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The purpose of the present study was to further investigate age differences in children's understanding how counterfactual reasoning affects emotions. More specifically, the study was designed to study the effect of the salience of the counterfactual alternative on judgments of others' emotions, and to examine possible correlates of individual differences in the understanding of counterfactual-reasoning-based emotions. The individual differences that were measured were verbal ability, information processing capacity, and perspective taking ability.

Thirty 6-year-olds, 36 7-year-olds, 36 8-year-olds, and 34 adults were each presented 4 scenarios. Each story involved two characters who experienced the same negative outcome; one character, however, would have avoided the outcome if he had made a different decision, whereas the other character would not have been able to avoid that outcome even if he had made the alternate decision. For half of the participants, the stories were written in such a way that it was made very salient that the characters reflected on "what might have been" if they had made the alternate decision about what to do; that information was less salient in the stories presented to the remaining participants. The participants also completed the measures of individual differences in processing capacity, verbal ability, and perspective taking ability.

Overall, adults stated that the character who could have avoided the negative outcome would feel worse about his or her choice than would the other character, but the

majority of the children stated that the two characters would feel the same. When the characters' thoughts were explicitly stated (high salience stories), however, 8-year-olds showed a response pattern closer to that of the adults than they did with the lower salience stories.

The analyses of individual differences revealed that, after age was taken into account, perspective taking (as measured by a test of second-order theory of mind ability) was the only measure of individual difference that remained a significant predictor of counterfactual emotion understanding. The importance of different social cognitive abilities for understanding people's affective responses to thinking about alternatives is discussed.

CHILDREN'S UNDERSTANDING OF COUNTERFACTUAL EMOTIONS: AGE
DIFFERENCES, INDIVIDUAL DIFFERENCES, AND THE EFFECTS OF
COUNTERFACTUAL-INFORMATION SALIENCE

by

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CHAPTER I

INTRODUCTION

Background

When people think about how things could have happened differently by mentally altering past events, they are engaging in “counterfactual” thinking. Research has shown that a number of situational factors affect the degree to which people will engage in counterfactual reasoning. These factors, which include exceptionality, involvement, controllability, and timing (Kahneman & Miller, 1986; Roese & Olson, 1995), affect counterfactual reasoning by making an aspect of a situation more “mutable,” that is, more easily changed mentally to permit consideration of an alternate reality. For example, a person is more likely to think about alternatives to reality when the situation involves an atypical or exceptional course of action rather than a typical or normal routine, when the person is more rather than less involved in the cause of an outcome, when the situation is thought to be readily controllable, and when the outcome is temporally close to an alternative outcome.

Counterfactual reasoning serves two major purposes: 1) to help people learn from their mistakes for future decision-making, and 2) to help people feel better about situations that could have been worse (Roese & Olson, 1995). Judgments about what could have changed a situation, and what alternate outcome could have resulted, have also been found to evoke certain emotions. These emotions, such as

regret, relief, and disappointment, are termed “counterfactual emotions” because all involve a comparison of a present situation with an imagined alternative to reality” (Roese & Olson, 1995). Different types of counterfactual thinking determine these emotions. Counterfactual thinking can be upward, which occurs when the imagined alternative to reality is more positive than the actual situation, or downward, in which the imagined alternative to reality is more negative than the actual situation (Kasimatis & Wells, 1995). When a person engages in upward counterfactual thinking, it is likely that he or she will feel regret. If the person engages in downward counterfactual thinking, however, that person would be likely to feel relief.

Counterfactual thinking has also been linked to the understanding of causal relations. Wells and Gavinski (1989) showed that people attribute greater causality to an antecedent when an alteration of that antecedent would have caused a different outcome than if altering the antecedent would have led to the same outcome. In their study, when participants were presented with a story in which a woman died from an allergic reaction from a meal chosen by her boss, the choice of dish was given more weight if the dish not chosen would not have caused the reaction than if the reaction would have occurred even if the alternative dish had been chosen. Wells and Gavinski (1989) concluded that when an event is perceived as causal, it must have a counterfactual that would not have caused the outcome and that the mental availability of the counterfactual alternative affects the perceived degree of causality.

Recent research with children has begun to explore the role of counterfactual thinking in children’s judgments of causality. Harris, German, and Mills (1996) presented

children scenarios in which an obvious alternative would have changed the outcome (e.g., using a pencil instead of a black pen would not have caused Sally's fingers to get inky) or in which the obvious alternative would not have changed the outcome (e.g., if Sally had chosen a leaky blue pen instead of a leaky black pen her fingers still could have gotten inky). Harris et al. (1996) found that children 3 to 5 years of age were able to differentiate actions that could have prevented the outcome from actions that would have resulted in the same outcome and, based upon the use of the counterfactual information, made judgments of causality accordingly. The finding that children demonstrate counterfactual reasoning abilities as part of their causal reasoning judgments beginning at 3-4 years of age is supported by other research as well (German, 1999; Riggs, Peterson, Robinson, & Mitchell, 1998).

While young children are able to use counterfactual reasoning to determine causality for different events, it remains unclear if children understand how counterfactual reasoning affects people's emotional responses to such situations, and it is not known how this understanding develops. Although previous researchers have found that children are able to understand the situations that produce the basic emotions of happiness and sadness by 5 years of age (Fabes, Eisenberg, Nyman, & Michaelieu, 1991), are able to understand how the anticipation of happiness and sadness affects behavior by 5 years of age (Denham, 1988; Denham & Couchard, 1990; Strayer, 1986), and are able to understand how situations affect self-conscious emotions (e.g., pride, guilt, shame) after 7 years of age (Arsenio & Lover, 1995; Berti, Garattoni, & Venturini, 2000; Harris, Olthof, Terwogt, & Hardman, 1987; Harter & Whitesell, 1989; Nunner-Winker &

Sodian, 1988; Thompson, 1987), much less research has been done concerning the link between children's understanding of counterfactual reasoning and emotional responses.

