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Counterfactual Thinking in Children

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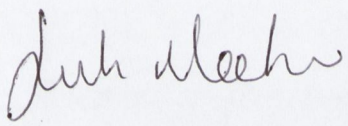
Signed: 

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Summary

The aim of this thesis is to examine how children imagine counterfactual alternatives to reality, that is, how they think about situations that once were possible, but are so no longer. We report six experiments, comprising of two series of experiments, which focus on the development of counterfactual thinking from early to middle childhood. We examine counterfactual thinking in children aged 3- and 4 years, and in children aged 6- and 8 years. We aim to examine the mental representations that children keep in mind when they think about counterfactual situations.

In Chapter1, we introduce the area of counterfactual thinking by describing the sorts of counterfactuals that adults typically generate and we outline two theories of counterfactual thinking in adults. We introduce the area of children's imaginative thinking by considering how children entertain non-factual situations such as pretence and false belief. We focus on the development of counterfactual thought in early and middle childhood in a review of the literature and we describe the key issues that may contribute to a more comprehensive understanding of counterfactual thinking in children.

Chapters 2 and 3 examine counterfactual thinking in pre-school children. We consider the difficulties that children aged 3- and 4 years experience when they think about counterfactual possibilities. In Chapter 2 we report an initial experiment aimed at exploring the proposal that children's responses to counterfactual thoughts are affected by a reality bias, that is, a difficulty disengaging from reality to consider a counterfactual alternative (Robinson & Beck, 2000). The results suggest that a reality bias may not be the primary factor underlying pre-schoolers' difficulty in considering counterfactual alternatives. In Chapter 3 we report two experiments that examine how mental imagery instructions affect

the accuracy of children's answers to counterfactual questions. We propose that the difficulty experienced by young children may rest on the need to keep in mind the conjectured possibility as well as the reality. We predict that instructions to form a mental image of the counterfactual possibility will help pre-schoolers to answer counterfactual questions. The results show that it is instructions to image possibilities that concern an absence pose a specific difficulty for 3-year-olds, but not for 4-year-olds.

In Chapters 4 and 5, we examine counterfactual thinking in 6- and 8-year-olds. In Chapter 4 we report two experiments which examine whether there is a developmental trend to the action effect in children's counterfactual thinking, that is, whether 6- and 8-year-olds tend to judge that an actor will feel worse and think "if only" more than a non-actor. The results show that there is a developmental trend to the emergence of the action effect in children's judgements of emotions, but not in their "if only" judgements.

In Chapter 5 we report a final experiment that examines whether there is a developmental pattern to the emergence of the temporal order effect, that is, the tendency to wish "if only" about the second event in an independent sequence of events, and to judge that the second player feels more guilt and is blamed more by the first. The results reveal a developmental trend to the emergence of the temporal order effect for children's judgements of guilt and blame and they show that the temporal order effect emerges very early in the development of children's "if only" counterfactual thoughts.

In Chapter 6 we summarize our findings and we consider their implications for understanding the development of counterfactual thought and representational ability in early and middle childhood. We also consider the implications for understanding the development of socio-emotional understanding and we suggest some possible questions for future research.

Chapter 1 Introduction

Adult: "What would have happened if that butterfly would have sat on your nose?"

Abe: (aged 3 years, 8 months): "Then what if he sat on my head?"

(Kuczaj and Daly, 1979)

In their everyday thinking, people's thoughts are not confined to considering reality and reality alone. People tend to think about many different situations that do not necessarily reflect what they know to be true about the world. They can readily imagine alternatives to reality that can range from thinking about how situations could have turned out differently, e.g., imagine if the butterfly had landed on Abe's nose, to thinking about situations that could never happen, e.g., imagine if the butterfly had landed on Abe's nose and had a conversation with him. The ability to think about how a situation could have turned out differently, which is termed counterfactual thinking, is a powerful and pervasive feature of human mental life (Kahneman & Tversky, 1982) and it emerges early in development (Guajardo & Turley-Ames, 2004; Harris, German & Mills, 1996). The objective of this thesis is to examine how children think about counterfactual situations from its emergence in the pre-school years to its development into middle childhood.

Children's capacity to engage in imaginary worlds, such as pretence and pretend play, and their ability to consider situations that are not true, such as a mistaken or a false belief, have been the focus of much attention in the cognitive developmental domain (e.g., Harris & Kavanaugh, 1993, Leslie, 1987; 1994; Lillard, 1996; Wimmer & Perner, 1983). In contrast, research on children's ability to think about alternatives to reality, such as counterfactual situations, is comparatively slight (e.g., Riggs & Mitchell, 2000). In this thesis we examine two aspects of the development of counterfactual thinking in children. We examine how 3- and 4-year-old children think about counterfactual situations and we

explore the nature of the difficulty they encounter when they think about alternatives to reality. Second, we examine how older children, that is, 6- and 8-year-old children, think about counterfactual situations. Children's understanding of emotions such as regret and guilt, which are closely associated with adults' counterfactual "if only" thoughts (e.g., Kahneman & Miller, 1986), emerge during the ages of 6 years and 9 years (e.g., Guttentag & Ferrell, 2004; Thompson, 1987). We explore children's "if only" thoughts and their judgements of emotions when they consider how a situation could have turned out differently.

This chapter is divided into five main sections. The first section introduces the general area of counterfactual thinking. Its focus is a review of some of the types of counterfactual alternatives that adults generate. We also briefly outline some theories of counterfactual thinking in adults. The second section introduces the topic of children's ability to consider alternatives to reality, such as pretence and false belief understanding. The third and fourth sections focus on a review of counterfactual thinking in pre-school children and school-aged children respectively. Finally, in the fifth section we attempt to draw together the major issues implicated in understanding the development of counterfactual thinking in children.

Counterfactual Thinking

Thinking about situations that once were possible, but are so no longer, such as counterfactuals, appears to be central to human thought (e.g., Byrne, 1997; Harris, 2000). Indicators of children's sensitivity to counterfactual thought emerge at a very young age. Children as young as 2 years can identify a situation that "almost" or "nearly" happened (Harris, 1997), and some psychologists have claimed that even infants have the capacity to recognise unrealized situations (e.g., Perner, Sprung & Steinkogler, 2004). Counterfactual thinking appears across cultures, irrespective of linguistic markers (Au,

1984) and it has been shown that the ability to produce spontaneous counterfactual assertions can be affected by damage to the dorsolateral prefrontal cortex (Gomez-Beladarrin, Garcia-Monco, Astigarraga, Gonzlaez & Graftman, 2005). It has been suggested that patients with lesions in this area of the brain demonstrate inflexible behaviour and appear to lack the ability to express emotions such as grief and regret (Knight & Grabowecky, 1995). Counterfactual thinking is in fact so pervasive in human mental life that it is literally impossible to imagine a life without it (Byrne, 1997).

When people think about how a situation could have turned out differently, they mentally compare the factual situation to an imagined situation. In essence, counterfactual thinking allows people to extend their thoughts beyond the facts of the current situation (e.g., the butterfly did not land on Abe's nose) and think about possibilities that may have happened but did not (e.g., the butterfly might have landed on Abe's nose). The mental comparison of the factual situation to a counterfactual possibility plays an integral part in higher level cognition (e.g., Hofstadter, 1985; Johnson-Laird & Byrne, 1991) and has been shown to serve a variety of functions in mental life, some of which will be outlined below.

Functions

To understand how people think about counterfactuals, it is necessary to consider why people tend to engage in these "subjunctive instant replays" (Hofstadter, 1985). One of the functions of counterfactual thinking may be a preparatory one: comparing the factual situation to a counterfactual one allows people to think about how past events might have been avoided (Mandel & Lehman, 1996) and may thus be implicated in helping people learn from past experience (Markman, Gavanski, Sherman & McMullen, 1993). Counterfactual thinking is more likely to occur following negative outcomes than positive outcomes in adults (e.g., Gavanski & Wells, 1989; Gleicher, Kost, Baker, Stratham,

Richman & Sherman, 1990) and in children (German, 1999). The result suggests that considering better alternatives to a bad outcome may help people to learn how to avoid the same mistakes again and prepare for the future (Roese, 1994).

Thinking about counterfactual alternatives has been shown to be instrumental in causal reasoning in adults (Wells & Gavanski, 1989) and in pre-school children (Harris et al., 1996). When an alternative to an event is available, people tend to judge the event to be more causally related to an outcome. For example, adults tend to judge the cause of a fatal accident to be related to a taxi driver's refusal to accept a fare from a couple when the couple's car was in the accident, but not when the taxi driver's car was also in the accident (Wells & Gavanski, 1989).

The function of counterfactual thinking may also be an affective one. Emotions such as regret, guilt, disappointment, shame, hope and relief appear to be amplified in the light of counterfactual information (Kahneman & Miller, 1986). In fact, these emotions have been described as "counterfactual" emotions (e.g., Kahneman & Tversky, 1982; Landman, 1987; Niedenthal, Tangney & Gavanski, 1994) and their amplification appears to rely on an ability to imagine how a situation could have turned out differently (Kahneman & Miller, 1986; Roese & Olson, 1995). Thoughts about what might have been have also been shown to play a role in judgements of social ascriptions such as blame assignment, accountability and responsibility (Branscombe, Owen, Garstka, & Coleman, 1996) as well as judgements of criminal punishment and victim compensation (Macrae, Milne & Griffiths, 1993; Miller & McFarland, 1986).

The ability to mentally compare a factual situation to a counterfactual situation appears to play a central role in many attributes of human experience and cognition. Recent research in counterfactual thinking in children has suggested that the kinds of counterfactual thoughts that children generate are similar, in at least some respects, to the sorts of counterfactual thoughts that adults generate (e.g., Guajardo & Turley-Ames,

2004; Guttentag & Ferrell, 2004). In order to establish what these similarities in thought might be, we must first consider the types of counterfactual alternatives that adults generate.

The Generation of Counterfactual Thoughts in Adults

Studies of counterfactual thinking in adults have shown that there are systematic similarities in the sorts of counterfactual thoughts that adults generate. Adults tend to mentally "undo", or change aspects of the factual situation in regular ways to imagine a counterfactual situation (Kahneman & Tversky, 1982). It has been suggested that these regularities in counterfactual thought give us a clue to the "joints" of reality (Hofstadter, 1985) where reality is most vulnerable to mutation (Kahneman & Miller, 1986).

There are many ways in which adults exhibit regularities in counterfactual thought, for example, they tend to focus on events that are exceptional and events that are within their control. They tend to focus on the most recent event in an independent sequence of events and they also focus on their actions more than on their failures to act, at least in some situations. We will consider some of these regularities in more detail later in this section, but first we turn our attention to how counterfactual mutations have been classified.

Counterfactual mutations can be classified in terms of the direction in which the alternatives to reality follow (Roese, 1994). *Upward* counterfactuals are those alternatives that focus on how a situation could have been better, for example, "If only I had taken my vitamins, I wouldn't have caught the flu". *Downward* counterfactuals are the kinds of mutations that focus on how a situation could have been worse, for example, "If I had not taken antibiotics, I would have got pneumonia". Adults tend to imagine how things could have been better more often than they imagine how things could have been worse, that is, they generate more upward counterfactuals than downward counterfactuals (Roese,

Sanna, & Galinsky, 2005). Upward counterfactuals serve a preparatory function, helping people to learn from their mistakes (Roese, 1994), whereas downward counterfactuals are thought to serve an affective function by making people feel better about their current situation (Markman et al., 1993).

The sorts of counterfactuals that people generate can also be classified in terms of their structure, that is, they can be either additive or subtractive (Roese & Olson, 1993). *Additive* counterfactuals add in a new element to the mutation in order to undo an outcome, for example, "If only I had brought my packed lunch, I would not be hungry". In contrast, *subtractive* counterfactuals remove elements from reality in order to undo an outcome, for example "If I had forgotten my packed lunch, I would be hungry". Of course, counterfactuals can be classified in terms of both structure and direction, for example the additive counterfactual, "If only I had brought my packed lunch, I would not be hungry", is also upward in that it focuses on how a situation could have turned out better.

Adults tend to show remarkable regularities in what they imagine. These regularities have provided researchers with valuable insights into how adults think about alternatives to reality, and to where reality seems to lend itself most readily to mutation. We will now consider some of these regularities in adult counterfactual thought. We briefly consider the exceptionality effect -- one of the earliest findings in the counterfactual literature -- and the controllability effect, which is a very pervasive finding in the literature. We then concentrate on the action effect and the temporal order effect. These two effects are ones that we will return to in later chapters.

The Exceptionality Effect

Adults tend to mentally undo events that are exceptional rather than events that are considered routine. In one experiment, adult participants read a story about a man called

Mr. Jones who died in a car crash on his way home from work. There were two versions of the story. In one version, participants read that Mr. Jones had left work at his usual time, but he took an unusual route home. In the other version, participants read that Mr. Jones had left work at an unusual time and had taken his regular route home. Participants were asked to complete the "if only" thoughts of Mr. Jones' family following the accident. Participants tended to undo the exceptional event irrespective of the story version they read. They undid the time Mr. Jones left work when it was presented as unusual (e.g., "If only he'd left work at his usual time") whereas they undid Mr. Jones' route home when it was considered exceptional (Kahneman & Tversky, 1982). This finding has lead to the suggestion that exceptional events are more cognitively "mutable" (Kahneman & Tversky, 1982), perhaps because exceptional situations readily recruit their corresponding norms (Kahneman & Miller, 1986) or because they are more salient (Seelau, Seelau, Wells & Windschitl, 1995).

The Controllability Effect

A controllable event, that is, an event that is considered to be within the control of an individual, lends itself more readily to mutation than an uncontrollable event, that is, an event that is considered to be beyond the control of an individual (Girotto, Legrenzi & Rizzo, 1991; McCloy & Byrne, 2000). Girotto et al. (1991) gave participants a scenario about a man, Mr. Bianchi, who was delayed on his journey home by a series of causal events. One of the events was controllable, that is, Mr. Bianchi's decision to stop in a bar for a beer. In contrast, the other events were beyond his control, such as the passage of a flock of sheep across the road he was travelling on. Participants tended to mutate the controllable event more readily than any other event, irrespective of its position in the causal chain. It has been suggested that controllable events are more mutable because they appear more salient (Legrenzi, Girotto & Johnson-Laird, 1993) or because

controllable events are usually perceived to be independent of external causes (Girotto et al., 1991).

The Action Effect

In their counterfactual thoughts, adults tend to mutate actions more than inactions, at least in some circumstances. Furthermore, they tend to judge greater emotional impact for actions rather than inactions. Consider a scenario in which two individuals, Dave and Jim are both attending the same university. Neither of them are happy in their current situation and both think about changing to another university. Dave decides to stay in the current university and Jim decides to move to another university. Their decisions turn out badly for both of them. When adult participants are asked to judge which individual will feel more regret, most tend to judge that the individual who acted, Jim, will feel more regret (Gilovich & Medvec, 1994; Kahneman & Tversky, 1982).

The action effect has been shown to occur in adults' "if only" counterfactual thoughts: adults tend to mentally undo actions (e.g., "If only Jim had stayed where he was") more than inactions (e.g., "If only Dave had transferred") (e.g., Byrne & McEleney, 2000). The action effect arises for both negative outcomes and positive outcomes, although the effect is stronger for those outcomes that are negative (e.g., Gleicher et al., 1990; Landman, 1987). Adults show this regularity in their counterfactual thoughts regardless of the order in which the action and inaction is described in scenarios (Gleicher et al., 1990) and it has also been found to occur in everyday situations. For example, people who appeared on a Dutch television show that required its guests to make some sort of apology were more likely to apologize for things they had done rather than things they had failed to do (Zeelenberg, van der Pligt, Manstead, 1998).

But in certain situations, the action effect can be reversed. Consider again the college story about Dave and Jim. When participants were asked to judge who would

regret his decision more in the long term, most judged that the individual who did not act, Dave, would feel the most regret (Gilovich & Medvec, 1994). People appear to regret their actions in the short term and their failures to act in the long term -- a finding that occurs in everyday situations too (Gilovich & Medvec, 1995). However, it has been shown that the action effect is reversed only when the outcome of a situation is negative and people do not have equal information about the consequences of both actions and inactions (Byrne & McEleney, 2000).

Adults may focus on actions more than failures to act when they think counterfactually because actions are more abnormal, or exceptional than inactions (Kahneman & Miller, 1986). Alternatively, the action effect may arise because adults mentally represent actions more fully than inactions and as a result they readily imagine alternatives to actions more than failures to act (Byrne, 2005; Byrne & McEleney, 2000).

The action effect has been studied in children's judgements of emotions (e.g., Guttentag & Ferrell, 2004) and we return to this effect in children's counterfactual thinking later in this chapter. We describe two experiments in Chapter 4 which examine the action effect in children's "if only" thoughts and in their judgements of emotions.

The Temporal Order Effect

Adults show a tendency to focus on the more recent event in a sequence of independent events. Consider a game in which two players, John and Michael both toss a coin. If the two coins come up the same (e.g., both heads or both tails) they win 1,000 euro. If the two coins do not come up the same, neither player wins anything. John goes first and tosses a head; Michael goes next and tosses a tail, and so they lose. In experimental situations, when participants are asked how the outcome could have been different, they tend to imagine Michael tossing a head, and they tend to judge that Michael will feel more guilt and be blamed more by John for not winning (Miller & Gunasegaram, 1990).

The tendency to undo the more recent event in a sequence of independent events occurs in everyday situations also. For example, when adults think about how a basketball team might have performed better in a league of ten games, they mentally undo the tenth game in which the team was defeated, irrespective of how the team performed in the nine games prior to the defeat (Sherman & McConnell, 1996). This tendency has been thought to play a role in other everyday situations such as the propensity for athletic teams to feature their fastest runner last in a relay race and the common aversion blackjack players have to playing on the last box (Miller & Gunasegaram, 1990; Kahneman & Miller, 1986).

The temporal order effect may occur because adults calculate the probabilities of a good outcome after each play, which changes only after the second player takes his turn (Spellman, 1997). However, the temporal order effect can be eliminated without changing the probabilities when an explicit alternative to the player's first turn is provided, e.g., John tosses heads, there is a technical hitch in the game and he must take his turn again, this time John tosses tails and Michael tosses heads (Byrne, Segura, Culhane, Tasso & Berrocal, 2000). The elimination of the temporal order effect also rules out the view that the temporal order effect occurs due to the availability of the more recent event to a backward search strategy through the events, or that it is more "fresh" in working memory. It has been proposed that the effect may arise because the earlier event is presupposed (Miller & Gunasegaram, 1990). When people represent the factual situation (e.g., John tosses heads and Michael tosses tails) earlier events in a sequence may act as a context or anchor against which subsequent events are interpreted (Byrne et al., 2000; Walsh & Byrne, 2004).

The temporal order effect is a robust phenomenon in counterfactual thinking in adults. This "joint of reality" may provide insight into how children entertain alternatives to reality. By examining whether children focus on the same aspects of reality as adults

may help us to understand how they undo reality, and yet to our knowledge there have been no studies that have examined whether children exhibit this tendency. We examine the temporal order effect in children's thoughts in Chapter 5. Before we examine the development of children's ability to consider alternatives to reality in more detail, we first consider some of the theories that have been advanced to explain how adults entertain counterfactual alternatives.

Theories of Counterfactual Thinking in Adults

There are two main theories that account for the way in which people undo reality to create counterfactual alternatives: the mental models theory of counterfactual generation (Byrne, 1997; 2005) and norm theory (Kahneman & Miller, 1986).

Norm theory focuses on the exceptionality of events (Kahneman & Miller, 1986). It proposes that the ease with which an event is mutated depends on the degree to which an outcome is considered exceptional. People undo exceptional or atypical events to make an outcome normal again. According to norm theory, the fundamental tenet governing counterfactual mutation is that exceptional events are highly mutable because they recruit alternatives that render the outcome normal. Another facet of norm theory is the principle of *emotional amplification*, that is, counterfactual thoughts amplify people's emotional reaction to an outcome.

The principles deriving from norm theory have found much support in the adult literature. That exceptional events appear to recruit their corresponding norms is consistent with Kahneman and Tversky's (1982) findings that adults tend to undo events that are considered exceptional rather than those that are considered routine or typical. Other findings in studies of counterfactual thinking in adults have also been consistent with the proposal that mutable events retrieve corresponding norms (e.g., Miller & Gunasegaram, 1990; Wells et al., 1987). For example, it has been proposed that people

undo actions more than inactions because an action is considered to be a deviation from the expected norm and an action retrieves its corresponding inaction. That counterfactual thoughts amplify adults' affective reactions has also found support in the adult literature (e.g., Gleicher et al., 1990; Landman, 1987).

The mental models theory of counterfactual generation focuses on the kinds of possibilities that people keep in mind when they think about the factual and counterfactual situations (Byrne, 1997; 2005). It proposes that when people imagine counterfactual alternatives, they mentally represent two possibilities from the outset. For example, when people think about a counterfactual alternative, such as, "If Marc had caught the train, he would have arrived on time", they tend to keep in mind two possibilities. They keep in mind the presupposed facts, e.g., "Marc didn't catch the train, and he didn't arrive on time", and a possibility that is false, but temporarily supposed to be true, e.g., "Marc caught the train and he arrived on time".

People tend to interpret counterfactual conditionals as implying that their antecedents and consequents are false (Fillenbaum, 1974). People tend to judge that someone uttering a counterfactual conditional, such as "If Marc had caught the train he would have arrived on time" intended to imply the facts "Marc didn't catch the train", and "he didn't arrive on time" (Thompson & Byrne, 2002). In reasoning tasks, adults tend to readily infer "Marc didn't catch the train" from the information "he didn't arrive on time" when they are presented with the counterfactual conditional (Byrne & Tasso, 1999). In contrast, adult reasoners find it more difficult to make the same inference when they are presented with the factual conditional "If Marc caught the train, he arrived on time".

When adults understand a factual conditional they tend to keep in mind a single possibility rather than multiple possibilities because of working memory constraints (Johnson-Laird & Byrne, 1991), and they tend to keep in mind true possibilities rather than false possibilities (Johnson-Laird & Byrne, 2002). As a result, adults find it more

difficult to make inferences such as "Marc didn't catch the train" from a factual conditional than from a counterfactual conditional (Byrne & Tasso, 1999). The theory proposes two key principles about the possibilities people usually represent when they think about the facts: they keep in mind true possibilities and they keep in mind few possibilities (Johnson-Laird & Byrne, 2002).

But thinking about counterfactual conditionals is different. Adults tend to think about two possibilities from the outset and they tend to think about possibilities that they know to be false, but temporarily supposed to be true. Counterfactuals are different because they require a richer mental representation from the outset, and they require adults to represent false possibilities temporarily supposed to be true (Byrne, 2005). We return to how this theory may account for the difficulty children experience when they think about counterfactual situations in Chapter 3.

On this account, some aspects of reality are highly mutable because they require multiple possibilities to be kept in mind from the outset. The mental representation of multiple possibilities is richer than that of a single possibility, and so it already includes an alternative to reality and so reality can be easily undone (Byrne, 2005). The predictions derived from this theory have found support in the domain of deductive reasoning (e.g., Byrne & Tasso, 1999; Santamaria, Espino & Byrne, in press) and in the domain of counterfactual thinking (e.g., Byrne, 1997). The theory has been relied on to account for phenomena in counterfactual thinking such as the action effect (Byrne & McEleney, 2000) and the temporal order effect (Byrne et al., 2000; Walsh & Byrne, 2004). We return to how the theory accounts for these phenomena in relation to counterfactual thinking in children in Chapters 4 and 5.

Both the mental models theory of counterfactual generation and norm theory focus on the mutability of events. Norm theory posits that some counterfactual situations are easily imagined because they return events to their normal state of affairs. The mental

models theory of counterfactual thinking proposes that the ease at which an event is mentally undone depends on how the factual situation is mentally represented. To that end, both theories have attempted to explain the same phenomena of counterfactual thinking from these perspectives.

Counterfactual Thinking: Summary and Conclusions

When people engage in counterfactual thinking, they mentally compare reality to an imagined situation. This ability is thought to help people to learn from their mistakes and amplify their affective experience. Although there are infinite possibilities available for people to consider when they think about counterfactual alternatives, adults tend to show remarkable similarities in the kinds of counterfactual thoughts they produce. It is these similarities of counterfactual thought (e.g., the propensity to focus on the most recent event in an independent sequence of events, the tendency to undo actions and events that are exceptional) that have allowed researchers to examine where reality lends itself most readily to the imagination of alternatives and to understand how adults think about factual situations as well as imagined situations.

We have now considered some of the issues concerning counterfactual thinking in adults. When children think about what might have been, there may also be certain "junctures of reality" that they focus on. Examining exactly what these joints of reality might be may allow us to understand how children think about non-factual possibilities. However, there are many other ways in which children entertain situations that run counter to reality, such as when they engage in pretence and when they consider mistaken beliefs. Before we consider the development of counterfactual thinking in more detail in the latter sections of this chapter, we consider two phenomena of children's imaginative thinking in the next section: pretence and false belief understanding.

Children's Imaginative Thinking: Pretence and False Belief Understanding

Counterfactual thinking involves temporarily setting aside reality to consider how it might have turned out differently. In a child's mental life, there are many situations that call for them to consider a situation that is known to be false, but is temporarily supposed to be true (e.g., Harris, 2000). Children entertain alternatives to reality when they engage in the act of pretending that a banana is a telephone, that they are a superhero, or when they think about the fact that Mum believes that there is chocolate in the fridge when they know there is not.

We will begin this section with a brief exploration of pretence in early childhood. We will explore some of the facets of the imagination that both pretence and counterfactual thinking have in common, namely the child's ability to differentiate reality from an imagined possibility. We will then consider the pre-schooler's understanding of mistaken or false beliefs.

Pretence and Pretend Play

One of the earliest and clearest forms of the imagination is pretence and pretend play. At the age of 18 months children begin to show signs of pretence (Bretherton, 1989) and by the beginning of their third year they appear to understand pretence in others (Harris & Kavanaugh, 1993). An especially intriguing feature of pretend play is children's apparent ability to keep track of reality and the imagined situation, that is, their ability to suspend objective truth for the sake of pretence (e.g., Harris, 2000). We will now consider this feature in more detail and we will describe the accounts offered to explain young children's ability to allow reality and pretence to co-exist in their realm of experience.

Reality and Pretence

Consider the situation in which a 2-year-old is pretending that a yellow brick is a banana. A central question is how does the child not suffer from confusion over the brick when the play episode is over? Children appear to perform this play episode without consequences for their concept of bananas or bricks. Young children appear to avoid "representational abuse" (Leslie, 1987), that is, they show the ability to represent one object as another in the pretend world without confusing their conception of the object in the real world.

The evidence suggests that young children are competent at distinguishing between, and keeping track of, different realities in pretend play (Gopnik & Slaughter, 1991; Harris & Kavanaugh, 1993). For example, children as young as 2 years show clear indications that they can identify that a brick is a brick in the real world, and it is a banana in the pretend world (Harris & Kavanaugh, 1993). It has been claimed that young children avoid the problem of representational abuse by adopting a form of counterfactual reasoning, that is, they create an alternative to the factual situation (Harris, 2000; Leslie, 1987). In effect, the child represents two identities of the same physical object (the brick): a true identity in the real world (a brick) and its false identity in the pretend world (pretend banana).

When children engage in an episode of pretence or joint pretend play, they may encode their representation of the facts in a different way to their representation of the pretend or false situation (Harris, 2000; Leslie, 1987, 1994). For example, Harris proposes (2000) that children construct mental "flags" for the representation of the pretend situation to separate it from the true state of affairs (e.g., when an adult refers to the brick as soap they encode that stipulation as "bricks are soap"). In essence, it is as if the encoded proposition is preceded with a statement: "For the duration of this episode, pretend that… this brick is pretend soap". But children need to first recognise that the

episode is a pretend one and that a special mode of processing is required for the length of the episode. When it draws to a close, the child assumes a normal mode of processing as the "flags" no longer guide their actions.

On this account, when children engage in pretence, the true state of affairs is temporarily redefined as a false or imagined state of affairs. To this effect, pretend play can be considered as one of the earliest indices of a child's ability to temporarily set reality aside to engage in an imaginary situation. But young children do not appear to be able to entertain every non-factual situation with such ease, and it is to these situations that we now turn.

Children's Understanding of False Belief

Consider the following scenario (Wimmer & Perner, 1983): Maxi is in the kitchen with his mother and he puts his chocolate in the cupboard. He then goes out to play. While he is away his mother bakes a cake and moves the chocolate to the fridge. Maxi then returns. Where will Maxi look for his chocolate? In this situation, Maxi has a false belief: he believes the chocolate is in the cupboard when it is really in the fridge. Children aged 4- to 5 years typically give correct answers to this question, stating that Maxi will look in the cupboard, despite the fact that the chocolate is really in the fridge. In contrast, 3-year-olds frequently err on this task, responding with their own knowledge of the chocolate's current location (e.g., in the fridge). This type of error has been termed a *realist error* (Flavell, 1988), that is, children report their knowledge of current reality and not what they once believed to be the case, or what they think someone else falsely believes to be the case.

False belief understanding has been studied extensively in the field of early social cognition in an effort to gain insight into how young children understand their own minds, and the minds and mental states of others (e.g., Wellman, Cross & Watson, 2001).

The theoretical construct of "theory-of-mind" has been used to describe and explain how young children acquire an understanding that mental life is distinct from the world of actuality. A child's own mind and that of others can represent desires, intentions, emotions and beliefs in a way that is not necessarily reflective of the actual state of the world (e.g., Wellman, 1990). An understanding of one's own mental life and that of others can, in turn, guide and predict behaviour (e.g., Wellman & Gelman, 1988).

There are a number of accounts that attempt to explain the difficulty young children experience in false belief ascription. The representational account, which predominates the false belief literature, posits that children possess an underlying difficulty with mental state representation (Perner, 1991). The reality bias account contends that children's difficulty may be due to the way in which children consider reality (e.g., Mitchell, 1996). The counterfactual account posits that false belief understanding rests on the ability to consider counterfactual alternatives to reality (Petersen & Riggs, 1999). We will consider this account in some detail as its theoretical assumptions rest on an association between false belief understanding and counterfactual thinking. First, we will briefly outline the representational account and the reality bias account of false belief understanding.

Representational Account

The representational account focuses on children's conceptual understanding of mental states (Gopnik & Astington, 1988; Perner, 1991). Consider again Maxi's false belief about the chocolate's location. According to the representational account, children must mentally represent that Maxi is misrepresenting the world. False beliefs are misrepresentations, and young children fail such tasks because they "appear to lack understanding that minds represent, rather than mirror reality" (Lillard & Sobel, 1999, p.75). This account falls in line with the "theory theory" account of theory of mind.

Theory theorists consider the metaphor of the child as a scientist. Children formulate and test hypotheses and postulate mental states as theoretical constructs to explain and predict behaviour in much the same way as a scientist (Gopnik & Wellman, 1991; 1994). Accordingly, a child's conceptualisation of mental sates, such as beliefs, desires and intentions, is guided by a set of quasi-scientific principles. When children acquire the conceptual understanding that their own and other's behaviour is not necessarily guided by the way things really are, but by the way the mind represents them to be, they have what is called a representational theory-of-mind (Gopnik & Wellman, 1991; Wellman, 1990).

Reality Bias Account

In contrast to the representational account, the reality bias account contends that the difficulty children encounter with false beliefs may be tinged with a "reality bias", that is, children may find it too difficult to disengage from current reality to reason about a false belief (e.g., Saltmarsh, Mitchell & Robinson, 1995). It has been argued that the standard false belief tasks (e.g., unexpected transfer) can undermine children's performance due to the burden they place on the child to disengage from current reality to consider a false belief (e.g., Leslie, 1994; Mitchell, 1996; Russell, 1996).

Failure on false belief tasks has been shown in some circumstances to be dependent on the salience of the task itself. For example, performance improves when the tasks are framed in the context of trickery or deception, when the child is actively involved in moving the object, and when the salience of reality is reduced (e.g., when Maxi's chocolate is not moved but eaten, and therefore no longer exists)(Chandler, Fritz & Hala, 1989; Sullivan & Winner, 1993). However, a recent meta-analysis of 178 separate studies of false belief understanding has shown that although such task manipulations help younger children to perform better, accurate performance improves

only from below chance to chance (Wellman et al., 2001). Wellman and his colleagues argue that random at-chance performance provides no evidence of conceptual understanding, although it does identify features of tasks that may consistently lead young children to choose the incorrect response. Nevertheless, the evidence shows that when young children entertain beliefs that are counter to reality, the influence of reality plays a role in their performance.

Counterfactual Account

The counterfactual account proposes that success on false belief tasks requires the ability to reason in a counterfactual manner (Petersen & Riggs, 1999; Riggs & Petersen, 2000; Riggs, Petersen, Robinson, & Mitchell, 1998). Difficulties in false belief ascription may not merely rest on children's inability to inhibit current reality, or on an inability to understand the representational mind. Instead, false belief understanding may rest on the ability to infer a counterfactual situation -- which according to Riggs and Petersen (2000) is a form of conditional reasoning requiring the cognitive effort of ignoring a known fact. On this account, thinking about a false belief is akin to entertaining a counterfactual alternative (Riggs et al., 1998).

There is existing evidence in support of the counterfactual account. Riggs et al. (1998) compared pre-schooler's ability to understand a false belief with their ability to reason about a counterfactual physical (belief free) state. Three- and four-year-old children were presented with two stories and they were either asked a counterfactual question or a false belief question after each story. For example, in the "post office" story children heard about two characters, Peter and Sally who were at home. Peter felt ill and went to bed. Sally went to the shop to buy him medicine. Whilst Sally was out Peter received a call from the man in the post office to ask him to help put out a fire. Peter went to the post office to help. The children were then told that Sally had finished her errands

and they were either asked a false belief question, "Where does Sally think Peter is ?", or a counterfactual question, "If there had been no fire, where would Peter be now?". Children performed poorly on both tasks, and task performance was highly correlated. This significant correlation was replicated across two more experiments in which mean chronological age and receptive language ability were accounted for.

According to Riggs et al., the findings imply that counterfactual thinking is as difficult as false belief ascription and that false belief ascription rests on an ability to consider counterfactual situations. They propose that children must ignore a new piece of information and impose a new reality on the situation to successfully reason about both phenomena. However, more recent studies have shown that counterfactual thinking may only partially account for false belief performance (e.g., Guajardo & Turley-Ames, 2004; German & Nichols, 2003, Perner et al., 2004). These findings pose a serious challenge for the counterfactual account of false belief understanding and we will return to the relationship between false belief understanding and counterfactual thinking with reference to these studies in more detail later in this chapter. Importantly, for the present, the results from Riggs et al. (1998) suggest that the demands of counterfactual thinking are excessive for most 3- and 4-year-old children.

Pretence and False Belief Understanding: Summary and Conclusions

Young children's ability to entertain alternatives to reality is evident in their readiness to immerse themselves in pretence and pretend play in late infancy. Two-year-olds appear to be able to distinguish reality from the imagined situation and keep track of the two situations without great difficulty. It has been proposed that children adopt a form of counterfactual reasoning in pretence to keep track of reality and the imagined situation. However, it is not until the age of 4 years that children exhibit the capacity to temporarily suspend their view of reality to entertain a false belief. Making reality more salient can

somewhat improve performance but it is widely accepted that a developmental shift occurs at the age of 4 years because it is at this age that children acquire a conceptual understanding that their minds can represent different realities. Recently it has been claimed that false belief understanding is symptomatic of a more general difficulty to reason about a counterfactual situation. This account suggests that pre-school children lack the ability to keep track of reality and its counterfactual alternative when they think about false beliefs and situations that once were possible, but are so no longer.

In this second section we have considered how young children think about alternatives to reality when they engage in pretence and when they entertain a belief that runs counter to their view of reality. In the remaining sections we focus on children's ability to think about counterfactual situations. In the next section, we review the studies that have focused on the development of counterfactual thinking in pre-schoolers.

Counterfactual Thinking in Pre-school Children

It is only in the past decade that research on counterfactual thinking in children has received some well-deserved attention in the cognitive developmental domain. These recent studies have shown that the capacity to entertain counterfactual alternatives emerges during the pre-school years (Guajardo & Turley-Ames, 2004; Harris et al., 1996) although the evidence is somewhat mixed about young children's level of competence (e.g., Riggs et al., 1998; Robinson & Beck, 2000). In this section we consider these studies. We first consider the studies that point to an early competence in counterfactual reasoning, and we then consider the studies that examine some of the difficulties pre-school children experience when they think about what might have been. We also consider the suggestions that have been advanced to account for these difficulties. However, many of these proposals are preliminary. In the final section of this chapter, we draw on these suggestions and on the some of the key issues that have arisen from the

study of counterfactual thinking in children in an attempt to form a more complete picture of the development of counterfactual thinking.

Early Competence in Children's Counterfactual Thinking

Existing evidence (Bowerman, 1986; Harris, 1997) suggests that very young children show a sensitivity towards counterfactual thinking, and that by the age of 3 years children are quite adept at entertaining counterfactuals during the causal reasoning process (Harris et al., 1996). Furthermore, recent findings suggest that 3-year-old-children are capable of generating counterfactual alternatives that are similar to those produced by adults (Guajardo & Turley-Ames, 2004).

Early Competence: Early Indications of Counterfactual Thinking

Clues from children's use of language suggest that very young children exhibit a sensitivity towards counterfactual thought (e.g., Bowerman, 1986; Harris, 1997). Although 2-year-old children omit appropriate markers in their hypothetical speech such as the modal *would* or the auxiliary *have* (Kuczaj & Daly, 1979), they use verbal expressions such as "almost" (e.g., "almost fall"), "about to" or "nearly" (Bowerman, 1986). At the same age, children begin to use verbs such as "thought" and "wish", e.g., "I wish Christy have a car. I wish me have a airplane" (C. aged, 2.1 years; Bowerman, 1986). It has been argued that the emergence of the use of these verbs suggests that children have the capacity to refer to situations that do not necessarily reflect reality long before the capacity for hypothetical references emerges (Bowerman, 1986).

Very young children can also identify events in terms of what might have happened (Harris, 1997). For example, in one study 2- and 3-year-olds observed two toy horses gallop across a table. One horse was made stop half way across the table, whilst the other horse was made stop just short of the edge of the table. When participants were

asked "Which horse almost fell off the table?", even the 2-year-olds performed above chance in choosing the horse that came closer to realising the outcome. Harris (1997) argues that even in late infancy, children can interpret events in light of what might have happened, but did not. Such studies indicate an almost precocious ability to perceive an actual event in terms of an imagined possibility.

Early Competence: Counterfactual Thinking and Causal Reasoning

One of the first studies in this area advanced the claim that children as young as 3 years are capable of entertaining counterfactuals in relation to causal reasoning. Harris et al. (1996) explored the possibility that 3- and 4-year-olds can engage in counterfactual thinking in reaching causal conclusions about a given causal outcome. For example, children observed enacted episodes, e.g., a doll named Carol walked across a clean floor with dirty shoes, rendering the floor dirty. They were then asked a counterfactual question, e.g., "What if Carol had taken her shoes off, would the floor be dirty now?" which required the children to judge a situation that had not been realized. Even the 3-year-olds performed above chance in this task.

Pre-schoolers also consider counterfactual alternatives in working out how an outcome could have been prevented. For example, in a scenario in which Sally chose some white chocolate for a snack and later became hungry, children answered prevention questions, such as, "What should Sally have done instead so she wasn't hungry?" by referring to an alternative mentioned in the story (choosing a sandwich) when it would have prevented the outcome. Children also referred to more general alternatives (e.g., "She should have had more food") when the alternative in the story (choosing brown chocolate) would not have prevented the outcome (Harris et al., 1996).

But children do not refer to counterfactual alternatives as readily when they are asked to reason about a good outcome. German (1999) gave 5-year-old children either a

story about a bad outcome, e.g., Sally chose chocolate instead of a sandwich and became hungry, or a story about a good outcome, e.g., Sally chose a sandwich instead of the chocolate and became full. Children readily referred to a counterfactual alternative in their answers to an explanation question, "Why did Sally become all hungry?" for the bad outcome story, but they rarely referred to the counterfactual alternative in their answers to the explanation question "Why did Sally become all full?" for the good outcome story. German (1999) claims that these findings undermine the view that the counterfactual thinking process, as indexed by reference to possible rejected courses of action, is necessary for causal reasoning.

Furthermore, German (1999) argues that given his findings, young children are more likely to consider counterfactuals following a bad outcome than following a good outcome. Studies of counterfactual thinking in adults have shown that adults are also more likely to think "if only" following bad outcomes rather than good outcomes (e.g., Gavanski & Wells, 1989). German's findings suggest that children's counterfactual thoughts may show some similarities to the types of thoughts that adults generate.

Early Competence: The Generation of Counterfactual Alternatives

The sorts of counterfactual alternatives that pre-school children generate are also similar to those generated by adults, at least in their direction and structure. Guajardo and Turley-Ames (2004) investigated 3- to 5-year-olds' responses to open-ended questions about counterfactual situations. Children's responses were assessed in terms of their direction, that is, whether the children produced upward or downward counterfactual assertions and structure, that is, whether the counterfactual statements were additive or subtractive. Pre-schoolers were asked counterfactual questions which were designed to elicit upward counterfactual responses (e.g., "What could you have done so that the kitchen floor would not have gotten dirty?") following scenarios about mishaps (e.g., you walk through the

mud and you keep your shoes on and you get dirt all over the kitchen floor). They were also asked counterfactual questions designed to elicit downward counterfactuals (e.g., "What could you have done so your clothes would have gotten dirty?") following scenarios about neutral outcomes (e.g., you are wearing your best clothes and you eat ice-cream and you keep your clothes clean). Children in all three age groups generated more additive counterfactual assertions (e.g., "Wipe your shoes off before you get into the house") than subtractive counterfactuals (e.g., "Wouldn't play in the mud") and they produced upward and downward counterfactual assertions with equal frequency.

Guajardo and Turley-Ames (2004) also found that pre-schoolers could answer questions that required them to undo an antecedent to an outcome (e.g., "What could you have done so the kitchen floor wouldn't have gotten dirty?") as well as questions that required them to undo an outcome itself (e.g. "If there had been no fire, where would Peter be?"). Even 3-year-old children could generate counterfactual alternatives to the antecedent questions (e.g., "Wouldn't play in the mud") and to the consequent questions (e.g., "Peter would be at home"). Performance on both types of task was highly correlated and it improved across age groups, although the performance between 3- and 4-year-olds did not differ reliably.

Although children's responses to both counterfactual tasks were not tested for performance above that expected by chance in this study, the findings show that children as young as 3 years can generate different sorts of counterfactual assertions to different types of questions and that they can generate counterfactual alternatives that are similar to the kinds of counterfactual alternatives generated by adults. The capacity for counterfactual thought appears to emerge early in development.

Difficulties in Counterfactual Thinking in Pre-school Children

But pre-schoolers can experience difficulties in answering counterfactual questions. For example, Riggs et al., (1998) showed that 3-year-old children commit many realist errors in response to counterfactual questions such as "If there had been no fire, where would Peter be?". The nature of this difficulty has been explored in a number of recent studies (German & Nichols, 2003; Perner et al., 2004; Robinson & Beck, 2000), which we will now consider.

Difficulties in Counterfactual Thinking: A Reality Bias?

Robinson and Beck (2000) explored the possibility that children's errors on counterfactual tasks are due to a reality bias. Following from the reality bias account in false belief understanding, Robinson and Beck proposed that children commit realist errors in counterfactual tasks because they have difficulty disengaging from reality to access counterfactual alternatives.

In a series of studies, the salience of current reality was manipulated so that reality would be made less accessible for children. For example, in one task, the counterfactual situation children were asked to reason about was not an alternative to current reality, but to past reality. Children were told a story about Peter who usually plays football in the garden before school, but that it had rained the previous night and Peter had to play in-doors with another toy instead. Children made as many errors when the counterfactual question referred to past reality "If it had not rained last night, what would Peter have played with?" when Peter was described as on his way to school, rather than when the question referred to current reality "If it had not rained last night, what would Peter be playing with now?" when Peter was currently at home playing. Other experiments in the series yielded similar findings: children's performance was not enhanced by making current reality less accessible by telling the children about it instead of letting them see it

occurring, or keeping the current reality uncertain by informing the children that no one is certain what the current reality is.

On the reality bias account, children should experience difficulty avoiding the powerful influence of reality when they think about other possibilities, such as what might happen in the future (Riggs et al., 1998). But children do not experience difficulty answering future hypothetical questions (Perner et al., 2004; Riggs et al., 1998; Robinson & Beck, 2000). For example, Robinson and Beck (2000) found that when children were given a task in which they had to sort objects with pictures on them into a certain box, they gave many more correct answers to a future hypothetical question, "If I rub out this drawing, which box will it be in?" than they gave to a counterfactual question, "If I had not drawn on this piece of paper, which box will it be in now?".

Robinson and Beck (2000) conclude that their studies yield little evidence to suggest that the difficulty of counterfactual thinking rests on an inability to disengage from reality. They suggest that the difficulty children experience with counterfactual alternatives may be a result of the way in which they mentally represent the actual state of affairs. They draw on Byrne's (1997; see also Byrne, 2005) account of counterfactual thinking in adults, which posits that people keep in mind few possibilities due to working memory constraints (see Johnson-Laird & Byrne, 1991) and they keep in mind true possibilities (Johnson-Laird & Byrne, 2002). On this account Robinson and Beck make two suggestions: first, children find mentally representing a counterfactual alternative alongside the current state of affairs too demanding, and second, this demand may be due to working memory capacity.

In Chapters 2 and 3 of this thesis we explore some of the suggestions made by Robinson and Beck in more detail. We further explore the possibility that pre-school children have difficulty disengaging from reality to answer a counterfactual question in an initial experiment reported in Chapter 2. In Chapter 3 we draw on the tenets of the mental

model theory of counterfactual generation to examine whether pre-school children have difficulty thinking about the current state of affairs alongside the counterfactual possibility in two experiments.

Difficulties in Counterfactual Thinking: Complexity of Causal Inferences

German and Nichols (2003) examined whether counterfactual questions that require pre-schoolers to undo events that occurred at the beginning of a story are more difficult than questions about events that occurred at the end of a story. They contend that pre-schoolers' difficulty in answering counterfactual questions is not due to a problem with counterfactual reasoning per se, but with the length of the causal chain in a story that they must reason about.

Drawing from an analysis of the tasks used by both Harris et al. (1996) and Riggs et al. (1998), German and Nichols (2003) argue that the causal sequences used in the scenarios of both studies differ in length and therefore complexity. For example, Harris et al. used simple causal stories. There is a starting point (e.g. clean floor) an event occurs (e.g. Carol walks across the floor with muddy shoes), and a change in the situation results (e.g. floor becomes dirty). German and Nichols propose that the counterfactual questions require an inference such as: *remove shoes -- no muddy footprints*. In contrast, the scenarios used by Riggs et al. involve longer causal chains. Recall Riggs et al.'s "post office" story for example. Children are asked where Peter would be if there had been no fire. The type of causal chain children must think about to make a correct counterfactual inference would be: *no fire -- no phone call -- Peter not go to post office -- Peter in bed.* German and Nichols point out that this causal chain is considerably longer than the Harris et al. causal chain, and it is for this reason that children frequently failed the tasks described in Riggs et al. (1998).

In order to test these predictions, German and Nichols (2003) gave 3- and 4-year-olds two stories with four event sequences. For example, they were told about Mrs Rosy who is happy because she has planted a flower in her garden and she calls Mr. Rosy from the house to see. When Mr. Rosy comes out to see, their dog escapes from the house, and runs around the garden and squashes the flower, and Mrs. Rosy is sad. Children were asked one of three counterfactual questions. The long inference question referred to events that happened at the beginning of the story (e.g., "What if Mrs. Rosy hadn't called her husband, would Mrs. Rosy be happy or sad?"). The medium inference question referred to events in the middle of the story (e.g., "What if the dog hadn't escaped from the house…?"). The short inference question was about the event that happened at the very end of the story (e.g., "What if the dog hadn't squashed the flower…?").

Children gave fewer correct answers to counterfactual questions about the medium and long causal chains than they gave for the short inference counterfactual questions. The two age groups did not differ in performance. Three-year-olds performed well above chance for the short inference questions, replicating Harris et al.'s findings, and failed to perform for the medium and long chain stories, which were similar in length to those used by Riggs et al. The findings show that pre-school children can encounter difficulties thinking about counterfactual alternatives, but these difficulties may rest on the complexity of the inferences required by the task.

German and Nichols (2003) suggest that the difficulty young children experience in thinking about longer causal chains may rest on working memory limitations. On their account, for a child to answer a counterfactual question the chain of events in a scenario must be held in mind. For example, to answer a counterfactual question such as, "What if the dog hadn't escaped from the house…?" children must mutate that antecedent event (e.g., the dog did not escape into the garden) which relies on the representation of the entire chain of events in working memory (e.g., that Mrs. Rosy called her husband from

the house, that the dog escaped and that he squashed her flower). If the representation of events is not adequately stored, it may prevent the mutation of the event referred to in the counterfactual question, which may in turn result in a high rate of errors.

Difficulties in Counterfactual Thinking: Complexity of Counterfactual Scenarios

Perner et al. (2004) examined the difficulty children encounter in counterfactual tasks by comparing their responses to counterfactual questions about two types of travel scenarios. In the simple travel scenario, one situation mapped directly on to another possible situation (e.g., Sue can only go from the barn to the pasture and she can only get there by coach; she can only go from the school to the play ground and she can only get there by tricycle). In the complex travel scenario each situation could be mapped on to more than one possible situation (e.g., Peter can go from the green station to the lake by bus and to the mountains by train; he can go from the blue station to the lake by train and to the mountains by bus).

