Children's Thinking About Regret and Relief

by

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Abstract

In six experiments, I investigated children's thinking about their own and others' regret and relief. The results were described in relation to the developmental counterfactual thinking literature which offers an account of gradual improvements in order to achieve adult-like counterfactual thinking.

Children aged 5 to 6 years old children experienced regret. Only children aged 7 to 8 years old experienced relief (Experiment 1). Children up to 6 to 7 years old failed to understand that another would experience regret or relief (Experiment 2). These findings are evidence for a lag between regret and relief. Investigation into the lag identified that relief trials may have been more difficult to process than regret trials but the lag was reduced. Children aged 4 to 5 years old experienced a fledgling regret (Experiment 3). Children's limited experience of regret was unlikely to result from their difficulty to access explicit information. Children demonstrated no implicit responses to what could have been (Experiment 4). From 5 to 6 years old, children could infer the happiness of another after seeing what could have been but did not provide counterfactual justifications until 8 to 9 years old (Experiment 5). Children were less likely to experience regret or relief when there was less responsibility for the outcome. Thus, it was unlikely that children were using non-counterfactual thinking strategies throughout this thesis (Experiment 6).

Children first think about regret at 4 to 5 years old. At 7 to 8 years old, they are able to think about relief. By 8 to 9 years old, when children can justify others' regret and relief, children are most adult-like in their development of thinking about regret and relief.

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had-I-wist, hadiwist, *obs.* First seen 1390

A phrase (= “if I had known”), expressing regret for something done in ignorance of circumstances now known; hence, as *n.* A vain regret, or the heedlessness or loss of opportunity which leads to it.

Chapter 1

Introduction

1.1. Overview

Adults often think about how outcomes of decisions could have been different. Thinking about imagined, possible alternatives to reality is known as counterfactual thinking, counterfactual literally meaning "contrary to the facts". When we think counterfactually, we make comparisons of reality to a better imagined alternative, known as "upwards counterfactual thinking", or to a worse imagined alternative, "downwards counterfactual thinking" (Kasimatis & Wells, 1995; Markman, Gavanski, Sherman & McMullen, 1993). Upwards counterfactual thinking is a precursor to negative emotional affect, an experience we know as regret. Downwards counterfactual thinking is a precursor to positive emotional affect, what we know as relief. The focus of this thesis is on the development of these pervasive emotions: At what age do children first experience regret and relief and under what circumstances.

I shall begin by briefly discussing the terms regret, relief and counterfactual emotions. I will review some of the most relevant and interesting adult findings which lead into the developmental literature. I aimed to investigate the development of these emotions, thus I will discuss children's cognitive developments that enable them to experience and understand regret and relief. I review evidence that suggests an experience and an understanding of regret and relief require skills in counterfactual thinking. Finally, I turn to the development of regret and relief and present the limited empirical evidence to support how these emotions are related to counterfactual thinking and each other.

1.2. A definition of regret and relief

Landman (1993) defined regret as a "more or less painful judgement and state of

feeling sorry for misfortunes, limitations, losses, shortcomings, transgressions or mistakes. It can be experienced in anticipation of a decision or retrospectively, after a decision" (p.4). Van Dijk and Zeelenberg (2005) added to Landman's definition and suggested that regret is "a negative emotion that we experience when we realize or imagine that our present situation would have been better, if only we had decided differently" (p.152). Relief is the opposite of regret (e.g., Connolly & Zeelenberg, 2002; Coricelli & Rustichini, 2010; Guttentag & Ferrell, 2004) as it is a result of comparisons between reality and a more negative, fictive reality. Both definitions are consistent on one aspect in particular: Regret and relief require a mental comparison between reality and what could have been (Mellers, 2000; Zeelenberg, 1999a, 1999b). Regret and relief, therefore, are products of counterfactual thinking (Ritov, 1996; Roese, 1997).

1.3. Counterfactual Emotions

Counterfactual thinking has been associated with emotional affect, which includes physiological experiences (Mandel, 2003). These experiences include increased blood pressure, heart rate and the production of tears (Landman, 1993; Coricelli, Critchley, Joffily, O'Doherty, Sirigu & Dolan, 2005) alongside feelings of distress or pleasure (Landman, 1987). The interaction of emotional affect and counterfactual thinking leads to "counterfactual emotions" (Kahneman & Tversky, 1982), two of which are regret and relief. Over the next couple of pages, I take the two aspects of counterfactual emotions: emotional affect and counterfactual thinking, and review what is known about both within the adult literature.

1.3.1. Counterfactual emotions: Emotional Affect

Emotional affect is based on the six basic emotions as identified by Ekman, Friesen and Ellsworth (1972): fear, sadness, disgust, anger, surprise and joy, plus their category members (e.g., category members of fear are dread, terror, panic). These are emotional reactions to a stimulus. Only when emotional reactions are associated with a counterfactual stimulus, a stimulus that could have been but did not materialize, does one experience counterfactual emotions, such as regret and relief. The difference between emotion and counterfactual emotion can be illustrated by a simple example: Imagine a woman has just fallen down some stairs after tripping over some toys left on them. She may be sad because she broke her leg or she may be angry at her young child who left the toys on the stairs: these are reactions to the event itself. However, once she compares her reality (a broken leg due to tripping over toys) to another alternative and has a relevant emotional reaction, she will experience counterfactual emotions. She may experience regret by comparing reality to walking down the stairs without any problems. Recall that counterfactual emotions can be experienced after downwards counterfactual thinking as well as upwards counterfactual thinking. The protagonist could think about how close she could have been to breaking both legs and thus experience relief.

Counterfactual emotions are not easily distinguishable from each other. Regret and relief can be easily confused with other counterfactual emotions, such as disappointment and guilt. Consider regret and disappointment. Both are frequent and pervasive counterfactual emotions: Regret and disappointment are both negative, aversive and are likely to be avoided by adults where possible (Saffrey, Summerville & Roese, 2008; Weiner, Russel & Lerman, 1979; Zeelenberg, Beattie, van der Pligt &

de Vries, 1996). In both regret and disappointment, one makes comparisons to alternate realities, real or imagined (e.g., Landman, 1993). The core difference between the two is found within this comparison. Regret is based on a comparison to alternate possibilities had *another* decision been made. As such, regret is based on bad decisions (Zeelenberg, van Dijk, van der Pligt, Manstead, van Empelen & Reinderman, 1998). Disappointment, on the other hand, is based on comparisons to alternate possibilities had the *same* decision been made. Thus, disappointment is based on expectations that never materialised (Zeelenberg, van Dijk, van der Pligt et al.). As disappointment requires a comparison of reality to a possible alternative reality, disappointment, like regret, is a counterfactual emotion. Landman's (1993) quote fittingly notes the difference between regret and disappointment: "The child is *disappointed* when the Tooth Fairy forgets his third lost tooth. The child's parents *regret* the lapse" (p.47).

Guilt also has similarities with regret. Adults have rated guilt and regret as equally non-pleasurable (Russell & Mehrabian, 1977). Both emotions require a comparison of reality to what could have been. The content of the comparison itself differs. To regret, one must negatively compare reality to an alternative that *could* have been different whereas to experience guilt, one must negatively compare reality to an alternative that *should* have been different (Amsel, Robbins, Tumarkin, Janit, Foulkes & Smalley, unpublished manuscript). Guilt is experienced after moral or social standards have been violated (Ferguson & Stegge, 1995; Ferguson, Stegge, Miller & Olsen, 1999; Niedenthal, Tangney & Gavanski, 1994) and one compares these transgressions to the non-violated moral or social standards.

The similarities between regret, disappointment and guilt resonates with research that finds that emotions tend to occur in clusters, particularly positive and negative clusters, rather than in isolation (Ellsworth & Smith, 1988; Izard, 1977; Schwartz & Weinberger, 1980). Within this thesis, I have focussed specifically on regret and relief, not the other, similar counterfactual emotions.

1.3.2. Counterfactual emotions: Counterfactual thinking

To think counterfactually, one must identify both reality and the alternate possibility and subsequently make a comparison between them (Kahneman & Miller, 1986). The comparison is manifested in counterfactual statements such as "what could have been", "if only" or "what if" (Epstude & Roese, 2008; Roese & Olson, 1993). Research into this comparison between reality and its alternatives has been particularly focussed on the cognitive and social processes behind counterfactual thinking and the functional basis of counterfactual thinking (Mandel, Hilton & Catellani, 2005). If we understand adults' thinking about what might have been, we may better understand the development of children's thinking about counterfactuals.

Kahneman and Tversky (1982) were the first to investigate the notion of what we regard as counterfactual thinking. They proposed a "simulation heuristic" in which people determine the likelihood of a course of action based on how easy it is to imagine that course of action actually happening. The simulation heuristic refers to how adults mentally reverse or undo outcomes of decisions and think about how reality would have been had the outcome been different. Kahneman and Tversky found that adults are more likely to mentally undo outcomes of decisions that have arisen due to atypical actions. They also argued that people are more likely to

mentally undo actions rather than inactions and that when an alternative outcome was close, either physically or temporally, adults are more likely to mentally mutate the actual outcome. Kahneman and Miller (1986) developed Kahneman and Tversky's (1982) simulation heuristic with "norm restoration" in which one desires to return abnormal outcomes back to the norm. Thus, it is due to norm restoration that we prefer to mentally mutate atypical actions over typical ones, actions over inactions and proximal over distal outcomes.

Roese and Olson (1995a) argued that thinking counterfactually has a functional basis. They suggested that adults used upwards counterfactual thinking to reason why negative outcomes had occurred. They argued that thinking how things could have been better is a learning mechanism to prevent the same course of action happening in future. They also suggested that adults use downwards counterfactual thinking to help themselves and others feel better by reasoning that things could have been worse.

This research into the functional basis of counterfactual thinking was the precursor for more in depth research into the causes of counterfactual thinking. Roese (1997) suggested that emotional affect triggers counterfactual thinking. Davis, Lehman, Wortman, Silver and Thompson (1995) reported that this was indeed the case: They found that the worse people felt after a traumatic incident, such as the death of their infant, the more likely they were to generate counterfactual thoughts in an attempt to undo the event. Sanna and Turley (1996) reported that when adults engaged in games and puzzles, they generated more counterfactual thoughts after negative outcomes rather than positive outcomes. Similarly, Klauer and Migulla (as cited in Roese, 1997) reported that after failure to achieve a target goal, counterfactual thinking was more

likely than after success in reaching that goal. This evidence suggests that negative emotional affect, such as unhappiness, anger or depression activates counterfactual thinking (Markman & Miller, 2006).

There is evidence to suggest that emotional affect only activates counterfactual thinking under certain circumstances. One of these circumstances is the closeness of the outcome, originally suggested by Kahneman and Tversky (1982). Roese (1997) proposed that the closer the outcome came to an alternative possibility, the greater the likelihood of counterfactual thinking. This closeness can be physical (e.g., betting on a horse that finished one metre behind the winner rather than betting on a horse that finished 50 metres behind the winner), temporal (e.g., missing a plane by two minutes rather than an hour) or numerical (e.g., missing out on a raffle draw by one ticket number rather than 50 ticket numbers). Kahneman and Varey (1990) labelled counterfactual thinking under these close circumstances as "close-call counterfactuals". Myers-Levy and Maheswaran (1992) reported evidence that after close-call counterfactual events, adults were more likely to think counterfactually than after non close-call counterfactual events: A man who forgot to submit an insurance policy three days before a serious fire would experience more counterfactual thought than a man who forgot to submit his policy six months before the fire. However, there is evidence to suggest that adults may perform poorly at thinking about close-call counterfactuals. Gilbert, Morewedge, Risen and Wilson (2004) concluded that adults were particularly poor at estimating how they would feel if they "nearly" caught a train rather than "clearly miss" the train: Adults overestimated how regretful they would feel. Gilbert et al. suggested that when we think about possible future close-call counterfactuals, we aim to avoid thinking about how things could have been but our

overestimation of the impact of counterfactual thinking may lead to irrational behaviour, such as overpayment for goods (Simonson, 1992) or overvaluing the ability to change one's mind (Gilbert & Ebert, 2002). The closeness of the outcome may activate counterfactual thinking, but adults have some limitations to their counterfactual thinking.

Gavanski and Wells (1989) noticed that the norm restoration and counterfactual thinking literatures had a particular focus on unusual antecedents (e.g., a good student who failed an exam) that have been mentally mutated to become normal (e.g., the good student failed because he may have drunk heavily the night before). Gavanski and Wells reported that adults also mutate normal events (e.g., a poor student who failed) so that they become unusual (e.g., a poor student who failed may have done better by greater study). Gavanski and Wells suggested that adults use a simple heuristic when it comes to norm restoration: Abnormal outcomes are due to abnormal events and normal outcomes are due to normal events. Roese (1997) argued that their findings only apply to a small part of counterfactual thinking, as the majority of the research suggests that counterfactual thinking is more likely when the antecedents are unusual rather than usual (Hilton & Slugoski, 1986; Kahneman & Miller, 1986; Miller, Taylor & Buck, 1991; Olson, Roese & Zanna, 1996; Wells, Taylor & Turtle, 1987). These researchers all found that participants were more likely to mutate an unusual antecedent so that it becomes normal again rather than a usual antecedent so it become abnormal.

Counterfactual thinking is more likely to revolve around acts of commission (choosing to do something) rather than acts of omission (choosing not to do

something). Kahneman and Tversky (1982) demonstrated this point in their often cited vignette, "Mr. Paul owns shares in company A. During the past year, he considered switching to stock in company but he decided against it [his act of omission]. 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 owned shares in company B. During the past year, he switched to stock in company A [his act of commission]. He now finds that he would have been better off by $1,200 if he had kept his stock in company B" (p. 142). Kahneman and Tversky asked participants to report who would feel worse. The majority of participants said that Mr. George would feel worse: evidence that acts of commission are more likely to lead to counterfactual thinking than acts of omission. Acts of commission are more cognitively mutable than acts of omission. Adults mutate acts of commission more based on the same logic as to why they are more likely to mutate unusual antecedents: If acts of omission are seen as the norm (e.g., a businessman who chooses not to drive to work on a daily basis), then acts of commission are seen as deviations from the norm (e.g., one day, the businessman chooses to drive) and as such they must be restored to the norm should an unusual outcome occur (e.g., the businessman is late for work, because he drove).

The content of counterfactuals has also been shown to be determined by controllability: Controllable antecedents are more cognitively mutable than uncontrollable ones. Girotto, Legrenzi and Rizzo (1991) described a businessman's journey home that was delayed due to several events. Participants had to determine how the businessman could have returned home quicker. Controllable antecedents, such as stopping for a drink on the way home, were the subject of the participants'

counterfactual thoughts more often than uncontrollable ones, such as waiting for a flock of sheep to cross the road.

The evidence suggests that the content of counterfactual thoughts involves antecedent normality, antecedent action and inaction and antecedent controllability (Roese, 1997). Adults are more likely to think counterfactually under these circumstances. We know that emotional affect activates counterfactual thinking and that such activation underpins counterfactual emotions, such as regret and relief. I now turn to the transition from counterfactual emotions to the experiences and understanding of regret and relief.

1.4. Adults' regret and relief

Over the past two decades, there has been much research into the relationship between adults' counterfactual thinking and their experiences of regret and relief. The results of such studies have identified the functions of regret and relief, the circumstances in which regret and relief are most likely to be experienced and what adults most regret. Investigation into the relationship between counterfactual thinking and regret and relief began with research in "emotional amplification" (Kahneman & Miller, 1986). Emotional amplification is the tendency for counterfactual thinking to influence the intensity of an emotional reaction based on how easy it is to imagine an alternative to reality. Miller, Turnbull & McFarland (1990) gave an example of emotional amplification: In a plane crash, we feel more sorrow for the passenger who changed last minute to this flight rather than the passenger who was booked on this flight all along. This example prompts such thoughts as "if only [he hadn't switched flights]",

characteristic of regret and relief. As such, we exaggerate the emotion for the first passenger as it is easier to imagine his alternatives to reality.

Studies into emotional amplification and regret have found evidence of the "agency effect" (Byrne & McEleney, 2000): Regret and relief are more likely to be experienced after acts of commission rather than acts of omission in the short-term (e.g., Gilovich & Medvec, 1994; Gilovich & Medvec, 1995a). In the long term, however, the agency effect seems to reverse and acts of omission tend to be more regretful than acts of commission (Gilovich & Medvec, 1994; Gilovich & Medvec, 1995b; Roese & Summerville, 2005). These long term regrets are based on failings in education, career, romance or parenting (e.g., "I wish I had studied dentistry rather than accountancy"). Gilovich and Medvec (1995a) found that adults find short term acts of commission more regretful but, upon reflection of their lives, acts of omission were more troubling. Thus, there seems to be a temporal pattern to regret. This temporal pattern has been demonstrated to be cross cultural. Gilovich, Wang, Regan and Nishina (2003) reported that participants from the USA, China, Japan and Russia all reported that acts of omission were more regretful in the long term than acts of commission.

A possible explanation for this temporal pattern is based on the motivational or emotional variables that mediate the agency effect. Gilovich and Medvec (1994) proposed that some motivational variables are crucial in the agency effect. One motivational variable can be seen when people try to compensate for bad outcomes from actions by engaging in reparative behaviour: Zeelenberg and Pieters (1999) reported that participants were more likely to amend life choices if they suffered

negative experiences. An alternative motivational variable can be seen when people try to look for positive aspects to bad outcomes from actions (often referred to as "silver linings") to reduce the aversive feelings of regret. Medvec, Madey and Gilovich (1995) coded facial expressions and gestures of gold, silver and bronze Olympic Medallists when they were awarded their prizes. The bronze medallists seemed to have experiences based on the counterfactual possibilities: At least they won something. The silver medallists also had counterfactual emotional experiences: They were rated as more *unhappy* than the bronze medallists, as their silver medal could have been gold.

Kahneman (1995) argued that there are also emotional variables that mediate the agency effect: Short-term regrets may be hot, whereas long-term regrets are wistful. People also judge that regret for acts of commission is accompanied by anger, whereas regret for acts of omission is accompanied by nostalgia or misery (Gilovich, Medvec & Kahneman, 1998). Gilovich and Medvec (1995a) and Roese and Summerville (2005) suggested that these variables can be explained within one theory, the "opportunity principle" in which greater potential opportunity leads to greater regret.

Other factors have been shown to influence adults' experiences of regret. One of these factors is the certainty of the possible outcomes (van Dijk & Zeelenberg, 2005). Participants were asked to make a decision between some prizes. When participants decided, they were either informed of the prize that they could have won or the alternatives remained unknown. Any alternative prize was better than the prize actually received by the participants. Participants did not base their emotions on what

could have been if the alternative prizes remained uncertain, thus uncertainty was found to alleviate feelings of regret.

An additional factor that influences adults' experiences of regret is responsibility for the outcome. Less responsibility for the outcome has been shown to reduce feelings of regret (Burks, 1946; Byrne, 2002; Connolly & Zeelenberg, 2001; Markman & Tetlock, 2000; Roese and Olson, 1995a; Zeelenberg, van Dijk & Manstead, 1998; Zeelenberg, van Dijk & Manstead, 2000). For example, Zeelenberg, van Dijk and Manstead (1998) asked participants to report life events in which they experienced regret and to rate how responsible they felt for the outcome. Results indicated that there was a strong positive correlation between regret and responsibility for the outcome.

In recent years, the neurological mechanisms of regret have been determined. Coricelli et al. (2005) used fMRI (functional Magnetic Resonance Imaging). They asked participants to choose one of two monetary gambles. Participants were subsequently shown what they could have won or lost had they chosen the other gamble. Results of the fMRI identified that the experience of regret was strongly correlated with activity in the ventromedial prefrontal cortex and orbitofrontal cortex, including the anterior cingulate cortex, hippocampus and amygdala. Camille, Coricelli, Sallet, Pradat-Diehl, Duhamel and Sirigu (2004), using a similar procedure to Coricelli et al. also reported the involvement of the orbitofrontal cortex. Camille et al. described that their patients with orbitofrontal cortex lesions did not experience regret under the same circumstances that control participants did. In addition, the same brain regions that are activated during a first-person experience of regret are also

activated when we observe that another achieves a regretful outcome (Canessa et al., 2009). The orbitofrontal cortex has even been implicated in regret tasks with rhesus monkeys (*Macaca mulatta*). The monkeys made choices that led to differing fruit juice rewards and demonstrated that they were influenced when they were shown what could have been chosen (Hayden, Pearson & Platt, 2009). The evidence suggests that the orbitofrontal cortex is implicated with the experience of regret in decision making. Thus, regret can be viewed as a cognitively-laden experience (Gilovich & Medvec, 1995).

This brief review of the established literature concerning regret and relief has highlighted that regret and relief are products of counterfactual thinking, as one must compare reality to an alternative, fictive reality. Based on the relationship between regret, relief and counterfactual thinking within the adult literature, children may only experience regret and relief once they are able to think counterfactually.

1.5. The development of counterfactual thinking

I take the next section of this introduction to discuss children's abilities to think counterfactually. Researchers have debated the age that children acquire adult-like counterfactual thinking. In this review the developmental counterfactual literature, I aim to determine the first age at which children can competently think counterfactually. Only at that age would children have the ability to then experience regret and relief. I also identify the cognitive processes that children acquire during the development of counterfactual thinking.

1.5.1. Children's first counterfactual thinking

Harris (1997) found evidence that children can think counterfactually at 2 years old. He showed children aged 2 and 3 years old two toy horses that "galloped" across a table top. One of these horses stopped 30cm from the edge of the table but the other stopped just before falling off. Adults would typically describe the second horse as "almost" falling off the table, referring to the fact that this horse could have fallen off, yet did not. Harris asked children to choose the horse that almost fell off. Children aged 2 and 3 years old correctly chose the horse closer to the edge of the table. Harris argued that as 2-year-olds were able to identify which horse almost fell off, they were able to think about counterfactual alternatives to reality.

Beck and Guthrie (2010) investigated the possibility that 2- and 3-year-olds made a counterfactual interpretation of "almost". They ran a similar procedure to Harris (1997) with 3- to 4-year-olds. They replicated Harris' results. In a second condition, one horse almost fell and the other actually fell. Beck and Guthrie argued that if children were able to understand that "almost" implied a counterfactual, they would be able to identify the horse that almost fell, and choose the horse that remained on the table. They found that the 3- to 4-year-olds were as likely to choose the horse that fell on the floor as the horse that almost fell off the table. Beck and Guthrie argued that Harris' 2- to 3-year-olds and their own 3- to 4-year-olds were arriving at the target answer based on another strategy. Children up to and including 4 years old did not make counterfactual interpretations even when the counterfactual world was close.

Children's first thinking about counterfactuals has been the focus of attention by many researchers. Harris, German and Mills (1996) and German and Nichols (2003)

provided evidence that 3-year-olds can think counterfactually. Riggs, Peterson, Robinson and Mitchell (1998) and Guajardo and Turley-Ames (2004) argued that children are not able to think counterfactually until 4 years old. Some researchers have argued that thinking about counterfactuals is later developing at 5 to 6 years old (Beck & Guthrie, 2010; Beck, Robinson, Carroll & Apperly, 2006; Rafetseder, Cristi-Vargas & Perner, 2010; Rafetseder & Perner, 2010): There is inconsistency between these findings. I will review them in an attempt to draw conclusions across them all to determine what we know about children's counterfactual thinking.

Harris et al. (1996) read four short stories to 3- to 4- and 4- to 5-year-old children. In these stories, a causal chain of events occurred based on a protagonist's behaviour (the antecedent). Children were then asked about the event sequence had the antecedent not happened. For example, Carol, a doll, comes home but when she comes inside, she does not take her shoes off. As a result, she leaves footprints all over the floor. Children were asked if they could imagine how this scenario would have been had the antecedent not occurred, i.e. "What if Carol had taken her shoes off – would the floor be dirty?" Children responded correctly on three or four of the four test questions. Harris et al. concluded that children aged 3 to 4 years old could make counterfactual predictions.

Riggs et al. (1998) argued that children aged 3 to 4 years old were in fact limited in their counterfactual thinking abilities. In one of their tasks, children aged 3 to 4 years old were read stories and asked to determine how the world would have been had an earlier event not happened. One of these stories was about Sally and Peter the fireman. Peter was not feeling well, and so went to bed. Sally went to the shops to get

some medicine. Whilst Sally was out, a man at the Post Office telephoned Peter to ask him to come to the Post Office to help put out a fire. Peter went to the Post Office. Sally finished her shopping and began to make her way home. Children were asked to identify where Peter would be had there been no fire. Three- to 4-year-olds performed poorly at this task. They made "realist errors", that is, they responded based on reality, "at the post office", rather than the counterfactual, correct alternative, "in bed, at home".

Thus, there are two conflicting claims as to children's abilities in thinking counterfactually: Harris et al. (1996) suggested that 3- to 4-year-olds are able to perform well on counterfactual tasks, yet Riggs et al. (1998) reported that these children performed poorly. Harris and Leevers (2000), who replicated Harris et al.'s finding that 3- to 4-year-olds can make counterfactual predictions, suggested that the conflict between the two claims was due a specific difference between the stories that were read to children: Harris et al. used stories resulting in negative outcomes that could have prompted children to think counterfactually, whereas Riggs et al. used stories that resulted in counterfactual reasoning about more abstract concepts, such as locations, rather than emotional outcomes. Robinson and Beck (2000), who argued that children cannot think counterfactually until 4 years old, also suggested Riggs et al.'s stories may have been more difficult for children to process, but based on different reasons to Harris and Leevers. Robinson and Beck argued that Harris et al. only asked children to judge if a situation could have been avoided, which does not require counterfactual thinking. They suggested that reasoning about the counterfactual had another action been taken, as in Riggs et al, was more difficult than simply making a judgement as to how a circumstances could have been avoided, as in

Harris et al.

There is an alternative explanation for the discrepancy between Harris et al. (1996) and Riggs et al. (1998): German and Nichols (2003) argued that the difference between the studies was based on the inferences that children had to make to reason counterfactually. German and Nichols (2003) suggested that the inferences children had to make in the Harris et al. (1996) stories were fairly simple: When asked, "What if Carol had taken her shoes off", it would be fairly simple to think that if Carol removed her shoes, the floor would not be dirty. In contrast, when Riggs et al. (1998) asked children where Peter would be had there been no fire, children had to infer that no fire meant no phone call, which would have meant that Peter would not have gone to the Post Office and therefore he would still be in bed. This longer chain of inference may have been more difficult for children to reason about. If this was the case, it would be the increased task demands in Riggs et al. that children found difficult rather than limits to their abilities in counterfactual thinking.

German and Nichols (2003) investigated the possibility that children struggled with longer causal chains. They asked children aged 3 and 4 years old to reason about counterfactuals based on causal chains of differing lengths. German and Nichols used two causal chain stories, both made up of four causally linked events. In both stories, the protagonist began happy, experienced a misfortune and thus became sad. For example, Event 1: Mrs. Rosy has just planted new flowers and she is happy. Event 2: Mr. Rosy comes outside to look at the flowers, the dog also comes outside. Event 3: The dog squashes Mrs. Rosy's flowers. Event 4: Mrs. Rosy is now sad. Children were asked if Mrs. Rosy would be happy or sad in one of three conditions: the short

inference question (based on event 3), "What if the dog hadn't squashed the flower?" A medium inference question (based on Event 2), "What if the dog hadn't escaped from the house?" And a long inference question (based on Event 1), "What if Mrs. Rosy hadn't called her husband?" The target response for all questions was that Mrs. Rosy would be happy.

German and Nichols (2003) found that the greater the complexity of the inference required to reach the answer, the more likely children were to provide the non-target response, Mrs. Rosy would be sad. The 3-year-olds performed well on the short inference question but poorly on the two greater inference questions. This result replicates the findings of Harris et al. (1996) that 3- to 4-year-olds are able to draw counterfactual conclusions based on a state of affairs. The 4-year-olds performed well on all the inference questions. These results suggest that 3-year-olds are able to reason about counterfactuals when events are based on short causal chains, but not when the causal chains are more complex. Therefore, there is evidence of gradual developments within information processing in order for children to reason counterfactually: As children age, their skills in information processing mature and so they can handle larger causal chain counterfactuals.

There is some evidence, however, to the contrary of German and Nichols' (2003) account. This evidence suggests that the 3-year-olds' success on the short causal chains are in fact false positives. Beck et al. (2006) and Perner (2000) argued that children do not need to use counterfactual thinking to achieve the target answer in the short chain inference questions. Rather, children can simply use their general knowledge of the world. For example, when flowers are squashed, people are

unhappy.

Beck, Riggs and Gorniak (2010) investigated if children answered questions on counterfactual tasks using their general knowledge. Children aged 3 to 4 years old were read stories similar to German and Nichols (2003), made up of four events. The first event resulted in the protagonist being happy. Due to the third event, the protagonist became unhappy. Children were asked either a short emotion question to judge if the protagonist would be happy or sad had event 3 not happened, or a long emotion question, had event 1 not happened. Children were also asked either a short location question to judge where an item in the story would be if the protagonist had not engaged in behaviour that led to the final outcome, had event 3 not happened, or a long location question, had event 1 not happened. If both the short emotion and location questions were easier than the long emotion and location questions, results would have provided evidence for the early counterfactual thinking explanation (German & Nichols). If the short emotion questions were easier than all the other questions, results would have provided evidence for the general knowledge explanation as only the short emotion questions could be answered with general knowledge.

Beck et al. (2010) failed to replicate the results by German and Nichols: Short causal chain questions were no easier than the long causal chain questions. In a second experiment with a larger number of participants and minor changes to the materials used, Beck et al. (2010) found that short location questions were more difficult for children than the short emotion question and the long location questions. This finding offers some support for the general knowledge explanation. However, children

performed well on both the long causal chain questions, a finding that cannot be explained by the general knowledge account. Beck et al. (2010) did not find sufficient evidence to support either the counterfactual thinking hypothesis or the general knowledge hypothesis.

To determine if this lack of support was due to differences from the original German and Nichols (2003) procedure, Beck et al. (2010) replicated German and Nichols' design and procedure. Beck et al. (2010) failed to replicate the advantage of short over long causal chains. In a final study, Beck et al. (2010) investigated children's linguistic ability in relation to children's counterfactual thinking, based on the original German and Nichols story. Results indicated that children who performed poorly on a measure of linguistic ability (British Picture Vocabulary Scale), performed worse on the short questions than on the long questions. Beck et al. (2010) explained that children with better linguistic abilities attempted to think counterfactually for both short and long causal chains. In contrast, children with poorer linguistic ability may not have understood the test questions and merely reported on the state of affairs at the point described in the test question. To do so, children had to think back to a point in time and report on the state of affairs then. Recalling a previous event may be an easier task than thinking about how a previous even could have been different. Thus, children who provided the target answer (Mrs. Rosy was happy) for long causal chain questions may not have been thinking counterfactually but simply remembering the beginning of the story. Beck et al. (2010) concluded that once children can engage in counterfactual thinking, their performance is not dependent upon the length of the chains of events but rather limitations to their linguistic maturity.

1.5.2. Further developments: Inhibitory control

It is possible that there are other developmental improvements that are necessary for the development of counterfactual thinking. Developments in inhibitory control may be necessary. Robinson and Beck (2000) suggested that an immature development of inhibitory control is most likely to be implicated in counterfactual tasks: One must resist responding to reality, which may be the more salient option, and rather respond to how the world could have been. A further reason to think that counterfactual thinking tasks places demands on inhibition is that children who cannot think counterfactually make realist errors, rather than making errors at random. These children find it difficult to inhibit responding to the world as it is rather than respond to how it could have been. In the story of Peter, who was called to the post office from his home because of a fire (Riggs et al., 1998), the 3- to 4-year-old children were unable to identify where Peter would have been had there been no fire. Their responses were that Peter would be at the post office, Peter's current location.

Beck, Riggs and Gorniak (2009) aimed to determine the relationship between counterfactual thinking and inhibition in 3- and 4-year-old children. Children participated in two inhibitory control measures. For example, in one task, children had to do an action described by a bear puppet but ignore the actions described by a dragon puppet. To compare children's executive functioning with counterfactual thinking, children were read two counterfactual stories tasks. One was a causal chains story, a replication of German and Nichols' (2003) four-part story about Mrs. Rosy, her flowers and the dog. The other was a location change story, replicated from Riggs et al. (1998). In this story, Piglet was drawing a picture. The wind blew and took the picture up into a tree. Children were asked, "What if the wind hadn't blown? Where

would the picture be, on the table or in the tree?" (Answer: "the table"). Beck et al. (2009) provided evidence that performance on the inhibition tasks predicted performance on counterfactual tasks: Children younger than 4 years old were *not* able to meet the inhibitory demands of counterfactual tasks. Beck et al. (2009), similarly to Beck et al. (2010), failed to replicate German and Nichols' findings: There was no difference between the short and long causal chains. Beck et al. (2009) found that there was a strong relationship between the linguistic demands of the task and children's responses: Children with greater linguistic skills were more likely to provide the target response on both the short and long causal chains than children with lesser linguistic skill, again similar to Beck et al. (2010).

The common feature of the counterfactual tasks that I have reviewed so far is that one must ignore what one knows to be true. As greater inhibitory control predicted a greater performance on the counterfactual questions (Beck et al., 2009), this is evidence to suggest that improvements to inhibitory control are necessary developments in order for children to provide the target counterfactual answer.