In a recent study relevant to this issue, Meehan and Byrne (2005) presented 6 and 8 year old children with 2 characters playing a card game in which each character picked a card, and if the cards were the same, they won a prize. Research with adults, using similar kinds of scenarios, has found evidence for a temporal order effect with respect to judgments of guilt and the assignment of blame when the prize wasn't won; adult participants judge the character who was the second one to pick a card as being more to blame and feeling more guilt concerning the outcome than was the case for the first character (Byrne, Segura, Culhane, Tasso, & Berrocal, 2000; Miller & Gunasegaram, 1990; Walsh & Byrne, 2004). Meehan and Byrne (2005) found that although both groups of children in their study were able to understand how the situation could have been different, the 6-year-olds judged that both characters would feel equally guilty and blamed the two characters equally, whereas the 8-year-olds demonstrated judgments similar to those previously found with adult participants.

Only two studies have been reported that focus directly on the question of the development of the understanding of regret and relief. Amsel et al. (2003) found that although preschool children were able to judge how they and others would feel if they had received an imagined, "alternative to reality" outcome that was either more positive or more negative than what actually occurred, it was not until about seven years of age that children understood that this knowledge would affect their feelings toward the outcome. These findings suggested that although children as young as three or four years

of age may be able to understand how they and others would feel if events had unfolded differently from the way they actually occurred, (in other words, they can reflect on alternatives to reality and can make appropriate judgments of emotion responses for the basic emotions of happiness and sadness), it is not until children are about seven years of age that they understand how imagined counterfactual alternatives may affect feelings about actual events.

Guttentag and Ferrell (2004) examined children's understanding of the effects of factors affecting event mutability on judgments on both regret and relief. In their first experiment, which focused on the understanding of regret, children and adults were presented scenarios in which two characters experienced the same negative outcome but differed with respect to either the typicality of their actions or whether the critical decision involved an act of commission or omission. Guttentag and Ferrell found that 7-year-olds responded similarly to adults, judging that characters who actively chose the outcome or who strayed from a typical routine would feel worse about a negative outcome than would those who were more passive or who followed a usual routine. Five-year-olds, however, did not take these aspects of the decision into account when judging characters' feelings. In fact, the most common response from 5-year-olds was that the two characters would feel the same because they both experienced the same outcome.

Guttentag and Ferrell (2004) also included scenarios in which the characters might feel relief as a result of downward counterfactual thinking. As was the case with the first experiment, these stories involved two characters who differed with respect to

the typicality of a course of action or the degree to which the course of action resulted from an act of commission vs. omission. The only difference between the stories in the two experiments was that the characters in the second experiment experienced a positive rather than a negative outcome and “would have” experienced a more negative outcome if the alternative course of action had been chosen. Participants were asked to judge which character would feel happier about the outcome or whether they would feel the same. The pattern of results for the relief scenarios was different from the one found with regret scenarios, even though the stories used for each were structurally identical. Whereas 7-year-olds responded similarly to adults with the regret scenarios, there was a much more marked age difference between 7-year-olds and adults in the relief data. Adults also showed a somewhat reduced tendency to take into account the mutability of the decision; on average 62% of adults responded that the character whose decision was more mutable would feel better (i.e., would feel greater relief), whereas on average with regret judgments 79% of adults responded that the character whose decision was more mutable would feel worse. For the 7-year-olds, however, most participants in the second experiment judged that the two characters would feel the same, a finding which stands in marked contrast with the pattern of results at this age when judgments of regret rather than relief were assessed.

Guttentag and Ferrell’s findings with regard to the understanding of regret indicate that although children are able to reason counterfactually by age 5 years, it is not until 7 years of age that they show an understanding of how counterfactual reasoning can affect people’s emotions. The study of the understanding of relief showed that 7-year-

olds and adults were less likely to use counterfactual reasoning when judging other's emotions than those groups in the regret studies; indeed, for the 7-year-olds, little evidence was found that the children factored alternatives to reality into their emotional response judgments at all when the outcome of the situations was neutral or positive.

This difference between responses for negative and positive outcomes has been found in previous studies with adult participants. Kahneman and Tversky (1982) presented adult participants with vignettes in which two characters experienced the same negative outcome, but where one character performed an action and one character did not act to cause the outcome. They found the typical pattern of results with these kinds of judgments: participants judged that the character who acted would feel more regret than would the character who did not act. Landman (1987) gave adult participants vignettes similar to that of Kahneman and Tversky (1982), but included some stories in which the outcomes were positive. Participants were asked to judge which character felt more regret in the negative outcome conditions and also which character felt better in the positive outcome conditions. Landman found that for both outcome valances participants judged that the character who made an active decision would feel the resulting emotion more than did the other character. However, this pattern was significantly stronger for the stories with negative outcomes than for the stories with positive outcomes. Landman explains these findings as being due to our tendency to mentally weigh negative events more heavily than we do positive events.

