stamps an ‘o’ on the little cowboy’s head and rides out of town. After the little cowboy sees what cowboy “X” has done he says “Oh Great!”

{CU} [Char. utterance] The little cowboy said “Oh, great!” Does he mean what he says?
{CU} [Prot. Evaluation] Was the little cowboy happy? Does he really think he really did a good thing?
{CU} [Char. utterance] The little cowboy said “please stop marking x’s” when he saw what cowboy X was doing and “Oh great!” when he saw his coat. One of these times was funny. Which one was it? Was it when he said “Please stop marking x’s” or was it when he said “Oh great!”?
{SE} [Subj. Emotion] Were you happy or sad when Cowboy X started making O’s all over the town? H or S.
APPENDIX B: SAMPLE SCHEMATIC FACES

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