1.5.3. Further developments: Structure of the questions

Guajardo and Turley-Ames (2004) noticed that the structure of the questions in the previous tasks may prompt children to imagine how an alternative reality would be *without* thinking back to the time when both possibilities could have occurred. They argued that if children were not thinking back to that moment in time, they may not be thinking counterfactually, but rather choosing the answer that seemed most likely. Guajardo and Turley-Ames read stories to children aged 3- to 5 years old. One such story read as follows, "Imagine that you are playing outside in the muddy yard. You

are thirsty so you go inside to the kitchen to get a drink of juice. You walk through the mud, you step over the doormat, and you keep your shoes on. Because your shoes are muddy, you get dirt all over the floor." Children were asked the test question "What could you have done so that the kitchen floor would not be dirty"? When children were asked this test question, they had to imagine multiple ways of getting the floor dirty, rather than simply responding to one of the available options, as in the previous tasks.

On the test questions, the 3-year-old children were able to generate some counterfactual antecedents. The 4-year-olds were able to generate more, and the 5-year-olds able to generate more still. Perhaps, similarly to Beck et al. (2009) and Beck et al. (2010), this could be due to developments in linguistic abilities. Guajardo and Turley-Ames (2004) suggested that children from 3 years old are able to understand the linguistic demands and understand that a chain of events could have been different, but the 4-year-olds' performance was much better. Their results suggested that it is not until children are 4 years old that they are able to perform well on counterfactual tasks. However, the 3-year-olds have some skill in counterfactual thinking. Children between 3- and 5 years old gradually increase their repertoire of antecedents that could lead to specific outcomes.

1.5.4. Further developments: Dual possibilities

Beck et al. (2006) suggested that children are not able to think counterfactually unless they can represent the counterfactuals as "dual possibilities". The idea of dual possibilities refers to a certain point in time, before the outcome of a decision has occurred, when either of the possible outcomes could occur: One possibility will

become reality and the alternative possibility will not materialise (Byrne, 2002). For example, imagine a car that turns left at a junction and ends up at location A, rather than turning right at the junction, to location B. To think about the counterfactual possibility that the car could have arrived at location B, one would have to understand that before passing through the junction, the car could end up at either location A (the possibility that will become reality) or location B (the possibility that will not materialise, but could have occurred).

Beck et al. (2006) asked children open counterfactual questions about what could have happened. To answer open counterfactual questions, children had to be able to imagine multiple outcomes, each of which was possible at a previous point in time. Children aged 3 to 4 and 5 to 6 years old participated in a game. In this game, there was a red slide that split into two: a spotty red slide and a stripy red slide. Thus, the red slide ended at two possible locations. A cotton wool ball was put into one of the slides. One trial was a Standard Counterfactual: The cotton wool ran down the whole of the red slide, and down either the spotty or stripy red slide. Children were asked, "What if it had gone the other way? Where would it be?" This question is similar to Riggs et al. (1998). Another trial was Open Counterfactual: The procedure was identical to the Standard Counterfactual trials except children were asked, "Could it have gone anywhere else?" To answer this question, children had to imagine an alternative to reality at the same time as thinking about reality. Performance on the standard counterfactuals was good for both age groups, but there was an age difference: The older children provided the target responses more often than the younger children. It was not until children were 5 to 6 years old that they could answer standard counterfactuals with adult-like competence. As for the open

counterfactuals, children of both ages found these more difficult than the standard counterfactuals, but there remained a marginal improvement with age, thus it was not until children were at least 5 to 6 years old that they were able to represent counterfactuals as dual possibilities. Additionally, results from Beck et al. (2006) strengthen Guajardo and Turley-Ames (2004) findings that the structure of counterfactual questions taps into different types of counterfactual thinking.

1.6. An alternative interpretation

There is an alternative interpretation of the developmental counterfactual thinking literature. Rafetseder et al. (2010) and Rafetseder and Perner (2010) raised an interesting possibility based on the responses that children have provided. On the counterfactual reasoning tasks that I have reviewed so far, if children did not provide a correct counterfactual response, they gave a realist error. Rafetseder et al. suggested that children who provided a response that seemed counterfactual may have in fact avoided realist errors by using basic conditional reasoning. Therefore they would have responded with the target answer via a non-counterfactual reasoning process. Children may have been unduly credited with the ability to think counterfactually.

Basic conditional reasoning is logical reasoning referring to when the existence of one event is dependent on the existence of another (i.e. If X is A, then Y is B). Basic conditional reasoning differs from counterfactual thinking as it depends on default assumptions about reality that may not necessarily be true at a specific moment in time. In contrast, counterfactual thinking does not depend on these assumptions (i.e. If X was A at a previous point in time, then Y could have been B). Consider Harris et al.'s (1996) test question, "What if Carol had taken off her shoes, would the floor be

dirty?" If children were answering with basic conditional reasoning, they could be thinking, "If shoes are off, then floors are clean" (If X is A, then Y is B), rather than thinking counterfactually, "If she had taken her shoes off, the floor could have been clean" (If X was A at a previous point in time, then Y could have been B). According to Rafetseder et al., children may have reached the target answer to the tasks within the literature using basic conditional reasoning, not counterfactual reasoning.

However, such basic conditional reasoning does not always seem to apply. Recall the Riggs et al. (1998) story of Peter who was originally at home in bed. Peter was called to the post office to help put out a fire. If children used basic conditional reasoning, may have been expected to base their thoughts on the assumptions that "When there are no fires, firemen are in the fire station." Children may have ignored Peter's actions, going to bed to get over his illness, and rather, considered the default location of Peter the fireman: in a fire station. As children did not provide this answer but rather the target answer, "Peter is at home", how could this result from basic conditional reasoning? Rafetseder and Perner (2010) argued that in fact children are using basic conditional reasoning: Children hold in mind the two possible answers to the test question, "If there had been no fire, where would Peter be?", "post office" and "home." Children have to understand that when no fires take place, the counterfactual possibility (if there had been no fire) refers to a location that is different to the location in reality (post office). Therefore, if there was no fire, then Peter could not be at the post office where there is a fire. As such, children can rule out "post office" as a possible answer, leaving "home" as the default answer. Therefore, according to Rafetseder and Perner, the 4-year-olds in Riggs et al. arrived at the apparent counterfactual answer through basic conditional reasoning.

Rafetseder et al. designed stories so that if children employed basic conditional reasoning they would arrive at a different answer than if they used counterfactual reasoning. Rafetseder et al. read these stories to 2- to 5-year-old children. One of their stories was about Simon and Julia who both like sweets. Everyday, mum puts sweets on *either* the top shelf, that only Simon can reach *or* in the bottom shelf that both Simon and Julia can reach. Simon and Julia come to the shelves individually. When Simon finds sweets, he takes them to his bedroom. When Julia finds sweets, she takes them to her bedroom. Children were asked to respond to the test questions, "What if (1) not Julia but Simon / (2) not Simon but Julia, had come looking for sweets, where would the sweets be?" All participants answered both test questions when the sweets were on the top shelf (two conditions) and when the sweets were on the bottom shelf (two conditions). In all four conditions, the default assumption of basic conditional reasoning was that sweets end up in the room of whoever comes to look for them. This assumption is only violated when the sweets are on the top shelf and Julia comes looking for them. Using basic conditional reasoning, the answer would be that the sweets end up in Julia's room. The counterfactual answer was that the sweets would remain on the top shelf. On the remaining three scenarios, responding based on default assumptions led to the same answer as counterfactual thinking. Rafetseder et al. (2010) suggested that if this one condition differed from the other three, children would be using basic conditional reasoning, not counterfactual thinking.

On this one condition, the 2- to 5-year-olds stated that the sweets would be in Julia's room, not on the top shelf. Children performed below chance on this one condition, whereas on the remaining three conditions, performance was above chance. This was

evidence that they employed basic conditional reasoning rather than counterfactual thinking. Children's reasoning was based on the final location of the sweets. As such, Rafetseder et al. (2010) argued that children up to and including 5 to 6 years old do not think counterfactually but rather use a non-counterfactual strategy: basic conditional reasoning and default assumptions about reality.

Rafetseder et al. (2010) highlighted that counterfactual thinking is later developing than some of the previous literature suggests. Their results call into question the claims that 3- to 4-year-olds can think counterfactually (German & Nichols, 2003; Guajardo and Turley-Ames, 2004; Harris et al., 1996; Riggs et al., 1998). On the other hand, Beck and Guthrie (2010), Beck et al. (2006), Beck et al. (2009) and Beck et al. (2010) claimed that counterfactual thinking is later developing. I have included Rafetseder et al.'s work in this review as an alternative to counterfactual thinking as to how children younger than 5 years old reason about situations that could have been different. Later in this thesis, I focus on children's thinking about regret and relief, which is underpinned by counterfactual thinking. I then return to the application of Rafetseder et al.'s claims.

Children aged 3 years old have demonstrated limited skills in counterfactual thinking when causal chains are short and the test question provides possible answers (standard counterfactual questions) (Harris et al., 1996; German & Nichols, 2003). The 4-year-olds are able to answer more complex standard counterfactual questions based on longer causal chains (Riggs et al., 1998; Guajardo & Turley-Ames, 2004). Beck et al. (2009), Beck et al. (2010) and Guajardo and Turley-Ames claimed that developmental improvements to children's linguistic sophistication are related to their ability to think

counterfactually: Children between 3 and 5 years old gradually build upon their skills to handle counterfactual possibilities. Only older children, aged 5 to 6 years old are able to represent counterfactuals as dual possibilities (Beck et al., 2006; Byrne, 2002) and thus think competently about counterfactuals (Beck & Guthrie, 2010). Children of 3 to 4 years old are able to answer standard counterfactual questions by thinking about the counterfactual event alone, whereas thinking about multiple possibilities develops later at around 5 to 6 years old. The developmental counterfactual thinking literature reveals a pattern of gradual improvements with age to skills in counterfactual thinking, from 3 years old through to 6 years old.

1.7. The development of regret and relief

To experience and understand regret and relief, both counterfactual thinking and skills in inhibition are required: One must compare reality to an alternative, fictive outcome (Gilovich & Medvec, 1995a; Kahneman & Miller, 1986; Kahneman & Varey, 1990: Mellers, 2000; Ritov, 1996; Zeelenberg, 1999a, 1999b) activated by an emotional, positive or negative reaction to a stimulus (Davis et al., 1995; Roese, 1997; Sanna & Turley, 1996). One must also inhibit responding to what one knows to be true and focus on the possible alternative (Beck et al., 2009). Once children have matured in counterfactual thinking and inhibition, it would seem that they would then be able to experience and understand regret and relief. In the review of the counterfactual thinking literature, children seem to gradually develop skills in counterfactual thinking between 3 and 6 years old. One would expect that children would have a limited handling of these emotions during this time period but a developed experience and understanding by 6 years old.

Before I review the developmental literature on counterfactual emotions, it is important to differentiate an experience from an understanding of regret and relief. An *experience* of regret is one's own comparison of reality with a better counterfactual world. An *understanding* of the same emotion requires one to reflect on the reasoning behind the emotion. For example, imagine a businesswoman getting stuck in traffic: This businesswoman feels particularly bad because if her journey had begun ten minutes earlier, the traffic would have been avoided. This is her *experienc*e of regret, her comparison of reality (stuck in traffic) to a possible alternative (not being stuck in traffic). We, the viewers of the businesswoman's circumstances, understand that she will experience regret because we know that she could have avoided the traffic. Our reflection on why she would experience regret demonstrates our understanding of the emotion. The current literature has a greater focus on children's understanding, rather than experience, of these emotions.

Amsel and Smalley (2000) were the first to investigate children's understanding of regret and relief. They asked children aged 3 to 5 years old, and adults, to report how a protagonist felt about receiving a gift before and also after seeing that an alternative gift could have been received. Participants rated the protagonist's happiness on a four-point scale, made up of smiling faces. In the first experiment, each participant was shown two dolls. Both dolls were shown two boxes. The boxes contained a high, medium or low valued gift. The dolls each had to choose one of their two closed boxes to open. The dolls could keep the contents of their chosen boxes. The participants' aim was to report how the dolls felt about their gifts, using the four-point scale. The dolls' boxes were opened to reveal the same medium-valued gifts. Participants were asked to rate the dolls' happiness by answering the initial question,

"How happy is [doll] with her gift? Not at all happy, a little happy, pretty happy or very happy?" The four possible answers were represented by the faces on the 4-point scale.

Participants were then shown what the dolls could have won had they chosen differently. The non-chosen boxes were either of greater value than the chosen box (positive alternative outcome) or of lower value than the chosen box (negative alternative outcome). When participants saw the contents of the non-chosen box, they were asked the counterfactual question, "How happy would [doll] have been if she had taken the other gift?" The four options on the scale were repeated. Participants were then asked the final question, "How happy is [doll] now with the gift she received?" and the scale was repeated. Responses to the final question indicted children's understanding of counterfactual emotions: Participants' answer determined the influence of the counterfactual possibility on the dolls' happiness. If participants provided a more negative rating on the final question than the initial question, participants were reported to have an understanding of regret (as the ratings were evidence that participants understood that the dolls could have been better off) whereas a more positive rating was regarded as an understanding of relief (the dolls could have been worse off).

Results identified that the 3- to 5-year-olds and the adults performed well on the initial and the counterfactual questions: All participants stated that after the dolls opened their initial boxes, the dolls would be happy. All participants responded to the counterfactual question by stating that the doll in the positive alternative outcome would have been happier had the alternative box been chosen and that the doll in the

negative alternative outcome would have been less happy had the other box been chosen. These results suggested that from the age of 3 years old, children are able to reason about a counterfactual alternative, providing some support for Harris et al. (1996) and German and Nichols (2003). These children may have been able to think about the possible alternative as the adults did. For the final question, only the adults rated the doll that could have been better off as less happy and the doll that could have been worse off as more happy. Thus, only the adults were influenced by the contents of the alternative box. The children did not change their ratings from the initial to the final question: Children's judgement of the dolls' feelings was not influenced by the counterfactual alternative. Amsel and Smalley (2000) argued that 3- to 5-year-olds were able to reason about counterfactual possibilities just as adults did but they were unable to make the comparison between reality and its possible alternatives.

Children aged 3 to 5 years old do not infer that *another* would experience regret or relief. Amsel and Smalley (2000) investigated if children could experience regret and relief *themselves*. In a second experiment, 3- to 5-year-olds and adults participated in a card game. Participants were dealt two face-down cards and the experimenter was dealt one face-up card. Each card was illustrated with a number from 0 to 5. Participants turned over one of their face-down cards with the aim of revealing a card higher than the experimenter's card. On all trials, participants had to rate their feelings having seen what could have been had the unselected card been chosen. The scale was shortened to three-points: a frowning face (*sad*) through neutral (*not happy or sad*) to a smiling face (*happy*). The critical trials were those when the children's chosen card was in fact the same as the experimenter's card. The experimenter asked the initial question, "How do you feel about the card you turned over? Happy, sad or not happy

or sad?" Participants then turned over their non-chosen card. On the critical trials, this meant that their unselected card was either higher (regret: as they could have beaten the experimenter) or lower (relief: they could have lost to the experimenter) than their chosen card. Participants once again rated their feelings about their about their chosen card in the light of the counterfactual information. They were then asked the final question, "How do you feel now about the card you turned over? Happy, sad or not happy or sad?"

Three- to 4-year-olds' ratings of their chosen card did not change after seeing their unselected card. Children did not experience regret or relief. However, they were able to say that they would have been happier had they turned over the unselected card when it won, and would have been sadder when the unselected card lost, just as adults did. Amsel and Smalley provided evidence that young children do not experience counterfactual emotions but they can engage in counterfactual thinking. These results are similar to Amsel and Smalley's first experiment: The 3- to 5-year-olds were unable to make comparisons between reality and an alternative false reality, despite their ability to reason about them separately[‡]. In relation to the counterfactual thinking literature, the results of both Amsel and Smalley's experiments provide support for the findings of Harris et al. (1996) and German and Nichols (2003). Three- to 5-year-olds are able to reason about different alternatives to reality, but Amsel and Smalley have provided evidence that children aged 3 to 5 years old cannot reason about regret and relief when things could have been different. Thus, these results provide support

[‡] Amsel et al. (unpublished) replicated this experiment but included children aged 5, 7 to 8 and 10 to 11 years old. They found that children from 7 years old rated themselves as less happy about their chosen card when the alternative was better, demonstrating an experience of regret and as more happy about their card when the non-chosen card was worse, demonstrating an experience of relief. Their results suggested that children from 7 years old are adult-like in their experiences of counterfactual emotions. These results were never published.

for the later development of regret and relief in comparison to children's counterfactual thinking.

Recall that adults experience more regret after outcomes that can be easily cognitively mutated (e.g., Gleicher, Kost, Baker, Strathman, Richman & Sherman, 1990; Kahneman & Miller, 1986; Landman, 1987; Roese & Olson, 1995). One factor of mutability is the typicality of the course of action: Atypical actions are more mutable than typical actions (Kahneman & Tversky, 1982). A second factor of mutability is the decision that led to feelings of regret or relief: Acts of commission, in which one chooses to act, are more likely to induce regret than acts of omission, in which one chooses not to act, in the short term (e.g., Gilovich & Medvec, 1994). Atypical actions and acts of commission are both more likely to induce regret as it is easier to imagine possible alternatives. Guttentag and Ferrell (2004) investigated the influence of typicality and commission on children's understanding of regret and relief. Over three experiments, they read stories to 5-, 7- and 9-year-old children and adults. These stories were about two protagonists who both experienced the same outcome but through different decisions: Typical or atypical behaviour (two stories) and acts of commission or omission (two stories).

In one of the typicality stories, two boys rode their bikes to school every morning around the pond. David took an atypical route, hit a tree root, fell and hurt himself. Bob took his typical route, hit the root, fell and hurt himself. In one of the commission stories, two girls each chose to open one of two boxes that contained prizes. One girl, Karen, chose a box, then, before opening it, changed her mind and chose to open the other box. Michelle, on the other hand, did not change her mind given the

opportunity. Both girls won the lesser prize. In both stories, children were asked, "Who would be more upset?" As atypical actions and acts of commission prompt more regret than typical actions or acts of omission, one would expect David and Karen to be more upset. Guttentag and Ferrell (2004) found that 7-year-olds claimed that David and Karen would be more upset. The 5-year-olds, on the other hand, said that both protagonists would feel the same. Guttentag and Ferrell (2004) argued that 5-year-olds were unable to understand how an alternative outcome might affect judgements of actuality. The results suggest that 5-year-olds based their judgements on the outcome itself rather than the counterfactual comparison between the outcome and a possible alternative. Children did not demonstrate an understanding of regret until 7 years old.

Guttentag and Ferrell (2004) suggested that children younger than 7 years old may have in fact been thinking about the counterfactual alternatives, but they were insensitive to the differences in typicality or commission. Thus, Guttentag and Ferrell ran a second experiment to investigate this possibility. Guttentag and Ferrell read similar stories to 5-year-olds. In these stories, both protagonists made the same decision that resulted in the same negative outcome. The difference between the protagonists was that the alternative possibilities differed: For one protagonist, the alternative outcome was better than reality (regret), for the other, the alternative outcome was the same as the reality (no matter what the decision, the same outcome would have occurred).

In one of these stories, both Tom and Bill like to eat dessert at their respective schools. Both Tom and Bill like vanilla and chocolate desserts. One day at Tom's

school, there were only two desserts left, one vanilla and one chocolate. Tom picked the vanilla dessert. Tom did not know but the dessert contained germs. Tom became sick after eating the dessert. If he chose the chocolate dessert, he would not have become sick. At Bill's school, there were only two desserts left, one vanilla and one chocolate. Bill picked the vanilla dessert and that contained germs. Bill became sick. The chocolate dessert also contained germs, so whichever dessert Bill picked, he would have become sick. Participants were asked, "Does one boy feel worse than the other about choosing the vanilla dessert that made him sick?" and asked to provide a justification for their response. "Tom" was the target response: He could have avoided becoming sick, whereas this was not the case Bill: He would have become sick no matter which dessert he chose. It is easier to imagine a counterfactual alternative for Tom, and as such it is more likely for him to be rated as feeling worse (Kahneman & Vary, 1990). Adults reported that Tom felt worse than Bill and referred to the counterfactual alternative that he could have avoided sickness. The 5-year-olds reported that Bill would feel worse. Their explanations referred to the fact that Bill would have would have become ill whichever dessert he chose and so he ought to feel worse. Guttentag and Ferrell (2004) reported that the 5-year-olds were not insensitive to the differences in typicality or commission, but rather were unable to infer that another would experience regret. Even when the stories were simplified so that only one protagonist could have been better off, the 5-year-olds still failed to choose the target response.

In Guttentag and Ferrell's second experiment, the 5-year-olds' consistently incorrect responses demonstrated that they were taking the counterfactual outcomes into account, but incorrectly evaluating the state of affairs. Guttentag and Ferrell (2004)

suggested that a possible explanation for this seemingly counterintuitive behaviour was that 5-year-olds' judgements were based on a "summative account". That is, 5-year-olds understood reality and understood the counterfactual possibilities but rather than comparing them as 7-year-olds would have done, the 5-year-olds summed them together. Thus, 5-year-olds did not make the comparison between reality and the alternative, despite understanding both possibilities. As such, they could be compared to the 3- to 5-year-olds in Amsel and Smalley's (2000) studies: They are not yet able to understand regret.

Guttentag and Ferrell (2004) also investigated children's understanding of relief. They ran a third experiment with 7-year-olds and adults, similar to Experiment 1, but the protagonists experienced positive outcomes rather than negative outcomes. The counterfactual alternatives were more negative than the outcomes. Therefore protagonists experienced positive outcomes that could have been worse. In all the stories, there were two protagonists. They each made a different decision that led to the same outcome in typicality and commission stories. For example, in the typicality story, one protagonist avoided a negative outcome due to typical actions, yet the other protagonist avoided the negative outcome due to atypical actions, and according to the adult literature, would therefore experience a greater feeling of relief (Gilovich & Medvec, 1994; Kahneman & Tversky, 1982). Adults responded as expected: Atypical actions and acts of commission led to a greater feeling of relief. Children, however, stated that both protagonists would feel the same. Typicality and commission did not influence 7-year-olds' judgements of others' relief. In Guttentag and Ferrell's (2004) first experiment, these factors of mutability influenced 7-year-olds' judgments of others' regret. The results of these two experiments identified that children's

understanding of relief may develop later than their understanding of regret.

McCloy and Strange (2009) further investigated children's understanding of regret and relief: They followed up Guttentag and Ferrell's (2004) summative account explanation. McCloy and Strange read two scenarios to 7-year-olds and adults. These scenarios involved three children playing a decision making game. Each of the three children chose three boxes and then one of those three boxes to open and keep its contents. In the negative outcome condition (n), all three children (n1, n2, n3) opened their chosen box to find that it was empty. All children then saw what they could have chosen had they picked either of the other two boxes. Child n1: both alternative boxes contained a prize, Child n2: one other box contained a prize, Child n3: neither of the other boxes contained a prize. Participants were asked to rank the children's happiness and to explain their reasons. Child n1 ought to feel the most regret as he could have won a prize had he chosen either of the two other boxes. Child n3 would feel the least regret, as no matter which box he chose, he would have won nothing. For the positive outcome condition (p), all three children (p1, p2, p3) opened their box to discover that they won a prize. Participants saw what could have been: Child p1: both alternative boxes contained a prize, Child p2: one alternative box contained a prize, Child p3: neither of the alternative boxes contained a prize. Child p3 ought to feel the most relief as he chose the only box that contained a prize. Child p1 ought to experience the least relief as he would have won a prize no matter which box was chosen.

For both the positive (relief) and the negative outcome (regret) conditions, adults focussed on the counterfactual possibilities and thus responded as expected: They chose Child n1 as the most regretful, and Child p3 as the most relieved. In contrast,

the 7-year-olds responded using a summative approach: They rated Child n3, who had three empty boxes and could never have won a prize, as the most regretful and Child p1, who had three boxes that all contained prizes, as the most relieved. These results provided evidence that whereas adults are able employ counterfactual thinking in order to infer which protagonist would experience the greatest counterfactual emotions, children aged 7 years old are not. These results emphasized that whilst adults used a comparative strategy to make their judgements, contrasting factual outcomes and counterfactual alternatives, children up to the age of 7 years old employed a summative approach. Children summed across both factual and counterfactual outcomes. These results provide support for Guttentag and Ferrell's (2004) summative account but are in conflict with Guttentag and Ferrell's results: Guttentag and Ferrell found that 5-year-olds used a summative approach on the regret stories, whereas 7-year-olds did not, as they demonstrated an understanding of regret.

The primary difference between Guttentag and Ferrell's (2004) first experiment and McCloy and Strange (2009) is that in the latter, children had to reason about "semifactuals" (Goodman, 1947), rather than counterfactuals. Semifactuals are comparisons between counterfactual antecedents and factual outcomes (Chisholm, 1946; McCloy & Byrne, 2002), whereas counterfactuals are comparisons between factual antecedents and counterfactual outcomes. Semifactuals are typically represented by the conditional "even if" or "no matter what." For example, in McCloy and Strange's scenario, *even if* Child p1 chose another box, he would have won a prize. In Guttentag and Ferrell's second experiment, the 5-year-olds participated in a semifactual study. In the story about the desserts, *even if* Bill chose the other dessert, he would have become sick. Children may find the processing of semifactuals more

difficult than counterfactuals, and as such employ a summative approach rather than a comparative approach that they may take for counterfactuals. It seems that when children do not generate counterfactual emotions, they may use a summative strategy.

These findings suggest that before children can reason about counterfactual emotions, they take a summative approach to counterfactual judgements, whereas adults take a comparative approach. McCloy and Strange argued that a summative approach is simpler than a comparative approach as it only requires the participants to keep track of the affective consequences of possible outcomes. In contrast, a comparative approach requires that in addition to holding in mind the affective consequences of possible outcomes, one must also make comparisons between the possible outcomes to make a judgement. This account supports the gradual developments account of counterfactual thinking: With age, children develop skills in counterfactual thinking so that there becomes no need to take the simplest approach to counterfactual judgements (Halford & Andrews, 2004).

The evidence that concerns children's experiences and understanding of regret and relief supports the gradual developments account of counterfactual emotions. Amsel and Smalley (2000) found that children up to 5 years old are able to think counterfactually but have not yet developed the skills required to experience or understand regret and relief. Similarly, Guttentag and Ferrell (2004) found that 5-year-olds were not able to understand regret or relief. It may be that they take a simpler approach to counterfactual judgements (McCloy & Strange, 2009) until they have developed the skills to understand that a protagonist could have been better off, at 7 years old.

Thus, there is some evidence to suggest that children understand that another would experience regret at 7 years old (Guttentag & Ferrell, 2004) but no positive evidence for an understanding of others' relief: There is a lag between the development of children's understanding of others' regret and understanding of others' relief.

One possible reason for the lag between regret and relief (Guttentag & Ferrell, 2004) may be the stronger influence of negative outcomes to a decision over positive outcomes. Another is the explicitness of the counterfactual alternatives. Research with both children and adults has highlighted both these issues (e.g., German, 1999; Gleicher et al., 1990; Ferrell, Guttentag & Gredlein, 2009).

For children as young as 5 years old, German (1999) found that negative outcomes were stronger prompts for counterfactual thinking than positive outcomes. German read stories to 5-year-olds that resulted in either a positive or negative outcome. For example, Jenny is going to play in the garden. She has to put on some shoes. She has the choice between wellies and trainers. She picks the wellies and because of her choice, her feet stay nice and warm (positive outcome) / she picks the trainers, resulting in wet and cold feet (negative outcome). German found that the children referred to the counterfactual alternative more after negative outcomes. After negative outcomes, children seemed to mentally undo the antecedents of the events.

This finding resonates with the pattern of results in the adult literature: Gleicher et al. (1990) gave vignettes to adults that described two protagonists who committed acts of commission or omission: One of the stories used was the stocks and shares story seen

in Kahneman and Tversky (1982). Gleicher et al. manipulated the valence of the vignettes so that they ended with wither a positive outcome (in which one protagonist acted to gain money whereas the other did not act and could have gained money) or a negative outcome (in which one protagonist acted to lose money, whereas the other did not act and could have lost money). Gleicher et al. also manipulated the salience of the counterfactual alternative. In the non-salient counterfactual condition, the focus of the story was on the actual outcome as opposed to the counterfactual: "Mr. George finds out that he is better off by $1,200 because he switched [the] stock." In the salient counterfactual condition, the focus was the alternative outcome: Each man "would have been better [or worse] off by $1,200..." In the negative outcome condition, participants rated the protagonist who lost money based on an act of commission as feeling worse than the protagonist who lost money based on an act of omission. This effect was reported in both the salient and non salient counterfactual conditions. However, in the positive outcome condition, the effect of commission was only found in the salient counterfactual condition. Results suggested that negative outcomes are more likely to lead to counterfactual thinking, but after a positive outcome, counterfactual thinking is likely if the context of the counterfactual alternative is emphasised.

Recently, Ferrell et al. (2009) investigated if salience of the counterfactual alternatives influenced children's understanding of regret and relief. Consistent with German (1999) and Gleicher et al. (1990), Ferrell et al. hypothesised that children may be less likely to compare reality to an alternative after a positive outcome, rather than a negative outcome, and so a prompt may encourage them to think in this manner. Ferrell et al. manipulated the salience of the counterfactual alternatives on children's

understanding of others' regret and relief. Perhaps with greater salience, children may understand regret earlier than 7 years old (Guttentag & Ferrell, 2004).

Ferrell et al. read stories to 5- to 8-year-old children and adults that involved two protagonists whose actions led to a negative outcome. For one protagonist, the alternative outcome was the same as reality, yet for the other protagonist, the alternative was more positive, resulting in a feeling of regret. Each story had two versions, high salience and low salience. One low salience story was about Faith and Emily, who both made the same decision that resulted in the same outcome. If they had decided differently, Faith would have encountered the same negative outcome that she achieved anyway but Emily would have been better off. Children and adults were asked which girl felt worse. In the high salience story, extra sentences were added to the stories to reinforce the fact that no matter what Faith chose to do, she would have received the negative outcome yet Emily would have been better off. Again, participants had to determine who felt worse. The target response was "Emily", as she could have decided differently and experienced a better outcome. Results indicated that only adults chose the target response on the majority of the four stories. The children performed poorly and the two youngest age groups both failed to identify that the target protagonist would feel worse in any of the stories. As for the salience of the stories, only the 7- to 8-year-olds were influenced by the salience of the counterfactual alternatives: Only these children were more likely to answer correctly in the high salience condition. Apart from the 7- to 8-year-olds in the high salience condition, all children reported that both protagonists would feel the same. None of the age groups except for the adults took into account the counterfactual alternatives when they were not made obvious. As would be predicted by Gleicher et

al. (1990), the 7- to 8-year-olds were influenced by the salience of the alternative outcome but younger children's reasoning was not influenced by the same factors. These results do not wholly support Guttentag and Ferrell (2004) who suggested that 7-year-olds are influenced by the counterfactual alternative and that they were able to understand that another would experience regret.

There is now an inconsistency within this literature: Guttentag and Ferrell (2004) suggested that 7-year-olds are able to understand that another would experience regret but Ferrell et al. (2009) found that 7- to 8-year-olds are only able to understand others' regret when the explicitness of the stories is high. There are two possible explanations for this inconsistency. The first is that Ferrell et al. did not consider typicality or commission in their stories. It may be the case that typicality or commission, as demonstrated by Guttentag and Ferrell, is the prompt that 7-year-old children used to infer which protagonist experienced the greater regret. The second possible explanation is that in Guttentag and Ferrell's first experiment, both protagonists experienced a negative outcome and both could have had the same counterfactual alternatives. In Ferrell et al., the counterfactual alternatives were different for both protagonists, one whose counterfactual alternative was the same as reality but a worse alternative for the other. These circumstances are thus based on semifactuals ("even if"). Semifactuals may in fact decrease the intensity of regret (McCloy & Byrne, 2002; Sanna, Schwarz & Small, 2002), as they can be used as a self-consoling mechanism ("it's not that bad" or "no matter what..."). Semifactuals, rather than counterfactuals, may be the reason for such poor performance.

1.8. Regret and counterfactual thinking

The results of the literature thus far suggest that an understanding of regret is first seen several years after children have been credited with a mature ability to think counterfactually (Beck et al., 2006). This delay between counterfactual thinking and understanding regret raises an interesting point: There seems to be no empirical link of counterfactual thinking and regret. Based on the literature, it seems that counterfactual thinking is necessary, but not sufficient for regret.

As the literature stands, there are two claims as to the further developments in counterfactual thinking that are critical for regret. The first is seen in Beck et al. (2006) who suggested that counterfactual thinking was developed once children were able to understand that counterfactual alternatives were possible at a previous point in time (i.e. they represented reality and its possible alternatives as dual possibilities). Recall that Beck et al. asked open counterfactual questions, "Could [the cotton wool] have gone anywhere else?" A correct response required one to think about alternative possibilities as to what could have happened. Children's responses were compared to their responses on standard counterfactual questions, "What if [the cotton wool] had gone the other way, where would it be?" Beck et al. found that between 3 and 6 years old, children gave the target answer more often on the standard counterfactual questions, but only the 5- to 6-year-olds performed well on the open counterfactual questions. Thus, there is a late development in children's counterfactual thinking in which children can understand that counterfactuals are possibilities that could have occurred in place of reality. Beck et al. (2006) suggested that an understanding of regret requires this understanding of multiple possibilities. The second claim to the further developments in counterfactual thinking that are critical for regret is by

Guttentag and Ferrell (2004). They suggested that 5-year-old children were not able to understand regret because they did not make a comparison between reality and the counterfactual alternative. They claimed that only when children are able to make this comparison are they able to understand regret.