Gleicher et al. (1990) performed a study similar to Landman's (1987) in which they investigated the effect of making the negative alternative to the positive outcome

more salient by explicitly stating the counterfactual alternative in the vignette. They felt that the differences found between positive outcome vignettes (relief) and negative outcome vignettes (regret) were due to the negative outcomes being more likely to elicit thinking about an alternative outcome and thus alternative antecedents. As in Kahneman and Tversky's (1982) study and Landman's (1987) study, the decision by the characters to follow a particular course of action was framed as an act of commission for one character and as an act of omission for the other character. Gleicher et al.'s results replicated the findings from the previous studies for the vignettes with negative outcomes, whether or not the counterfactual alternative was explicitly stated. They also found that when the outcome was positive and the counterfactual alternative was not explicitly stated, participants were significantly less likely to judge that the character that acted would feel better than the character who did not act. However, when the outcome was positive and the alternative was explicitly stated (salient condition), participants were highly likely to judge that the character who acted would feel better than the character who did not act.

Based on these findings, Gleicher et al. (1990) developed a four stage model to describe the process of feeling an emotion after imagining a counterfactual alternative. In Stage 1, the person creates a counterfactual outcome as a response to an actual outcome. In Stage 2, the person generates possible steps to having attained this counterfactual outcome. In Stage 3, the person judges the likelihood of the counterfactual outcome occurring based on these possible steps. In Stage 4, affective experience is based on the quality of the counterfactual alternative, the nature of the events that might lead to this

counterfactual alternative, the likelihood of this counterfactual situation, and the valance of the outcome that actually occurred. Gleicher et al. (1990) claim that with negative outcomes, a person experiences all four stages, but with positive outcomes, the first stage is not activated because people are not likely to spontaneously imagine alternatives to positive outcomes. In other words, they propose that negative outcomes serve as a much stronger trigger for, or supporter of, counterfactual reflection.

Proposed Study

The purpose of the present study was to examine further the development of children's understanding of the effects of counterfactual-reasoning based emotions. More specifically, the first goal of this study was to investigate how the manipulation of the salience of counterfactuals alternatives affects age differences in using counterfactual alternatives to understand others' affective states. The second goal of the study was to examine how individual differences in information processing capacity, verbal ability, and theory of mind ability predict performance on a measure of children's understanding of counterfactual reasoning-based emotions.

Effect of the Salience of the Counterfactual Alternative

Gleicher et al.'s study and model suggest that, for adults, the salience of an alternative-to-reality outcome affects the likelihood that emotion judgments will be affected by counterfactual reasoning processes. Gleicher et al.'s (1990) model may also assist in explaining the age differences in counterfactual reasoning that have been previously discussed in this paper. Gleicher et al. (1990) implied that the reason adults do not judge more feelings of relief for a character who acts than a character who does not

act when the alternative is not explicitly stated is because a positive event does not provide a strong enough trigger for the first stage of the process to occur. When, however, the process is triggered by explicit presentation of the possible alternative outcome, adults' emotion judgments for positive outcomes are affected by counterfactual reasoning in a manner parallel to the processes that occur for negative outcomes.

These findings raise the possibility that the “understanding” of counterfactual-reasoning-based emotions may not develop in an all-or-none manner. Rather, there may be age differences in the general tendency or ability to engage in counterfactual reasoning, and this pattern of age differences should interact with the strength of the “trigger” for counterfactual reasoning present in any situation to affect whether the alternative-outcome is taken into account when making an emotion response judgment. Thus, it is predicted, that when a counterfactual alternative is more explicitly stated, children will show adult-like performance at an earlier age than when the alternative is not explicit.

Individual Differences

In addition to studying the effects of manipulating the salience of the counterfactual outcome, the second goal of this study was to examine predictors of individual differences in the understanding of how counterfactual reasoning affects emotions. Presumably, by identifying factors associated with individual differences, we should learn more about the factors responsible for age-related changes in the understanding of counterfactual reasoning-based emotions. The factors of individual differences I investigated are based on the different abilities an individual needs to make

an emotion judgment in a counterfactual reasoning task, with certain abilities showing more influence at different stages of the process of a counterfactual reasoning task, such as in the process outlined by Gleicher et al. (1990).

While the model provided by Gleicher et al. is sufficient to describe the steps a person experiences when thinking of an alternative and then feeling a certain emotion, several elaborations are needed to describe the steps involved for a participant who is judging the emotions of two characters based on their mental actions of counterfactual reasoning. A participant in the previously mentioned studies involving the comparison of two characters (Gleicher et al., 1990; Guttentag & Ferrell, 2004; Landman, 1987; Kahneman & Tversky, 1982) must engage in thinking about the characters' mental processes, then go through the steps as described by Gleicher et al. for each character, then compare the two characters' affective responses based on these individual mental evaluations (see Figure 1).

According to this model, a participant must not only be able to go through the process of counterfactual reasoning to understand certain emotions, but also use perspective taking skills to understand other people's mental processes, as well as the ability to hold all of these steps in mind in order to accurately compare the two characters. Therefore, for young children, the age differences that have been found when participants are asked to determine who would feel worse when both characters experience an identical outcome, but are differing with respect to their mental reasoning, may be a result of problems with perspective taking or mental capacity instead of merely a problem with counterfactual reasoning. This idea is supported by the fact that adults

tend not to take antecedents into account when making judgments of emotions when the alternative is not salient, even though they clearly have the ability to do so (Gleicher et al., 1990; Landman, 1987).

Understanding of Mental States

False Belief Tasks. The first step required for participants in this study, and previous similar studies, is to think about the characters' mental processes involved in counterfactual reasoning. The ability to think about others' mental states has been found to emerge around 3-4 years of age (Astington, Harris, & Olson, 1988; Wellman, 1992). When children gain this ability, they are said to possess a "theory of mind" (Astington et al., 1988; Wellman, 1992).