Pre-schoolers gave many more correct answers to the counterfactual questions about the simple travel scenarios (e.g., Sue is at the barn. If she had gone to the school and she had taken the tricycle from there, where would she have ended up?) than those about the complex travel scenarios (e.g., Peter is at the lake. If he had gone to the Blue station and had taken the bus, where would he have ended up?).When children were asked a question about a future possibility such as, "If Peter goes to the green station where will he end up?", they gave many more correct responses to the future hypothetical question than they gave for the counterfactual questions.

Perner et al. offer a tentative explanation for these findings. They contend that to answer some counterfactual questions (e.g., the simple travel scenario counterfactual questions) children need only refer to the antecedent to work out how the outcome could have turned out differently. In other counterfactual questions (e.g., the complex travel

scenario questions) children need to refer to the preceding course of events to derive the correct answer. For example, they claim that children can easily answer counterfactual questions such as "If Carol had taken off her shoes, would the floor be dirty now?" (Harris et al., 1996) because the children need only refer to the antecedent inherent in the question, that is, that Carol had shoes on. They can easily infer that if Carol had taken off her shoes the floor would be clean. In contrast, children err on counterfactual questions such as "If there had been no fire, where would Peter be?" (Riggs et al., 1998) because they must think about events in the story that are not explicitly referred to in the counterfactual question, that is, that Peter was sick in bed and he was called to the post office to help put out a fire.

These findings suggest that first, similar to the findings obtained by both Riggs et al. (1998) and Robinson and Beck (2000), children find it easier to think about future possibilities than counterfactual possibilities. Second, the nature of the difficulty that children experience in thinking about counterfactual situations appears to rest on the inherent complexity of the factual situation the children must reason about.

Counterfactual Thinking in Pre-School Children: Summary and Conclusions

The capacity to answer questions about counterfactual possibilities appears to emerge during the pre-school years, although young children can encounter difficulties when they think about counterfactual situations. Children as young as 3 years can identify a counterfactual alternative to an outcome in a causal story and they refer to alternatives that might have happened, but did not, when they are asked to reason about the cause of an outcome (Harris, et al., 1996). The kinds of counterfactual alternatives that pre-schoolers generate show certain similarities to the counterfactual thoughts that adults tend to produce (German, 1999; Guajardo & Turley-Ames, 2004).

Children can however experience difficulties answering counterfactual questions, frequently responding with their view of current reality (e.g., Riggs et al., 1998; Robinson & Beck, 2000). But children do not experience the same problems reasoning about what might happen in the future (Robinson & Beck, 2000; Perner et al., 2004). Recent studies have attempted to address the nature of the difficulty young children experience when they think about counterfactual alternatives (e.g., German & Nichols, 2003; Perner et al., 2004; Robinson & Beck, 2000). It has been suggested that children's difficulty in inhibiting reality cannot account for poor performance alone (Robinson & Beck, 2000) and that factors such as the complexity and the mental representation of the factual situation (Perner et al., 2004; Robinson & Beck, 2000), complexity of causal inferences (German & Nichols, 2003) and working memory (German & Nichols, 2003; Robinson & Beck, 2000) may be key in the attempt to unearth the difficulty young children encounter when they think about what might have been. In the final section of this chapter we examine these factors and their implications for our understanding of children's counterfactual thinking in more detail.

Many of the studies that address counterfactual thinking in pre-school children have focused on the difficulties that young children may experience. The studies that examine counterfactual thinking in middle childhood shift their attention to focus on the development of children's judgements of emotions in counterfactual situations. In the next section, we consider the few studies that address the development of this form of imaginative thinking in children aged 5- to 9 years.

Counterfactual Thinking in Middle Childhood

The studies that have been described thus far have focused on counterfactual thinking in pre-school children. A number of these studies have included 5-year-olds in their sample, and the results obtained from these studies have been revealing. For example, Guajardo

and Turley-Ames (2004) showed that 3- to 5-year-olds improve across age groups in their responses to counterfactual questions that undo an outcome (e.g., "If there had been no fire, where would Peter be?") as well as counterfactual questions that undo an antecedent to the outcome (e.g. "What could you have done so the kitchen floor would not have gotten dirty?"). The evidence suggests that counterfactual reasoning ability improves across the pre-school years. But little is known about its development in middle childhood. There are three studies that focus on the relationship between counterfactual reasoning and the judgements of emotions that children aged 5- to and 9 years tend to make in counterfactual situations.

Counterfactual Thinking and Judgements of Emotions

Studies of counterfactual thinking in adults have shown that counterfactual "if only" thoughts appear to be closely related to emotions such as regret, guilt, shame and relief (e.g., Byrne et al., 2000; Byrne & McEleney, 2000; Kahneman & Tversky, 1982). Children's judgements of negative affect, such as "who feels worse", have been examined in three recent studies of counterfactual thinking. This affective measure has been referred to as children's understanding of regret in these studies.

In one study, Amsel and Smalley (2000) examined whether children can update their judgements of emotions about a factual situation in light of counterfactual information. They contend that this ability is central to the experience of regret. On their account, children must do several things to appropriately demonstrate regret. First, they must mentally compare reality with a counterfactual possibility, and they must infer an agents' (self or other) feelings about the imagined possibility (e.g., He would have felt X if he had been in that situation). Second, they must make judgements about the agents' feelings about the factual situation (e.g., Now he feels Y about the present) and to do so

they must consider the agents' feelings about the imagined possibility (e.g., because he would have felt X in the counterfactual situation).

Amsel and Smalley (2000) presented 3-year-olds, 6-year-olds and adults with an opportunity to either play a card game or to observe a puppet play a card game. The participant (or puppet) chose one of two cards, which in some trials had a higher value than the unselected card, and in other trials it carried a lower value than the unselected card. Participants were then shown the unselected card and they were required to make two judgements of emotion. The initial judgement was about how they (or the puppet) would have felt if they *had* chosen the unselected card, e.g., "How happy would you (or the puppet) be if you (or he) had taken the other gift box: not happy or sad, a little happy, pretty happy, or very happy?". The second judgement of emotion was about how they (or the puppet) felt about their chosen card in light of the information about the unselected card, e.g., "How happy are you (or the puppet) now with the gift you (he) received…?"

For the initial judgement of emotion even the 3-year-old participants could make assertions that accounted for the counterfactual information. They could appropriately judge how they (or the puppet) would have felt if they had chosen the unselected card. But only the children aged 6 years and older could make such assertions about the subsequent counterfactual judgement. They judged that they would feel better about their chosen card when the unselected card was of lower value, whereas they judged that they would feel worse about their chosen card when the unselected card was of higher value. In contrast, the 3-year-olds did not update their judgements about how they felt about their chosen card. Amsel and Smalley (2000) claim that it is not until 6 years that children bring the counterfactual alternative to bear on their emotional judgements of the facts. Accordingly, children younger than 6 years lack the capacity to judge regret in themselves and others.

Children's judgements of emotions in counterfactual situations have also been examined by Guttentag and Ferrell (2004). Adults show systematic similarities in the events that they undo to create a counterfactual alternative (Kahneman & Tversky, 1982). As we described in the first section of this chapter, adults tend to undo events that are exceptional and they tend to undo actions more than inactions (Kahneman & Tversky, 1982). Furthermore, adults tend to judge greater emotional impact for such events, which has lead to the suggestion that the mutability of such events amplifies affective experience (Kahneman & Miller, 1986). Following from these findings, Guttentag and Ferrell (2004) explored whether children show the tendency to judge greater emotional impact for exceptional events and for actions rather than failures to act.

Children (aged 5, 7, and 9 years) and adults were given two types of scenarios. The scenarios featured two protagonists. In one sort of scenario, one protagonist chooses to act, whereas the other protagonist fails to act. In the second sort of scenario one protagonist adopts their typical course of action, and the other adopts an atypical course of action. For example, one scenario featured two boys, Bob and David, who both cycle around the lake each morning to go to school. Normally Bob cycles around the right hand side of the lake and David cycles around the left hand side. On the day in question, David decided not to take his usual route and he cycled around the right side of the lake instead. Bob took his usual route. There was a branch on the path on the right side and both boys hit it and fell off their bikes. Participants were asked to make judgements of emotions (e.g., "Who will be more upset? Or do you think they would feel the same?") and to justify their judgements.

For both sorts of scenarios, participants of 7 years and older displayed the standard action and exceptionality effect in their judgements of emotions. For the scenarios about the exceptionality effect, 7- and 9-year-olds (and adults) judged that the protagonist who adopted the atypical course of action (e.g., David) would feel more

upset. Similarly, for the scenarios about the action effect more 7- and 9-year-olds (and adults) judged that the actor would feel worse than the non-actor. For both scenarios, most of the 7- and-9-year-olds' justifications focused on the alternative course of action (e.g., "David would have been OK if he had ridden the other way"). In contrast, the 5-year-olds did not judge greater emotional impact for one protagonist or another. Guttentag and Ferrell (2004) conclude that it is only by the age of 7 years that children take into account the situational factors that affect event mutability in their judgements of emotions in a counterfactual situation. For this reason, 7-year-olds show patterns in their judgements of emotions that are similar to adults.

But children aged 7 years and older do not show an adult-like pattern of responses in their judgements of emotions in every counterfactual situation. In a follow up study, Ferrell (2005) gave children (aged 6, 7 and 8 years) and adults scenarios that were based on those used by Guttentag and Ferrell (2004). The scenarios were either about bad or neutral outcomes. There were two characters in each scenario (e.g., Chris and Dave who chose one of two different paths each to cycle to school) who experienced the same outcome (e.g., hitting a branch and falling off their bikes). For one character (e.g., Chris) the alternative to reality would have resulted in a different outcome (e.g., the path not chosen was clear) whereas for the other character (e.g., Dave) the alternative to reality would have resulted in the same outcome (e.g., there was also a branch on the path not chosen). There were two versions of each story: in the "most explicit" version, a sentence was included about the characters' counterfactual thoughts (e.g., "Chris thinks that if he had taken the path that goes past the playground instead of the path he took, he wouldn't have fallen off his bike") whereas in the "least explicit" version the alternative outcome was simply stated (e.g., the path not chosen was clear).

Participants were asked to judge which character felt worse or whether they judged them to feel the same. Adults tended to judge that the character whose alternative

course of action would have resulted in a different outcome (e.g., Chris) would feel worse than the character whose alternative course of action would have resulted in the same outcome (e.g., Dave). Children of all age groups tended to judge that both characters would feel the same for the "least explicit" stories. Whereas children aged 6- and 7-years showed a similar pattern of responses for the "most explicit" stories, the 8-year-olds responded in a manner similar to adults.

Ferrell (2005) concludes that age differences in children's judgements of emotions may vary according to the counterfactual "trigger" that is inherent in a counterfactual situation. Actions and events that are exceptional act as triggers for children aged 7 years and 9 years to make judgements of emotions in counterfactual situations that are similar to the pattern of responses shown by adults (Guttentag & Ferrell, 2004). In contrast, increasing the salience of a counterfactual situation by making it more explicit helps 8-year-olds, but not 6- and 7-year-olds, make judgements of emotions that are similar to adults in counterfactual situations (Ferrell, 2005).

The findings from these studies (Ferrell, 2005; Guttentag & Ferrell, 2004) suggest that children's mental representations of the counterfactual situation (e.g., whether the counterfactual alternative is explicit, or the factual situation is highly mutable) affect their judgements of emotions in different ways. Another way to assess children's counterfactual "if only" thoughts in such situations is to ask them to complete the counterfactual thoughts of the protagonists involved in the stories. This method may help us to better understand the mental representations children are keeping in mind when they think about counterfactual situations. We return to this issue in Chapter 4.

Counterfactual Thinking in Middle Childhood: Summary and Conclusions

Three studies have examined the kinds of judgements of emotions that children may make when they think about counterfactual situations. These studies suggest that at the

age of 6 years, children's mental representation of the counterfactual situation appears to influence their judgements of emotions of a factual situation (Amsel & Smalley, 2000). When 7- and 9-year-old children (but not 5-year-olds) think about how actions and exceptional events could have turned out differently, they show patterns in their judgements of emotions that are similar to those shown by adults (Guttentag & Ferrell, 2004). Children aged 8 years, but not younger, tend to judge greater emotional impact for events that could have happened differently than for events that would have resulted in the same outcome -- but only when the counterfactual alternative is made explicit (Ferrell, 2005). Taken together, these findings suggest that the relationship between counterfactual thinking and affective experience emerges sometime during the ages of 6 to 8 years. We further explore this relationship and how it pertains to children's "if only" thoughts in Chapters 4 and 5.

Understanding Counterfactual Thinking in Children

In this chapter we have reviewed many aspects of the development of children's ability to consider alternatives to reality, including false belief understanding, and counterfactual thinking in pre-school and school-aged children. Although children as young as 3 years appear to be able to answer counterfactual questions about simple factual situations, pre-school children can experience difficulties with some counterfactual tasks, which appears to be a result of the complexity of the factual situation that they must reason about. Studies of counterfactual thinking in older children show that they begin to exhibit a pattern of responses that is similar to the judgements of emotions that adults make between the ages of 6 and 8 years. The age at which children begin to make these judgements appears to vary slightly, which may be associated with the counterfactual situation they must reason about.

Several factors appear to be at play in the development of counterfactual thinking in early and middle childhood, such as working memory limitations, mental representational ability and the ability to adopt perspective taking. In this final section we draw together the suggestions and accounts that have focused on these issues in an attempt to establish a more coherent understanding of how children consider situations that once were possible but are so no longer. We first consider the relationship between false belief understanding and counterfactual thinking in more detail in an effort to glean a richer understanding of how counterfactual thought develops.

Understanding Counterfactual Thinking in Children: False Belief Understanding

A great amount of emphasis has been placed on the exact relationship between counterfactual thinking and false belief understanding in an attempt to understand these two forms of imaginative thinking in children (e.g., German & Nichols, 2003; Guajardo & Turley-Ames, 2004). We consider the implications of these findings for our understanding of how pre-school and school-aged children think about what might have been.

Counterfactual Thinking and False Belief Understanding in Pre-School Children

As we described earlier in this chapter, it has been suggested that there is a close relationship between false belief understanding and counterfactual thinking (e.g., Riggs & Peterson, 2000). According to this account, children must rely on the same strategy to perform successfully in both types of task (Petersen & Riggs, 1999; Riggs & Petersen, 2000). Riggs and his colleagues illustrate their proposal with a description of the "Maxi and the chocolate" story (e.g., Maxi puts the chocolate in the cupboard; unbeknownst to him, his mother uses the chocolate to bake a cake and moves the chocolate to the fridge). In order to answer a false belief question, e.g., "Where will Maxi look for the chocolate?"

and a counterfactual question, "If Maxi's mother has not baked a cake, where would the chocolate be?", children must ignore the new piece of information (e.g., that the chocolate has been moved) and respond with the default answer (e.g., "In the cupboard"). To support their proposal Riggs and Petersen (2000) rely on evidence from the study by Riggs et al. (1998) in which it was found that children's performance on a false belief task and a counterfactual task were highly correlated.

There are several criticisms of this account. We have already seen that a number of studies of counterfactual thinking in children show that the capacity for counterfactual thought appears to develop before the age of 4 years (e.g., Harris et al., 1996). It is widely accepted that the capacity for false belief ascription emerges at the age of 4 years, and not before (Wellman et al., 2001). This issue alone challenges the account to the extent that the two forms of imaginative thinking do not appear to follow the same developmental trajectory (Perner et al., 2004).

Furthermore, the findings from recent studies that have examined the relationship between false belief understanding and counterfactual thinking have cast doubt over the account. For example, Guajardo and Turley-Ames (2004) found that that performance on false belief tasks only partially correlated with performance on the counterfactual tasks. Other studies have suggested that pre-schoolers' ability to answer certain counterfactual questions precedes their ability to ascribe false beliefs (German & Nichols, 2003; Perner et al., 2004). For example, German and Nichols (2003) found that children performed significantly better on short inference counterfactual questions (e.g., "What if the dog hadn't squashed the flower?") than they did on false belief tasks (e.g., unexpected transfer task) in their study of the complexity of causal inferences in children's counterfactual thinking. However, there was a correlation between performance on false belief tasks and counterfactual questions that required the children to make longer inferences about the factual situation (e.g., "What if the dog hadn't escaped from the house…?). German and

Nichols (2003) argue that for there to be an association between these two abilities, performance on all types of tasks should be correlated, but they were not.

Taken together, these findings suggest that the relationship between counterfactual thinking and false belief ascription is not as clear-cut as Riggs et al. (1988) suggest. False belief performance only correlates with counterfactual questions that require a more complex representation of the factual situation. This finding challenges the claim made by Riggs and his colleagues that false belief understanding rests on an ability to think about counterfactual alternatives. It has been suggested that the critical difference between false-belief tasks and counterfactual reasoning tasks is that the former types of task require children to represent a mental state (e.g., Maxi's belief). In contrast, counterfactual tasks do not require such mental state inference; instead they focus on physical states, such as what would have prevented a floor from getting dirty (Guajardo & Turley-Ames, 2004).

Counterfactual Thinking and False Belief Understanding in Older Children

Performance in more complex theory-of-mind tasks has been shown to be closely associated with older children's ability to make adult-like judgements of emotions in counterfactual situations. In the study carried out by Ferrell (2005), children aged 6- to 8 years were given two second-order theory of mind tasks that were used to measure their ability to understand a character's belief about another character's belief (e.g., Sullivan, Zaitchik & Tager-Flusberg, 1994). For example, in one task, children were informed that John puts a chocolate bar in a drawer but he tells Mary it is in the pantry. But Mary sees John put the chocolate in the drawer, and she does not tell John. In such a situation, John believes Mary has a false belief about the chocolate's location, that is, John has a false belief about Mary's belief. Children and adults were also asked to make judgements of emotions about two characters in a counterfactual situation. The results showed that

children's ability to attribute second-order mental states was a key predictor in determining whether they made adult-like judgements of emotion in counterfactual tasks.

Ferrell (2005) concludes that children's ability to understand another person's beliefs about another person's beliefs is associated with their ability to judge how two characters feel in a counterfactual situation because both tasks require children to adopt another person's perspective using their mental states as a guide. Ferrell argues that in the counterfactual emotion task used in her study, children must compare two characters' counterfactual thoughts and their resulting emotions (e.g., Who feels worse, Chris or Dave?), and in the theory-of-mind task children must adopt John's perspective and make their judgements based on his belief about Mary's belief. In both cases, children must have the ability to think about other people's complex thoughts and it is this ability that might account for the close association between the two types of task.

Counterfactual Thinking and False Belief Understanding: Interim Summary and Conclusions

Evidence from studies that have compared performance on counterfactual thinking tasks to performance on false belief/theory-of-mind tasks in children show that the relationship between these two phenomena is a complex one. Pre-schoolers' ability to answer less complex counterfactual questions appears to surpass their ability to answer false belief questions but they make as many errors on counterfactual tasks that require a more complex representation of reality as they do on false belief tasks (German & Nichols, 2003; Perner et al., 2004). Older children's ability to make judgements of emotions in counterfactual situations that are comparable to those made by adults is associated with their ability to ascribe second-order mental states (Ferrell, 2005). The evidence suggests that although counterfactual thinking and false belief understanding are not as closely associated as once suggested (e.g., Petersen & Riggs, 1999), their relationship is one that

can help us to gain more of an understanding of the development of counterfactual thinking in children. In the final part of this section we attempt to draw together the main factors that might account for the development of the child's capacity to think about counterfactual situations.

Factors in Understanding Counterfactual Thinking in Children

Pre-school children err more frequently on counterfactual tasks that require them to reason about a complex factual situation. As we have seen, 3- and 4-year-olds gave many more correct answers to counterfactual questions about simple travel scenarios (which demanded a simple one to one mapping of relations in the factual situation) than to counterfactual questions about complex travel scenarios (which required multiple relational mapping) (Perner et al., 2004). Pre-schoolers also find it easier to answer counterfactual questions about short causal chains than those about longer chains of events (German & Nichols, 2003). Young children's performance on the more difficult counterfactual tasks is correlated with their performance on false belief tasks (German & Nichols, 2003; Perner et al., 2004).

The evidence suggests that the difficulty for young children lies with the complexity of the factual situation that the children must consider in order to access a counterfactual alternative. German and Nichols (2003) tentatively suggest that counterfactual questions that require children to keep in mind a lot of information to infer the correct answer may be more difficult because of working memory constraints. They draw on evidence reported by Gordon and Olson (1998) that shows that working memory correlates highly with false belief tasks. Following from these findings, German and Nichols (2003) propose that the difficulty young children have with "holding information in mind" (Gordon & Olson, 1998) may account for the relationship between counterfactual questions about longer chains and false belief found in their study.

Robinson and Beck (2000) also draw on the role of working memory to account for the difficulties that young children may face in a counterfactual situation. The findings described in their study of counterfactual thinking in pre-school children show that 3- and 4-year-olds err on counterfactual questions, irrespective of whether the current reality is made more or less available to the children. In their interpretation of these findings, Robinson and Beck (2000) suggest that children may encounter difficulty representing both the actual state of affairs as well as the counterfactual alternative perhaps because of working memory limitations. They refer to Byrne's (1997; see also Byrne, 2005) account of counterfactual thinking in adults for this analysis, which posits that adults keep in mind true possibilities (Johnson-Laird & Byrne, 2002) and they keep in mind few possibilities due to working memory constraints (Johnson-Laird & Byrne, 1991). Robinson and Beck suggest that children may err on counterfactual tasks because the demands of mentally representing both the current state of affairs alongside the counterfactual alternative may exceed the mental resources of a young child.

Studies of counterfactual thinking in older children show that there is a developmental shift that occurs between the ages of 5/6 years and 8 years regarding children's judgements of emotions in counterfactual situations (Amsel & Smalley, 2000; Guttentag & Ferrell, 2004; Ferrell, 2005). Factors which have been implicated to account for this developmental shift include children's ability to adopt perspective taking, that is, the ability to judge how someone would feel in a counterfactual situation and compare this mental state to how another may feel, and the way in which the counterfactual alternative is represented during the counterfactual thinking process (Ferrell, 2005).

The evidence from this review of counterfactual thinking in pre-school children suggests that there are at least two central features that are implicated in the difficulties pre-school children experience in thinking about what might have been. These features are: the way in which children represent the current state of affairs (e.g., German &

Nichols, 2003; Perner et al., 2004; Robinson & Beck, 2000) and the possible role of working memory in children's counterfactual thinking (German & Nichols, 2003; Robinson & Beck, 2000). Evidence from studies of counterfactual thinking in middle childhood suggest that the factors implicated in children's ability to make judgements of emotions in counterfactual situations may rely on the way in which the counterfactual alternative is represented and the capacity for complex mental state understanding (Ferrell, 2005). In this thesis we explore the development of counterfactual thinking from early to middle childhood by examining the possibilities that children keep in mind when they think about how a factual situation could have turned out differently.

Aims of the Thesis

When people think about how a situation could have turned out differently, they mentally compare the factual situation to an imagined, counterfactual one. Our aim in this thesis is to examine the mental representations children construct when they compare the factual situation to a counterfactual one. Most studies of counterfactual thinking in children have focused on the difficulty pre-school children encounter when they think about what might have been. Many advances have been made in this burgeoning area of research, yet many of the proposals to account for this difficulty are preliminary. Very few studies have extended their scope to explore the way in which children in middle childhood might think about counterfactual situations, and the sorts of counterfactual alternatives they might imagine. Our aim is to gain further insight into the development of counterfactual thinking by examining the mental representations children construct when they imagine counterfactual alternatives, from its emergence in the pre-school years to its development into middle childhood.

In this thesis we describe two series of experiments that examine counterfactual thinking in 3- and 4-year-olds and 6- and 8-year-olds respectively. In Chapters 2 and 3 we

describe the first series of three experiments that examine counterfactual thinking in pre-schoolers. In this chapter we reviewed many aspects of counterfactual thinking. We focused on pre-school children's ability to think about counterfactual situations by grouping together those studies that suggest that pre-schoolers show an early competence in counterfactual thinking, and those studies that highlight the difficulty pre-schoolers encounter with some counterfactual tasks. In Chapter 2 we describe an initial experiment that aims to further explore the difficulty pre-schoolers may experience with counterfactual questions when they think about reality and its counterfactual alternatives. In Chapter 3 we describe two experiments that examine the mental representations 3- and 4-year-olds may consider when they answer counterfactual questions. We suggest that the difficulty young children encounter with counterfactual situations rests on the mental representations they must keep in mind. We wished to test whether instructions to form a mental representation of the counterfactual possibility in a story help 3- and 4-year-olds to answer counterfactual questions.

In Chapters 4 and 5 we examine whether 6- and 8-year-old children focus on similar aspects of reality as adults when they think about a counterfactual situation. In the first section of this chapter we described some of the regularities adults show in the sorts of counterfactual alternatives they generate. There are certain aspects of reality that adults tend to focus on when they think about how reality may have turned out differently. These effects of counterfactual thinking, such as the action effect and the temporal order effect, have yielded many clues to the possibilities adults may represent when they think about the factual situation and its counterfactual alternatives. Studies of counterfactual thinking in school-aged children have shown that children's judgements of emotions in counterfactual situations may emerge between the ages of 6 years and 8 years. In Chapter 4 we describe two experiments that examine whether 6- and 8-years-olds keep in mind the same possibilities as adults when they think about actions and inactions. We wished to

test whether children of this age show the standard action effect in their "if only" thoughts and in their judgements of emotions. In Chapter 5 we further examine children's "if only" thoughts. We describe an experiment that examines whether 6- and 8-year-olds show the temporal order effect in their "if only" thoughts and judgements of emotions. We aimed to test whether children of this age keep in mind the same possibilities, and make the same sort of judgements of emotions, as adults when they think about the most recent event in an independent sequence of events.

In the final chapter, we discuss the implications of our findings for our understanding of the development of counterfactual thinking in early and middle childhood. We consider the implications of our findings for understanding the development of children's mental representational ability and for understanding the broader area of early social cognition. We conclude by suggesting other possible avenues of research in children's counterfactual thinking that may be explored in the future.

In summary, the aim of this thesis is to further explore the development of counterfactual thinking in early and middle childhood by examining the mental representations children construct when they think about how reality could have turned out differently.

Chapter 2 Counterfactual Thinking in Pre-school Children: An Exploratory Study

In this chapter we will examine how pre-school children think about counterfactual possibilities such as "If only the field had been full of bunnies, Billie the bunny could have played with his friends". We will tentatively explore the possibility that the accuracy of 3- and 4-year-olds' answers to counterfactual questions is affected by a reality bias, that is, a difficulty disengaging from current reality to access a counterfactual alternative. We investigate how pre-school children respond to counterfactual questions such as "If the field had not been full of bunnies, would Billie be able to play with his friends now?" when they are instructed to focus on either the current reality, or the now past counterfactual possibility in a causal story.

As we described in Chapter 1, the evidence is somewhat mixed regarding pre-schoolers' ability to answer counterfactual questions. Children as young as 3 years can engage in counterfactual thinking to reach a causal conclusion (e.g., If Carol had taken off her muddy shoes, then the floor would be clean now) (Harris et al., 1996) although they are more likely to access counterfactual alternatives when they reason about a bad outcome rather than a good outcome (German, 1999). But 3- and 4-year-olds have difficulty responding to counterfactual questions such as "If there had been no fire, where would Peter be now?" about a story in which Peter is at home and he is called out to put out a fire at the post office (Riggs et al., 1998). They tend to make "realist" errors in their responses to such questions, that is, they tend to respond with their view of current reality (e.g., "Peter is at the post office") rather than with the false possibility temporarily supposed to be true (e.g., Peter is at home) (Riggs et al., 1998; Robinson & Beck, 2000).

A number of explanations have been advanced to account for the difficulties young children experience when they think about counterfactual situations. It has been suggested

that the complexity of the factual situation that children must reason about may be an important variable in counterfactual task performance (e.g., German & Nichols, 2003; Perner et al., 2004). For example, German and Nichols (2003) proposed that the difficulty may rest on the complexity of the causal sequences that children must reason about to undo a counterfactual antecedent. They showed that pre-schoolers can readily answer counterfactual questions about short causal sequences (e.g., Mrs Rosy would not be sad if her dog had not trampled on her flowers) but they err frequently on counterfactual questions which require them to reason about longer causal sequences (e.g., Mrs. Rosy would not be sad if she had not called Mr. Rosy from the house who let the dog into the garden, who in turn trampled on her flowers).

Another account that also focuses on children's ability to think about factual situations is the reality bias account of counterfactual thinking. Drawing on the reality bias account of false belief understanding (e.g., Leslie, 1994; Saltmarsh, Mitchell & Robinson, 1995), Robinson and Beck (2000) proposed that pre-schoolers make realist errors in counterfactual tasks because they have difficulty in disengaging from current reality to access a counterfactual alternative. In a series of experiments, they attempted to make either the current reality less available, or the counterfactual alternative more available, by modifying the content of causal stories. On Robinson and Beck's account, manipulating current reality to make it *less* salient, and the counterfactual alternative to make it *more* salient, may help children to access the counterfactual alternative and therefore improve their performance on counterfactual tasks.

However, the findings reported by Robinson and Beck (2000) suggest that manipulating the current reality or the counterfactual alternative in a causal story does little to facilitate pre-schoolers in their ability to think about counterfactual possibilities. For example, as we described in Chapter1, it was found that 3- and 4-year olds made as many mistakes when a counterfactual question referred to past reality "If it had not rained

last night, what would Peter have played with?" when Peter, who usually plays football every morning, is described as on his way to school now, rather than when it refers to current reality "If it had not rained last night, what would Peter be playing with now?" when Peter is at home playing with another toy. In the former case -- Peter on his way to school -- the children did not have to consider reality at all, and yet they still responded with their view of current reality. Robinson and Beck (2000) suggest that they either did not achieve their aim of manipulating the availability of the current reality or the counterfactual alternative, or that this manipulation makes it no easier for the child to think about how a situation could have turned out differently.

Before we consider the nature of the reality bias account in more detail, it must be noted that the two versions of the "Peter and the football" story (e.g., the past reality version and the current reality version) used by Robinson and Beck (2000) differ in their causal length, as outlined by German and Nichols (2003). The past reality version (*Way to school -- Night before -- Morning at home)* is longer in its causal sequence than the current reality version *(Night before -- Morning at home). On German and Nichol's account, the counterfactual questions referring to the past reality version of the story* (e.g., "If it had not rained last night, what would Peter have played with?") should be more difficult than the counterfactual questions referring to the current reality (e.g., If it had not rained last night, what would Peter be playing with now?") due to the difference in their causal complexity. However, Robinson and Beck report that children made as many mistakes in their answers to the counterfactual questions about the past reality version as they did to the counterfactual questions about the current reality version. Robinson and Beck's findings suggest that the complexity of the causal inferences may not underlie the difficulty experienced by the children in these particular counterfactual tasks.

Another possibility is that Robinson and Beck's attempts at modifying reality and its counterfactual alternative were somewhat indirect. Consider again the story about Peter playing football. The difference between the "alternative to current reality" version of the story and the "alternative to a past reality" version may make no difference to a child who must access a counterfactual alternative. To answer the counterfactual question "If it had not rained last night, what would Peter be playing with now/what would Peter have played with?" the child must think about the factual situation, that is, that it rained and Peter did not play football, and they must also consider the counterfactual situation, that is, that it did not rain and Peter played with his football. They must think about reality and its counterfactual alternative, irrespective of how the question is posed. Instead of manipulating the content of causal stories, it may be more effective to manipulate the salience of current reality, or its counterfactual alternative in a more direct fashion by instructing the child to directly focus on representations of either one or the other. In the experiment reported in this chapter we test the reality bias account of counterfactual thinking by exploring the possibility that instructions to focus on the current reality or the counterfactual alternative in a causal story affect the accuracy of children's answers to counterfactual questions.

There is existing evidence to suggest that modifying premises in other reasoning tasks to make them more salient can help pre-school children to think about alternatives to reality. Consider the problem: "All fish live in trees. Tot is a fish. Does Tot live in a tree?". When young children are presented with problems that contain a premise that runs counter to their knowledge of the world, such as the Tree-fish one, they tend to reject the main premise, and rely solely on their knowledge of the world where fish do not live in trees. Children can however, temporarily set aside their knowledge of the world and reason from such premises (Markovits & Vachon, 1989). For example, when these premises were presented to children in a story-telling intonation, or when they were told to

"Make a picture in your head", they made correct inferences from the main contrary-to-fact premise (Dias & Harris, 1990). Make-believe cues facilitate logical reasoning in young children (Dias & Harris, 1990; Markovits & Vachon, 1989; Richards & Sanderson, 1999).

However, it has been suggested that it is not the effect of make believe cues per se that helps children to reason about contrary-to-fact premises, but the effect of instructing the children to focus on the premises given (Leevers & Harris, 1999). Leevers and Harris (1999) examined the responses of 4-year-olds to two sets of contrary-to-fact problems such as the Tree-fish ones, which were presented in two sessions, two weeks apart. In the first session, a group of children were given instructions to make a picture in their heads and they were told about the benefits of mental imagery. The other group received no instructions. In the second session, neither group received instructions. It was found that those 4-year-olds who were told to make a picture in their heads, and who were told about the benefits of this mental imagery, gave correct answers to contrary-to-fact premises, not only in the first session, but in the second session where they received no further instructions. When 4-year-olds were instructed to make a picture in their heads of abstract content e.g., "All mib is black. Jane sees some mib. Is it black?" they once again provided more correct answers. Leevers and Harris (1999) contend that it is the pragmatic interchange between experimenter and child that orients the child to focus on the initial premises, whether make-believe cues are deployed or not.

Instructions could also provide a mechanism for making current reality, or its counterfactual alternative, more salient when children think about counterfactual situations: instructions to focus on a representation of either the current reality, or of the counterfactual alternative of a causal story, may facilitate pre-schoolers in separating current reality from its counterfactual alternative in a more direct way than the methods used by Robinson and Beck (2000). If children are prone to realist errors, instructions to

focus on the current reality of a story should increase errors whereas instructions to focus on the counterfactual alternative should reduce such errors.

In this chapter we will report an initial experiment that explores the possibility that instructions to focus on either the current reality, or the counterfactual possibility of a causal story affects the accuracy of 3- and 4-year-olds' responses to counterfactual questions. We gave 3- and 4-year-old children scenarios such as the following:

Bobby is a bee. He lives in a beehive. He likes to collect nectar from flowers. He sucks the nectar from the sunflower. There is lots of nectar in the sunflower. Then one day the sunflower is cut down. And Bobby is really sad because he is not able to collect nectar now.

We showed the participants accompanying pictures after each sentence of the story. We asked them the counterfactual question "If the sunflower had not been cut down, would Bobby be able to collect nectar from it now?". We compared instructions to think about the picture of the current reality in the story (e.g., the cut down sunflower) to instructions to think about the picture of the now past counterfactual possibility (e.g., all the nectar in the sunflower) to no instructions.

Experiment 1

The experiment aimed to explore how pre-schoolers respond to counterfactual questions such as "If the sunflower had not been cut down, would Bobby be able to collect nectar from it now?" about a scenario in which Bobby the bee collects nectar from a sunflower but the sunflower is cut down. In order to answer the counterfactual question, children need to think about the current reality in the story, i.e., the sunflower is cut down and Bobby is not able to collect nectar from it. But they also need to think about the counterfactual possibility in the story, i.e., there was lots of nectar in the sunflower and

Bobby was able to collect nectar from it. We gave children scenarios of four different contents (See Appendix A). There were three groups: a "reality" group, a "counterfactual" group and a control group. Children in the "reality" group were instructed to focus on a picture of the current reality in the story whereas children in the "counterfactual' group were instructed to focus on a picture of the now past counterfactual possibility in the story. The children in the control group were given no instructions. Instructions to focus on the current reality (e.g., "Think really hard about this picture of the cut down sun flower") may make it more difficult for children to think about the counterfactual possibility whereas instructions to focus on the counterfactual possibility in the story (e.g., "Think really hard about this picture of all the nectar in the sunflower") may help children to think about the counterfactual alternative. We wished to see whether the frequency of children's correct responses to the counterfactual questions is increased by instructions to focus on the current reality, the counterfactual possibility or by no instructions

Instructions to focus on a picture of either the current reality or the counterfactual possibility may be a more direct method of manipulating their salience than those methods used by Robinson and Beck (2000). Instructions to focus on the current reality of the story may increase the salience of reality whereas instructions to focus on the now past counterfactual possibility in the story may indirectly decrease the salience of reality. If children's answers to counterfactual questions are affected by a reality bias, then errors made by children in the "reality" group should be greater than those made by children in the control group. In contrast, the errors made by children in the "counterfactual" group should be fewer than those made by the children in the control group.

Method

Participants

The participants were 62 children aged 3 to 4 years. There were 32 boys and 30 girls (with an age range of 3 years, 0 months to 4 years, 11 months, and a mean age of 4 years, 1 month). They were divided into two different age groups: 30 3-year-olds (14 boys and 16 girls, with an age range of 3 years, 0 months to 3 years, 11 months, mean age of 3 years, 7 months) and 32 4-year-olds (18 boys and 14 girls, with and age range of 4 years, 0 months to 4 years, 11 months, mean age of 4 years, 7 months). The children were assigned at random to three groups: control group (n = 22: 10 3-year-olds and 12 4-year-olds), a "reality" group (n = 20, 10 3-year-olds and 10 4-year-olds) and a "counterfactual" group (n = 20, 10 3-year-olds and 10 4-year-olds). Two children were replaced because they answered, "yes" to all the questions asked. The children were pupils from three pre-schools and one primary school in Dublin and Carlow and were primarily from middle class backgrounds. Written parental consent (See Appendix G for a sample letter seeking parental consent) and verbal child assent was obtained for each participant.

Materials

We constructed a set of four scenarios (see Appendix A). Each scenario contained seven sentences: the first and second described an animal character and its location, e.g., ''Billie is a bunny. He lives in a forest". The third and fourth sentences described the animal's favourite pastime and the action necessary to accomplish it, e.g., "He likes to play with his friends. He goes to the field to play with them". The fifth and sixth sentences described the two target situations: the now past counterfactual situation, and the current reality of the story, e.g., "But the field is empty. Then one-day the field is full of friends". The final sentence described the outcome, e.g., "And now Billie is really happy because he is able to play with his friends".

Two of the stories had a good outcome, and two had a bad outcome. The Billie Bunny story is an example of a good outcome story and the Bobby Bee story described in the introduction to this chapter is an example of a bad outcome story. The two other stories were about Millie Monkey who likes to eat bananas for her treat (good outcome) and Polly Penguin who likes to gather snow to build snowmen (bad outcome). We created a set of pictures to accompany each of the four scenarios. There were seven pictures for each scenario, with each picture corresponding to a sentence in the scenario. For the Billie Bunny scenario, for example, the first picture represented a picture of Billie Bunny corresponding to the first sentence ("Billie is a bunny"), the second picture portrayed Billie in a forest, corresponding to the second sentence ("He lives in a forest"), the third picture depicted Billie with his friends, which corresponded to the third sentence ("He likes to play with his friends") and so on. (See Appendix A for a full listing of the scenarios and accompanying pictures.) The pictures for each scenario were presented on seven 13cm by 9cm cards. Each sentence was read to the children and the corresponding picture was shown after the sentence was read out.

We gave the four scenarios to every child, and they each received them in a different random order. Each scenario was followed by three questions. The first two questions were warm-up questions: a "past reality" question e.g., "When the field was empty, was Billie able to play with his friends?" (Answer: No) (About the fifth sentence and the animal character's pastime). The second question was a "current reality" warm-up question, e.g., "Is Billie able to play with his friends now?" (Answer: Yes) (About the seventh sentence). The third question was the key experimental measure and it was a counterfactual question about the situation that once was possible, but is so no longer, e.g., "If the field had not been full of bunnies, would Billie be able to play with his friends now?" (Answer: No). Each counterfactual test question was in the subjunctive mood, and

the antecedent contained negation, e.g., "If p had not happened..." (where p referred to the event in the sixth sentence).

Each child received the three questions in the same fixed order, and they answered twelve questions in total. The questions required "yes" and "no" answers (see Appendix A) and we balanced them by ensuring that each scenario required a mix of "yes" and "no" answers: Each type of question required a "yes" answer for half the scenarios and a "no" answer for the other half. In this way, the correct answers to the three questions for the good outcome scenarios were "no", "yes", and "no" respectively, and the correct answers for the bad outcome scenarios were "yes", "no" and "yes" respectively.

Design and Procedure

The children were assigned at random to three groups, and they differed only in the instructions they were given immediately before the counterfactual question. The "reality" group were shown the seven corresponding pictures to the seven sentences in the scenarios, but immediately before the counterfactual question, they were shown the picture of the current reality (e.g., the field full of bunnies) for a second time and they were instructed to think really hard about it. The "counterfactual" group were shown the seven pictures and immediately before the counterfactual question they were shown the picture of the now past counterfactual alternative (e.g., the empty field) for a second time and they were instructed to think really hard about it. The control group were shown seven pictures corresponding to the seven sentences in the scenarios but they were not given any instructions, or shown any pictures immediately before the counterfactual question. The three groups received the same scenarios, pictures and questions, and differed only in the instructions and pictures they were given just before the counterfactual question.

The instructions were based on the study by Leevers and Harris (1999) of syllogistic reasoning. All children were told, "I'm going to read you some stories and show you some pictures about different animals and I want you to pretend that the things in the story are really happening". The children in the control group received no further instructions. Children in the two experimental groups were then given further instructions as follows: "Let's try one together. I'm going to tell you a little story and I want you to think really hard about what's happening in the pictures". The children were shown a corresponding picture to each sentence, e.g., "Connie is a cow" (picture of a cow). "She lives in a farm yard" (picture of a farmyard). The children were then reminded to think hard about the pictures and given a check question, e.g., "Are you thinking really hard about this picture of Connie the cow?" (Response). "Good, now where does Connie live?". The children were shown two pictures: one representing the correct answer, and the other representing an incorrect choice, e.g., "Does she live here?" (Picture of farmyard). "Or does she live here?" (Picture of house). "Can you show me?" A pointing response was required of the participants. If they indicated the incorrect choice they were reminded of the task and asked the question again. A further check was then given to ensure the children were following the instructions to think about the pictures as follows: "Good, so now I'm going to say something else about Connie and ask you a question: When it rains Connie sits down in her farmyard" (picture of Connie sitting down in the farmyard). "Are you thinking really hard about this picture of Connie sitting down in the farmyard?" (Response). "Now, it's raining" (picture of rain). "Is Connie doing this?" (Picture of Connie standing up). "Or is she doing this?" (Picture of Connie sitting down). (Response). "Good! Every time you hear a story like that you should try to think really hard about the pictures in the story, just like you did with Connie the cow and then the answers will be easier! So now I'm going to read you some other stories and remember: every time I read you a story I want you to think really hard about the things happening in

the pictures, just like you did with Connie the cow". (See Appendix A for the introductory task and the accompanying pictures).

The children in the two experimental groups were given the scenarios after the introductory task. They were prompted to think really hard about the accompanying pictures after the first two sentences in each scenario, e.g., "Are you thinking really hard about this picture of Billie the bunny?" They were then asked, "Where does Billie live?" and given a choice of two pictures, with only one indicating the correct response, and asked to point to the correct picture, "Does he live here (picture of a beach)? Or does he live here (picture of a forest)?" This prompt was given to ensure that the children in the experimental groups were following the instructions. The children in the control group did not receive either the warm-up task or prompts, instead they were given the scenarios immediately after the initial instructions to "Pretend that the things in the story are really happening".

The two experimental groups received the same instructions as each other with the exception of a single instruction given immediately before the target counterfactual question. Children in the "reality" group were instructed before the counterfactual test question to think really hard about the current reality of the story that was described in the sixth sentence of the scenario and were shown the corresponding picture again, e.g., "I want you to think really hard about this picture of the field full of bunnies". Children in the "counterfactual" group were instructed before the test question to think about the now past counterfactual alternative that was described in the fifth sentence of the story and they were shown the picture again, e.g., "I want you to think really hard about this picture of the empty field ". (See Appendix A).

The children were tested individually in a quiet corner of their classroom by the author. Each child was asked whether they would like to hear some stories and talk about

them afterwards. Each session lasted on average about ten minutes and afterwards the children were invited to ask questions and talk about the stories.

Results and Discussion

We report the results for the children's correct responses to the counterfactual questions. The results show that instructions to focus on a picture of the current reality decrease the accuracy of 3- and 4-year-olds' responses to counterfactual questions, and instructions to focus on the picture of the counterfactual alternative do not, but this effect occurs only for the bad outcome stories. In contrast, instructions to focus on the current reality, or the counterfactual alternative, do not affect the accuracy of pre-schoolers' answers to counterfactual questions about good outcomes. We carried out an ANOVA on the correct responses to the counterfactual questions to compare the three groups (control, reality and counterfactual), the two age groups (3-year-olds, 4-year-olds) and the two scenario types (good outcome, bad outcome), with repeated measures on the last factor. It showed no main effect of group, $F(2, 56) = 1.29$, $MSE = .55$, $p = .14$ (all p-values are one-tailed, unless otherwise stated) or scenario, $F(1, 56) = .54$, $MSE = .23$, $p = .46$, two-tailed, or age, $F(1, 56) = .54$, $p = .23$, two-tailed. There was no significant interaction between group and age, $F(2, 56) = .83$, $MSE = .354$, $p = .22$, or between scenario and age, $F(1, 56) = 1.59$, $MSE = .67$, $p = .21$, two-tailed. The three-way interaction between scenario, group and age was not significant, $F(2, 56) = .429$, $MSE = .181$, $p = .33$, but there was a significant interaction between scenario and group, $F(2, 56) = 3.72$, $MSE = 1.57$, $p = .02$.

Table 2.1: Percentages of correct answers to the counterfactual questions given by the 3- and 4-year-olds in the three groups for the good and bad outcome scenarios in Experiment 1.

	Good Outcome	**Bad Outcome**	**Total**
Counterfactual	80	80	80
Reality	80	68	74
Control	73	95	84
Total	*78*	*81*	*80*

We decomposed the interaction between scenario and group by carrying out a series of planned comparisons. The results show that for the bad outcome scenarios, children in the control group gave more correct answers than the "reality" group (95% vs. 68%, t = -3.18, df = 59, p =. 001) and the "counterfactual" group (95% vs. 80%, t = .190, df = 59, p = .03), as Table 2.1 shows. Children in the "counterfactual" group gave somewhat more correct answers than the "reality" group (80% vs. 68%) but the difference was not significant (t = 1.29, df = 59, p = .10). For the good outcome scenarios, there were no differences between the control group and the two experimental groups (73% vs. 80%, t = -.695, df = 59, p = .25, in both cases) and the two experimental groups did not differ (80% in each case). The children in the control group gave more correct responses to the counterfactual questions about the bad outcomes than the good outcomes (95% vs. 73%, t = -3.17, df = 21, p = .0025) but the two experimental groups did not differ in their responses to the counterfactual questions about the bad and good outcomes (reality: 68% vs. 80%, t = 1.05, df = 19, p = .16; counterfactual: 80% vs. 80%). A one sample t-test confirmed that the children performed above chance in their responses to the counterfactual questions overall (80% correct, t = 10.2, df = 61, p = .0001).

The experiment shows that instructions to focus on a picture of current reality decreases the accuracy of pre-schoolers' answers to counterfactual questions, but only for

the bad outcome stories. Instructions to focus on a picture of current reality do not affect children's answers to counterfactual questions about good outcomes. The finding suggests that manipulating the salience of current reality in a more direct fashion than the methods employed by Robinson and Beck (2000) affects the accuracy of children's responses to counterfactual questions about bad outcomes only. If children experience a general difficulty disengaging from current reality to think about a counterfactual possibility, we would expect that increasing the salience of current reality would affect the accuracy of their responses to counterfactual questions about good outcomes as well as bad outcomes, but the findings show that it did not.

Furthermore, the experiment shows that instructions to focus on a picture of the counterfactual possibility affects children's responses to the counterfactual questions about the good and bad outcomes in different ways. Instructions to focus on the counterfactual possibility did not affect the accuracy of children's responses to the counterfactual questions about the good outcome stories. In contrast, instructions to focus on the picture of the counterfactual possibility decreased the accuracy of children's responses to the counterfactual questions about the bad outcome stories. This result suggests that increasing the salience of the counterfactual possibility by instructing children to focus on pictures does little to help them answer counterfactual questions about bad outcomes. But the instructions have no affect on their answers to the counterfactual questions about the good outcomes. Instructions to focus on the counterfactual possibility is an indirect way of decreasing the salience of reality and so by Robinson and Beck's account, the accuracy of children's responses to counterfactual questions about both types of scenarios should be improved. Once again, these findings suggest that a general inability to inhibit the influence of current reality may not be the primary difficulty encountered by children when they answer counterfactual questions.

The experiment also shows that there were differences between the accuracy of the responses to the counterfactual questions about the good and bad outcomes given by those children who did not receive instructions. Children in the control group gave more correct answers to the counterfactual questions about the bad outcomes than the good outcomes. This finding is consistent with existing evidence that suggests that pre-schoolers are better able to think about counterfactual alternatives for bad outcomes than good outcomes (e.g., German, 1999).

Finally, the experiment shows that children performed well above chance in their responses to the counterfactual questions overall. Pre-school children can readily answer counterfactual questions such as "If the field had not been full of bunnies, would Billie the bunny be able to play with his friends?" . This finding is in line with the view that children's capacity to think about what might have been develops early in the pre-school years (Harris, 1997; Harris et al., 1996).