Beck and Crilly (2009) investigated which of these two claims best explained the relationship between counterfactual thinking and an understanding of regret. Children aged 5 to 6 years old were read stories similar to those used by Guttentag and Ferrell (2004) and were asked standard and open counterfactual questions based on scenarios similar to those in Beck et al. (2006). If there was a relationship between children's performance on both tasks and both tasks were of similar difficulty, children's understanding of regret would be dependent upon them understanding counterfactual as possibilities. If children's performance revealed no relationship between the two tasks and a difference in difficulty, children would be likely to be limited by their ability to compare reality to a counterfactual alternative, as originally suggested by Amsel and Smalley (2000).

Beck and Crilly (2009) used Guttentag and Ferrell's (2004) typicality and commission stories but also included a regret open counterfactual question, which asked if an alternative course of action was possible, "Could David have gone any other way [around the pond]?" As for the counterfactual questions similar to Beck et al. (2006), participants saw a road that forked in two directions: left to the sweet shop, or right to the swimming pool. One car turned left and children were asked standard counterfactuals, "What if he had gone the other way, where would he be?" and open counterfactuals, "Could he have gone anywhere else?" Beck and Crilly reported two

key findings: First, children's performance on the regret stories task was worse than performance on responding to the two open counterfactual questions, which were no different to each other. Second, the 5- to 6-year-olds did not understand that another would experience regret, replicating Guttentag and Ferrell (2004). Children's performance on these tasks provided evidence that the children's difficulties were in the comparisons of reality to an alternative possibility, supporting the claim that Amsel and Smalley (2000) and Guttentag and Ferrell made: Children's failure to understand that another would experience regret was due to their difficulty to compare reality to its possible alternatives. Beck and Crilly, however, reported that the children who were able to understand that the target protagonist would feel worse in the stories were able to represent the counterfactuals as possibilities. All the children who correctly chose the target protagonist gave the correct answer to the regret open counterfactual question. When children develop skills in representing counterfactuals as dual possibilities, at 5 to 6 years old, they have acquired the necessary skills to understand regret.

Thus, there is a delay between counterfactual thinking and an adult-like understanding of regret that requires further research. There also remains the question as to when children can understand relief.

1.9. Overall conclusions and introduction to experimental work

I have considered four broad areas of research: adults' counterfactual thinking, adults' regret and relief, children's counterfactual thinking and children's regret and relief. Here, I return to the issues raised by the developmental regret and relief literature and describe how these ground the current experimental work.

There are two striking problems within the established literature. First, there is no positive evidence that children can experience regret or relief themselves; they have only had to infer these emotions in others (Guttentag & Ferrell, 2004, Ferrell et al., 2009, Amsel & Smalley, 2000). Within this thesis, I have used a methodology that distinguishes between an experience and an understanding of regret and relief. Therefore I am able to contrast children's own experiences with their understanding. If an understanding of regret and relief is a later development than an experience of these emotions, these results would be an addition to the developmental improvements account within the literature. Children are able to make counterfactual predictions from 3 years old (Harris et al., 1996; German & Nichols, 2003) developing in complexity through to 6 years old (Beck & Guthrie, 2010; Beck et al., 2006). At a later age, children are able to understand these emotions, at 7 years old (Ferrell et al., 2009; Guttentag & Ferrell, 2004). There is the possibility of developmental improvements between an experience and an understanding of these emotions, both of which can only occur after a matured ability to think counterfactually (Beck & Crilly, 2009; Gilovich & Medvec, 1995; Kahneman & Miller, 1986; Kahneman & Varey, 1990; Mellers, 2000; Ritov, 1996; Zeelenberg, 1999a, 1999b).

The second problem within the established literature is that there is no positive evidence for children's first understanding of relief. Children of 7 years old have demonstrated an understanding of regret but not of relief (Guttentag & Ferrell, 2004). I aimed to determine the first age that children understand relief. In doing so, I aimed to determine what children's difficulties are with relief, providing a possible

explanation for the lag between the two emotions.

In the review of the children's counterfactual thinking literature, I referred to Rafetseder et al. (2010) and Rafetseder and Perner (2010), who argued that children up to the age of 5 to 6 years old do not think counterfactually but rather use basic conditional reasoning. Even though I do not investigate children's counterfactual thinking abilities, if children demonstrated an experience or understanding of regret and relief, this would suggest that they are able to engage in counterfactual thinking: Regret and relief cannot be experienced or understood without comparing reality to what could have been (Asmel & Smalley, 2000; Beck & Crilly, 2009; Gilovich & Medvec, 1995; Guttentag & Ferrell, 2004; Zeelenberg, 1999a, 1999). Thus, if children are able to experience or understand regret and relief before the age of 5 to 6 years old, I would have provided evidence to the contrary of Rafetseder et al. (2010) and Rafetseder and Perner's (2010) claims.

In the chapters that follow, I report experiments that investigate children's and adults' experiences and understanding of regret and relief. Throughout this thesis, the game that I used is fairly similar to Amsel and Smalley (2000) in terms of making a 50:50 decision between two options, seeing the outcome of that decision and then seeing what could have been had a different decision been made. The experimental work in this thesis is arranged in four chapters. The first experimental chapter (Chapter 2) addressed the issue of experience and understanding regret and relief. I investigated children's first experiences of regret and relief and compared them to their first understanding that another would experience these emotions under the same conditions. In Chapter 3, I examined the lag between regret and relief and discussed

the possibility that regret and relief may in fact appear even earlier than the literature currently suggests. In Chapter 4, I returned to the debate about children's difficulty in understanding regret. I asked children to infer if others would experience regret and relief and to provide their justifications. In Chapter 5, I manipulated children's responsibility for the outcome of the game to investigate if children were experiencing regret and relief or using basic conditional reasoning (Rafetseder et al., 2010; Rafetseder & Perner, 2010). By the end of this thesis, I hope to have offered a more precise account as to what children struggle with on their way to a mature handling of regret and relief.

Chapter 2

Children's thinking about their own and others' regret and relief

The experiments in this chapter form the basis for a paper:

Weisberg and Beck (2010) published in the Journal of Experimental Child Psychology.

In the introduction to this thesis, I reviewed evidence concerning children's experience and understanding of regret and relief. It is useful at this point to reiterate the difference between these two terms. An experience of these emotions is the personal comparison of reality with a better or worse counterfactual world. To understand regret, one must reflect on the reasoning behind the emotion. This extra stage in thinking may result in a later development of understanding regret and relief compared to an experience of regret and relief. In this first experimental chapter, I investigated both aspects of children's counterfactual emotions: their experience and understanding.

The established literature makes several claims about children's understanding of regret and relief. One of these claims is that 3- to 5-year-olds do not understand regret or relief (Amsel & Smalley, 2000) as they do not compare reality to its alternatives. In their first experiment, 3- to 5-year-olds and adults had to infer the happiness of two dolls. Both dolls made a decision to open one of two boxes. Their decisions led to winning a prize. All children and adults were able to infer that the dolls would be happy with their prize. The participants were shown what the dolls could have won, which was either a higher valued prize (and would lead to feelings of regret) or a lower valued prize (feelings of relief). All participants were able to state that the dolls would have been happier had they chosen the better prize or less happy had they chosen the worse prize. This is evidence that children as young as 3 years old were able to understand counterfactual alternatives (Harris et al., 1996). However, when participants were asked to infer the dolls' happiness in light of the counterfactual alternative, adults' ratings of happiness differed from their initial ratings of happiness. This was not the case for children's ratings: Children did not say that the dolls were

less happy knowing that a better prize could have been won, or more happy knowing that a worse prize could have been won. Children of 3 to 5 years old did not understand regret or relief.

Guttentag and Ferrell (2004) made further claims regarding children's understanding of regret. They claimed that 5-year-olds did not understand regret but by the age of 7 years old, children were old enough to understand as they were able to make and evaluate the appropriate comparisons between reality and an unrealised alternative. Guttentag and Ferrell asked children to infer which of two protagonists would feel worse after they made different decisions that resulted in the same negative outcome. The 7-year-olds, but not the 5-year-olds, were able to identify the target protagonist. Consistent with the adult literature, the target protagonist, who made an act of commission or an atypical action which led to a negative outcome, experienced greater regret than the protagonist who made an act of omission or a typical action (e.g., Gleicher et al., 1990; Kahneman & Tversky, 1982; Roese & Olson, 1995). The 5-year-olds' judgements of affect were not influenced by the effect of commission or typicality.

Guttentag and Ferrell (2004) also claimed that 7-year-olds, who understood regret, did not understand that another would experience relief. Using similar commission and typicality stories, the participants' task was to determine which protagonist would feel better after both achieved the same positive outcome, but based on different decisions. The 7-year-olds were unable to identify the target protagonist. Guttentag and Ferrell's results concluded that an understanding of relief is later developing than an understanding of regret.

Amsel and Smalley (2000) are the only researchers within the literature to have investigated children's own experiences of regret and relief. They claimed that 3- to 5-year-olds do not experience regret or relief. They asked children and adults to participate in a card game. Participants had to choose one of two face-down cards in the hope that it would beat the experimenter's face up card. On the critical trials, when the participant's card matched the experimenter's card, the 3- to 5-year-olds were unable to make the comparison between the card that they chose and the card that they could have chosen. Thus, they did not experience regret when the alternative card was higher than the experimenter's card or relief when the alternative card was lower.

There is, therefore, no positive evidence that children can experience regret or relief. This chapter aims to determine the first age that children can experience regret and relief. There is also little positive evidence for children's understanding of regret and no positive evidence for an understanding of relief, thus this chapter also aims to determine the first age at which children can understand relief. Guttentag and Ferrell (2004) reported that there was a lag between children's understanding of regret (at 7 years old) and relief (later than 7 years old). The third aim of this chapter is to investigate the difference between children's experience and understanding of the two emotions. Once children have demonstrated an ability to experience regret and relief, I will be able to determine if the reported lag between regret and relief also applies to children's own experience of these emotions.

In Experiment 1, I sought evidence for children's experience of regret and relief using a game based on Amsel and Smalley (2000). In Experiment 2, I used the same task

and asked children to report another's feelings to make a comparison between experiencing and understanding regret and relief.

2.1. Experiment 1

Children's own experiences of regret and relief

2.1.1. Introduction

In the first experiment of this thesis, I focussed on children's own experiences of regret and relief. I aimed to determine when children first experience counterfactual emotions and if the reported lag between regret and relief (Guttentag & Ferrell, 2004) also applied to children's own experiences of regret and relief, not just their understanding.

To investigate these aims, I modified a procedure devised by Amsel and Smalley (2000). In the original procedure, children and adults watched two dolls choose to open one of two identical boxes. The dolls won the contents of their chosen box. The contents were low, medium or high in value. Participants were asked to rate the dolls' happiness. After choosing their box, the dolls saw what they could have chosen had they chosen the alternative box. Participants were again asked to rate the dolls' happiness. If the participants understood that the dolls would feel regret due to missing out on a better prize, they would assign a lesser rating of happiness after seeing what could have been in comparison to their initial rating. The opposite pattern would be the case if they understood relief. In this first experiment, I was interested in this change in rating of happiness based on the chosen prize: As in the Amsel and Smalley (2000) procedure, my participants were asked two questions, an "initial

question" regarding the chosen box, and an "alternative question", regarding the chosen box in light of the counterfactual possibility. A decrease in ratings of happiness from the initial to the alternative box was evidence of regret, whereas an increase was evidence of relief.

The results of the current experiment are expected to determine the first age at which children first experience regret and relief, and if a lag exists between the experience of these two emotions.

2.1.2. Method

2.1.2.1. Participants.

There were 31 child participants, 11 aged 5 to 6 years old (5 to 6) (mean age (M) = 5 years; 7 months (5;7), range (r) = 5;4 to 6;0, 5 boys and 6 girls), 10 aged 6 to 7 (M = 6;8, r = 6;3 to 7;2, 1 boy and 9 girls) and 10 aged 7 to 8 (M = 7;8, r = 7;3 to 8;2, 6 boys and 4 girls) recruited from one school in Manchester, U.K. serving a predominantly middle-class population. All child participants were White and spoke English as their first language. Twelve adult participants (1 man, 11 women), were Psychology university students (M = 20;4 years, 18;7 to 24;8) who received research credits for participation.

2.1.2.2. Materials.

I used three white boxes, approximately $3cm^3$, containing coloured smiley face stickers and a 5-point scale based on a white horizontal board (55 x 19 x 11cm) and made up of five yellow faces (8.5cm in diameter) ranging from very sad to very happy. A screen hid the boxes from participants' view on all the trials.

2.1.2.3. Procedure.

All child participants completed a simple pre-test to confirm their understanding of the scale. The experimenter sat opposite the participant and asked the child to point to the very happy face and then to the very sad face (half in the reverse order). No children failed this pre-test.

Two boxes were placed on the table between the participant and the experimenter. The experimenter explained that only one box could be chosen by the participant and the contents of that particular box were the participant's to keep. After opening their box (the *initial box*), participants were asked the *initial question* ("How do you feel after opening your box?") and asked to rate their happiness using the scale ("Please point to a face"). They were assigned an *initial score* between 1 (*very unhappy*) and 5 (*very happy*).

Participants were then told that the non-chosen box (the *alternative box*) would be opened to see what would have been won. Upon identification of the contents, participants were asked to rate their feelings towards their initial box once again. Participants were asked the *alternative question* ("How do you feel about your box now? Please point to a face") and were assigned an *alternative score* of between 1 and 5.

The initial box always contained two or three stickers. Unbeknown to the participant, the two boxes placed on the table contained an identical number of stickers. Whilst the participant was investigating the contents of the initial box, an identical looking alternative box was taken from behind the screen and subtly replaced the non-chosen

box. No participants commented on the sleight of hand. On relief trials, the replaced alternative box contained no stickers (participants were expected to be more positive about the initial box) and on the regret trials, the replaced alternative box contained eight stickers (participants should be less positive). There were four experimental trials that were presented in four fixed orders: (a) relief (initial win of 2 stickers), regret (3), regret (2), relief (3) or (b) regret (2), relief (2), relief (3), regret (3). On the remaining two orders, the number of stickers that were won were alternated. After the fourth trial, participants were thanked and took away the stickers that they had accumulated.

2.1.3. Results and Discussion

For each participants, the initial score was subtracted from the alternative score to give a difference score between -4 and 4. Scores below zero showed that participants were more unhappy (regret) with their initial box having viewed the contents of the alternative box. Scores above zero indicated relief. Mean scores are seen in Figure 1.

To investigate age differences for regret and relief, I conducted a 4 (age: 5 to 6, 6 to 7, 7 to 8, adult) x 2 (trial type: regret, relief) Analysis of Variance (ANOVA). There was a main effect of trial type, $F(1, 39) = 57.15$, $p < .001$, partial $\eta^2 = .594$ and an interaction between trial type and age, $F(3, 39) = 5.77$, $p = .002$, partial $\eta^2 = .307$. I made a Bonferroni correction ($\alpha = .025$) to account for two within group comparisons. Based on participants' change in ratings from the initial to the alternative questions, post hoc t-tests showed that there was a significant difference between the regret and relief trials for both the 7- to 8-year-olds, $t(9) = 9.26$, $p < .001$, $r = .95$ and the adults, $t(11) = 10.16$, $p < .001$, $r = .95$. There was no significant difference between regret

and relief for the 5- to 6-year-olds (p = .609) and the 6- to 7-year-olds (p = .022). There were no significant differences between age groups on regret scores, highest t = 1.35, lowest p = .193. However, on relief scores, the 5- to 6-year-olds differed from the 7- to 8-year-olds, $t(19) = -3.00$, p = .007, r = .57, and the adults, $t(11.14) = -3.25$, p = .008, r = .70. The 6- to 7-year-olds differed from the 7- to 8-year-olds, $t(18) = -3.31$, p = .004, r = .62 and adults, $t(20) = -3.98$, p = .001, r = .66. There were no other significant differences, highest t = -.09, lowest p = .233.

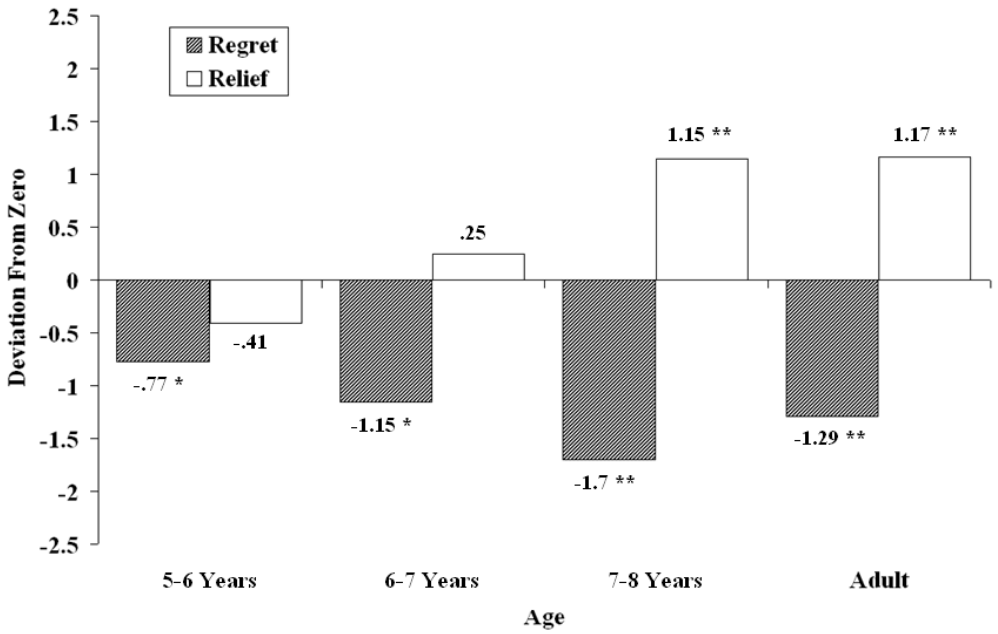


Figure 1. Mean scores on regret and relief trials.

One asterisk (*) indicates that the score differs from zero at $p < .05$. Two asterisks (**) indicate that the score differs from zero at $p < .025$.

The ANOVA revealed developmental changes but I also wanted to see if there was evidence that participants were experiencing an emotional change that could be called

regret or relief. I tested if participants' changes in ratings for each age group deviated from zero using one-sample t-tests. A significant positive result (i.e. a larger alternative score than initial score) demonstrated relief whereas a significant negative result (i.e. a smaller alternative score than initial score) demonstrated regret. The first evidence for regret in children was at 5 to 6 years, $t(10) = -2.54$, $p = .029$, $r = .63$. Although children in the younger two groups did not clearly differentiate regret trials from relief trials, my data suggest that they were showing regret. Children first experienced relief at 7 to 8 years old, $t(9) = -7.14$, $p < .001$, $r = .92$. This is the first evidence that children think about relief, and also support for the lag between regret and relief. Adults demonstrated both regret, $t(11) = -5.34$, $p < .001$, $r = .85$ and relief, $t(11) = 10.38$, $p < .001$, $r = .95$.

Finally, I checked that child participants did not just use the extremes of the scale. This could have prevented them showing a change in emotion. I compared their initial responses to 1 for regret (the lowest possible score) and 5 for relief (the highest possible score). Results showed that child participants used the scale appropriately for both regret, $t(30) = -10.73$, $p < .001$, $r = .98$ and relief trials, $t(30) = -21.62$, $p < .001$, $r = .79$.

Thus, whilst I replicated the asymmetry observed by Guttentag and Ferrell (2004) that regret precedes relief, I had some evidence that both emotions were seen at an earlier age than current evidence suggests. This evidence suggests that regret is first experienced at 5 to 6 years old, the same age that children have matured skills in counterfactual thinking (Beck et al., 2006). Only at this age are children able represent counterfactuals as dual possibilities. Thus, it may be that being able to represent

counterfactuals as dual possibilities is sufficient for children to experience regret. Relief developed a little later, aged 7 to 8 years old.

I have identified two avenues for further research: The first is to determine what was more difficult about Amsel and Smalley's (2000) and Guttentag and Ferrell's (2004) tasks in comparison to the one reported here. Perhaps children's particular difficulty was due to the involvement of reasoning about other people. If this were the case, this would be evidence of dissociation between children's experiences of regret and relief and their understanding of these emotions. Experiment 2 investigated whether children experienced counterfactual emotions before they could understand when others experience them. The second avenue for further research is to investigate what makes relief more difficult than regret. In Chapter 3, I investigated several possibilities to resolve this question.

2.2. Experiment 2

Children's understanding of others' regret and relief

2.2.1. Introduction

In Experiment 1, I provided evidence that children are able to experience regret from the age of 5 to 6 years old. The results provided the first positive evidence for children's experience of relief, first experienced at 7 to 8 years old. It seems that the first age that children can experience relief and that the lag reported between children's understanding of regret and relief (Guttentag & Ferrell, 2004) extends to children's experiences of these emotions. These conclusions are followed up in later chapters. In the following experiment, I focussed on the conclusion that children have

now been shown to experience regret two years younger than they can understand regret in others (Guttentag & Ferrell). In Experiment 2, I investigated the possibility that understanding regret and relief is more difficult than experiencing these emotions.

One reason why understanding regret is more difficult for children than experiencing regret may be that of the methodology that was used. Children may have had difficulty understanding Guttentag and Ferrell's (2004) stories. The stories involved two protagonists who both engaged in different actions yet both achieved the same outcome. Children may have been confused by the sequence of events or misunderstood the notions of typicality and commission. However, Guttentag and Ferrell reported that their participants correctly answered the memory and comprehension check questions. An alternative possibility is that the demands of the task were too great. Guttentag and Ferrell's participants had to infer the happiness of two protagonists and compare them to determine who felt worse. Perhaps asking children to infer the happiness of two protagonists and then make a further comparison between them placed too high demands on their information processing. A third possibility is that children's difficulty was with making the appropriate counterfactual comparisons within the stories: Amsel and Smalley (2000) found that 3- to 5-year-old children were able to understand the counterfactual alternatives but were unable to compare them to reality. Perhaps the 5-year-olds in Guttentag and Ferrell's (2004) stories struggled to make this comparison.

In Experiment 2, I addressed these possibilities. The methodology that I used was similar to Experiment 1, but participants watched another play the game. Participants were asked to report on the other's happiness throughout the game. In this way, only

one methodology would be used, thus the possibility that the stories were more difficult than games because of increased information processing demands could be avoided. In addition, participants only had to infer the happiness of one other, rather than make a comparison between two. In using a methodology that was similar to Experiment 1, I was able to investigate if children do indeed experience regret and relief before they can understand when others experience them.

2.2.2. Method

2.2.2.1. Participants.

There were 53 child participants, 28 aged 5 to 6 (M = 5;10; r = 5;4 to 6;3, 10 boys and 18 girls) and 25 were aged 6 to 7 (M = 6;10; r = 6;4 to 7;3, 13 boys and 12 girls). Children were recruited from one school in Birmingham, U.K. serving a predominantly middle-class population. Participants were White (58%), Asian (38%) and Black (4%). All participants spoke English as their first language. Sixteen Psychology students (2 men, 14 women) participated as a comparison group (M = 19;3 years, 18;8 years to 25;9 years) receiving research credits for their participation. Half the participants (n = 27 children, 8 adults) played the game themselves (*Self condition*) and half (n = 26 children, 8 adults) observed someone else play the game (*Other condition*).

2.2.2.2. Materials.

I used the materials from Experiment 1 plus a toy penguin, Arnold, manoeuvred by the experimenter.

2.2.2.3. Procedure.

Participants were allocated alternately to the Self or Other condition based on the teachers' class list (or for adults, the order in which they were recruited). In the Self condition, I replicated the Experiment 1 procedure. In the Other condition, the experimenter explained to children that Arnold, the toy penguin, would play and that they had to judge how Arnold felt when playing the game. The initial question was "How do you think Arnold feels about his box? Please point to a face [on the scale]"; the alternative question was "How do you think Arnold feels about his box now? Please point to a face." The procedure was otherwise similar to that of the Self condition.

On the first trial, participants were told, "Arnold does not win what is inside this [the alternative] box" just before opening the alternative box. Sleight of hand was not required as Arnold always "chose" the box that contained two or three stickers. At the end of the game, Arnold donated his stickers to the participant.

2.2.3. Results and Discussion

I used the same data coding as in Experiment 1. Mean scores can be seen in Figure 2.

A 3 (age: 5 to 6, 6 to 7, adult) x 2 (condition: Self, Other) x 2 (trial type: regret, relief) ANOVA revealed a main effect of trial type, $F(1, 63) = 10.34$, $p = .002$, partial $\eta^2 = .141$. There were significant interactions between trial type and age, $F(2, 39) = 12.39$, $p < .001$, partial $\eta^2 = .282$ and between trial type and condition, $F(1, 63) = 19.67$, $p < .001$, partial $\eta^2 = .238$. A three-way interaction approached significance, $F(2, 63) =$

2.83, $p = .066$, partial $\eta^2 = .082$. There were no other significant effects or interactions, highest $F = 2.44$, lowest $p = .096$.

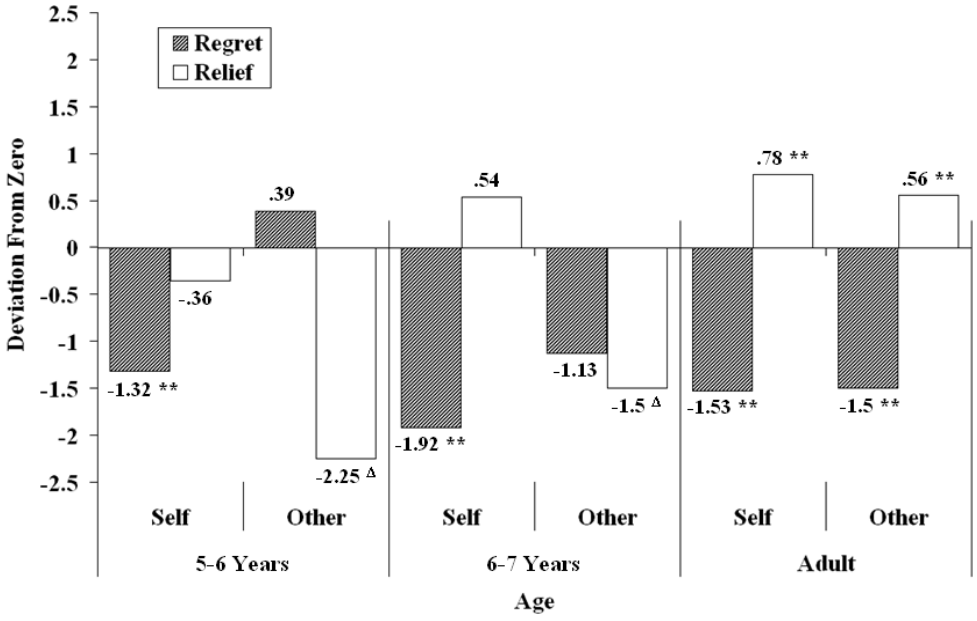


Figure 2. Mean scores on regret and relief trials.

One asterisk (*) indicates that the score differs from zero in the expected direction at p = .05. Two asterisks (**) indicate that the score differs from zero in the expected direction at p = .025. A triangle (Δ) indicates that the score significantly differs from zero in the unexpected direction at p = .05.

The main effect of trial type revealed that regret scores (-1.17) were lower than relief scores (-.33). I conducted post hoc t-tests to investigate the significant interactions. To investigate the first interaction between trial type and age, I combined the Self and Other conditions. I made a Bonferroni correction ($\alpha = .006$) for nine comparisons. Neither the 5- to 6-year-olds nor the 6- to 7-year-olds were different in their responding between regret and relief trials, highest $t = 1.82$, lowest $p = .082$, unlike the adults, $t(15) = 12.33$, $p < .001$, $r = .95$. Collapsing across condition, the 5- to 6-

year-olds performed significantly worse than the adults for relief, $t(31.83) = -6.74$, $p < .001$, $r = .77$, but there was no difference between the age groups for regret, $p = .021$.The pattern of results for the 6- to 7-year-olds was similar: They performed significantly worse than the adults for relief, $t(26.59) = -3.07$, $p = .005$, $r = .51$, but there was no difference for regret, $p = .983$. There were no differences between the 5- to 6- and the 6- to 7-year-olds, highest $t = 2.23$, lowest $p = .030$.

Post hoc tests on the second interaction between trial type and condition, making a Bonferroni correction ($\alpha = .013$) for four comparisons, revealed that in the Self condition, participants discriminated between regret and relief trials, $t(34) = 6.01$, $p < .001$, $r = .72$, but the same difference was not seen in the Other condition, $p = .162$. Collapsing across age, participants discriminated between the Self and Other conditions for both regret, $t(67) = -2.68$, $p = .009$, $r = .31$, and relief, $t(67) = 4.35$, $p < .001$, $r = .47$.

To determine if responses differed from zero, I used one sample t-tests. In the Self condition, adults demonstrated experience of regret, $t(7) = -5.38$, $p = .001$, $r = .90$, and relief, $t(7) = 10.58$, $p < .001$, $r = .97$. Five- to 6-year-olds experienced regret, $t(13) = -3.04$, $p = .009$, $r = .64$, but not relief, $t(13) = -.96$, $p = .355$, $r = .26$. Six- to 7-year-olds also experienced regret, $t(12) = -5.19$, $p < .001$, $r = .83$, but not relief, $t(12) = 1.24$, $p = .237$, $r = .34$. In the Other condition, adults demonstrated understanding of both regret $t(7) = -7.94$, $p < .001$, $r = .95$ and relief $t(7) = 4.97$, $p = .002$, $r = .88$. Five- to 6-year-olds' ratings were not significantly different from zero for regret, $t(13) = 1.12$, $p = .285$, $r = .30$, but they were for relief, $t(13) = -7.62$, $p < .001$, $r = .90$. However, children reported that Arnold would feel worse on discovering that the non-chosen

box was empty. Six- to 7-year-olds showed the same pattern: They demonstrated no evidence of regret, $t(11) = -1.76$, $p = .107$, $r = .47$ and systematically "inappropriate" responses on relief trials, $t(11) = -2.91$, $p = .014$, $r = .66$.

I checked that child participants were not responding at the extreme end of the scale preventing them from showing change in emotion. This was the neither the case for regret, $t(52) = -7.88$, $p < .001$, $r = .98$ nor relief, $t(52) = -24.01$, $p < .001$, $r = .66$.

Performance in the Self condition confirmed the findings from experiment 1: Five- to 7-year-olds experienced regret and these children showed no evidence of an experience of relief. Performance by children in the Other condition was worse. Five- to 6-year-olds and 6- to 7-year-olds did not indicate that Arnold would feel regret. The Other condition revealed systematically inappropriate responding. On relief trials, the 5- to 7-year-olds responded as if Arnold felt worse after discovering that the non-chosen box contained no stickers. One possible explanation for this is that children, unable to apply counterfactual thinking to infer what emotion another might feel, based their ratings on a different feature of the game. On relief trials the non-chosen box contained zero stickers. Perhaps seeing an empty box led children to think that the experimenter was mean, and they inferred that Arnold would like the game less, thus rate him as unhappy. On the regret trials, the non-chosen box contained eight stickers. Children may have perceived the overall set up of the game more positively because there was a chance that Arnold could have won eight stickers. This may not constitute a mature understanding of emotion but it would be a logical way of reasoning.

As I did not find any positive evidence for 5- to 7-year-olds' understanding or regret

or relief, I was unable to replicate the lag between an understanding of these emotions found by Guttentag and Ferrell. However, in the Self condition, a replication of Experiment 1, the results demonstrated a similar pattern: There was a lag between children's first experiences of regret and their first experiences of relief.

In Experiment 2, I investigated children's understanding of regret and relief using a similar methodology to Experiment 1. This was done to investigate if children did indeed experience regret and relief before they could understand when others experience them. I found that this was the case. Children's difficulty with others' regret and relief cannot simply be attributed to using stories or involving comparisons between two protagonists, as in Guttentag and Ferrell (2004). Rather, children seemed to struggle with identifying that Arnold would feel happier or sadder than before in light of the counterfactual alternatives. When children make adult-like inferences about others' emotions based on counterfactuals should, therefore, be the subject of future research.

2.3. Discussion of Experiments 1 and 2

In Experiment 1, I found positive evidence of children's experience of regret at 5 years old. I also found the first positive evidence for an experience of relief, at 7 years old. These results demonstrated a lag between children's first experience of regret and first experience of relief. The results of the Self condition of Experiment 2, a replication of Experiment 1, showed the same pattern of results. Guttentag and Ferrell (2004) reported a lag but only in relation to children's understanding of others' regret, at 7 years old and relief, for which there was no positive evidence. In the Other condition of Experiment 2, children up to the age of 7 years old did not infer that

another would experience regret or relief. I did not replicate the lag reported by Guttentag and Ferrell but from comparisons between the Self and Other conditions, I found that an understanding of regret and relief is later developing than an experience of these emotions.