There is reason to believe that the development of a theory of mind is related to the development of the understanding of counterfactual emotions. Several researchers have found a relationship between performance on false belief tasks and basic counterfactual reasoning abilities (Guajardo & Turley-Ames, 2004; Riggs & Peterson, 2000; Riggs et al., 1998). The reason for the connection between these two abilities remains unclear, however. Riggs et al. (1998) suggest that young children's difficulty with false belief tasks is due to problems with modified derivation (see Peterson & Riggs, 1999), which requires counterfactual reasoning ability. To use the modified derivation strategy, children must be able to ignore a piece of information and impose a new reality onto the situation. This ability to ignore reality for an alternative situation is a key to both counterfactual reasoning and performance on false belief tasks, where participants must

be able to think about an imaginary situation or belief different from what they know to be true.

Guajardo and Turley-Ames (2004) also found that counterfactual reasoning ability predicts false belief task performance, and suggest that this relationship may be the result of language ability, cognitive flexibility, or other cognitive abilities such as working memory or inhibitory control. They also suggest that although there is just a correlational relationship between counterfactual reasoning and false belief task performance, they argue for a causal relationship between the two variables such that counterfactual reasoning ability is necessary for, and therefore should develop before, the development of a theory of mind.

Arguing somewhat against this position, German and Nichols (2003) found that task complexity affects performance on tasks of counterfactual reasoning. They presented 3-and 4-year-olds with scenarios describing a series of causal events, and asked them to reason about alternatives that could have occurred at different parts of the story, creating the need for short, medium, or long lengths of inference. Children were also given standard false belief tasks. German and Nichols found a correlation between counterfactual reasoning and false belief tasks for the medium and long chains of inference, but not the short chain, after age was partialled out as a variable. Three-year-olds were able to correctly reason counterfactually when presented with the shorter chains of counterfactual reasoning, but had difficulty with the longer chains and the false belief tasks, suggesting that problems with false belief tasks were not a result of an inability to reason counterfactually per se. German and Nichols state that these results

indicate that there may be a more complex type of counterfactual reasoning ability that needs to develop to solve problems involving longer chains of inference and also to solve false belief tasks. They suggest that the development of basic cognitive abilities such as increased inhibitory control and working memory capacity may be the basis for correlations between counterfactual reasoning and false belief understanding.

Adding further to the complexity of the picture regarding counterfactual reasoning and theory of mind, Perner, Sprung, and Steinkogler (2004) did not find a correlation between counterfactual reasoning ability and false belief task performance once they partialled out age and verbal intelligence. In their study, children 3-5 years of age were able to solve a simple counterfactual problem, but had more difficulty with a more complex counterfactual scenario and the false belief tasks. These results suggest that because children were able to reason counterfactually in the simple scenario they should have the ability to respond accurately to the false belief questions, but the difference in performance and lack of a correlation imply that performance on these tasks is affected by differences in task and information processing demands.

Emotion Understanding. Whether or not children are able to reason counterfactually or understand false beliefs and hold a theory of mind, understanding other people's emotions resulting from counterfactual reasoning not only involves both of these abilities but the coordinated use of both of these abilities. Bradmetz and Schnieder (1999, 2004) have included questions about emotions in false belief tasks and found that children can understand a false belief (i.e., that Little Red Riding Hood believes her grandma is in the bed) but still give incorrect emotional assessments despite that

knowledge (i.e., that Little Red Riding Hood is afraid). They have shown that there is a developmental lag between understanding false beliefs and understanding false emotions based on that belief (Bradmetz & Schnieder, 1999), and also between false belief understanding and knowing if a character thinks he or she would be able to fulfill their desires in this false state of affairs (Bradmetz & Schnieder, 2004).

In a related study by Harris, Johnson, Hutton, Andrews, and Cooke (1989), children were told a story about a toy elephant that liked to drink either milk or Coke (but not both). They were told that a monkey switched the drinks and put them in the wrong containers. When 4- and 6-year-olds were asked how the elephant would feel when she drank the contents, both age groups were able to express the correct answers. When they were asked how she would feel before opening the container, however, 4-year-olds did not take the elephant's beliefs into account and instead responded according to their own beliefs. Six-year-olds accurately judged how the elephant would feel before opening the container based on her beliefs. This study by Harris et al. shows that even though 4-year-olds are able to identify people's basic emotions and are able to understand false beliefs, they have difficulty with tasks requiring them to make, and logically integrate, both kinds of judgments simultaneously.

In counterfactual reasoning tasks, participants are required to think about each character's mental processes following the steps involved in Gleicher et al.'s (1990) model, a process that is similar to false belief tasks in the sense that both tasks require participants to think about the mental states of another person. The process of thinking about a person engaging in the mental processes involved in Gleicher et al.'s

counterfactual-reasoning-based-emotions model is more complex, however, than that required by false belief tasks. Indeed, whereas children as young as 3-4 years of age can successfully perform a theory of mind task, it is not until about 7 years of age that participants are usually able to use take counterfactual situation emotion responses into account when judging a character's emotional responses to what actually occurred.