General Discussion

The aim of this chapter was to tentatively explore the possibility that the accuracy of pre-schoolers' responses to counterfactual questions such as, "If the sunflower had not been cut down, would Bobby be able to collect nectar from it now?" is affected by a reality bias. We wished to explore whether instructions to focus on pictures of either the current reality or the counterfactual alternative would affect the accuracy of 3- and 4-year-olds' responses to counterfactual questions.

The results from this initial experiment show that the children performed well above chance in their responses to the counterfactual questions overall. Pre-school children can accurately answer counterfactual questions such as "If the field had not been full of bunnies, would Billie be able to play with his friends now?". The experiment shows that when children are given no instructions, their answers to counterfactual

questions about good and bad outcomes differ. Children in the control group gave reliably more correct responses to the counterfactual questions about the bad outcomes than the good outcomes. In fact, the responses provided by the children in the control group to the counterfactual questions about the bad outcomes were almost at ceiling performance.

The results also show that instructions to focus on pictures of the current reality decreased the accuracy of pre-schoolers' responses to counterfactual questions compared to those children who were given no instructions, but only for the bad outcome stories. Furthermore, instructions to focus on a picture of the counterfactual alternative also reduced the accuracy of children's answers to counterfactual questions about the bad outcome stories. In contrast, the accuracy of children's responses to the good outcome counterfactual questions was not affected by instructions to focus on pictures of either the current reality or the counterfactual possibility.

When we consider the children's overall performance, the findings suggest that 3- and 4-year-olds can readily answer counterfactual questions such as "If the field had not been full of bunnies, would Billie be able to play with his friends now?". This finding is in line with the suggestion that the capacity to think about how a causal outcome could have turned out differently emerges early in development (Harris et al., 1996). The finding is also consistent with the proposal that the ease with which children can answer such counterfactual questions may rest on the length of the causal chain that they must reason about (German & Nichols, 2003). For example, the length of the causal chain that children must consider to answer the counterfactual question, "If the field had not been full of bunnies, would Billie be able to play with his friends?" is relatively short. Such a counterfactual question requires an inference such as: *Field empty -- Billie not able to play with friends*. This inference is similar in length to the inferences required to answer the short inference chain counterfactual questions used by German and Nichols (2003) in their study (e.g., *Dog not squashed flower -- Mrs. Rosy happy*) and those required to

answer the counterfactual questions used by Harris et al. (1996) (e.g., *Remove shoes -- No muddy footprints*). The findings suggest that children find it difficult to hold in mind a lot of information when they think about the factual situation. In the next chapter we examine whether children are helped to answer counterfactual questions when they are helped to keep in mind the counterfactual situation as well as the factual situation.

It is important to note that although the counterfactual question referring to the current reality version of the "Peter and the football" story used by Robinson and Beck (2000) is similar in causal complexity to those counterfactual questions described above, children in Robinson and Beck's study performed poorly in their answers to counterfactual questions referring to both the current reality and past reality versions of the story. This finding suggests that the two versions of the "Peter and the football" story may differ in another important way to the stories used in this current experiment and to those used by Harris et al. (1996) and German and Nichols (2003). For example, the two versions of the story also differ in terms of the crucial event: the past reality version requires children to undo an inaction (i.e., no play with football), whereas the current reality version requires them to undo an action (i.e., play with another toy). As we described in Chapter 1, studies of counterfactual thinking in adults show that adults' counterfactual thoughts tend to mentally undo actions more than inactions (e.g., Landman, 1987), which is termed the action effect. Although little is known about the action effect in pre-schoolers' counterfactual thinking, young children may find it difficult to answer counterfactual questions that require them to undo actions or inactions. We explore the action effect in children's counterfactual thinking in Chapter 4.

That children in the control group were better able to answer counterfactual questions about bad outcomes rather than good outcomes is consistent with the view that children, like adults, consider counterfactual alternatives more readily when the outcome of a causal situation is a bad one (German, 1999). The tendency people show to think

about counterfactual alternatives more readily for bad outcomes than for good outcomes may serve a preparatory function, helping people to learn from their mistakes and to prepare for the future (Markman et al., 1993; Roese, 1994). This finding suggests that the ability to think about how a bad outcome could have turned out differently emerges early in development, perhaps because it serves a preparatory function. However, children are no more likely to give correct responses to counterfactual questions about bad rather than good outcomes when they are instructed to focus on pictures of the current reality or the counterfactual alternative. In the experiments reported in the next chapter we further explore the difference between children's responses to counterfactual questions about good and bad outcomes.

Furthermore, the results suggest that the reality bias explanation cannot fully account for the difficulties children may have in considering counterfactual alternatives to reality. On the reality bias account, instructions to focus on the current reality should reduce the accuracy of responses to counterfactual questions because children may have difficulty avoiding the powerful influence of reality to access the counterfactual alternative (e.g., Robinson & Beck, 2000). Accordingly, increasing the salience of current reality should affect children's responses to counterfactual questions -- irrespective of the valence of the outcome of the story the children must reason about. But when children answer counterfactual questions about good outcomes, they do not appear to be affected by the powerful influence of reality.

In addition, instructions to focus on a picture of the counterfactual possibility do little to increase the accuracy of children's responses to counterfactual questions about bad outcomes, whereas the instructions have no effect on children's answers to the counterfactual questions about good outcomes. According to Robinson and Beck (2000), increasing the salience of the counterfactual possibility may make the counterfactual alternative more accessible to children and the accuracy of their responses may therefore

be increased. But once again, the findings from the experiment provide little support for this claim. These findings suggest that the overwhelming influence of reality may not be the primary factor underlying the difficulty encountered by pre-schoolers when they answer counterfactual questions. Nonetheless, the findings do not rule out the possibility that children's representation of the current reality, and the counterfactual possibility, may play an important role in children's ability to consider counterfactual alternatives. Children may err on counterfactual tasks because of a difficulty keeping in mind the factual situation alongside the conjectured possibility, that is, the counterfactual situation. We further explore this possibility in the experiments reported in the next chapter.

The results from this experiment suggest that although pre-school children can readily answer counterfactual questions such as "If the field had not been full of bunnies, would Billie be able to play with his friends now?", instructions to focus on pictures of either the current reality, or the counterfactual alternative do not help them to answer these questions compared to no instructions. Although the findings from the experiments reported by Leevers and Harris (1999) show that mental imagery instructions help children to focus on counter-to-fact premises in syllogistic reasoning tasks, they argue that the beneficial effects of mental imagery instructions are not a result of the mental imagery per se, but because the instructions help orient the child towards the premise in question. But the results from this experiment suggest that instructions to focus on external pictures do not help children orient towards a representation of either the current reality, or the counterfactual possibility, in counterfactual reasoning tasks. It is possible that there may be differences in how children understand instructions to focus on pictures (e.g., "Think really hard about the picture of…") and mental imagery instructions (e.g., "Make a picture inside your head of…") such as those used by Leevers and Harris (1999). There is existing evidence to suggest that very young children (e.g., 2.5-year-olds) have difficulty understanding the representational nature of symbolic objects such as pictures

and maps because they have difficulty understanding that a symbolic object relates to something other than itself (DeLoache, 1991; 2000; 2004). It has been suggested that this difficulty may rest on the representational burden that understanding symbolic objects imposes on young children. The very nature of symbolic objects requires children to keep in mind two representations when they think about them: they must mentally represent the concrete object itself (e.g., the picture) as well as its abstract relation to what it stands for (DeLoache, De Mendoza & Anderson, 1999).

Although existing evidence suggests that by the age of 3 years children can hold in mind both representations when they think about symbolic objects (DeLoache, Pierroustsakos, Uttal, & Troseth, 1997), it is possible that the instructions we relied upon in the current experiment may have increased the task demands for the children in the experimental groups. Instructions to focus on pictures may have imposed representational demands upon the children that were too great, or they may have distracted the children from answering the counterfactual questions. The use of mental imagery instructions, such as those deployed by Leevers and Harris (1999), rather than instructions to focus on external representations, may be a more useful method of unearthing the difficulties that pre-schoolers encounter when they think about counterfactual situations. In the experiments reported in the next chapter we explore how mental imagery instructions affect the accuracy of children's responses to counterfactual questions.

Conclusions

The findings from this introductory experiment suggest that the reality bias account cannot fully account for the difficulties experienced by young children when consider counterfactual possibilities. Although children may appear to be affected by the influence of reality in their answers to counterfactual questions about bad outcomes, they do not appear to be influenced by a reality bias when they think about good outcomes. These

findings, taken together with those reported by Robinson and Beck (2000), suggest that the influence of reality may not be the primary factor contributing to children's difficulty in thinking about counterfactual situations. However, the methods we relied upon to orient children towards a representation of either the current reality or the counterfactual alternative may not have been the most effective, perhaps because instructions to focus on external representations (e.g., pictures) differ from instructions to focus on internal representations (e.g., mental imagery instructions).

Although the ability to disengage from reality may not be the primary factor in determining counterfactual task performance, the way in which children understand the factual situation as well as the counterfactual situation may still play an important role in how children think about what might have been. When people think about counterfactual situations they mentally represent the facts of the situation (e.g., that the field is full of bunnies) as well as the situation that is false, but temporarily supposed to be true (e.g., the field is empty) (Byrne, 1997; 2005). The difficulty of counterfactual scenarios for young children may rest on the need to keep in mind situations that are false but temporarily supposed to be true. In our next chapter we explore whether mental imagery instructions help children to keep in mind counterfactual possibilities when they think about what might have been.

Chapter 3 Counterfactual Thinking in Pre-school Children: Mental Imagery

The experiment reported in Chapter 2 showed that instructions to focus on pictures of the current reality decreased the accuracy of 3- and 4-year-olds' responses to counterfactual questions about bad outcome stories, but not good outcome stories. This finding suggests that a reality bias may not be the primary factor contributing to the difficulty pre-schoolers experience when they think about counterfactual situations. In this chapter we further explore the difficulties that pre-school children may encounter when they consider counterfactual alternatives to reality by examining how mental imagery instructions, rather than instructions to focus on external representations, affect the accuracy of pre-schoolers' answers to counterfactual questions. We examine the possibility that the difficulties young children experience may rest on the possibilities that they keep in mind when they think about counterfactual situations such as, "If only the field had been full of bunnies, Billie the bunny could have played with his friends". We will examine how instructions to form a mental representation of the counterfactual possibility help pre-schoolers to answer counterfactual questions such as, "If the field had not been full of bunnies, would Billie be able to play with his friends now?".

The findings reported in Experiment 1, taken together with those reported by Robinson and Beck (2000), suggest that the overwhelming influence of current reality may not be the primary factor in preventing children from accessing counterfactual alternatives. However, this finding does not rule out the possibility that the way in which children mentally represent the factual situation may play an important role in their counterfactual thinking. As we described in Chapters 1 and 2, pre-school children make many errors when they answer counterfactual questions that require them to keep in mind a lot of information, whereas they readily answer counterfactual questions that require them to keep in mind less information (German & Nichols, 2003). Findings such as these

have led to the suggestion that the complexity of the factual representation that children must reason about appears to be an important factor in counterfactual task performance (e.g., German & Nichols, 2003; Perner et al., 2004).

However, the difficulty of counterfactual scenarios for pre-school children may rest not only on the need to keep in mind the factual situation, but also on the need to keep in mind the situation that is false, but temporarily supposed to be true. According to the mental models theory of counterfactual generation, when adults imagine alternatives to reality, such as "If he had worn his seatbelt he would have escaped injury", they tend to keep in mind two possibilities, the presupposed true facts, e.g., "He didn't wear a seatbelt and he didn't escape injury", and the counterfactual possibility, a false possibility temporarily assumed to be true, "He wore a seatbelt and he escaped injury" (Byrne, 2005). In general when adults understand *factual* conditionals such as, "If he wore his seatbelt, he escaped injury" they tend to think about a single possibility rather than multiple possibilities because of working memory constraints (Johnson-Laird & Byrne, 1991), and they tend to think about true possibilities rather than false possibilities (Johnson-Laird & Byrne, 2002). The theory proposes two key principles about the possibilities that people usually envisage: they envisage *true* possibilities, and they envisage *few* possibilities. But counterfactual conditionals are different: adults tend to understand them by thinking about two possibilities from the outset. They tend to think about the possibility corresponding to the facts and they tend to think about possibilities that they know to be false but temporarily suppose to be true. The theory identifies two unique aspects of counterfactuals: first, they require people to keep in mind multiple possibilities; and second, they require people to keep in mind false possibilities temporarily supposed to be true (Byrne, 2005).

The theory can be extended to identify that these unique aspects of counterfactuals may be the source of difficulty for pre-school children when they consider counterfactual

alternatives. It implies that pre-school children may have difficulty keeping in mind two possibilities, the reality and the conjectured possibility. Instead they may tend to keep in mind just a single possibility, the one corresponding to the true facts, rather than the false possibility temporarily assumed to be true. The theory predicts that pre-school children can be helped to answer counterfactual questions when they are helped to keep in mind not only the reality but also the counterfactual possibility.

As we described in Chapter 2, instructions to form a mental image (e.g. "Make a picture inside your head of fishes in trees") help pre-school children to reason from premises that run counter to their knowledge of the world (e.g., "All fish live in trees. Tot is a fish. Does Tot live in a tree?") (Dias & Harris, 1990; Leevers & Harris, 1999). It has been proposed that it is the effect of instructing children to focus on the premises that improves their performance, irrespective of whether the instructions are about mental imagery or not (Leevers & Harris, 1999). This proposal suggests that instructions may help children form a mental representation of the premises given.

But the findings from Experiment 1 show that instructions to focus on pictures of the current reality, or the counterfactual alternative, appear to be only partially effective in helping children to answer counterfactual questions. The children who were instructed to focus on pictures may have had difficulty answering counterfactual questions because of the task demands associated with such instructions. Instructions to focus on symbolic objects such as pictures may impose a representational demand upon children that may exceed pre-schoolers' abilities (e.g., DeLoache, 2000; 2004) or they may serve to distract children from focusing on the representation in question. Instructions to focus on internal representations (e.g., mental imagery instructions) may impose less task demands on children than instructions to focus on external representations (e.g., pictures).

In this chapter we will report two experiments that examine whether pre-school children can be helped to answer counterfactual questions by instructions to form a mental

image of the counterfactual possibility. We gave 3- and 4-year-old children the same scenarios used in Experiment 1. For example, we gave them a scenario such as the following:

Polly is a penguin. She lives in the South Pole. She likes to build snowmen. She gathers snow from the mountain to build the snowmen. There is lots of snow on the mountain. Then one day the snow melts. And now Polly is really sad because she is not able to build snowmen.

We asked them a counterfactual question, "If the snow had not melted, would Polly be able to build snowmen now?". We compared instructions to image the counterfactual possibility (all the snow on the mountain) to instructions to image the current reality (the snow melting on the mountain). On our account young children tend to keep in mind the reality so children given instructions to form a mental representation of the reality will perform just like children who are given no instructions. But children do not tend to keep in mind the counterfactual possibility, and so instructions to form a mental representation of the counterfactual possibility should improve their performance compared to children instructed to image reality or given no instructions.

Experiment 2

The experiment aimed to test whether instructions to form a mental image of the counterfactual possibility would help pre-school children to answer counterfactual questions such as "If the snow had not melted, would Polly be able to build snowmen now?", about a scenario in which Polly the penguin gathers snow from a mountain to build a snowman, but the snow melts and she is not able to build the snowman. We propose that children form a mental representation of the events in a story that encapsulates the current reality, i.e., the melting snow on the mountain and Polly is not

able to build the snowman. In order to answer the counterfactual question, children need to think about the counterfactual possibility in the story, i.e., there is lots of snow on the mountain and Polly can build the snowman. On our account, keeping in mind multiple possibilities exceeds working memory capacity (Johnson-Laird & Byrne, 1991; 2002). Pre-school children tend to keep in mind just a single possibility, the one corresponding to current reality, rather than the counterfactual possibility. The theory predicts that instructions to image the counterfactual possibility may help children to keep in mind this possibility, as well as the current reality. Instructions to image the current reality may only reaffirm what children do spontaneously in this situation and so instructions may not help children to answer the counterfactual question any more accurately than the control group who receive no instructions about imagery.

Method

Participants

The participants were 62 children aged 3 to 4 years. There were 28 boys and 34 girls (with an age range of 3 years, 0 months to 4 years, 11 months, and a mean age of 4 years, 0 months). They were divided into two different age groups: 31 3-year-olds (15 boys and 16 girls, with an age range of 3 years, 0 months to 3 years, 11 months, mean age of 3 years, 7 months) and 31 4-year-olds (13 boys and 18 girls, with an age range of 4 years, 0 months to 4 years, 11 months, mean age of 4 years, 5 months). They were assigned at random to six different groups, for each age group there was a control group (10 3-year-olds and 10 4-year-olds) and two experimental groups: image-reality (11 3-year-olds and 10 4-year-olds) and image-counterfactual (10 3-year-olds and 11 4-year-olds). The children were pupils from three pre-schools and two primary schools in Dublin and Kildare and were primarily from middle class backgrounds. Written parental consent (See Appendix G) and verbal participant assent was obtained for each child. Five children

were replaced, two because they responded "yes" to every question and three because they indicated they were unable to make a picture in their minds when we gave them the instructions about imagery.

Materials

The four scenarios used in this experiment were identical to those used in Experiment 1, however no pictures were shown. As in Experiment 1, two of the stories had a good outcome (e.g., Millie Monkey and Billie Bunny) and two had a bad outcome (e.g., Polly Penguin and Bobby Bee). We gave the four scenarios to every child, and they each received them in a different random order. Each scenario was followed by the same three questions used in Experiment 1: the two warm-up questions (i.e., the "past reality" and the "current reality" question) and the counterfactual question, (e.g., "If the snow had not melted, would Polly be able to build snowmen now?"). The children received the three questions in exactly the same order given to the children in Experiment 1, and they answered twelve questions in total. The questions required the same "yes" and "no" answers (See Appendix B).

Design and Procedure

The children were assigned at random to different test groups, which differed in the instructions they were given. The image-reality group (n = 21: 11 3-year-olds and 10 4-year-olds) were given instructions to form a mental picture of the current reality (e.g., the melting snow). The image-counterfactual group (n = 21: 10 3-year-olds and 11 4-year-olds) were given instructions to form a mental picture of the now past counterfactual alternative (e.g., all the snow on the mountain). The control group (n = 20: 10 3-year-olds and 10 4-year-olds) were not told to form a mental picture. The six groups (three groups

for each age group) received the same scenarios and questions, and differed only in the instructions they were given.

The instructions were similar to those used in Experiment 1, however instructions to focus on pictures were replaced with mental imagery instructions. All children were told, "I'm going to read you some stories about different animals, and I want you to pretend that the things in the story are really happening". The children in the control group received no further instructions. Children in the two imagery groups (image-reality and image-counterfactual) were then given the same introductory exercise as the one used in Experiment 1, but no pictures were shown. The instructions to "Think really hard about the pictures in the story" given to children in Experiment 1 were replaced with instructions to "Make a picture inside your head" as follows: "Let's try one together. I'm going to tell you a little story and I want you to make a picture inside your head of what's happening in the story. Connie is a cow. She lives in a farmyard. Are you making a picture inside your head of Connie the Cow in her farmyard?" (Response). "Good, now where does Connie live?" (Response). "Good, so now I'm going to say something else about Connie and ask you a question: When it rains Connie sits down in her farmyard. Can you make a picture inside your head of Connie sitting down in her farmyard?" (Response). "Good! It's raining, is Connie sitting down in her farmyard?" (Response). "Good! Every time you hear a story like that you should try and make a picture inside your head of the things in the story, just like you did with Connie the Cow and then the answers will be easier. So now I am going to read you some more stories and remember: every time I read you a story I want you to make another picture inside your head of the things happening in the story, just like you did with Connie the Cow." A second example based on Percy the Pig who lived in a pigsty was read for any children who had difficulty answering the questions, or who said they were not able to form a picture (five children in total) (See Appendix B). Children in the two imagery groups were prompted to make a

picture in their heads after the first two sentences of each scenario, e.g., "Are you making a picture in your head of Polly the Penguin?" and they were asked "where does Polly live?" to ensure that they were following these instructions. These prompt questions were repeated twice if any child indicated any difficulty in understanding them.

The image-reality and image-counterfactual groups received the same instructions as each other with the exception of a single instruction given immediately before the target counterfactual question. Children in the image-reality group were instructed before the counterfactual question to make a picture in their heads of the current reality (i.e., the sixth sentence), e.g., "Make a picture inside your head of all the snow melting on the mountain." Children in the image-counterfactual group were instructed before the counterfactual question to make a picture in their heads of the counterfactual alternative (i.e., the fifth sentence), e.g., "Make a picture inside your head of all the snow on the mountain". (The instructions for each scenario are provided in Appendix B).

The children were tested individually in a quiet corner of their classroom by the author. Each child was asked whether they would like to hear some stories and talk about them afterwards. Each session lasted on average about ten minutes and afterwards the children were invited to ask questions and talk about the stories.

Results and Discussion

We analysed the 3- and 4-year-olds' correct responses to the counterfactual questions. The results show that mental imagery instructions help 3- year-olds and 4-year-olds to answer counterfactual questions in different ways. We carried out an ANOVA on the correct responses to the counterfactual questions to compare the three groups (control, reality and counterfactual), the two age groups (3-year-olds, 4-year-olds) and the two scenario types (good outcome, bad outcome). It showed a marginal main effect of group, $F(2, 56) = 1.83$, $MSE = .92$, $p = .09$ (all p-values are one-tailed unless otherwise stated)

and age, $F(1, 56) = 3.75$, $MSE = 1.89$, $p = .06$, two-tailed, but there was no main effect of scenario, $F(1, 56) = .01$, $MSE = .01$, $p = .94$, two-tailed. There was no significant interaction between group and age, $F(2, 56) = .80.$, $MSE = .40$, $p = .29$, or between scenario and age, $F(1, 56) = .27$, $MSE = .17$, $p = .33$. There was also no significant interaction between scenario and group, $F(2, 56) = 1.38$, $MSE = .87$, $p = .13$ and the three-way interaction between scenario, group and age was not significant, $F(2, 56) = .98$, $MSE = .67$, $p = .19$.

We decomposed the non-significant three-way interaction to further examine the 3-year-olds' and the 4-year-olds' correct responses to the counterfactual questions by carrying out a series of planned comparisons (see Winer, 1971[1], for a defence of the legitimacy of carrying out planned comparisons in such circumstances).

3-year-olds

The results for the 3-year-olds show that instructions to form images help 3-year-olds to answer counterfactual questions. As Table 3.1 shows, the image-counterfactual group gave more correct answers for the bad outcome scenarios compared to the control group (90% vs. 60%, $t = 1.92$, $df = 28$, $p = .03$) and compared to the image-reality group (90% vs. 68%, $t = 1.43$, $df = 28$, $p = .09$) although the latter difference was marginal. There was no difference between the control and image-reality groups (60% vs. 68%, $t = .54$, $df = 28$, $p = .30$). For the good outcome scenarios, a different pattern emerged: the image-reality group gave more correct answers to the counterfactual questions than the image-

[1] With regard to inferences on comparisons among means selected from a larger set, Winer (1971 see also Winer, Brown & Michels, 1991) distinguishes between tests which are based on an *a priori* and *a posteriori* basis. The former tests (also referred to as planned comparisons) are based on *a priori* hypotheis, that is, a hypothesis which is establised from the outset of investigation, and so they do not derive from the structure of the outcome. It is for this reason that it has been argued that such tests do not require a significant overall *F* for their legitimacy (e.g., Howell, 2004). In contrast *poseteriori* or unplanned (post-hoc) tests derive from the structure of the outcome and so their legitimacy is dependent on the significance of the overall *F*.

counterfactual group (91% vs. 65%, t = -2.19, df = 28, p = .02) and the control group (91% vs. 75%, t = 1.34, df = 28, p = .08) although this difference was marginal. There were no differences between the image-counterfactual and the control groups (65% vs. 75%, t = -.825, df = 28, p = .21).

Overall, the 3-year-olds in both the image-reality group (80%) and image-counterfactual group (78%) tended to give more correct answers to the counterfactual questions than the control group (68%), but these differences were not reliable (t = 1.28, df = 28, p = .11, and t = 1.04, df = 28, p = .15, respectively). There were no differences between the two imagery groups (80% vs. 78%, t = -.218, df = 28, p = .42). A one sample t-test confirmed that the 3-year-old children performed above chance in their responses to the counterfactual questions overall (75% correct, t = 6.50, df = 30, p = .0001).

Table 3.1: Percentages of correct answers to the counterfactual questions given by the 3-year-olds and the 4-year-olds in the three groups for the good and bad outcome scenarios in Experiment 2.

	Good Outcome	**Bad Outcome**	**Total**
3-year-olds			
Image Counterfactual	65	90	78
Image Reality	91	68	80
Control	75	60	68
Total	*77*	*73*	*75*
4-year-olds			
Image Counterfactual	73	77	75
Image Reality	60	55	58
Control	50	60	55
Total	*61*	*65*	*63*

4-year-olds

The results show that instructions to form images of the counterfactual possibility help 4-year-old children to answer counterfactual questions overall. Overall, the image-counterfactual group gave more correct answers to the counterfactual questions than the control group (75% vs. 55%, $t = 1.62$, $df = 28$, $p = .06$) and the image-reality group (75% vs. 58%, $t = 1.42$, $df = 28$, $p = .09$) although neither,difference is reliable, as Table 3.1 shows. There were no reliable differences between the image-reality group and the control group (58% vs. 55%, $t = .20$, $df = 28$, $p = .42$).

For the bad outcome scenarios, 4-year-olds in the image-counterfactual group tended to give more correct answers to the counterfactual questions compared to the control group (77% vs. 60%, $t = .95$, $df = 28$, $p = .17$) and the image-reality group (77% vs. 55%, $t = 1.2$, $df = 28$, $p = .12$), although neither difference is reliable. There was no difference between the control group and the image-reality group (60% vs. 55%, $t = -.270$, $df = 28$, $p = .40$). For the good outcome scenarios, a similar pattern emerges: the image-counterfactual group tended to give more correct answers to the counterfactual questions than the control group (73% vs. 50%) and the image-reality group (73% vs. 60%), although neither difference is reliable ($t = 1.17$, $df = 28$, $p = .127$; $t = .65$, $df = 28$, $p = .26$). There was no difference between the control group and the image-reality group (50% vs. 60%, $t = .50$, $df = 28$, $p = .31$). A one sample t-test confirmed that the 4-year-old children performed above chance in their responses to the counterfactual questions overall (63% correct, $t = 2.50$, $df = 30$, $p = .02$).

The experiment shows that the two age groups differ in how instructions to image the counterfactual alternative and the current reality affect their responses to the counterfactual questions about the good and bad outcomes. Instructions to image the counterfactual alternative help 3-year-olds answer counterfactual questions about bad outcomes, and instructions to image the current reality help them to answer questions

about good outcome stories. In contrast, instructions to image the counterfactual alternative help 4-year-olds to answer counterfactual questions overall.

Post-Test Manipulation Check

To check the ease of comprehension of the scenarios we carried out a post-test manipulation check with a new set of participants. The participants were 20 children who had not taken part in the original experiment (8 3-year-olds and 12 4-year-olds from a pre-school in Dublin). We gave them two tasks. The first was the British Picture Vocabulary Scale II (BPVS II; Dunn & Dunn, 1997). It consists of a series of four picture choices (e.g., a picture of a hand, a picture of a duck, a picture of a teacup, a picture of a baby) and children are asked to point to which picture best corresponds to spoken words (e.g., "Put your finger on 'baby'"). It is standardised to have a mean score of 100 and any child scoring less than 70 is to be excluded. All of the children scored above 70 on the BPVS.

The second task was designed to be analogous to the BPVS but tailored to our scenarios. The children were read the four stories used in the experiment. No pictures were shown to them when the stories were read and they were not given any imagery instructions. After each story was read to them, they were shown four pictures on an A4 page. For example, for the Polly Penguin story, they were shown four coloured illustrations corresponding to the past, now counterfactual sentence (e.g., lots of snow on the mountain), the current reality sentence (e.g., snow melting on the mountain), the animal character (e.g., a penguin) and a filler picture (e.g., a beach) (See Appendix B for an example of the page lay-out). They were asked to point at the picture that best corresponded to a sentence repeated to them from the story. Twelve of the children were asked to point at the picture corresponding to the now past counterfactual event (e.g., "Put your finger on the picture of all the snow on the mountain") and eight children were asked

to point at the picture corresponding to the current reality (e.g., "Put your finger on the picture of the snow melting on the mountain"). The children pointed to the correct picture for the now past counterfactual event on 69% of trials (71% for the bad outcome scenarios and 67% for the good outcome scenarios), and they pointed to the correct picture for the current reality on 84% of trials (69% for the bad outcomes and 100% for the good outcomes).

The findings from the manipulation check provide evidence that the results do not arise simply because the children have not understood the scenarios.

Summary

Overall, the experiment provides a novel result: instructions to image the counterfactual possibility help 3-year-olds to answer counterfactual questions about the bad outcome scenarios, and instructions to image the current reality help them answer counterfactual questions about the good outcome scenarios. Imaging the counterfactual possibility helps the 4-year-olds to answer counterfactual questions overall, but their responses to the counterfactual questions about the good and bad outcomes do not differ.

Hence, there appears to be a difference between the bad outcome stories and the good outcome stories. One difference between the two types of scenarios is that the correct answers to the counterfactual questions about the bad and good outcome scenarios differ. The correct answer to the counterfactual question for the bad outcome scenarios (e.g., "If the snow had not melted, would Polly be able to build a snowman now?") is "Yes", and the correct answer for the counterfactual question for the good outcome scenarios (e.g., "If the field had not been full of bunnies, would Billie be able to play with his friends now?") is "No". Very young pre-school children (e.g., 2.5 year-olds) can show an affirmation bias, that is, a tendency to answer "yes" in their responses to "yes" and "no" questions (Fritzley & Lee, 2003). But this difference cannot underlie the result: if

the 3-year-old children were exhibiting this bias, then 3-year-olds in the image-reality group should have performed as well as the 3-year-olds in the image-counterfactual group for the bad outcome scenarios. They did not.

But the bad outcome scenarios and the good outcome scenarios differ in another important way. For the bad outcome stories the children were required to image a counterfactual possibility corresponding to a presence (all the snow; all the nectar), whereas for the good outcome stories the children were required to image a counterfactual possibility corresponding to an absence (the empty field; bare banana tree). Perhaps imaging a counterfactual possibility only helps 3-year-old children to answer counterfactual questions when the image is of a presence and not an absence? Our next experiment aims to address this question.

In the current experiment, the participants in the image-counterfactual group image a presence for the bad outcome stories (all the snow) and an absence for the good outcome stories (the empty field). In contrast, participants in the image-reality group image a presence for the good outcome stories (the field full of bunnies) and an absence for the bad outcome stories (the melting snow) as Table 3.2 shows.

Table 3.2: The content type of the mental imagery instructions given to the two imagery groups for the good outcome scenarios and the bad outcome scenarios in Experiment 2.

	Good outcome	**Bad outcome**
Image-reality group	presence	absence
Image-counterfactual group	absence	presence

At the age of 3 years, imaging a presence of an entity appears to help children answer counterfactual questions, irrespective of whether the child images the reality or the counterfactual alternative. In contrast, by 4 years of age, imaging the counterfactual possibility helps children to answer counterfactual questions overall. For 3-year-olds,

attempting to image an absence may be so difficult that any beneficial effects of imaging the counterfactual possibility are lost. Four-year-olds may have developed the cognitive capacity to image an absence as well as a presence and so they are helped by instructions to image the counterfactual alternative overall. Experiment 3 aims to test this difference.

Experiment 3

The aim of the third experiment was to examine whether the accuracy of the responses given by 3-year-olds and 4-year-olds to counterfactual questions is affected by instructions to image a counterfactual possibility when it corresponds to a presence or an absence. The previous experiment showed that the two age groups' responses to the counterfactual questions about the good and bad outcome stories differed. The 3-year-olds' answers to the counterfactual questions for the bad outcome stories were helped when they imaged the counterfactual possibility (where the image concerned a presence; e.g., the mountain full of snow) whereas their answers to the counterfactual questions for the good outcomes were helped when they imaged the current reality (where the image also concerned a presence; e.g., the field full of bunnies). The 4-year-olds' answers to counterfactual questions were helped by imaging the counterfactual possibility overall, irrespective of the outcome valence of the stories.

Absence (e.g., the field empty of bunnies) can be considered as a form of negation (the field is not full of bunnies) and processing negative information is more difficult than processing affirmative information (e.g., Evans & Handley, 1999; Wason, 1959). Negative information can take more time to understand and can lead to more errors in reasoning (for reviews see Evans, Newstead & Byrne, 1993; Manktelow, 1999). The beneficial effects of forming an image of a counterfactual possibility may be undermined when it is an image of an absence rather than an image of a presence.

We expect that 3-year-olds are able to image a counterfactual possibility (and a current reality) corresponding to a presence better than one corresponding to an absence and so they should be better able to answer counterfactual questions when they are instructed to image a presence rather than an absence. We expect 4-year-olds are able to image a counterfactual possibility corresponding to an absence just as well as one corresponding to a presence and so we expect that instructions to image an absence or a presence will not affect the accuracy of their responses to counterfactual questions.

To test the predictions we constructed two versions of each scenario. Consider the Billie Bunny story. The original version is as follows:

Billie is a bunny. He lives in the forest. He likes to play with his bunny friends. He goes to the field to play with them. The field is full of bunnies. But then one day the field is empty. And now Billie is sad because he is not able to play with his bunny friends.

The counterfactual question is: "If the field had not been empty, would Billie be able to play with his friends now?" (Yes). The instructions to image the counterfactual possibility are: "Make a picture inside your head of the field full of bunny friends" and the instructions to image the current reality are: "Make a picture inside your head of the empty field". In this version the counterfactual alternative concerns a presence, and the current reality concerns an absence.

We constructed a new version of the Billie Bunny story in which the counterfactual possibility concerns an absence, as follows:

Billie is a bunny. He lives in the forest. He likes to play on his own. He goes to the field to play on his own. The field is empty. But then one day the field is full of other bunnies. And now Billie is sad because he is not able to play on his own.

The counterfactual question is: "If the field had not been full of other bunnies, would Billie be able to play on his own now?" (Yes). The instructions to image the counterfactual possibility are: "Make a picture inside your head of the empty field" and the instructions to image the current reality are: "Make a picture inside your head of the field full of other bunnies". In this version the counterfactual alternative concerns an absence, and the current reality concerns a presence. The experiment aims to test whether the 3-year-olds are helped to answer counterfactual questions by imaging a counterfactual possibility when it corresponds to a presence but not an absence.

Method

Participants

The participants were 62 children, 36 boys and 26 girls, aged 3- to 4 years (with an age range of 3 years, 0 months to 4 years and 11 months, and a mean age of 4 years, 0 months). The children were divided into two different age groups: 32 3-year-olds (14 boys and 18 girls, with an age range of 3 years, 0 months to 3 years, 11 months, mean age of 3 years 6 months) and 30 4-year-olds (18 boys and 12 girls, with an age range of 4 years 0 months to 4 years 11 months, mean age 4 years 5 months). They were assigned at random to six different groups, for each age group there was a control group (10 3-year-olds and 10 4-year-olds) and two experimental groups: image-reality (10 3-year-olds and 10 4-year-olds) and image-counterfactual (12 3-year-olds and 10 4-year-olds). All participants had passed the cut-off 70 score on the BPVS (control = 102, *SD* =13; image-reality = 104, *SD* = 9, and image-counterfactual = 100, *SD* = 8). Four children were replaced: three because they answered "yes" to all the questions, and one child was replaced because they indicated that they were unable to make a picture in their minds when we gave the imagery instructions at the beginning of the task. The children were pupils from four pre-schools in Dublin and Carlow and were primarily from middle-class

backgrounds. Written parental consent (See Appendix G) and verbal participant assent was obtained for each child.

Materials, Design and Procedure

The materials were based on the four scenarios used in the previous experiments and they were about bad outcomes. We constructed two versions of each scenario: a counterfactual-presence version and a counterfactual-absence version (See Appendix C for the full set of scenarios and questions).

In the counterfactual-presence version of the four stories, the sentence about the now past counterfactual possibility in the story (the fifth sentence) concerned a presence (e.g., field full of bunnies) and in the counterfactual-absence version the sentence about the now past counterfactual possibility concerned an absence (e.g., the field is empty). Each child received two counterfactual-presence scenarios and two counterfactual-absence scenarios. To control for content effects we gave half of the children counterfactual-presence versions of the Polly Penguin and the Bobby Bee scenarios and counterfactual-absence versions of the Millie Monkey and the Billie Bunny scenarios, and we gave the other half of the children the opposite versions of these scenarios.

We created a good outcome filler about Tammy Tiger who likes to take a nap in the afternoon, with two versions, a counterfactual-presence version and a counterfactual-absence version. The structure followed that of the four bad outcome scenarios with the exception that the final sentence was about a good outcome. Each child received one version of the good outcome filler at random (See Appendix C).

Each child received the five scenarios in a different random order. Each scenario was followed by the same three questions used in the previous experiment (two warm-up questions: past reality, current reality and the key experimental measure: the counterfactual question). The instructions and procedure were identical to those used in

the previous experiment. After the experimental task, each child completed the BPVS, and then a post-test manipulation check. Each session lasted about fifteen minutes.

Results and Discussion

We carried out an ANOVA on the 3- and 4-year-olds' correct responses to the counterfactual questions to compare the three groups (control, image-reality and image-counterfactual), the two age groups (3-year-olds, 4-year-olds) and the two scenario types (counterfactual-presence/reality-absence; counterfactual-absence/reality-presence). It showed no main effect of age, $F(1, 56) = .01$, $MSE = 59.52$, $p = .47$, or of group, $F(2, 56) = .21$, $MSE = .17$, $p = .41$, or of scenario, $F(1, 56) = 1.09$, $MSE = .40$, $p = .14$. There was no significant interaction between scenario and age, $F(2, 56) = .04.$, $MSE = .12$, $p = .43$. There was a marginal interaction between scenario and group, $F(1, 56) = 2.00$, $MSE= .67$, $p = .07$, and the three-way interaction between scenario, group and age was also approaching significance, $F(2, 56) = 1.98$, $MSE = .66$, $p = .07$. We decomposed the marginal three-way interaction by carrying out planned comparisons to further examine the 3-year-olds' and 4-year-olds correct responses to the counterfactual questions.

3-year-olds

The results show that instructions to image the counterfactual possibility help 3-year-olds to answer counterfactual questions when they are instructed to image a presence and not an absence. The 3-year-olds in the image-counterfactual group gave fewer correct answers to the counterfactual questions when they were instructed to image an absence rather than a presence (46% vs. 75%, $t = - 3.02$, $df = 11$, $p = .006$) as Table 3.3 shows.

For the "counterfactual-absence/reality-presence" scenarios, the 3-year-olds in the image-counterfactual group (who imaged an absence) gave fewer correct answers to the counterfactual questions than the image-reality group (who imaged a presence) (46% vs.

75%, t = - 1.74, df = 29, p = .047) as Table 3.3 shows. The 3-year-olds in the image-counterfactual group also gave fewer correct answers to the counterfactual questions than the control group (46% vs. 70%, t = -1.44, df = 29, p = .08), although the difference was marginal. For the "counterfactual-presence/reality-absence" scenarios, the 3-year-olds in the image-reality group (who imaged an absence) gave somewhat fewer correct answers to the counterfactual questions than the image-counterfactual group (who imaged a presence) (55% vs. 75%, t = 1.11, df = 29, p = .14), although the difference is not reliable. There was no difference between the image-counterfactual and control groups (75% in both cases, t = 1.00, df = 29, p = .5) in their answers to the counterfactual questions for the "counterfactual-presence/reality-absence" scenarios.

Table 3.3: Percentages of correct answers to the counterfactual questions given by the 3-year-olds and the 4-year-olds in the three groups for the counterfactual-absence/reality-presence and counterfactual-presence/reality-absence scenarios in Experiment 3.

	Counterfactual-Absence /Reality-Presence	**Counterfactual-Presence /Reality-Absence**	**Total**
3-year-olds			
Image Counterfactual	46	75	60
Image Reality	75	55	65
Control	70	75	73
Total	*63*	*69*	*67*
4-year-olds			
Image Counterfactual	60	70	65
Image Reality	65	75	70
Control	75	65	65
Total	*63*	*70*	*67*

4-year-olds

The results show that the 4-year-olds do not experience difficulty answering counterfactual questions when they are instructed to image an absence. There were no differences for the 4-year-olds in the image-counterfactual group in their answers to the counterfactual questions when they were instructed to image an absence rather than a presence (60% vs. 70%, t = -1.00, df = 9. p = .17) as Table 3.3 shows.

For the counterfactual questions to the "counterfactual-absence/reality-presence" scenarios, there was no difference between the 4-year-olds in the image-counterfactual group (who imaged an absence) and in the image-reality group (who imaged a presence) (60% vs. 65%, t = -.31, df = 27, p = .38). The image-counterfactual and the control group did not differ (60% vs. 75%, t = -.31, df =27, p = 38). Likewise, for the counterfactual questions to the "counterfactual-presence/reality-absence" scenarios, there was no difference between the 4-year-olds in the image-counterfactual group (who imaged a presence) and the image-reality group (who imaged an absence) (70% vs. 75%, t = -.32, df = 27, p = .38). The image-counterfactual and the control groups did not differ (70% vs. 65%, t = .322, df = 27, p = .38).

Although there is no overall main effect for age, the results show that there is an age difference in how instructions to image the counterfactual possibility help pre-school children to answer counterfactual questions. The 3-year-old children are helped to image the counterfactual possibility and the current reality when the instructions they are given are instructions to image a presence only. Instructions to image a presence or an absence of a counterfactual possibility do not affect 4-year-olds' answers to counterfactual questions. This result implies that instructions to focus on the counterfactual possibility do not help 4-year-olds to answer counterfactual questions about bad outcomes only. To check that the ease of comprehension of the scenarios we carried out two manipulation checks which we will now describe.

Manipulation checks

We carried out two manipulation checks. In both tasks, the children were given a set of pictures corresponding to the four stories (See Appendix C for a sample set of pictures). Each picture was presented to the children in a set of four pictures: a picture corresponding to the fifth sentence, i.e., the now past counterfactual possibility (e.g., the empty field), the sixth sentence, i.e., the current reality (e.g., the field full of bunnies), a picture of the animal character, and a distracter picture (e.g., a picture of a beach).

For the post-test manipulation check test, which immediately followed the main experiment, the children were first given the BPVS and then they were told, "Now, I'm going to show you some more pictures and I want you to do the same thing as you did before: I will say something and I want you to point to the best picture of it". The children in the image-counterfactual group were asked to point at a picture that corresponded to the past now counterfactual possibility (the fifth sentence, e.g., for the counterfactual-presence version of the Billie Bunny story, the children were told, "Can you put your finger on 'the field is full of other bunnies'?"), and the children in the image-reality group were asked to point at a picture that corresponded to the current reality (the sixth sentence) ("Can you put your finger on 'the field is empty'?"). Half of the children in the control group of the main experiment were asked to point at the pictures corresponding to the counterfactual possibility and the other half to the current reality. The results show that the children were highly accurate in their selection of the correct picture choice. Children pointed accurately to the picture corresponding to the counterfactual possibility on 87% of trials, and to the current reality on 75% of trials for all four stories.

For the pre-test manipulation check a different group of 22 3- and 4-year-old children were given the BPVS. All the children scored above the cut-off point of 70. All the children were told "I'm going to read you some stories about different animals and when I've finished reading each story I'm going to ask you some things about the story.

When I ask you the things about the story I am going to show you some pictures and I want you to put your finger on the picture of what I have said." The children were then given the same Connie Cow introductory task used in the previous experiment to ensure that they understood the task. They heard the first few lines of the story and they were then told, "Now, see all the pictures on this page. I will say something; then I want you to put your finger on the picture of what I have said. Put your finger on, "Connie is sitting down in the farm yard". The children were then told, "Now, I'm going to read you some other stories about animals and when I have finished reading each story I will show you some pictures and I want you to put your finger on the picture of what I have said".

The children were then read the four stories used in the experiment. The children were given two counterfactual-presence versions of the scenarios and two counterfactual-absence versions of the scenarios used in Experiment 3. No imagery instructions were given to them. They were instructed to point at the picture that best corresponded to a sentence in the stories. Half the children were asked to point at the picture that corresponded to the counterfactual possibility and half were asked to point at the picture that corresponded to the current reality. The results show that the children were highly accurate in their selection of the correct picture choice for both groups. Children pointed accurately to the picture corresponding to the counterfactual possibility on 87% of trials, and to the current reality on 93% of trials for all four stories.

The results of these comprehension checks indicate that the results do not arise due to the children's misunderstanding of the scenarios.

Summary

The experiment shows that instructions to image a possibility corresponding to an absence reduce the accuracy of 3-year-olds' responses to counterfactual questions about bad outcomes. Instructions to image a counterfactual possibility of a bad outcome story

help 3-year-olds to answer counterfactual questions when they concern a presence (75% correct) but not an absence (46% correct). Additionally, 3-year-olds in the image-counterfactual group who imaged an absence (46%) gave less correct responses to the counterfactual questions than the image reality group who imaged a presence (75%). The instructions to image a presence or an absence did not affect accuracy of the 4-year-olds' responses to the counterfactual questions.

Instructions that concern an absence pose a specific difficulty for 3-year-olds when they answer counterfactual questions. It is the absence-based nature of the task that poses the greatest difficulty for 3-year-olds, one that may surpass the facilitatory effect of imaging the counterfactual possibility. Instructions that concern an absence do not pose the same difficulty for 4-year-olds in their responses to counterfactual questions when they are instructed to image a counterfactual possibility (60% correct) or the current reality (75% correct). Three- and 4-year-olds differ in how they form mental representations of an absence and a presence.

Many counterfactual thoughts in everyday life may tend to focus on an absence rather than a presence. Both adults and young children tend to create counterfactual alternatives most often after bad outcomes (Gavanski & Wells, 1989; German, 1999; Roese & Olson, 1995). The counterfactual alternatives that people create can be subtractive in nature, that is, they are based on deleting or subtracting events that happened rather than adding different ones (e.g., "If the driver had not been drunk, I would have escaped injury") (Guajardo & Turley-Ames, 2004; Kahneman & Tversky, 1982). Counterfactual thoughts may tend to focus on negating aspects of reality, removing their presence from the mental representation of the facts. The experiment suggests that it is the absence-based nature of counterfactual thoughts that may cause special difficulty for 3-year-olds, but by the age of 4 years this difficulty is resolved.

The development of the pre-schoolers' representational ability appears to undergo a developmental shift at the age of 4 years, which is marked by a developing capacity to think about possibilities concerning an absence as well as a presence.

General Discussion

The aim of this chapter was to examine whether instructions to form a mental image of the counterfactual possibility help pre-school children to think about counterfactual situations. In the first experiment in this chapter (Experiment 2) we compared instructions to image the counterfactual possibility to instructions to image the current reality of bad outcome scenarios and good outcome scenarios. The results from Experiment 2 show that 3- and 4-year-olds' correct answers for the scenarios about the good and bad outcomes differ. Instructions to image the counterfactual possibility (which concerned a presence, e.g., all the snow on the mountain) increased the accuracy of 3-year-olds' responses to counterfactual questions about bad outcomes, whereas instructions to image the current reality (which also concerned a presence, e.g., the field full of bunnies) increased the accuracy of their responses to counterfactual questions about good outcomes. The results show that the instructions to image the counterfactual possibility helped 4-year-olds answer counterfactual questions overall, and their responses to the counterfactual questions about the good outcome stories and the bad outcome stories did not differ. This finding suggests that there is a finer distinction in how instructions to image the counterfactual possibility help pre-school children to answer counterfactual questions. Three-year-olds may experience difficulty with imaging an absence (e.g., the empty field; the cut-down sunflower) that may undermine the effectiveness of imaging the counterfactual possibility. But by the age of 4 years, this absence-based difficulty may no longer exist. We addressed this hypothesis in Experiment 3.

In Experiment 3 we aimed to test whether the accuracy of 3-year-olds' responses to counterfactual questions is reduced when they are instructed to image a counterfactual possibility concerning an absence. We also wished to test whether the accuracy of 4-year-olds responses to counterfactual questions is affected by instructions to image an absence or a presence. We predicted that if imaging an absence poses a specific difficulty for 3-year-olds, instructions to image an absence would decrease the accuracy of 3-year-olds' responses to counterfactual questions. We predicted that if this difficulty is resolved by the age of 4 years, instructions to image an absence or a presence will not affect the accuracy of 4-year-olds' responses to the counterfactual questions.

The results from Experiment 3 support our predictions. Three-year-olds answered counterfactual questions more accurately when they were instructed to image a counterfactual possibility concerning a presence (e.g., the field full of bunnies) and not an absence (e.g., the field empty of bunnies). But they also answered counterfactual questions more accurately when they were instructed to image a current reality that concerned a presence (e.g., the wide-open flower) and not an absence (e.g., the closed up flower). Instructions to image a counterfactual possibility corresponding to an absence or a presence did not affect the accuracy of 4-year-olds' responses to the counterfactual questions. Furthermore, instructions to image the counterfactual possibility did not increase the accuracy of 4-year-olds' responses to counterfactual questions overall. For 3-year-olds, the beneficial effects of imaging the counterfactual possibility appear to be undermined when the counterfactual possibility corresponds to an absence, and by the age of 4 years children's difficulty in thinking about possibilities concerning an absence appears to be resolved.