In Experiment 1, I reported the first positive evidence of children's experiences of relief. At 7 to 8 years old, children reported feeling happier when the counterfactual outcome could have been worse than the reality that they experienced. That relief is experienced later than regret may reflect a bias in children's counterfactual reasoning that is also seen in adults. Gleicher et al. (1990) and Roese (1997) reported that adults more frequently think counterfactually when real outcomes are negative. This pattern is also seen in the developmental literature: German (1999) observed that 5-year-olds more often referred to a counterfactual when they heard stories with negative rather than positive outcomes. In the current chapter, on both regret and relief trials, participants or Arnold initially received a positive outcome, win two or three stickers. On regret trials, the overall outcome was relatively negative, as the alternative outcome was greater than the initial outcome, and on relief trials, the overall outcome was relatively positive, as the alternative outcome was worse than the initial outcome. Consistent with the literature, children may be less likely to engage in counterfactual thinking when events are positive and therefore less likely to experience relief. This is consistent with the notion of negativity bias, in which adults pay greater attention to negative outcomes over positive ones (Rozin & Royzman, 2001). This is because the salience, potency and dominance of negative events are stronger triggers for a reaction than positive ones. It may be possible that the negative overall outcome of the regret trials influenced children's responses but did not do so for the relief trials.

In Experiment 2, despite evidence that 5- to 7-year-olds experienced regret in the Self condition, the 5- to 7-year-olds were unable to predict the correct counterfactual emotions in others. For children to have a mature understanding that others feel regret or relief, they must be able to identify all the relevant actual and counterfactual information and infer how the other person will evaluate the possible alternative outcomes. It may be possible that children find it too demanding to infer others' evaluations. Perhaps children have limits to their understanding of others' affective states. Findings within the Theory of Mind literature provide support for this possibility. Harris, Johnson, Hutton, Andrews and Cooke (1989) told stories to children in which one protagonist, Ellie, likes Coke but hates milk. Another protagonist, Mickey, has emptied a Coke can and filled it with milk. Children were asked if Ellie would be happy or sad when she first sees the can. Four-year-olds judged that Ellie would be sad. According to the false belief literature (e.g., Bradmetz & Schneider, 1999; Gopnik, 1993; Moses & Flavell, 1990; Wellman, Cross and Watson, 2001) once children are 4-years-old, they would be aware of false beliefs held by others. It was only the 6-year-olds who were able to judge the protagonist's emotions by ignoring what they themselves knew to be true. The 4-year-olds were limited in their understanding of the protagonist's emotions. Rieffe, Meerum Terwogt and Cowan (2005) reported similar findings. They investigated 4-, 6- and 10-year-olds' explanations of stories in which a protagonists ought to feel happy, sad or angry or afraid. The 4-year-old children provided explanations that focussed on reality, and did not focus on beliefs. The 6-year-olds provided belief-based explanations for happiness, but less so for sadness or anger. The 10-year-olds provided belief-based explanations for all the stories. This is evidence that only with later developments within theory of mind does children's understanding of knowledge and belief lead to

re-evaluations of judgements of emotion (Doherty, 2009). Such an account may explain my results: Children have difficulty inferring other' emotions based on their beliefs as well as reality

There may be gradual developments within children's thinking about their own and others' regret and relief. Amsel and Smalley's (2000) proposal of how children handle pretend and possible worlds resonates with this possibility. They suggested that there are developmental improvements to both higher-order conceptual understanding and lower-level information processing. Thus, as children get older, they develop more powerful cognitive capacities and control systems. In the case of my findings, children can thus proceed from thinking about their own regret and relief to more complex forms of counterfactual thinking, understanding than another would experience these emotions.

An important question remains for future research. Children first provided the target responses on the regret trials at 5 years old, substantially earlier than the previously published literature had reported. Yet it remains unknown at what age children first show regret. Based on the established link between counterfactual thinking and regret (Beck & Crilly, 2009; Gilovich & Medvec, 1995; Kahneman & Miller, 1986; Kahneman & Varey, 1990; Mellers, 2000; Ritov, 1996; Zeelenberg, 1999a, 1999b), and the pattern of gradual improvements to children's counterfactual thinking, regret may be possible from as young as 3 years old, as children of this age have demonstrated some counterfactual thinking abilities (Harris et al., 1996; German & Nichols, 2003). Many researchers have suggested that children do not think counterfactually younger than 5 to 6 years old because they do not represent

counterfactuals as dual possibilities (Beck et al., 2006; Beck & Guthrie, 2010; Byrne, 2002) or because they use another strategy to achieve the same responses as counterfactual thinking, such as basic conditional reasoning (Rafetseder et al., 2010; Rafetseder & Perner, 2010). Thus, future research should adapt decision making tasks to make them accessible for even younger children to explore the conflicts within the emergence of an understanding of regret. In the following chapter, I included children of 4 to 5 years old to investigate the possibility that regret is understood at an even younger age.

In the first two experiments of this thesis, I explored children's experience and understanding of counterfactual emotions. I found that children as young as 5 years old experienced regret, and two years later, experienced relief. I found no evidence for children up to 7 years old being able to explain these same emotions in others. There have now emerged two further avenues of future work. The first concerns the lag between regret and relief. This lag should be subject of further investigation to identify why relief develops later than regret, and the possible implications this may have for children's actions and behaviour. This lag is the focus of Chapter 3. The second avenue of future work is the dissociation between children's experiences and understanding of regret and relief. In Chapter 4, I return to this discussion.

Chapter 3

Earlier developments of regret and relief

Experiment 3 in this chapter forms the basis for part of a paper:

Weisberg and Beck (2010) under resubmission in Cognition and Emotion

In Chapter 3, I aimed to resolve the question of the youngest age that regret and relief can be experienced. Despite evidence that 3-year-olds have some ability to think about counterfactuals (Harris et al., 1996; German & Nichols, 2003), children of this age may not yet have the counterfactual maturity to succeed at the task within this thesis. Guajardo and Turley-Ames (2004), Riggs et al. (1998) and Beck et al. (2010) suggested that children from 4 years old may have a greater counterfactual maturity as they have the linguistic sophistication to handle more complex counterfactual thinking. Thus, I have included children aged 4 to 5 years old in Experiments 3 and 4.

In the developmental counterfactual thinking literature, there is evidence to suggest that counterfactual thinking is gradual in its development. As I reviewed in the introduction, these gradual developments begin when children can make counterfactual predictions in relation to short chain causal sequences (Amsel & Smalley, 2000; Harris et al., 1996; German & Nichols, 2003), ranging through more complex sequences (Riggs et al., 1998, Guajardo & Turley-Ames, 2004), and later developments such as representing counterfactuals as dual possibilities (Beck & Crilly, 2009; Beck et al., 2006). Developments in inhibitory control are also implicated in the gradual development of counterfactual thinking (Beck et al., 2009; Robinson & Beck, 2000). Further evidence for counterfactual thinking after 5 to 6 years old is found in the literature on regret and relief when children have demonstrated the ability to spontaneously compare actual and counterfactual outcomes from 7 years old (Amsel & Smalley, 2000; Ferrell et al., 2009; Guttentag & Ferrell, 2004). In Chapter 1 of this thesis, I presented evidence that suggested children can make the critical comparison between the actual world and the counterfactual world from 5 years old. Based on the gradual developments account of counterfactual

thinking, it remains possible that children younger than 5 years old are able to make the comparison between reality and the counterfactual. Within the established literature, children younger than 5 years old have not demonstrated any evidence of thinking about regret or relief. In fact, Beck and Crilly (2009) argued that only when children develop skills in representing counterfactuals as dual possibilities, at 5 to 6 years old, they have acquired the necessary skills to understand regret. Thus, it seems unlikely that children younger than this age would be able to think about regret and relief. However, a limitation of Experiments 1 and 2 of this thesis remains: Children younger than 5 years old did not participate. Thus, 4- to 5-year-olds have been included in Experiments 3 and 4.

In Experiment 4, I investigated if children younger than 5 years old may have been able to experience counterfactual emotions at an earlier age: Children may have been able to make the appropriate comparisons between reality and the counterfactual but they were unable to explicitly access their knowledge. To determine if this was the case, I used an implicit measure of children's emotional experience: Their implicit responses may have demonstrated an experience of regret or relief, even if their explicit responses did not.

In Guttentag and Ferrell's (2004) first experiment, the 5-year-olds' systematic responding that neither protagonist would feel worse may have been false negatives. Guttentag and Ferrell demonstrated that children understood the events in the stories and, based on Amsel and Smalley's (2000) findings, 5-year-old children ought to understand counterfactual alternatives: Amsel and Smalley found that 3- to 5-year-olds in that study were able to understand counterfactual alternatives. Children may

have understood how the counterfactual outcomes would affect the protagonists' emotional responses to the state of affairs, and thus they may have understood that one protagonist would experience the greater regret. However, it may be possible that they were unable to explicitly access their knowledge. That is, children may have made correct evaluations of the outcome and counterfactual outcome but were unaware of having done so. Children's response, that both protagonists felt the same, would therefore have been the default response as they based their responses on judgements of the outcome of the stories rather than reference to what could have happened. Thus, if children provided the target implicit responses more often than the target explicit responses, children younger than 5 years old may have been able to think about counterfactual emotions at an earlier age than we have thought. In Experiment 4, I investigated this possibility.

There were additional aims of Chapter 3. In Experiment 1 and 2 of this thesis, I provided evidence of a lag between children's experiences of regret and relief: Participants aged 5 years old were able to experience regret but only 7-year-olds experienced relief. In Experiment 3, I aimed to determine why children's first experiences of relief lag behind their first experiences of regret.

If we consider the evidence thus far that children experience regret earlier than relief within the literature (Guttentag & Ferrell, 2004) and this thesis (Experiment 1 and the Self condition of Experiment 2) there are two possible reasons for the lag between these emotions. The first is that there genuinely is a lag and regret develops earlier than relief, the second is that Experiments 1 and 2 both had methodological limitations that made passing the relief trials more difficult than regret.

In order to investigate the possibility that Experiment 1 and 2 had methodological limitations, the procedures in both Experiments 3 and 4 were slightly adapted from Experiment 1 and the Self condition of Experiment 2. Participants were still required to make a decision between two options both of which led to unknown prizes. Their choice could either be to their advantage: Their non-chosen option was a lesser prize and participants would be expected to experience relief, or to their disadvantage: Their non-chosen option was a greater prize, leading to feelings of regret. Participants were also still asked to rate their happiness with their chosen option before and after seeing what could have been. The most critical change between experiments in the current chapter and Experiment 1 and the Self condition of Experiment 2 was the introduction of two further trials. There was the possibility that participants could lose after making their decision rather than only winning. These two further trials were an additional regret trial and an additional relief trial. The additional regret trial involved a negative initial outcome (a loss rather than a gain of tokens) that could have been avoided had the alternative card been chosen (win tokens). The additional relief trial was a negative initial outcome followed by a more negative counterfactual, so in fact the negative initial outcome was the better outcome. These methodological changes meant that it was possible to investigate regret and relief after an initial positive outcome and an initial negative outcome.

I also made some further methodological changes to investigate if relief trials, but not regret trials, were artefactually difficult for children. The first involved a change to the ratings of children's happiness. In Experiment 1 and 2, I used a 5-point scale ranging from very happy to very sad. Participants may have responded using one extreme of the scale after winning two stickers (e.g., very happy). When participants then saw

that they could have won nothing, even if they experienced relief, they had no way of showing on the scale that they were even happier. In the analysis of both Experiments 1 and 2, I checked that child participants did not just use the extremes of the scale, which could have prevented them showing a change in emotion and this was not the case. However, I adapted the scale to avoid this possibility. The second change regarded the number of stickers that children won. In Experiment 1, children won two stickers and then saw that they could have won nothing. On regret trials they could have won eight stickers. Perhaps, on relief trials, the counterfactual world was uninteresting as it involved winning no stickers. If the counterfactual was not interesting, children may not have been prompted to think about the possible alternative. A related point is that the relative difference on relief trials (two or three stickers) was smaller than that on regret trials (five or six stickers) and may not have resulted in a counterfactual emotion. These changes outline how I was able to investigate the possibility that relief trials were artefactually difficult for children. If, after these methodological changes, children experienced relief at the same age as regret, I would have provided evidence that the development of relief does not lag behind regret and the results in Chapter 1 were artefacts of the design.

3.1. Experiment 3

Reasons for the lag between regret and relief

3.1.1. Introduction

There were two aims of Experiment 3. The first was to investigate if children younger than 5 years old were able to experience regret. As such, children aged 4- to 5-years-

old have been included. The second was to identify why there was a lag between regret and relief.

Recall that there were two possibilities why there is a lag between the two emotions. The first is that there genuinely is a lag and regret develops earlier than relief. The second is that Experiments 1 and 2 had methodological limitations that made providing the target response on the relief trials more difficult than providing that target response on the regret trials.

The current literature offers some support for the first possibility: There is a lag between the emotions. In German's (1999) study, children were most likely to think counterfactually after negative outcomes to events. German (1999) read stories to 5-year-olds. Each story resulted in either a positive or negative outcome. German found that children referred to the counterfactual alternatives more often after negative outcomes. It seemed that after negative outcomes, rather than positive outcomes, children were more likely to mentally undo the antecedents of the events so that they could reconstruct the events. German's results may be applicable to regret and relief: As regret occurs following an overall negative outcome, children may be more likely to engage in counterfactual thinking than after relief, an overall positive outcome. As relief occurs after an overall positive outcome, similar to the 5-year-olds in German's study, the younger participants may not be prompted to think counterfactually on relief trials. As such, a lag would be seen between the development of the two emotions.

To facilitate the investigation into the lag between regret and relief, I have included

two additional trials. In these trials, participants initially lost tokens but had they chosen differently they would have won tokens (regret) or lost even more (relief). These inclusion of the Initial-Lose trials meant that participants do not have to base their feelings of happiness only on the overall emotion. That is, in Experiments 1 and 2, regret trials were an overall negative experience which prompts counterfactual thinking more than on the relief trials, an overall positive experience (German, 1999; Gleicher et al., 1990). The Initial-Lose trials may prompt participants to think about what could have been based on the negative outcome of their choice rather than their negative experience as a whole.

In the current study, I improved on the methodology of Experiment 1 and the Self condition of Experiment 2 in three ways: I changed the counterfactual outcome in the hope that it would be viewed as significant by participants, the difference between reality and the counterfactual was equal across regret and relief trials, and the scale allowed children to show regret and relief regardless of the initial rating equally well on any trial. With these methodological improvements, I investigated which of the two possibilities explain the reported lag between children's first experiences of regret and relief: There is a genuine lag or the lag was due to artefacts of the design. Additionally, with the inclusion of the 4- to 5-year-olds, I investigated if children experienced regret or relief earlier than I had previously reported.

3.1.2. Method

3.1.2.1. Participants.

There were 162 participants, 55 aged 4 to 5 (M = 5;1 r = 4;8 to 5;7, 28 boys, 27 girls) 52 aged 5 to 6 (M = 6;2, r = 5;8 to 6;7, 30 boys, 22 girls) and 55 aged 6 to 7 (M = 7;3,

r = 6;8 to 7;7, 25 boys, 30 girls). Children were recruited from two schools in Birmingham, U.K. One school served a predominantly middle-class population, and the other was from an area of low socio-economic status (SES) and ethnic diversity. Individuals from the two schools were equally distributed across age groups. Children were White (50%), Asian (43%) and Black (7%). All spoke English as their first language. Five participants (aged 4 to 5) were excluded due to failing the practice sessions with the scale after three attempts, each time with feedback, so 83 boys and 74 girls were included in the final dataset.

3.1.2.2. Materials.

I used a 5-point scale for rating of happiness (see Figure 3), which was based on a white horizontal board (55 x 19 x 11cm) and made up of five yellow faces (8.5cm in diameter) ranging from very sad to very happy. A circular "window" (8.5cm in diameter) was cut into a white vertical piece of cardboard (12 x 18.5cm). Below the window were three blue arrows, a left-facing, a right-facing and an upwards-facing arrow. Gold stars printed on laminated card (5.5 x 5.5cm) were the tokens during the game. I used laminated playing cards (7 x 9cm), with either "WIN" or "LOSE" printed at the top of the card. Below this were printed gold stars which determined the number of tokens won or lost. The reverse of the card were blank. The cards were sufficiently thick so that when placed faced-down, the illustrations could not be seen. A screen was used to hide the tokens, cards for the remaining trials and the stickers to give the participants thanking them for their participation.

(i) (ii)

Figure 3. The 5-point rating scale

(i) Participants rated their feelings of happiness after seeing the initial card

(ii) Participants rated their feelings of happiness with the arrows after seeing what could have been

3.1.2.3. Procedure

Throughout this description, an arrowhead (^) represents the moment when the experimenter pointed to the appropriate place.

3.1.2.3.1. Pre-test.

All participants completed a simple pre-test to confirm their understanding of the scale. The experimenter asked the participant to point to the very happy face, and then to the very sad face (half in the reverse order). Sixty-two participants did not point to a face on the extremes of the scale, but rather the less happy or less sad faces. The experimenter asked these participants, "Which is the really, really happy [sad] face?" to which all these participants responded correctly.

3.1.2.3.2. Explanation of the scale.

Participants were shown the "window" with the three arrows underneath. The

experimenter said, “This is my window. It’s a special window because it goes on top of any of my faces like this.” The experimenter placed the window over all five face faces, one by one. “Now, wherever my window goes, these arrows^ always mean the same thing. This [^ left-facing] arrow always means even sadder than the face that you can see in the window. This is because it points towards the sad faces. This [^ right-facing] arrow always means even happier than the face that you can see in the window because it points towards the happy faces. This [^ upwards-facing] arrow always means the same as the face that you can see in the window, because it points towards the face in the window.” The window was moved over the three remaining happy and sad faces (not the neutral face) and the key points of the descriptions were repeated, highlighting the use of the left-facing arrow (“even sadder”) on the very unhappy face, and the right-facing arrow (“even happier”) on the very happy face, despite the scale itself having ended.

Finally, the window was placed over the middle, neutral face and participants were asked to identify the arrow that meant even happier than the face in the window, the arrow that meant even sadder than the face in the window, and the arrow that meant the same as the face in the window (counterbalanced across all participants). Feedback was provided. Only five participants (all 4 to 5 years old) failed to correctly identify the three arrows despite feedback each time. These children continued with the game but were not included in the data analysis.

3.1.2.3.3. Training.

Participants had six rounds of training to use the scale. On the first round, participants were given six tokens. Having received these tokens, they were asked to rate their

happiness by pointing to one of the faces on the 5-point scale. The experimenter took away four tokens and put the window over the face the participant had chosen. The experimenter asked "How do you feel now that four have been taken away?" The experimenter pointed to the arrows referring to them in turn as "this one" [^ right-facing], "this one" [^ left-facing] and "or this one" [^ upwards-facing]. The appropriate arrow was the left-facing arrow, as this represented the meaning "even sadder than the face in the window." Participants were given feedback following correct responses, "Yes, well done, I think it's this one too because after losing, you feel sad" and incorrect responses, "I think it's this one, because after losing, you feel sad." The remaining five training procedures covered other situations in which children won, lost, or retained the same number of stars. Thus after training, children had experienced two trials in which the correct response was to use the left-facing arrow, two trials to use the right-facing arrow and two trials to use the upwards-facing arrow. Every participant correctly answered at least four of the six training rounds with the majority (n = 118) responding correctly to all six rounds.

3.1.2.3.4. Experimental Procedure.

Participants were shown two face-down cards. The experimenter explained that the participant could choose only one card and the contents of that particular card would be the participant's to keep. After participants chose a card (the *initial card*), the experimenter read what was written on the reverse of the card and gave or took away the according number of tokens. Participants were asked the *initial question* ("How do you feel about choosing ^your card?") and rated their happiness. Once completed, the participants were told that the non-chosen card (the *alternative card*) would be turned over to see what would have been chosen. The window was placed over the face that

the participants initially chose. The alternative card was turned over and participants were told, "If you chose this card, you would have won / lost X tokens." Participants were then asked, "How do you feel about choosing your card^ now? (the *alternative question*). This one [^ right-facing arrow], this one [^ left-facing arrow] or this one [^upwards-facing arrow]?"

The experimental procedure was fixed so that the participant always chose a pre-determined initial card. Unbeknown to the participant, the two cards placed on the table were identical. While the participant was looking at the initial card, an identical looking alternative card was taken from behind the screen and subtly replaced the non-chosen card. No children commented on this sleight of hand.

Table 1 details the regret and relief trials. Both regret and relief trials had an initial win trial, in which participants initially won tokens but the alternative was better (regret) or worse (relief) and one Initial-Lose trial, in which participants initially lost tokens but the alternative was better (regret) or worse (relief). For each participant, the initial outcome of one regret trial and one relief trial was to win or lose two tokens. For the other regret trial and the other relief trial, the initial outcome was to win or lose three tokens. This was done so that participants did not always win or lose the same number of tokens. The correct response on regret trials was to point to the left-facing arrow ("even sadder") and on the relief trials, the right-facing arrow ("even happier"). The filler trial was used so that participants did not end the game with no tokens. Data were not collected on the filler trial. Trials were presented in four fixed orders: (a) Regret Initial-Win (3 tokens), Filler, Regret Initial-Lose (2), Relief Initial-Win (2), Relief Initial-Lose (3) or (b) Relief Initial-Win (2), Regret Initial-Win (3),

Relief Initial-Lose (2), Filler, Regret Initial-Lose (3). On the remaining two orders, the order of the trials remained the same but the initial outcome switched from 2 to 3 tokens or vice versa. All children accumulated five tokens over the course of the game that were swapped at the end for two stickers.

Table 1. Description of trials used in Experiment 3

Trial Type	Initial Outcome		Alternative Outcome		Known As
Regret	Win	2 or 3	Win	8	Regret Initial-Win
Regret	Lose	2 or 3	Win	3	Regret Initial-Lose
Relief	Win	2 or 3	Lose	3	Relief Initial-Win
Relief	Lose	2 or 3	Lose	8	Relief Initial-Lose
Filler	Win	5	Lose	2	Filler

3.1.3. Results and Discussion

As there were three possible answers to each alternative question, the probability of responding correctly by chance was 33%. I ran binomial sign tests to compare the choice of arrow to chance performance. I made a Bonferroni correction ($\alpha = .013$) to account for the fact that there were four measures from each age group. The results are shown in Table 2. Results suggest that the 4- to 5-year-olds experienced regret after winning, $p = .010$. The 5- to 6-year-olds experienced regret after winning and losing. Relief following an initial win was experienced from the age of 5 to 6 years old. However, children did not experience relief on Initial-Lose trials until they were 6 to 7 years old.

Table 2. Results of the Binomial tests: Comparisons of participants' chosen arrows to chance (33%) in Experiment 3

		Regret Initial-Win				**Regret Initial-Lose**				**Relief Initial-Win**				**Relief Initial-Lose**			
Age (years)		*%*			*p*	*%*			*P*	*%*			*p*	*%*			*p*
	N	←	↑	→		←	↑	→		←	↑	→		←	↑	→	
4 to 5	*55*	49	31	20	.010*	22	60	18	.049$^{\Delta}$	9	60	31	.432	16	64	20	.025$^{\Delta}$
5 to 6	*52*	55	25	20	.001**	69	19	12	<.001**	14	14	73	<.001**	39	22	39	.212
6 to 7	*55*	62	36	2	<.001**	73	21	6	<.001**	0	22	78	<.001**	22	29	49	.010*

Note. Shaded area represents the target arrow for that trial (← = *even sadder*, ↑ = *the same*, → = *even happier*)

One asterisk (*) indicates that the result of the Binomial test is significant in the expected direction at $p < .05$. Two asterisks (**) indicate that the result is significant in the expected direction at $p < .013$. A triangle (Δ) indicates that the score is significant in the unexpected direction at $p < .05$.

Participants received a score of 0 (*incorrect*) or 1 (*correct*) for their responses to the alternative question. Answering with the upwards arrow ("the same") was regarded as incorrect for both the regret and relief trials. Participants' scores were then summed for both regret and both relief trials so that each participant received two further scores of 0 (*both incorrect*), 1 (*one correct*) or 2 (*both correct*). A 3 (age: 4 to 5, 5 to 6, 6 to 7) x 2 (trial type: regret, relief) ANOVA revealed significant main effect of age, $F(2, 154) = 25.13$, $p < .001$, partial $\eta^2 = .246$. There were no other significant effects or interactions (highest $F = 2.76$, lowest $p = .099$).

I used independent samples t-tests to break down the main effect of age, making a Bonferroni correction for three tests ($\alpha = .017$). For children's scores on the regret and relief trials combined (max. 4), there were significant differences between the 4- to 5-year-olds (M = 1.24) and the 5- to 6-year-olds (M = 2.31), $t(100) = 5.23$, $p < .001$, $r = .46$ and between the 4- to 5-year-olds and the 6- to 7-year-olds (M = 2.62) , $t(103) = 7.30$, $p < .001$, $r = .58$. There was no significant difference between the 5- to 6- and 6- to 7-year-olds, $p = .149$.

The results from experiment 1 and 2 provided evidence that children experience regret from the age of 5 to 6 years old. The results of Experiment 3 provided some support for this finding. I also found that 4- to 5-year-olds experienced regret on one trial type, the Regret Initial-Win trial, and there was a significant improvement in performance between the 4- to 5- and the 5- to 6-year-olds. The 4- to 5-year-olds seemed to have a fledgling experience of regret. Although there is evidence to suggest that children cannot think counterfactually until at least 5 to 6 years old (Beck & Guthrie, 2010; Beck et al., 2006; Byrne, 2002; Rafetseder et al., 2010; Rafetseder & Perner, 2010),

the finding that children experience some regret at 4 to 5 years old should not come as a surprise. In the review of the counterfactual literature, I noted that there were gradual developments within counterfactual thinking. The results of Experiment 3 identified that the developments within counterfactual emotions are seen as early as 4 to 5 years old. These children therefore have demonstrated some skill in comparing a positive reality to a more positive alternative reality (Regret Initial-Win trials). Under these circumstances, children responded appropriately to an outcome that could have been better, i.e. they rated themselves as more unhappy than they were before they saw the counterfactual. However, these children performed poorly when the same emotion was expected for the trial in which reality was negative but the alternative was a positive (Regret Initial-Lose trials). Perhaps for the 4- to 5-year-olds, the gradual developments within counterfactual thinking are limited by the greater demands of the processing required: Comparing a relatively negative alternative to a negative reality may be more difficult than the comparison to a positive reality. The 4- to 5-year-olds did not demonstrate any experiences of relief.

Regarding the lag between children's first experience of regret and relief, the first possible explanation that I considered was that this delay was genuine. The second possible explanation was that children's first experiences of relief lagged behind regret due to artefacts of the design. Unexpectedly, results supported *both* possibilities: Relief was first experienced at a younger age than I reported in Experiment 1 and the Self condition of Experiment 2, but it still lagged behind the development of regret, which was experienced at an even younger age than I previously reported.

With the introduction of trials in which the outcome of the participants' choice was negative (i.e. losing) rather than only positive (i.e. winning), as in Experiment 1, I found that the apparent lag was greatly reduced. Although, it seems that regret after a positive outcome may be experienced slightly earlier, at 4 to 5 years old, than regret after a negative outcome, at 5 to 6 years old, regret was still experienced earlier than relief after a positive outcome, at 5 to 6 years old, and after a negative outcome, at 6 to 7 years old.

In the discussion of Experiments 1 and 2, I suggested that the lag may be due to the fact that one tends to engage in less counterfactual analysis when the overall outcomes are positive than when the overall outcomes are negative (German, 1999; Gleicher et al., 1990; Guttentag & Ferrell, 2004). In addition, the strength of the trigger needed to think counterfactually after a positive outcome decreases with age (Ferrell et al., 2009; Guttentag & Ferrell; Landman, 1987; Roese, 1997). These explanations can be extended to the results of Experiment 3. Thus relief, an overall positive outcome, is not experienced until a later age than that of regret, an overall negative outcome.

Further evidence that the development of relief lags behind that of regret comes from children's responses to the Relief Initial-Lose trials. On these trials, children lost tokens yet could have been worse off. Under these circumstances, children first experienced relief at 6 to 7 years old. The experience of relief after seeing that a negative outcome could have been worse seems to be a relatively late development in childhood.

One possible reason for this later development may be that the combination of two

negatives is more difficult to process. Decision Affect Theory (DAT) may provide another explanation for why children's performance on Relief Initial-Lose trials is worse than on the other trials. DAT is an account of perceived pleasure (Mellers, 2000; Mellers, Schwartz, Ho & Ritov, 1997; Mellers, Schwartz & Ritov, 1999), that is, the pleasure that one receives based on an outcome depends on two factors. The first is the satisfaction with the outcome itself: The balance of pleasure and displeasure increases with the utility of achieved outcomes but decreases with the utility of alternative outcomes (Larsen, McGraw, Mellers & Cacioppo, 2004). The second is the counterfactual comparison between reality and any possible alternatives.

This theory may account for children's difficulties with the Relief Initial-Lose trials, in which children did not experience relief despite an objectively better outcome. Children were less likely to experience relief when they lost two tokens rather than losing eight tokens in contrast to losing two tokens rather than winning three. It may be possible that the balance of children's pleasure and displeasure during these trials was tipped in an unexpected direction based on the utility of the non chosen outcome: A loss of eight tokens may have had a greater negative influence over children's behaviour than a win of three tokens. That is to say, the negative influences of the non chosen outcomes may have mistakenly led participants to be less happy with the objectively better state of affairs. Similar examples of this thought can be seen in the adult literature: Larsen et al. (2004) found that adult participants who lost $5 rather than $12 were more ambivalent than those participants who lost $5 rather than $3. The non chosen outcome (a loss of $12) may have had a greater negative influence over the participants relative to the loss of $3. Similarly, Mellers et al. (1997) reported that adult participants who won $5 rather than lost money rated themselves as happier

than those participants who won $9, yet could have won more. Mellers and McGraw (2001) reported that university students who achieved a C grade but expected to perform worse, reported themselves as happier than the students who achieved a better grade, but expected to achieve an A. These findings have commonalities with my Relief Initial-Lose trials, thus providing a possible explanation as to why younger participants did not experience relief after an outcome could have been worse.

An alternative possibility for the relative difficulty of the Relief Initial-Lose trials may be that children are performing as they did in Guttentag and Ferrell's second experiment (2004) and McCloy and Strange (2009): employing a summative strategy. In this experiment, children were asked to compare the happiness of two protagonists. One protagonist made a decision that resulted in a negative outcome but the alternative decision would have led to the same negative outcome. The other protagonist made a decision that led to a negative outcome which turned out to be the best possible outcome as the alternative was more negative. The 5-year-old participants were unable to infer that the second protagonist should have been happier than the first protagonist having seen that he could have been worse off. Guttentag and Ferrell, and McCloy and Strange, both provided evidence that children used a summative approach: They combined the two negatives to result in a net negative, rather than compare the reality to its alternatives. It is possible that children were using such an approach for the Relief Initial-Lose trials in the current Experiment. Children may have seen a negative outcome (lose two tokens) and a negative alternative (lose eight) but rather than make a comparison between the two, they may have summed the two negatives together resulting in a greater net negative. It is unlikely that children were using such an approach as there seems to be no reason to

be employing this strategy for this one particular trial but not for the remaining three trials, in particular the Regret Initial-Win trials: A positive outcome and a positive alternative outcome ought to have resulted in a net positive, yet children from 4 years old did not respond in this manner.

These results contribute to the established counterfactual literature. Although there is evidence to suggest that it is not until children are 5 to 6 years old that they are able to think counterfactually (Beck & Guthrie, 2010; Beck et al., 2006; Byrne, 2002; Rafetseder et al., 2010; Rafetseder & Perner, 2010), the results of Experiment 3 suggest that children of 4 to 5 years old can engage in some form of counterfactual thinking: Children of this age have developed the necessary skills to compare a positive reality to a more positive alternative reality. Although I did not explicitly measure children's counterfactual thinking, the results of Experiment 3 revealed the possibility that the asymmetry between children's first success on counterfactual emotions tasks and thinking about counterfactuals may not be as great as previously thought (e.g., Amsel & Smalley, 2000; Beck & Crilly, 2009; Beck, Riggs & Burns, in press; Guttentag & Ferrell, 2004).

Two findings were reported in the current study: The first was that there was that there remained a lag between children's experiences of regret and relief. It seems that even after the improvements to the methodology of Experiment 1, an experience of regret seems to develop earlier than relief. These methodological changes have not been made in relation to children's understanding of counterfactual emotions. As such, the presence of a lag between children's understanding of others' regret and others' relief, as first evidenced by Guttentag & Ferrell (2004), ought to be subject to

further investigation. In Experiment 5, I return to the debate regarding children's relative difficulty with inferring others' regret and relief, and I address this question. The second key finding was that 4- to 5-year-olds demonstrated a fledgling experience of regret. This is the youngest age that children have demonstrated such thinking.

The performance of the 4- to 5-year-olds conflicts with some of the findings within the established literature. Beck and Crilly (2009) found that children do not think counterfactually until at least 5 to 6 years old, yet alone experience regret and relief. It may be possible that the performance of the 4- to 5-year-olds has highlighted a limitation in children's thinking that previous studies into counterfactual emotions have not noticed: Children may struggle to access their own knowledge about regret and relief. Perhaps children may implicitly respond to these emotions. That is, respond to them before they are consciously aware of their knowledge. If this is the case, children younger than 4 to 5 years old may experience implicit regret and relief. In Experiment 4, I investigated children's implicit responses to regret and relief. If children responded implicitly to the same game as in Experiment 3, children may be likely to experience regret and relief at an earlier age than when they are able to report their feelings of happiness on a scale.