A more complex theory of mind task that has been used to study older children's understanding of other people's mental states is the second order theory of mind task (Perner & Wimmer, 1985; Sullivan, Zaitchik, & Tager-Flusberg, 1994). In a second order theory of mind task a participant must be able to understand a character's beliefs about another character's beliefs. Research using second order theory of mind tasks has demonstrated that they are more challenging than standard false beliefs tasks, although the exact age at which children can solve such tasks remains unclear; whereas Perner and Wimmer's original experiment found that it is not until 6 or 7 years of age that children successfully perform a second order theory of mind task, Sullivan et al. modified the stories to reduce the complexity of the stories while keeping the same structure and purpose, and found that children were able to successfully perform the tasks by 5 to 6 years of age.

In general, both second order theory of mind tasks and the kinds of counterfactual-reasoning-based emotion judgment tasks used in the present study would seem to have overlapping task demands; each requires not just the ability to understand another person's mental state, but the ability to make a judgment based upon the coordination of information about two people's mental states. Accordingly, in the

present study, one of the tasks presented to participants as a possible predictor of performance on the emotion judgment tasks was a second order theory of mind task.

Information Processing Capacity

The focus on the parallel levels of complexity of second order theory of mind tasks and tasks designed to assess the understanding of regret highlights the possible role of general information processing capacity as a variable that may affect performance on both kinds of tasks. Notably, an influence of information processing capacity on the relationship between false belief tasks and counterfactual reasoning tasks has been suggested previously by German and Nichols (2003) and Guajardo and Turley-Ames (2004), and other researchers have found a correlation between false belief tasks and measures of working memory capacity (Gordon & Olson, 1998). Because false belief tasks and counterfactual reasoning tasks both rely on an ability to think about an outcome while holding a different prior event in mind, it seems very plausible that age-related increases in processing capacity could be affecting both abilities. In the present study, along with previous similar experiments (Gleicher et al., 1990; Guttentag & Ferrell, 2004; Kahneman & Tversky, 1982; Landman, 1987), participants must be able to remember and consider the events of the story, both characters' mental processes, and compare the two characters in order to respond to the relevant test question. Thus performance on these tasks and the understanding of counterfactual emotions more generally may be limited by young children's limited processing capacity. Accordingly, the present study included measures of processing capacity in order to examine the relationship between processing capacity and the understanding of regret.

Verbal Ability

Another factor that has been found to be related to counterfactual reasoning ability is verbal ability. Guajardo and Turley-Ames (2004) found that when language ability was included as a control variable, age effects for performance on a counterfactual reasoning task were removed. Similarly, Perner et al. (2004) found that when age and verbal intelligence was controlled, the correlation between the false belief tasks and counterfactual reasoning tasks was eliminated. In the domain of emotion understanding, Pons, Lawson, Harris, and deRosnay (2003), who studied individual variability in emotion understanding, found a strong relationship between language ability and the ability to attribute basic emotions (e.g., happy, sad, just alright, scared) when presented with different scenarios in children aged 4-11 years, even when age was controlled. They suggest that language is important for the understanding of emotions because language is a tool of both cognitive representation and social communication. Verbal ability will therefore also be assessed in the present study to investigate any possible relationship between verbal ability and performance on the counterfactual emotion task used in this study.

Summary

In summary, the purpose of the present study was to examine the development of children's understanding of regret by manipulating the salience of the counterfactual alternative, and by examining factors correlated with individual differences in the understanding of counterfactual emotions.

CHAPTER II

METHOD

Participants

The participants were 30 6-year-olds ($M = 5.9$ years, $SD = 3.9$ months), 36 7-year-olds ($M = 7.1$ years, $SD = 4.5$ months), and 36 8-year-olds ($M = 8.2$ years, $SD = 3.4$ months). There were 24 females and 6 males in the youngest age group, 17 females and 19 males in the middle age group, and 14 females and 22 males in the oldest age group. The children were selected from a parochial school and had parental permission to participate.

Thirty-four adults ($M = 24.9$ years, $SD = 114.7$ months) were also presented the counterfactual emotion reasoning task (but not any of the measures of individual differences in language, processing capacity, or second-order theory-of-mind ability). The adults were selected from psychology courses and received course credit for their participation.

Materials

Peabody Picture Vocabulary Test, 3rd edition (PPVT). The PPVT is a measure of receptive language and was used as a measure of verbal ability in this study. In this task, on each trial, a label was provided to the participant by the experimenter, and the participant indicated which picture out of four options he or she thought best represented that label.

Kaufman Assessment Battery for Children (K-ABC) Number Recall. The number recall subtest of the K-ABC assesses forward memory span. In this task, on each trial, the experimenter stated a series of numbers, and the participant attempted to repeat the numbers in the correct order. The length of the number sequence increased with each unit of 3 items.

M-space span task. The M-space span task is a measure of memory span developed by Case, Kurland, and Goldberg (1982). In this task, participants were required to remember the number of green dots on cards with various numbers of blue and green dots on each card. The number of green dots on each card ranged from one to five dots, and the total number of dots on each card ranged from three to seven dots. In this task, there were three “sets” of cards at each level. For the first level, there was just one card in each set, for the second level there were two cards for each set, and so on. After each set of cards was presented, participants were required to recall the numbers of green dots on each card in that set in the order that the cards were presented. If a participant incorrectly stated any numbers in a set, that set was considered incorrect. The task was ended if a participant missed all three sets at a level.

Second-Order Theory of Mind Task. This task included two stories (see Appendix A) developed by Sullivan, Zaitchik, and Tager-Flusberg (1994) used to measure children’s ability to attribute second-order mental states. In this task, participants were required to make judgments about characters’ thoughts about another character’s thoughts.