This finding suggests that there may be a developmental trend to children's ability to mentally represent possibilities concerning an absence. For 3-year-olds, the requirement to image an absence may exceed their cognitive capacity but by the age of 4

years children's representational ability may have developed sufficiently to allow them to think about possibilities that concern an absence as well as a presence. The construction of counterfactual alternatives to reality can focus on the absence of key events, that is, counterfactual alternatives can be subtractive in nature. Subtractive counterfactuals focus on mentally undoing the outcome of an event (e.g., "The accident would not have happened…) by mentally removing some antecedents (e.g., "If only the driver had not been drunk"). Evidence suggests that both adults and pre-schoolers are more likely to generate counterfactual alternatives that add an element to the counterfactual possibility (e.g., "The floor wouldn't be dirty if I had wiped my shoes") and less likely to generate counterfactual alternatives that delete events (e.g., "The floor wouldn't be dirty if I hadn't played in the mud")(Guajardo & Turley-Ames, 2004; Roese, Hur & Pennington, 1999). Moreover, recent evidence suggests that adults spend more time processing subtractive counterfactuals than any other type of counterfactual (Turley-Ames & Whitfield, 2000). The ability to mentally delete an event from a mental representation may require increased cognitive resources, which may develop over the pre-school years.

A developmental shift in representational understanding during the pre-school years is not uncommon. As we described in Chapter 1, many 3-year-olds have difficulty with false belief tasks such as the "Maxi and the chocolate" task (See Chapter 1) whereas 4-year-olds perform well (e.g., Gopnik & Astington, 1998; Wimmer & Perner, 1983). It has been suggested that the developmental shift in false belief understanding may be due to a developing capacity to understand the mental states of others, that is, an ability to mentally represent misrepresentations about the world (Perner, 1991). The findings from the experiments reported in this chapter suggest that representational ability may also play a role in counterfactual task performance, but that the developmental shift in counterfactual reasoning ability is marked by an ability to think about possibilities

concerning an absence, rather than possibilities which concern mental states (e.g., Maxi *thinks/believes* the chocolate is in the cupboard).

The results from the experiments reported in this chapter also suggest that a bias towards reality alone (e.g., Robinson & Beck, 2000) cannot account for the 3- and 4-year-olds' performance. The results from Experiment 3 show that 3-year-old children are helped to answer counterfactual questions when they image the current reality when it corresponds to a presence (e.g., the mountain full of snow) rather than when it corresponds to an absence (e.g., the snow melting on the mountain). If 3-year-olds experienced a reality bias, then we would expect that instructions to image the current reality would reduce the accuracy of their responses regardless of whether they imaged an absence or a presence. But they did not. In addition, the accuracy of 4-year-olds' responses to the counterfactual questions was not affected by instructions to image the current reality or the counterfactual possibility. If children experienced difficulty disengaging from current reality to answer counterfactual questions, then we would expect that 4-year-olds would make more errors than those children who were not given mental imagery instructions (or instructions to image the counterfactual possibility) but they did not.

It has also been proposed that the difficulty underlying pre-schoolers' ability to think about a counterfactual situation may rest on the amount of information that children must keep in mind when they think about the facts of a situation (German & Nichols, 2003). In this chapter, we proposed that the difficulty may rest on the need to keep in mind the counterfactual possibility as well as the factual situation. Although the results from Experiment 2 suggest that instructions to image the counterfactual possibility help 4-year-olds to answer counterfactual questions overall, the results from Experiment 3 do not replicate this finding. This finding might imply that the difficulty encountered by 4-year-olds may be due to a more general representational ability, perhaps associated with the

amount of information they must keep in mind when they think about counterfactual situations. In contrast, there may be a more specific difficulty encountered by 3-year-olds that may rest on the nature of the possibilities that they keep in mind when they think about counterfactual alternatives. Three-year-olds have difficulty thinking about possibilities which concern an absence, regardless of whether they correspond to the facts or the counterfactual alterative.

Conclusions

On our account, the difficulty that young children experience in understanding counterfactual alternatives may rest on the possibilities they keep in mind. To think about a counterfactual possibility, children need to keep in mind two possibilities, the current reality and the counterfactual possibility. Our proposal suggests that young children keep in mind just one possibility, the reality, when they think about counterfactual situations.

The findings from the first experiment reported in this chapter suggest that there is a finer distinction in how instructions to image possibilities help pre-schoolers. Three-year-olds are helped to answer counterfactual questions when they image a possibility concerning a presence, but not an absence. Imaging the counterfactual possibility helps 4-year-olds overall, regardless of whether the possibility concerns an absence or a presence.

The findings from Experiment 3 suggest that the absence-based nature of the mental representations that people keep in mind when they think about counterfactual situations poses a particular difficulty for 3-year-olds. This difficulty may undermine the beneficial effects of imaging the counterfactual possibility. There appears to be a developmental shift during the pre-school years in how children envisage possibilities: by the age of 4 years children appear to be able to think about possibilities concerning an absence and a presence equally well. Thinking about counterfactuals often involves

thinking about an absence and it is the absence-based nature of counterfactual thinking that is difficult for very young children.

The results reported in this chapter provide a novel finding in relation to the difficulties pre-school children experience with counterfactual alternatives. Relatively little is known about the development of counterfactual thought beyond the pre-school years, but existing evidence suggests that the way in which children mentally represent the facts and the counterfactual alternative may play an important role in determining the events that they mentally undo and the judgements of emotions that they make in counterfactual situations (e.g., Amsel & Smalley, 2000; Guttentag & Ferrell, 2004). In our next chapter we examine the development of counterfactual thought during middle childhood. We examine whether children aged 6 years and 8 years tend to undo their mental representation of the factual situation in the same way as adults do when they think "if only".

Chapter 4 Counterfactual Thinking in School-aged Children: The Action Effect

Relatively few studies have examined the mental representations that children older than 4 years may keep in mind when they think about counterfactual situations. Findings from studies on counterfactual thinking in children aged 3 to 5 years show that 5-year-olds can answer counterfactual questions about complex factual situations (Perner et al., 2004), which suggests that by this age children can mentally represent both possibilities when they reason about how an outcome could have turned out differently. Studies of counterfactual thinking in older children, that is, children aged 5 to 9 years, have primarily focused on the judgements of emotions that children make in counterfactual situations (e.g., Amsel & Smalley, 2000; Ferrell, 2005; Guttentag & Ferrell, 2004). In this chapter, we extend our focus to examine both the "if only' thoughts and judgements of emotions of school-aged children when they think about counterfactual situations. We focus on children aged 6 years and 8 years because it is during these years of middle childhood that children begin to make judgements of emotions in counterfactual situations that are comparable to those made by adults (e.g., Amsel & Smalley; Guttentag & Ferrell, 2004).

As we described in Chapter 1, when adults imagine counterfactual alternatives to reality, they tend to undo reality in very regular ways (Kahneman & Tversky, 1982). In this chapter our aim is to determine whether children aged 6 years and 8 years mentally undo the same aspects of reality and make the same sorts of judgements of emotions as adults when they think about counterfactual situations. Our focus in this chapter is on the action effect in children's counterfactual thinking, that is, the tendency to undo actions more than inactions. We will examine whether children's "if only" thoughts tend to focus on actions rather than inactions when they understand a story about two individuals who either decide to act, or not to act in a given situation. We will also examine whether

children judge that the individual who acted will feel worse than the individual who failed to act and whether these judgements of emotions are associated with their "if only" thoughts.

As we described in Chapter 1, when adults think about what might have been they tend to feel regret about their actions more than their inactions, at least in the short term, and their counterfactual "if only" thoughts tend to focus on undoing actions. Consider the following scenario (from Kahneman & Tversky, 1982, p.173):

Mr. Paul owns shares in company A. During the past year he considered switching to stock in company B, but he decided against it. He now finds out that he would have been better off by $1,200 if he had switched to the stock of company B. Mr. George owns shares in company B. During the past year he switched to stock in company A. He now finds out that he would have been better off by $1,200 if he had kept his stock in company B. Who feels greater regret?

Most adults tend to judge that the individual who acted (Mr. George) will feel greater regret than the individual who failed to act (Mr. Paul) and they judge that the individual who acted will think "if only" most (Kahneman & Tversky, 1982; Byrne & McEleney, 2000). The action effect appears to be pervasive in adult's counterfactual thoughts (e.g., Landman, 1987) and it occurs in everyday situations (e.g., Gilovich & Medvec, 1995) as well as in experimental situations (e.g., Gleicher et al., 1990; Landman, 1987).

The tendency to focus on actions more than inactions in counterfactual thoughts may arise because of the nature of the mental representations that people construct (Byrne, 2005; Byrne & McEleney, 2000). People may mentally represent an action such as Mr. George's decision to switch his stock from company B to company A, by keeping in mind two possibilities, the pre-action possibility, Mr. George has stock in company B, and the post-action possibility, Mr. George has stock in company A. They may mentally

represent an inaction such as Mr. Paul's decision not to switch his stock from company A to company B, by keeping in mind only one possibility, Mr. Paul has stock in company A. Adults may mentally represent actions explicitly by envisaging two possibilities, that is, they mentally represent two possibilities from the outset, and so they can imagine a counterfactual alternative to an action more readily, by mentally "rewinding" the post-action possibility to be like the pre-action possibility (Byrne, 2005).

The action effect has been shown to occur for children's judgements of emotions in experimental situations (e.g., Guttentag & Ferrell, 2004). Guttentag and Ferrell (2004) showed that children aged 7 and 9 years tended to judge that an actor will feel worse than a non-actor, but 5-year-olds do not. When the children were asked to justify their judgements of emotions, the justifications offered by the children aged 7 years and older focused on actions rather than inactions. These findings suggest that children aged 7 years and older display the standard action effect in their judgements of emotions, a pattern that is comparable to adults' judgements of regret when they think about actions and inactions.

However, as we described in Chapter 1, the age at which children tend to make counterfactual judgements of emotions that are comparable to those made by adults appears to depend on the counterfactual situation they must reason about. For example, adults tend to judge that when two individuals experience the same bad outcome, the individual who thinks "if only" (e.g., "If I had taken another route I would not have fallen off my bicycle") will feel worse than the individual who thinks "even if" (e.g., "Even if I had taken the other route, I would have fallen off my bicycle") but children aged 6, 7 and 8 years do not (Ferrell, 2005).

Adults' counterfactual thoughts appear to amplify their judgements of emotions (Kahneman & Miller, 1986). But existing evidence might suggest that there is a developmental lag between children's ability to think about counterfactual situations and

their ability to make counterfactual judgements of emotions (e.g., Amsel & Smalley, 2000; Ferrell, 2005; Guttentag & Ferrell, 2004). Pre-schoolers can think about how things could have been different (e.g., Harris et al., 1996) but it is not until the age of 7 years, and in some cases 8 years or older, that children make judgements of emotions that are comparable to those made by adults. Children's ability to understand a person's belief about another person's belief, as measured by second-order theory-of-mind tasks (e.g., Sullivan et al., 1994) has also been found to be predictive of whether children make adult-like judgements of emotions in counterfactual situations (Ferrell, 2005). When people think about someone else's thoughts or beliefs they must adopt that person's perspective, an ability which may be required when people make judgements about how two people might feel in light of counterfactual information.

A similar developmental lag exists in children's ability to make judgements of emotions in false belief tasks (Bradmetz & Schneider, 1999; 2004). For example, children aged 4 to 6/7 years can attribute a false belief to a protagonist (e.g., that Little Red Riding Hood believes her grandmother is in bed) but when they are asked to judge how the protagonist holding the false belief will feel, they attribute an incorrect emotion based on their true belief (e.g., that Little Red Riding Hood is afraid because they know that the wolf will eat her). Bradmetz and Schneider (1999) contend that although children younger than 8 years (but older than 3 years) can attribute mental states to a protagonist, it is not until after 7 years of age that they can co-ordinate their mental state understanding and the corresponding judgements of emotions in a unified and consistent fashion.

Drawing from Bradmetz and Scheider's (1999) analysis of the lag between false belief and false emotion attribution, Ferrell (2005) suggests that a difficulty in co-ordinating the processes involved in ascribing counterfactual judgements of emotions may underlie the lag between children's ability to think about counterfactual situations

and their ability to make judgements of counterfactual emotions. When children are asked to judge which one of two individuals feels worse given a counterfactual situation, they must generate a counterfactual alternative and keep track of the actual outcome for *both* individuals -- which involves the ability to adopt each individuals' perspective -- and then they must make an affective comparison based on a co-ordination of these abilities. Although children may be able to process each step in the sequence, the co-ordination of processing the multiple steps for both individuals may exceed their abilities. On this account, certain situations may support the co-ordination of these multiple processes, such as when the mutability of a counterfactual situation is increased (e.g., when the factual situation is about an action or an exceptional event) (Ferrell, 2005).

Children may be supported in their ability to ascribe judgements of emotions for counterfactual situations about actions because of the possibilities they must keep in mind. Children, like adults, may keep in mind two possibilities, the pre-action possibility and the post-action possibility, when they think about an action, whereas they keep in mind just one possibility when they think about an inaction. Children may keep in mind more information for actions from the outset and so they can imagine a counterfactual alternative to an action more readily, by mentally "rewinding" the post-action possibility to be like the pre-action possibility (Byrne, 2005).

Although children aged 7 years and 9 years tend to judge greater emotional impact for actions rather than inactions in counterfactual situations (Guttentag & Ferrell, 2004), relatively little is known about whether children's "if only" counterfactual thoughts focus on undoing actions more than inactions. Of course, the findings about the justifications children made in Guttentag and Ferrell's (2004) study suggest that 7- and 9-year-olds (but not 5-year-olds) focus on actions more than inactions when they compare reality to a counterfactual alternative. But to our knowledge, no studies have directly tested whether children's "if only" counterfactual assertions tend to focus on undoing actions more than

inactions. By examining children's "if only" thoughts more directly we may establish whether children's "if only" thoughts follow the same pattern as their judgements of emotions for actions and inactions.

One aim of the experiments reported in this chapter is to pinpoint the developmental trend in children's judgements of emotions for actions and inactions more precisely. The age at which children begin to make adult-like judgements of emotions appears to vary, which may depend on the counterfactual situation children must reason about (e.g., Guttentag & Ferrell, 2004; Ferrell, 2005) and so we examine whether children aged 6 years and 8 years differ in their judgements of who feels worse when they think about actions and inactions. We expect that 8-year-olds, but not 6-year-olds, will judge greater emotional impact for actions, just as adults (and 7- and 9-year-olds) do, perhaps because it is only by the age of 8 years that children acquire the ability to co-ordinate the processes involved in counterfactual affective judgement.

A second aim of the experiments is to examine children's judgements of who thinks "if only" most often. Adults' "if only" judgements follow the same pattern as their judgements of emotions, that is, they judge that the actor will think "if only" more, and feel worse, than the non-actor (Byrne & McEleney, 2000). The association is consistent with the emotional amplification proposal, which contends that counterfactual "if only" thoughts amplify judgements of emotions such as regret (Kahneman & Miller, 1986). It is also consistent with the proposal that factual situations that are highly mutable, such as actions, support the co-ordination of the mental processes involved in the attribution of counterfactual emotions (Ferrell, 2005). The experiments test whether children's judgements of who thinks "if only" most follow the same pattern as their judgements of who feels worse.

In this chapter we will report two experiments that examine whether 6- and 8-year-old children exhibit the standard action effect in their "if only" thoughts and in their

judgements of who feels worse. We gave 6-year-olds and 8-year-olds scenarios such as the following:

Here are two girls, Pam and Sue, who are in after-school clubs. Pam was in the arts and crafts club. During the past year she thought about switching to the singing club. But she decided not to. She then found out that the singing club got to go on a school tour; the arts and crafts club stayed in school. Sue was in the singing club. During the past year she thought about switching to the arts and crafts club. And she decided to. She then found out that the singing club got to go on a school tour; the arts and crafts club stayed in school.

We examined the action effect in children's "if only" thoughts by asking them which individual, the actor or the non-actor, wished that they could have made a different decision and we asked the children to complete the wish the individuals made. We examined the action effect in children's judgements of emotions by asking the children which individual feels worse about their decision, or whether they judged them to feel the same.

Experiment 4

The experiment aimed to test whether the action effect is observed in the judgements of who feels worse and the "if only" thoughts provided by 6- and 8-year-old children. The experiment tests whether children aged 6 years and 8 years differ in their judgements of who feels worse and whether their judgements of who thinks "if only" follow the same pattern as their judgements of emotions.

Method

Participants

The participants were 64 children divided into two separate age groups: there were 32 6-

year-olds (18 boys and 14 girls, with an age range of 6 years, 3 months to 6 years, 11 months, and a mean age of 6 years, 7 months) and 32 8-year-olds (14 boys and 18 girls, with an age range of 8 years, 1 month to 8 years, 11 months, and a mean age of 8 years, 7 months). The children were from three primary schools in Dublin and were primarily from middle class backgrounds. Written parental consent (see Appendix G) and verbal participant assent was obtained for each child. Two 6-year-olds were replaced for failing to answer the seven memory check questions (see below) correctly after being corrected once, and/or the final recall question (e.g., "I've forgotten which team Jim and Mark were in before they thought about switching teams! Can you remind me?").

Materials and Design

We adapted three scenarios with bad outcomes from Landman's (1987) study of the action effect in counterfactual thinking in adults. The three scenarios we used featured two individuals (or two families) who either decide to act or not to act in a given situation and the outcome for both individuals is a bad one. The following scenario is an example of the Basketball scenario (see Appendix D for a full listing of the three scenarios):

Here are two boys, Jim and Mark, who are in basketball teams. Jim played basketball for the Red basketball team. Last year he thought about switching to the Blue basketball team. But he decided not to. A month ago the Blue basketball team won the big basketball competition; the Red basketball team lost the big basketball competition. Mark played basketball for the Blue basketball team. Last year he thought about switching to the Red basketball team. And he decided to. A month ago the Blue basketball team won the big basketball competition; the Red basketball team lost the big basketball competition.

We adhered to the content and structure of the scenarios used by Landman (1987) as closely as possible, however a number of modifications were made to ensure that the children would understand the scenarios. The content of each scenario was modified to

make the context more familiar to children. For example, the first scenario described by Landman (1987) is about two students who either decide to stay in the original Biology class they enrolled in or to switch to a different Biology class. The outcome for both of them is that they get a D in the course. We adapted this scenario to be about two children who either decide to stay in their current after-school club or switch to another one. The other two scenarios were about two basketball players who either decide to stay in their current basketball team or switch to another one, and two families who either decide to return to their usual holiday destination or to go to a new one (see Appendix D).

The structure of the scenarios was also modified for children. There were nine sentences in each scenario: the first sentence described the two individuals (or families) involved in the scenarios whose gender matched those of the participants (e.g., "Here are two boys, Jim and Mark, who are in basketball teams"), the second sentence described the non-actor and their current position (e.g., "Jim played basketball for the Red basketball team") and the third and fourth sentences described the non-actor's thoughts about acting to change their current position, plus their decision not to act (e.g., "Last year he thought about switching to the Blue team. But he decided not to"). The fifth sentence described the outcome (e.g. "A month ago the Blue basketball team won the big basketball competition; the Red basketball team lost the big basketball competition"). The remaining sentences described the actor's current position (e.g., "Mark played basketball for the Blue basketball team"), their thoughts about acting to change this position, and their decision to do so (e.g., "Last year he thought about switching to the Red basketball team. And he decided to"). The ninth sentence was identical to the fifth sentence, which described the outcome for both individuals (e.g., "A month ago the Blue basketball team won the big basketball competition; the Red basketball team lost the big basketball competition"). Each scenario was accompanied by nine pictures, presented on 5cm by 4 cm flashcards that depicted the main events in each story (See Appendix D). The

characters' emotional responses following the outcome were not portrayed in the pictures.

A number of check questions were included to ensure that the children understood the content and the actions/inactions described in the scenarios (a question about identity, six memory check questions and a final recall question). A check question about the identity of the characters was included after the first sentence of each scenario to ensure that the children could differentiate between the two characters (e.g., "Can you show me which boy is Jim and which boy is Mark?"). After each scenario the children were asked this identity question (check question 1, see Appendix D for a full listing of the questions) again plus six short memory check questions. The second and third check questions tested the children's knowledge about the actor (e.g., "Both these boys thought about switching teams; one of them decided to switch and one of them decided not to switch. Can you tell me which boy decided to switch?) and their action (e.g., "And which team did he switch to?"). The fourth and fifth check questions tested the children's knowledge about the non-actor (e.g., "Which boy decided not to switch teams?") and their inaction (e.g., "Which team did he stay in?"). The sixth and seventh check questions focused on the outcome of the scenario (e.g., "Which team won the big basketball competition?" and "Which team lost the big basketball competition?").

Children's "if only" thoughts were measured by two tasks. Both tasks were adapted from the questions used by Byrne and McEleney (2000) in their study of the action effect in counterfactual thinking in adults. In Byrne and McEleney's (2000) study, the participants were given a scenario about two individuals who either chose to act or not to act in a given situation and they were asked to judge which individual would think "if only" the most and how they would complete this "if only" thought. In order to make the wording of these tasks as familiar as possible to children, we changed the wording of these questions so the characters' "if only" thoughts were described as wishes. We asked the children to judge which character (e.g. Mark or Jim) wished that they could have

made a different decision (e.g., "One of these two boys has just wished that he could have made a different decision about what team to be in. Which boy do you think made that wish?"). For the sentence completion task we asked the children to complete the character's wish (e.g., "So, Jim/Mark just wished that he could have made a different decision about what team to be in. He could have made a different decision about what team to be in if only...can you finish the wish?").

To measure children's judgements of who feels worse, the actor or the non-actor, the children were asked, "Which boy do you think feels worse about the decision they made about what club to be in, or do you think they feel the same?". The last element to this question ("or do you think they feel the same?") was included to remove the forced choice aspect to the question (most adult studies are based on a forced-choice judgement between the actor and the non-actor). A final recall question (check question 8) was included at the end of all the questions to ensure that the children remembered the characters' positions at the beginning of the scenarios (e.g., "I've forgotten which team Jim and Mark were in before they thought about switching teams! Can you remind me?")(See Appendix D for a full listing of the scenarios and their questions).

There were eleven questions for each scenario: eight short check questions (six memory check questions, one question about identity and one recall question) and three test questions. All questions were asked in the same fixed order after each scenario.

Design and Procedure

The children were tested individually in a room adjacent to their classroom by the author. The children sat at a desk facing the experimenter. All children were told, "I'm going to read you some stories -- and show you some pictures -- about people doing different things and I'm going to ask you some things about the stories after I read each one to you. O.K.? So here's the first story". The children then heard the scenarios and were shown the

accompanying pictures after each sentence was read out. After the first sentence was read out, the two pictures depicting the two characters involved in the scenario were placed in front of the children and they were asked the identity question (e.g. "Can you show me which boy is Jim and which boy is Mark?"). These pictures were then removed and the remaining eight sentences were read out.

After the scenarios were read to the children and they were shown the accompanying pictures, the two pictures depicting the two characters involved in the scenario were placed in front of them again. These pictures remained in front of the children for the duration of the question session. At this stage the children were asked the reminder question about identity (e.g., "Can you remind me which boy is Jim and which boy is Mark?") again. The six memory check questions were then asked in the same fixed order. If the children failed to answer any of these questions correctly the first time, they were corrected. If they failed to answer any of these questions a second time, they were eliminated from the study. The children were then asked the three test questions and the recall question in the same fixed order. If the children failed to answer the final recall question correctly, they were eliminated from the study without being corrected.

The scenarios were presented to each child in a different random order. Each session lasted on average about 10 minutes and the children were invited to ask questions and talk about the stories afterwards. The design of the experiment was a between participant one, with two groups: 6-year-olds and 8-year-olds.

Results and Discussion

Judgements of Emotions The results show that overall across the three scenarios, the two age groups differed in their judgements of who feels worse. As Table 4.1 shows, as many 6-year-olds judged that the actor would feel worse as judged that the non-actor would feel worse (45% vs. 32%, binomial $n = 74$, $z = 1.27$, $p = .10$; all p-values are one-

tailed unless otherwise stated). The remaining 23% of 6-year-olds judged that the two characters would feel the same. More 8-year-olds judged that the actor would feel worse than the non-actor, than vice versa (41% vs. 21%, binomial, $n = 59$, $z = 2.34$, $p = .01$). The remaining 38% of 8-year-olds judged that the two characters would feel the same. The two age groups differed in their judgements of who feels worse overall, $\chi^2(2, N = 133) = 6.38$, $p = .02$.

When the children's judgements about who feels worse were analysed in terms of the responses given to the individual scenarios, essentially the same results were found for each of the three individual scenarios (See Appendix D for further details).

Table 4.1 Percentage of judgements of who feels worse/same for actions and inactions given by the two age groups overall across the three scenarios in Experiment 4.

	6-year-olds	8-year-olds	Total
Overall			
Action	45	41	43
Inaction	32	21	27
Same	23	38	30

"If only" thoughts

Who wishes "if only" We asked the children who wishes "if only" and how they would complete the wish. The results show that the two age groups differ in their judgements of who wishes "if only". Overall across the three scenarios, more 6-year-olds judged that the actor had made the "if only" wish compared to the non-actor (66% vs. 34%, binomial, $n = 96$, $z = 2.96$, $p = .002$). The same pattern did not emerge for the 8-year-olds however: marginally more 8-year-olds judged that the non-actor had made the wish compared to the actor (56% vs. 42%, binomial $n = 94$, $z = -1.34$, $p = .09$). The two groups differed reliably in their judgements of who wishes "if only", $\chi^2(1, N = 190) = 10.18$, $p = .001$, two-tailed, as Table 4.2 shows.

When the children's judgements for who wishes "if only" were analysed in terms of the responses given for the individual scenarios, essentially the same results were found (See Appendix D for further details).

Table 4.2 Percentage of judgements of who wishes "if only" for actions and inactions given by the two age groups overall across the three scenarios in Experiment 4.

	6-year-olds	8-year-olds	Total
Overall			
Action	66	42	54
Inaction	34	56	45
Both	0	2	1

Sentence completion task The 6-year-olds completed the counterfactual thought by undoing the characters' actions or inactions (which was contingent upon whether they focused on the actor or non-actor) in 83.5% of the cases overall across the three scenarios. However, 9.5% of the 6-year-olds who focused on the actor undid their actions as if they were inactions (e.g., "If only Mark had moved to the Red team"). For the remaining 16.5 % of mutations, 7% focused on the outcome of the scenarios (e.g., "Jim wishes that the Red team had won" or "Jim wishes that he had known that the Red team would lose"); 6.5% were general mutations (e.g., "Jim wishes that he could have done his best to win") and 3% of 6-year-olds said that they could not complete the wish. The 8-year-olds completed the counterfactual thought by undoing the characters' actions or inactions in 58% of the cases overall, but 2% who focused on the actor undid their actions as if they were inactions. For the remaining 42% of cases, 20% of the mutations focused on the outcome and 22% focused on more general mutations.

As the children's sentence stem completions were contingent upon whether they judged that the actor or the non-actor had made the "if only" wish, the pattern of results for their sentence stem completions was similar to the pattern of results found for the who

wishes "if only" task. As table 4.3 shows, more 6-year-olds completed the counterfactual thought by undoing the actor's actions rather than the non-actor's inactions (48 % vs. 26%, binomial $n = 71$, $z = 2.37$, $p = .009$) and the 8-year-olds completed the counterfactual thought by undoing the actor's actions as often as they undid the non-actor's inactions (29% vs. 27%, binomial $n = 54$, $z = 0.51$, $p = .45$). There was a marginal difference between the two groups, χ^2 $(1, N = 125) = 2.13$, $p = .07$. Essentially the same pattern of responses was observed when the sentence stem completions provided by the children were analysed in terms of the responses given for the individual scenarios (See Appendix D for further details).

Table 4.3 Percentage of mutations given by the two age-groups for the sentence completion task overall across the three scenarios in Experiment 4.

	6-year-olds	8-year-olds	Total
Overall			
Action	48	29	38.5
Inaction	26	27	26.5
Actor's "inaction"	9.5	2	6
Outcome	7	20	13.5
Don't know	3	0	1.5
Other	6.5	22	14

The experiment reveals a developmental trend to the emergence of the action effect in children's judgements of who feels worse. Eight-year-olds exhibit the standard action effect in their judgements of emotions, that is, they judged that an actor will feel worse than a non-actor, just as adults do. In contrast, the 6-year-olds did not: they judged that an actor will feel worse as often as they judged that a non-actor will feel worse. The findings from Guttentag and Ferrell (2004) show that 7-year-olds and 9-year-olds, but not 5-year-olds tend to judge that the actor will feel worse than the non-actor. The finding from Experiment 4, taken together with the findings reported by Guttentag and Ferrell (2004), helps pinpoint the emergence of this counterfactual judgement of emotion for

actions and inactions.

The experiment also shows that there is an inconsistency to the pattern of results observed for the two age groups' "if only" thoughts. Six-year-olds, but not 8-year-olds, were more likely to judge that an actor, and not a non-actor, will wish "if only" (and following from this judgement, their mutations for the sentence completion task focused on the actor's action more than the non-actor's inactions). But the 8-year-olds showed a slight tendency towards the reversal of the action effect, that is, they judged that a non-actor will wish "if only" slightly more often than they judged that an actor will wish "if only" (although their mutations focused on inactions as often as they focused on actions). The result suggests that children's "if only" thoughts do not follow the expected developmental trend: the action effect is observed for the "if only" thoughts provided by the 6-year-olds, but not the 8-year-olds. We return to this inconsistency in the next experiment.

Summary

Overall, the pattern of responses for children's judgements of emotions is as we expected: 8-year-olds, but not 6-year-olds, show the action effect in their judgements of who feels worse. This finding is in line with existing evidence that shows that children aged 7 and 9 years (but not 5 years) show the action effect in their judgements of emotions (Guttentag & Ferrell, 2004) and it suggests that children begin to show a tendency to judge greater emotional impact for actions between the ages of 6 and 8 years. But there is an inconsistency to the pattern of results observed for their "if only" thoughts: 6-year-olds show the action effect for their "if only" thoughts, but 8-year-olds do not. The finding for the "if only" thoughts provided by the 8-year-olds is incongruent with existing evidence.

In the next experiment we attempt to test the hypotheses put forward in Experiment 4 from a fresh perspective in order to address two potential limitations of the

experiment. The way in which the actions and inactions, and their corresponding outcomes, are described in the scenarios may affect the children's "if only" thoughts. One possibility is that the children did not fully appreciate that the two individuals' actions or inactions are independent of each other, and so their decisions to act, or not to act, should also be considered independent of each other. The events occur without the other party's knowledge. The description of the scenarios in Experiment 4 may not have conveyed the independent nature of the actions and the inactions to the children.

Consider again the scenario about the two basketball players, Jim and Mark. The children first learn about Jim's inaction (e.g., "Last year he thought about switching to the Blue basketball team but he decided not to") and the outcome of his inaction ("A month ago the Blue basketball team won the big basketball competition, the Red basketball team lost the big basketball competition."). The children then learn about Mark's action (e.g., "Last year he thought about switching to the Red basketball team. And he decided to"), and the outcome ("A month ago the Blue basketball team won the big basketball competition, the Red basketball team lost the big basketball competition."). Because the children learn about the actor's (e.g., Mark's) action after they learn about the outcome for the non-actor (e.g., Jim), they may mistakenly believe that the actor's decision (e.g., Mark decides to switch to the Red team) could have been influenced by the outcome for the non-actor (e.g., the Red team lost the basketball competition). In the next experiment we present scenarios to the children with the use of puppets and props so they can observe that the individuals' actions and inactions and their corresponding outcomes are independent of one another.

We also wished to address another potential limitation of Experiment 4. The scenarios were presented to the children so that the actor, and their decision to act, was described second. Studies on the action effect in adults show that it is not influenced by the order in which the events are described (e.g., Gleicher et al., 1990) but children's

mutations of events may be more sensitive to the temporal order of the descriptions of the actions and inactions within the scenarios. Experiment 5 aims to test whether the order in which the actions and inactions are described in the scenarios affects children's judgements of emotions and their mutations for actions and inactions.

Experiment 5

The aim of Experiment 5 was to establish whether the standard action effect is observed in 6- and 8-year-olds' "if only" thoughts and judgements of who feels worse when the scenarios are presented with the aid of puppets and props. We expect to observe a more consistent pattern of results for the 6- and 8-year-olds' "if only" thoughts when the independent nature of the events in the scenarios is made more explicit to the children.

To test the prediction, we gave children aged 6- and 8 years three new scenarios, which were games about cards, marbles and coins. The children observed the scenarios enacted with the use of props and puppets. The puppets took turns to play the games in which they were given a choice to act or not to act (switch their choice of card, marble or coin). Their choice resulted in a bad outcome (they did not win the game). In order to convey that the choices made by each puppet were made independently, the puppet who was not taking their turn, that is, the puppet who was not facing the choice to act or not to act, was temporarily removed from the game. In this way, the independent nature of the events and the fact that the puppets' decisions are made without the other puppet's knowledge of the outcome is demonstrated.

We also wished to examine whether the order in which the actions and inactions are presented in the scenarios affects the children's responses to the "if only" counterfactual tasks. Although adults do not focus on the most recent event in standard action effect scenarios (Gleicher et al., 1990), it is unknown whether children show this tendency in their judgements of who feels worse or in their "if only" thoughts when they

are presented with scenarios about actions and inactions. We varied the order in which the actions and inactions were presented. The non-actor and their inaction was described first for half of the scenarios and the actor and their action was described first for the other half of the scenarios.

The experiment aims to test whether the action effect is observed in the "if only" thoughts and judgements of who feels worse for children aged 6 years and 8 years when the independent nature of the actions and inactions within the scenarios is explicitly demonstrated. We also wished to examine whether the order in which the actions and inactions are described affects the children's "if only" thoughts and their judgements of who feels worse.

Participants

The participants were 64 children divided into two separate age groups: 30 6-year-olds (16 boys and 14 girls, with an age range of 6 years, 0 months to 6 years, 8 months, and a mean age of 6 years, 4 months) and 34 8-year-olds (17 boys and 17 girls, with an age range of 8 years, 0 months to 8 years, 11 months and a mean age of 8 years, 4 months). The children were from three primary schools in Dublin and were primarily from middle class backgrounds. Written parental consent (See Appendix G) and verbal participant assent was obtained for each child. Any child who failed to answer any of the seven memory check questions (the identity question plus the six memory check questions) correctly after being corrected once, and/or the final recall question (e.g., "Oscar has forgotten how the puppets could have won the game, can you remind him?") was to be eliminated from the study. No child was eliminated from the study however, as all children answered these control questions correctly.

Materials and Design

We created three new scenarios about games based on cards, marbles and coins (from Byrne et al., 2000). The scenarios were enacted with the aid of puppets and props (See Appendix E for a full listing of the scenarios). The following scenario is an example of the card game:

This is Oscar and he tells these two puppets, Ann and Beth, about this great game. Oscar puts two cards each face down on the table in front of both puppets. So two cards for Ann and two cards for Beth. Each puppet has to pick one of their two cards and look at it. Now, one of Ann's cards is black, and one of them is red. And one of Beth's cards is black, and one of them one is red. The puppets don't know which one of their cards is black and which is red. Now, they will each win a prize if they pick the black card. So Ann will win her stickers if she picks the black card. And Beth will win her stickers if she picks the black card. But if they pick the red card, they win nothing. So Ann will win nothing if she picks the red card. And Beth will win nothing if s*he* picks the red card.

Ann goes first so Oscar asks Beth to wait outside. Oscar then asks Ann to pick one of her two cards. So Ann picks this card. Before she looks at it, Oscar asks her if she is sure about *this* card or does she want to switch the card she's picked with *that* card? Ann thinks about switching cards, but she decides to stay with *this* card. Oscar then says she can look at the card she's picked. Ann looks at the card and it is the red card. So she doesn't win her prize.

Beth goes next and Oscar asks her to pick one of her two cards. So Beth picks this card. Before she looks at it, Oscar asks her if she is sure about *this* card or does she want to switch the card she's picked with *that* card. Beth thinks about switching cards. And s*he* decides to switch to *that* card. Oscar then says she can look at the card she's picked. Beth looks at the card and it is the red card. So she doesn't win her prize.

Each scenario contained two different puppets with monosyllabic names such as Ann and Beth (or Al and Bill), which were written clearly on a badge attached to the

puppets' chests. The gender of the puppets matched that of the participant (e.g., "Here are two puppets, Ann/Al and Beth/Bill"). Children observed the two puppets playing a game. The puppets had two objects each to play with (e.g., two cards each). Both objects were identical except for their colour (e.g., one black card and one red card each) and their colour was excluded from view (e.g., the two cards were placed face down on the table). A third puppet, Oscar, was introduced to present the choice to act or not to act to the puppets. The puppets had to choose one of their objects (e.g., one of the two cards) and if they chose a particular coloured object (e.g., the black card) they would win the prize. The prize was a set of stickers and each puppet could win independently of the other puppet.

In order to demonstrate the puppets' actions or failures to act, Oscar presented the puppets with a choice immediately before they looked to see if they had chosen the correctly coloured card. The choice was to either stay with the object they had chosen (not to act) or to switch their object with the unselected object i.e., to act (e.g., "Before Ann looks at her card, Oscar asks her, 'are you sure about this card, or do you want to switch to that card?'"). One of the puppets (the actor) decides to switch their object with the unselected object (e.g., "Beth thinks about switching cards, and she decides to switch to that card") and the other puppet (the non-actor) decides to stay with the object they chose (e.g., "Ann thinks about switching cards and she decides to stay with this card"). The outcome for both puppets is that they do not pick the winning object (e.g., "Ann looks at the card and it is the red card" and "Beth looks at the card and it is the red card").

In order to convey to the participants that the puppets' decisions to act or not to act were made independently of each other, and that the outcome did not influence the decision of either puppet, the puppet who was not taking their turn was temporarily removed from view (e.g., "Ann goes first so Oscar asks Beth to wait outside" and "Beth goes next and Oscar asks Ann to wait outside").

The three scenarios shared the same structure and the winning conditions for each scenario were the same (e.g., the object that each puppet chose had to be of a certain colour). The only difference between the three scenarios was that the nature of the games differed depending on the objects used to play the games. For the coin scenario for example, the puppets had two boxes each and there was a green coin in one box and a yellow coin in the other box. The puppets had to pick the box with the green coin inside to win.

We used the same measures and check questions (eleven questions in total: eight short check questions and three test questions) employed in Experiment 4. The identity question, the six memory check questions that precede the test questions (e.g., "Can you tell me which puppet decided to switch cards?") and the test question about who feels worse (e.g., "Which puppet do you think feels worse about how they played the game or do you think they feel the same?") were conveyed directly to the children without the use of the third puppet, Oscar. The two "if only" test questions and the final recall question were presented to the children with the use of Oscar. For the question about who wishes "if only" for example, the children observed the puppets whispering to Oscar and they are told, "One of these two puppets has just told Oscar that they wish they had played the game differently, which puppet do you think said that to Oscar?". For the sentence completion task the children were told, "So Ann (or Beth) wishes she could have played the game differently. She could have played the game differently if only…Can you guess how she finishes her wish?". For the final recall question the children were told, "Oscar has forgotten how the puppets could have won the game, can you remind him?" (See Appendix E for a full list of the questions).

The wording of the test questions used in Experiment 4 was modified slightly for the current experiment. The wording was modified to ensure that the language used was accessible to all children. For example, instead of the children being asked to judge which

puppet wished they had made a different decision, the children were asked to judge which puppet wished they had played the game differently.

We created two sets of scenarios, set A and set B, which were counterbalanced across participants. The content of the two sets of scenarios was identical; the only difference between the two sets was the order in which the description of the actor and non-actor was presented (set A: non-actor first, actor second; set B: actor first, non-actor second). Half of the children received set A and half received set B in a random order. The three scenarios were also presented in a random order. The design of the experiment was a between participant one with two groups: 6-year-olds and 8-year-olds.

Procedure

The procedure was similar to that of Experiment 4. The children were tested individually in a room adjacent to their classroom by the author. They sat at a desk facing the experimenter. All children were told, "I'm going to show you some puppets playing different games with cards, marbles and coins, and I'm going to ask you some things about the games and what the puppets said after they played each game. So it's your job to watch the puppets playing the games, O.K? So here's the first game". The three scenarios were then presented to the children with the use of puppets (e.g., the two puppets playing the game, and Oscar) and the objects necessary to play the games (e.g., cards, two bags of marbles and four boxes containing the coins). The two puppets sat facing the participant with the play objects sitting in front of them. The position of the two puppets in each scenario was alternated from left to right. The children observed the puppets playing the games and after each game the children were presented with both the check and test questions in exactly the same order they were presented in Experiment 4. If the children failed to answer any of the memory check questions correctly the first time, they were corrected. If they failed to answer any of these questions correctly a second

time, they were to be excluded from the study. The children were then asked the three test questions and the final recall question in the same fixed order. If the children failed to answer the recall question correctly, they were eliminated from the study without being corrected. Each session lasted about 15 minutes and the children were invited to ask questions and talk about the stories afterwards.

Results and Discussion

Judgements of emotions The results show that the 8-year-olds judged greater emotional impact for actions than inactions, whereas the 6-year-olds did not. As Table 4.4 shows, as many 6-year-olds judged that the actor would feel worse as judged that the non-actor would feel worse (27% vs. 21%, binomial, $n = 43$, $z = 0.61$, $p = .27$). The remaining 52% of 6-year-olds judged that the two characters would feel the same. In contrast, more 8-year-olds judged that the actor would feel worse than the non-actor, than vice versa (34% vs. 18%, binomial, $n = 53$, $z = 2.20$, $p = .01$). The remaining 48% of the 8-year-olds judged that the two puppets would feel the same. The two age groups did not differ overall in their judgements of who feels worse, $\chi^2(2, N = 192) = 1.38$, $p = .50$ These results replicate the developmental trend found in the previous experiment for judgements of who feels worse.

When the children's judgements of who feels worse were analysed in terms of the responses given for the individual scenarios, essentially the same pattern of responses was observed (See Appendix E for further details).

Table 4.4 Percentage of judgements of who feels worse/same for actions and inactions given by the two age groups overall across the three scenarios in Experiment 5.

	6-year-olds	8-year-olds	Total
Overall			
Action	27	34	31
Inaction	21	18	19
Same	52	48	50

The results also show that the order in which the action is described in the scenarios does not affect children's judgements of who feels worse for actions or inactions. There was no difference in the judgements of who feels worse for those 6-year-olds who received the scenarios that described the action first and those 6-year-olds who received the scenarios that featured the action second, $\chi^2(1, N = 43) = .352, p = .55$, two-tailed. There was no difference in the judgements of who feels worse for those 8-year-olds who received the scenarios that featured a description of the action first and those 8-year-olds who received the scenarios that described the action second, $\chi^2(1, N = 53) = .23, p = .64$, two-tailed.

"If only" mutations

Who wishes "if only" We asked the children which puppet would wish "if only" most and how they would complete this wish. The results show that the two age groups did not differ in their judgements of who wishes "if only". As Table 4.5 shows, as many 6-year-olds judged that the actor wished "if only" as judged that the non-actor wished "if only" (52% vs. 48%, binomial, $n = 90, z = 0.32, p = .38$). The results for the 8-year-olds show that they judged that the actor had wished "if only" as often as they judged that the non-actor had wished "if only" (56% vs. 44%, binomial, $n = 102, z = 1.09, p = .14$), although the pattern of results is in the direction of an action effect. The two groups did not differ reliably in their judgements of who wishes "if only", $\chi^2(1, N = 192) = 0.21, p = .89$, two-tailed.

When the children's judgements were analysed in terms of the responses given for the individual scenarios, essentially the same pattern was observed (See Appendix E for further details).

Table 4.5 Percentage of judgements for who wishes "if only" for actions and inactions given by the two age groups overall across the three scenarios, in Experiment 5.

	6-year-olds	8-year-olds	Total
Overall			
Action	52	56	54
Inaction	48	44	46

The results also show that the order in which the action and inaction is described in the scenarios does not affect the children's judgements of who wishes "if only". There was no difference between the judgements of those 6-year-olds who were given the scenarios that featured the description of the action first and those 6-year-olds who were given the scenarios which described the action second, $\chi^2(1, N = 90) = 1.11, p = .29$, two-tailed. Likewise, there was no difference between the judgements of those 8-year-olds who were given the scenarios which described the action first and those 8-year-olds who were given the scenarios which described the action second, $\chi^2(1, N = 102) = .36, p = .55$, two-tailed.

Sentence completion task The 6-year-olds completed the counterfactual thought by undoing the puppets' actions or inactions (which was contingent upon whether they focused on the actor or the non-actor) in 62% of the cases overall across the three scenarios. For the remaining 38% of mutations, 12% focused on the puppets winning the games (e.g., "If only they had won"), 5% focused on wishing for a second chance to play the game (e.g., "If only they could play again") and 21% were more general mutations (e.g., "If only they knew which coloured marbles were in the bags"). The 8-year-olds completed the counterfactual thought by undoing the puppets' actions or inactions in 76% of cases overall. For the remaining 24% of mutations, 6% focused on Oscar's

involvement in the games (e.g., "If only Oscar had not asked them if they were sure"), 7% focused on the puppets winning the games, 1% were mutations focusing on a second chance to play and 10% focused on mutations of a more general kind (e.g., "If only the card to win was the red one").

As the children's sentence stem completions were contingent upon whether they judged that the actor or the non-actor had made the "if only" wish, the pattern of results for their sentence stem completions was similar to the pattern of results observed for the who wishes "if only" task. As Table 4.6 shows, the 6-year-olds completed the counterfactual thought by undoing the actor's actions as often as they undid the non-actor's inactions (32% vs. 30%, binomial $n = 56$, $z = 0.14$, $p = .45$) as did the 8-year-olds, although the pattern of results for the 8-year was in the direction of an action effect (44% vs. 32%, binomial $n = 78$, $z = 1.25$, $p = .11$). The two age groups did not differ for those children whose mutations focused on either the actor's actions or the non-actor's inactions, $\chi^2(1, N = 134) = 0.46$, $p = .49$.

When the children's sentence stem completions were analysed in terms of the responses given for the individual scenarios, essentially the same pattern of results was observed (See Appendix E for further details).

Table 4.6 Percentage of mutations given by the two age-groups for the sentence completion task overall across the three scenarios in Experiment 5.

	6-year-olds	**8-year-olds**	**Total**
Overall			
Action	32	44	39
Inaction	30	32	31
Oscar	0	6	3
Winning	12	7	9
Play Again	5	1	3
Other	21	10	15

The results also show that the order in which the action and inaction is described

in the scenarios does not affect children's sentence stem completions for the "if only" wish. There was no difference in the sentence stem completions of those 6-year-olds who received the scenarios that described the action first and those 6-year-olds who received the scenarios that featured the action second, $\chi^2(1, N = 56) = .05, p = .82$, two-tailed. Similarly, there was no difference in the sentence stem completions of those 8-year-olds who received the scenarios that described the action first and those 8-year-olds who received the scenarios that featured the action second, $\chi^2(1, N = 78) = .67, p = .67$, two-tailed.

The experiment shows that the two groups differed in their judgements of who feels worse. An action effect is observed for 8-year-olds' judgements of emotions, that is, they judged that an actor will feel worse compared to a non-actor, but 6-year-olds did not. In fact, we offered the children the option of judging that the actor felt the same. About half of the children in each age group judged that the puppets would feel the same. Nonetheless, of those who judged one or other to feel worse, 8-year-olds showed an action effect, and 6-year-olds did not. The pattern of results for the children's judgements of who feels worse for actions and inactions replicates the results found in Experiment 4. The results show that an action effect is observed in 8-year-olds' judgements of who feels worse regardless of whether the scenarios are presented to children with the aid of puppets and props or when they are presented as stories.

The experiment also shows that the two groups do not differ for their "if only" thoughts. The action effect is not observed for the 6-year-olds' judgements of who wishes "if only" (and their mutations for the sentence completion task focus on the actors' actions as often as they focus on the non-actors' inactions). Likewise, the action effect was not observed for the 8-year-olds' "if only" thoughts. Although the 8-year-olds judged that the actor had wished "if only" more often than the non-actor (and their mutations for

the sentence completion task focused on actions more than inactions) these differences were not reliable. The results show that when the independence of the actions and inactions is made explicit in the scenarios with the use of puppets, there is a more consistent pattern of results for the children's "if only" thoughts. This finding suggests that the pattern of results observed for the "if only" thoughts provided by the children in Experiment 4 may have arisen because they did not fully understand the independent nature of the events in the scenarios.

The experiment also shows that the order in which the action and inaction was described in the scenarios did not affect the children's judgements of emotions or their "if only" thoughts. The finding suggests that it is not the order of the description of the events in the scenarios used in the previous experiment that led to the anomalous results for the "if only" thoughts provided by the children. Children, like adults, do not appear to be sensitive to the order in which the events are described.

The experiment also shows that when the independent nature of the events in the scenarios is made more explicit with the use of puppets and props, a dissociation between children's judgements of emotions and "if only" thoughts occurs for 8-year-olds only. They judged that an actor will feel worse than a non-actor, but they do not judge that an actor will wish "if only" more often than a non-actor (although their "if only" thoughts were in the direction of the action effect). This result shows that 8-year-olds' judgements of who thinks "if only" most do not follow the same pattern as their judgements of who feels worse. A dissociation does not occur for the 6-year-olds: they do not judge that an actor will feel worse than a non-actor, and they do not judge that an actor will wish "if only" more than a non-actor. There is a developmental trend to the emergence of children's judgements of emotions, but not for their "if only" judgments for actions and inactions.