3.2. Experiment 4

Children's implicit experiences of regret and relief

3.2.1. Introduction

In this thesis thus far, I have asked children to reflect on their own or others' current

state and report it using the scale, before and after seeing the counterfactual alternatives. To successfully make the alternative rating, the second rating of happiness after seeing what could have been, children may have to recall their initial rating of happiness before the alternatives had been revealed and subsequently evaluate the current state of affairs by determining if the circumstances were to their advantage (relief) or disadvantage (regret). Only then would it be possible to make a second rating on the scale (Experiments 1 & 2) or a response of "even happier", "even sadder" or "the same" (Experiment 3). For all three experiments, this process seems to be relatively slow in comparison to a spontaneous response. Additionally, this process is reflective. That is, one must to recall a previous emotional state to determine the influence of the counterfactual alternative. It may be possible that children are unable to access their knowledge required for the task in hand, a limitation for such a cognitively-laden process.

There is literature to suggest that children's implicit knowledge becomes increasingly explicit with development. Karmiloff-Smith's (1992) model of Representational Redescription describes this phenomenon. In this model, all knowledge is originally represented in an implicit, procedural format ("Level I"). With time and rehearsal ("redescriptions", Zelazo, 2000), this knowledge develops into a more explicit, yet abstract format ("Level EI"). This representational knowledge is still not yet conscious. Consciousness occurs with further redescriptions: "Level E2". The next level, "Level E3", is conscious and verbally accessible.

Further evidence for this pattern of developing explicitness within cognitive development can be found in the Theory of Mind literature. Clements and Perner

(1994) reported that young children are able to successfully choose the correct answer in false belief tasks but they are unable to provide verbal responses to the questions. Children watched a protagonist who did not see an object unexpectedly transferred from one location to another. Children as young as 2 years, 11 months stated that the protagonist would search at the current location of the object but these children looked to the empty location, where the protagonist thought the object was stored. A recent, similar non-verbal study by Onishi and Baillargeon (2005) reported a similar pattern of results, in infants as young as 15 months. Children's implicit knowledge seems to develop earlier than their explicit knowledge. Based on this literature, it may be possible that children younger than 5 years old are able to experience regret and relief but they are not able to make explicit responses based upon them. Therefore, one may expect children to demonstrate an implicit response to the game before they are able to make an explicit response. In Experiment 4, I investigated the possibility that children younger than 5 years old were able to experience regret "implicitly" that is, before they are consciously aware of their own experiences.

In Experiment 4, I compared children's implicit responses to their explicit responses. A possible measure of implicit responses is by facial expressions. Darwin (1872/1998) was the first to suggest that facial expressions represent innate and automatic behaviour patterns. In more recent years, many researchers have furthered Darwin's ideas and argued that facial expressions are implicit consequences of individual's experiences (e.g., Buck, 1984; Izard & Malatesta, 1987; Ekman, 1997). Thus, one would expect that during an experience of regret and relief, one would produce an appropriate facial expression. That is, after regret, a negative experience, facial expressions would be likely to be negative: frowning, shocked, fearful. After

relief, facial expressions would be likely to be positive: smiling, laughing. Thus, if children provided the target implicit response to regret and relief (by their facial expressions) at an earlier age than when they are able to provide the target explicit response (by pointing to the scale), children's performance on the two responses, implicit and explicit, may differ. If the two response types differed, and target implicit responses were seen at an earlier age than target explicit responses, children may not have yet developed the skills in accessing their implicit knowledge, but they can experience counterfactual emotions.

One must be cautious employing facial expressions as an indicator of implicit regret and relief. Social referencing is one particular concern. That is, participants may produce facial expressions based on the expressions of the experimenter, without taking into account the outcome of the game itself (Klinnert, Campos, Sorce, Emde & Svejda, 1983; Klinnert, Emde, Butterfield & Campos, 1986; Walker-Andrews, 1998). To avoid this possibility, the experimenter maintained a neutral expression throughout the game with each participant. "Display rules" (Ekman & Friesen, 1969) are another concern with using facial expressions as a measure of regret and relief. Display rules are the societal rules to which emotion and its intensity should be displayed in given circumstances. Thus participants may manipulate their facial expressions based on what they believe is an appropriate expression. However, the evidence suggests that children do not seem to learn display rules, or act upon them, until middle childhood at around 10 years old (Saarni, 1979; 1984). Saarni (1979) gave children aged 6-, 8- and 10 years old a desirable gift for completing a task. Each child was then given a less desirable gift after completing a second task. After the first task, many children smiled, made eye contact with the experimenter and demonstrated positive affect.

After receiving the gift from the second task, only the 10-year-olds demonstrated positive expressions. The younger children demonstrated negative affect, evidence that they had not yet learned one of society's most common display rules, to look pleased when given an undesirable gift (Goffman, 1967). As display rules only influence older children, one would not expect the younger children included in my experiments to be influenced by these rules. Therefore, to the advantage of the current study, the true expressions of younger children ought to be easier to detect.

In addition, the literature regarding the production of facial expressions suggests that children and adults are more likely to produce facial expressions in social contexts: Children and adults are more likely to smile or show distress when they are in the company of another (Hinde, 1985; Chovil, 1991; Fridlund, 1991). Thus, children may be likely to produce facial expressions at the game in Experiment 3 as they are in a social context: They are in direct contact with the experimenter.

Three age groups were included in Experiment 4: Four- to 5-year-olds, 6- to 7-year-olds and 8- to 9-year-olds. As children younger and older than those in previous experiments of this thesis participated, only alternate year groups were included. A further reason to only include children of these ages was based on the results of Experiment 3. These results revealed that the 5- to 6-year-old were no different to children aged 6 to 7 years old, who have been included. Experiment 1 revealed that children aged 7 to 8 years old were no different to children aged 8 to 9 years old. As such only the 8- to 9-year-olds have been included in the current experiment.

In Experiment 4, I investigated if children's spontaneous facial expressions to the

game indicated an experience of regret and relief more so than their reflective responses on the scale. If the 4- to 5-year-olds provided target implicit responses to the game but remained unable to explicitly perform as the older children did in Experiment 3, I would have provided evidence that children are able to experience regret and relief but are unable to access their explicit and verbal representations of the state of affairs. This evidence would be consistent with Karmiloff-Smith's (1992) Representation Redescription account, children's knowledge becomes more explicit with age. So that I could identify children's implicit responses to the game, I recorded their gestures and facial expressions by video camera whilst they played the same game as in Experiment 3.

3.2.2. Method

3.2.2.1. Participants.

There were 44 participants, 10 aged 4 to 5 (M = 4;9, r = 4;5 to 5;1, 4 boys, 6 girls), 20 aged 6 to 7 (M = 6;8, 6;3 to 7;2, 9 boys, 11 girls) and 14 aged 8 to 9 (M = 8;8, 8;3 to 9;2, 8 boys, 6 girls). Children were recruited from one school in Birmingham, U.K. serving a predominantly middle-class population. Children were White (43%), Asian (48%), Black British (7%) and mixed race (2%). Only participants whose parents or carers had provided consent for participation to be recorded by video were included in this experiment. Personal details of participants, such as name or date of birth, were not recorded on the videos.

3.2.2.2. Materials.

The materials were identical to that of Experiment 3 plus a Sony SR10 video camera based on a tripod.

3.2.2.3. Procedure.

The procedure was identical to that of Experiment 3, except that children did not have a filler trial but rather began the experimental procedure with four tokens. The video camera recorded children's facial expressions and gestures. Neither the experimenter nor the game were in view of the camera. Similarly to the previous experiments within this thesis, the experimenter maintained a neutral expression during each trial. As social referencing may have influenced children's facial expressions, the experimenter paid particular attention to maintaining a neutral expression.

3.2.2.4. Coding of Videos.

Each participant was recorded throughout the whole game. Each participant's video (n = 44) was split into eight clips: four clips were of children's reactions to their initial card (responding to reality) and four clips were of children's reactions to their alternative card (responding to seeing what could have been). Each clip was edited so that coders could only see the immediate reaction to the turning of the card, without sound. Three adult coders recruited from the School of Psychology, University of Birmingham, were asked to code each video clip. All three coders were unaware which trial or condition to which the clips referred. Two clips were missing (one for an initial and one for an alternative card on one trial) due to a technical fault with the camera. Thus there were 350 clips in total (44 participants x 8 clips per participant = 352 – 2 missing clips = 350). Video clips ranged in length from 1.5 seconds (s) to 4.9s (M = 2.3s). Children's responses were coded on a rating scale of 1 (*extremely negative reaction*) through 3 (*neutral*) to 5 (*extremely positive reaction*). An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency amongst raters of the video clips. For the initial videos, there was

excellent agreement between raters, $k = .76$, $p < .001$. For the alternative videos, inter-rater reliability was only fair, $k = .35$, $p < .001$. Overall agreement was moderate, $k = .55$, $p < .001$.

3.2.3. Results and Discussion

The analysis is split into three parts: (1) Participants' responding on the scale, the explicit measure; (2) analysis of the videos, the implicit measure; (3) comparisons between the explicit and the implicit measures.

3.2.3.1. Analysis of explicit responses.

Similarly to Experiment 3, I ran binomial sign tests to compare the choice of arrow to chance performance. I made a Bonferroni correction ($\alpha = .013$) to account for the fact that there were four measures from each age group. Results can be seen in Table 3.

These results are similar to the pattern reported in Experiment 3, with the exception that the 4- to 5-year-olds did not demonstrate an experience of regret on the Regret Initial-Win trials. There were only 10 participants aged 4 to 5 years old. This result may be attributed to the small sample size of the group. However the majority of the 4- to 5-year-olds chose the upwards-facing arrow. Thus, it is unlikely that small sample size was the reason for the 4- to 5-year-olds' poor performance on the Regret Initial-Win trials in Experiment 4, but better performance in Experiment 3. A more likely alternative is that there were small age differences between the 4- to 5-year-olds in the two experiments: Even though participants in both experiments were between 4- and 5 years old, the children in Experiment 3 had a higher mean age (5;1) than children in Experiment 4 (4;9). It may be that during these four months, children

develop their fledgling ability to experience regret, demonstrated in Experiment 3. A related possibility is that there were sample differences between the schools from which participants were recruited in Experiments 3 and 4. Children from the school in Experiment 4 may have been advanced than the children from the schools in Experiment 3. Regret was experienced by the 6- to 7-year-olds, as was relief after a positive initial outcome. The 6- to 7-year-olds also experienced relief after losing. In Experiment 3, it was not until children were 7 to 8 years old that they were able to correctly respond to the Relief Initial-Lose trial. The 8- to 9-year-olds performed similarly to the 6- to 7-year-olds.

Participants received scores of 0 (*incorrect*) or 1 (*correct*) for their responses to the alternative question. Answering with the upwards arrow ("the same"), was regarded as incorrect. A 3 (age: 4 to 5, 6 to 7, 8 to 9) x 2 (trial type: regret, relief) ANOVA revealed significant main effect of age, $F(2, 41) = 12.34$; $p < .001$; partial $\eta^2 = .376$. There was no other main effects or interaction, highest $F = .33$, lowest $p = .57$. I used independent samples t-tests to break down this effect of age, making a Bonferroni correction ($\alpha = .02$) for three comparisons. Children's responses on the two regret and two relief trials were combined to give a total score out of 4. The post hoc tests revealed that the children aged 6 to 7 (M = 2.75) performed significantly better than the children aged 4 to 5 (M = 1.10), $t(28) = -3.37$, $p = .002$, $r = .54$. The children aged 8 to 9 (M = 3.43) also performed significantly better than children aged 4 to 5, $t(22), = -5.35$, $p < .001$, $r = .75$. There was no difference between the two older age groups, $p = .088$.

Table 3. Results of the binomial tests: Comparisons of participants' chosen arrows to chance (33%) in Experiment 4

		Regret Initial-Win				**Regret Initial-Lose**				**Relief Initial-Win**				**Relief Initial-Lose**			
		%			*p*	*%*			*p*	*%*			*p*	*%*			*p*
Age (years)	*N*	←	↑	→		←	↑	→		←	↑	→		←	↑	→	
4 to 5	*10*	20	70	10	.307	20	50	30	.568	10	60	30	.307	10	50	40	.432
6 to 7	*20*	80	15	5	<.001**	65	20	15	.003**	0	30	70	.001**	5	35	60	.012**
8 to 9	*14*	86	7	7	<.001**	86	0	14	<.001**	0	14	86	<.001**	7	7	86	<.001**

Note. Shaded area represents the target arrow for that trial (← = *even sadder*, ↑ = *the same*, → = *even happier*)

Two asterisks (**) indicate that the result is significant in the expected direction at $p < .013$.

3.2.3.2. Analysis of implicit responses.

To investigate children's implicit responses to the alternative card, the mean ratings of children's reactions to the alternative card, determined by the three coders, were re-coded so that for each trial, participants were coded as either showing the target expression (score of 1) or non target (score of 0) implicit response. On regret trials, the target expression was a negative emotional reaction. On relief trials, the target expression was a positive emotional reaction.

The two regret trials were combined, as were the two relief trials, to give participants two scores of a maximum of two trials correct. Results are presented in Table 4. All age groups seemed to fail to produce the target facial expressions on both regret and relief trials.

Table 4. Mean (M) target implicit responses and Standard Deviation (SD) to what could have been

	Regret Trials		**Relief Trials**		
Age (years)	**M (max.2)**	**SD**	**M (max. 2)**	**SD**	**Total (max. 4)**
4 to 5	.55	.51	.35	.51	.90
6 to 7	.18	.39	.30	.46	.48
8 to 9	.14	.36	.27	.50	.41

I ran a 3 (age: 4 to 5, 6 to 7, 8 to 9) x 2 (trial type: regret, relief) ANOVA to determine any differences between the three age groups and trial types. Results revealed no significant effects or interaction, highest $F = .69$, lowest $p = .508$. Children of any age did not seem to provide the target implicit responses.

It may be possible that there were differences in children's implicit responses between winning and losing tokens. To investigate this possibility, I ran a 3 (age: 4 to 5, 6 to 7, 8 to 9) x 2 (outcome: win, lose) ANOVA to test for the differences in outcome. I used children's responses to the alternative card. The target response was that after a win card, participants were expected to provide a positive expression. After a lose card, participants were expected to provide a negative expression. There were no effects of outcome, age or any interaction, highest $F = 2.72$, lowest $p = .107$. Results are consistent with the previous analyses: Children did not provide the target implicit responses to the game.

3.2.3.3. Comparison between explicit and implicit responses.

I predicted that children as young as 4 to 5 years old may experience regret and relief but be unable to explicitly access their knowledge. Therefore there ought to be a difference between children's implicit and explicit responses. The previous results section (analysis of implicit responses), revealed that children did not demonstrate any precocious implicit responses. Thus a difference between the response types (implicit and explicit responses) is already evident, but not in the predicted direction. To determine the extent of the difference, I ran a 3 (age: 4 to 5, 6 to 7, 8 to 9) x 2 (trial type: regret, relief) x 2 (response type: implicit, explicit) ANOVA. It is important to note that there is current debate over the appropriate statistics at this point. In this ANOVA, the implicit and explicit measures were initially very different. The implicit measure was recorded on a scale of 1 (*very negative reaction*) to 5 (*very positive reaction*). Thus, the implicit measure is merely a response to an event. In contrast, the explicit measure was a comparison to a previous state: even happier, even sadder or the same as before. The question remains if it is appropriate for the re-coding of two

distinct measures into the same coding in order to meet the assumptions of ANOVA. There are some psychologists who would argue that such data transformation is acceptable (e.g., Fischler & Kendall, 1988; Luh & Guo, 1999) and completed such analyses in their research. Such transformations have been employed within developmental psychology, (e.g., Fabes, 1987; Thorpe, Trehub, Morrongiello & Bull, 1988). However, there are some psychologists who argue that such data transformation is not appropriate (e.g., Coolican, 2004; Dancey & Reidy, 2004; Rozin, 2001) and non-parametric alternatives ought to be used. This thesis is not the forum for this discussion, but the issue remains: an ANOVA may not be appropriate? As such, I ran both analyses, a repeated measures ANOVA and its non-parametric equivalent, a Friedman's test. Firstly, the repeated measures ANOVA: There was a significant main effect of response type, $F(1, 40) = 35.94$, $p < .001$, partial $\eta^2 = .473$ and a significant main effect of age, $F(2, 40) = 6.08$, $p = .005$, partial $\eta^2 = .233$. There was a significant interaction between response type and age, $F(2, 41) = 5.74$, $p = .006$, partial $\eta^2 = .223$. There was no significant effect of trial type or any other interactions, highest $F = .98$, lowest $p = .384$.

To explore the interaction between age and response type, I used independent samples t-tests, making a Bonferroni correction ($\alpha = .006$) for nine comparisons. Collapsing across trial type, there were significant age differences between the 4- to 5-year-olds (M = 1.10, max. 4) and the 6- to 7-year-olds (M = 2.74) for the explicit measure, $t(27) = -3.37$, $p = .002$, $r = .54$, but not for the implicit measure ($p = .507$). There was a significant difference between the 4- to 5-year-olds and the 8- to 9-year-olds (M = 3.43) for the explicit measure, $t(22) = -5.35$, $p < .001$, $r = .75$, but not for the implicit

measure (p = .646). There were no differences between the 6- to 7-year-olds and the 8- to 9-year-olds for the explicit (p = .088) or the implicit (p = .705) measures.

I made comparisons between response types for each age group. The 6- to 7-year-olds performed better on the explicit measure than on the implicit measure (M = .70), $t(18) = 3.53$, $p < .002$, r = .64. A similar pattern was found for the 8- to 9-year-olds, who also performed better on the explicit measure than the implicit measure (M = .79), $t(13) = 10.67$, $p = < .001$, $r = .95$. There was no difference between the two measures for the 4 to 5-year-olds, p = .468.

The Friedman's test revealed the same pattern of results as the ANOVA: For each age group, there were significant differences between the two response types at the level of significance $p < .001$. Significant differences were found for each age group for the difference between the regret and relief trials, $p < .001$. In this instance, one method of analysis held no advantage over the other, but the appropriateness of data transformation within ANOVA ought to be considered in future.

2.3.4. An alternative method of coding.

It may be possible that the method of coding children's implicit responses was not sensitive to the change in children's emotion. The system of coding that I have used focussed on children's happiness to what could have been, that is, children's reactions to the counterfactual were determined to be positive or negative. The analyses did not investigate a change in facial expression from the initial to the alternative card. Therefore, to provide a measure of change in expression, I subtracted the rating of the initial video from the rating of the alternative video for each trial. Thus, a decrease in

ratings would indicate an experience of regret and the reverse pattern would indicate an experience of relief.

There remained a fair inter-rater reliability, $k = .32$, $p < .001$. A 3 (age: 4 to 5, 6 to 7, 8 to 9) x 2 (trial type: regret, relief) ANOVA revealed no significant effects or interactions, highest $F = 1.00$, lowest $p = .77$. It seems that insensitivities in the original method of coding were not the reason that children did not provide the target implicit responses.

There is an opportunity for further research with a similar methodology to Experiment 4. Children may smile throughout a game, even if it a completely negative experience, simply because children are content with participating (Schneider & Unzner, 1992; Soussignan & Schaal, 1996). However, when children lose or fail, their smiles are coordinated with eye-contact with the experimenter (Schneider & Josephs, 1991). It is not known if this phenomenon of looking to the experimenter is found when children experience regret, that is a positive counterfactual outcome, or relief, a negative counterfactual outcome. I was unable to investigate this possibility as the quality of the camera was not great enough to focus on children's subtle eye movements. Additionally, the experimenter spoke throughout the game, which may have prompted children to look at the experimenter simply because he was communicating with them.

In Experiment 4, I investigated whether children responded implicitly to regret and relief. I asked if children were immature in their ability to access their explicit knowledge (Karmiloff-Smith, 1992; Zelazo, 1996, 2000) of regret and relief. The

results of Experiment 4 did not support this prediction but rather revealed two findings: Firstly, children did not demonstrate the target implicit responses to what could have been. These results are evidence that children's implicit responses to what could have been are not seen earlier than their explicit responses. Secondly, explicitly, the 4- to 5-year-olds did not experience regret as they did in Experiment 3. Both the 6- to 7-year-olds and the 8- to 9-year-olds experienced regret and relief with seemingly adult-like competence.

3.3. Discussion of Experiments 3 and 4

In Chapter 3, I aimed to identify if children experienced regret and relief earlier than previously reported. I included 4- to 5-year-olds in both Experiment 3 and 4. Results of Experiment 3 revealed that children aged 4 to 5 years old had fledgling experiences of regret. In Experiment 3, I also reported evidence to suggest that children's thinking about relief was influenced by artefacts of the design of relief trials in earlier experiments. Relief was in fact first experienced at 5 to 6 years old, rather than 7 to 8 years old (Experiments 1 and the Self condition of Experiment 2). The lag between the two emotions was reduced, but based on 4- to 5-year-olds performance, it was still evident. In Experiment 4, however, I failed to replicate this lag. The mean age of the 4- to 5-year-olds in Experiment 3 was four months greater than that of the 4- to 5-year-olds in Experiment 4. It seems that only older 4- to 5-year-olds have developed the necessary skills to experience regret. Therefore, evidence for the lag between regret and relief is not substantial. In Experiment 4, I investigated if children were unable to access their explicit knowledge about regret and relief, and provided implicit responses to the task in hand. I did not find any evidence for children's earlier implicit responses to the game. In fact, based on the implicit measure (facial

expressions), children up to and including 8- to 9-year-olds, demonstrated neither regret nor relief.

Despite the seemingly poorer performance of younger children on the Relief Initial-Lose trials, children of all ages in both Experiments 3 and 4 were no different in their performance on regret trials compared to their performance on relief trials: Differences were only found between age groups. These results provide evidence that there are in fact no differences in children's experiences between regret and relief. In Experiment 1 of this thesis, I reported a similar pattern: Even though I found that 5- to 6-year-olds and 6- to 7-year-olds did not experience relief, the ANOVA revealed that they did not discriminate between regret and relief. I did not replicate this finding in Experiment 2, but the possibility that children's skills in thinking about counterfactual positive outcomes and counterfactual negative outcomes develop in parallel must be subject to further research.

Children may have responded implicitly before they were able to provide an explicit response but the implicit measure was insensitive: It may have been difficult for adults to identify implicit responses. In support of the possibility that children were "good actors" is the emotion literature that suggests children attempt to send out a positive message of happiness despite losing (Schneider & Josephs, 1991; Schneider & Unzner, 1992; Soussignan & Schaal, 1996). Children may use non-enjoyment smiles rather than "Duchenne smiles". Ekman (2003) described a Duchenne smile as one that people make when they are genuinely happy. A non-enjoyment smile is made when one attempts to looks happy, even if this is not their current state. In Experiment 4, I reported a fair inter-rater reliability when children responded to seeing what could

have been. This may have been due the adult coders' difficulty to interpret children's Duchenne and non-enjoyment smiles. Children may have been manipulating their facial expressions as not to appear unhappy. However, it seems surprising that this would be the case, as research has found that adults ought to be sensitive to the differences between Duchenne and non-enjoyment smiles (Gosselin, Perron, Legault & Campanella, 2002; Gosselin, Perron & Maassarani, 2010). Additionally, recall that there is evidence that children do not act upon display rules until middle childhood at around 10 years old (Saarni, 1979; 1984). It seems unlikely that children manipulated their facial expressions so that they would look happier.

The possibility that the adult coders struggled to identify the implicit responses of the children ought to be subject to future work. A methodological improvement would seem to resolve this issue: Ekman and Friesen's (1976) Facial Action Coding System (FACS), an analysis to systematically classify the physical expressions of human emotions, may be more sensitive to the children's implicit responses in contrast to a naïve coding of expression. Ekman and Friesen (1982) suggested that FACS is as sensitive to children's facial expressions as it is for adults' facial expressions. Despite some logistic complexities of facial expression analysis, such as requiring the appropriate technology and an expert to code expressions, FACS is a reliable indicator of expression (Fasel & Luettin, 2003). Using FACS in future research would remove the possibility of adults failing to infer the correct emotion. Although the use of FACS may be a better way to code evidence, after the results of Experiment 4, one would not be optimistic that this method would work. I found no evidence to suggest that children provided the target implicit responses to regret and relief.

There is inconsistent evidence regarding the abilities of the 4- to 5-year-olds' experiences of regret. Future research concerning young children's fledgling experiences of regret and relief should include a larger range of children aged between 4- and 5 years old, from the whole age range, in a task similar to Experiment 3. This research ought to consider the possibility of small developments within this age group. Results of this research would be an important addition to the debate over young children's first abilities to experience regret, for I can only speculate that older 4- to 5-year-olds (5;1) have a fledgling experience of regret and that they can reason about counterfactuals in some form, whereas younger 4- to 5-year-olds (4;9) cannot. Despite the difference between the 4- to 5-year-olds over the two experiments, the explicit responses of the participants were similar across the experiments. These results provide support for the explicit task as a measure of children's experiences of regret and relief.

Chapter 4

Children's justifications of others' regret and relief

In the current chapter, I return the focus of investigation to children's understanding of others' regret and relief. I further investigated the lag between regret and relief. In Experiment 1, the Self condition of Experiment 2 and Experiment 3, I reported a lag between children's first experiences of regret and relief. The primary aim of the current chapter was to investigate if this lag extended to children's understanding of others' regret and relief.

Guttentag and Ferrell (2004) were the first to report a lag between children's understanding of these emotions. They read four stories to children. In these stories, there were two protagonists. Both protagonists experienced the same negative outcome but both protagonists arrived at this same outcome based on different decisions: Typical or atypical behaviour (two stories) and acts of commission or omission (two stories). Participants' task was to determine, in each story, which of the two protagonists would be more upset, and would thus experience the greater regret. Guttentag and Ferrell found that 5-year-olds did not report the target protagonists as more upset but the 7-year-olds did. They argued that 5-year-olds based their judgements on the outcome itself rather than the counterfactual comparison between the outcome and a possible alternative. It was not until children were 7 years old that they demonstrated an understanding of regret: Only at 7 years old were children able to make a comparison between reality and what could have been on behalf of another.

In an additional experiment, Guttentag and Ferrell (2004) read similar stories that resulted in a *positive* outcome that could have been worse. These "relief" stories, also based on typicality and commission, were read to 7-year-old children. In contrast to 7-year-olds' performance on the regret stories, the 7-year-olds did not choose the target

protagonist in the relief stories. Thus, Guttentag and Ferrell did not find any positive evidence for children's understanding of others' relief. As such, they reported that the development of children's understanding of relief lagged behind the development of their understanding of regret.

In Experiment 2 of this thesis, I found no positive evidence to suggest that children up to the age of 6 to 7 years old could understand others' regret and relief. To determine the first age that children can understand others' regret and relief, I tested children older than 6 to 7 years old in a procedure similar to Experiment 2. However, the results of Experiment 3 of this thesis revealed that there were possible limitations to the relief trials of Experiment 2 that made them more artefactually difficult compared to the regret trials: The counterfactual outcome of relief trials may not have been viewed as significant by participants and the difference between reality and the counterfactual was not equal across regret and relief trials. Additionally, the scale may not have allowed children to show regret and relief when their initial rating was at the extremes of the scale. In Experiment 3, I improved on these three methodological limitations, and found that relief was experienced at a younger age and the lag between the two emotions was greatly reduced. Thus, in the current chapter, I used this improved methodology to investigate if a lag exists between children's understanding of others' regret and relief.

In the current chapter, I also aimed to investigate why children found it particularly difficult to understand others' regret and relief. In Chapter 2, children demonstrated a difference between their own experiences and another's experiences of regret and relief. A possible reason for the difference was that children may find it more difficult

to think about others' regret and relief in contrast to their own experiences, perhaps due to the increased processing demands or children's difficulty to attribute an emotion to another.

In Experiment 5, I wanted to determine what children struggle with when it comes to others' regret and relief. I asked children to explain why they rated another as "even happier", "the same" or "even sadder" rather than only making a judgement of others' affect. The content of children's justifications may reveal what they find particularly difficult when it comes to understanding others' regret and relief.

Asking children to justify their responses is not uncommon within the developmental counterfactual thinking literature. In Guttentag and Ferrell's (2004) task, once children had chosen which protagonist felt worse, children were asked to justify why they had chosen their protagonist. When the participants chose the target protagonist, they provided counterfactual justifications, that is, they referred to the possibility of an alternative course of action taking place. When the participants chose the non-target protagonist, their justifications referred to the current reality: They described the state of affairs. A similar pattern was found in Guttentag and Ferrell's second experiment, and McCloy and Strange (2009): Children aged 5 years old who were unable to choose the target protagonist provided justifications that referred to the current state of affairs, not the counterfactual alternatives. Similar evidence can be found in Guttentag and Ferrell's (2008) investigation into children's understanding of anticipatory regret. Children, and adults, chose one of two boxes and won the medium-sized prize. Participants were asked how they felt about choosing the box that contained the medium-sized prize before seeing the possible alternative, "How do

you feel about receiving the medium-sized prize?" Children and adults provided the target response, "happy". Participants were subsequently asked, "Why do you feel that way about receiving the medium-sized prize?" The target anticipatory response answer made reference to the possibility that alternative box could be worse or better than reality. The majority of the child participants, from 7 to 8 years old, and adults, provided the target answer: Responses included reference to how the smaller prize could have been won or how the more desirable larger prize could have been chosen. Participants' responses were not counterfactual but rather about future hypothetical situations (Beck et al., 2006) that could result in different possibilities. Even so, Guttentag and Ferrell found that children were able to provide coherent justifications to explain their feelings of happiness.

Thus, with the exception of Guttentag and Ferrell's (2008) anticipatory study, there is evidence to suggest that from the age of 7 years old, children are able to provide counterfactual justifications during tasks that require a judgement based on a counterfactual possibility. Based on the established literature, this evidence demonstrates that once children are able to make appropriate inferences about counterfactual emotions, they can provide a counterfactual justification that supports their inference. The children who failed to make the correct counterfactual judgement provided justifications that referred to reality. As some children provided non-counterfactual justifications, this supports the possibility that children who do not make counterfactual judgements, do not think counterfactually.

In Experiment 5, I asked children to justify another's feelings towards his chosen card after seeing what could have been. In doing so, I aimed to investigate what children

think about when it comes to others' regret and relief. If children failed to understand that another would experience regret or relief, the content of their justifications would determine if children focussed on reality (Guttentag & Ferrell, 2004; McCloy & Strange, 2009) rather than on the counterfactual alternatives.

4.1. Experiment 5

Children's reasoning about others' regret and relief

4.1.1. Introduction

In Experiment 2, I found no positive evidence that children up to the age of 6 to 7 years old could infer that another would experience regret or relief. In fact, within the developmental literature, there is no positive evidence that children can infer that another would experience relief. One aim of the current experiment was to determine the age when children are able to understand that another would experience relief. In Experiment 3, I reported evidence to suggest that the lag between regret and relief was not as large as previously reported in Experiment 1 of this thesis and in Guttentag and Ferrell (2004). In fact, in Experiment 4, I did not find any positive evidence for the lag between children's first experiences of the two emotions. Thus, a second aim of the current experiment was to investigate if the lag between regret and relief extended to children's understanding of these emotions. To so do, I determined the first ages that children can understand regret and relief. The third aim of this experiment was to identify the reasons why children find it particularly difficult to infer others' regret and relief.

To address these aims, I asked children to watch another play the game from

Experiment 3 and 4. They watched another make a decision between two cards. Their choice led to the other either winning or losing some tokens. I then revealed what could have been won or lost had the other card been chosen. I asked children to determine the other's feelings of happiness and then to justify their reasoning after they provided a response. These justifications could be counterfactual, that is, a reference to a comparison of reality with a possible alternative, or not counterfactual, in which reference to the comparison between reality and its alternatives would not be evident.

Table 5 details the four possible outcomes to participant's responses to the game. Guttentag and Ferrell (2004) provided evidence for the first and third possible outcomes: Children provided the correct counterfactual justifications when they chose the target protagonist. When children chose the non-target protagonist, they provided a justification that described the current state of affairs. In Experiment 2 of this thesis, I found that children aged 6 to 7 years old and younger were unable to infer that another would experience regret or relief. There is evidence to suggest that a counterfactual justification would only be provided when the target response has been given. Therefore, one would only expect participants to provide counterfactual justifications when they can provide the target response. If children were to provide non-counterfactual justifications in response to the alternative question, it would be possible that children were unable to understand that another could experience regret and relief. Alternatively, children may find it difficult to verbalise their counterfactual justifications. If this were the case, one would expect to see an asymmetry between children's responses on the scale and their justifications.

At 7 to 8 years old, children have demonstrated an understanding that others experience regret (Guttentag & Ferrell, 2004; Ferrell et al., 2009). Based on the lack of positive evidence of children's understanding of others' relief younger than the age of 7 years old, it is likely that the youngest age children will understand others' relief is 8 years old.