Counterfactual Emotion Reasoning Task. This task included four different stories (see Appendix B) in which two characters experienced the same negative (as opposed to neutral) or neutral (as opposed to positive) outcome. For one character, the alternative outcome that might have occurred would have resulted in the same negative outcome. For the other character, however, the alternative would have resulted in a more positive outcome. In two of the stories, the outcome was neutral, and the alternative would have been good. In the other two stories, the outcome was bad, and the alternative would have been neutral. Thus, rather than manipulating factors thought to affect event mutability (typicality or an action or the degree to which a decision is framed as involving an act of omission vs. commission), the present study contrasted a character for whom “things might have been better” with a character for whom the two alternative possible courses of action would have resulted in the same outcome. McCloy and Byrne (2002) have referred to this kind of comparison as a comparison between an “even-if” situation and an “if-only” situation. In a study with adults, McCloy and Byrne confirmed that adults judge that feelings of regret are much more likely to occur in “if only” contexts than in “even if” contexts.

There were also two versions of each story: explicit and non-explicit. The explicit version made specific reference to the characters thinking about the alternative outcome, whereas the non-explicit story simply stated the alternative outcome. In addition, two forms of each version of each story were created. The two forms differed solely in terms of which character was talked about first in the story. Cartoon pictures depicting scenes from each story were drawn to present to participants while an experimenter read each

scenario for all child participants. Comprehension questions for each of the counterfactual emotion reasoning scenarios were also used (see Appendix C).

Procedure

Adult participants received only the counterfactual emotion reasoning task. Adult participants were tested in groups of about 15-20 participants. These participants were presented printed copies of the stories to read. These printed copies of the stories also included printed requests for judgments about the characters' emotional responses. Adults provided written response to these questions.

Child participants were tested one-on-one by an experimenter in a private, quiet location and completed all six tasks listed in the materials section. Each child was tested in two separate sessions. The second session occurred on a separate day within two weeks of the first session. For all participants, the first session included the second-order Theory of Mind Task, the K-ABC Number Recall Task, and the PPVT. The second session included the Counterfactual Emotion Reasoning Task and the M space span test.

For the Counterfactual Emotion Reasoning Task, an experimenter read each story while presenting the accompanying pictures. After an experimenter read each counterfactual emotion reasoning scenario, children were asked which character would feel worse about the outcome and were also asked to explain their answer. Children were also asked several comprehension questions for each story after this response was given for each scenario. Half the participants in each age group received all "explicit" versions of each story, while the remaining participants received all non-explicit stories. The order of presentation of the different stories was counterbalanced across participants at each

age. At the end of the second session, children were given stickers as a token of appreciation for participating in the study

CHAPTER III

RESULTS

Scoring Procedures

PPVT. The standard procedure for scoring the PPVT was used. For each participant, the total number of errors was subtracted from the ceiling item to create the participant's raw score. The ceiling item was designated by the last item in the "ceiling set," that is, the set during which the participant made eight or more incorrect responses.

K-ABC Number Recall Task. The standard procedure for scoring the K-ABC task was used. The Number Recall Task was scored by subtracting the errors from the ceiling item to calculate the raw score. The ceiling item was designated by the last number in the ceiling set, which is the set in which the participant missed all items in the set or reached the stopping point for their age as designated by the K-ABC Number Recall task procedure.

Second-order Theory of Mind Task. In this task, probe questions and control questions were used to make sure the children understood and remembered key elements of the stories. Feedback was given to children for these questions and incorrect answers were corrected. The second-order ignorance question, the second-order false belief question, and the justification question were coded as correct or incorrect based on the standards described in Sullivan et al. (1994). Participants were given a point for each

correct response for the second-order ignorance question, the second-order false belief question, and the justification question for each of the two stories resulting in a total score of 0-6 for each participant.

M space Span task. Participants were given an M space span score equal to the highest level during which they were able to recall at least two out of three sets completely, as well as a third of a point for any higher levels where they only correctly stated totals from one set at that level.

Counterfactual Emotion Reasoning Task. Scores on the comprehension questions were examined to judge children's comprehension and memory for the events of the story. In order to score the participant's responses to the emotion judgments questions, a "target response" was defined as the judgment that the character who could have experienced a better outcome would have felt worse than the character for whom the alternative course of action would have resulted in the same negative or neutral outcome. Participants were given a point for each story for which they responded with the "target response," where they also provided a relevant explanation of counterfactual reasoning for the target, resulting in each participant receiving a score from 0-4.

Preliminary Analyses

Comprehension questions. Participants who scored less than 80% correct, as averaged over all four stories, on the comprehension questions were not included in the analysis. Eight of the excluded participants were in the 6-year-old age group, and two were in the 7-year-old age group. For the remaining participants, there was no significant difference between the scores of the 8-year-olds ($M = 95.67$, $SD = 6.02$) and the 7-year-

olds ($M = 95.33$, $SD = 4.56$), $F(1, 100) = .06$, $p = .81$, but the 7-year-olds did perform significantly better on the comprehension questions than the 6-year-olds ($M = 90.90$, $SD = 6.73$), $F(1, 100) = 9.74$, $p = .002$. For the remaining participants, there was no significant difference between the scores of the 8-year-olds ($M = 95.67$, $SD = 6.02$) and the 7-year-olds ($M = 95.33$, $SD = 4.56$), $F(1, 100) = .06$, $p = .81$, but the 7-year-olds did perform significantly better on the comprehension questions than the 6-year-olds ($M = 90.90$, $SD = 6.73$), $F(1, 100) = 9.74$, $p = .002$.