Summary

Overall, the experiment shows that when the scenarios are presented to the children with the aid of puppets and props, the standard action effect is observed for the 8-year-olds' judgements of who feels worse, but it is not observed for the 6-year-olds. Although neither age group showed the action effect in their "if only" thoughts, the "if only" thoughts provided by the 8-year-olds were in the direction of the action effect. Nevertheless, the results show that the "if only" thoughts provided by 8-year-olds do not follow the same pattern as their judgements of who feels worse. The experiment shows that there appears to be a slight developmental lag between the emergence of judgements of who feels worse and children's "if only" thoughts for actions and inactions.

General Discussion

The aim of this chapter was to examine whether children aged 6 years and 8 years tend to judge greater emotional impact for actions rather than inactions and whether their "if only" thoughts focus on undoing actions more than inactions when they think about counterfactual situations.

The results from the first experiment in the series show that as we expected, 8-year-olds judge greater emotional impact for actions, but 6-year-olds do not. But the experiment revealed a puzzling pattern of results for the children's judgements for who wishes "if only". The 6-year-olds tended to judge that the actor will wish "if only" most (and they completed the wish by undoing the action) but the 8-year-olds did not. (In fact, the 8-year-olds showed a slight reversal of the action effect for their judgements of who will wish "if only" most). The results from Experiment 4 were unexpected because they show a dissociation between children's judgements of emotions and their "if only" thoughts that does not follow a consistent pattern.

The second experiment in the series addressed the possibility that this puzzling

pattern of results may have arisen because the children did not fully understand that the two individuals, and their respective actions or inactions, were independent of each other. We also wished to address another potential reason for the observed inconsistencies in Experiment 4, that is, whether the order in which the actions and inactions were described in the stories affected children's "if only" thoughts. We gave 6- and 8-year-olds scenarios that were enacted with the use of puppets and props to convey that the actions of the actor, and the inactions of the non-actor, were independent of one another. We also varied the order in which the actions and inactions were described in the scenarios.

The second experiment in the series provided a clearer pattern of results for children's judgements of emotions and their judgements of who wishes "if only" most. The findings for the children's judgements of emotions replicated those observed in the previous experiment, that is, the 8-year-olds, but not the 6-year-olds, showed the action effect in their judgements of who feels worse. The findings for the children's "if only" thoughts followed a more consistent pattern, that is, neither the 8-year-olds nor the 6-year-olds showed the action effect in their judgements of who wishes "if only" most. The experiment also showed that the order in which the action and the inaction were presented in the stories did not affect children's judgements of emotions or their "if only" thoughts. The findings suggest that the anomalous pattern of results found in Experiment 4 may have occurred because the independence of the actions and inactions was not explicitly conveyed.

The results from the two experiments show that there is a developmental shift between the ages of 6 years and 8 years in how children make counterfactual judgements of emotions for actions and inactions. Taken together with the findings reported by Guttentag and Ferrell (2004) (7- and 9-year-olds, but not 5-year-olds judged greater emotional impact for actions), these findings help pinpoint the emergence of this counterfactual judgement of emotion.

The results also show a dissociation between judgements of emotion and "if only" thoughts. The dissociation occurs for 8-year-olds, who judge that an actor will feel worse than a non-actor, but they do not judge that an actor will wish "if only" more often than a non-actor. (Six-year-olds do not judge that an actor will feel worse than a non-actor, and they also do not judge that an actor will wish "if only" more often than a non-actor). The results suggest that children aged 6 years and 8 years may rely on different strategies when they make a judgement of emotion in a counterfactual situation.

There may be different ways of judging emotions in others (Graham & Weiner, 1986; Weiner & Graham, 1984). One strategy relies on a consideration of the outcome of a situation alone. Emotional inferences such as happiness and sadness, *outcome-dependent* emotions, may be generated from such a strategy. A second strategy encompasses a consideration of the outcome and the causal steps leading up to the outcome. Emotional inferences such as guilt, gratitude and pride, *attribution-dependent* emotions, may be generated from this strategy. This second strategy may be related to a counterfactual strategy, which depends on the amplification of judgements of emotion by the construction of a counterfactual alternative (Kahneman & Miller, 1986). Children younger than 8 years appear to rely on an outcome-dependent strategy, whereas older children use outcome-dependent and attribution-dependent strategies, depending on the type of emotional inference made (Thompson, 1987). The findings from the experiments reported in this chapter suggest that when 6-year-olds are asked to judge which puppet, the actor or the non-actor, feels worse, they appear to focus solely on the outcome when they make counterfactual judgements. Hence, they judge that each character feels the same, since the outcome was the same. The result suggests the view that 6-year-olds rely on an outcome-dependent strategy in their counterfactual judgements of who feels worse when they think about actions and inactions.

Eight-year-olds judge that the actor feels worse than the non-actor, which suggests

that they are not relying on an outcome-dependent strategy. However, the dissociation between the judgements of who feels worse and the "if only" thoughts suggests that their judgements of emotions are not wholly guided by the attribution-dependent counterfactual strategy either. Existing evidence suggests that although children begin to make more attribution-dependent emotional inferences around the age of 8 years, their justifications for their choice of emotional inference do not always suggest that they are relying on an attribution-dependent strategy. For example, Thompson (1987) showed that when children were asked to justify the judgements they made about how a character felt at the end of a story, many of the justifications provided by children aged 7 and 8 years who made attribution-dependent emotional inferences (e.g., attributing guilt or pride to the character) were outcome-oriented and not attribution-oriented. In contrast, children aged 10 and 11 years tended to show more consistencies between their judgements of emotions and their justifications. At the age of 8 years children may begin to move from relying on a purely outcome-oriented strategy to one in which they appear to rely on a mixed strategy for their counterfactual judgements of emotions. This mixed strategy may result in 8-year-olds relying partially on an outcome-dependent strategy and partially on an attribution-dependent strategy.

Children aged 6 years and 8 years do not appear to undo actions more than inactions for their "if only" judgements. These findings provide little support for the proposal that the counterfactual representation of actions helps children to co-ordinate the processes involved in the attribution of judgements of counterfactual emotions. Instead, the findings suggest that thinking about counterfactual alternatives to actions may be particularly difficult for children. There are several possibilities for why children do not appear to show the action effect for their "if only" judgements. The finding may have occurred as a result of task demands because the "if only" judgement always occurred before the judgement of emotion. However, the final experiment in this series (which is

described in Chapter 5) examines "if only" judgements further and it shows that the finding is not a product of task demands.

An alternative explanation is that children may mentally represent actions and inactions in a different way to adults, that is, they may keep in mind just a single possibility when they think about the current reality for both actions and inactions. Adults tend to think "if only" more for actions than inactions because actions require a richer mental representation from the outset (Byrne, 2005; Byrne & McEleney, 2000). But children may tend to think about actions by mentally representing the current situation, that is, the post-action possibility, without keeping track of the past pre-action situation. Although children may be able to keep in mind both the pre-action possibility and the post-action possibility when required (i.e., when they think about the counterfactual situation) they may not do so spontaneously, perhaps because of the cognitive effort involved. When they think about the current reality for actions, they may keep in mind just one possibility, the post-action possibility, as they may not spontaneously keep in mind the pre-action possibility. As a result they do not have access to a ready-made counterfactual to an action and so their "if only" thoughts focus on actions and inactions equally. In this way, imagining a counterfactual alternative to either an action or an inaction may require the same cognitive effort for children. Eight-year-olds may show a dissociation between their "if only" thoughts and judgements of emotions perhaps because the way in which actions are mentally represented results in their reliance on a mixed strategy for their judgements of counterfactual emotions.

The findings from the experiments reported in this chapter point to a developmental trend in children's judgements of counterfactual emotions for actions and inactions. But the tendency for children to think "if only" for actions and inactions, as measured by their "if only" judgements, does not appear to emerge simultaneously with their judgements of emotions. The development of the action effect appears to be marked

by a number of changes over the life span: children tend to judge greater emotional impact for actions rather than inactions before they show a tendency to think "if only" for their actions. The developmental trend for the action effect changes again in older adulthood: when people look back over their lives they tend to think "if only" and judge greater regret for failures to act rather than for actions (Gilovich & Medvec, 1995). The affective experience of children aged 8 years, but not 6 years, may be amplified following an action, although they may not tend to ponder about how the action could have turned out differently. In contrast, when older adults ponder over a lifetime of actions and inactions, their affective experience appears to be amplified most by their counterfactual thoughts about inactions.

Conclusions

The findings from the experiments reported in this chapter have revealed a developmental trend to the emergence of the action effect in children's judgements of who feels worse: 8-year-olds, like adults, tend to judge that an actor will feel worse than a non-actor, but 6-years-olds do not, as both experiments show. But there is no developmental trend to the emergence of children's "if only" thoughts for actions and inactions: 8-year-olds and 6-year-olds both judge that an actor will wish "if only" as often as a non-actor, unlike adults, as Experiment 5 shows. The findings suggest that 6- and 8-year-olds may rely on different strategies for their counterfactual judgements of emotions for actions and inactions: 6-year-olds appear to rely entirely on the outcome for their judgements of emotions, that is, they use an outcome-dependent strategy (e.g., Weiner & Graham, 1984). Eight-year-olds do not appear to rely entirely on either an outcome-dependent strategy or on a counterfactual strategy when they make counterfactual judgements of emotions.

Counterfactual thoughts about actions and inactions may be particularly difficult

for children, perhaps because of the way in which they are mentally represented. Unlike adults, children aged 6 years and 8 years may envisage a single possibility for both actions and inactions when they think about the facts, and so they may not have access to a ready made counterfactual to an action. This particular difficulty may result in the dissociation of 8-year-olds' judgements of emotions and their "if only" thoughts which may not be resolved until later in development.

As we described in Chapter 1, the action effect is just one phenomenon of counterfactual thinking. There are many other aspects of reality that people tend to focus on when they think about counterfactual alternatives. For example, adults show a tendency to undo the most recent event in an independent sequence of events, which is termed the temporal order effect (e.g., Miller & Gunasegaram, 1990). In the next chapter we describe an experiment that further examines 6- and 8-year-olds' "if only" thoughts and judgements of emotions. We examine children's "if only" thoughts for the temporal order effect, which has been suggested to reflect fundamental cognitive properties of the mental representations people construct of reality (Byrne, 2005). We also examine children's judgements of more specific emotions and social ascriptions, such as guilt and blame, as well as their judgements of who feels worse. We further examine the relation between children's "if only" thoughts and their judgements of emotions and social ascriptions in an effort to determine the developmental trend to how children make judgements of emotions in counterfactual situations.

Chapter 5 Counterfactual Thinking in School-aged Children: The Temporal Order Effect

The experiments reported in Chapter 4 showed that there is a developmental trend to the emergence of the action effect in 6- and 8-year-olds' judgements of who feels worse. But there is no developmental trend to the emergence of the action effect in their "if only" thoughts. As a result, there is a dissociation between 8-year-olds' judgements of emotions and their "if only" judgements. These findings suggest that children do not undo actions as readily as adults when they make judgements of who wishes "if only" most, perhaps because they represent actions in a different way to adults. In addition, the results suggest that 8-year-olds may not fully rely on a counterfactual strategy for their judgements of emotions, at least when they think about actions and inactions. In this chapter we examine whether there is a developmental trend to 6- and 8-year-olds' "if only" judgements when they think about other counterfactual situations. More specifically, we examine whether children, like adults, mentally undo the most recent event in a sequence of independent events when they think about what might have been. We further examine the relation between children's "if only" thoughts and their judgements of who feels worse, but we also extend our focus to examine children's judgements of guilt and blame.

It is the tendency to mentally undo the more recent event in a sequence of independent events, termed the temporal order effect, which will be the focus of the experiment we report in this chapter. The temporal order effect is a robust and regular phenomenon in adults' counterfactual thinking and the tendency may play a role in many everyday situations (e.g., the tendency for athletic teams to feature their fastest player last in a relay race and the common aversion blackjack players have to playing in the last box; Miller & Gunasegaram, 1990; Kahneman & Miller, 1986). As we described in Chapter 1,

adults tend to undo the more recent event in an independent sequence of events in experimental situations. Consider the following scenario (from Byrne et al., 2000, p. 280):

Imagine two individuals (John and Michael) who are offered the following very attractive proposition. Each individual is asked to toss a coin. If the two coins come up the same (both heads or both tails) each individual wins £1,000. However, if the two coins do not come up the same, neither individual wins anything. John goes first and tosses a head; Michael goes next and tosses a tail. Thus the outcome is that neither individual wins anything.

When adult participants are asked to undo the outcome by completing a sentence such as "John and Michael could each have won £1,000 if only one of them had tossed a different coin face, for instance if..." they tend to focus on the second event, that is, they tend to undo Michael's toss of tails and imagine he tossed heads instead. In addition, they tend to judge that Michael, the second player, feels more guilt and that he will be blamed more by John (Byrne et al., 2000; Miller & Gunasegaram, 1990). Both events in the scenario are of chance, and so logically, neither event should be considered more mutable and neither individual should be more likely to blame the other or feel more guilt. But almost 90% of adults judge that it is easier to undo the outcome by undoing Michael's toss of tails instead of John's earlier toss of heads (e.g., Miller & Gunasegaram, 1990).

Thinking about a counterfactual situation requires people to keep in mind multiple possibilities and it requires people to keep in mind false possibilities that are temporarily supposed to be true (Byrne, 2005). People tend to think about true possibilities (Johnson-Laird & Byrne, 2002) rather than false possibilities, and they tend to think of few possibilities, because of the constraints of working memory (Johnson-Laird & Byrne, 1991). People may understand the story about John and Michael tossing their coins by envisaging several possibilities. They may mentally represent the facts, John tossed heads

and Michael tossed tails and they lost, and they may think of only one of three counterfactual possibilities, the one in which John tossed heads and Michael tossed heads. The tendency to think of this possibility rather than other possibilities (e.g., that John tossed tails and Michael tossed tails) may indicate that the earlier events in the sequence are presupposed (Miller & Gunasegaram, 1990). Earlier events in a sequence act as a context or anchor against which subsequent events are interpreted and are thus less mutable than subsequent events (Byrne et al., 2000).

Little is known about the development of this tendency in children's thoughts about what might have been. The findings reported in the previous chapter show that children aged 6 years and 8 years do not exhibit the action effect in their "if only" judgements, perhaps because they envisage a single possibility when they think about the current situation for actions as well as inactions. Unlike adults, children may think about actions by mentally representing the current situation, without keeping track of the past pre-action situation, and so they wish "if only" about actions and inactions equally. The aim of the experiment reported in this chapter is to examine whether there is a developmental trend to the emergence of the temporal order effect in 6- and-8-year-old children.

We propose that children aged 6 years and 8 years, like adults, will exhibit the temporal order effect in their "if only" judgements. We suggest that imagining a counterfactual alternative to the last event in a sequence of independent events reflects fundamental properties of the nature of the mental representations that people construct (Byrne, 2005; Byrne et al., 2000). Consider again the story about the coin toss game in which John goes first and tosses a head and Michael goes next and tosses a tails and they lose. We suggest that children understand the story in a similar way to adults. They mentally represent the facts of the game by envisaging a single possibility for the current reality, John tossed heads and Michael tossed tails and they lost, and they mentally

represent only one of three counterfactual possibilities, the one in which John tossed heads and Michael tossed heads and they won. Children mentally represent this possibility instead of any other possibility because earlier events act as an anchor against which subsequent events are interpreted. Although children may mentally represent two possibilities -- the reality and the counterfactual alternative -- when they think about the counterfactual situation, they need only mentally represent a single when they think about the current reality.

Following from this proposal, we wished to examine whether there is a developmental trend to the emergence of children's judgements of who feels worse for the temporal order effect and whether their judgements of who feels worse follow the same developmental pattern as their "if only" thoughts. We also wished to examine the more specific judgements of guilt and blame. The tendency for children to ascribe guilt to themselves or others in a particular situation emerges sometime during the ages of 7 to 9 years (Harris, Olthof, Meerum Terwogt, & Hardman, 1987; Tangney, 1995; Thompson, 1987). For example, when children aged 5 to 14 years are given a variety of emotion terms (e.g., happy, angry, guilty) and they are asked to describe a situation that would invoke a particular emotion, children aged 7 years and older appropriately describe situations which would elicit emotions such as guilt, but children younger than 7 years do not (Harris et al., 1987).

It has been suggested that second-order mental state understanding, which is the ability to understand a mental state in another, underlies the developmental trend to the emergence of guilt attribution in children (Harris, 1989). For children to experience guilt they must consider whether their action (e.g., a transgression of some kind) meets, or falls short of normative standards. In order to measure their action against normative standards, children must be aware of the role of an audience, who will either approve or disapprove of their action. Guilt is experienced when children appreciate how an audience

would react in such a situation. According to Harris (1989), children's conception of the role of an audience changes developmentally from an initial awareness of the reaction of others (e.g., parental disapproval) to a developing awareness of their own reaction to an event, that is, their own internal "audience".

On Harris' proposal, children's understanding of guilt *in others* requires a more sophisticated ability to understand the mental states of others. For example, for a child to understand that their friend (e.g., Jack) experiences guilt following some transgression, they must imagine that the "audience" (e.g., Jack's mother) feels negative affect (disapproval) following the transgression. The child must then appreciate that their friend feels negative affect (guilt) as a result of how his mother feels. Harris (1989) contends that the child is effectively stating that, "'I can imagine how Jack will feel when he imagines how his mother will feel'"(Harris, 1989, p. 94).

Second-order mental state understanding has been shown to be predictive of whether children make counterfactual judgements of emotions that are comparable to those made by adults (Ferrell, 2005). Following from the proposal that the co-ordination of counterfactual thinking processes and perspective taking, as measured by second-order mental state understanding, emerges between the ages of 7- and 8 years (e.g., Ferrell, 2005), we propose that there may be a difference between 6- and 8-year-old children in their judgements of guilt and blame. Blame is a social ascription that has been shown to be closely associated with judgements of guilt in children (e.g., Bybee, 1998) and adults (e.g., Tangney, 1995).

In this chapter we will report an experiment that examines whether 6- and 8-year-old children exhibit the temporal order effect in their "if only" thoughts and in their judgements of emotions and social ascriptions. We gave 6-year-olds and 8-year-olds scenarios, which were enacted with the use of puppets and props, such as the following:

Here are two puppets, Jim and Pat, who are told about this great game. Each puppet is given a coin to toss and each one tosses their coin. Do you see that this side of the coin is green and that the other side of the coin is yellow? Now, if the two coins come up the same -- so both on the green side or both on the yellow side -- each puppet wins the prize. But if the two coins do not come up the same, neither puppet wins anything. Jim goes first and tosses the coin and it lands on the green side of the coin. Pat goes next and tosses the coin and it lands on the yellow side of the coin. So, neither puppet wins anything.

We examined the temporal order effect in the children's "if only" thoughts by giving them a sentence completion task to determine which event, the first or the second, (e.g., Jim's toss of the green side of the coin or Pat's toss of the yellow side of the coin) the children would mentally undo. We also introduced two new tasks in order to measure children's "if only" judgements by various methods. We gave the children a physical manipulation task in which we asked them to physically change the puppets' objects to make it look like they had won. Once again, we wished to determine which event, the first or the second, the children would physically undo. We also asked them a causal attribution question, e.g., "Can you tell me why the puppets didn't win?" to examine whether their answers would make reference to either the first or second event, which may give us a clue to the mutability of the event. We measured the temporal order effect in judgements of emotions and social ascriptions by asking the children three questions about guilt, blame and who feels worse.

Experiment 6

The experiment aimed to test whether the temporal order effect is observed in the "if only" thoughts, causal attributions and emotion and social judgements of 6-year-old and 8-year-old children. The experiment tests whether children aged 6 years and 8 years differ

in their judgements of emotions and social ascriptions and whether their "if only" thoughts follow the same pattern as their judgements of emotions and social ascriptions.

Method

Participants

The participants were 62 children in two separate age groups: there were 33 6-year-olds (15 boys and 18 girls, with an age range of 6 years, 0 months to 6 years, 11 months, and a mean age of 6 years, 7 months) and 29 8-year-olds (14 boys and 15 girls, with an age range of 8 years 0 months, to 8 years, 11 months and a mean age of 8 years, 7 months). The children were pupils from four primary schools in Dublin and were primarily from middle class backgrounds. Written parental consent (see Appendix G) and verbal child assent was obtained for each child. Any child who failed to answer the first comprehension question about the winning conditions (e.g., "Can you show me how they both can win?") after being corrected once, and the final recall question (e.g., "Oscar's forgotten how they could have won the prize! Can you remind him?") was to be eliminated from the study for failing to understand the crucial winning conditions. However, all the children answered these comprehension questions correctly and no child was eliminated from the study.

Materials

We adapted three scenarios from those used by Byrne et al. (2000) in their study of the temporal order effect in counterfactual thinking in adults. The scenarios were about cards, marbles and coins and their structure was identical to those used by Byrne et al. (2000). The following scenario is an example of the card scenario (see Appendix F for a full listing of the three scenarios):

Here are two puppets, Al and Bill, who are told about this great game. Each puppet is given a pile of cards, and each one picks a card from his own pile. Can you see that there are only red and brown cards in each pile? Now, if the two cards they pick are the same colour -- so if both are brown or both are red -- each puppet will win this prize. But if the two cards are not the same colour, neither puppet wins anything. Al goes first and picks a brown card from his pile. Bill goes next and picks a red card from his pile. So, neither puppet wins anything.

Some aspects of the scenarios were modified for children, for instance the scenarios were enacted with the use of props and the individuals involved were represented as puppets. There were two different puppets in each scenario and their gender matched that of the participant. They had monosyllabic names such as Al and Bill (or Ann and Beth), which were written clearly on a badge attached to their chests. We included a check question about the identity of the puppets (e.g., "Can you show me which puppet is which?") to ensure that the children could differentiate between the two puppets. The props were the objects necessary to play the three different games and a set of stickers for the prize. The objects for the card scenario were twenty 5cm x 3 cm cards; there were ten red cards and ten brown cards equally distributed between the two piles of cards. For the marbles scenario, there were two drawstring pouches filled with five white and five blue marbles in each, with a total of twenty marbles in all. For the coin scenario, the two coins were made out of two large cardboard disks, approximately 4 cm in diameter, which were covered with yellow paper on one side and green paper on the other side.

We adhered to the wording of the original scenarios as closely as possible but some wording was modified to be more accessible to children. For example, instead of the individuals winning £1,000, the children were told the puppets would win stickers. The three scenarios shared the same structure and the premise and winning conditions for

each scenario were the same (i.e., the objects necessary to play the game had to be of the same colour for the puppets to win). The only difference between the three scenarios was that the nature of the games differed depending on the objects necessary to play them. For example, in order to win in the marbles scenario, the puppets had to pick a marble each from a bag, whereas in order to win in the coin scenario, the puppets had to toss a coin.

The task and questions for each scenario were also based on the questions used by Byrne et al. (2000), with a number of modifications and additions included for children. Children's creation of counterfactual alternatives to the events was measured by a sentence completion task and physical manipulation task. For the sentence completion task we introduced a third puppet named Oscar. The children were informed that he was a friend of the two puppets and that he liked to wish that things could have been different for his friends. The children were asked by the experimenter to complete the counterfactual sentence in the following way: "Oscar is going to whisper a wish in my ear about his friends and it's your job to guess how he finishes his wish. So Oscar just said that he wishes that Al and Bill could have won the prize. They could have won the prize if only one of them had picked a different colored card, so if....Can you guess how he finishes his wish?"

For the physical manipulation task the children were asked to indicate how the objects the puppets were playing with (e.g., the cards) would look if they had won the prize e.g., "Can you show me how the cards would look if they had won?". Our interest here was to observe which puppets' objects the children would change: the object of the puppet who took his turn first (e.g., Al) or the object of the puppet who took his turn second (e.g., Bill). In both the sentence completion and the physical manipulation tasks we were interested in whether the children's responses made reference to the first or second events. The order in which the children undo the events can give us a clue to the

mutability of an event as it may indicate which event they focus on when they think "if only".

For the children's judgements of emotions and social ascriptions, participants were asked to indicate which puppet felt worse, "Which puppet do you think feels worse about them not winning the prize?". As well as this general measure of emotion, we included two more specific judgements about who felt more guilt and which puppet was blamed by the other. For these questions we simulated the puppets whispering to the experimenter about how they felt. The question about guilt was, "One of these two puppets just said that they feel guilty about them not winning the prize. Which puppet do you think said that?". The question about blame was ,"One of these puppets just said that they really blame the other one for not winning the prize. Which puppet do you think said that?".

The children were also asked a causal question about why the puppets did not win the prize, e.g., "Can you tell me why the puppets didn't win the prize?". This question measures what type of causal attributions the children offer in relation to the puppets not winning. Specifically, whether the children mention the order in which the puppets took their turn, may provide a clue as to whether they are holding in mind one event (e.g., the first or the second event) more so than the other.

There were two comprehension questions about the winning conditions. One was included directly after the winning conditions were described, "Can you show me how they both can win?" and the second recall comprehension question was asked at the end of the task. For this question, Oscar was introduced again in the following way: "Guess what? Oscar's forgotten how they could have won the prize! Can you remind him?" (See Appendix F for a full listing of the three scenarios and their questions).

Design and Procedure

The children were tested individually in a room adjacent to their classroom by the author. The children sat at a desk facing the experimenter. All children were told, "I'm going to show you some puppets playing different games with cards, marbles and coins, and I'm going to ask you some things about the games and what the puppets said after they played each game.". The three scenarios were then presented to the children with the use of puppets (e.g., the two individuals playing the game and Oscar, their friend) and props (e.g., the objects necessary to play the games: the cards, marbles and coins). The two puppets sat facing the children with the play objects sitting in front of them. The experimenter manipulated the play objects to simulate the puppets playing the games.

For example, for the card scenario, the experimenter placed a pile of red and brown cards facedown in front of the two puppets, Al and Bill, (e.g., "Each puppet is given a pile of cards, and each one picks a card from his own pile.") and the participants were shown the cards in order to demonstrate that each pile contained red and brown cards only (e.g., "Can you see that there are only red and brown cards in each pile?"). Two sets of cards of the same colour were then pulled from each pile to demonstrate how the puppets could win (e.g., "Now, if the two cards they pick are the same colour -- so if both are brown or both are red -- each puppet wins the prize. But if the two cards are not the same colour, neither puppet wins anything"), and the children were asked to demonstrate the winning conditions (e.g., "Can you show me how the puppets both can win?"). After the comprehension question the game began. The experimenter pulled a brown card from Al's pile and said, "Al goes first and picks a brown card from his pile". The experimenter then pulled and a red card from Bill's pile and said, "Bill goes next and picks a red card from his pile". The children were then informed of the outcome of the game, "So, neither puppet wins anything".

The scenarios were presented in a different random order for each child. The position of the puppets in each scenario was alternated from left to right to ensure that the children were not only focusing on the position of one particular puppet (e.g., the puppet sitting on their right-hand-side). The coin and marbles scenarios were presented in much the same way as the card game was presented, with the winning conditions of each game being described with the use of props and puppets.

The eight questions were asked in the following fixed order after each scenario: check question, sentence completion, physical manipulation, guilt, blame, worse, causal, check question. For the sentence completion task, the experimenter introduced Oscar, the puppets' friend, and she mimed Oscar whispering his wish in her ear. For the questions about judgements of emotions and social ascriptions (e.g., "Now one of these puppets just told me that they feel guilty about them not winning the prize. Which puppet do you think said that?") the experimenter mimed the two puppets whispering in her ears. Both the physical manipulation task (e.g., "Can you show me how the cards would look if they had won?") and the causal question (e.g., "Can you tell me why they didn't win?") were asked directly without the use of the puppets. Finally for the recall comprehension question, Oscar was re-introduced by the experimenter in order for the children to remind him how the puppets could have won the prize.

Each session lasted on average about 15 minutes and the children were invited to ask questions and talk about the games afterwards. All children received the same three scenarios in a different random order. The design of the experiment was a between participant one with two separate groups: the 6-year-olds and the 8-year-olds.

Results and Discussion

Judgements of emotion and social ascriptions

Guilt Six- and 8-year-olds differ in their judgements of guilt. More 8-year-olds, like

adults, judged the second player would feel guilt rather than the first puppet (66 % vs. 34%, binomial $n = 87$, $z = 2.78$, $p = .0025$; p-values are one-tailed unless otherwise stated). But 6-year-olds judged guilt equally for the second puppet and the first (46 % vs. 53%, binomial $n = 98$ $z = -.51$, $p = .31$). There was a reliable difference between the two age groups for their judgements of guilt $\chi^2(1, N = 185) = 13.87$, p = .0001. Most of the 6-year-olds (97.5%) and all of the 8-year-olds (100%) judged that one or other of the puppets would experience guilt with the remainder of the 6-year-olds indicating that both puppets would feel guilt as Table 5.1 shows.

When the children's judgements of guilt were analysed in terms of the responses given to the individual scenarios, a somewhat mixed pattern of results was found for each of the three individual scenarios (See Appendix F for further details).

Table 5.1 Percentage of judgements of guilt given by the two age groups overall across the three scenarios in Experiment 6.

	6-year-olds	**8-year-olds**	**Total**
Overall			
First mentioned	53	34	44
Second mentioned	46	66	55
Both	1	0	1

Blame Six- and 8-year-olds also differ in their judgements of blame. More 8-year-olds, like adults, judged that the first puppet would blame the second puppet rather than that the second puppet would blame the first (69% vs. 31%, binomial $n = 87$, $z = 3.43$, $p = .0001$). But 6-year-olds judged blame equally for the first puppet and the second (48% vs. 52%, binomial $n = 99$, $z = -.20$, $p = .42$). The two groups differed reliably in their judgements of blame $\chi^2(1, N = 186) = 7.98$, p = .0025. All of the 6-year-olds (100%) and 8-year-olds (100%) judged that either one of the puppets would blame the other one as Table 5.2 shows.

When the children's judgements of blame are analysed in terms of the responses

given to the individual scenarios, again, a mixed pattern of results was found for each of the three individual scenarios (See Appendix F for further details).

Table 5.2 Percentage of blame ascriptions given by the two age groups overall across the three scenarios in Experiment 6.

	6-year-olds	8-year-olds	Total
Overall			
First mentioned	48	69	58
Second mentioned	52	31	42

Worse As Table 5.3 shows, the children's judgements of who would feel worse for not winning show a similar pattern for 6-year-olds and 8-year-olds. More 8-year-olds judged that the second puppet would feel worse compared to the first puppet (75% vs. 25% binomial $n = 87$, $z = 4.5$, $p = .0001$) as did the 6-year-olds (61% vs. 35%, binomial $n = 95$, $z = 2.46$, $p = .007$). But again the two age groups differed in their judgements of who feels worse, $\chi^2 (1, N = 182) = 2.81$, $p = .047$. The majority of the 6-year-olds (96%) and all of the 8-year-olds (100%) judged that one or other of the puppets would feel worse, with 2% of the remaining 6-year-olds judging that neither of the puppets felt worse and the other 2% judging that both puppets felt worse.

When the children's judgements of who feels worse were analysed in terms of the responses given to the individual scenarios, essentially the same pattern of results were found for each of the three individual scenarios (See Appendix F for further details).

Table 5.3 Percentage of judgements of who feels worse given by the two age groups overall across the three scenarios in Experiment 6.

	6-year-olds	8-year-olds	Total
Worse			
First mentioned	35	25	31
Second mentioned	61	75	67
Neither	1	0	.5
Both	3	0	1.5

"If only" thoughts

Children's "if only" thoughts were measured by a sentence completion task and a physical manipulation task.

Sentence completion task For the sentence completion task, the results show that for those children whose sentence stem completions focused on a single event (e.g., "If only Bill had picked a brown card"), the temporal order effect was observed for both age groups. Overall across the three scenarios, reliably more 6-year-olds (58% vs. 24%, binomial $n = 81$, $z = 3.55$, $p = .0001$) and 8-year-olds (60% vs. 23%, binomial $n = 72$, $z = 3.65$, $p = .0001$) mentally undid the second event rather than the first. The two age groups did not differ, $\chi^2(1, N = 153) =. 06$, $p = .40$.

Table 5.4 presents the percentages of sentence stem completions that focused on the first event or the second event overall, and the breakdown of these mutations into those that undid only one event (e.g., "If only Bill had picked a brown card") and those that undid one event and posed the other as an alternative (e.g., "If only Bill had picked a brown card or Al had picked a red card"). We combined the two sorts of responses in a second analysis on the basis that the order of mention gives us a clue to the mutability of an event. The temporal order effect was found for mutations that focused on the second or

first events, or both, for the 6-year-olds (64% vs. 25%, binomial $n = 88$, $z = 3.94$ $p = .0001$) and the 8-year-olds (63.5 % vs. 25%, binomial $n = 77$, $z = 3.65$ $p = .0001$). The two age groups did not differ for those children who undid both events, $\chi^2 (1, N = 165) = .01, p = .49$.

Overall, most children in both age groups undid the first, the second, or both events (6-year-olds: 92% overall; 8-year-olds: 88.5% overall), with the majority of the remaining sentence completions (6-year-olds: 8%; 8-year-olds: 11.5%) comprising of statements that were a repetition of the wish uttered by Oscar (e.g., "They could have won the prize if only one of them had picked a different coloured card").

When the children's sentence stem completions were analysed in terms of the responses given to the individual scenarios, essentially the same pattern of results were found for each of the three individual scenarios (See Appendix F for further details).

Table 5.4 Percentages of mutations of each event for the sentence completion task given by the two age groups across the three scenarios in Experiment 6.

	6-year-olds	8-year-olds	Total
Overall sentence completion			
First mentioned only	24	23	23.5
First then second	1	2	2
First mentioned overall	25	25	25.5
Second mentioned only	58	60	58.5
Second then first	6	3.5	5
Second mentioned overall	64	63.5	63.5
Other	11	11.5	11

Physical manipulation task We asked the children how the objects (e.g., cards, coins and marbles) in the scenarios would look if the puppets had won. We wished to encourage the children to physically undo an event or events in the scenarios so as to change the losing outcome to a winning outcome. The order in which the children undo the events can give us a clue to the mutability of an event. The temporal order effect was

observed for both age groups in the physical manipulation task. For those 6-year-olds whose mutations focused on a single event overall across the three scenarios, reliably more 6-year-olds physically undid the second event rather than the first event (57% vs. 25%, binomial $n = 94$, $z = 1.75$, $p = .04$). For those 8-year-olds whose mutations focused on a single event overall across the three scenarios, more 8-year-olds physically undid the second event rather than the first event (64% vs. 22%, binomial $n = 75$, $z = 4.16$, $p = .0001$). The two age groups did not differ, $\chi^2(1, N = 156) = .33$, $p = .28$.

Table 5.5 presents the percentages of mutations of the second event or the first event overall, and the breakdown of these mutations into those that undid only one event (e.g., Bill's red card is changed to a brown card) and those that undid one event and posed the other as an alternative (e.g., first Bill's red card is changed to a brown card so that two brown cards are showing; then Al's brown card is changed to a red card and Bill's card is returned to a red card so that two red cards are showing). We combined the two sorts of responses in a second analysis on the basis that the order in which the objects were changed can give us a clue to the mutability of an event. More 6-year-olds undid the second event rather than the first (69% vs. 31%, binomial $n = 99$, $z = 3.62$, $p = .0001$), as did the 8-year-olds (73 % vs. 27%, binomial $n = 87$, $z = 4.28$, $p = .0001$). The two age groups did not differ for those children who focused on the second or first, or both events, $\chi^2(1, N = 186) = .52$, $p = .14$. Overall, all of the 6-year-olds (100%) and the 8-year-olds (100%) undid the first, the second or both events.

When the children's responses were analysed in terms of the responses given to the individual scenarios, essentially the same pattern of results were found for each of the three individual scenarios (See Appendix F for further details).

Table 5.5 Percentages of mutations of each event for the physical manipulation task given by the two age groups across the three scenarios in Experiment 6.

	6-year-olds	8-year-olds	Total
Overall Physical manipulation			
First changed only	25	22	24
First then second	6	5	5
First changed overall	31	27	29
Second changed only	57	64	60
Second then first	12	9	11
Second changed overall	69	73	71

Causal Question

We asked the children why the puppets did not win. If the children's causal attributions refer to either event, the order of reference to these events may provide a clue to the mutability of the events. Overall, for children who explained why the puppets did not win by referring to a single event, more 6-year-olds mentioned the second event rather than the first (18% vs. 2%, binomial $n = 20$, $z = 3.35$, $p = .0001$), as did 8-year-olds (24% vs. 4.5%, binomial, $n = 28$, $z = 3.59$, $p = .0001$). The two age groups did not differ, $\chi^2(1, N = 48) = 196$, $p = .33$.

Table 5.6 presents the percentages of references to the first event or the second event overall for the three scenarios, and the breakdown of these references into those that mentioned only one event (e.g., "They didn't win the prize because Al picked a red card") and those that mentioned one event and then the other (e.g., "They didn't win because Al picked a red card and then Bill picked a brown card" or "They didn't win because Bill picked a brown card and Al picked a red card".) We combined the two sorts of responses in a second analysis on the basis that the order of mention provides a clue to the mutability of an event. On this analysis slightly more 6-year-olds mentioned the second event followed by the first, (33% vs. 27%, binomial, $n = 60$, $z = 0.65$, $p = .26$) but not reliably so. More 8-year-olds mentioned the second event followed by the first (50.5

% vs. 10.5%, binomial, $n = 53$, $z = 4.67$, $p = .0001$). The two age groups differed, $\chi^2(1, N = 113) = 10.18$, $p = .0001$.

Overall, 60% of the 6-year-olds and 61% the 8-year-olds mentioned the first, the second or both events. For the remaining responses, 38% of the 6-year-olds and 37% of the 8-year-olds made reference to the winning conditions not being met (e.g., "Because the cards they picked were different/were not the same"), and the remaining 2% in both age groups made reference to other situational factors (e.g. "Because that's the way it happened" or "Because that's the way the coins landed").

When the children's explanations were analysed in terms of the responses they gave to the individual scenarios, essentially the same pattern of results were found for each of the three individual scenarios (See Appendix F for further details).

Table 5.6 Percentage of causal attributions for each event given by the two age groups across the three scenarios in Experiment 6.

	6-year-olds	**8-year-olds**	**Total**
Overall			
First mentioned only	2	4.5	3
First then second	25	6	16
First mentioned overall	27	10.5	19
Second mentioned only	18	24	22.5
Second then first	15	23	19
Second mentioned overall	33	50.5	41.5
"Different"	38	37	37.5
Other	2	2	2

The experiment reveals that the temporal order effect in "if only" judgements emerges early in children's thinking. The results show a temporal order effect for both the 6-year-olds and the 8-year-olds in their sentence stem completions, in their physical manipulations and in their judgements of why an outcome occurred (although the 6-year-olds exhibited the temporal order effect for their causal judgements when they focused on a single event only). The early emergence of the temporal order effect in children's

counterfactual thoughts is consistent with the proposal that the effect reflects very fundamental properties of the nature of the mental representations that people construct of reality (Byrne, 2005; Byrne et al., 2000). Children may mentally represent the facts of the game by envisaging a single possibility, Al picked a red card and Bill picked a brown card, and the first event anchors the representation and appears immutable, just as it does for adults.

The experiment reveals a developmental trend in the emergence of the temporal order effect in children for their judgements of guilt and blame. Eight-year-olds judged that the second player would feel more guilt than the first player, and be blamed more by the first player, just like adults. But 6-year-olds did not. This result is consistent with previous findings which suggest that children's understanding of guilt emerges sometime during 7 to 9 years of age (e.g., Harris et al., 1987; Tangney, 1995). However, for the more general question of who feels worse, both 6- and 8-year-olds exhibited the temporal order effect, judging that the second player would feel worse. This finding suggests that 6-year-olds appear to be able to co-ordinate the processes involved in the attribution of the more general judgement of who feels worse for the temporal order effect. Judgements of guilt and blame do not emerge simultaneously with the judgement of who feels worse. Judgements of guilt and blame may require a more sophisticated understanding of second-order mental states than is required for the more general judgment of who feels worse.

The results show a dissociation between judgements of emotion and "if only" thoughts. The dissociation occurs for the 6-year-olds, who focus on the second player in their "if only" thoughts, but who do not judge the second player to feel more guilt or to be blamed more. (The 8-year-olds focus on the second player in their "if only" thoughts and they judge the second player to feel more guilt and be blamed more, just like adults). The results suggest that for the temporal order effect, children may rely on a counterfactual

strategy for their attributions of judgements of emotions, but that the amplification of emotions by the representation of a counterfactual alternative may emerge developmentally.

Summary

Overall, the results show that 6- and 8-year-olds tend to undo the most recent event in a sequence of independent events, just as adults do. Six- and 8-year-olds tend to focus on the second event in their "if only" sentence stem completions, they tend to manipulate the second puppet's object to win, and they explain the outcome with reference to the second puppet. Taken together, these findings show that there is an early emergence to the temporal order effect in children's thoughts about what might have been "if only". The results also show that 6- and 8-year-olds exhibit the temporal order effect in their judgements of who feels worse. Children's judgements of who feels worse for the temporal order effect emerge early in development. But there is a developmental trend to the emergence of children's judgements of guilt and blame for the temporal order effect: 8-year-olds, but not 6-year-olds, tended to judge that the second puppet would feel more guilt and would be blamed more. As a result, there is a dissociation between 6-year-olds' "if only" judgements and their judgements of guilt and blame. These findings suggest that the attribution of judgements of guilt and blame may require a richer understanding of mental states in others than the more general judgement of who feels worse.

General Discussion

The aim of this chapter was to examine the temporal order effect in the "if only" thoughts, causal explanations and judgements of emotion and social ascriptions in 6-year-olds and 8-year-olds. We wished to test whether 6- and-8-year-olds tend to undo their mental representation of a factual situation when they think about a counterfactual

possibility in the same way as adults. We also wished to test whether 6- and 8-year-olds show the temporal order effect in their judgements of guilt, blame and who feels worse.

The experiment shows that both 6-year-olds and 8-year-olds exhibit the temporal order effect in their "if only" thoughts. They undid the second event rather than the first in both the sentence completion task and the physical manipulation task and they referred to the second puppet more often than the first in their explanations for why the puppets did not win.

The experiment also shows that both age groups exhibit the temporal order effect in their judgements of who feels worse, that is, they judged that the second puppet would feel worse than the first puppet. However, the age groups differed in their judgements of guilt and blame: the 8-year-olds showed the temporal order effect in their judgements of guilt and blame, judging that the second player would feel more guilt and be blamed more by the first puppet, just as adults do. But the 6-year-olds did not. As a result, the experiment reveals a dissociation between the 6-year-olds' "if only" thoughts and their judgements of guilt and blame (the 8-year-olds exhibited the temporal order effect for their "if only" thoughts and judgements of emotions and social ascriptions).

That the experiment found a temporal order effect in 6- and 8-year-olds' "if only" thoughts suggests that the effect emerges early in the development of counterfactual thinking. This effect may emerge early in development because it reflects very fundamental properties of the mental representations that people construct of reality. Children, like adults, may mentally represent the facts of the game by envisaging a single possibility, Al picked a red card and Bill picked a brown card. They may think about how the game turned out differently by envisaging only one of several counterfactual possibilities, Al picked a red card and Bill picked a red card, because the first event anchors the representation and renders it immutable, just as it does for adults.

Both 6-year-olds and 8-year-olds exhibit the temporal order effect in their judgements of who feels worse. This finding shows that there is an association between 6- and 8-year-olds' "if only" thoughts and their judgements of who feels worse. It has been proposed that highly mutable aspects of reality, such as actions and exceptional events, may support the co-ordination of emotional attribution in counterfactual situations (Ferrell, 2005). The findings from the current experiment suggest that the mutability of the most recent event in a sequence of independent events helps children to make counterfactual judgements of who feels worse. Children as young as 6 years appear to be able to co-ordinate the ability to think counterfactually with the ability to adopt differing perspectives when they make judgements of who feels worse, at least for the temporal order effect. This ability may emerge early in development as a result of the early emergence of the temporal order effect if children's "if only" thoughts.

However, there is a developmental trend to the emergence of the temporal order effect for the children's judgements of guilt and blame: 8-year-olds exhibit the temporal order effect in their judgements of guilt and blame, but 6-year-olds do not. This finding is consistent with the view that guilt attribution requires a complex understanding of the mental states of others. Children must be aware that an agent's negative affect (guilt) is mediated by the negative affect (e.g., disapproval) of an "audience" (Harris, 1989). For example, 8-year-old children judged that the second player, Bill, felt more guilt than the first player, Al. In order to arrive at this judgement children must mentally represent that Al (who is the audience in this case), feels negative affect because Bill picked the brown card. They must then ascribe negative affect (guilt) to Bill based on their representation of how Al feels. Such mental state ascription may exceed the cognitive resources of 6-year-old children.

Furthermore, that children's judgements of who feels worse do not emerge simultaneously with their judgements of guilt and blame suggests that guilt attribution

requires a richer understanding of second-order mental state ascription than the more general judgement of who feels worse. To make a judgement about who feels worse, children need to be aware that a certain outcome has occurred and that two individuals feel negative affect as a result. They then need to judge which individual feels more negative affect, which may rest on their counterfactual representation of the facts. For example, 6- and 8-year-old children judged that Bill felt worse than Al. In order to arrive at this judgement, children need to represent that Bill feels worse because if he had picked the red card they both would have won. They do not need to take into account that the negative affect of one individual is mediated by the negative affect of the other. Judgements of who feels worse may not require the same degree of mental state understanding that is required in judgements of guilt.

These findings therefore suggest that 6-year-olds may be able to co-ordinate the processes involved in the attribution of judgements of who feels worse for the temporal order effect, but the attribution of judgements of guilt and blame may exceed their abilities. When children think about how the last event in a sequence of independent events could have been different, they may be able to co-ordinate their ability to think counterfactually with their ability to adopt differing perspectives for the more general judgements of who feels worse. But they may fail to co-ordinate the processes involved for the attribution of guilt and blame in such a situation because a more complex understanding of the mental states of others may be required. The ability to co-ordinate the processes involved in order to make judgements of emotion may depend on the complexity of the mental state ascription required.

The experiment also shows that the children's responses to the questions for the card scenario differed from their responses to the scenarios about the coins and marbles (See Appendix F for the separate analyses of the children's responses to each question for each of the three individual scenarios). The experiment shows that neither the 6-year-olds

nor the 8-year-olds exhibited a temporal order effect in their "if only" thoughts for the card scenario. For the children's judgements of emotion and social ascriptions, the temporal order effect was reversed for the 6-year-olds and the effect did not occur at all for the 8-year-olds. These findings suggest that children's mental representation of the facts of the card scenario differs from their mental representation of the coin and marbles scenarios and that neither event is more mutable than the other. This difference may be due to the way in which children understand card games. At a very young age many children become familiar with the rules of card games such as "Snap". In such a card game the objective is to identify when two cards sharing the same number (e.g., the 7 of Spades and the 7 of Hearts) appear. One card must be immediately followed by another matching card. The sequence of events leading up to a winning outcome is an independent one, as both events (the appearance of the 7 of Spades and the subsequent appearance of the 7 of Hearts) occur by chance. However, the sequence of events is usually longer than the sequence of events observed by the children in Experiment 6: very often a game of "snap" may require many cards to be placed on top of each other before the winning conditions are met. Children in the experiment may have understood the card game in a different way than they understood the coin and marbles scenarios because of their familiarity with more traditional card games that rely on slightly different sets of rules to win.

Finally, when we consider the findings from this experiment in relation to the findings reported in Chapter 4, the experiments show that there is a developmental trend to the emergence of children's judgements of emotions. But there is no developmental trend to the emergence of "if only" thoughts. The second experiment reported in Chapter 4 (Experiment 5) found no action effect in 6- and 8-year-olds' judgements of who will wish "if only" most (Experiment 4 found an action effect for 6-year-olds' "if only" thoughts and judgements of emotions, however Experiment 5 showed that this anomalous

pattern of results may have been because the children did not fully appreciate the independence of the actions and inactions). In contrast, the experiment reported in this chapter found a temporal order effect in 6- and-8-year-olds' "if only" thoughts.

There may be a number of reasons as to why the action effect does not emerge simultaneously with the temporal order effect in children's "if only" thoughts. One possibility is that the tasks used to elicit the action effect (in Experiments 4 and 5) and the temporal order effect (in Experiment 6) are not matched in how they measure counterfactual thoughts. For example, the tasks used to elicit the temporal order effect simply ask the children to envisage a counterfactual alternative (e.g., "They could have won the prize if only…") whereas the tasks used to elicit the action effect require children to make a comparison (e.g., "Which boy do you think made that wish?"). The questions that require children to make a comparative judgement may be more difficult than the questions which require them to complete a counterfactual "if only" thought. As a result, the comparison tasks may not elicit the action effect in children's "if only" thoughts. However, the tasks used to measure the action effect in children's judgements of emotions in Experiments 4 and 5 are also comparative in nature (e.g., "which boy do you think feels worse…?") and yet the 8-year-olds exhibited the action effect in their judgements of who feels worse. Similarly, Guttentag and Ferrell (2004) found that children aged 7- and 9 years showed the action effect in their judgements of emotions when they were asked to judge which one of two characters felt worse. These findings suggest that the difference between the temporal order effect and the action effect is not merely due to task demands.