Table 5. Interpretation of possible outcomes and justifications in Experiment 5

Response on Scale	Justification of Response	Interpretation of Outcome
Target	Counterfactual	Evidence of understanding others' regret and relief
Target	Non-Counterfactual	The decision making process was not counterfactual. Alternatively, children may have found it difficult to verbalise a counterfactual justification
Non-Target	Non-Counterfactual	No evidence of understanding others' regret and relief
Non-Target	Counterfactual	Children demonstrated an understanding of others' regret and relief but did not report it on the scale: The scale may be an inadequate measure of others' happiness

In Experiment 5, I aimed to determine if the lag between children's own experiences of regret and relief extended to their understanding of others' regret and relief. I aimed to determine the youngest age that children can understand others' regret and relief. In asking children to justify their responses on the scale, the content of their responses may reveal what it is about others' regret and relief that they found particularly

difficult to understand. In Experiment 5, I used a similar game to Experiments 3 and 4, but focussed on others' experiences of regret and relief.

4.1.2. Method

4.1.2.1. Participants.

There were 122 child participants, 24 aged 4 to 5 (M = 4;9, 4;3 to 5;2, 15 boys, 9 girls), 29 aged 5 to 6 (M = 5;8, 5:2 to 6;2, 16 boys, 13 girls), 25 aged 6 to 7 (M = 6;8, 6;2 to 7;1, 13 boys, 12 girls), 21 aged 7 to 8 (M = 7;10, 7;4 to 8;2, 11 boys, 10 girls) and 23 aged 8 to 9 (M = 8;10, 8;3 to 9;2, 8 boys, 15 girls). Children were from a school in Birmingham, U.K., that served a predominantly middle-class population. The participants were White (86%), Black (4%), Asian (4%) and mixed race (6%). One 4- to 5-year-old failed the pre-test and did not continue with the remainder of the experiment, thus 121 children, 62 boys and 59 girls, were included in the final dataset.

4.1.2.2. Materials.

Materials were identical to Experiment 3, plus the same toy penguin, Arnold, used in Experiment 2 and a digital voice recorder (Olympus VN-3100) connected to a small external microphone for greater clarity.

4.1.2.3. Procedure.

Throughout this description, an arrowhead (^) represents the moment when the experimenter pointed to the appropriate place. The procedure was similar to that of Experiment 3 and 4 with the exception that children watched Arnold play the game and rated Arnold's happiness. Arnold, controlled by the experimenter, sat opposite the children. Participants completed the five trials as used in Experiments 3 and 4 with the

exception that Arnold chose between the cards (see Table 1). The order of the trials was the same as in Experiments 3 and 4. Data were not collected on the filler trial. It was only used to ensure that Arnold finished the game with some tokens that could be converted to stickers as a gift for the child's participation.

4.1.2.3.1. Pre-test.

All participants completed a simple pre-test to confirm their understanding of the scale. The test was identical to the pre-test in Experiment 3. Twenty-two participants did not point to one of the faces on the extremes of the scale, but rather the less happy or less sad face. The experimenter asked these participants, "Which is the really, really happy [sad] face?" to which all but one these participants (aged 4 to 5 years old) responded correctly. The experimenter identified the correct faces for this child but he failed to identify the faces again after being asked to point to both the "really, really happy [sad] face" again. This participant did not proceed through the experiment.

4.1.2.3.2. Explanation of the scale and training.

The explanation and training to use the scale was identical to Experiments 3 and 4.

4.1.2.3.3. Experimental procedure.

Participants were introduced to Arnold. The experimenter explained that Arnold was going to play a game and that the participants' aim of the game was to say how Arnold was feeling. Arnold was given two face-down cards and chose one of them The experimenter read what was written on Arnold's chosen card (the *Arnold-initial card*) and gave or took away tokens from Arnold as appropriate. Participants were

asked the *Arnold-initial question,* "How do you think Arnold feels about choosing his card?" and were asked to rate his feelings on the 5-point scale. The non-chosen card was turned over. Its illustrations were read out loud. Children were asked the *Arnold-alternative question*, "How do you think Arnold feels about choosing ^his card now?" The window with the three arrows was placed over the face that children initially chose, and the experimenter said, "this one [^ right-facing arrow], this one [^ left-facing arrow] or this one [^upwards-facing arrow]?" Children were asked the *justification question*, "Why do you think Arnold feels ^this one?" Children's responses were recorded on the voice recorder. The procedure was repeated for the four remaining trials. After Arnold had accumulated his tokens, he swapped them for stickers which he gave to the participants.

4.1.2.3.4. Coding of the justifications.

The experimenter plus another coder, blind to condition and trial type, coded the justifications that children provided. The justifications were categorized into one of five options: (1) a counterfactual justification. This included any response that involved reference or inference to the counterfactual world, e.g., "He could have got the better card" or "he should have picked the other box." Only a counterfactual justification was regarded as correct. (2) A reference or description of reality or the current state of affairs, e.g., "He's won three stars" or "The box that he picked was empty." (3) An irrelevant response, e.g., "He has a sad face" or "Arnold likes to win." (4) An ambiguous response. This option included responses that seemed to refer to a comparison between reality and the counterfactual, similar to a counterfactual response but the reference to the counterfactual for that particular trial was not evident, e.g., "He has more stickers" or "He got the win card." (5) Any other

response. These included "don't know", non-interpretable responses or no response at all. All justifications were categorized into one of these five options and inter-rater reliability was outstanding, $k = .82$, $p < .001$.

4.1.3. Results

The analysis is split into three parts: (1) Participants' responding on the scale, the measure of participants' understanding of another's experience of regret and relief; (2) analysis of the justifications that they provided; (3) comparisons between the responses on the scale and the justifications.

4.1.3.1. Analysis of responses on the scale.

As there were three possible answers to each alternative question, the probability of responding correctly by chance was 33%. Similarly to Experiments 3 and 4, I ran binomial sign tests to compare the choice of arrow to chance performance. I made a Bonferroni correction ($\alpha = .013$) to account for four measures from each age group. Results of the tests can be seen in Table 6.

The results of the binomial tests identified that the 4- to 5-year-olds did not demonstrate an understanding that another would experience regret or relief: These children consistently chose the upwards-facing arrow. Children from the age of 5 to 6 years old were able to identify that another would experience regret. The 5- to 6-year-olds were also able to identify that Arnold would experience relief but only after a positive outcome. Children first demonstrated an understanding that another would experience relief after a negative outcome at 8 to 9 years old. Overall, there are two

Table 6. Results of the Binomial tests: Comparisons of participants' chosen arrows to chance (33%) in Experiment 5

Age (years)		Regret Initial-Win				Regret Initial-Lose				Relief Initial-Win				Relief Initial-Lose			
		%			*P*	%			*P*	%			*p*	%			*p*
	N	←	↑	→		←	↑	→		←	↑	→		←	↑	→	
4 to 5	*23*	33	50	17	.506	21	42	37	<.001$^{\Delta}$	33	54	13	.029$^{\Delta}$	29	63	8	.007$^{\Delta}$
5 to 6	*29*	58	14	28	.004*	66	17	17	<.001**	24	7	69	<.001**	48	14	38	.350
6 to 7	*25*	60	36	4	.005*	44	52	4	.169	20	28	52	.026*	24	40	36	.448
7 to 8	*21*	81	5	14	<.001**	62	38	0	.006*	5	28	67	.002**	24	28	48	.118
8 to 9	*23*	91	9	0	<.001**	70	13	17	<.001**	0	17	83	<.001**	9	0	91	<.001**

Note. Shaded area represents the target arrow for that trial (← = *even sadder*, ↑ = *the same*, → = *even happier*)

One asterisk (*) indicates that the result of the Binomial test is significant in the expected direction at $p < .05$. Two asterisks (**) indicate that the result is significant in the expected direction at $p < .013$. A triangle (Δ) indicates that the score is significant in the unexpected direction at $p < .05$.

findings reported here: The first is that children's success on this task is seen surprisingly early. In the discussion of this chapter, I return to this finding and discuss possible reasons for children's improved performance from Experiment 2 of this thesis. The second finding is that the pattern of results is similar to that of children's own experiences of regret and relief, reported in Experiment 3 and 4. In these experiments, with the exception of the fledgling experiences of 4- to 5-year-olds, children experienced regret and relief after a positive outcome at 5 to 6 years old. The development of relief after a negative outcome lagged behind, at 7 to 8 years old. In the current experiment, this later success on the Relief Initial-Lose trial provides some evidence that children's understanding of relief develops after their understanding of regret.

The 6- to 7-year-olds' responses seem to be anomalous to the overall pattern of results. After making the Bonferroni correction, the 6- to 7-year-old did not identify that Arnold would experience regret after a negative outcome or relief after a positive outcome, yet children aged one year younger were able to do so. This result may be due to 6- to 7-year-olds preference to use of the upwards-facing arrow. The 6- to 7-year-olds used the upwards-facing arrow on 40% of trials, whereas the 5- to 6-year-olds did so for only 13% of trials, and the 7- to 8-year-olds did so for 28% of trials. Thus the 6- to 7-year-olds seem to have a greater tendency to choose the upwards-facing arrow than the other age groups. An alternative possibility is that the 6- to 7-year-olds were using other strategies to respond on the scale that the other age groups were not using. However, the 6- to 7-year-olds have not seemed to demonstrate a different way of thinking to the other age groups in any of the other experiments within this thesis.

To investigate the seemingly anomalous result of the 6- to 7-year-olds, I made comparisons to determine any differences between age and trial type. Participants received a score of 0 (*incorrect*) or 1 (*correct*) for their responses to the alternative question. Answering with the upwards arrow ("the same") was regarded as incorrect for both the regret and relief trials. Participants' scores were then summed for both regret and both relief trials so that each participant received two further scores of 0 (*both incorrect*), 1 (*one correct*) or 2 (*both correct*). I ran a 5 (age: 4 to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9) x 2 (trial type: regret, relief) ANOVA which revealed a significant main effect of trial type, $F(1, 115) = 5.73$, $p = .018$, partial $\eta^2 = .047$ and a significant main effect of age, $F(4, 115) = 20.63$, $p = < .001$, partial $\eta^2 = .418$. There was no interaction, $F = 1.31$, $p = .270$.

I broke down the main effect of trial type. I compared regret scores with relief scores collapsing across age group (max. 2). Children performed significantly better on regret trials (M = 1.18) than on relief trials (M = 1.01), $t(119) = 2.48$, $p = .015$, $r = .22$. To break down the main effects of age, I ran independent samples t-tests comparing the age groups collapsing across trial types. The scores for trial type were combined so that each participant had a score out of 4. I made a Bonferroni correction for 10 comparisons ($\alpha = .005$). Results revealed that there was an improvement with age: The 4- to 5-year-olds performed worse (M = .78) than the children aged 5 to 6 (M = 2.31), $t(50) = 5.83$, $p < .001$, $r = .64$, 6 to 7 (M = 2.00), $t(45) = 4.81$, $p < .001$, $r = .58$, 7 to 8 (M = 2.57), $t(42) = 6.15$, $p < .001$, $r = .69$ and 8 to 9 (M = 3.35), $t(44) = 10.34$, $p < .001$, $r = .84$. As for the 5- to 6-year-olds, they performed worse than the 8- to 9-year-olds, $t(50) = -3.66$, $p = .001$, $r = .46$. The 6- to 7-year-olds performed significantly worse than the 8- to 9-year-olds, $t(45) = -4.83$, $p < .001$, $r = .59$. There

was a marginal significant improvement in age between the 7- to 8-year-olds and the 8- to 9-year-olds, $t(42) = -2.45$, $p = .019$, $r = .35$.

Results of the post hoc tests revealed that children aged 4 to 5 years old performed worse than all the other age groups. The results of the post hoc tests in combination with the results of the binomial tests suggest that the 4- to 5-year-olds are unable to infer that another would experience regret or relief. These results also revealed that by 8 to 9 years old, children are more adult-like in their performance on both the regret and relief trials than any other age group. Results of the binomial tests may have suggested that the 6- to 7-year-olds did not quite fit into the pattern of results but results of the ANOVA revealed that these children were no worse than the 5- to 6-year-olds, and that overall, there is a continual improvement with age for both regret and relief trials.

4.1.3.2. Analysis of children's justifications.

Each participant was assigned a score of 0 (*incorrect*) or 1 (*correct*) for the justifications that they provided on the two regret trials (max. 2) and the two relief trials (max. 2). Only counterfactual justifications were regarded as the correct response. To compare the justifications across the age groups and trial type, I ran a 5 (age: 4 to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9) x 2 (trial type: regret, relief) ANOVA. The ANOVA revealed only a significant main effect of age, $F(4, 116) = 22.26$, $p < .001$, partial $\eta^2 = .434$. There was no main effect of trial type or interaction between the two, highest $F = .64$, lowest $p = .425$.

To break down the main effect of age, the scores were combined so that each

participant had a score out of 4, one mark for each trial with a counterfactual justification. I compared the difference between the justification scores for each age group using independent samples t-tests, making a Bonferroni correction for 10 multiple comparisons ($\alpha = .005$). The results of the tests can be seen in Figure 4. The 4- to 5-year-olds provided the fewest counterfactual justifications (M = .09). There was a borderline difference between the 4- to 5-year-olds and the 5- to 6-year-olds (M = .66), $t(33.24) = -2.78$, $p = .008$, $r = .43$. The 4- to 5-year-olds were also borderline different to the 6- to 7-year-olds (M = .68), $t(28.38) = -2.87$, $p = .008$, $r = .47$. The 4- to 5-year-olds provided significantly fewer counterfactual justifications than the 7- to 8-year-olds (M = 1.10), $t(22.18) = -3.82$, $p = .001$, $r = .63$, and the 8- to 9-year-olds (M = 2.65), $t(24.57) = -10.04$, $p < .001$, $r = .90$. As for the 5- to 6-year-olds, they demonstrated no difference to the 6- to 7-year-olds, $p = .929$, or the 7- to 8-year-olds, $p = .170$. The 8- to 9-year-olds, however, provided significantly more counterfactual justifications than the 5- to 6-year-olds, $t(50) = -6.44$, $p < .001$, $r = .67$. The 6- to 7-year-olds were no different to the 7- to 8-year-olds, $p = .200$ but the 8- to 9-year-olds provided significantly more counterfactual justifications than the 6- to 7-year-olds, $t(46) = -6.26$, $p < .001$, $r = .68$. The 7- to 8-year-olds provided significantly fewer counterfactual justifications than the 8- to 9-year-olds, $t(42) = -4.35$, $p < .001$, $r = .56$. There seems to be a significant improvement between the 7- to 8-year-olds and the 8- to 9-year-olds. The step change between these ages, in combination with the results of the post hoc tests, suggests that at 8 to 9 years old, children become proficient in their use of counterfactual justifications when referring to others' regret and relief.

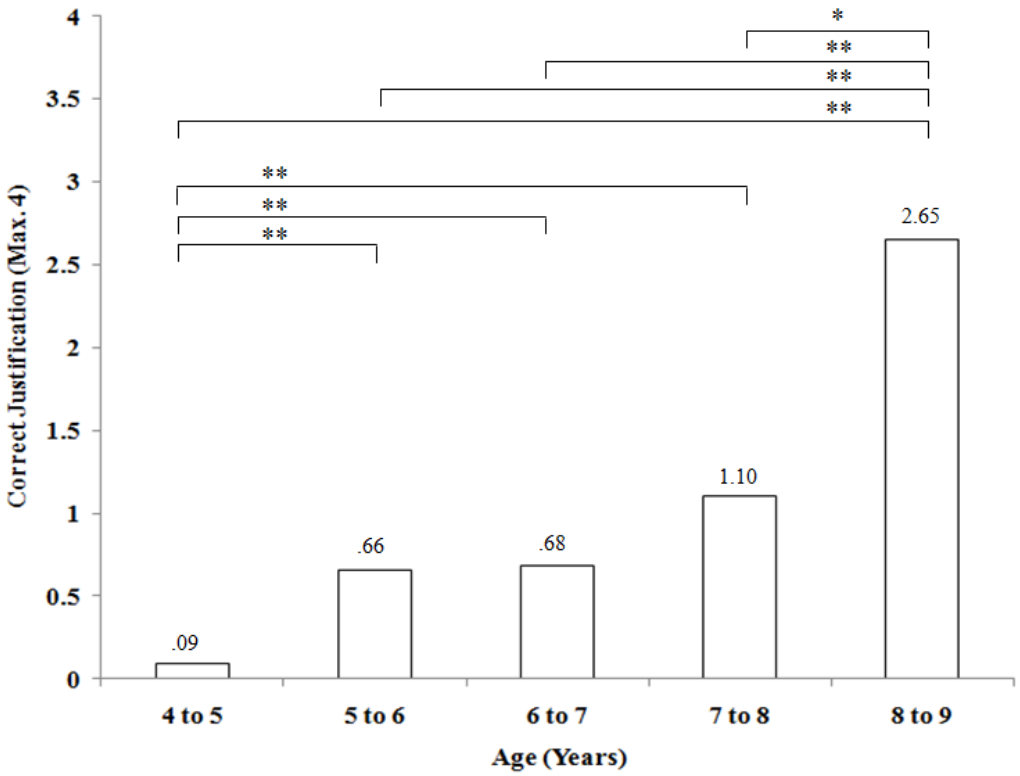


Figure 4. Mean number of counterfactual justifications by age group

One asterisk (*) indicates that the score differs from zero at $p < .05$. Two asterisks (**) indicate that the score differs from zero at $p < .005$.

Table 7. Percentages of type of justifications by age group

Age (Years)	*N*	*N x 4 trials*	Justification Type %				
			Counterfactual	***Description of Reality***	***Ambiguous***	***Irrelevant***	***Other***
4 to 5	*23*	*92*	2	55	2	25	16
5 to 6	*29*	*116*	16	63	7	7	7
6 to 7	*25*	*100*	17	70	5	2	6
7 to 8	*21*	*84*	27	65	8	0	0
8 to 9	*23*	*92*	67	24	5	4	0

Note. Shaded area represents the target response.

N x 4 trials describes the total number of trials per age group

Table 7 displays the percentages of the frequencies of the justification types that each age group provided most frequently. From the percentages seen in Table 7, one can identify two findings. The first is that children up to the age of 7- to 8 predominantly referred to the current reality in their justifications. Only when children were 8 to 9 years old did they refer to the counterfactual alternative on the clear majority of trials. The second is that the majority of all children's justifications were either descriptions of reality or reference to the counterfactual alternatives. Relatively few justifications were coded outside of these two categories.

To determine which type of response participants provided most frequently, I compared the frequency of the five categories of justification with age group. Trial type was not compared. I ran 5 (age: 4 to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9) x 5 (justification type: counterfactual, descriptions of reality, ambiguous, irrelevant, other) χ^2 of independence test. The test revealed a significant difference in patterns of responding by age group, χ^2 (16, N = 484) = 188.81, $p < .001$, Cramer's V = .32.

There is the possibility that within the coding process of children's justifications of Arnold's regret and relief, the criterion that referred to descriptions of reality was not sensitive to justifications that may have implied a counterfactual reasoning process. Children's justifications were coded as a description of reality if the response simply described the current state of affairs. This strict criterion included those justifications that referred to Arnold's chosen card, e.g., "Arnold has three stars", or "He chose two stars" *and* the counterfactual alternative, e.g., "Because he won stars instead of losing stars", or "That one's got eight", without differentiating the two. Children's language directed towards the alternative card may not have been counterfactual, but the

content of the response may refer to counterfactual circumstances. As such, these responses could be viewed as counterfactual.

I recoded children's justifications that were initially classified as a description of reality. Children's justifications that referred to the initial card, e.g., "He has two stars" remained as a description of reality, but children's justifications that made a reference to the alternative card, e.g., "He didn't want to lose eight stars", were coded as a counterfactual justification. Of 269 original codes of descriptions of reality, only 40 were reclassified as counterfactual. Despite the small number of examples, I have included an additional analysis to determine if the strict coding system was insensitive to children's reference to the counterfactual alternative without using counterfactual language.

Similarly to the original analysis, each participant was assigned a score of 0 (*incorrect*) or 1 (*correct*) for the justifications that they provided on the two regret trials (max. 2) and the two relief trials (max. 2) and only counterfactual justifications were regarded as the correct response. To compare the justifications across the age groups and trial type, I ran a 5 (age: 4 to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9) x 2 (trial type: regret, relief) ANOVA. The ANOVA revealed the same pattern of results as the original analysis. There was only a significant main effect of age, $F(4, 116) = 16.31$, $p < .001$, partial $\eta^2 = .360$. There was no main effect of trial type or interaction between the two, highest $F = 1.28$, lowest $p = .284$.

I broke down the main effect of age and revealed a similar pattern to the original analysis (see page 130). There was only one minor difference between the original

analysis and the revised analysis: There was now no difference between the 4- to 5-year-olds and 6- to 7-year-olds, $p = .020$. The similarity of the two analyses provides further evidence that children only become proficient in their use of counterfactual justifications when referring to others' regret and relief at a much later age (8 to 9 years-old) than when they can provide explicit responses on the scale (5 to 6 years old).

4.1.3.3. Comparisons of the scale and justifications.

From children's responses on the scale, children demonstrated an understanding that Arnold would experience regret or relief from the age of 5 to 6 years old. When children were asked to justify why Arnold would feel even happier or even sadder than he did before, children did not provide counterfactual justifications until they were 8 to 9 years old. There is a difference between the two response types: the scale and the justifications.

I determined the extent of the difference between children's performance on the two response types. On the scale, participants' responses were correct if they rated Arnold as "even sadder" on regret trials and "even happier" on relief trials. Participants' scores on the scale for the two regret trials were combined (max. 2), as were their scores on the two relief trials (max. 2). For the justifications, participants' responses were correct if they used a counterfactual justification. Participants' scores for their justifications for the two regret trials were combined (max. 2), as were their scores on the relief trials (max. 2). To determine the difference between the two response types, I ran a 5 (age: 4 to 5, 5 to 6, 6 to 7, 7 to 8, 8 to 9) x 2 (trial type: regret, relief) x 2 (response type: justification, scale) ANOVA. The ANOVA revealed significant main effects of age, $F(4, 115) = 29.11$, $p < .001$, partial $\eta^2 = .503$, trial type, $F(1, 115) =$

4.83, $p = .030$, partial $\eta^2 = .040$, and response type, $F(1, 115) = 131.32$, $p < .001$, partial $\eta^2 = .533$. There was a significant interaction between response type and age, $F(4, 115) = 3.99$, $p = .005$, partial $\eta^2 = .122$. There were no other interactions, highest $F = 1.96$, lowest $p = .106$.

I broke down the main effect of age, making a Bonferroni correction for 10 tests ($\alpha = .005$). I compared each age group on their overall scores (Max. 8). The 4- to 5-year-olds performed significantly worse (M = .87) than the 5- to 6-year-olds (M = 2.97), $t(50) = -5.07$, $p < .001$, r = .58. The same pattern was revealed in comparison to the 6- to 7-year-olds (M = 2.71), $t(34.82) = -5.06$, $p < .001$, $r = .65$, the 7- to 8-year-olds (M = 3.67), $t(26.23) = -6.08$, $p < .001$, $r = .76$, and the 8- to 9-year-olds (M = 6.00), $t(44) = -12.55$, $p < .001$, $r = .88$. As for the 5- to 6-year-olds, they performed significantly worse than the 8- to 9-year-olds, $t(50) = -5.98$, $p < .001$, $r = .65$. The only other age differences were between the 6- to 7-year-olds and the 8- to 9-year-olds, $t(45) = -6.72$, $p < .001$, $r = .71$, and the 7- to 8-year-olds and the 8- to 9-year-olds, $t(42) = -4.14$, $p < .001$, $r = .54$. I explored the main effect of trial type: There was a significant difference between the two trial types (max. 2). Participants performed better on regret trials (M = 1.72) than relief trials (M = 1.50), $t(119) = 2.20$, $p = .030$, $r = .20$. I also explored the main effect of response type: There was a significant difference between the two response types (max. 4). Participants performed better on the scale (M = 2.20) than on the justifications (M = 1.02), $t(119) = -11.18$, $p < .001$, $r = .72$.

For the interaction between response type and age, the analyses have been completed in a previous analysis (see 4.1.3.2. Analysis of children's justifications, pp. 129-130). In this previous analysis, I explored the difference between participants' responding

on the scale and providing justifications. What is not yet known, however, is the relationship between the two response types. A bivariate correlation between the two response types found a significant moderately positive relationship, $r(120) = .56$, $p < .001$, $r^2 = .31$. I conducted a first-order correlation, partialling out the effect of age. The first-order correlation revealed a significant relationship between the two response types, $r(117) = .62$, $p < .001$, $r^2 = .38$.

Similarly to Experiment 4 (see page 108), it may be inappropriate to use a repeated measures ANOVA as disparate measures were transformed and the assumptions of ANOVA may not have been met. Thus, I also ran a Friedman's Test, the non-parametric alternative of the repeated measures ANOVA. I found a similar pattern of results to the ANOVA: For each age group, there were significant differences between the two response types at the level of significance $p < .001$, and between regret and relief trials, $p < .005$.

These analyses identified that there was an asymmetry between children's responses on the scale and the justifications to back up their responses. There were circumstances, however, when children did provide the target response on the scale. What is not yet known is if there was a relationship between children's target responses on the scale and whether or not their explanations for those specific trials were counterfactual. To determine this relationship, I ran paired samples t-tests, making a Bonferroni correction for five comparisons ($\alpha = .001$). If there were any differences between children's correct responses on the scale and the justifications that they provided, this is further evidence for the asymmetry between the two response types. If, on the other hand, there were no differences between the two

response types, one may conclude that once children provide a counterfactual response on the scale, their justifications are more likely to be counterfactual.

I compared children's mean target scores for their justifications if they correctly responded on the scale. There were significant differences between the two response types for the 4- to 5-year-olds (M = .11), $t(17) = 11.66$, $p < .001$, $r = .94$, the 5- to 6-year-olds (M = .43), $t(66) = 9.30$, $p < .001$, $r = .75$, the 6- to 7-year-olds (M = .29), $t(47) = 10.69$, $p < .001$, $r = .84$, the 7- to 8-year-olds (M = .48), $t(53) = 7.56$, $p < .001$, $r = .72$ and the 8- to 9-year-olds (M = .81), $t(76) = 4.29$, $p < .001$, $r = .44$. These results suggest that even when children provided the target response on the scale, their justifications did not necessarily refer to the counterfactual alternative: It seems to be more difficult for children to provide the target counterfactual justifications than the target responses on the scale.

4.1.4. Discussion

The purpose of Experiment 5 was threefold. The first was to determine the age when children are able to understand that another would experience relief. Second, I aimed to identify if the lag between children's own experiences of regret and relief emotions extended to their understanding. Third, I aimed to identify possible reasons why children experienced regret and relief earlier than understanding them.

Children were able to identify that Arnold would feel relief after a positive outcome and regret from the age of 5 to 6 years old and relief after a negative outcome from the age of 8 to 9 years old. This pattern of results allow us to draw two conclusions: One of these conclusions is that the development of children's understanding of regret and relief was similar to that of their own experiences of regret and relief

(Experiments 3 and 4). The results of Experiment 5 identified that children can understand that another would experience regret at a similar age to when they can experience regret themselves. Similarly for relief, children from 5 years old understood that another would experience relief after a positive outcome, the same age that they can experience relief themselves after a positive outcome. The second conclusion is that there was no difference between when regret and relief were first understood: I found no evidence for the lag between children's first understanding of regret and relief (Experiment 2 of this thesis; Guttentag & Ferrell, 2004). Rather, the lag was evident between children's understanding of relief after a positive outcome and relief after a negative outcome.

There are two limitations to the account that there is a similarity between children's experiences and understanding of regret and relief. The first is that the 4- to 5-year-olds who experienced a fledgling regret in Experiment 3 did not demonstrate a fledgling understanding of others' regret. However, in Experiment 3, I identified that 4- to 5-year-olds' fledgling experiences of regret may have been due to developments in counterfactual emotions around children's 5th birthday. The same phenomenon could apply their understanding: The 4- to 5-year-olds were 4 years and 9 months in age but children just four months older (5;1) may have demonstrated an understanding of regret. This possibility warrants further investigation. It may be possible that children's first experiences and understanding of regret can be pinpointed to a matter of months. The second limitation to the similarity between children's experiences and understanding is that for relief after a negative outcome, children only demonstrated an understanding at 8 to 9 years old: *two* years older than when they are able to experience relief themselves. In Experiment 3 and 4, I found that children's

experiences of relief after a negative outcome were first seen at a later age than relief after a positive outcome. That pattern is also found within children's understanding of relief but the first age that children demonstrated an understanding of relief after a positive outcome is surprisingly late in development. During the discussion of children's performance on the Relief Initial-Lose trials, I provided several possible explanations for why children do not experience relief, despite receiving an objectively better outcome, until a later age (p. 93). For example, the processing of two negatives may have been more difficult to process. Even if these reasons provided adequate explanation for children's performance regarding their own experiences, it is not clear why they do not account for children's understanding of others' relief after a negative outcome. Perhaps it is more interesting that children's performance was only impaired on their understanding of the Relief Initial-Lose trials but not the remaining three. Children's understanding of others' relief after a negative outcome ought to be the focus of further research if we are to determine why children's understanding of relief after a negative outcome is so much later in development.

The content of children's justifications offers insight into what they found difficult about others' regret and relief. Recall that in the introduction of Experiment 5, in Table 5, I listed the possible outcomes of the experiment. The counterfactual literature currently provides evidence that a target response is made in combination with a counterfactual justification, and a non-target response is made with a non-counterfactual justification (Guttentag & Ferrell, 2004; Ferrell et al., 2009). In the current experiment, I found that an alternative possible outcome proved to be correct: Children provided a counterfactual judgement of Arnold's feelings on the scale and provided a non-counterfactual justification until 8 to 9 years old, when they provided

a counterfactual justification to support their judgement. The results of the Pearson's first-order correlation identified that despite the differences between the two response types, there was a linear relationship between the two response types: The more target responses children provided on the scale, the more likely they were to provide a counterfactual justification. However, children up to and including 7- to 8-year-olds, who correctly responded counterfactually on the scale, did not provide counterfactual justifications. The question as to why, currently remains. On a note of caution, throughout this thesis it has been assumed that a target response on the scale *must* be based on counterfactual thinking. It is likely that this is the case as children experienced negative affect after an initial win (Regret Initial-Win trials) and positive affect after an initial loss (Relief Initial-Lose) which cannot be explained by alternative strategies such as thinking about reality. However, there remains the possibility that children have achieved the target answer on the scale through an alternative strategy. In Experiment 6, I investigated this possibility.

One explanation as to why children, aged up to and including 7 to 8 years old, provided the target response on the scale but not a counterfactual justification to support their response is that children may not have been able to verbalise the comparison between reality and the counterfactual. Perhaps providing this justification was too demanding for young children. Thus, even if children were able to think counterfactually, they may not have been able to provide a justification that referred to the counterfactual alternative. Children's responses were factually correct, in the sense that they described a real aspect of the world, but they were judged incorrect in terms of the task in hand.

Within the Theory of Mind literature, there is evidence to suggest that children may be able to understand others' beliefs, yet not be able to provide reasons for why another would have these beliefs. Hadwin and Perner (1991) presented stories to 4- to 6-year-olds. In these stories, for example, one protagonist discovered unexpected contents of a Smarties box (e.g., Jelly Babies). Hadwin and Perner found that children were able to identify that the protagonist held a false belief at the age of 5 years old, which was beyond the ability of the 4-year-olds. However, these 5-year-olds were similar to the 4-year-olds in their justifications about the false belief. It was not until children were 6 years old that they were able to make correct belief-based attributions. These particular attributions were based around the emotion of surprise. In another experiment, the same pattern was found for justifications of happiness.

There seems to be a mismatch in development between providing the target response and the target justification of that response (De Rosnay, Pons, Harris & Morrell, 2004). Bradmetz and Schneider (1999) replicated this mismatch: They demonstrated that in children's understanding of false belief, there are age differences between when children can provide a target response and a target justification of that response. In several experiments, 4- to 7-year-olds participated. They reported that almost half of their participants identified that a protagonist held a false belief, yet they could not provide a correct justification as to why. This mismatch between providing a correct answer and a correct justification was robust: In two further experiments, they counterbalanced the order of the questions so that the justification question was sometimes asked before, rather than only after, the false belief questions. Even so, children gave correct justifications aged one year older than those children who were able to identify that a protagonist held a false belief. In a similar experiment,

Bradmetz and Schneider asked children to predict the actions of a protagonist rather than answer a false belief question. Children had to explain their reasons for why they predicted the protagonist to act in a certain way. Once again, children who were able to justify their responses to the game were several years older than the children who provided the correct response. In a final experiment, children's justifications were challenged by the experimenter in a counter-argument. Children did not change their justifications and the mismatch between a target response and a target justification remained. The evidence suggests that children are sometimes able to provide the target response on a task at an earlier age than they are able to provide the target justification for their response. This mismatch between children's responses and their justifications of their responses may be present in the current experiment: Children may be able to make a judgement as to how another is feeling from the age of 5 to 6 years old but they do not justify their response until 8 to 9 years old.