Gender effects. The first analysis assessed whether there were gender differences with respect to judgments of emotion responses. Males ($M = .97$, $SD = 1.32$) and females ($M = .91$, $SD = 1.38$) were equally likely to state that the target characters in the counterfactual stories were more likely to feel worse than the other character. The main effect of gender was not significant, nor did gender interact with age. Accordingly, gender was not included as a variable in any further analyses.

Story effects. Counterfactual Emotion Reasoning scores did not vary significantly across the four different stories. Accordingly, “story” was not included as a variable in any further analyses.

Salience and Age Effects

A 4 (age) X 2 (explicitness) between-subjects ANOVA was performed to assess the effects of these variables on the counterfactual emotions task score. There was a main effect of age group for performance on the counterfactual emotions reasoning task, $F(3, 128) = 33.09$, $p < .001$. A Tukey HSD analysis showed that adults ($M = 2.61$, $SE = .18$) were more likely to give the target response than were the 8-year-olds ($M = 1.02$, $SE =$

.17), $p < .001$. Also, the 8-year-olds were more likely to give the target response than were the 7-year-olds ($M = .33$, $SE = .17$), $p = .048$, and the 6-year-olds ($M = .34$, $SE = .17$), $p = .42$, who did not significantly differ from each other, $p = 1.00$.

The main effect of explicitness was not significant, $F < 1$. However, there was a significant Age X Explicitness interaction, $F(3, 139) = 2.90$, $p < .05$. Figure 2 reveals that, whereas there was little if any effect of explicitness for the 6-year-olds, 7-year-olds, and adults, the 8-year-olds were much more likely to give the target response in the more explicit condition than in the less explicit condition.

There was an overall age difference for the more explicit condition, $F(3, 63) = 14.04$, $p < .001$. A Tukey HSD analysis was performed to further investigate the age differences in the explicit and non-explicit versions. In the more explicit condition, adults ($M = 2.44$, $SD = 1.36$) were marginally more likely to give the target response than 8-year olds ($M = 1.44$, $SD = 1.55$), $p = .067$. Eight-year-olds were significantly more likely to give the target response than 7-year-olds ($M = .11$, $SD = .32$), $p = .006$. Seven-year-olds and 6-year-olds ($M = .47$, $SD = 1.01$) did not differ significantly in their tendency to give the target response, $p = .836$.

There were also overall age differences for the less explicit version, $F(3, 66) = 24.28$, $p < .001$, though there was a different pattern for this condition. Adults ($M = 2.77$, $SD = 1.11$) were more likely to give the target response than the 8-year-olds ($M = .60$, $SD = .94$), $p < .001$. However, there were no significant differences between the 8-year-olds and the 7-year-olds ($M = .61$, $SD = 1.14$), $p = .998$, the 8-year-olds and the 6-year-olds

($M = .21$, $SD = .58$), $p = .650$, and the 7-year-olds and the 6-year-olds in the less explicit version, $p = .750$.

The 8-year-olds were the only age group to show a difference in target responses between the less and more explicit conditions, $t(34) = 2.01$, $p < .05$.

Individual Differences

Means and standard deviations by age groups can be found in Table 1. Table 2 presents the simple correlations between Age (in months), K-ABC scores, M space span scores, PPVT scores, second-order TOM scores, and Counterfactual Emotions Reasoning Task scores. In order to examine which factors served as reliable predictors of scores on the Emotion Judgment Task, a series of stepwise regression analyses were performed with Emotion Judgments Task scores as the dependent variable. In all of these analyses, age was entered as the first predictor variable, followed by one of the other individual difference measures.

These analyses revealed that, although the PPVT score (verbal ability) had the highest simple correlation with Emotion Judgment scores, it did not remain a significant predictor when age was entered into the regression first. After age was entered into the stepwise regression, the only factor that remained predictive of performance on the counterfactual emotion reasoning task was the second-order ToM task score, $F(1, 99) = 4.65$, $p < .05$ (see Table 3).

A similar set of analyses was also performed separately for the more explicit and less explicit conditions of the Counterfactual Emotions Reasoning task. For participants who received the more explicit version of the task, again the only variable that remained

a predictor of Emotion Judgment scores after partialling out the effects of Age was second order ToM task performance, $F(1, 48) = 4.75, p < .05$. For the participants who received the less explicit version of the task, none of the variables significantly predicted performance on the counterfactual emotions reasoning task, including age.

Second-order Theory of Mind Task

Previous studies by Guajardo and Turley-Ames (2004), Perner et al. (2004) and Riggs et al. (1998), have examined counterfactual reasoning as a predictor of theory of mind performance. Accordingly, a set of regression analyses was conducted here in which ToM scores served as the dependent variable. As was done with the analyses described above, age was always entered as the first predictor variable, followed by each of the other individual difference variables, including Emotion Judgment scores as a predictor. These analyses revealed that, after partialling out the effects of age, K-ABC number span scores, $F(1, 100) = 4.15, p < .05$, PPVT scores, $F(1, 100) = 20.74, p < .001$, and the Counterfactual Emotions Reasoning scores, $F(1, 100) = 7.68, p = .<.05$, were all still significant predictors of the second order ToM task performance. A set of analyses was then conducted involving all possible orderings of more than one individual differences variable (after partialling out the effects of Age). These analyses revealed that, among the individual difference variables that were included in the present study, PPVT performance was the most important predictor of ToM task performance; PPVT remained a significant predictor even when it was entered after each of the other variables, whereas none of the other variables remained a significant predictor when entered after PPVT scores.

CHAPTER IV

DISCUSSION

The major goals of this study were to investigate the pattern of age differences for reasoning about counterfactual emotions, to study the effects of salience of the counterfactual alternative on task performance, and to examine individual difference factors that may affect this performance.