Another possibility is that there may be a fundamental difference in how children think about these two different phenomena. This difference may rest on the possibilities that children keep in mind when they think about the factual situation. When adults think about actions, they tend to keep in mind two possibilities for the facts: the past pre-action

possibility and the post-action possibility (Byrne, 2005). But the action effect may not occur for children's "if only" thoughts because, unlike adults, they may tend to think about actions by mentally representing the current reality without keeping track of the pre-action situation. When they think about the facts, they may envisage just a single possibility for the representation of both actions and inactions. As a result, they wish "if only" about actions and inactions equally. Actions may be more complex because they require a richer representation of the factual situation, which may exceed the representational abilities of children aged 6- and 8-years. Although children may be able to keep in mind two possibilities when they think about the counterfactual situation, they may not spontaneously keep in mind two possibilities when they think about the factual situation. But the temporal order effect is different because it requires people to envisage just one possibility when they think about the facts. The findings from Experiment 6 suggest that children understand the story about the coin toss by keeping in mind a single possibility for the facts (e.g., that John tossed heads and Michael tossed tails) and a single possibility for the counterfactual alternative (e.g., that John tossed heads and Michael tossed heads). Children envisage a single possibility for the factual situation and a single possibility for the counterfactual alternative because the first event acts as an anchor and thus appears immutable. The early emergence of the temporal order effect may suggest that it reflects very fundamental properties of the nature of the mental representations that people construct of the factual situation.

Conclusions

The findings from the experiment reported in this chapter suggest that the temporal order effect in children's "if only" thoughts emerges early in the development of children's imaginative thinking. When children think about the last event in an independent sequence of events they may mentally represent the facts of the situation by envisaging a

single possibility, just as adults do. When they think about how the situation could have been different, they mentally undo the most recent event because the first event may act as an anchor and thus render it immutable.

There is a developmental trend to the emergence of the temporal order effect in children's judgements of guilt and blame. Six-year-olds exhibit the temporal order effect for their judgements of who feels worse, but not for their judgements of guilt and blame. This developmental shift in children's ascription of judgements of emotions in counterfactual situations may be due to the degree of mental state understanding that is required. Although counterfactual judgements of who feels worse may require second-order mental state understanding, judgements of guilt and blame may require a more sophisticated understanding of the mental states of others (e.g., Harris, 1989).

There is a developmental trend to the amplification of emotions by the representation of the counterfactual alternative for the temporal order effect. Children may attribute adult-like judgements of who feels worse because the mental representation of the counterfactual situation helps them to co-ordinate the processes involved for the attribution of counterfactual judgements. But the richer understanding of second-order mental state ascription that may be required for judgements of guilt and blame may underlie the dissociation between the "if only" thoughts and judgements of guilt and blame of 6-year-olds. Children appear to rely on a counterfactual strategy for their counterfactual judgements for the temporal order effect, perhaps because it reflects fundamental properties of the nature of the mental representations that people construct of reality. When children aged 6 years and 8 years think about how the last event in a sequence of independent events could have turned out differently they show systematic regularities in how they mentally undo reality to create a counterfactual alternative.

Chapter 6 Discussion

Our aim in this thesis was to examine how children think about counterfactual possibilities. We wished to examine the mental representations that children construct when they consider counterfactual alternatives to a factual situation.

We carried out two series of experiments on children's counterfactual thinking. The first series comprised of three experiments that examined how 3- and 4-year-olds think about counterfactual possibilities: in Chapter 2 we described an initial experiment which aimed to explore the difficulty 3- and 4-year-olds experience when they answer counterfactual questions; in Chapter 3, we presented two further experiments that examined whether instructions to form a mental representation of the counterfactual possibility help pre-schoolers to answer counterfactual questions. The second series of experiments comprised of three experiments that examined the development of counterfactual thoughts in 6- and 8-year-old children. We wished to examine whether children keep in mind the same possibilities as adults when they think about counterfactual situations: in Chapter 4 we reported two experiments that examined whether children, like adults, show an action effect in their "if only" thoughts and their judgements of emotions; in Chapter 5 we described a final experiment that examined whether children, like adults, show a temporal order effect in their "if only" thoughts and judgements of emotions and social ascriptions.

This chapter is divided into three main sections. In the first section we will summarize our findings from the two series of experiments respectively. In the second section we will discuss the implications of the findings: we will discuss the implications for understanding the development of counterfactual thinking and their implications for the development of theories of mental representations. We consider the implications for understanding the development of emotions and for understanding early social cognition.

In the final section we will suggest some possibilities for future work in this burgeoning area of research.

Summary of Findings

Counterfactual Thinking in Pre-school Children

In Chapters 2 and 3 we examined how 3- and 4-year-old children think about counterfactual situations. A number of studies suggest that pre-school children encounter difficulties with counterfactual questions (e.g., Riggs et al., 1998) but some of the findings are inconclusive as to the nature of this difficulty (e.g., Robinson & Beck, 2000). It has been proposed that the complexity of the factual situation that children must reason about may be an important variable in counterfactual task performance (e.g., German & Nichols, 2003; Perner et al., 2004). Other studies show that young children can readily imagine counterfactual alternatives (Harris et al., 1996), especially when they think about how a bad outcome could have turned out differently (German, 1999).

Counterfactual Thinking in Pre-Schoolers: An Exploratory Experiment

In Chapter 2 we described an initial experiment on counterfactual thinking in pre-school children. The aim of Experiment 1 was to tentatively explore the possibility that responses given by 3- and 4-year-olds to counterfactual questions are affected by a reality bias, that is, a difficulty disengaging from current reality to access a counterfactual alternative (e.g., Robinson & Beck, 2000). We aimed to explore how pre-schoolers respond to counterfactual questions when they are instructed to focus on either the current reality, or the now past counterfactual possibility in a causal story. On the reality bias account, instructions to focus on current reality may prevent children from disengaging from reality to access the counterfactual alternative.

We gave 3- and 4-year-old children stories such as the following: "Billie is a bunny. He lives in a forest. He likes to play with his bunny friends. He goes to the field to play with them. But the field is empty. Then one day the field is full of bunnies. And now Billie is happy because he is able to play with his friends." We asked them a counterfactual question, "If the field had not been full of bunnies, would Billie be able to play with his friends now?". Each sentence in the story was accompanied by a picture. There were two good outcome and two bad outcome stories. There were three groups, that is, two experimental groups and one control group. Before the counterfactual question, the "reality" experimental group was instructed to think about the picture of the current reality (e.g., the field full of bunnies) and the "counterfactual" experimental group was instructed to focus on the picture of the now past, counterfactual possibility in the story (e.g., the empty field). The control group were given no instructions.

The results from Experiment 1 showed that pre-school children can readily answer counterfactual questions such as "If the field not been full of bunnies, would Billie be able to play with his friends now?". The children performed well above chance (80% correct) in their answers to the counterfactual questions overall. This finding is in line with the findings reported by Harris et al. (1996), which showed that even 3-year-olds can answer questions about how a causal outcome could have been different.

The findings also showed that instructions to focus on the current reality (and the counterfactual possibility) reduced the accuracy of children's responses to the counterfactual questions about the bad outcomes stories only. Children in the control group (95%) gave reliably more correct responses to the counterfactual questions about the bad outcomes than the "reality" group (68%) and the "counterfactual" group (80%). But instructions to focus on pictures of the current reality (or the counterfactual possibility) did not affect the accuracy of children's responses to the counterfactual questions about the good outcome stories. The three groups did not differ in their

responses (control: 73%; reality: 80%; counterfactual: 80%). This finding suggests that the reality bias explanation cannot fully account for the difficulty pre-schoolers encounter when they think about counterfactual situations, because instructions to focus on the current reality do not affect the accuracy of the responses given by the children to the good outcome stories.

The results from Experiment 1 also showed that there were differences between the responses given by the children in the control group to counterfactual questions about good and bad outcome stories. Children who were given no instructions gave reliably more correct answers to the counterfactual questions about the bad outcome stories than about the good outcome stories (95% vs. 78%). This finding is consistent with the claim that pre-school children are more likely to produce counterfactual alternatives when they think about a bad outcome (German, 1999).

In summary, the findings from the initial experiment suggest that a difficulty disengaging from current reality is not the primary factor contributing to the difficulties encountered by pre-school children when engage in counterfactual thinking. However, the findings do not rule out the possibility that the way in which children think about reality, and its counterfactual alternative, may play an important role in determining how counterfactual thought develops in early childhood. We wished to explore the difficulties that pre-school children may experience when they answer counterfactual questions in more detail in the experiments reported in Chapter 3.

Thinking About Possibilities: Mental Imagery in Pre-Schoolers' Counterfactual Thinking

In Chapter 3 we explored some of the issues relating to the preliminary findings from Experiment 1 in more detail and we examined how mental imagery instructions affect pre-school children's answers to counterfactual questions. We proposed that the difficulty pre-school children experience with counterfactual situations rests on the possibilities

they must mentally represent. When adults think about counterfactual alternatives to reality, they tend to keep in mind two possibilities from the outset: the reality and the counterfactual possibility (Byrne, 2005). Pre-school children may err on counterfactual tasks because they may have difficulty keeping in mind two possibilities. They may tend to keep in mind just one possibility, that is, the one corresponding to reality. On this account, pre-school children may be helped to answer counterfactual questions when they are helped to keep in mind not only the reality, but also the counterfactual possibility.

In Experiment 2 we gave 3- and 4-year-olds the same four stories used in Experiment 1, but no pictures were shown. There were six groups: for each age group there were two imagery groups and one control group. Children in the image-counterfactual group were instructed to make a picture in their heads of the counterfactual possibility (e.g., the empty field) and those in the image-reality group were instructed to make a picture in their heads of the current reality of the story (e.g., the field full of bunnies). Children in the control group were given no mental imagery instructions. We expected that instructions to form a mental representation of the counterfactual possibility would help children to answer counterfactual questions compared to no instructions or instructions to image the current reality.

The results from Experiment 2 showed that there is an age difference in how instructions to form a mental representation of the counterfactual possibility help pre-school children. Three-year-old children in the image-counterfactual group (90%) gave reliably more correct answers to the counterfactual questions about bad outcomes than the control group (60%) and marginally more compared to the image-reality group (68%). In contrast, 3-year-olds in the image-reality group (91%) gave reliably more correct answers to the counterfactual questions about the good outcome stories than the image-counterfactual group (65%) and marginally more compared to the control group (75%). The findings suggest that 3-year-olds were helped to answer counterfactual questions

about bad outcomes when they imaged the counterfactual possibility (e.g., "Make a picture inside your head of all the snow on the mountain"), whereas they were helped to answer counterfactual questions about good outcomes when they imaged the current reality (e.g., "Make a picture inside your head of the field full of bunnies"). In contrast, the results showed that the 4-year-olds in the counterfactual group (75%) gave more correct answers to the counterfactual questions overall compared to the image-reality group (58%) and the control group (55%), although the latter difference was marginal. Both age groups performed well on the counterfactual task overall: both the 3-year-olds (75% correct) and the 4-year-olds (65% correct) performed above chance.

The results from Experiment 2 suggest that there is a finer distinction in how instructions to image a counterfactual possibility help 3-year-olds and 4-year-olds to answer counterfactual questions. The instructions to image the counterfactual possibility concern a presence (all the snow) for the bad outcome stories and an absence for the good outcome stories (empty field). In contrast, instructions to image the current reality concern a presence for the good outcome stories (field full of bunnies) and an absence for the bad outcome stories (melting snow). Three-year-olds appear to be helped most by imaging a possibility that concerns a presence. The results suggest that by the age of 4-years, children appear to be able to image both an absence as well as a presence, and instructions to image the counterfactual possibility may help children to answer counterfactual questions.

Experiment 3 aimed to test whether pre-school children are helped to answer counterfactual questions by imaging a counterfactual possibility when it concerns a presence or an absence. We expected that 3-year-olds should be able to answer counterfactual questions more readily when the counterfactual possibility corresponded to a presence rather than an absence. In contrast, we expected that instructions to image a counterfactual possibility corresponding to an absence or a presence would not affect the

accuracy of 4-year-olds' responses to counterfactual questions. There were six groups: two imagery groups and a control group for each age group (3-year-olds; 4-year-olds). We gave the children four stories about bad outcomes that were based on the stories used in the previous experiments. Children in the two imagery groups were instructed to make a picture in their heads of a possibility concerning a presence for half of the stories (e.g., "Make a picture inside your head of the field full of bunnies") and a possibility concerning an absence for the other half (e.g., "Make a picture inside your head of the empty field").

The results from Experiment 3 supported our predictions. Three-year-olds in the image-counterfactual group gave significantly fewer correct answers to the counterfactual questions when they were instructed to image an absence (46% correct) rather than a presence (75% correct). In addition, the 3-year-olds in the image-counterfactual group gave significantly fewer correct answers to the counterfactual questions when they imaged an absence (46% correct) compared to the image-reality group who imaged a presence (75% correct). The results also showed that there were no differences in the responses given by the 4-year-olds in either imagery group to the counterfactual questions when they were instructed to image an absence (image-counterfactual group, 60% correct; image-reality group 75% correct) or a presence (image-counterfactual group, 70%; image-reality group, 65% correct). In addition, instructions to image the counterfactual possibility did not help 4-year-olds to answer counterfactual questions overall. Once again, the results showed that both age groups performed well on the counterfactual task, with both the 3-year-olds (67% correct) and the 4-year-olds (65% correct) performing above chance in their overall responses to the counterfactual questions.

These novel results suggest that there is an important age difference in how instructions to image the counterfactual possibility affect pre-schoolers' answers to

counterfactual questions. Three-year-olds encounter difficulty answering counterfactual questions when they image a possibility corresponding to an absence. But instructions to image a counterfactual possibility or a current reality that concern an absence do not appear to pose the same difficulty for 4-year-olds in their answers to counterfactual questions. The difficulty 3-year-olds show in imaging an absence appears to be resolved by the age of 4 years. However, the results from Experiment 3 also suggest that instructions to image a counterfactual possibility do not help 4-year-olds to answer counterfactual questions overall. Imaging the counterfactual possibility does not appear to increase the accuracy of 4-year-olds' responses to counterfactual questions overall.

The first experimental series aimed at exploring the difficulties pre-schoolers encounter when they think about what might have been. The results suggest that a reality bias may not be the primary source of this difficulty. Similarly, the difficulty may not rest on the need to keep in mind the situation that is false but temporarily supposes to be true. Instead the results point to a specific difficulty encountered by 3-year-olds, which appears to rest on their inability to think about possibilities that concern an absence. The capacity to think about possibilities which concern an absence may emerge by the age of 4 years. Nonetheless, the results from this first series show that 3- and 4-year-olds exhibit an early competence in their ability to think about how a causal outcome could have turned out differently. In the next series of experiments we wished to examine the development of counterfactual thought beyond the pre-school years and into middle childhood. Relatively few studies have examined counterfactual thought in children aged older than 4 years. The focus of these studies has primarily been on the relation between counterfactual thought and judgements of emotions (e.g., Amsel & Smalley; Guttentag & Ferrell, 2004). In the second series of experiments we examine the possibilities that children keep in mind when they think about counterfactual situations by examining their "if only"

thoughts and we explore the relation between these thoughts and their judgements of emotions.

Counterfactual Thinking in School-Aged Children

When adults think about a counterfactual situation, they tend to keep in mind two possibilities from the outset: the facts and the counterfactual possibility (Byrne, 2005). The experiments reported in Chapter 3 suggest that although pre-schoolers can readily answer counterfactual questions, 3-year-olds may experience a specific difficulty in thinking about possibilities which concern an absence. To our knowledge, few studies have directly examined whether children older than 4 years have difficulty keeping multiple possibilities in mind when they think about a counterfactual alternative to a factual situation. However, by the age of 5 years children can answer counterfactual questions about complex factual situations (Perner et al., 2004). This finding suggests that by the age of 5 years children can mentally represent both possibilities when they reason about how an outcome could have turned out differently.

The experiments reported in Chapters 4 and 5 aimed to explore whether children aged 6 years and 8 years mentally represent the same possibilities as adults when they think about how reality could have turned out differently. Adults tend to undo reality in very regular ways when they think "if only", which has lead to the suggestion that certain aspects of reality are highly mutable (Kahneman & Tversky, 1982). For example, people tend to undo their actions more than their failures to act, at least in the short term (e.g., Kahneman & Tversky, 1982; Landman, 1987) and they tend to undo the last event in a sequence of independent events (e.g., Miller & Gunasegaram, 1990). The way in which adults mentally undo reality to create a counterfactual alternative may reflect fundamental properties of the nature of the mental representations they construct (Byrne, 2005). Examining how children aged 6 years and 8 years mentally undo reality to think about a

counterfactual possibility may help us to understand how children beyond the pre-school years entertain counterfactual situations. For example, examining whether children tend to think "if only" more for actions than inactions may help us to gain insight into the possibilities that children keep in mind when they mentally represent reality and its counterfactual alternatives.

In the experiments reported in Chapter 4 we examined whether children aged 6 years and 8 years show the same tendency as adults to undo actions more than inactions. In Chapter 5 we further examined children's counterfactual thoughts by examining whether they show the same tendency as adults to undo the last event in an independent sequence of events. We also wished to explore the relation between children's counterfactual thoughts and their counterfactual judgements of emotions. It is believed that it is during the middle school years that children's understanding of emotions that are thought to be closely associated with counterfactual thoughts begin to emerge (e.g., Amsel & Smalley, 2000; Tangney, 1995). We wished to examine whether children's judgements of emotion follow the same pattern as their counterfactual thoughts.

The Action Effect in Children's Counterfactual Thoughts

Adults tend to exhibit an action effect in their judgements of emotions and in their "if only" thoughts, in some circumstances at least. They tend to judge greater emotional impact for actions rather than for failures to act, that is, they tend to judge that an actor will feel worse than a non-actor about a bad outcome that is a result of their actions or inactions (Kahneman & Tversky, 1982). Furthermore, their "if only" judgements tend to follow the same pattern as their judgements of emotions, that is, they tend to judge that the actor will think "if only" more than the non-actor (Byrne & McEleney, 2000). This pattern is consistent with the emotional amplification proposal, which suggests that

counterfactual "if only" thoughts amplify judgements of emotions (Kahneman & Miller, 1986).

It has been shown that children aged 7 and 9 years also exhibit the action effect in their judgements of who feels worse, but 5-year-olds do not (Guttentag & Ferrell, 2004). It is unknown whether children's "if only" thoughts follow the same pattern as their judgements of emotions. One aim of the two experiments reported in Chapter 4 was to compare the judgements of emotions provided by 6-year-olds to those provided by 8-year-olds. In doing so we wished to pinpoint the developmental trend in children's judgements of emotions in counterfactual situations more precisely. We expected that the 8-year-olds, like adults and children aged 7- and 9 years, would judge greater emotional impact for actions, but 6-year-olds would not. We also wished to examine whether children's "if only" thoughts would follow the same pattern as their judgements of who feels worse.

In Experiment 4 we gave 6- and 8-year-olds three scenarios about two individuals (or families) who either decide to act, or not to act, in a given situation. Their respective choices both result in a bad outcome. Each scenario was accompanied with pictures. We examined the action effect in the children's judgements of emotions by asking them to indicate which individual, that is, the actor or the non-actor, they judged would feel worse about their decision, or whether they judged them to feel the same. For the children's "if only" thoughts we asked them to judge which individual wished they could have made a different decision, and we asked them to complete the wish.

The results from Experiment 4 showed that as we expected, the two age groups differed in their judgements of who feels worse. The 8-year-olds showed the action effect in their judgements of emotion but the 6-year-olds did not. Reliably more 8-year-olds judged that the actor would feel worse than the non-actor, than vice versa (41% vs. 21%). In contrast, 6-year-olds judged that the actor would feel worse as often as they judged that

the non-actor would feel worse (45% vs. 36%). The results show a developmental trend to the emergence of the action effect in children's judgements of emotions. Children aged 8 years, but not 6 years exhibit the action effect in their judgments of who feels worse.

The results from Experiment 4 also show that the two age groups differed in their judgements of who will wish "if only" most. But there was an inconsistency to the pattern of results. The 6-year-olds showed the action effect in their "if only" thoughts: reliably more 6-year-olds judged that the actor would wish "if only" compared to those who judged that the non-actor would wish "if only" (66% vs. 34%) and following from this judgement, they completed the wish by undoing the actor's actions rather than the non-actor's inactions (48% vs. 26%). However, marginally more 8-year-olds judged that the non-actor will wish "if only" compared to the actor (42% vs. 56%), a pattern which shows a tendency towards a reversal of the standard action effect for "if only" thoughts (although 8-year-olds completed the wish by undoing the non-actor's actions as often as they undid the actor's actions: 27% vs. 29%). This finding is unexpected as it suggests that children's "if only" thoughts do not follow a developmental trend.

Overall, the findings show that there is a dissociation between 6- and 8-year-olds' judgements of emotion and their "if only" thoughts that appears to follow an inconsistent pattern. The 6-year-olds judged that the actor would wish "if only" more often than the non-actor, but they did not judge that the actor would feel worse than the non-actor. In contrast, the 8-year-olds showed a slight tendency towards a reversal of the action effect in their judgements of who will think "if only" most, but they showed the standard action effect in their judgements of emotion, that is, they judged that the actor would feel worse than the non-actor. This finding suggests that, unlike adults, children's "if only" thoughts do not follow the same pattern as their judgements of who feels worse.

These inconsistencies may have had their source in some potential flaws in the methodology of Experiment 4. The description of the scenarios may not have conveyed to

the children that the decisions made by the two individuals were entirely independent of each other. Additionally, children may have been sensitive to the order in which the actions and inactions were described in the scenarios used (the actions were described second). Experiment 5 aimed to test the hypotheses examined in Experiment 4 afresh.

In Experiment 5, we gave children aged 6- and 8 years three new scenarios, which were games about cards, marbles and coins. The children observed the scenarios enacted with the use of props and puppets. The structure of the scenarios followed that of the previous experiment in that two individuals (or puppets in this case) were given a choice to act or not to act (switch their choice of card, marble or coin) and their choice resulted in a bad outcome (they did not win the game). In order to convey that the choices made by each puppet were made independently, the puppet who was not facing the choice was temporarily removed from the game. The order in which the action and the inaction was presented to the children was also varied. We asked the children to indicate which puppet they judged would feel worse or whether they judged them to feel the same. For the children's "if only" thoughts we asked them to judge which puppet wished they could have played the game differently, and we asked them to complete the puppet's wish.

The results from Experiment 5 showed that the two age groups differed in their judgements of emotions. The action effect was observed for the 8-year-olds' judgements of who feels worse, but it was not observed for the 6-year-olds. Reliably more 8-year-olds judged that the actor would feel worse than the non-actor, than vice versa (34% vs. 18%). In contrast, as many 6-year-olds judged that the actor would feel worse as judged that the non-actor would feel worse (27% vs. 21%). These findings replicate the pattern of results for the 6- and 8-year-olds' judgements of emotions reported in Experiment 4. Taken together with those findings reported by Guttentag and Ferrell (2004), our findings suggest that there is a developmental shift between the ages of 6 years and 8 years in how

children make judgments of emotions for actions and inactions in counterfactual situations.

The results from Experiment 5 also showed a more consistent pattern of results for the "if only" thoughts provided by both age groups. There was no age difference for the children's judgements of who will wish "if only" most, or for how they completed this wish (which was contingent upon whether they focused on the actor or the non-actor). As many 6-year-olds judged that the actor wished "if only" as judged that the non-actor wished "if only" (52 % vs. 48%); as did the 8-year-olds (56% vs. 44%). The 8-year-olds completed the counterfactual thought by undoing the actor's actions as often as they undid the non-actor's inactions (44% vs. 32%), as did the 6-year-olds (32% vs. 30%). These findings indicate that the unexpected pattern of results found in the previous experiment for the 8-year-olds' "if only" thoughts may have arisen because the children might not have understood that the decisions made by the two individuals in the scenarios were independent of each other.

Although the results from Experiment 5 showed a more consistent pattern for the children's "if only" thoughts, they showed that the action effect was not observed in the "if only" thoughts provided by either age group. Both the 8-year-olds and the 6-year-olds judged that the actor would wish "if only" as often as the non-actor. This pattern differs from the pattern shown by adults for their "if only" thoughts. The findings suggest that children may mentally represent actions and inactions in a different way to adults. Adults may mentally represent an action by keeping in mind two possibilities from the outset: the pre-action possibility and the post-action possibility. They may mentally represent an inaction by keeping in mind a single possibility. Adults can imagine a counterfactual alternative to an action more readily by rewinding the post-action possibility to be like the pre-action possibility (Byrne, 2005). But children may keep in mind a single possibility

for both actions and inactions and so they may think "if only" for actions and inactions equally.

Finally, the results from Experiment 5 show a dissociation between judgements of emotion and "if only" thoughts for 8-year-olds: they judged that the actor would feel worse than the non-actor, but they did not judge that the actor would wish "if only" most (6-year-olds did not exhibit the action effect for their "if only" thoughts or for their judgements of emotions). This finding suggests that when children aged 6 years think about actions and inactions, they may rely on an outcome-dependent strategy (e.g., Weiner & Graham, 1984), in which judgements of emotion depend solely on the outcome of a situation, for their counterfactual judgements of emotions. But children aged 8 years do not appear to rely entirely on an outcome-dependent strategy. Nor do they appear to rely on a counterfactual strategy in which judgements of emotions are amplified by the creation of a counterfactual alternative (Kahneman & Tversky, 1982) since their "if only" thoughts did not focus on actions more than inactions. Children aged 8 appear to rely on a mixed strategy for their judgements of emotions for actions and inactions. They may rely partially on an outcome-dependent strategy and partially on a counterfactual strategy, perhaps because their capacity to co-ordinate the processes involved in the attribution of counterfactual emotions (e.g., Ferrell, 2005) may only be developing. The development of this capacity may rely on how they mentally represent the factual situation for actions.

In summary, the results from the experiments reported in Chapter 4 suggest that there is a developmental trend to the emergence of the action effect in children's judgements of who feels worse, but that there is no developmental trend to the emergence of children's "if only" thoughts between the ages of 6- and 8 years. The tendency to think "if only" more for actions than inactions may emerge later in development, perhaps because children aged 6- and 8 years envisage a single possibility when they think about both actions and inactions. We wished to further explore 6- and 8-year-olds' "if only"

thoughts in the experiment reported in Chapter 5 by examining the temporal order effect in children's counterfactual thoughts. The temporal order effect is thought to reflect fundamental properties of the nature of the mental representations that people create when they think about the factual situation (Byrne, 2005). We wished to examine whether children mentally represent the same possibilities as adults when they think about the last event in a sequence of independent events and whether there is a developmental trend to the judgements of emotions they make in such a situation.

The Temporal Order Effect in Children's Counterfactual Thinking

Adults tend to imagine a counterfactual alternative to the most recent event in an independent sequence of events (Miller & Gunasegaram, 1990). Consider the story about two players who take turns in an attempt to pick the same colour card to win a prize (e.g., John and Michael must both pick either a red card or a black card to win £1,000. John goes first and picks a red card, Michael goes next and picks a black card, so neither player wins). When adults are asked to imagine how the outcome could have been different, their "if only" thoughts tend to focus on the second event ("If only Michael had picked a red card"). They also tend to judge that the second player will feel more guilt and that they will be blamed more by the first player.

Adults may understand the story about the card game by mentally representing a single possibility for the facts, John picks red and Michael picks black and they lose, and they may imagine just one of several counterfactual possibilities, John picks red and Michael picks red, because the first event acts as an anchor and is therefore less mutable than subsequent events (Byrne et al., 2000). Children may keep in mind the same possibilities as adults, by envisaging just one possibility for the facts and one possibility for the counterfactual alternative.

In Experiment 6 we wished to test whether there is a developmental trend to the emergence of the temporal order effect in children aged 6 years and 8 years. We also wished to test whether children show the temporal order effect in their judgements of guilt, blame, and who feels worse as well as in their "if only" thoughts. Children's understanding of emotions such as guilt emerge around the age of 7 or 8 years (e.g., Bybee, Merisca & Velasco, 1998). It has been suggested that these "second-order" emotions (Fischer & Tangney, 1995) require a sophisticated understanding of the mental states of others that younger children may not possess (Harris, 1989). Furthermore, it has been suggested that the attribution of emotions in counterfactual situations may rest on the ability to think counterfactually as well as the ability to adopt differing perspectives, which requires second-order mental state understanding (Ferrell, 2005). We expected that the two age groups would differ in their judgements of emotions.

The children were presented with three scenarios enacted with puppets and props. The scenarios were based on the games used in Experiment 5, that is, they were about cards, marbles and coins. The structure of the scenarios followed that of the standard temporal order effect scenarios but they were modified for children (e.g., two puppets, Al and Bill, must pick the same colour card to win a prize. Al goes first and picks red, Bill goes next and picks black, so they lose). We measured children's "if only" thoughts with two tasks: a sentence completion task and a physical manipulation task. We also asked them an explanation question about why the puppets did not win. For the judgements of emotions and social ascriptions we asked the children to judge which puppet felt more guilt and which one blamed the other for not winning. We also asked them to judge which puppet felt worse.

The results from Experiment 6 showed that the two age groups differed in their judgements of guilt and blame: reliably more 8-year-olds judged that the second player would feel more guilt (66% vs. 34%) and they judged that the first player would blame

the second rather than the second would blame the first (69% vs. 31%). But 6-year-olds judged guilt equally for the second player and the first (47% vs. 53%). They also judged blame equally for the first player and the second (48% vs. 52%). These findings reveal that there is a developmental trend to the emergence of the temporal order effect in children's judgements of guilt and blame: 8-year-olds, but not 6-year-olds, showed the temporal order effect in both these judgements. There is a developmental shift between the ages of 6 years and 8 years in these counterfactual judgements, which may rest on an understanding of second-order mental states.

The results also showed that the two age groups differed in their judgements of who feels worse, although both age groups exhibited the temporal order effect. More 8-year-olds judged that the second player would feel worse than the first (75% vs. 25%), as did the 6-year-olds (61% vs. 35%). This finding suggests that the more general judgement of who feels worse does not emerge simultaneously with the more specific judgements of guilt and blame. Although all three counterfactual judgements of emotion may require second order-mental state understanding, the nature of the counterfactual judgement of emotion may determine the degree of mental state understanding that is required.

The results from Experiment 6 also showed that the temporal order effect was observed in both age groups' "if only" thoughts: children in both age groups focused on second event more so than the first event in the sentence completion task and in the physical manipulation task. For children whose "if only" sentence completions focused on a single event, reliably more 6-year-olds and 8-year-olds focused on the second event than the first (58% vs. 24% and 52% vs. 20% respectively). For children whose physical manipulations changed a single object, reliably more 6-year-olds and 8-year-olds changed the second object rather than the first (64% vs. 25% and 56% vs. 19% respectively). When we combined responses that focused on one event and those that focused on one event and then the other, a similar pattern was observed.

The results show that the temporal order effect is observed for both age groups for their "if only" thoughts. This finding points to an early emergence of the temporal order effect in children's counterfactual thoughts. This finding is in line with our proposal that children keep in mind the same possibilities as adults for the temporal order effect, perhaps because it reflects fundamental properties of the nature of the mental representations that people construct of reality. In contrast, the results from Experiment 5 suggest that children do not think 'if only" more for actions than inactions, perhaps because children envisage a single possibility for both the factual representation of an action and an inaction. The results also showed that there is a dissociation between 6-year-olds' judgements of emotions and their "if only" thoughts, a pattern which is not observed for 8-year-olds. The temporal order effect was observed for their "if only" thoughts and judgements of who feels worse, but not for their judgements of guilt and blame. The amplification of emotions by the representation of a counterfactual alternative appears to emerge developmentally, which may rest on the amount of mental state understanding required.

In summary, the second series of experiments reported in this thesis aimed to test whether children aged 6 years and 8 years mentally represent the same possibilities as adults when they think about actions and inactions, and when they think about the last event in an independent sequence of events. We also wished to examine whether there was a developmental trend to the judgements of emotions that children make in such counterfactual situations. We found a developmental trend to the emergence of the action effect and the temporal order effect in the children's judgments of emotions, but we did not find a developmental pattern in "if only" thoughts: there is no action effect in the judgements of who will wish "if only" most given by either the 6-year-olds or the 8-year-olds; but there is a temporal order effect in "if only" judgements for both 6-year-olds and 8-year-olds. The action effect and the temporal order effect may not emerge

simultaneously in children's "if only" thoughts because of the possibilities they keep in mind when they think about the factual situation.

Summary of Findings: Conclusions

The aim in this thesis was to examine the development of counterfactual thought from the pre-school years to the middle school years. The experimental results reported in this thesis show that the development of counterfactual thought emerges early in childhood. But pre-schoolers can experience difficulties answering counterfactual questions (e.g., Robinson & Beck, 2000) and these difficulties do not appear to rest on an inability to disengage from current reality or the need to keep in mind the conjectured possibility. However, there appears to be a developmental shift at the age of 4 years in children's ability to think about possibilities that concern an absence. The development of counterfactual thought during middle childhood also appears to be marked by a developmental shift in how children make counterfactual judgements of emotion. Children aged 6 years and 8 years differ in how they make judgements of emotions and social ascriptions. By the age of 8 years children make counterfactual judgements of emotions that are comparable to those made by adults. But children do not show the same consistency in their "if only" thoughts. The action effect in children's "if only" thoughts does not emerge simultaneously with the emergence of the temporal order effect, which emerges early in the development of counterfactual thought.

Implications

In this section we consider the implications of the experimental results. We first consider how the findings from our experiments contribute to our understanding of the development of counterfactual thought from early to middle childhood. We then consider the implications for understanding the development of children's ability to think about

possibilities and for their ability to attribute emotions in counterfactual situations. We also consider the ways in which our experimental results might contribute to understanding early social cognition.

Implications for Understanding The Development of Counterfactual Thinking

The experimental results contribute to understanding children's counterfactual thinking by addressing two key issues: the difficulty 3- and 4-year-old children experience when they think about counterfactual situations, and how 6- and 8-year-old children mentally undo reality to imagine counterfactual alternatives to it. This section considers the implications of the experimental results for these key issues.

The work in this thesis may help to discern the exact nature of the difficulty experienced by pre-school children when they think about counterfactual situations. The findings from Experiment 3 show there is a developmental trend to the nature of the difficulties encountered by pre-school children. Three-year-olds experience difficulties thinking about possibilities that concern an absence, but by the age of 4 years, this specific difficulty appears to be resolved. That there is a developmental shift in how pre-schoolers think about mental representations concerning an absence has a number of implications for understanding the development of counterfactual thinking. First, the finding shows that there is a specific aspect of counterfactual thinking that 3-year-olds have difficulty with, that is, the absence-based nature of many counterfactual thoughts. Counterfactual thoughts often involve thinking about an absence. Adults are more likely to think about counterfactual alternatives when an outcome is negative (e.g., Gavanski & Wells, 1989) and their counterfactual thoughts are often subtractive in nature (Roese & Olson, 1993), that is, they focus on removing an element from their representation of the factual situation e.g., "If only I had taken my shoes off I would not have slipped". Although pre-schoolers are more likely to think about counterfactual alternatives to bad

outcomes than good outcomes (German, 1999) they rarely produce counterfactuals that are subtractive in nature (Guajardo & Turley-Ames, 2004). This finding, taken together with the findings reported in Chapter 3 of this thesis suggest that 3-year-old children have difficulty in mentally undoing an outcome that requires them to mentally remove an element from the factual situation.

But the findings from Chapter 3 show that 4-year-olds do not have the same difficulty with the absence-based nature of counterfactual thoughts. Four-year-olds appear to be able to think about counterfactual alternatives that require them to remove elements from their mental representation of the facts. Existing evidence shows that although pre-schoolers produce more additive than subtractive counterfactuals overall, 5-year-olds produce slightly more subtractive counterfactuals than both 3-year-olds and 4-year-olds (Guajardo & Turley-Ames, 2004). These findings suggest that over the pre-school years, children develop the capacity to mentally represent counterfactual alternatives that concern an absence as well as those that concern a presence.

In fact, mentally representing counterfactual possibilities that concern an absence may require more cognitive resources for both children and adults. Although adults tend to produce both additive and subtractive counterfactuals (Roese & Olson, 1993), in general they tend to produce less subtractive counterfactuals (Roese et al., 1999). They also tend to spend more time processing subtractive counterfactuals than they spend processing additive counterfactuals (Turley-Ames & Whitfield, 2000). Thinking about information which concerns an absence (the empty field) may be similar to thinking about negative information (the field is *not* full of bunnies) and adults have more difficulty processing negative information than affirmative information (e.g., Evans & Handley, 1999; Wason, 1959). Thinking about counterfactual alternatives that delete an element from reality may require more cognitive resources, which may exceed the cognitive capacity of 3-year-olds.

Although the findings from Experiment 2 suggest that 4-year-olds are helped to answer counterfactual questions overall when they image a counterfactual possibility, the results from Experiment 3 do not replicate this finding. This result suggests that the difficulty experienced by children aged 4 years does not rest on the need to keep in mind the counterfactual possibility, or on the ability to keep in mind possibilities that concern an absence. The difficulty experienced by 4-year-olds may rest on other factors. Previous findings on counterfactual thinking in pre-schoolers have shown that young children's difficulty in entertaining counterfactual situations may rest on the amount of information that they must hold in mind when they think about the factual situation (e.g., German & Nichols, 2003). We may speculate that the difficulty for pre-school children may rest on the complexity of the factual situation they must reason about, but that there is a specific difficulty experienced by 3-year-olds that 4-year-olds do not encounter when they think about what might have been.

Counterfactual thinking may help people to learn from their mistakes and prepare for the future (Mandel & Lehman, 1996). The ability to imagine how an outcome could have been different emerges early in development (e.g., Harris, 2000) and children's propensity to produce counterfactual alternatives following a bad outcome suggest that this early emergence of counterfactual thought may help young children to learn from past mistakes (German, 1999). The findings from Experiment 1 show that 3-year-olds and 4-year-olds who were given no instructions to think about current reality or the counterfactual possibility gave more correct answers to counterfactual questions about bad outcomes than they did for the good outcomes. These findings are consistent with the suggestion made by German (1999) that children are more likely to undo negative outcomes, perhaps because it serves a preparatory function. But the findings from Experiment 2 suggest that 3-year-olds are more likely to produce counterfactual alternatives to bad outcomes than good outcomes when the counterfactual possibility

concerns a presence only. We may therefore speculate that the propensity for young children to produce counterfactual alternatives following bad outcomes may occur only when the alternatives they create are additive and not subtractive in nature.

Adults undo reality to create a counterfactual alternative in systematic ways (Kahneman & Tversky, 1982). The experiments reported in Chapters 4 and 5 show that there is a developmental trend to the way in which people undo certain aspects of reality, as measured by their counterfactual "if only" thoughts. Adults tend to undo actions more than inactions, at least in the short term (Byrne & McEleney, 2000; Kahneman & Tversky, 1982) and they tend to mentally undo the most recent event in a sequence of independent events (Miller & Gunasegaram, 1990). But children aged 6 years and 8 years do not appear to exhibit the tendency to think "if only" more for their actions than failures to act, although they show the tendency to mentally undo the more recent event in a sequence of independent events.

The tendency for people to think "if only" more for their actions than their inactions appears later in the development of counterfactual thought. In fact, the development of this tendency over the life span is marked by another change in older adults. Studies have shown that older adults show a tendency to think "if only" more for failures to act than for actions (Gilovich & Medvec, 1994; 1995). The tendency to think "if only" more for actions than failures to act appears to follow a developmental path that changes over the life span: children younger than 8 years do not appear to be any more likely to ruminate over things that they have done rather than things that they have failed to do; but later in development, when they are adults, people show a propensity to undo actions more readily than inactions. But when they look back over their lives, they are more likely to ponder on what could have been different "if only…" they had done something that they failed to do.

That children tend to undo the most recent event in a sequence of independent events has implications for their everyday counterfactual thoughts. The temporal order effect has been shown to occur in many everyday situations (Miller & Gunasegaram, 1990; Sherman & McConnell, 1996). For example, when adults were informed of a student failing an examination and they were asked to consider how they -- as students -- might have passed, they tended to wish that their preparation had been different when they were led to believe that the questions had been set after they had prepared for the examination, whereas they wished that their preparation had been different when they were led to believe that the questions had been set before their preparation (Miller & Gunasegaram, 1990). Our findings suggest that by the time children reach middle childhood, their everyday counterfactual thoughts may also focus on most recent events when they ponder about how things could have been different.

Implications for Understanding The Development of Mental Representations

The experiments in this thesis have aimed to explore the possibilities that pre-school and school-aged children keep in mind when they imagine counterfactual alternatives to reality, and in doing so we have attempted to develop an account of the development of mental representations in counterfactual thinking from early to middle childhood.

In general when adults understand a factual conditional such as "If Marc caught the train, he arrived on time" they tend to keep in mind a single possibility rather than multiple possibilities due to working memory limitations (Johnson-Laird & Byrne, 1991) and they tend to keep in mind true possibilities rather than false possibilities (Johnson-Laird & Byrne, 2002). But when people think about counterfactual situations they tend keep in mind two possibilities from the outset: the presupposed facts of the situation (the reality) and the situation that is false, but temporarily supposed to be true (counterfactual alternative). Counterfactuals are different because they require people to keep in mind

multiple possibilities and they require people to keep in mind false possibilities temporarily supposed to be true (Byrne, 2005).

We proposed that pre-school children have difficulty answering counterfactual questions because of the mental representations they must keep in mind. Pre-schoolers may keep in mind just a single possibility, that is, the possibility corresponding to the facts, rather than the false possibility assumed to be true. On our proposal, instructions to form a mental representation of the counterfactual possibility may help pre-schoolers to keep in mind both the counterfactual possibility. We found that instructions to image the counterfactual possibility can be somewhat beneficial in helping 4-year-olds answer counterfactual questions overall. But when we consider 3- and 4-year-olds as separate age groups, the results suggest that the nature of the possibilities that pre-schoolers keep in mind affects the accuracy of their responses. There appears to be a developmental shift between the ages of 3 years and 4 years in children's representational ability: 3-year-olds do not appear to have the capacity to keep in mind possibilities which concern an absence, but this capacity may be developed by the age of 4 years. When 3-year-olds think about a counterfactual situation, they may have difficulty deleting an element from their mental representation of the factual situation, a difficulty which appears to be resolved by 4 years.

It has been proposed that some aspects of reality are highly mutable because they require a richer representation of the factual situation from the outset (Byrne, 2005). The action effect may arise as a result of the possibilities people keep in mind when they think about actions and inactions (Byrne, 2005; Byrne & McEleney, 2000). Consider the story about Dave and Jim who are in the same university (University A). Both think about switching colleges: Dave decides to stay and Jim decides to move to another university (University B) (Gilovich & Medvec, 1994). Adults may mentally represent actions explicitly by keeping in mind two possibilities from the outset (the pre-action possibility:

Jim was in University A and the post-action possibility: Jim is in University B), whereas they may represent inactions by keeping in mind just a single possibility (Dave is in University A). Adults may readily imagine a counterfactual alternative to an action by mentally "rewinding" the post-action possibility to be like the pre-action possibility (Byrne, 2005).

However, the experiments reported in Chapter 4 of this thesis show that children aged 6 years and 8 years do not exhibit the tendency to think "if only" more for actions than inactions. This finding suggests that children mentally represent actions in a different way to adults. Thinking about actions is different to thinking about failures to act. Thinking about actions requires a more complex representation of the factual situation than thinking about an inaction. Evidence from studies of counterfactual thinking in younger children suggests that they have difficulty thinking about counterfactual situations that require a complex representation of the factual situation (German & Nichols, 2003; Perner et al., 2004). One possibility is that children have difficulty mentally representing actions because they exceed their representational demands. Instead, children may mentally represent actions and inactions by keeping in mind one possibility for the factual situation. When they think about the factual situation for an action, they may mentally represent the post-action possibility (e.g., Jim is in University B) without keeping track of the past pre-action possibility (e.g., Jim was in University A). As a result, they do not have access to a ready-made counterfactual to an action. Because they may keep in mind only one possibility for both actions and inactions, imagining a counterfactual alternative to either possibility may require the same cognitive effort and so their "if only" thoughts focus on actions and inactions equally.

When people undo actions, they tend to remove or delete the action from their mental representation ("If only Jim had not moved universities"). Children aged 6 years and 8 years may not think "if only" more for actions than inactions because the capacity

to delete actions from their mental representation may develop over middle childhood. The experimental results reported in Chapter 3 show that 3-year-olds have difficulty thinking about possibilities that concern an absence, a finding that suggests that they may have difficulty mentally removing an element from their mental representation when they think about counterfactual situations. Although the results suggest 4 year-olds can think about possibilities corresponding to an absence and a presence equally well, it is possible that children's ability to delete elements from their mental representation may not fully develop until later in middle childhood. For this reason, children may not tend to remove an action from their mental representation of the factual situation as readily as adults.

The experiment reported in Chapter 5 showed that children aged 6 years and 8 years exhibit the temporal order effect in their "if only" thoughts. For example, when they hear a story about two players who must pick the same colour card to win a prize (e.g., Al and Bill must both pick either a red card or a black card to win. Al goes first and picks a red card, Bill goes next and picks a black card, so neither player wins) their "if only" thoughts tend to focus on the second event ("If only Bill had picked a red card"). It has been proposed that the temporal order effect reflects fundamental properties of the nature of the mental representations that people construct of reality (Byrne, 2005; Walsh & Byrne, 2004). Children, like adults, tend to keep in mind one possibility for their mental representation of the facts, Al picked red and Bill picked black, and they may keep in mind one possibility when they think about the counterfactual alternative, Al picked red and Bill picked red. The first event may anchor the mental representation against which later events are interpreted.

The action effect in children's "if only" thoughts does not emerge simultaneously with the temporal order effect. This developmental trend may arise because of the way in which children's representational ability to think about the factual situation develops. Children aged 6 years and 8 years may tend to think about the factual situation by

mentally representing a single possibility, and they may tend to think about the counterfactual situation by mentally representing one possibility. The temporal order effect may emerge early in development because children need only envisage a single possibility for the facts, and a single possibility for the counterfactual situation. But the action effect may emerge later in development because thinking about actions requires a richer mental representation of the factual situation, which may exceed the representational capacity of 6- and 8-year-olds. Instead, children may envisage a single possibility for the factual representation of an inaction (e.g., Dave is in University B) *and* an action (e,g., Jim is in University A) from the outset and so imagining a counterfactual alternative to either an action or an inaction may require a similar amount of cognitive work. The capacity to mentally represent more than two possibilities for the factual representation may emerge later in development (e.g., Barrouillet & Lecas, 1999; Markovits, 2000) and it may emerge simultaneously with the tendency to mentally undo actions more than inactions.

Overall, the experiments reported in this thesis show that there is a developmental trend to the way in which children form mental representations when they think about counterfactual situations. The capacity to mentally represent possibilities that concern an absence appears to emerge at the age of 4 years. Children aged 6 years and 8 years show the temporal order effect in their "if only" thoughts because it may reflect very fundamental properties of the mental representations that people construct of reality. The action effect may not occur in their "if only" thoughts because thinking about actions may require a more complex representation of the factual situation and so 6- and 8-year-olds think "if only" about actions and inactions with equal frequency.

Implications for Understanding Counterfactual Judgements of Emotions

The experimental results from the studies that focused on the action effect and the temporal order effect may help discern the developmental trend of children's judgements of emotions in counterfactual situations.

The findings from Experiment 6 suggest that there is a developmental shift in how children make judgements of emotions for the temporal order effect. The temporal order effect has not been examined in children's counterfactual thinking before, and our findings show that children aged 8 years show the temporal order effect in their judgements of guilt and blame, but 6-year-olds do not. Previous findings have shown a similar developmental shift in children's understanding of guilt in other situations (e.g., Graham, 1988, Harris et al, 1987). The developmental shift in children's judgements of guilt and blame for the temporal order effect may rest on the mental state understanding that is required in guilt attribution. Harris (1989) proposes that when children make judgements of guilt in others they must appreciate the role and mental state of the "audience" and how this is directed to the protagonist. For example, in Experiment 6, children were asked to attribute guilt to one of two puppets: Al or Bill. One puppet becomes the audience and the other puppet becomes the protagonist. In order to attribute guilt to Bill for example, children must appreciate that Al (the audience) feels negative affect (disapproval) as a result of an action carried out by Bill (picking the brown card); children must then appreciate that Bill will feel negative affect (e.g., guilt) as a result of how Al feels. The mental state understanding required for this sort of emotional judgement may exceed the cognitive resources of children aged 6 years.

However, both age groups show the temporal order effect in their judgements of who feels worse. In children's counterfactual thinking about the most recent event, the more general judgement of who feels worse does not emerge simultaneously with the more specific judgements of guilt and blame. Children's judgements of who feels worse

may not require the same degree of mental state understanding that is required for judgements of guilt. For judgements of who feels worse, children need only to consider that an event has occurred which has resulted in two agents experiencing negative affect. They then need to judge which agent feels more negative affect than the other, which according to the amplification proposal, rests on the counterfactual thoughts that people mentally represent (Kahneman & Miller, 1986). They do not need to employ the same degree of empathetic understanding that is required for judgements of guilt.

The findings from Experiment 6 show that 6-year-olds exhibit the temporal order effect in their "if only" thoughts and judgements of who feels worse, but not in their judgements of guilt and blame. It has been suggested that the attribution of emotions in counterfactual situations may rest on the co-ordination of the ability to think counterfactually with the ability to adopt differing perspectives, which requires second-order mental state understanding (Ferrell, 2005). A developmental lag may exist between children's "if only" thoughts and their counterfactual judgements of emotions because the capacity to co-ordinate these abilities may only emerge around the age of 7 or 8 years (Ferrell, 2005). That there is an association between 6-year-olds' "if only" thoughts and judgements of who feels worse suggests that children as young as 6 years may have the capacity to co-ordinate the processes required for the attribution of judgements of who feels worse, perhaps because these more general judgements do not require the same degree of mental state understanding as the more specific judgements of guilt and blame.