It is possible that there was no mismatch between children's responses on the scale and their justifications. That is, if children were *not* thinking counterfactually, but rather thinking about reality when they responded on the scale, their justifications may have supported their responses on the scale. If this were the case, children would have been employing a non-counterfactual strategy to achieve the target answers. Their answers therefore, would have appeared to be evidence of counterfactual thinking whereas in fact, children were merely thinking about the current state of affairs. Based on the literature concerning the mismatch between the two response types (e.g., Bradmetz & Schneider, 1999; De Rosnay et al., 2004, Hadwin & Perner, 1991), it seems unlikely that children were employing an alternative strategy to counterfactual thinking. However, the possibility that children used alternative strategies remains a

potential explanation: Children may have made a comparison between the two cards and judged whether Arnold had won or lost the game without thinking counterfactually. If Arnold's card had more tokens, he won, and therefore would feel happy. If he had the card with a smaller number of tokens, he would have lost and would thus feel sad. Thinking about winning or losing would therefore have provided the same pattern of results as genuine experiences of regret and relief but would be based entirely on an evaluation of reality, not a comparison with a counterfactual.

If children were employing a non-counterfactual strategy, the results of Experiment 2 are inconsistent with this account. In Experiment 2, children up to the age of 6 to 7 years old were unable to infer the correct emotion held by another, whereas they were able to do so in Experiment 5. It seems unlikely that if children were using a non-counterfactual strategy in both Experiments 2 and 5, they would perform poorly in one (Experiment 2), but perform well in the other (Experiment 5). A further reason to doubt that children used an alternative strategy was that, in the current experiment, children from the age of 5 to 6 years old performed well on the Regret Initial-Win trials: If children based their thinking on default assumptions about reality, in a similar manner to basic conditional reasoning (Rafetseder et al., 2010; Rafetseder & Perner, 2010), they should have rated Arnold as "even happier" as he had won tokens ("If Arnold wins tokens, he is happy"). In fact they rated him as "even sadder". Such a response only seems possible with counterfactual reasoning.

An alternative non-counterfactual strategy can provide an explanation for children's responses. Children may have been experiencing a non-counterfactual negative emotion, rather than regret, or a non-counterfactual positive emotion, rather than

relief. An example of a non-counterfactual negative emotion is frustration. Frustration is the reaction to a state of affairs when there is some obstruction to a goal (Berkowitz, 1998). Children may have been frustrated at not having won the largest number of tokens (The goal was to gain the most tokens). Thus, on regret trials, when children saw that they could have won more than their initial card, they may have interpreted the state of affairs as frustrating as they did not win all the tokens. A positive non-counterfactual emotion would be happiness. Children may have been happy that they did not lose the larger number of tokens. Thus, on Relief trials, when children could have lost more than their chosen card illustrated, they may have been happy that they did not lose more tokens. This alternative strategy may have been appeared to be counterfactual, whereas in fact children were only thinking about their current emotional state. In Experiment 6, I address the claim that children are not thinking counterfactually but using an alternative strategy based on their thinking about reality.

In Experiment 5, I aimed to investigate why children did not understand others' regret and relief until at least 6 to 7 years old (Experiment 2 of this thesis). Surprisingly, I found the children aged 5 to 6 years old were able to understand regret and some relief. There are several possible explanations for the difference in results between these two experiments.

One possible explanation is that in Experiment 5, there was a more salient prompt of counterfactual thinking than in Experiment 2: Asking participants to provide a justification for Arnold's feelings. In Experiment 2, participants were only required to make a judgement of affect, whereas in Experiment 5, they were required to verbalise

their reasoning about this judgement. Perhaps asking children to reason about Arnold's feelings was the catalyst that prompted them to think about Arnold's alternatives to reality. On children's first trial, they would not have known that they had to provide a justification until they were asked to provide one. Children's performance on their final trial would have been after the greatest exposure to the requests for justifications. If children's performance on their last trial was significantly better than their performance on the first trial, this argument would be correct.

I made a Bonferroni correction for six comparisons ($\alpha = .008$) and I conducted Wilcoxon Signed Rank Tests. The tests revealed that the first trial was significantly different from the last trial for the 5- to 6-year-olds, $Z = -3.00$, $p = .003$ but in the direction opposite to expectation. On their first trials, the 5- to 6-year-olds provided the target response of Arnold's happiness on 69% of the trials. In contrast, on the 5- to 6-year-olds' final trials, they provided the target response on only 38% of the trials. There were no other differences for any of the age groups, highest $Z = -.33$, lowest $p = .157$. Thus, these results do not support the possibility that children were prompted by justifications to think counterfactually.

A second possibility may provide an explanation for the difference between the two experiments. In Experiment 3, I made three methodological improvements to Experiments 1 and 2. The first change was to the counterfactual outcome in the hope that it would be viewed as significant by participants. The second change altered the number of tokens initially won or lost (the initial card) and the number of tokens that could have been won or lost (the alternative card) so that they were equal across both

regret and relief trials. Experiment 5 was also improved by a third methodological change, a change to the scale, so that it allowed children to show regret and relief equally well. In changing the scale, children may have found it easier to rate others' counterfactual emotions: Making a relative judgment about others' on the scale may be an easier task than identifying one specific face. In Experiment 3, children's improved performance on regret and relief trials, demonstrated that the children's performance in Experiments 1 and 2 was slightly limited by artefacts of the design. Relief could in fact be experienced even earlier than I reported in Experiment 1. These three methodological changes are critical differences between Experiments 2 and 5 and may be the cause of the difference between the results of the two experiments.

One implication of this second possibility is that children are able understand that another would experience regret and relief (after a positive outcome) at 5 to 6 years old, the same age that they are able to experience regret themselves (with the exception of the 4- to 5-year-olds' fledgling experiences reported in Experiment 3). As a consequence, the possibility that there is no difference between children's thinking about their own and others' regret and relief conflicts with the results of Experiments 1 and 2 of this thesis: In these experiments I demonstrated that children experience counterfactual emotions at an earlier age than understanding them. The possibility that there is no difference between children's experiencing and understanding of regret and relief ought to be the focus of future work if we are to further our understanding of children's first handling of counterfactual emotions: One could replicate the methodology of Experiment 5 and include an additional group of participants, those who justified their own experiences rather than others' experiences. If these two groups were compared in their responses on the scale and the content of

their justifications, one would find greater evidence to support or reject the possibility that children's experience and justifications develop in parallel. Based on 4- to 5-year-olds fledging experiences (Experiment 3), children as young as this should be included in these future works.

Children aged 5- to 8 years old provided non-counterfactual justifications but they were able to think counterfactually to respond appropriately on the scale. This could be due to the possibility that children are not thinking counterfactually before the age of 8 to 9 years old: If this was the case, there would not be a mismatch between children's responses on the scale and their justifications. It is also possible that children were thinking counterfactually to respond on the scale but they could not verbalise their counterfactual reasoning. If children cannot justify their counterfactual thoughts, there may be implications to how children are understood by people around them. Investigation into the mismatch between children's responses on the scale and their justifications to support their responses ought to continue: One possible procedure could involve children asked to justify another's happiness by choosing from a list of possible statements, each based on a theoretical position of children's thoughts after responding on the scale (e.g., Arnold is happy because: (a) he could have lost tokens [based on counterfactual thinking], (b) he won tokens [based on reality], (c) he has more tokens than when he started [based on relative judgements of reality], (d) he has a smiling face [based on irrelevance]). One noticeable advantage of this multiple choice method procedure is that the linguistic demands of the justifications would be reduced: Children would just have to choose from a list of possible options. Such a procedure may determine why children did not provide a counterfactual justification to support their counterfactual response on the scale.

The results of the Experiment 5 allow us to draw two conclusions. The first is that children are able to infer that others experience regret and relief at an earlier age than expected, from the age of 5 to 6 years old. With the exception of the fledging experiences of the 4- to 5-year-olds, this is the same age that children can experience regret and relief themselves, reported in Experiments 3 and 4. The second is that, despite the counterfactual reasoning thought to be required to respond on the scale, children were not able to provide counterfactual justifications about their inferences of others' regret and relief until they are aged 8 to 9 years old. Before this age, children focussed on factually correct descriptions of reality. These descriptions of reality seem to be representative of a lag between children's abilities to respond on the scale and to provide justifications of their reasoning. However, there remains the possibility that children used non-counterfactual strategies to respond to the test questions. In the final chapter to this thesis, I aimed to provide evidence that children have been thinking counterfactually and not basing their answers on alternative strategies based on reality.

Chapter 5

Regret and Relief or Responding to Reality?

Experiment 6 in this chapter forms the basis for part of a paper:

Weisberg and Beck (2010) under resubmission in Cognition and Emotion

In the experiments thus far, I have interpreted children's behaviour as showing that they experience regret from the age of 5 to 6 years old (Experiments 1, 3 & 4). There is evidence to suggest that children as young as 4 to 5 years old have fledgling experiences of regret (Experiment 3). Children have demonstrated that they can experience relief also from the age of 5 to 6 years old (Experiments 3 & 4). I identified that children are able to experience these emotions at these ages using a rating scale: Participants rated their happiness based on the outcome of a decision (the initial rating) and then, in light of the counterfactual information, rated their happiness (the alternative rating). If the alternative outcome was larger in size than the outcome itself (i.e. the alternative outcome was a larger number of tokens than the initial outcome), one would expect to feel more unhappy based on the missed opportunity ("It could have been better"). If the alternative outcome was smaller in size than the outcome itself, one would expect to feel greater happiness, as the better of two options was chosen ("It could have been worse"). The notion of re-rating feelings of happiness based on what could have been seemed to rely on counterfactual thinking. Thus far, I have only viewed it possible to respond appropriately on the scale if one engages in counterfactual thinking.

In the discussions of both Experiments 3 and 5, the possibility was raised that children were *not* using counterfactual thinking but rather an alternative strategy to achieve the target responses. Rafetseder et al. (2010) and Rafetseder and Perner (2010) suggested that children use one alternative strategy, basic conditional reasoning, because children under the age of 6 to 7 years old may be unable to think counterfactually. In the current counterfactual thinking literature, if children used basic conditional reasoning, they would have achieved the same response if counterfactual thinking

would have been used. For example, in one of Harris et al.'s (1996) stories, children read about Carol who came inside with dirty shoes and as a consequence, dirtied the floor. When 3-year-olds were asked, "What if Carol had taken off her shoes, would the floor be dirty?" they responded by saying "no". Harris et al. interpreted these responses by saying that 3-year-olds can make counterfactual predictions. Rafetseder et al. (2010), on the other hand, argued that children could have answered this question using basic conditional reasoning: The default assumption about the scenario is that "if shoes are off, then floors are clean." Therefore responding with "no" could be based on basic conditional reasoning, not counterfactual thinking.

Rafetseder et al. (2010) investigated this possibility by describing scenarios to 2- to 6-year-old children and asking them to report on a counterfactual alternative. If children employed basic conditional reasoning, they would arrive at a different answer than if they used counterfactual reasoning. One protagonist, Simon, entered a room. Simon could take sweets from the top or bottom shelf back to his room. Julia on the other hand, could only reach the bottom shelf and take those sweets back to her room. Children were asked to determine what would happen if the other protagonist entered the room and found sweets. The default assumption of basic conditional reasoning was that sweets tend to end up in the room of whoever comes to look for them. If children used counterfactual reasoning ("If Julia looked for sweets and they were not on the bottom shelf, the sweets would remain on the top shelf") they would state that the sweets would remain on the top shelf. On the other hand, if children employed basic conditional reasoning, using the default assumption "Sweets end up in the room of whoever searches", children would respond that the sweets would end up in Julia's room. Rafetseder et al. (2010) reported this pattern: Children responded that the

sweets would be in Julia's room, not on the top shelf. This was evidence to demonstrate that they employed basic conditional reasoning rather than counterfactual thinking. As such, Rafetseder et al. (2010) argued that children up to the age of 6 years old do not think counterfactually but rather use basic conditional reasoning and default assumptions about reality.

Basic conditional reasoning, however, cannot explain how children would choose the same arrow on the Initial-Win and Initial-Lose trials for both regret and relief trials. Whereas the default assumptions about reality would remain consistent throughout a game, the outcome of the trials are not consistent: Basic conditional reasoning could be based on thoughts such as, "If a card says win tokens, then I am happy" or "If a card says lose tokens, then I am sad". There were two regret trials, one that resulted in a win, the other resulted in a loss. Based on these default assumptions, children should state that they are happy after the Regret Initial-Win trial, and sad after the Regret Initial-Lose trial. From 5 to 6 years old, children stated that they felt sad after both trials. A similar pattern was found in relief trials. Thus, basic conditional reasoning could not have led to the responses that children provided for the two regret trials and the two relief trials. Even though children may not engage in basic conditional reasoning in my tasks, Rafetseder et al.'s argument resonates with a possibility that forms the basis of this chapter: Children may use a non-counterfactual thinking strategy to reach the target response.

A possible non-counterfactual thinking strategy draws parallels with basic conditioning reasoning: Children could be making a comparison based on reality. That is, children could compare what they won, to what they *did not* win, rather than

the counterfactual that they *could have* won. For example, on Regret Initial-Win trials, participants won two or three tokens, but did not win eight, so they may be frustrated: the same response on the scale as regret. On Relief Initial-Lose trials, participants did not lose eight, thus they would be happy: the same response as relief. Thus, a target response would be a false positive, as answers would have been based on reality. In the final experiment of this thesis, I aimed to provide empirical evidence that children were thinking counterfactually in my tasks and not basing their answers on reality.

Within the adult counterfactual emotions literature, there is evidence to suggest that a feeling of responsibility for the outcome of a decision results in the increased likelihood of an experience of regret and relief and other counterfactual emotions. Burks (1946), a philosopher, first suggested that an experience of regret is only possible if one is responsible for the outcome. He argued that regret is due to "[man's belief] that he has failed in the execution of his responsibility – that he should have done other than he did" (p.170). Gilovich and Medvec (1995) reported that when their respondents listed their regrets in life, very few of them listed regrets outside of their control. As such Gilovich and Medvec concluded that responsibility seemed to be central within experiences of regret. Markman, Gavanski, Sherman and McMullen (1995) reported similar findings: They asked adults to play a computer simulated game in which outcomes were determined by Roulette wheel. Participants felt greater regret when they had greater control over the wheel. Shefrin and Statman (1986) also reported a relationship between regret and responsibility. Through interviews with investors in stocks and shares, Shefrin and Statman found that investors preferred to spend their money on better known companies. That was because if investment was made into a lesser known company and the value of the stocks then decreased, the

investors would be more likely to blame themselves. In contrast, if better known companies lost value, the misfortune would then be attributed to other sources. Zeelenberg, van Dijk and Manstead (1998) demonstrated that there were clear effects of responsibility on regret. In similar stories to Kahneman and Tversky's (1982) stocks and shares story, Zeelenberg, van Dijk and Manstead (1998) manipulated whether protagonists arrived at an outcome based on their own decision or if they had no influence over that decision as it was made by a computer. Participants were asked to rate the happiness of the protagonists when the decision that was made resulted in a negative outcome. Zeelenberg, van Dijk and Manstead (1998) identified a strong relationship between regret and responsibility for the outcome. Additionally, Zeelenberg, van Dijk, van der Pligt et al. (1998) asked participants to report life events in which they experienced regret and to rate how responsible they felt over the outcome. Results revealed that there was a significant positive correlation between regret and responsibility over the outcome. They argued that this indicated that the greater responsibility over the outcome, the more intense the regret. There is a consistent body of evidence to suggest that the greater the responsibility for the outcome, the more likely is an experience of regret.

A greater sense of responsibility leads to a greater feeling of regret, but what is experienced when there is no responsibility for the outcome? When one does not feel responsible for an outcome of a causal chain of events, emotions are still experienced. One may experience a negative emotion rather than regret, for example frustration, or a positive emotion rather than relief, for example, happiness. Imagine choosing a raffle ticket and then selling the ticket to a colleague. Subsequently, you find out that the ticket you sold won the jackpot. While one would feel intense regret in this

situation, the negative emotion would be greatly reduced if the ticket had originally been allocated to you at random. There is well known empirical evidence of such an effect: Langer (1975) asked office workers to take part in a raffle. Half the entrants were given a ticket. The other entrants chose their own ticket. A couple of days before the draw, Langer asked each entrant how much money they would ask for in order to sell their ticket. Entrants who were given a ticket asked for $2, yet the entrants who chose a ticket demanded for at least $8. If one does not hold responsibility for an outcome, emotions are still experienced. These emotions, however, are less likely to be based on counterfactual thought, but rather based on reality and comparisons to what did not happen.

In Experiment 6, I manipulated children's responsibility for the outcome of the game used within this thesis. Based on the literature concerning responsibility and regret, one would expect that with no responsibility for the outcome of the decision, children would not experience regret or relief, but rather their negative and positive counterparts, respectively. If this were to be the case, I would have provided evidence to support the task that I have used throughout this thesis as a test of children's counterfactual emotions and not children's thinking about reality.

5.1. Experiment 6

Responsibility, regret and relief

5.1.1. Introduction

Based on the literature that describes a consistent and robust relationship between responsibility for an outcome and the feeling of regret, it is possible to determine

whether children were thinking counterfactually or if they were reasoning about reality: I manipulated children's responsibility for the outcome of the game in three between-subject conditions. The first condition, Choice, was a replication of Experiment 3 and similar to Experiment 4. In this condition, children chose between one of two face-down cards. In doing so, the outcome was based on their choice. In the second condition, No Choice-Experimenter, the experimenter rolled a die, the outcome of which determined the card given to participants. Under these circumstances, the participant held no responsibility for the outcome. However, children were barely involved in this game. If children did not experience regret or relief, this could be due to an overall muting of emotions based on a lack of involvement in the game. To address this, I included a third condition, No Choice-Child. In this condition, the roll of a die still determined the card given to the participants, however the participant, rather than the experimenter, rolled the die. Children may feel some responsibility for the outcome but it would be expected to be less than in the Choice condition. Therefore, if children did not experience regret and relief after an outcome for which they had no responsibility, I would have provided evidence that the task used in the game throughout this thesis is answered using counterfactual thinking rather than thinking about reality.

One would expect that, consistent with the literature concerning the relationship between regret and responsibility (e.g., Gilovich & Medvec, 1995; Markman et al., 1995; Miller & Gunasegaram, 1990; Shefrin & Statman 1986; Zeelenberg, van Dijk & Manstead, 1998, Zeelenberg, van Dijk, van der Pligt et al., 1998), it is likely that if children are thinking counterfactually rather than using an alternative strategy, they will experience the greatest regret and relief in the Choice condition, in which there is

the greatest responsibility for the outcome. The No Choice-Child condition, in which there is reduced responsibility for the outcome, the likelihood of regret and relief would be reduced and a lesser counterfactual emotion would be experienced. The No Choice-Experimenter condition, in which there was no responsibility for the outcome, one would not expect children to experience counterfactual emotions. Children's emotional experiences in the No Choice-Experimenter condition would be based on an evaluation of reality. These emotions include frustration, a reaction to a state of affairs when there is some obstruction to a goal (Berkowitz, 1998), and happiness, a reaction to a positive set of circumstances.

All three conditions involve the same number of tokens that are won or lost, and the same number of tokens that could have been won or lost. Is it possible that only due to differences to the responsibility of the participant for the outcome, different emotions are experienced? Irrespective of the responsibility for the outcome, children are likely to experience frustration or happiness, for this is an emotional reaction to the current state of affairs. As I described in the introduction to this thesis (see page 6), once children compare their current state with what could have been, counterfactual emotions are experienced. It is likely that only after the Choice condition do children make the comparisons between reality and what could have been. If this is the case, frustration and happiness can be regarded as non-counterfactual emotions that underpin counterfactual responses.

The illusion of control literature can provide the basis for a further prediction of the results of Experiment 6. There is evidence to suggest that positive outcomes of a game are attributed to personal involvement, whereas negative outcomes are attributed to

external factors, such as chance (e.g., Langer & Roth, 1975; Wortman, Costanzo & Witt, 1973) or a higher being (Shefrin & Statman, 1986). Over the four trials, there were positive outcomes (Initial-Win trials) and children may have attributed responsibility for these outcomes to themselves but there were also negative outcomes (Initial-Lose trials), which children may have attributed to chance. Thus, if children are thinking counterfactually rather than responding to reality, one might expect to see stronger emotions on the Initial-Win trials. Consistent with the first prediction, this effect is less likely to be seen as the level of responsibility for the outcome decreases.

To summarize, in this sixth and final experiment of this thesis, I manipulated whether children should feel responsible for the outcome of the game. If they were as likely to report positive and negative emotions when they had no responsibility for the outcome and full responsibility for the outcome, the most parsimonious conclusion would be that children were not in fact experiencing counterfactual emotions but were reasoning about reality. Such a finding would resonate with Rafetseder et al. (2010) and Rafetseder and Perner (2010) who argued that children younger than 6 to 7 years old use non-counterfactual thinking strategies on a counterfactual reasoning task. However, if this pattern of results is not found, I would have provided support for children's counterfactual thinking within this thesis.

5.1.2. Method

5.1.2.1. Participants.

There were 297 participants, 101 aged 5 to 6 years old (M = 6;2, r = 5;7 to 6;10, 50 boys, 51 girls), 94 aged 6 to 7 years old (M = 7;2, r = 6;3 to 7;10, 48 boys, 46 girls) and 102 aged 7 to 8 years old (M = 8;3, r = 7;7 to 8;10, 56 boys, 46 girls). Participants

were recruited from three schools in Birmingham, U.K. All schools served a predominantly middle-class population. The three age groups were represented in all three schools: 32% of all participants were from one school, 35% from the second and 33% from the third. Children were White (55%), Asian (37%) and Black (8%) and all spoke English as their first language. Three participants (one from the 5- to 6-year-old group, two from the 6- to 7-year-old group) were excluded from the analysis due to failing the test questions during the rounds of training with the scale on three separate occasions. This left 294 participants, 152 boys and 142 girls, in the final dataset.

5.1.2.2. Materials.

I used the same materials as in Experiment 3, with the addition of a small die ($4cm^3$) and a playing mat (21 x 30cm). Three sides of the die were coloured green and the other three were coloured yellow. The playing mat was coloured in two halves: the same green and yellow as the die.

5.1.2.3. Procedure.

Participants were assigned to one of three conditions: Choice, No Choice-Experimenter or No Choice-Child according to the order of the teachers' class lists.

5.1.2.3.1. Choice condition

(n = 108 distributed across all age groups)

The procedure was identical to that of Experiment 3.

5.1.2.3.2. No Choice-Experimenter condition.

(n = 95)

The procedure was similar to Experiment 3 with several differences. Two playing cards were presented face-down on the playing mat. The cards were verbally labelled for the participants by the colour on which they were unsystematically placed. Throughout the experimenter's instructions of the game, the words "choice" or "choose" were replaced by "get" or "give" to give participants as little ownership over their chosen card as possible. The participants' initial card was determined by the throw of the die. The participants were told that the experimenter would throw the die and the colour that it landed on would correspond to the colour of the card to be given (the *initial card*). The corresponding card to the colour on the die was picked up by the experimenter and given to the participant. After the experimenter read the card to the participant, and gave or took away the number of tokens according to the card, participants were asked the *initial question* ("How do you feel about getting your card?"). They rated their happiness using the scale. Once completed, the participants were told that the other card (the *alternative card*) would be turned over to see what would have been won or lost. Sleight of hand was used similarly to Experiment 3. As in Experiment 3, the window was placed over the face that the participant initially chose on the scale. Participants were asked the same question as in Experiment 3, "How do you feel about getting your card? ^This one, ^this one or ^this one?" The procedure was repeated for the remaining four trials.

5.1.2.3.3. No Choice-Child condition.

(n = 94)

The procedure was identical to the No Choice-Experimenter condition with the exception that the participant rolled the die.

5.1.3. Results

Coding procedures were the same as in Experiment 3: The arrow that children chose was compared with chance performance. I made a Bonferroni correction ($\alpha = .004$) to account for 12 measures from each age group. Results of the binomial sign tests can be seen in Table 8.

In the Choice condition, I replicated the pattern of results seen in Experiments 3 and 4: Children experienced both regret and relief (after winning) from 5 years and relief (after losing) from 7, $p < .001$. In the No Choice-Experimenter condition, none of the three age groups reported a positive or negative change in their emotions on any of the four trials. Rather, they consistently chose the upwards-facing arrow suggesting that the counterfactual possibilities did not affect their happiness ratings. That is to say, children did not experience counterfactual emotions in the No Choice-Experimenter condition. Children, aware that they were not responsible for the outcome, were more likely to have been happy or sad at what they received in the game and not influenced by the counterfactual alternative. When there was some responsibility for the outcome in the No Choice-Child condition, children demonstrated some change in emotion. This pattern of results identified positive and negative emotions in the No Choice-Child condition. Due to the lack of emotional experiences in the No Choice-Experimenter condition, one can infer that these positive and negative emotions in the No Choice-Child condition are counterfactual. As children did not experience regret or relief on the No Choice-Experimenter condition, I have provided initial evidence to suggest that children have used counterfactual thinking on the game within this thesis: they did not simply reason about reality.

Table 8. Results of the binomial tests: Comparisons of participants' chosen arrows to chance (33%) in Experiment 6

Age (years) Condition		Regret Initial-Win				Regret Initial-Lose				Relief Initial-Win				Relief Initial-Lose			
		%			*P*				*p*				*p*				*p*
	N	←	↑	→		←	↑	→		←	↑	→		←	↑	→	
5 to 6																	
Choice	*37*	65	16	19	<.001**	76	13	11	<.001**	0	13	87	<.001**	14	54	32	.548
No Choice - Child	*32*	44	50	6	.135	25	59	16	.222	0	47	53	.015*	6	69	25	.222
No Choice - Experimenter	*31*	23	55	22	.148	26	64	10	.259	3	61	36	.450	19	58	23	.148
6 to 7																	
Choice	*33*	88	12	0	<.001**	82	6	12	<.001**	3	12	85	<.001**	6	60	33	.549
No Choice - Child	*27*	56	33	11	.013*	30	63	7	.443	0	41	59	.005*	7	71	22	.162
No Choice - Experimenter	*32*	31	62	7	.500	16	84	0	.024$^{\Delta}$	3	81	16	.024$^{\Delta}$	12	66	22	.123
7 to 8																	
Choice	*37*	92	5	3	<.001**	97	3	0	<.001**	0	5	95	<.001**	2	30	68	<.001**
No Choice – Child	*33*	55	39	6	.009*	64	36	0	<.001**	3	45	52	.021*	3	55	42	.167
No Choice – Experimenter	*32*	22	78	0	.123	22	75	3	.123	0	72	28	.352	3	63	34	.500

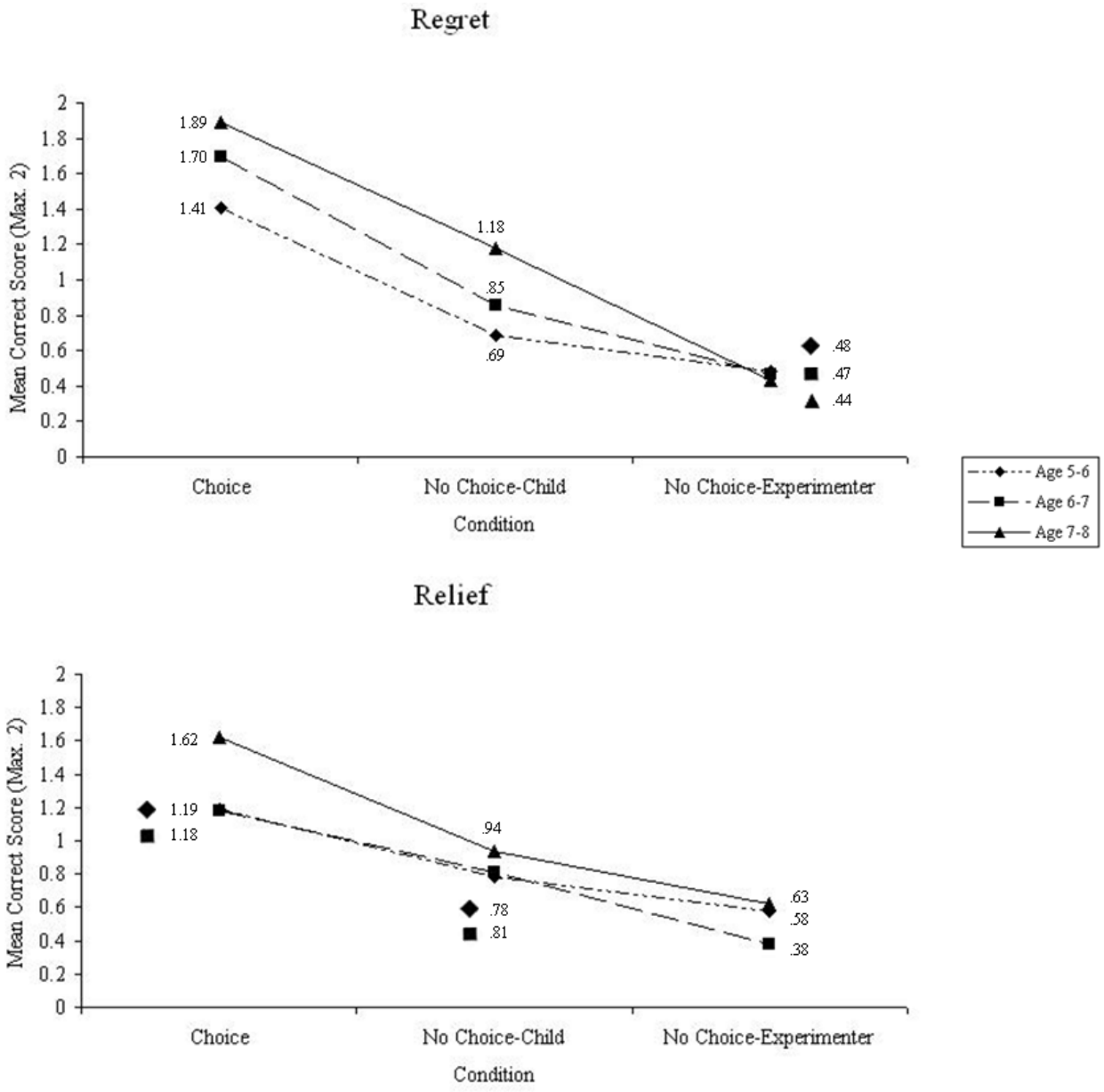
Note. Shaded area represents the target arrow for that trial (← = *even sadder*, ↑ = *the same*, → = *even happier*)

One asterisk (*) indicates that the result of the Binomial test is significant in the expected direction at $p < .05$. Two asterisks (**) indicate that the result is significant in the expected direction at $p < .004$. A triangle (Δ) indicates that the score is significant in the unexpected direction at $p < .05$.

To compare children's experiences in the three conditions, each participant received two scores of 0 (*both incorrect*), 1 (*one correct*) or 2 (*both correct*) for their responses on the regret trials and on the relief trials. The mean scores for each age group and condition can be seen in Figure 5. A 3 (age: 5 to 6, 6 to 7, 7 to 8) x 3 (condition: choice, no choice-child, no choice-experimenter) x 2 (trial type: regret, relief) ANOVA revealed significant main effect of trial type, $F(1, 285) = 6.81$, $p = .010$, partial $\eta^2 = .023$. There was a main effect of age, $F(2, 285) = 6.42$, $p = .002$, partial $\eta^2 = .043$ and a main effect of condition, $F(2, 285) = 84.77$, $p < .001$, partial $\eta^2 = .373$.There was a significant interaction between trial type and condition, $F(2, 285) = 7.96$, $p < .001$, partial $\eta^2 = .053$. There were no other interactions, highest $F = 1.93$, lowest $p = .146$.

I explored the main effect of age. I made a Bonferroni correction for three post hoc t-tests ($\alpha = .017$). The 5- to 6-year-olds (M = 1.76) performed significantly worse than the 7- to 8-year-olds (M = 2.29), $t(200) = -2.71$, $p = .007$, $r = .19$. There was a borderline difference between the 6- to 7-year-olds (1.82) and the 7- to 8-year-olds, $t(192) = -2.36$, $p = .019$, $r = .17$. The 5- to 6-year-olds' performance was no different to the 6- to 7-year-olds' performance, $p = .780$.

Figure 5. Mean scores by age group and condition for regret and relief trials



I used independent samples t-tests to explore the interaction between trial type and condition, making a Bonferroni correction ($\alpha = .006$) for nine comparisons. Collapsing across ages, there were significant differences between Choice (M = 1.67, max. 2) and No Choice-Child (M = .91) conditions for regret, $t(197) = 7.68$, $p < .001$, $r = .48$ and relief (Choice M = 1.33, No Choice-Child M = .85), $t(197) = 5.09$, $p <$

.001, $r = .34$. The Choice and No Choice-Experimenter (M = .46) conditions were significantly different for regret, $t(200) = 14.24$, $p < .001$, $r = .71$ and relief (No Choice-Experimenter M = .53), $t(200) = 8.69$, $p < .001$, $r = .52$. There were significant differences between the two No Choice conditions for both regret, $t(185) = 4.34$, $p < .001$, $r = .30$ and relief, $t(185) = 3.09$, $p = .002$, $r = .22$. I made comparisons between regret and relief within each condition. Children in the Choice condition performed better on the regret trials (M = 1.66, max. 2) than on the relief trials (M = 1.34), $t(106) = 4.67$, $p <.001$, $r = .41$. There were no differences between regret and relief for the No Choice-Child condition, $p = .426$, and No Choice-Experimenter, $p = .368$.

5.1.4. Discussion

In Experiment 6, I explored the possibility that the evidence I had thought indicated children's experiences of counterfactual emotions was in fact a false positive. Children may have responded to the task using alternative, non-counterfactual strategies such as comparing reality to what was not won. To investigate this possibility, I drew upon the literature that suggested with decreasing levels of responsibility, the likelihood of an experience of counterfactual emotions is also decreased: When there is no responsibility for the outcome, any emotional experiences are likely to be based on evaluations of reality. I found that children experienced no change in emotion when they held no responsibility at all for the outcome of the game, yet when they were responsible for the outcome, children experienced both regret and relief.

I have provided evidence against the argument that children were using non-counterfactual strategies to think about the game in this thesis. My results were consistent with the literature regarding responsibility and counterfactual emotions: As the responsibility for the outcome decreased, the likelihood of children's experiences of counterfactual emotions also decreased. I have provided support that children indeed respond to the task in this thesis by using counterfactual thinking. If children had reasoned about reality, or engaged in basic conditional reasoning (Rafetseder et al., 2010; Rafetseder & Perner, 2010) and responded using default assumptions about the circumstances, their responses would have revealed no effect of responsibility.

In the Choice condition of Experiment 6, the procedure replicated Experiments 3 and 4. The results of the Choice condition in Experiment 6 are similar to the results of Experiments 3 and 4. That is, from the age of 5 to 6 years old, children experienced regret and relief.[*] However, children only experienced relief after a negative outcome at a later age. In Experiment 6, children were able to experience relief after a negative outcome at the age of 7 to 8 years old. In Experiments 3 and 4, children experienced relief under these circumstances aged 6 to 7 years old. This difference in ages could be due to variations in age or linguistic skill amongst the participants. This variation between 6- to 7-year-olds and the 7- to 8-year-olds could be the subject of future research if we are to identify the age at which children are able to think about negative outcomes that could have been worse. However, despite the difference in ages, Experiments 3, 4 and 6 have been consistent in demonstrating that children's thinking about a negative outcome that could have been worse, is later developing than their thinking about other positive and negative counterfactuals.

[*] Experiment 6 did not include participants aged 4 to 5 years old. Children of this age had demonstrated some fledgling abilities to experience regret (see Experiment 3).

In the No Choice-Child condition, children were less likely to experience regret or relief than in the Choice condition. However, children still experienced counterfactual emotions. In the No Choice-Child condition, the relationship between responsibility and counterfactual emotions was investigated under circumstances when responsibility for the outcome was reduced but not eliminated. The outcome of the game was based on a chance event: the roll of a die. However, it was the participants themselves who rolled the die, so the outcome of the die *could* have been attributed to the participants. For example, on relief trials, participants' thoughts could have been similar to "Thank goodness I rolled the die to get the better of the two outcomes", whereas on regret trials, participants may have denied holding responsibility for the more negative outcome, "It's not my fault that the die told me which card to get". Although I found no differences between regret and relief, the Binomial test results for the two younger groups hinted that children were more likely to experience counterfactual emotions when they won rather than when they lost. This finding provides some support for one of the predictions of Experiment 6: Positive outcomes may be attributed to personal involvement but negative outcomes may be attributed to external factors, such as chance (e.g., Langer & Roth, 1975, Wortman, Costanzo & Witt, 1973) or a higher being (Shefrin and Statman, 1986). This effect would not be seen in the No Choice-Experimenter condition as there was no responsibility for the outcome, thus children would not need to make such attributions of responsibility: They were simply not responsible for the outcome. This effect may not have been seen in the Choice condition as children were wholly responsible for the outcome. Alternatively, the feelings of responsibility for the outcome may overpower any other effects, such as attributing negative outcomes to another source.

The results of the No Choice-Child condition revealed that when there is less responsibility for an outcome, the likelihood of an experience of regret and relief is reduced. It is only in this condition that we are yet to determine what children were thinking. Children may have made the comparisons between the counterfactual alternative and reality, just as they did in the Choice condition, but they were not as influenced by this comparison as they were in the Choice condition. Such a possibility could be labelled "shifting the blame", as children were aware of the consequences of the outcome but chose not to act upon them: The outcome of the comparison did not seem to influence children's experiences of regret or relief. Alternatively, there is the possibility that children did not think counterfactually in the No Choice-Child condition. This possibility would mean that children did not make the comparison of reality with the counterfactual. Rather, they focussed only on reality. Both these possibilities ought to receive attention from future research if we are to determine what children think when they are not totally responsible for an outcome.

The results of Experiment 6 provide evidence that after the No Choice-Experimenter condition, children do not experience counterfactual emotions. However, children may still have an emotional experience. In the introduction to this experiment (see page 157), I described the non-counterfactual alternative emotions, frustration and happiness. These emotions are most likely to be experienced when there is no counterfactual thinking process. What is interesting to consider is if these emotions, based on reality, are influenced by control, i.e. can one feel frustrated at a set of circumstances out of one's control? Consider the example of the aeroplane passenger delayed at the airport. If the passenger is delayed due to technical faults with the

aeroplane, these are clearly events out of his control. This is enough reason for him to experience frustration: The technical faults are causing an obstruction to his goal, his holiday. Even if the passenger is delayed due to circumstances within his control, e.g., he forgets his passport, his goal of having a holiday has been obstructed, and thus he will experience frustration. Recall that frustration is an emotional reaction to a state of affairs: it is not a counterfactual emotion. An error of forgetting one's passport is likely to trigger counterfactual thinking ("If only I picked up my passport on my way out") (Kahneman & Varey, 1990), and thus counterfactual emotions are more likely to be experienced above and beyond frustration. Frustration is likely influenced by control, similarly to regret, but under circumstances within one's control, counterfactual thinking, and counterfactual emotions, are also likely to be experienced.

In Experiment 6, I found that the greater the responsibility over the outcome, the greater children's feelings of regret and relief. Children's performance was poor when they had no responsibility for the outcome, yet performance was excellent when they were completely responsible for the outcome. These results reject the possibility that in the experiments within this thesis, children were using non-counterfactual thinking strategies to reach the target response. I have provided evidence that confirms children have been thinking counterfactually to achieve the target response.

Chapter 6

General Discussion

6.1. Summary

In this thesis, I aimed to explore children's first experiences and understanding of the counterfactual emotions, regret and relief. My experimental work fell into three themes: In the first theme, in Experiments 1, 3 and 4, I attempted to find the youngest experience of regret and relief. Additionally, I explored the circumstances under which children experience regret and relief. That is, children's experiences of regret were investigated after both initial positive and negative outcomes: Children discovered that the alternative could have been better. Children's experiences of relief were investigated after both initial positive and negative outcomes: The alternative could have been worse. I aimed to determine the age at which children acquired an adult-like ability to think about regret and relief. In the second theme, Experiments 2 and 5, I shifted the investigation from children's own experiences of regret and relief to children's understanding of others' regret and relief. In the third theme, Experiment 6, I investigated the possibility that children were using alternatives strategies to respond to the game in this thesis. As such, Experiment 6 ensured that the game in this thesis did indeed investigate children's counterfactual emotions rather than provide children an opportunity to think about reality.

The motivation for the first theme, children's first experiences of regret and relief, was due to the gap in the literature. In my review of the developmental counterfactual emotions literature, there was evidence that children first understood that another would experience regret from the age of 7 years old (Beck & Crilly, 2009; Guttentag & Ferrell, 2004; Ferrell et al., 2009) but there was no positive evidence for the first age that children could experience regret and relief themselves. In Chapter 1, my investigation into children's first experiences of these emotions, I identified that

children as young as 5 to 6 years old were able to experience regret whereas only older children, aged 7 to 8 years old, were able to experience relief. However, I identified that relief trials may have been artefactually difficult for young children. I made several improvements to the methodology: I changed the number of tokens that could have been won or lost so that there was greater possibility that the counterfactual alternative would be viewed as significant by participants. I made the difference between reality and the counterfactual equal across both regret and relief trials. I adapted the scale so that children were able to show regret and relief equally well. Upon improving the methodology, I found that children were able to experience both regret and relief from the age of 5 years old (Experiments 3 & 4).

Interestingly, in Experiment 3, children aged 4 to 5 years old demonstrated a fledgling experience of regret. Children's performance at this age provides support for Riggs et al. (1998) and Guajardo and Turley-Ames (2004) who argued that 4-year-olds are able to think counterfactually. However, in Experiment 4, I was unable to find consistent evidence for 4- to 5-year-olds' experiences of regret. It was possible that there were age differences between the 4- to 5-year-olds across Experiments 3 and 4. Younger 4- to 5-year-olds (M = 4;9) did not experience regret, but older 4- to 5-year-olds did (M = 5;1), thus, children at around their 5th birthday may have developed the necessary cognitions to experience regret.

There remained the possibility that children were in fact able to experience regret and relief from a younger age but unable to report these feelings as they were not explicitly available to them. Children may implicitly experience regret and relief before they were aware of their own experiences. Children's implicit knowledge may

develop earlier than their explicit knowledge (Clements & Perner, 1994; Karmiloff-Smith, 1992; Onishi & Baillargeon, 2005; Zelazo, 2002). Thus, it may be possible that children younger than 5 years old are able to experience regret and relief but they are not able to make responses based on them. To investigate children's implicit responses, I analysed their facial expressions as an indicator of implicit regret and relief, immediately after revealing the counterfactual outcome of their decision. Children did not demonstrate the target implicit responses to what could have been. These results were evidence that children's implicit responses were not seen earlier than their explicit responses.

The second theme of this thesis concerned children's understanding of others' regret and relief. The established literature suggests that children can first understand regret from 7 years old (Beck & Crilly, 2009; Guttentag & Ferrell, 2004; Ferrell et al., 2009), but there was no positive evidence for children's understanding of relief. I initially found that children up to the age of 6 to 7 years old did not understand that another would experience regret or relief under the same circumstances that children were able to experience these emotions themselves. Once I made the three changes to the methodology (the number of tokens won or lost on the alternative card, reality and the counterfactual were equal across both regret and relief trials, children were able to show regret and relief equally well on the scale), children understood that others would experience regret and relief from the age of 5 to 6 years old. Children did not understand that Arnold would experience relief after a negative outcome until they were at least 8 to 9 years old. Thus, the pattern of results was similar to children's own experiences of regret and relief.

In my investigation into children's understanding of others' regret and relief, I asked children to provide justification to support their judgements of another's happiness after seeing what could have been. Children's justifications were used to make explicit what children were thinking when they responded on the scale. Despite children's overall good performance in identifying Arnold's emotion on the scale, children were unable to provide counterfactual justifications to support their response until they were 8 to 9 years old. Rather, children referred to descriptions of reality. I found a mismatch between an understanding and providing a justification of an understanding. A similar mismatch has been demonstrated within the Theory of Mind literature between performance in attributing the correct emotion on the task in hand and justification of the emotional attribution (Bradmetz & Schneider, 1999; Hadwin & Perner, 1991; Rosnay et al., 2004). Justification of another's experiences may be a later developing ability. One may expect children to have also struggled to provide a justification for their own experiences. I did not investigate this possibility, but if one were to find a similar mismatch between children's experiences and their justifications to support their experiences, one could be more confident that an ability to provide justifications of counterfactual emotions is later developing than a handling of the emotions themselves.

As experiencing and understanding regret and relief requires counterfactual thinking, it is necessary to discuss how these first two themes fit into the counterfactual thinking literature. There is evidence to suggest that until children are 5 years old, they are not able to represent counterfactuals as dual possibilities (Beck et al., 2006; Beck & Crilly, 2009; Byrne, 2002). That is, children only think counterfactually when they understand that at a previous point in time, before any outcome was determined,

that an alternative outcome could have occurred. I found evidence that children were able to experience regret and relief from the age of 5 to 6 years old. The findings within this thesis are consistent with the dual possibilities account: Children are not able to experience or understand regret and relief until at least 5 to 6 years old. Although I have not tested children's thinking of counterfactuals as dual possibilities, it is likely that if children do not think that alternative possibilities could have been before any alternatives were revealed, children would not be able to experience or understand regret and relief.

I found that children aged 4 to 5 years old demonstrated a fledgling experience of regret. If children of this age do not think about dual possibilities (Beck et al., 2006), how are they able to experience regret? Some psychologists claimed that children can engage in counterfactual thinking at a younger age. Harris et al. (1996) and German and Nichols (2003) provided evidence that 3-year-olds can think counterfactually. Riggs et al. (1998) and Guajardo and Turley-Ames (2004) argued that children are not able to think counterfactually until 4 years old. The differences between these tasks may be the linguistic sophistication required, the load on information processing or the structure of the counterfactual questions. At a later age, it is evident that the developments of language and information processing are sufficient for one to achieve the target answer irrespective of the structure of the question. Thus, it is likely that there are gradual developments within counterfactual thinking, beginning at 3 years old, before children were able to think counterfactually with adult-like competence. Based on this gradual developments account, the results of the 4- to 5-year-olds are not surprising. There may be adequate developments within 4- to 5-year-olds' thinking so that they can begin to experience regret. In addition, recall that only older

4- to 5-year-olds experienced regret. Thus, these older 4- to 5-year-olds may have an early understanding of dual possibilities: If one were to replicate Beck et al.'s (2006) study into children's handling of dual possibilities, but with age groups of two or three months rather than year groups, we may discover that children's understanding of dual possibilities is at a younger age than we have previously thought.

The third theme of this thesis concerned the strategies that children may have been using to achieve the target answer. There was the possibility that children responded to the task by referring to reality rather than thinking counterfactually. Rafetseder et al. (2010) and Rafetseder and Perner (2010) argued that one particular alternative strategy is basic conditional reasoning and that up to the age of 6 years old, children use this logical reasoning to reach the same answer as counterfactual thinking. If children based their responses on the default assumption that if a card stated a win of some stars, they would feel happy, or if the card stated a loss of some stars, they would be sad, their responses may have been interpreted as genuine experiences of regret and relief. Children's responses throughout this thesis cannot be explained by such simple default assumptions, as these assumptions would lead to differences in the results of the two –win trials. The same would apply for the two –lose trials. An alternative explanation is that children made comparisons of reality to what they did not win: If children did not win eight, they would be sad, which was the same target response as that of regret. If children did not lose eight, they would be happy, the same target response as relief. Similar to Rafetseder et al.'s claim, children's responses to the game within this thesis may have been false positives.

To address this possibility, I manipulated children's responsibility for the outcome.

There is evidence within the adult counterfactual emotions literature that a greater sense of responsibility for the outcome leads to a greater experience of regret and relief (e.g., Burks, 1946; Byrne, 2002; Markman & Tetlock, 2000; Roese & Olson, 1995; Zeelenberg, van Dijk & Manstead, 1998; Zeelenberg et al., 2000). Results confirmed that children showed a change in emotion when they were responsible for the outcome, replicating results of Experiment 3 and 4. In the condition with reduced responsibility, children were less likely to show these changes. In Experiment 6, results provided evidence of the need for responsibility for the outcome to experience of regret and relief. As children experienced regret and relief when responsible for the outcome, but did not when they did not hold responsibility for the outcome. I have provided evidence that children's responses were based on counterfactual thinking rather than non-counterfactual thinking strategies.

These three themes further the counterfactual thinking literature. The literature describes gradual developments within counterfactual thinking. I can extend these gradual developments to counterfactual emotions. Children have fledgling experiences of regret aged 4 to 5 years old and they first experience relief aged 5 to 6 years old. Children experienced relief after a negative outcome at a later age, at 7 to 8 years old. A similar pattern can be found for children's understanding of these emotions: Children first understood that another would experience regret and relief at 5 to 6 years old. Children's understanding of relief after a negative outcome develops later at 7 to 8 years old. At an even later age, 8 to 9 years old children are able to justify their understanding.

6.2. Links to the established literature

Children's understanding of both regret and relief has been subject to more research than children's experiences of the same emotions. Amsel and Smalley (2000) revealed that children aged 3 to 4 years old were unable to infer that another would experience regret or relief. Guttentag and Ferrell (2004) reported that children aged 7 years old were able to understand regret but not relief. Ferrell et al. (2009) found that once children were aged 7 to 8 years old, they were able to identify from two protagonists, the more regretful target protagonist. McCloy and Strange (2009) replicated this finding. Yet, before the findings within this thesis, there was no positive evidence of children's understanding of relief.

The results of Experiment 5 revealed that children were able to understand regret after both positive and negative outcomes from the age of 5 to 6 years old, the same age at which children were able to experience regret themselves. These results provide the first positive evidence for children's understanding of relief and the earliest evidence of children's understanding of regret. Children demonstrated an understanding of relief after a negative outcome at 8 to 9 years old, a relatively late developing ability. These results from children's own experiences and understanding of these emotions are the basis for two conclusions: The first is that there may be no difference between children's experiences of regret and relief and their understanding of regret and relief. The second is that to experience and understand relief after a negative outcome, i.e. something negative that could have been worse, further developments in children's thinking are required.

Throughout this thesis, I found regret and relief to be understood earlier than

Guttentag and Ferrell (2004), Amsel and Smalley (2000), Ferrell et al. (2009) and Beck and Crilly (2009). It may be possible that the difference between my results and those in the established literature is due to differences in methodology. Within the literature, researchers have used a stories task: Children are read a story and have to answer questions based on the events. In my tasks, I used a games task. Children played a game or watched another play a game and had to answer questions based on those events. A further difference was that in my experiments, children had to infer the happiness of only themselves or one protagonist rather than make a comparison between two. In the literature, participants had to identify which of two protagonists would experience the greater regret. Perhaps future work ought to consider these differences between the two methodologies. It seems that children's experiences and understanding of regret and relief in the games task are seen at an earlier age than in the stories task. As such, children's relative difficulty with the stories task in comparison to the games task should be subject to further work. There are two differences in methodology reported here: a narrative task (stories) or an interactive task (games), and the number of protagonists within the task, one or two. Here, I have identified an opportunity for future work. This work could involve a direct comparison between the methodologies and the number of protagonists. Based on the results of this thesis and the established literature, one would expect that others' regret and relief in a stories task and two protagonists would be understood at a later age than others' regret and relief in a games task and one protagonist. If this were the case, we would have further evidence of gradual developments to achieve adult-like counterfactual thinking: As stories have to be imagined, they would require greater demands on information processing, particularly working memory, thus one would expect others' regret and relief in games to be understood at an earlier age than others'

regret and relief in stories. A similar pattern would be expected for the number of protagonists. Additionally, if the differences between methodologies and the number of protagonists were to be reduced with age, this would be adequate evidence for a gradual developments account within children's understanding of others' emotions.

Children's performance on Relief Initial-Lose trials has been worse than that on the other three trials, for both children's understanding and experiences. Children's first success on these trials was seen at 6 to 7 years old, when they experienced relief, but it was not until 7 to 8 years old that they understood that another would experience relief. It is a relatively late development to experience or understand relief after a loss that could have been an even greater loss. Larsen et al. (2004) labelled these trials as "Relieving Losses". It may be possible that relieving losses elicit relatively neutral emotional reactions and are thus manifested by little or no positive or negative affect (Mellers et al., 1997). Another possible explanation for children's performance on the relieving losses trials is that children were experiencing mixed emotions, happiness and sadness, at the same time (i.e. one may be sad at choosing a losing card but happy upon realisation that this card was the best possible outcome). If this was the case, children would have responded to neither regret nor relief, and used the upwards-facing arrow. However, this explanation does not account for children's good performance on another mixed emotion trial, the Regret Initial-Win trial. Larsen et al. (2004) labelled these "Disappointing Wins". These are experienced after a positive outcome that could have been better. My Regret Initial-Win trials involved a positive outcome (winning two tokens) that could have been better (could have won eight tokens). Larsen et al. and Mellers et al. (1997) reported that disappointing wins resulted in the same pattern of results as relieving losses. Thus, children's

performance on the Regret Initial-Win trials ought to have been similar to the Relief Initial-Lose trials.

It may be possible that the combination of a negative reality and a negative counterfactual alternative placed high demands on children's information processing. These demands may have been too great for young children. However, it would seem likely that the same processing demands are required for the combination of a positive reality and a positive counterfactual alternative. It is not clear why there would be a difference. If there were to be a difference in counterfactual thinking between two positives and two negatives, one would expect that children would be more proficient at thinking about the negatives based on the established literature, as negatives are more likely to trigger counterfactual thought (German, 1999; Gleicher et al., 1990; Kahneman & Tversky, 1982; Roese, 1997).

What is it about the Relief Initial-Lose trials that is more difficult for younger children than the Regret Initial-Win trials? The reasons behind children's relative difficulty with Relief Initial-Lose trials cannot be answered by the current work in this thesis, and as such, can only be left as unanswered questions. Further research is required if we are to understand when children think about relief after a negative outcome just as well as adults. There are several possible avenues for future research. One possibility is based on the evidence that more salient counterfactual alternatives may be stronger triggers for children (Ferrell et al., 2009): One could make comparisons of Regret Initial-Win trials and Relief Initial-Lose trials with manipulations made to the size of the counterfactual. Perhaps if the counterfactual was larger and more valuable than the tokens within this thesis, children may experience and understand the relief trials at

the same age as the regret trials. If this were the case, the possible alternative in my Relief Initial-Lose trials may not have been large enough for children to think about what they could have lost.

An alternative possibility is to alter the methodology so that rather than asking children about how they felt, children could read descriptions of feeling even happier on Relief Initial-Lose trials, and even sadder on Regret Initial-Win trials, and asked to explain why this would be the case. One would expect children to provide counterfactual explanations on the Regret Initial-Win trials, as I found that children from 5 to 6 years old were able to experience and understand regret. In contrast, on Relief Initial-Lose trials, one would expect children of this age not to provide a counterfactual answer, based on my findings that only older children, at 6 to 7 years old, experience and understand relief after a negative outcome. On the other hand, if children were to provide a counterfactual response, it may be the case that wording of the test question on the Relief Initial-Lose trial made it more difficult for children to provide the target response. However, there is no evidence to suggest that this would be the case: Why would a one test question lead to such different performance? If this methodology was to be run, results would provide greater evidence as to what children's were thinking on these particular trials.

A further piece of future work could include an investigation into adults' regret and relief. To investigate if negative outcomes that could have been worse are more difficult to process than positive outcomes that could have been better, one could run a similar methodology to the experiments within this thesis, but investigate adults' response times. In doing so, one may find that successful performance on the Relief

Initial-Lose trials requires a longer period of time before a response in comparison to the Regret Initial-Win trials. If there was no difference between the two trials, this may be evidence that children's difficulty with negative outcomes that could have been worse is limited to childhood developments. The nature of that particular difficulty remains unknown.

Within this thesis, I did not investigate children's executive functioning. It is useful at this point to note that there is evidence to suggest that developments of regret and relief are likely to be related to specific aspects of executive functioning, in particular inhibitory control. In the introduction, I reviewed evidence to suggest that inhibition is a necessary development for counterfactual thinking (Beck, Carroll, Brundson & Gryg, 2010; Beck, Riggs, et al., 2009; Riggs & Beck, 2007; Robinson & Beck, 2000). Recent research has identified that there are further developments within executive functioning in order to experience regret.

Burns, Beck and Riggs (under review) argued that to experience regret, one must have a degree of cognitive flexibility. Cognitive flexibility concerns an active comparison between reality and its alternative *plus* controlled shifts in attention between reality and the counterfactual alternative. Burns et al. predicted that children's ability to switch between tasks, a measure of their cognitive flexibility, would be a good predictor of children's experiences of regret. Their measure of cognitive flexibility was a task switching procedure, in which 4- to 7-year-olds had to press a button based on an eye gaze on screen. The eye gaze was Congruent with the button press (directly below the face, eyes looking down), or Incongruent (on the opposite side to the face, eyes looking across). Results identified that all children were less accurate and slower

to respond on the Incongruent trials than on the Congruent trials. Their measure of regret was a games task, similar to the one used in Experiment 1 of this thesis. Results found that 6-year-olds and the 7-year-olds showed regret. They rated themselves as less happy on regret trials than on baseline trials (the initial and alternative outcomes were the same), but the 4- and 5-year-olds did not demonstrate any evidence of an experience of regret. Overall, the researchers revealed that a greater cost of task switching is associated with a decreased likelihood of experiencing regret. With continued research into children's regret and relief, we improve our understanding of children's first experiences of regret and the necessary developments that children acquire in order for them to do so.

6.3. The scale

Within this thesis, children and adults rated their happiness on a five-point scale. I have used two similar scales: In Experiments 1 and 2, the scale ranged from very happy through neutral to very sad, based on a horizontal board. Children responded to the initial question by rating their or Arnold's happiness and then, after seeing what could have been, they had the opportunity to change their rating when asked the alternative question. When participants' provided a second rating that was more positive than the first, they experienced relief. When their second rating was more negative than the first, they experienced regret. In Experiment 3, I identified a potential problem with the scale: If children responded using the extreme of the scale after winning two stickers, when they then saw that they or Arnold could have won nothing, even if they experienced relief, they had no way of showing on the scale that they were even happier. The same applied for regret: Children who rated themselves as initially unhappy had no way of describing on the scale that they were even sadder.

The solution was to ask children to make a comparative judgement on the alternative question rather than a second rating. This comparative judgement permitted children to state that they were even happier, no different or even sadder than they were before. This may have been a satisfactory solution to the limitations of the original scale that I used.

It is also the case that the comparative scale has further advantages over the original scale that I used. There is evidence to suggest that if children are encouraged to stop and think about the answer in tests of inhibition, their performance improves. Diamond, Kirkham and Amso (2002) and Gerstadt, Hong and Diamond (1994) reported that when children had to report the opposite of a stimulus on a card (e.g., if children saw a picture of the sun, they had to say "moon"), performance in children as young as 4 years old improved when an impulsive response was prevented. Similar results have been reported when children had to direct an arrow to the correct answers and think about their answers, rather than point to the correct answers themselves, and respond impulsively (Beck, Carroll, et al., 2010; Carlson, Moses & Hix, 1998; Hala & Russel, 2001). In this thesis, children are directed to think about the alternative before they are asked to make a rating of happiness. In asking children the alternative question, they are prompted to stop and think about reality and the counterfactual. Similarly to Diamond et al., Gerstadt et al. and Beck, Carroll, et al., children may have spent time to think before they responded. In doing so, they were more likely to reduce any impulsive responses to the game and as such, improve their performance.

It may have been possible that children were inhibited from providing an impulsive response on the comparative scale based on having to think about which of three

options one should choose, but not on the original scale. In order to determine the effect of the scales, further work could compare children's responses based on the different scales. A comparison between the original scale and the comparative scale on the two regret and the two relief trials would determine the effect of the scale. If an effect of scale was found, this would have implications for how we ask children about their feelings, and in relation to counterfactual events, we should encourage children should stop and think about their feelings before they report them.

6.4. Future work

The research that I have presented in this thesis has left some questions unanswered. Several possibilities for future research have been identified. Here, I discuss the most interesting follow-up work to the experiments reported in this thesis.

One of my most surprising results was that the 4- to 5-year-olds demonstrated an experience of regret in Experiment 3. This fledgling development is the earliest positive evidence of young children's ability to experience regret: Three years younger than the literature currently reports. However, I failed to replicate this finding in Experiment 4. This was possibly because the 4- to 5-year-olds in Experiment 3 had a mean age several months older than the 4- to 5-year-olds in the other experiments. This could be evidence that the earliest development of children's experiences of counterfactual emotions is around children's 5th birthday. The question remains as to what 4- to 5-year-olds' abilities are in terms of experiencing counterfactual emotions.

In terms of the counterfactual thinking literature, the gradual developments within children's counterfactual thinking are in line with the finding that 4- to 5-year-olds

can experience regret. However, this is speculative and future research should consider a comparison between children's experiences of regret with their ability to reason counterfactually. Beck and Crilly (2009) were made a direct comparison between regret and counterfactual thinking. They used a stories task, similar to Guttentag and Ferrell (2004). Future work may consider the use of a regret task similar to the interactive task used in this thesis. Studies involving a narrative task, based around two protagonists, have produced inconsistent results (e.g., Guttentag & Ferrell, 2004; Guttentag & Ferrell, 2008). Children's consistent performance on an interactive task, with the exception of the 4- to 5-year-olds, suggest that such a methodology may be more appropriate than a narrative task for investigating children's experiences and understanding of regret. If, using an interactive task, one were to compare children's regret and their counterfactual thinking, one may find further evidence to support or reject the conclusions of the current counterfactual thinking literature: Counterfactual thinking may be gradual in its development and there are sufficient developments by the age of 4 to 5 years old in order to experience some form of regret. Only with later developments do children fully experience and understand regret and relief.

Results of Experiment 5 revealed that children are able to understand regret and relief at the same age that they are able to experience them. In Experiment 6, I provided evidence that with greater responsibility for the outcome, the more likely children were to experience regret and relief. I did not investigate children's understanding of regret and relief under varying levels of responsibility, only children's experiences. If one were to investigate the relationship between children's understanding of counterfactual emotions and responsibility, one would determine if children are able

to infer that another would only experience regret if they were responsible for the outcome. To investigate this hypothesis, future work should investigate children's understanding of others' regret and relief under varying levels of responsibility over the outcome. Future research could replicate Experiment 6 and, in addition, include conditions that manipulated others' responsibility for the outcome, in a similar manner to Experiment 5. In doing so, one would be able to add strength to the claim that children's experiences and understanding of regret and relief develop in parallel. One would expect that children would be able to infer that another would be less likely to experience regret and relief when there is less responsibility for the outcome, replicating the pattern for one's own experiences of counterfactual emotions. Alternatively, there may be no effect of responsibility for the outcome on children's understanding of regret and relief. If this were the case, children may not understand that regret and relief can only be experienced if a protagonist is responsible for the outcome. Another interpretation is that children may understand the effect of responsibility, but are not influenced by this effect when it comes to others' regret and relief. Future work should consider that if there was no effect of responsibility on children's understanding, these possibilities would mark the differences between children's experiences and their understanding of counterfactual emotions.

This thesis concerns typically developing children's experiences and understanding of regret and relief. It would be interesting to extend these findings into the atypical development literature. Research into counterfactual thinking and autism has found some surprising results: Scott and Baron-Cohen (1996) found that children with autism may have no deficit in counterfactual thinking. To think counterfactually, children have to face the initial difficulty of inhibiting the real world when thinking

about what could have been and they must make the comparison between reality and the counterfactual (Amsel & Smalley, 2000; Ferrell et al., 2009; Guttentag & Ferrell, 2004; Markovits, 1995; Scott, Baron-Cohen & Leslie, 1999). Children with autism may struggle to compare reality to the counterfactual as they as they have deficits in integrating information in relation to context and previous knowledge (Frith, 1989; Happe, 1997). Thus, children with autism may think about counterfactuals as isolated information, without the drive to compare reality to the counterfactual. Scott et al. provided evidence that autistic children's performance on an abstract counterfactual task was not impaired and their performance was significantly better than two control groups. There is no research into autistic children's experiences of regret and relief. Theoretically, autistic children may not be able to experience regret similarly to typical developing populations as they may struggle with the comparisons between reality and the counterfactual. Future research may consider a task similar to the one used in this thesis with autistic populations.

Research into autistic children's experiences of regret and relief would be strengthened by research into their understanding of regret and relief. The established literature reports that autistic children's understanding of emotion caused by situations and desires was no different than a typical developing group (Baron-Cohen, 1991; Capps, Yirmiya & Sigman, 1992; Dapretto et al., 2006). These emotions however, were simple emotions, such as happiness and sadness following a reaction to reality. Similarly to Experiment 5 of this thesis, one may consider an investigation into autistic children's understanding of counterfactual emotions to determine if autistic children's apparent success with handling counterfactuals (Scott et al., 1999; Scott & Baron-Cohen, 1996) extends to their understanding of the emotions regret and relief.

Integration of research into practice is a challenge for lawmakers, practitioners and teachers to name but a few professions. Further work into children's thinking about regret and relief may benefit from the links between the theory and the practice. Throughout this thesis, implications may be evident for teachers and parents who attempt to consider encouraging children to feel regret or relief, only to find that this falls on uncomprehending ears. One could investigate adults' understanding of children's regret and relief. Based on the findings within this thesis and the established literatures, one could give teachers and parents several scenarios that depict young children who achieve negative or positive outcomes, only to realise that they could have been better or worse off. Adults could be asked to report children's experiences at that time. In addition, adults could be asked to determine if children would understand that another would experience regret or relief. It would be interesting to determine what adult's know about children's counterfactual emotions. For example, imagine a children's hockey coach who was shouting at his 4-year-old attacker, "If only you had played in your position, you would have scored that goal." The hockey coach shouted such a comment so that the child would not only feel upset about not scoring, but to regret his actions as he could have scored. Would adults be aware that such a comment should fail to elicit regret in this child, but not in a 6-year-old?

6.5. Conclusion

In conclusion, I have suggested several new avenues of research that address the unanswered and most interesting follow-up questions from the findings in this thesis. I have presented some evidence that children can experience a fledgling regret from the age of 4 to 5 years old. Children demonstrated an experience and an understanding

of both regret and relief from the age of 5 to 6 years old but they do not have the ability to experience or understand relief after a negative outcome until they are at least 6 to 7 years old. These findings provide evidence for gradual developments within counterfactual emotions. The results of this thesis should further our understanding of children's thinking about regret and relief. These results, however, leave open the questions of what has developed at the age of 4 to 5 years old, through to what develops further when children are able to provide counterfactual justifications to why another would experience regret and relief at 8 to 9 years old. From the experiments within this thesis, I can only speculate about these developments within counterfactual emotions but the methods that I have developed offer exciting new directions in a growing field of developmental psychology.

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