The developmental trend to the emergence of children's counterfactual judgements of emotions for the action effect follows a slightly different pattern. When adults think about actions and inactions in counterfactual situations, they tend to judge greater emotional impact for actions (Kahneman & Tversky, 1982). Previous findings indicate that children aged 7 and 9 years, but not 5 years, tend to judge that an actor will feel worse than a non-actor, just like adults (Guttentag & Ferrell, 2004). The experimental

results in Chapter 4 help pinpoint the exact age at which this tendency emerges in counterfactual situations. Children aged 8 years tend to judge that an actor will feel worse than a non-actor, but 6-year-olds do not. Our findings, taken together with previous findings, point to a developmental shift between the ages of 6 years and 7 years in how children make judgements of who feels worse for actions and inactions.

The experimental results reported in Chapter 4 also reveal a different pattern for the development of the relationship between counterfactual thoughts and judgements of emotions. The findings show that there is a dissociation between 8-year-olds' "if only" thoughts and their judgements of emotions for the action effect: they show the action effect in their judgements of emotions but not for their "if only" thoughts (the action effect was not observed in 6-year-olds' "if only" thoughts or judgements of emotions). Adults tend to rely on a counterfactual strategy when they make judgements of emotions, that is, their judgements of emotions are amplified by the creation of a counterfactual alternative (Kahneman & Miller, 1986). These findings suggest that during the ages of 6 years and 8 years, children tend to rely on different strategies for making judgements of counterfactual emotions. When 6-year-olds think about actions and inactions, they tend to rely on an outcome-dependent strategy for their emotional attributions and so they they tend to judge that the actor and the non-actor feel the same. Eight-year-olds do not appear to rely either on an outcome-dependent strategy or a counterfactual/attribution dependent strategy; instead, they appear to rely on a mixed strategy for making counterfactual judgements of emotions. When 6-year-olds think about the last event in an independent sequence of events, they rely on a counterfactual/attribution dependent strategy, although they may lack the mental state understanding required for making judgements of guilt and blame. Eight-year-olds appear to fully rely on a counterfactual strategy for their judgements of emotions and social ascriptions, just as adults do.

Children's reliance on different strategies for making judgements of emotions in counterfactual situations may be mediated by their mental representation of that counterfactual situation. Children may be able to rely on a counterfactual strategy for the temporal order effect because it reflects fundamental properties of the mental representations that they construct of reality. But children may rely on either an outcome-dependent strategy or mixed strategy (which may comprise of both an outcome-dependent and counterfactual/attribution dependent strategy) for making judgements of emotions for the action effect because actions may require a more complex mental representation of the factual situation.

Implications for Early Social Cognition

Our findings show that the development of counterfactual thought from early to middle childhood is marked by a number of developmental shifts. We consider the implications of these findings for the development of children's understanding of mental states and their socio-emotional understanding .We also consider how these implications can be understood within a broader cognitive developmental framework.

It is widely accepted that during the pre-school years, children undergo a change in how they think about mental states (e.g., Astington et al., 1988). Perhaps the most striking example of this developmental shift is observed in pre-schoolers' performance in false belief tasks. In such tasks children are required to attribute a false belief to themselves or to someone else (e.g., Maxi thinks the chocolate is in the cupboard but it is really in the fridge). Children aged 4 years and older often perform above chance in these tasks, whereas 3 year-olds typically perform at, or below chance (e.g., Wellman et al., 2001). There are a number of theories to account for this developmental shift in false belief understanding. The representational account, which predominates theory-of-mind research, emphasises children's difficulty in understanding that other people can hold

beliefs that may not necessarily represent reality (e.g., Perner, 1991). The counterfactual account emphasizes children's difficulty in thinking about a state of affairs that runs counter to reality (Petersen & Riggs, 1999).

As we described in Chapter 1, the counterfactual account of false belief understanding has some evidence in its favour: performance on counterfactual and false belief tasks has been shown to be highly correlated (Riggs et al., 1998). However, there is also compelling evidence against this proposal: in general, 3- and 4-year-olds' performance on counterfactual tasks does not show the same dramatic age change that is observed in most false belief tasks (e.g., Harris et al., 1996; Perner et al., 2004). Furthermore, recent studies have shown that performance on false belief tasks is only correlated with more difficult counterfactual tasks that require a richer representation of reality (e.g., German & Nichols, 2003; Perner et al., 2004). These findings point to a dissociation between the two forms of imaginative reasoning and they highlight the tension between these two competing accounts of false belief understanding: counterfactual thinking emerges earlier in development and there is a difficulty inherent to false belief understanding that is not common to all counterfactual reasoning tasks.

Our findings show that there is a specific developmental shift in how 3- and 4-year olds think about counterfactual possibilities. This finding has implications for the debate concerning the relationship between counterfactual thinking and false belief understanding. First, unlike false belief task performance, our findings do not reveal a developmental shift in overall task performance: both age groups performed above chance in their responses to the counterfactual questions. Instead, there is a more specific developmental shift in pre-schoolers' counterfactual task performance which may be reflective of how they think about possibilities: 3-year-olds have difficulty thinking about possibilities that concern an absence, but this difficulty is resolved by the age of 4 years.

The capacity to think about what might have been emerges before the capacity to think about a mistaken belief.

Our account of counterfactual thinking focuses on the possibilities that children mentally represent when they think about counterfactual situations. From this perspective, counterfactual thinking and false belief understanding may share some similarities, that is, they both require children to think about multiple possibilities. In both cases, children must keep in mind the possibility relating to reality, and the false possibility, assumed to be true. However, it is the very nature of the possibilities that children must represent that may set the two forms of reasoning apart. False belief understanding requires children to keep in mind a false possibility that concerns a mental state, that is, a belief (e.g., Maxi thinks the chocolate is in the cupboard). However, counterfactual thinking does not necessarily involve the ascription of a mental state (such as a belief, desire or emotion) to either possibility, but it may require the child to think about a possibility that concerns an absence. In false belief tasks 3-year-olds have difficulty keeping in mind a possibility that is about a mental state, whereas in counterfactual tasks they have difficulty keeping in mind a possibility that is about an absence. But counterfactual possibilities do not always concern an absence. Three-year-olds readily answer counterfactual questions when they think about a possibility concerning a presence. The ability to think about counterfactual situations may emerge earlier in development because the mental representations children must keep in mind do not necessarily correspond to a mental state such as a belief.

A consideration of the relationship between counterfactual thinking and mental state understanding cannot be confined to early childhood. Existing evidence suggests that second-order mental state understanding (an ability to think about a person's thought about another person's thought) may be central to the ability to make counterfactual judgements of emotions that are similar to those made by adults (Ferrell, 2005). For example, when children are asked to judge which one of two individuals feels worse in

light of counterfactual information, not only must they think about how the situation could have been different for both individuals, but they must imagine how both individuals feel. This ability requires children to adopt differing perspectives, which is akin to the ability to think about a person's thought about another person's thought (Ferrell, 2005). The findings from the final experiment suggest that there may be a dissociation between 6-year-olds' "if only" thoughts and their judgements of guilt and blame because these judgements require a complex understanding of mental states of others. The development of the relation between counterfactual thought and judgements of emotions in middle childhood may rest at least partially on complex mental state understanding.

Of course, developmental shifts in how children understand the world are not confined to children's understanding of mental states alone. In fact, all major theories of cognitive development are underpinned by the tension between cognitive stability and change (e.g., Wellman et al, 2001). Theories such as Piaget's theory of development are defined by their stage-like approach to understanding how children develop from early infancy to early adulthood. According to Piagetian theory for example, children progress through four stages of development: the sensorimotor period (birth to 2 years), the pre-operational period (2 to 7 years), the concrete operational period (7 to 12 years) and the formal operational period (12 years and older) (e.g., Piaget, 1951; 1952; Piaget & Inhelder, 1969). The developmental shifts observed in the experiments presented in thesis can be considered within this broader theoretical framework -- in some respects at least. For example, Piaget's pre-operational period is marked by the acquisition of the ability to represent the world symbolically, an ability which, according to the findings reported in Chapter 3, may underlie the development of counterfactual thought during the pre-school years. Furthermore, during the concrete operational stage of development children are believed to acquire the ability to adopt other points of view, an ability which, as we have

seen, may play an integral role in determining the kinds of judgements of emotions that children aged 6- and 8-years make judgements in counterfactual situations.

One theoretical implication of stage-like theories of cognitive development is that children's thinking is believed to show abstract similarities across many domains within each stage (e.g., Flavell, 1971). For example, Piagetian theory assumes that children in the concrete-operations stage should master all aspects of conservation (i.e., the understanding that certain qualities of objects are conserved irrespective of whether transformations change their appearance) simultaneously. This assumption implies that children within a certain stage may show similarities in how they think about counterfactual situations, such when they think about the last event in an independent sequence of events or when they think about actions and inactions. However, the findings reported in Experiments 5 and 6 in this thesis suggest that children aged 6- and 8- years do not show such similarities, that is, they exhibit the temporal order effect but not the action effect in their counterfactual thinking. Although these findings appear somewhat inconsistent with Piagetian theory, they are in line with more recent evidence which has shown that there is more variation in children's thinking than previously assumed. For example, although children are assumed to master Piaget's concepts of number and weight conservation concurrently, evidence suggests that they master number conservation at 6 years and weight conservation tasks at 10 years (Elkind, 1961; Miller 1976).

A final issue we wish to consider concerns the developmental patterns observed in children's judgements of emotions in counterfactual situations and their implications for the regulation of behaviour. The functions of counterfactual thinking may include the amplification of certain affective experiences (Kahneman & Miller, 1986) and the prevention of future unwanted outcomes (Mandel & Lehman, 1996). The amplification of negative affective experience such as regret may help people to regulate their future

behaviour (Roese, 1994). Our findings show that the developmental pattern in children's judgements of emotions in counterfactual situations differs for the action effect and the temporal order effect. These varying developmental patterns may have varying consequences for how children regulate their future behaviour.

Our findings show that children aged 8 years, but not 6 years, show the action effect in their judgements of who feels worse, although neither age group show the action effect in their "if only" thoughts. Judgements of who feels worse have been operationalised as judgements of regret in studies of children's counterfactual thinking (e.g., Guttentag & Ferrell, 2004). Counterfactual "if only" thoughts for actions amplify judgments of regret in adults (Kahneman & Tversky, 1982), which may help them to avoid certain actions in the future. Our finding suggests that 6-year-olds may experience as much regret thinking "if only" for actions as for failures to act, and so we may speculate that this tendency may do little to influence a change in their future behaviour. Although 8-year-olds do not show a tendency to think "if only" more for actions than failures to act, they judge greater emotional impact for actions, which may serve to help them to avoid certain actions in the future.

But children show a different developmental pattern for their judgements of emotions for the temporal order effect. Children aged 8 years, but not 6 years, show the temporal order effect in their judgements of guilt and blame, whereas both age groups show the temporal order effect in their judgements of who feels worse (and for their "if only" thoughts). The experience of guilt has been associated with a particular form of self-regulatory behaviour which not only focuses on how to avoid the experience in the future, but on how to repair the breach of social norms or standards caused by a particular misdemeanour (Bybee et al., 1998). Our findings suggest that certain "if only" counterfactual thoughts may amplify the experience of regret of children aged 6 years and 8 years, and so we may speculate that these thoughts may help them to avoid the

recurrence of certain unwanted outcomes. But the behaviour of 8-year-olds may be more socially oriented: they may also change their behaviour to focus on reparative actions, such as attempting to rebuild damaged social relationships, that often follow the experience of guilt.

Future Directions

In this section we consider some of the limitations and strengths of the work presented in this thesis and we suggest some possible directions that research in this area might follow in the future.

The study of counterfactual thinking in children is still a relatively new area of exploration within the realm of cognitive development. Although work that is carried out in such a burgeoning area of research can produce many revealing findings, the very nature of the research implies that there are many avenues that have yet to be explored. Our experiments have added to this small but growing body of research by testing an account of the development of counterfactual thinking from early to middle childhood, but one limitation of our experiments is that the cross-sectional focus did not reach beyond middle childhood. Furthermore, the focus of our experiments was entirely on typically developing children. For a complete developmental account of counterfactual thinking to be provided, the focus of research must not only extend to late childhood but it must encompass the atypical development of counterfactual thinking in children with developmental difficulties. Future research is therefore required that embraces the development of counterfactual thinking in older children and in atypically developing children.

Before we make some suggestions regarding the possible routes that research in older and atypically developing children may take, we consider another limitation of our experiments that is also associated with conducting research in such a new area of

cognitive development. Because the quantity of studies in children's counterfactual thinking is relatively slight, especially compared to the vast amount of studies devoted to false belief understanding, the materials that are to be relied upon to measure key variables are often new, and therefore have yet to be standardised. This limitation can be a particular concern when the focus of research is on pre-school children. However the creation of new materials, such as the scenarios we used for the first series of experiments, is necessary if the quantity and quality of existing materials is to be increased for future work in the area. Certain measures must be taken to ensure that the children understand the content of the materials, and it is for this reason that we employed measures such as the manipulation checks for the first set of experiments in this thesis. The benefits outweigh the costs however, as the creation of new materials that are accessible to young children can help us to explore the many research questions that burgeoning areas of research typically generate.

The aim of the work presented in this thesis was to explore the development of counterfactual thinking by examining the mental representations that children construct when they think about counterfactual alternatives to reality. In order to examine the possibilities that children represent, we adapted and modified measures from studies of syllogistic reasoning in children (e.g., Leevers & Harris, 1999) and counterfactual thinking in adults (e.g., Byrne et al., 2000). In doing so, we have devised new tasks to examine children's mental representations, which up until now have only been applied in the study of counterfactual thinking in adults. For example, to examine the "if only" thoughts of 6- and 8-year-olds, we modified tasks employed in studies of adults' counterfactual thinking (e.g., Byrne et al., 2000; Byrne & McEleney, 2000) such as the sentence completion task (Experiments 4, 5 and 6) and the "who wishes 'if only'" task (Experiments 4 and 5). We introduced a new physical manipulation task (Experiment 6) to assess how children physically undo a factual situation to create a counterfactual

alternative. We also included an explanation question, which has not been used often in studies of adults' or children's counterfactual thinking, to assess whether children focus on the last event in their causal attributions as well as in their "if only" thoughts (Experiment 6). In doing so we have developed a variety of different tasks to measure the mental representations that children may form when they think about how an outcome could have been different.

As the field of research into counterfactual thinking in children is in its own early years of development, there are many possible routes that future work could follow. The focus of our experiments has been on the mental representations that children think about in counterfactual situations. One possible avenue of future research could focus on the mental representations that atypically developing children keep in mind when they think about counterfactual situations. Studies of false belief understanding in children with autism have shown that they typically err on standard false belief tasks, and this difficulty has been attributed to an underlying representational deficit for mental state understanding (e.g., Baron-Cohen, Leslie & Frith, 1985). But children with autism, who have a verbal age of at least 4 years, appear to be moderately successful in their responses to counterfactual questions such as, "If there had been no fire, where would Peter be?" (Petersen & Bowler, 2000). Taken together, these findings suggest that children with autism appear to be able to keep in mind reality and the counterfactual possibility, but they may experience difficulty keeping in mind a false possibility that concerns a belief. Given our finding that 3-year-olds have difficulty in keeping in mind possibilities that concern an absence in counterfactual tasks, we suggest that future work might investigate whether children with autism experience similar difficulties when they think about possibilities that concern an absence. Such an investigation may be a useful way to trace the development of counterfactual thinking in both atypically and typically developing children.

Another possible route for future work in this area might focus on the mental representations that older children keep in mind when they think about counterfactual situations. Our findings have shown that children aged 6 years and 8 years mentally undo the same aspects of reality as adults when they think about the most recent event in a sequence of independent events. But unlike adults, they undo actions as often as inactions, perhaps because they think about actions and inactions in a different way to adults. Studies that examine the action effect in older children may help to determine the age at which the action effect emerges in children's "if only" thoughts, and whether this emergence is dependent on how children mentally represent actions and inactions. Of course, there are many other aspects of reality that adults tend to focus on in their counterfactual thoughts. For example, they tend to undo exceptional rather than routine events (Kahneman & Tversky, 1982) and they tend to undo controllable events more so that uncontrollable events (Girotto et al., 1991; McCloy & Byrne, 2000). We suggest that studies that explore the emergence of these phenomena in middle or late childhood may help to provide a more comprehensive picture of the development of counterfactual thinking in children.

Conclusions

In this thesis we investigated the development of counterfactual thinking from early to middle childhood by examining the mental representations that children keep in mind when they imagine counterfactual alternatives to reality. Our findings demonstrate that that very young children experience a specific difficulty thinking about possibilities which concern an absence. Our findings demonstrate that there is a developmental trend to the way in which older children mentally undo their representation of reality to think about how an outcome could have turned out differently.

The findings have implications for understanding the development of imaginative thought and representational ability. The way in which children mentally represent the factual situation and the counterfactual situation may play a role in the kinds of counterfactual alternatives that children imagine: at the age of 3 years children can think about how about how a causal outcome could have turned out differently, but they may have difficulty removing an event from their mental representation of the facts; by 6 years they begin to undo certain aspects of reality, such as the more recent event, to create counterfactual alternatives, just as adults do. But the tendency adults exhibit to undo other aspects of reality, such as actions, may develop later in childhood, perhaps because of the way in which children mentally represent actions from the outset. The findings also have implications for understanding the development of the relationship between imaginative thought and socio-emotional understanding: at the age of 3 years, children may not only have difficulty representing a mistaken belief, but they may have difficulty thinking about the absence-based nature of many counterfactual thoughts. Between the ages of 6 years and 8 years, children's understanding of how other people understand mental states may guide their ability to make judgements of emotions when they imagine counterfactual alternatives to reality.

Children's ability to consider how a situation could have been different appears to be marked by a number of developmental shifts from its emergence in early childhood to its development into middle childhood.

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Appendix A Experiment 1

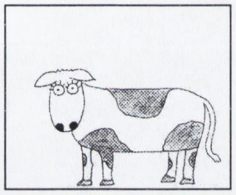
1) The introductory instructions given in Experiment 1

Control Group

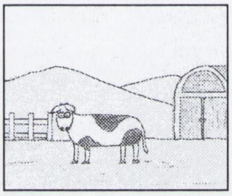
I'm going to read you some stories about different animals, and show some pictures, and I want you to pretend that the things in the story are really happening.
And then I'm going to ask you some things about them.
O.K
Here's the first one.....

Experimental Groups

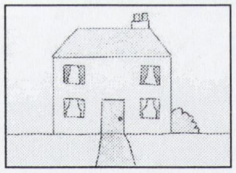
I'm going to read you some stories about different animals, and show you some pictures, and I want you to pretend that the things in the story are really happening by thinking really hard about the things in the story.
O.K? Lets' try one together first. I'm going to tell you a little story and show you some pictures, and I want you to think really hard about what's happening in the pictures:



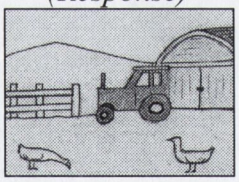
Connie is a Cow



She lives in a farmyard.
Are you thinking really hard about this picture of Connie the cow in her farmyard?
(Response)

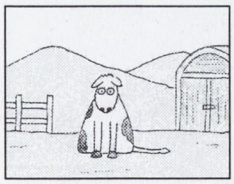


Good, now where does Connie live? Does she live here?

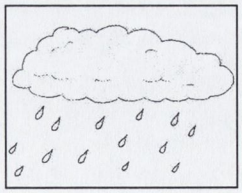


Or does she live here?

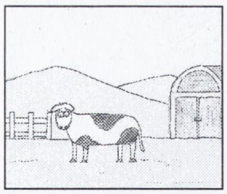
Good, so now I'm going to say something else about Connie and ask you a question:



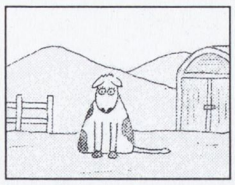
When it rains Connie sits down in her farm yard. Are you thinking really hard about
this picture of Connie sitting down in her farmyard?(*Response*)Good



Now, it's raining,



Is Connie doing this?

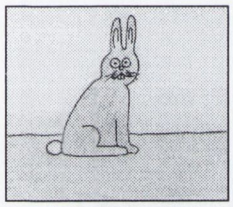


Or is she doing this? Can you show me?
(Response)

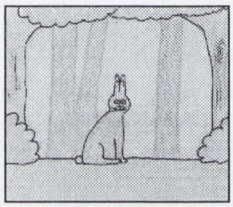
Good!
Every time you hear a story like that you should try to think really hard about the pictures in the story, just like you did with Connie the Cow and then the answers will be easier!
So now I am going to read you some other stories and remember: every time I read you a story I want you to think really hard about the things happening in the story, just like you did with Connie the cow. O.K. Here's the first story....

2) Scenarios, questions and accompanying pictures

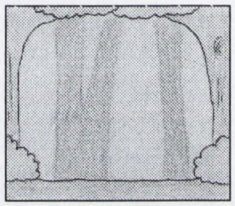
Billie Bunny Scenario



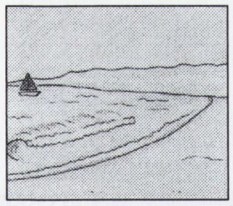
Picture 1
Billie is a bunny



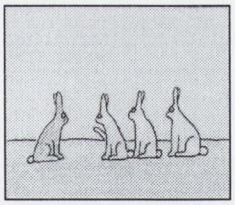
Picture 2
He lives in a forest



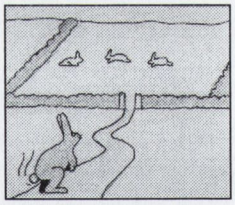
Correct Picture choice
Does he live here?



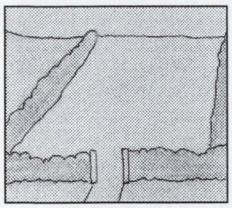
Incorrect picture choice
Or does he live here?
Can you show me?



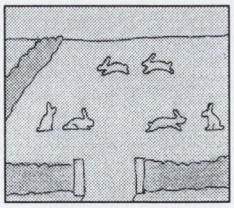
Picture 3
He likes to play with his bunny friends



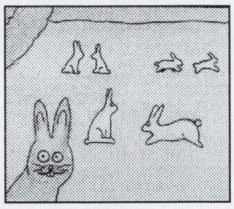
Picture 4
He goes to the field to play with them



Picture 5
But the field is empty



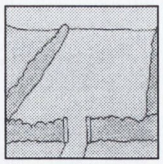
Picture 6
Then one day the field is full of friends



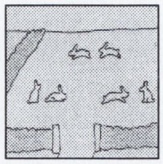
Picture 7
And now Billie is really happy because he is able to play with his friends.

Past reality: When the field was empty, was Billie able to play with his friends? (No)
Current reality: Is Billie able to play with his friends now? (Yes)

Counterfactual group: Now, I want you to think really hard about this picture of the empty field.

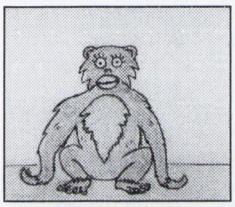


Reality group: Now I want you to think really hard about this picture of the field full of Billie's friends.



Counterfactual: If the field had not been full of Billie's friends, would Billie be able to play with them now? (No)

Mille Monkey Scenario



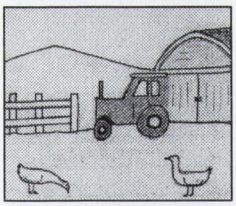
Picture 1
Millie is a monkey



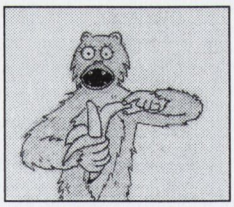
Picture 2
She lives in a jungle



Correct picture choice
Does Millie live here?



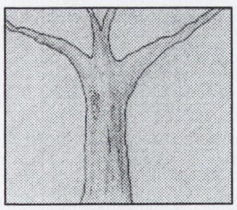
Incorrect picture choice
Or here? Can you show me?



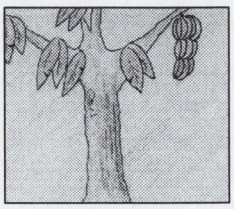
Picture 3
She likes to eat bananas for her treat



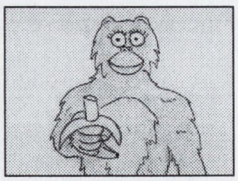
Picture 4
She goes looking in the banana tree for bananas



Picture 5
But the banana tree is bare



Picture 6
Then one day a bunch of bananas grows on the tree



Picture 7
And now Millie is really happy because she is able to
eat bananas for her treat.

Past reality: When the banana tree was bare, was Millie able to have bananas to eat for her treat? (No)
Current reality: Is Millie able to have bananas to eat for her treat now?(Yes)

Counterfactual group: Now, I want you to think really hard about this picture of the bare banana tree.

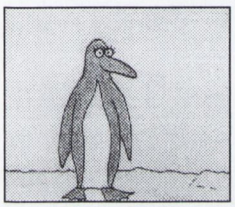


Reality group: Now I want you to think really hard about this picture of the bunch of bananas on the tree.

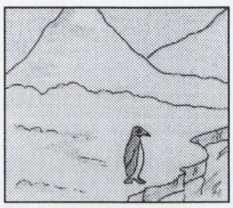


Counterfactual: If the bunch of bananas had not grown on the tree, would Millie be able to have bananas to eat for her treat now? (No)

Polly Penguin Scenario



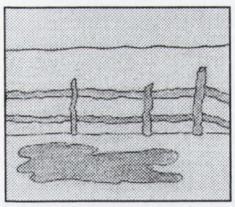
Picture 1
Polly is a Penguin



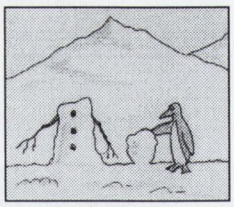
Picture 2
She lives in the South Pole



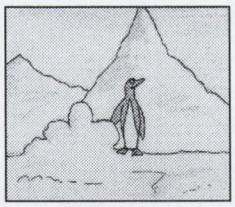
Correct picture choice
Does Polly live here?



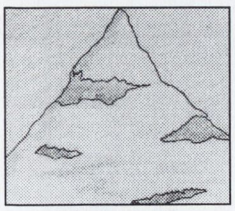
Incorrect picture choice
Or does she live here?
Can you show me?



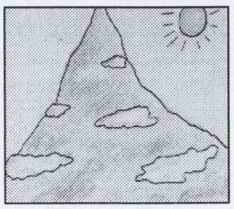
Picture 3
She likes to build snowmen



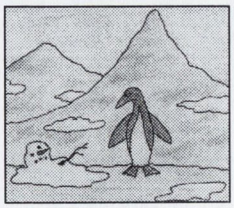
Picture 4
She gathers snow from the mountain to build the snowmen



Picture 5
There is lots of snow on the mountain



Picture 6
Then one day the snow melts



Picture 7
And now Polly is really sad because she is not able to build snowmen

Past reality: When there was lots of snow on the mountain, was Polly able to build snowmen? (Yes)
Current reality: Is Polly able to build snowmen now? (No)
Counterfactual group: Now, I want you to think really hard about this picture of all the snow on the mountain.

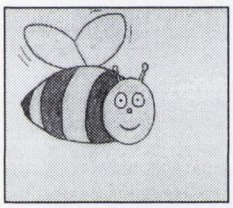


Reality group: Now, I want you to think really hard about this picture of all the snow melting on the mountain

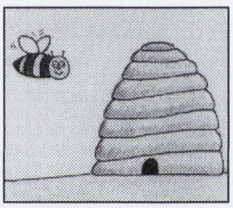


Counterfactual: If the snow had not melted, would Polly be able to build snowmen now (Yes)

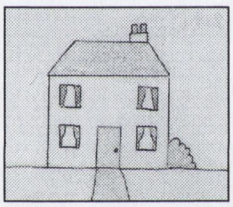
Bobby Bee Scenario



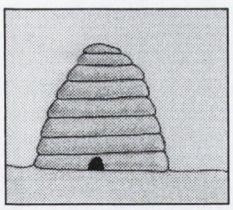
Picture 1
Bobby is a bee



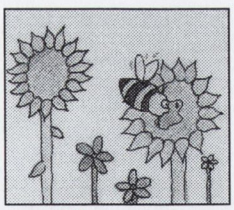
Picture 2
He lives in a beehive



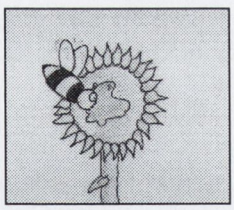
Incorrect picture choice
Does Bobby live here?



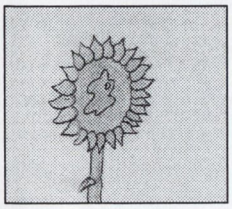
Correct picture choice
Or does he live here?
Can you show me?



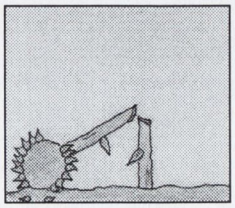
Picture 3
He likes to suck nectar from flowers



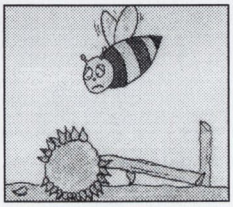
Picture 4
He sucks the nectar from the sunflower



Picture 5
There is lots of nectar in the sunflower

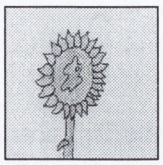


Picture 6
Then one day the sunflower is cut down

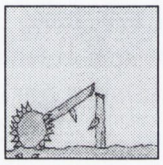


Picture 7
And Bobby is really sad because he is not able to collect nectar now

Past reality: When there was lots of nectar in the sunflower, was Bobby able to collect nectar from it? (Yes)
Current reality: Is Bobby able to collect nectar from the sunflower now? (No)
Counterfactual group: Now, I want you to think really hard about this picture of all the nectar in the sunflower.



Reality group: Now, I want you to think really hard about this picture of the cut down sunflower



Counterfactual: If the sunflower had not been cut down, would Bobby be able to collect nectar from it now? (Yes)

Appendix B Experiment 2

1) The introductory instructions given in Experiment 2

Control Group
I'm going to read you some stories about different animals, and I want you to pretend that the things in the story are really happening. And then I'm going to ask you some things about them.
O.K? Here's the first one…

Imagery Groups
I'm going to read you some stories about different animals and I want you to pretend that the things in the story are really happening by making a picture inside your head of the things in the story.
O.K? Let's try one together first. I'm going to tell you a little story and I want you to make a picture inside your head of what is happening in the story: Connie is a Cow
She lives in a farmyard. Are you making a picture in your head of Connie the cow in her farmyard? *(Response)*
Good, now where is Connie?
(Response)(if incorrect, give alternative worked example) Good, so now I'm going to say something else about Connie and ask you a question: When it rains Connie sits down in her farmyard. Can you make a picture inside your head of Connie sitting down in her farmyard? (*Response*) Good. Now, it's raining, is Connie sitting down in her farmyard? *(Response)*Good!
Every time you hear a story like that you should try and make a picture inside your head of the things in the story, just like you did with Connie the Cow and then the answers will be easier! So now I am going to read you some other stories and remember: every time I read you a story I want you to make another picture inside your head of the things happening in the story, just like you did with Connie the cow. O.K. Here's the first story….

Alternative Worked Example
Percy is a pig. He lives in a pigsty. Are you making a picture inside your head of Percy the pig in his pigsty? (*Response).* Good, now where is Percy? *(Response)* Good, so now I'm going to say something else about Percy and ask you a question. When it rains Percy rolls in the mud. Can you make a picture in your head of Percy rolling in the mud? (*Response).* Good!

****

2) Scenarios and questions
(With instructions for the two imagery groups in italics)

Good outcome scenarios
i) Billie is a bunny. He lives in a forest.
Are you making a picture inside your head of Billie the bunny? (Response) Where does Billie live? (Response) Good! (Repeat this twice if necessary)
He likes to play with his friends. He goes to the field to play with them. But the field is empty. Then one day the field is full of friends! And now Billie is really happy because he is able to play with his friends.

Past reality: When the field was empty, was Billie able to play with his friends? (No)
Current reality: Is Billie able to play with his friends now? (Yes)
Image-counterfactual: Now, make a picture inside your head of the empty field.
Image-reality: Now make a picture in your head of the field full of Billie's friends.
Counterfactual: If the field had not been full of Billie's friends, would Billie be able to play with them now? (No)

ii) Millie is a monkey. She lives in the jungle
Are you making a picture inside your head of Millie the Monkey? (Response) Where does Millie live? (Response) Good! (Repeat if necessary)
She likes to eat bananas for her treat. She goes looking in the banana tree for bananas. But the banana tree is bare. Then one-day a bunch of bananas grow on the tree. And now Millie is really happy because she is able to eat bananas for her treat.
Past reality: When the banana tree was bare, was Millie able to have bananas to eat for her treat? (No)
Current reality: Is Millie able to have bananas to eat for her treat now? (Yes)
Image-counterfactual: Now make a picture inside your head of the bare banana tree.
Image-reality: Now make a picture inside your head of the bunch of bananas on the tree.
Counterfactual: If the bunch of bananas had not grown on the tree, would Millie be able to have bananas to eat for her treat now? (No)

Bad outcome scenarios
iii) Polly is a Penguin. She lives in the North Pole.
Are you making a picture inside your head of Polly the Penguin?(Response) Where does Polly live? (Response) Good! (Repeat if necessary)
She likes to build snowmen. She gathers the snow from the mountain to build the snowmen. There is lots of snow on the mountain. Then one day the snow melts. And now Polly is really sad because she is not able to build snowmen.
Past reality: When there was lots of snow on the mountain, was Polly able to build snowmen? (Yes)
Current reality: Is Polly able to build snowmen now? (No)
Image-counterfactual: Now, make a picture inside your head of all the snow on the mountain.
Image-reality group: Now, make a picture in your head of all the snow melting on the mountain
Counterfactual: If the snow had not melted, would Polly be able to build snowmen now (Yes)

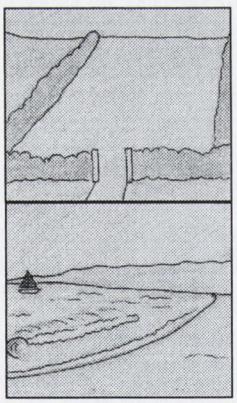
iv) Bobby is a bee. He lives in a beehive
Are you making a picture inside your head of Bobby the bee? (Response) Where does Bobby live? (Response) Good! (Repeat if necessary)
He likes to collect nectar from flowers. He sucks the nectar from the sunflower. There is lots of nectar in the sunflower. Then one day the sunflower is cut down. And now Bobby is really sad because he is not able to collect nectar.
Past reality: When there was lots of nectar in the sunflower, was Bobby able to collect nectar from it? (Yes)
Current reality: Is Bobby able to collect nectar from the sunflower now? (No)
Image-counterfactual: Now, make a picture in your head of all the nectar in the sunflower.
Image-reality: Now make, a picture inside your head of the cut down sunflower

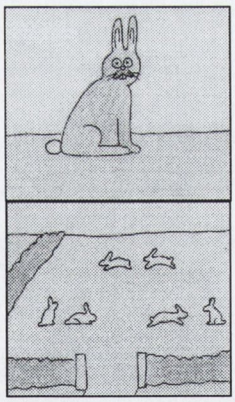
Counterfactual: If the sunflower had not been cut down, would Bobby be able to collect honey from it now? (Yes)

3) Pre-test Manipulation Check
Instructions
I'm going to read you some stories about different animals and when I've finished reading each story I'm going to ask you some things about the story. When I ask you the things about the story I am going to show you some pictures and I want you to put your finger on the picture of what I have said.

Introductory task
Let's try one together.
Connie is a Cow
She lives in a farmyard
She likes to sit down in the farmyard.
Now, see all the pictures on this page. I will say something; then I want you to put your finger on the picture of what I have said.
Put your finger on "Connie is sitting down in the farm yard"
Good!
Now I'm going to read you some other stories about animals and when I have finished reading each story I will show you some pictures and I want you to put your finger on the picture of what I have said:

An example of the four pictures shown to participants in the manipulation check tests (Billie Bunny Scenario)





i) Billie Scenario
Billie is a bunny. He lives in a forest. He likes to play with his friends. He goes to the field to play with them. But the field is empty. Then one day the field is full of friends. And now Billie is really happy because he is able to play with his friends.
Can you put your finger on:
The field is empty
The field is full of other bunnies

ii) Millie Scenario
Millie is a monkey. She lives in the jungle. She likes to eat bananas for her treat. She goes looking in the banana tree for bananas. But the banana tree is bare. Then one-day a bunch

of bananas grow on the tree. And now Millie is really happy because she is able to eat bananas for her treat.
Can you put your finger on the picture of:
The bare banana tree
The bunch of bananas on the tree

iii) Polly scenario
Polly is a Penguin. She lives in the North Pole. She likes to build snowmen. She gathers the snow from the mountain to build the snowmen. There is lots of snow on the mountain. Then one day the snow melts. And now Polly is really sad because she is not able to build snowmen.
Can you put your finger on the picture of:
All the snow on the mountain
The snow melting on the mountain

iv) Bobby scenario
Bobby is a bee. He lives in a beehive. He likes to collect nectar from flowers. He sucks the nectar from the sunflower. There is lots of nectar in the sunflower. Then one day the sunflower is cut down. And now Bobby is really sad because he is not able to collect nectar.
Can you put your finger on the picture of:
All the nectar in the sunflower
The cut-down sunflower

Appendix C Experiment 3

1) The counterfactual-presence and counterfactual absence scenarios
(The instructions for the imagery groups are in italics).

i) Billie Bunny
Counterfactual-presence version
Billie is a bunny
He lives in the forest
He likes to play with his bunny friends
He goes to the field to play with them
The field is full of bunnies
But then one day the field is empty
And now Billie is sad because he is not able to play with his bunny friends.
Past Reality: When the field was full of bunnies, was Billie able to play with his friends? (Yes).
Current Reality: Is Billie able to play with his friends now? (No).
Image Counterfactual: Make a picture inside your head of the field full of bunny friends
Image-Reality: Make a picture inside your head of the empty field
Counterfactual question: If the field had not been empty, would Billie be able to play with his friends now? (Yes).

Counterfactual-absence version
Billie is a bunny
He lives in the forest
He likes to play on his own
He goes to the field to play on his own
The field is empty
But then one day the field is full of other bunnies
And now Billie is sad because he is not able to play on his own
Past Reality: When the field was empty, was Billie able to play on his own? (Yes)
Current Reality: Is Billie able to play on his own now? (No)
Image Counterfactual: Make a picture inside your head of the empty field
Image-Reality: Make a picture inside your head of the field full of other bunnies
Counterfactual question: If the field had not been full of other bunnies, would Billie be able to play on his own now? (Yes)

ii) Millie Monkey
Counterfactual-presence version
Millie is a monkey
She lives in the jungle
She likes to eat bananas that are growing on the tree for her treat
She goes looking in the banana tree for growing bananas
The bananas are growing on the tree
Then one day the bananas fall off the tree
And now Millie is sad because she is not able to eat growing bananas for her treat.
Past Reality: When the bananas were growing on the tree, was Millie able to eat growing bananas for her treat? (Yes)
Current Reality: Is Millie able to eat growing bananas for her treat now? (No)
Image Counterfactual: Make a picture inside your head of the bananas growing on the tree

Image-Reality: Make a picture inside your head of the bananas falling off the tree.
Counterfactual question: If the bananas had not fallen off the tree, would Millie be able to eat growing bananas for her treat now? (Yes)

Counterfactual-absence version
Millie is a monkey
She lives in the jungle
She likes to eat bananas that are falling off the tree for her treat
She goes looking in the banana tree for falling bananas
The bananas are falling off the tree
Then one day the bananas grow on the tree
And now Millie is sad because she is not able to eat falling bananas for her treat.
Past Reality: When the bananas were falling off the tree, was Millie able to eat falling bananas for her treat? (Yes)
Current Reality: Is Millie able to eat falling bananas for her treat now? (No)
Image Counterfactual: Make a picture inside your head of the bananas falling off the tree
Image-Reality: Make a picture inside your head of the new bananas growing on the tree.
Counterfactual question: If the new bananas had not grown on the tree, would Millie be able to eat falling bananas for her treat now? (Yes)

iii) Polly Penguin
Counterfactual-presence version
Polly is a penguin
She lives in the South Pole
She likes to build hard snowmen with hard snow
She gathers the snow from the mountain to build the hard snowmen
The snow is going hard on the mountain
Then one day the hard snow melts
And now Polly is sad because she is not able to build hard snowmen
Past reality: When the snow was going hard on the on the mountain, was Polly able to build hard snowmen? (Yes)
Current reality: Is Polly able to build hard snowmen now? (No)
Image-Counterfactual: *Make a picture inside your head of the snow going hard on the mountain*
Image-Reality: Make a picture inside your head of the hard snow melting on the mountain
Counterfactual question: If the snow had not melted, would Polly be able to build hard snowmen now? (Yes)

Counterfactual-absence version
Polly is a penguin
She lives in the South Pole
She likes to build melting snowmen with melting snow
The snow is melting on the mountain
Then one day the melting snow goes hard
And Polly now is sad because she is not able to build melting snowmen
Past reality: When the snow was melting on the mountain, was Polly able to build melting snowmen? (Yes)
Current reality: Is Polly able to build melting snowmen now? (No)

Image-Counterfactual: *Make a picture inside your head of the snow melting on the mountain*
Image-Reality: Make a picture inside your head of the melting snow going hard on the mountain
Counterfactual question: If the melting snow had not gone hard, would Polly be able to build melting snowmen now? (Yes)

iv) Bobby Bee
Counterfactual-presence version
Bobby is a bee
He lives in a beehive
He likes to collect nectar from open flowers
He sucks the nectar from the open flower
The flower is wide-open
Then one day the flower closes up
And now bobby is sad because he is not able to collect nectar from the wide-open flower.
Past Reality: When the flower was wide open, was Bobby able to collect nectar from it? (Yes)
Current Reality: Is Bobby able to collect nectar from the wide-open flower now? (No)
Image-Counterfactual: *Make a picture inside your head of wide-open flower*
Image-Reality: Make a picture inside your head of the flower closing up
Counterfactual question: If the flower had not closed up, would Bobby be able to collect nectar from the open flower now? (Yes)

Counterfactual-absence version
Bobby is a bee
He lives in a beehive
He likes to collect nectar from closed-up flowers
He sucks the nectar from the closed-up flower
The flower is closed-up
Then one day the flower opens wide
And now Bobby is sad because he is not able to collect nectar from the closed-up flower.
Past Reality: When the flower was closed up, was Bobby able to collect nectar from it? (Yes)
Current Reality: Is Bobby able to collect nectar from the closed-up flower now? (No)
Image-Counterfactual: *Make a picture inside your head of the closed up-flower*
Image-Reality: Make a picture inside your head of the flower opening up
Counterfactual question: If the flower had not opened wide, would Bobby be able to collect nectar from the closed flower now? (Yes)

Good outcome filler
v) Tammy Tiger
Counterfactual-presence version
Tammy is a tiger
She lives in Africa
She likes to take a nap in a cool place in the afternoon
She goes looking for a cool place to take her nap
But the sun is shining hard
Then the sun goes in behind a cloud
And now Tammy is happy because she is able to take a nap in the cool place

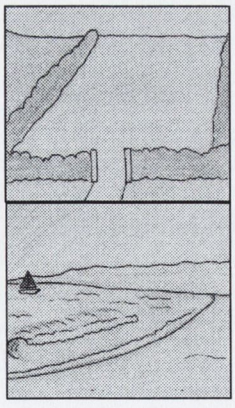
Past Reality: When the sun was shining hard, was Tammy able to take a nap in a cool place? (No)
Current Reality: Is Tammy able to take a nap in a cool place now? (Yes)
Image-Counterfactual: Make a picture inside your head of the sun shining hard
Image-Reality: Make a picture inside your head of the sun going in behind a cloud
Counterfactual Q: If the sun had not gone in behind a cloud, would Tammy be able to take a nap in a cool place now? (No)

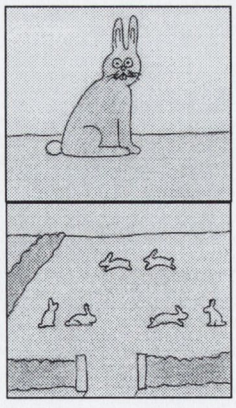
Counterfactual-absence version
Tammy is a tiger
She lives in Africa
She likes to take a nap in a sunny place in the afternoon
She goes looking for a sunny place to take a nap
But the sun is behind a cloud
Then the sun starts to shine hard
And now Tammy is happy because she is able to take a nap in a sunny place.

Past Reality :.When the sun was behind a cloud, was Tammy able to take a nap in a sunny place? (No)
Current Reality: Is Tammy able to take a nap in a sunny place now? (Yes)
Image-Counterfactual: Make a picture inside your head of the sun behind a cloud
Image-Reality: Make a picture inside your head of the sun starting to shine hard
Counterfactual Q : If the sun had not started to shine, would Tammy be able to take a nap in a sunny place now? (No)

2) Post-Test Manipulation Check
Now I'm going to show you some more pictures and I want you to do the same as you did before: I will say something and I want you to point to the best picture of it:
See these pictures here? Can you put your finger on:

An example of the four pictures shown to participants in the manipulation check tests (Billie Bunny Scenario)





ii) Billie Bunny
Counterfactual-presence version
Image-counterfactual group: The field is full of other bunnies
Image-reality group: The field is empty
Counterfactual-absence version
Image-counterfactual group: The field is empty

Image-reality group: The field is full of other bunnies

ii) Millie Monkey

Counterfactual-presence version

Image-counterfactual group New bananas grow on the tree

Image-reality group The bananas are falling off the tree

Counterfactual-absence version

Image-counterfactual group: The bananas are falling off the tree

Image-reality group: New bananas grow on the tree

iii) Polly Penguin

Counterfactual-presence version

Image-counterfactual group: The snow is going hard on the mountain

Image-reality group: The hard snow melts on the mountain

Counterfactual-absence version

Image-counterfactual group: The hard snow melts on the mountain

Image-reality group: The snow is going hard on the mountain

iv) Bobby Bee

Counterfactual-presence version

Image-counterfactual group: The flower is open wide

Image-reality group: The flower is closed up

Counterfactual-absence version

Image-counterfactual group: The flower is closed up

Image-reality group: The flower is open wide

3) Pre-test Manipulation Check

Instructions

I'm going to read you some stories about different animals and when I've finished reading each story I'm going to ask you some things about the story. When I ask you the things about the story I am going to show you some pictures and I want you to put your finger on the picture of what I have said.

Warm-up task

Let's try one together.

Connie is a Cow

She lives in a farmyard

She likes to sit down in the farmyard.

Now, see all the pictures on this page. I will say something; then I want you to put your finger on the picture of what I have said.

Put your finger on "Connie is sitting down in the farm yard"

Good!

Now I'm going to read you some other stories about animals and when I have finished reading each story I will show you some pictures and I want you to put your finger on the picture of what I have said:

Billie absence

Billie is a bunny. He lives in the forest. He likes to play on his own. He goes to the field to play on his own. The field is empty. Then one day the field is full of other bunnies. And now Billie is sad because he is not able to play on his own

Can you put your finger on:

The field is empty

The field is full of other bunnies

Millie absence
Millie is a monkey. She lives in the jungle. She likes to eat bananas that are falling off the tree for her treat. She goes looking in the banana tree for falling bananas. The bananas are falling off the tree. Then one day new bananas grow on the tree. And now Millie is sad because she is not able to eat falling bananas for her treat.
Can you put your finger on:
The bananas are falling off the tree
New bananas grow on the tree

Polly Presence
Polly is a penguin. She lives in the South Pole. She likes to build hard snowmen with hard snow. She gathers the snow from the mountain to build the hard snowmen. The snow is going hard on the mountain. Then one day the hard snow melts. And Polly is sad because she is not able to build hard snowmen now.
Can you put your finger on:
The snow is going hard on the mountain
The hard snow melts

Polly absence
Polly is a penguin. She lives in the South Pole. She likes to build melting snowmen with melting snow. She gathers the snow from the mountain to build the snowmen. The snow is melting on the mountain. Then one day the melting snow goes hard. And Polly is sad because she is not able to build melting snowmen now
Can you put your finger on:
The snow is melting on the mountain
The melting snow goes hard

Bobby Presence
Bobby is a bee. He lives in a beehive. He likes to collect nectar from open flowers.
He sucks the nectar from the wide-open flower. The flower is wide-open. Then one day the flower closes up. And now Bobby is sad because he is not able to collect nectar from the wide-open flower.
Can you put your finger on:
The flower is wide-open
The flower closes up

Appendix D Experiment 4

1) Materials: introductory instructions, scenarios, questions and accompanying pictures

I'm going to read you some stories, and show you some pictures, about people doing different things and I'm going to ask you some things about the stories after I read each one to you. O.K.? So here's the first story.

i) After-School Scenario

Here are two girls (boys) -- Pam and Sue (Paul and Sam) -- who are in after-school clubs. Pam was in the arts and craft's club. During the past year she thought about switching to the singing club. But she decided not to. She then found out that the singing club got to go on a school tour; the arts and craft's club stayed in school. Sue was in the singing club. During the past year she thought about switching to the arts and craft's club. And she decided to. She then found out that the singing club got to go on a school tour; the arts and craft's club stayed in school.

1. Can you remind me which girl is Pam and which one is Sue? *(Check question 1)*

Both these girls thought about switching clubs: one of them decided to switch and one of them decided not to switch

2. Can you tell me which girl decided to switch? *(Check question 2)*
3. And which club did she switch to? *(Check question 3)*
4. And which girl decided not to switch? *(Check question 4)*
5. And which club did she stay in? *(Check question 5)*
6. Which club got to go on the school tour? *(Check question 6)*
7. And which club stayed in school? *(Check question 7)*
8. One of these two girls has just wished that she could have made a different decision about what club to be in...Which girl do you think made that wish? *(Who wishes "if only"?)*
9. So Pam/Sue just wished that she could have made a different decision about what club to be in...now it's your job to guess how she finished her wish. I'll say the first part of the wish again, O.K.?

Pam/Sue just wished that she could have made a different decision about what club to be in, they could have made a different decision if only...can you finish the wish? *(Sentence completion task)*

10. Which boy/girl do you think feels worse about the decision they made about what club to be in, or do you think they feel the same? *(Worse judgement)*
11. I've forgotten which club Paul/Pam and Sam/Sue were in before they thought about switching clubs! Can you remind me? *(Check question 8)*

ii) Basketball Scenario

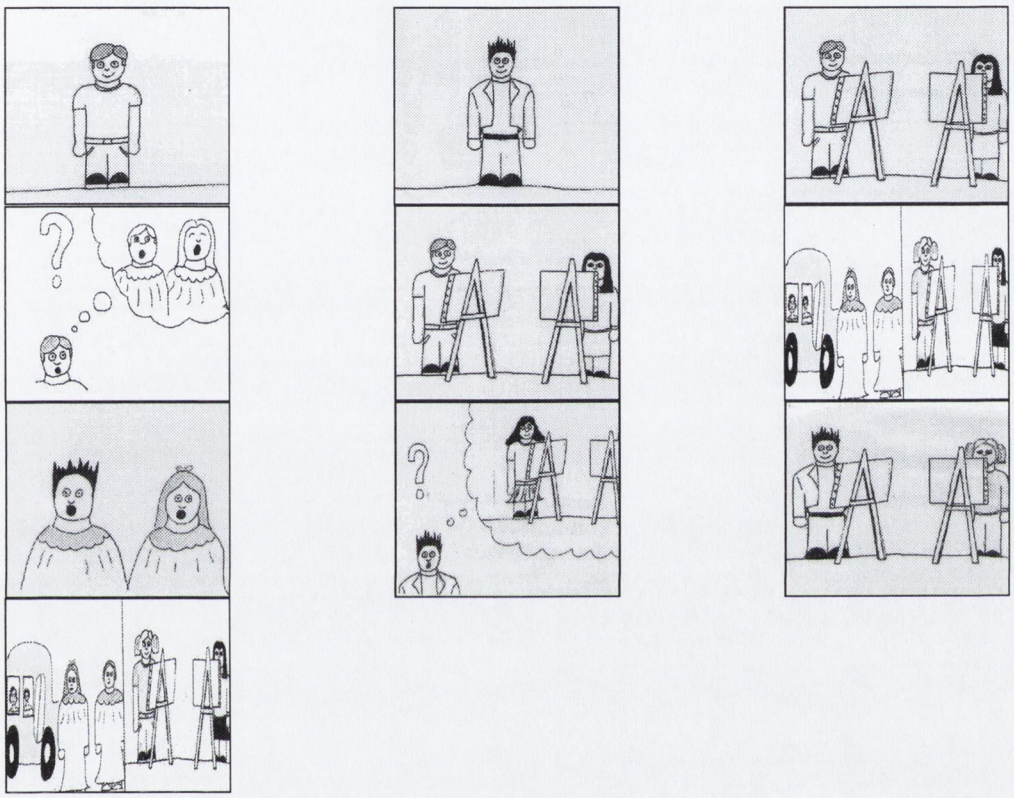
Here are two girls (boys) -- Jane and Mel (Jim and Mark) -- who are in basketball teams. Jane played basketball for the Red basketball team. Last year she thought about switching to the Blue basketball team. But she decided not to. A month ago the Blue basketball team won the big basketball competition; the Red basketball team lost the big basketball competition. Mel played basketball for the Blue basketball team. Last year she thought about switching to the Red basketball team. And she decided to. A month ago the Blue basketball team won the big basketball competition; the Red basketball team lost the big basketball competition.

iii) Holiday Scenario

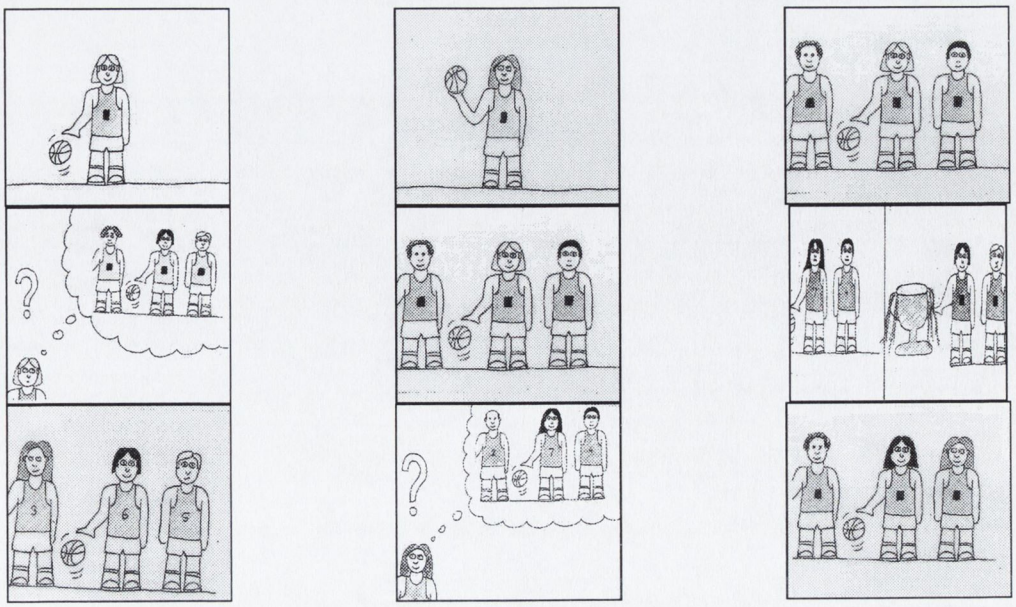
Here are two families -- the Clarkes and the Bradys -- who like to go on holidays. For

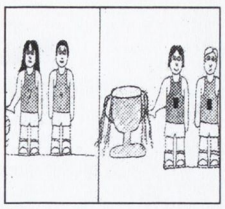
years the Clarke family has gone on holidays to the mountains for two weeks in July. This year they thought about going on holidays to the seaside. But they decided to go back to the mountains. It rained for the whole 2 weeks in the mountains; it was sunny at the seaside. For years the Brady family has gone on holidays to the seaside for two weeks in July. This year they thought about going on holidays to the mountains instead. And they decided to. It rained for the whole two weeks in the mountains; it was sunny at the seaside

After-school Scenario

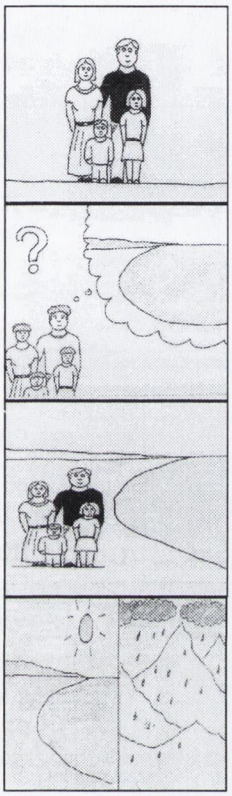


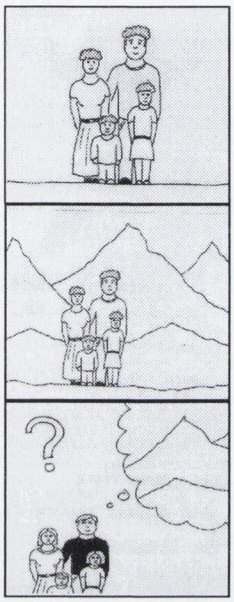
Basketball Scenario

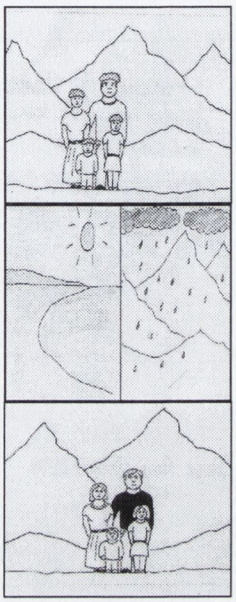




Holiday Scenario







2) Results for individual scenarios

Judgements of Emotions As many 6-year-olds judged that the actor would feel worse as judged that the non-actor would feel worse for the after-school scenario (50% vs. 28%, binomial $n = 25$, $z = 1.2$, $p = .12$), the basketball scenario (44% vs. 34%, binomial $n = 25$, $z = 0.4$, $p = .35$) and the holiday scenario (41% vs. 34%, binomial $n = 24$, $z = 0.20$, $p = .42$). More 8-year-olds judged that the actors would feel worse than vice versa for the holiday scenario (44 % vs. 9%, binomial $n = 17$, $z = 2.42$, $p = .007$), however the difference was not significant for the after-school scenario (34% vs. 16%, binomial $n = 16$, $z = 0.66$, $p = .15$) or for the basketball scenario (44% vs. 37%, binomial $n = 26$, $z = 1.96$, $p = .42$). The two groups differed reliably in their judgements of emotions for the after-school scenario, $\chi^2(2, N = 64) = 5.59$, $p = .03$, and the holiday scenario, $\chi^2(2, N = 64) = 6.74$, $p = .02$, but not for the basketball scenario $\chi^2(2, N = 64) = .12$, $p = .46$.

Table D.1 Percentage of judgements of who feels worse/same for actions and inactions given by the two age groups for each individual scenario in Experiment 4.

	6-year-olds	8-year-olds	Total
After-School Scenario			
Action	50	34	42
Inaction	28	16	22
Same	22	50	36
Basketball Scenario			
Action	44	44	44
Inaction	34	37	36
Same	22	19	20
Holiday Scenario			
Action	41	44	42
Inaction	34	9	22
Same	25	47	36

Who wishes "if only" More 6-year-olds judged that the actor had made the wish in comparison to the non-actor for the after-school scenario (67% vs. 33% binomial $n = 32$, $z = 1.59$ $p = .056$), the basketball scenario (69% vs. 31%, binomial $n = 32$, $z = 1.94$, $p = .025$) and for the holiday scenario, but this difference was not reliable (62.5% vs. 37.5%, binomial $n = 32$, $z = 1.24$, $p = .11$). Eight-year-olds judged that the actor had made the wish as often as they judged that the non-actor had made the wish for the basketball scenario (44% vs. 56%, binomial $n = 32$, $z = -0.53$, $p = .30$) and the holiday scenario (47 % vs. 47%, binomial $n = 30$ $z = -0.17$, $p = .50$) scenarios. The action effect was reversed for the 8-year-olds' judgements for the after-school scenario however: more 8-year-olds judged that the non-actor (67%) had made the "if only" wish compared to the actor (33%), and this difference was approaching significance (binomial, $n = 32$, $z = -1.59$, $p = .056$). There was a reliable age difference for the after-school scenario, χ^2 $(2, N = 64) = 6.25$, $p = .01$ two-tailed, and the basketball scenario, χ^2 $(2, N = 64) = 4.06$, $p = .04$ two-tailed, but not for the holiday scenario, $\chi^2(2, N = 62) = .98$, $p = .32$ two-tailed.

Table D.2 Percentage of judgements of who wishes "if only" for actions and inactions given by the two age groups overall for each individual scenario in Experiment 4.

	6-year-olds	8-year-olds	Total
After-school Scenario			
Action	67	33	50
Inaction	33	67	50
Both	0	0	0
Basketball Scenario			
Action	69	44	56
Inaction	31	56	44
Both	0	0	0
Holiday Scenario			
Action	62.5	47	55
Inaction	37.5	47	42
Both	0	6	3

Sentence completion task More 6-year-olds completed the counterfactual thought by

undoing the actor's actions rather than the non-actor's inactions for the basketball scenario only (53% vs. 22%, binomial $n = 24$, $z = 1.84$, $p = .03$); although more 6-year-olds undid the actor's actions more often than the non-actor's inactions for the after-school and holiday scenarios, the difference was not reliable (50% vs. 31%, $n = 26$, $z = 0.98$ $p = .164$ and 41% vs. 25%, binomial $n = 21$, $z = 0.87$, $p = .19$ respectively). The 8-year-old children completed the counterfactual thought by undoing the actor's actions as often as they undid the non-actor's inactions for the after-school scenario (28% vs. 25%, binomial $n = 17$, $z = 0.47$, $p = .50$), the basketball scenario (31% vs. 31%, binomial $n = 20$, $z = -0.22$, $p = .5$) and for the holiday scenario (28% vs. 25%, binomial $n = 17$ $z = 0$, $p = .50$). The two groups did not differ reliably for the after-school, $\chi^2(1, N = 43) = .31$, $p =$. 29, or the holiday scenarios, $\chi^2(1, N = 21) = .310$, p = .289, whereas there was a marginal age difference for the basketball scenario, $\chi^2(1, N = 24) = 1.99$, $p = .08$.

Table D.3 Percentage of mutations given by the two age-groups for the sentence completion task for each individual scenario in Experiment 4.

	6-year-olds	8-year-olds	Total
Afterschool Scenario			
Action	50	28	39
Inaction	31	25	28
Actor's "inaction"	3	0	1.5
Outcome	6.5	22	14
Don't know	3	0	1.5
Other	6.5	25	16
Basketball Scenario			
Action	53	31	42
Inaction	22	31	27
Actor's "inaction"	9	3	6
Outcome	13	19	15.5
Don't know	3	0	1.5
Other	0	16	8
Holiday Scenario			
Action	41	28	34.5
Inaction	25	25	25
Actor's "inaction"	16	3	9.5
Outcome	3	19	11
Don't know	3	0	1.5
Other	12	25	18.5

Appendix E Experiment 5

1) Materials: introductory instructions, scenarios and questions

i) Coin Scenario

This is Oscar and he tells these two puppets, Jill and Pam, about this great game.
1. Can you show me which puppet is which? *(Check question 1)*
Oscar puts two boxes each on the table in front of the two puppets. So two boxes for Jill, and two boxes for Pam. Each puppet has to pick one of their two boxes and look inside. One of Jill's boxes has a yellow coin inside, and one of them has a green coin inside; And one of Pam's boxes has a yellow coin inside, and one of them has a green coin inside. The puppets don't know which of their boxes has the yellow coin inside and which box has the green coin inside. Now, they will each win a prize if they pick the box with the green coin inside. So Jill will win her stickers if she picks the box with the green coin inside. And Pam will win her stickers if she picks the box with the green coin inside.
But if they pick the box that has the yellow coin inside, they win nothing. So Jill will win nothing if she picks the box with the yellow coin inside. And Pam will win nothing if she picks the box with the yellow coin inside.
2. Can you tell me how the puppets can win the prize? (*Check question 2)*

Jill goes first so Oscar asks Pam to wait outside. Oscar then asks Jill to pick one of her two boxes. So Jill picks *this* box (pointing). Before she looks inside, Oscar asks her if she is sure about *this* box (pointing) or does she want to switch the box she's picked with *that* box (pointing). Jill thinks about switching boxes, but she decides to stay with this box (pointing). Oscar then says she can look inside the box she's picked. Jill looks inside the box and the yellow coin is inside. So she doesn't win her prize. Pam goes next so Oscar asks Jill to wait outside. Oscar then asks Pam to pick one of her two boxes. So Pam picks *this* box. Before she looks inside, Oscar asks her if she is sure about *this* box or does she want to switch the box she's picked with *that* box? Pam thinks about switching boxes. And she decides to switch to *that box.* Oscar then says she can look inside the box she's picked. Pam looks inside the box and the yellow coin is inside. So she doesn't win her prize.
3. Can you remind me which puppet is Jill and which one is Pam? *(Check question 3)*
4. Both these puppets thought about switching boxes. One of them decided to switch and the other one decided not to switch. Can you tell me which puppet decided to switch boxes? *(Check question 4)*
5. And can you show me the box she looked inside to see if she won her prize? *(Check question 5)*
6. And which one decided not to switch boxes? *(Check question 6)*
7. And can you show me which box she looked inside to see if she won her prize? *(Check question 7)*
8. One of these two puppets has just told Oscar that they wish that they had played the game differently. Which puppet do you think said that to Oscar? *("If only" question)*
9. So Jill/Pam has just told Oscar that she wishes that she could have played the game differently. She could have played the game differently if only… Now it's your job to guess how she finishes the wish. I'll say the first part of the wish again, O.K.? Jill/Pam wishes that she could have played the game differently. She could have played the game differently if only… Can you guess how she finishes her wish? *("If only" sentence completion)*
10. Which puppet do you think feels worse about how they played the game? Or do you

think they feel the same? *(Worse judgement)*
11. Guess what? Oscar's forgotten how the puppets could have won the game. Can you remind him? *(Check question 8)*

ii) Card Scenario
This is Oscar (again) and he tells these two puppets -- Ann and Beth -- about this (another) great game.
Oscar puts two cards each face down on the table in front of both puppets. So two cards for Ann and two cards for Beth. Each puppet has to pick one of their two cards and look at it. Now, one of Ann's cards is black, and one of them is red. And one of Beth's cards is black, and of them one is red. The puppets don't know which one of their cards is black and which is red. Now, they will each win a prize if they pick the black card. So Ann will win her stickers if she picks the black card. And Beth will win her stickers if she picks the black card. But if they pick the red card, they win nothing. So Ann will win nothing if she picks the red card. And Beth will win nothing if s*he* picks the red card.

iii) Marbles Scenario
This is Oscar (again) and he tells these two puppets -- Fee and Sue -- about this (another) great game. Oscar puts two bags of marbles each down on the table in front of both puppets. So two bags for Fee and two bags for Sue. Each puppet has to pick one of their two bags and look inside. Now one of Fee's bags has blue marbles in inside, and one of them has white marbles inside. And one of Sue's bags has blue marbles in inside, and one of them has white marbles inside. The puppets don't know which of their two bags has the blue marbles inside and which has the white marbles inside. Now, they can each win a prize if they pick the bag with the white marbles inside. So Fee will win her stickers if she picks the bag with the white marbles inside. And Sue will win *her* stickers if she picks the bag with the white marbles inside. But if they pick the bag with the blue marbles inside, they win nothing. So Fee will win nothing if she picks the bag with the blue marbles inside. And Sue will win nothing if s*he* picks the bag with the blue marbles inside.

2) Results for individual scenarios

Judgements of Emotions As many 6-year-olds judged that the actor would feel worse as judged that the non-actor would feel worse for the coin scenario (26.5% vs. 26.5%, binomial, $n = 16$, $z = 0$, $p = .5$), the card scenario (27% vs. 20%, binomial, $n = 14$, $z = 0.27$, $p = .40$) and the marbles scenario (27% vs. 16.5 %, binomial, $n = 13$, $z = 0.56$, $p = .29$). For the 8-year-olds the results show that reliably more children judged that the actor would feel worse than the non-actor, than vice versa for the coin scenario (41 % vs. 15%, binomial, $n = 19$, $z = 1.84$, $p = .03$) and the card scenario (38% vs. 15%, binomial, $n = 18$, $z = 1.65$, $p = .05$), although for the marbles scenario, as many 8-year-olds judged that the actor would feel worse as judged that the non-actor would feel worse (23.5% vs. 23.5%, binomial, $n = 16$, $z = 0$, $p = .5$). The two groups did not differ reliably in their judgements of who feels worse for actions and inactions for the coin scenario χ^2 (2, $N = 64$) = 2.12, $p = .35$ two-tailed, the card scenario, $\chi^2(2, N = 64) = 1.04$, $p = .60$ two-tailed, or the marbles scenario, $\chi^2(2, N = 64) = .47$, $p = .80$ two-tailed.

Table E.1 Percentage of judgements of who feels worse/same for actions and inactions given by the two age groups for the three individual scenarios in Experiment 5.

	6-year-olds	8-year-olds	Total
Coin Scenario			
Action	26.5	41	34.5
Inaction	26.5	15	20.5
Same	47	44	45
Card Scenario			
Action	27	38	33
Inaction	20	15	17
Same	53	47	50
Marbles Scenario			
Action	27	23.5	25
Inaction	16.5	23.5	20
Same	56.5	53	55

Who wishes "if only" Six-year-olds judged that the actor had made the wish as often as they judged that the non-actor had for the coin scenario (57% vs. 43%, binomial, $n = 30$, $z = 0.57$, $p = .29$), the card scenario (37% vs. 63%, n = 30, $z = -1.28$, $p = .10$), and the marbles scenario (63% vs. 37%, $n = 30$, $z = 1.28$, $p = .10$). Similarly, 8-year-olds judged that the actor had made the wish as often as they judged that the non-actor had for the coin scenario (56% vs. 44%, binomial $n = 34$, $z = 0.51$, $p = .30$), the card scenario (59% vs. 41%, binomial $n = 34$, $z = 0.86$, $p = .20$) and for the marbles scenario (53% vs. 47%, binomial, $n = 34$, $z = 0.17$, $p = .43$). There was no reliable age difference in the children's judgements of who wishes "if only" for the coin scenario, $\chi^2(1, N = 64) = .004$, $p = .95$ two-tailed, the marbles scenario, $\chi^2(1, N = 64) = .71$, $p = .40$ two-tailed or the card scenario, although this difference was approaching significance $\chi^2(1, N = 64) = 3.13$, $p = .08$ two tailed.

Table E.2 Percentage of judgements for who wishes "if only" for actions and inactions given by the two age groups overall for the three individual scenarios in Experiment 5.

	6-year-olds	8-year-olds	Total
Coin Scenario			
Action	57	56	56
Inaction	43	44	44
Card Scenario			
Action	37	59	48
Inaction	63	41	52
Marbles Scenario			
Action	63	53	58
Inaction	37	47	42

Sentence completion task The 6-year-olds completed the counterfactual thought by undoing the actor's actions as often as they undid the non-actor's actions for the coin scenario (37% vs. 30%, binomial $n = 20$, $z = 0.22$, $p = .41$), the card scenario (20% vs. 37%, binomial, $n = 17$, $z = -0.97$, $p = .17$) and for the marbles scenario (40% vs. 23%, binomial, $n = 19$, $z = 0.92$, $p = .18$). The results for the 8-year-olds show that they completed the counterfactual thought by undoing the actor's action as often as they undid the non-actor's inaction for the coin scenario (44% vs. 32%, binomial $n = 26$, $z =$

0.59, $p = .278$) and for the marbles scenario (33% vs. 38%, binomial, $n = 25$, $z = 0$, $p = .5$). The 8-year olds undid the actor's action more than the non-actor's inaction in their sentence stem completions for the card scenario and this difference was marginal (53% vs. 26%, binomial, $n = 27$, $z = 1.54$, $p = .06$). The two age groups differed reliably in their sentence completions for the card scenario only, $\chi^2(1, N = 44) = 4.14$, $p = .04$, two-tailed; they did not differ reliably for the coin scenario, $\chi^2(1, N = 46) = 0.03$, $p = .86$ two-tailed, or the marbles scenario, $\chi^2(1, N = 44) = 1.00$, $p = .32$ two-tailed.

Table E.3 Percentage of mutations given by the two age-groups for the sentence completion task overall across the three scenarios in Experiment 5.

	6-year-olds	8-year-olds	Total
Coin Scenario			
Action	37	44	41
Inaction	30	32	31
Oscar	0	6	3
Winning	10	6	8
Play Again	3	3	3
Other	20	9	14
Card Scenario			
Action	20	53	36.5
Inaction	37	26	31.5
Oscar	0	6	3
Winning	13	6	9.5
Play Again	7	0	3.5
Other	23	9	16
Marbles Scenario			
Action	41	34	38
Inaction	23	39	31
Oscar	0	6	3
Winning	13	9	11
Play Again	3	0	1
Other	20	12	16

Appendix F Experiment 6

1) Introductory instructions, scenarios and questions

I'm going to show you some puppets playing different games with cards, marbles and coins, and I'm going to ask you some things about the games and what the puppets said after they played each game. O.K.? So here's the first game:

i) Coin Scenario

Here are two puppets, Jill and Pam (Jim and Pat) who are told about this great game.
1. Can you show me which puppet is which? *(Check question 1).*
Each puppet is given a coin and each one tosses their coin. Now do you see that this side of the coin is green and that the other side of the coin is yellow? If the two coins come up the same -- both on the green side or both on the yellow side -- each puppet will win this prize (pointing to stickers). But if the two coins do not come up the same, neither puppet wins anything
2. Can you show me how they both can win? *(Check question 2).*
Jill goes first and tosses the coin and it lands on green side of the coin. Pam goes next and tosses the coin and it lands on the yellow side of the coin. So, neither puppet wins anything.
3. Now this is Oscar. He is friends with Jill and Pam. Oscar likes to wish that things could have been different for his friends. He is going to whisper a wish in my ear about his friends, and it's your job to guess how he finishes his wish. O.K.? Oscar just said that he wishes that Jill and Pam could have won the prize. They could have won the prize if only one of them had tossed a different side of the coin, so if… Can you guess how he finishes his wish? I'll say the first part of his wish again: Oscar wishes that Jill and Pam could have won the prize. They could have won the prize if only one of them had tossed a different side of the coin, so if…Can you guess how he finishes the wish? *(Sentence completion task)*
4. Now one of these puppets just said that they feel guilty about them not winning the prize. Which puppet do you think said that? (*Guilt judgement*)
5. And one of the puppets just said that they really blame the other one for not winning the prize. Which puppet do you think said that? *(Blame judgement)*
6. Which puppet do you think feels worse about them not winning the prize? (*Worse judgement)*
7. Can you show me how the coins would look if they had won? (*Physical manipulation task)*
8. Can you tell me why the puppets didn't win the prize? *(Causal question)*
9. Guess what? Oscar's forgotten how they could have won. Can you tell him how the puppets could have won the prize? (*Check question 3*).

ii) Card Scenario

Here are two puppets, Ann and Beth (Al and Bill) who are told about this great game. Each puppet is given a pile of cards, and each one picks a card from his/her own pile. Can you see that there are only red and brown cards in each pile? Now, if the two cards they pick are the same colour -- so if both are brown or both are red -- each puppet wins the prize. But if the two cards are not the same colour, neither puppet wins anything.
Ann goes first and picks a brown card from her pile. Beth goes next and picks a red card from her pile. So, neither puppet wins anything.

iii) Marbles Scenario

Here are two puppets, Fee and Sue (Finn and Sam) who are told about this great game. Each puppet is given a sack of marbles, and each puppet takes a marble from their own sack. Can you see that the sacks only have white and blue marbles? If the two marbles they take are the same colour, so if both are blue or both are white, each puppet wins the prize. But, if the two marbles are not the same colour, neither puppet wins anything. Fee goes first and takes a blue marble from her sack. Sue goes next and takes a white marble from her sack. So, neither puppet wins anything.

2) Results for individual scenarios

Judgements of emotions and social ascriptions

Guilt

More 8-year-olds judged the second puppet would feel guilt rather than the first puppet for the marbles scenario (69% vs. 31% binomial $n = 29$, $z = 1.86$, $p = .03$) and marginally so for the card scenario (66% vs. 34 % binomial, $n = 29$, $z = 1.48$, $p = .07$). The difference was not reliable for the coin scenario (62% vs. 38% binomial, $n = 29$, $z = 1.11$, $p = .13$). The 6-year-olds judged guilt equally for the second puppet and the first for the marbles scenario (45% vs. 52%, binomial $n = 32$, $z = -.176$, $p = .33$). But more 6-year-olds judged the second puppet would feel guilt rather than the first for the card scenario (70% vs. 30%, binomial $n = 33$, $z = -2.08$, $p = .04$, two-tailed) and marginally more ascribed guilt to the second puppet rather than the first for the coin scenario (64% vs. 36%, binomial $n = 33$, $z = 1.39$, $p = .08$). The two age groups differed for the card scenario, $\chi^2(1, N = 62) = 7.68$, $p = .003$ and the marbles scenario $\chi^2(1, N = 61) = 3.04$, $p = .041$, but not for the coin scenario, $\chi^2(1, N = 62) = .016$, $p = .45$.

Table F.1 Percentage of judgements of guilt given by the two age groups for each individual scenario in Experiment 6.

	6-year-olds	8-year-olds	Total
Coins			
First mentioned	36	38	37
Second mentioned	64	62	63
Both	0	0	0
Cards			
First mentioned	70	34	53
Second mentioned	30	66	47
Both	0	0	0
Marbles			
First mentioned	52	31	42
Second mentioned	45	69	56
Both	3	0	2

Blame More 8-year-olds judged that the first puppet would blame the second rather than the second would blame the first for the marbles scenario (76% vs. 24%, binomial $n = 29$, $z = 2.59$, $p = .005$) and marginally so the coin (66% vs. 34%, binomial $n = 29$, $z = 1.48$, $p = .07$) and card scenarios (66% vs. 34%, binomial $n = 29$, $z = 1.48$, $p = .07$). More 6-year-olds judged that the first puppet would blame the second puppet for the coin scenario (70% vs. 30% binomial $n = 33$, $z = 2.08$, $p = .037$, two-tailed), the reverse pattern was found for the card scenario (27% vs. 73% binomial $n = 33$ $z = -2.44$,

$p = .015$, two-tail) and they judged blame equally for the first player than the second for the marbles scenario (48% vs. 52% binomial $n = 33$, $z = 0$, $p = 1.00$ two-tailed). The two age groups differed for the judgements of blame for both the card, $\chi^2(1, N = 62) = 9.11$, $p = .002$, and marbles, $\chi^2(1, N = 62) = 4.87$, $p = .02$ scenarios, but they did not differ for the coin scenario $\chi^2(1, N = 62) = .12$, $p = .38$.

Table F.2 Percentage of blame ascriptions given by the two age groups for each individual scenario in Experiment 6.

	6-year-olds	8-year-olds	Total
Coins			
First mentioned	70	66	68
Second mentioned	30	34	32
Cards			
First mentioned	27	66	45
Second mentioned	73	34	56
Marbles			
First mentioned	48	76	61
Second mentioned	52	24	39

Worse The 8-year-olds judged that the second puppet would feel worse compared to the first puppet for the coin scenario (69% vs. 31% binomial, $n = 29$, $z = 1.86$, $p = .03$), the card scenario (76% vs. 24% binomial, $n = 29$, $z = 2.59$, $p = .005$) and the marbles scenario (79% vs. 21%, binomial $n = 29$, $z = 0.77$, $p = .0002$). More 6-year-olds judged that the second puppet would feel worse compared to the first puppet for the coin scenario (76% vs. 18%, binomial $n = 31$, $z = 3.23$, $p = .001$ two-tailed) but as many 6-year-olds judged that the second puppet would feel worse as judged that the first puppet would feel worse for the card (55% vs. 42%, binomial $n = 32$, $z = .79$, $p = .60$) and marbles scenarios (52% vs. 45% $n = 32$, $z = -.17$, $p = .86$). The two age groups differed in their judgements of who feels worse for the card, $\chi^2(1, N = 61) = 2.59$, $p = .054$, and marbles scenario, $\chi^2(1, N = 61) = 4.62$, $p = .02$, but they did not differ for the coin scenario, $\chi^2(1, N = 60) = 1.09$, $p = .15$.

Table F.3 Percentage of judgements of who feels worse given by the two age groups for each individual scenario in Experiment 6.

	6-year-olds	8-year-olds	Total
Coins			
First mentioned	18	31	24
Second mentioned	76	69	73
Neither	0	0	0
Both	6	0	3
Cards			
First mentioned	42	24	34
Second mentioned	55	76	64.5
Neither	0	0	0
Both	3	0	1.5
Marbles			
First mentioned	45	21	34
Second mentioned	52	79	64.5
Neither	3	0	1.5
Both	0	0	0

"If only" thoughts

Sentence completion task For the 6-year-old participants whose sentence stem completions focused on a single event, reliably more children undid the second event rather than the first for the coin scenario (67% vs. 21%, binomial $n = 29$, $z = 2.59$, $p = .005$) and the marbles scenario (55% vs. 18%, binomial $n = 24$, $z = 2.25$, $p = .01$) and marginally so for the card scenario (52% vs. 33%, binomial $n = 28$, $z = .94$, $p = .09$). Reliably more 8-year-olds undid the second event rather than the first for the coin scenario (65.5% vs. 27.5%, binomial $n = 27$, $z = 1.92$, $p = .01$) and the marbles scenario (66% vs. 17%, binomial $n = 24$, $z = 2.65$, $p = .004$) and marginally so for the card scenario (48% vs. 24%, binomial $n = 21$, $z = 1.31$, $p = .09$). The two age groups did not differ for the coin scenario $\chi^2(1, N = 56) = .22$, $p = .32$, the card scenario, $\chi^2(1, N = 49) = .18$, $p = .34$, or the marbles scenario $\chi^2(1, N = 48) = .12$, $p = .73$.

Essentially the same pattern was observed when we combined the sentence stem completions that focused on a single event and those that focused on one event and then the other. For the 6-year-olds the temporal order effect was observed for "if only" thoughts that focused on the first or second events or both for the coin scenario (67% vs. 24%, binomial $n = 30$, $z = 2.37$, $p = .009$), and the marbles scenario (67% vs. 18%, binomial $n = 28$, $z = 2.83$, $p = .003$) but not for the card scenario (58% vs. 33% binomial $n = 30$ $z = 1.27$, $p = .10$). For the 8-year-olds the temporal order effect was observed for mutations that focused on the first or second events or both for the coin scenario (65.5% vs. 27.5% binomial $n = 27$, $z = 1.92$, $p = .03$) and the marbles scenario (69.5% vs. 20.5%, binomial $n = 26$, $z = 2.55$, $p = .006$), and marginally for the card scenario (55% vs. 27.5% binomial $n = 24$, $z = 1.43$, $p = .08$). The two age groups did not differ for those children who undid both events for the coin, $\chi^2(1, N = 57) = .06$, $p = .84$ two-tailed, the card $\chi^2(1, N = 53) = .121$, $p = .73$ two-tailed, or the marbles scenario, $\chi^2(1, N = 50) = .02$, $p = .87$ two-tailed.

Table F.4 Percentages of mutations of each event for the sentence completion task given by the two age groups for the individual scenarios in Experiment 6.

	6-year-olds	8-year-olds	Total
Coin Scenario			
First mentioned only	21	27.5	23
First then second	3	0	3
First mentioned overall	24	27.5	26
Second mentioned only	67	65.5	66
Second then first	0	0	0
Second mentioned overall	67	65.5	66
Other	9	7	8
Card Scenario			
First mentioned only	33	24	29
First then second	0	3.5	2
First mentioned overall	33	27.5	31
Second mentioned only	52	48	50
Second then first	6	7	6
Second mentioned overall	58	55	56
Other	9	17.5	13
Marbles Scenario			
First mentioned only	18	17	18
First then second	0	3.5	1
First mentioned overall	18	20.5	19
Second mentioned only	55	66	60
Second then first	12	3.5	8
Second mentioned overall	67	69.5	68
Other	15	10	13

Physical manipulation task For those 6-year-olds whose mutations focused on a single event, reliably more participants undid the second event than the first event for the coin scenario (58% vs. 24%, binomial, $n = 27$, $z = 1.92$, $p = .03$) and the marbles scenario (67% vs. 15%, binomial $n = 27$, $z = 3.08$, $p = .001$) but participants undid the second event as often as they undid the first event for the card scenario (45% vs. 36%, binomial $n = 27$, $z = 0.38$, $p = .35$). For those 8-year-olds whose mutations focused on a single event, reliably more participants undid the second event rather than the first event for the coin scenario (72% vs. 21%, binomial, $n = 27$, $z = 2.69$ $p = .004$) and the marbles scenario (72.5% vs. 17%, binomial $n = 26$, $z = 2.94$, $p = .002$) but participants undid the second event as often as the first for the card scenario (48% vs. 28%, binomial $n = 22$ z $= 1.06$, $p = .14$). The two age groups did not differ for the coin, $\chi^2(1, N = 54) = .39$, $p = .27$, the card, $\chi^2(1, N = 49) = .33$, $p = .28$, or the marbles scenario, $\chi^2(1, N = 53) = .01$, $p = .47$.

The same pattern was observed when we combined the responses that changed a single object and those that changed one object and the other. For the 6-year-olds, the temporal order effect was observed for mutations that focused on the first or second

events or both for the coin scenario (67% vs. 33% binomial $n = 33$, $z = 1.74$, $p = .04$) and the marbles scenario (85% vs. 15% binomial $n = 33$, $z = 3.83$, $p = .0001$), but not for the card scenario (54% vs. 45% binomial $n = 33$ $z = 0.35$, $p = .34$). For the 8-year-olds the temporal order effect was observed for mutations that focused on the first or second event, or both for the coin scenario (79% vs. 21% binomial $n = 29$, $z = 2.97$, $p = .002$), the marbles scenario (83% vs. 17%, binomial $n = 29$, $z = 3.34$, $p = .001$) but not for the card scenario (58% vs. 42% binomial, $n = 29$, $z = 0.74$, $p = .23$). The two age groups did not differ for those children who undid both events for the coin, $\chi^2(1, N = 62) = 1.24$, $p = .27$, two-tailed, the card, $\chi^2(1, N = 62) = .104$, $p = .75$, two-tailed, or the marbles scenario, $\chi^2(1, N = 62) = .05$, $p = .82$ two-tailed.

Table F. 5 Percentages of mutations of each event for the physical manipulation task given by the two age groups for the individual scenarios in Experiment 6.

	6-year-olds	8-year-olds	Total
Coin Scenario			
First changed only	24	21	22.5
First then second	9	0	5
First changed overall	33	21	27.5
Second changed only	58	72	64.5
Second then first	9	7	8
Second changed overall	67	79	72.5
Card Scenario			
First changed only	36	28	32
First then second	9	14	11.5
First changed overall	45	42	43.5
Second changed only	45	48	47
Second then first	9	10	9.5
Second changed overall	54	58	56.5
Marbles Scenario			
First changed only	15	17	16
First then second	0	0	0
First changed overall	15	17	16
Second changed only	67	72.5	69.5
Second then first	18	10.5	14.5
Second changed overall	85	83	84

Causal question For those children who made reference to a single event in their causal attributions for the individual scenarios, more 6-year-olds mentioned the second event rather than the first for the coin (12% vs. 0%, binomial, $n = 12$ $z = 3.17$, $p = .06$), card (21% vs. 0%, binomial, $n = 7$ $z = 2.26$, $p = .08$) and marbles scenarios (21% vs. 6%, binomial, $n = 9$, $z = 1.33$, $p = .09$) although each effect was marginal. More 8-year-olds mentioned the second rather than the first event for the coin (28% vs. 3%, binomial, $n = 12$, $z = 2.02$, $p = .04$), card (28% vs. 7%, binomial, $n = 10$, $z = 1.58$, $p = .05$) and marbles scenarios (28% vs. 3.5%, binomial, $n = 9$, $z = 2.00$ $p = .02$). The two age groups did not differ for the coin, $\chi^2(1, N = 13) = .48$, $p = .24$, the card, $\chi^2(1, N = 17) = 1.59$, $p = .10$, or the marbles scenario, $\chi^2(1, N = 18) = .40$, $p = .264$.

For those causal attributions that made reference to both events, reliably more 6-year-olds made reference to the second then first event than they did to the first then second event for the coin scenario (12% vs. 36%, binomial, $n = 21$ $z = 1.75$, $p =$. 04) but not reliably for the card scenario (18% vs. 24%, binomial, $n = 42$, $z = .77$, $p = .19$) or the marbles scenario (15% vs. 15%, binomial, $n = 10$, $z = - 0.32$, $p = .5$). Reliably more 8-year-olds made reference to the second then first event for the coin scenario (34% vs. 7%, binomial, $n = 21$ $z = 2.02$, $p = .001$), and card scenarios (14% vs. 7%, binomial, $n = 16$ $z = 0.67$, $p = .04$) and marginally for the marbles scenario (20.5% vs. 3.5%, binomial $n = 7$, $z = 1.51$, $p = .06$). The two groups differed for those children who focused on both events for the coin scenario $\chi^2(1, N = 28) = 9.33$, $p = .001$ and they differed marginally for the marbles scenario, $\chi^2(1, N = 17) = 2.30$, $p = .07$. They did not differ for the card scenario $\chi^2(1, N = 20) = .95$, $p = .17$.

Table F.6 Percentage of causal attributions for each event given by the two age groups for each individual scenario in Experiment 6. .

	6-year-olds	**8-year-olds**	**Total**
Coin scenario			
First mentioned only	0	3	1.5
First then second	36	7	22.5
First mentioned overall	36	10	24
Second mentioned only	12	28	19
Second then first	12	34	23
Second mentioned overall	24	62	42
"Different"	37	28	32
Other	3	0	1.5
Card Scenario			
First mentioned only	0	7	3
First then second	24	7	16
First mentioned overall	24	14	19
Second mentioned only	21	28	24
Second then first	18	14	16
Second mentioned overall	39	42	30
"Different"	37	41	39
Other	0	3	2
Marbles Scenario			
First mentioned only	6	3.5	5
First then second	15	3.5	9.5
First mentioned overall	21	7	14.5
Second mentioned only	21	28	24
Second then first	15	20.5	18
Second mentioned overall	36	48.5	42
"Different"	43	41	42
Other	0	3.5	1.5

Appendix G Parental Letters Of Consent

1) Parental letters of consent for Experiments 1, 2 and 3.

Dear Parent,

My name is Julie Meehan and I am a first (second) year postgraduate student in research in the Department of Psychology, Trinity College Dublin. I am carrying out research into children's imaginary thinking with the supervision of Professor Ruth Byrne. As part of this research I plan to carry out studies into how children understand and think about stories which are read to them.

I would like to invite you to consent to your child taking part in one of my studies, if your child wishes to. I plan to read four stories to the children in this school who agree to take part in this study and then ask them some questions about what is going on in each story. The stories are short narratives about animal characters doing different things, such as Millie the Monkey looking for bananas and Polly the Penguin playing in the snow. I will also show the children some pictures and ask them to point to the picture that best corresponds to a word or sentence that I will read out to them.

I will read the stories to each child individually in a quiet corner of the classroom while the other children are carrying out their usual activities. I will ask the questions after each story. The story and question session will last about 15 minutes. I expect that the children will enjoy hearing the stories being told to them and talking about them afterwards.

The aim of the study is to help us understand more about how children think about imaginary situations. The study is not a test of intelligence or achievement. The information I will have cannot be meaningfully interpreted for any single child: the aim is to see what children in general think about imaginary stories.

The answers will be treated anonymously: The only information I will record will be their answers, ages and gender. Each answer will also be treated confidentially. Although my study is concerned with everyday thinking and is not intended to address any issues concerning children's welfare, I am of course ethically bound to report to my

supervisor any indication any child gives to me that their welfare has been, or is endangered.

The data I collect will be held in accordance with the Freedom of Information Act (1997; 2003). The data will be stored confidentially and anonymously. If the participants (or parents in this case) would like access to the summary of the whole study, or ask any questions about it, they can do so after the study is completed by contacting me at the address below. Additionally, if any parent is interested in seeing the stories I have read to the children, I will leave a copy of the stories with (name of teacher/principal) when I have finished my visit to this school.

I would like to carry out this research during class time. I would greatly appreciate it if you would agree to allow your child to participate. If you would prefer your child not to participate, or if you would like to withdraw your child from the study after I have received your written consent, your decision will be respected without any negative consequence. Similarly, if any child does not wish to listen to the stories or indeed answer questions about them, they will be allowed to withdraw from the study at any stage.

I would be grateful if you could please fill out the consent form below and return it to (name of teacher/principal) by (date). I plan to carry out my study during the week of the (date) to the (date). I will not be able to carry out this research with your child unless I have your written consent.

If you would like to talk to me about any aspect of the research before then, please feel free to contact me. My contact details, and those of my supervisor, Prof. Ruth Byrne, can be found below. I thank you in advance for your co-operation,

Yours Sincerely

Julie Meehan
Julie Meehan
Dept. of Psychology
Aras an Phiarsaigh
Trinity College Dublin

Prof. Ruth Byrne
Dept. of Psychology
Aras an Phiarsaigh
Trinity College Dublin

Dublin 2
Tel:
Fax:

Dublin 2
Tel:
Fax:

2) Parental Consent Letter for Experiment 4
(Paragraphs 4-9 of the letter are identical to the letter for Experiments 1-3).

Dear Parent,

My name is Julie Meehan and I am a third year postgraduate student in research in the Department of Psychology, Trinity College Dublin. I am carrying out research into children's imaginary thinking with the supervision of Professor Ruth Byrne. As part of this research I plan to carry out studies into how children understand and think about stories that are read to them and how the outcome could have turned out differently.

I would like to invite you to consent to your child taking part in one of my studies, if your child wishes to. I plan to read four short stories to the children in this class who agree to take part in this study and then ask them some questions about what is going on in each story. The stories are about different characters making decisions about everyday matters; for example, one story is about two families who make a decision to either return to their usual holiday destination or to try out a new destination.

I will read the stories to each child individually in a quiet corner of the classroom -- or in a room adjacent to the classroom -- while the other children are carrying out their usual activities. I will ask the questions after each story. The story-and-question session will last about 15 minutes. I expect that the children will enjoy listening to the stories and talking about them afterwards.

3) Parental consent form for Experiments 5 and 6
(Paragraphs 5-9 are identical to letters for experiments 1-4).

Dear Parent,

My name is Julie Meehan and I am a third year postgraduate student in research in the Department of Psychology, Trinity College Dublin. I am carrying out research into children's imaginary thinking with the supervision of Professor Ruth Byrne. As part of this research I am carrying out studies into how children understand and think about how

simple games are played and how the outcome could have turned out differently. I have visited (name of school) on previous occasions for the purpose of these studies.

I would like to invite you to consent to your child taking part in one of my studies, if your child wishes to. I plan to show three games to the children in this class who agree to take part in this study and then ask them some questions about what is going on in each game. The games will be acted out in front of each child with two puppets who will play with marbles, coins and cards. I will ask the children to judge how they believe the puppets feel after each game and how the puppets could have played the games differently.

I will show the games to each child individually in a quiet corner of the classroom - or in a room adjacent to the classroom - while the other children are carrying out their usual activities. I will ask the questions after each game. The game-and-question session will last about 15 minutes. I expect that the children will enjoy watching the games being played in front of them and talking about them afterwards.

The aim of the study is to help us understand more about how children think about imaginary situations. The study is not a test of intelligence or achievement. The information I will have cannot be meaningfully interpreted for any single child: the aim is to see what children in general think about how games are played and how they could have turned out differently.

4) Parental consent form for Experiments 1-6

PARENTAL CONSENT FORM

I…… give my consent for my child……to participate in a study on children's imaginary thinking that will be carried out by Julie Meehan -- a first (second/third) year postgraduate in the Department of Psychology, Trinity College Dublin -- in (name of School) in (month and year)

Signed: Dated:

Appendix H Letters Of Ethical Approval

WebMail - Ethics Decision

Delete | File | Create | Reply | Reply All | Forward | Previous | Next | Options | Index | Help

Date Sent: 20 November 2002 11:15

From: Hugh Garavan <Hugh.Garavan@tcd.ie> Add to Address Book

To: meehanje <meehanje@tcd.ie>,

Subject: Ethics Decision

Status: ☐ Urgent ☐ New

Hi,

The ethics committee has approved your application pending incorporation of the following points:

Approved but because the precise procedures are not outlined, the eventual design of the study should not stray beyond the parameters outlined in the proposal, i.e., no new procedures should be introduced.
For the Letter to parents, the parents do have access to the child's data, the parent can withdraw the child at any stage and the statement regarding welfare of the child is ok.

****

Dr. Hugh Garavan,
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Dublin 2,
Ireland.

Ph: +353-1-608-3910
Fax: +353-1-671-2006
E-mail: Hugh.Garavan@tcd.ie
http://www.tcd.ie/Psychology/Hugh_Garavan/

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Department of Psychology
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Tel: +353 1 608 1886
Fax: +353 1 671 2006

Head of Department: Professor Ian Robertson

Department of Psychology
Ethics Committee

November 06 , 2003

Dear Julie Meehan

The Department of Psychology Ethics Committee met recently to consider your application entitled '*Childrens use of imaginary Thinking when considering alternations to reality.*'.
The Committee decided to approve your application provided the following conditions are met. It is not necessary to resubmit to the Committee. However, approval is conditional on you complying with the conditions listed.

- Parents who do not wish to participate should not be required to indicate this on a consent form. They should merely not return the form.
- Need to state in information sheet that the parents and school can withdraw at any point

You may wish to discuss these matters with your supervisor. I am happy to provide clarification on the points raised.

Yours sincerely,

K Tierney.

Kevin Tierney,
Chairperson,
Department of Psychology Ethics Committee

http://www.tcd.ie/Psychology

RB

Department of Psychology
University of Dublin, Trinity College
Dublin 2, Ireland

Tel: +353 1 608 1886
Fax: +353 1 671 2006

Department of Psychology
Ethics Committee

08/12/2004

Dear Ms. Moohan

The Department of Psychology Ethics Committee met recently to consider your application entitled
Children's use of magical thinking in explaining aspects of reality

I am pleased to inform you that the Committee has approved your application.

Yours sincerely,

K. Tierney.

Kevin Tierney
Chairperson,
Department of Psychology Ethics Committee

K T

http://www.tcd.ie/Psychology