Adults' responses on the Emotion Judgment task demonstrated an understanding that when two people experience the same negative or neutral outcome, one is likely to feel worse than the other if that first individual thinks about how things would have been better if an alternative course of action had been chosen. In contrast, children at all ages tested here usually judged that both characters would feel the same. The exception to this pattern of results occurred with just one version of the stories with the 8-year-olds. Children at this age responded like younger children when the story did not stress that one of the characters was reflecting on how things might have been better. In contrast, 8-year-olds tended to respond more similarly to adults when the counterfactual thinking of the characters was made particularly salient in the story.

Gleicher et al. argued that, when a course of action leads to a positive outcome, adults are unlikely to reflect on "what might have been" unless some other feature of the situation serves as a strong trigger for such counterfactual thinking. In the present study, the 8-year-olds responded to stories describing negative outcomes in a manner very

similar to the way adults in Gleicher et al.'s study responded to stories describing events leading to positive outcomes. In each case, there was very little evidence that “what might have been” was taken into account unless the counterfactual possibility was made very salient in the story.

For children younger than age 8, however, participants failed to factor “what might have been” into their judgments even with the more explicit versions. This finding was somewhat surprising, because the stories used in the present study were quite similar to those used by Guttentag and Ferrell (2004), who found that even at 7-year-of-age children seemed to understand not only that upward counterfactual thinking can make someone feel worse about a negative event that actually occurred, but also that both typicality of a course of action and whether or not a behavioral decision is thought of as an act of commission or omission can affect the intensity of regret.

Despite their overall similarity, there were a couple of ways in which the stories used in the present study differed from those used by Guttentag and Ferrell. One difference was that the present stories did not include any mention of typicality of the courses of action or the degree to which the courses of action involved acts of commission vs. omission. A second difference was that in the Guttentag and Ferrell stories, both characters were in a situation in which counterfactual thinking would have involved reflecting on upward counterfactuals; for both characters, the likely alternative course of action would have resulted in a better outcome than what actually occurred. In contrast, in the present study, for one of the characters, the alternative course of action would have resulted in the same outcome as the course of action that actually occurred.

These features of the stories used the present study were included specifically to make the stories easier for the younger children to understand. Accordingly, it had been hypothesized that a mature pattern of responding would be found at younger age in the present study than had been the case in Guttentag and Ferrell (2004). Contrary to expectations, the opposite pattern was found; features of the present stories that were designed to simplify the stories ended up actually making the counterfactual thinking element of the stories less salient and/or less supportive of the child's reflecting on the effects of upward counterfactual thinking on emotional responding.

It is not known exactly which feature of the stories used in the present study is responsible for the differences found between the present findings and those reported by Guttentag and Ferrell (2004). One possibility is that the inclusion of a situation for one character in which the alternative course of action would have produced the same outcome may have reduced the salience of "what might have been." Indeed, previous researchers (McCloy & Byrne, 2002) have suggested that semifactual reasoning (where the alternative choice would have led to the same outcome) is represented differently than counterfactual reasoning, causing people to see the antecedent as less causal than in situations of counterfactual reasoning. While participants in the present study were not asked specifically to undo the outcomes, this added layer of difficulty with the semifactual character may have elevated the age where understanding of counterfactual emotions was found compared to previous studies.

Even though the pattern of differences between the findings in the present study and those found by Guttentag and Ferrell was not in the expected direction, the mere fact

that a different pattern of results was found provides further support for the view that age differences in the tendency to reflect on the effects of counterfactual thinking interacts with the degree to which a specific story or situation makes such thinking more or less salient. Elements of the stories used by Guttentag and Ferrell (2004) provided a stronger trigger for reflection on the effects on emotional responses of “what might have been” than was the case with the stories used here. Similarly, negative outcomes provide a stronger trigger for such thinking than do positive outcomes, and the salient versions of the stories used here provided a stronger trigger than was the case with the less salient versions.

Measures of individual differences revealed that a key predictor of understanding characters’ counterfactual-thinking-based emotions was their ability to take other people’s perspectives, as measured by a second order Theory of Mind task. This finding is not surprising, as there are clear parallels between comparing two characters’ thought processes and resulting emotions (counterfactual emotion reasoning task) and thinking about a character’s thoughts about another character’s thoughts. Essentially, both tasks require a sophisticated ability to think about others’ complex thoughts. More directly, making adult-like judgments on the Counterfactual Emotion Reasoning task used here would seem to be dependent upon the ability to take the perspective of the characters in the stories in order to judge what the characters’ emotional responses would be. Due to these similarities, it is more likely that a general ability of social cognition and perspective taking using other people’s mental states may be driving these performances on both the Counterfactual Emotion Reasoning task and the second order Theory of Mind

task, than a case that second order false belief understanding is driving the ability to understand people's emotions based on their counterfactual reasoning.

When the second order TOM task was used as a dependent measure, verbal ability (as measured by scores on the PPVT) emerged as a significant predictor of second-order ToM performance, even after partialling out the effects of age and the effects of the other individual difference variables measured here. This finding suggests that verbal ability may be an important influence on perspective taking, and social cognition in general, although the exact reason for this relationship is unclear. One possibility is that language may play an important role in the representation of social cognitive concepts. Further research, however, is needed to determine the nature of the relationship between language ability and second order ToM ability.

Previous studies investigating the relationship between false belief tasks and counterfactual reasoning (Guajardo & Turley-Ames, 2004; Perner et al., 2004; Riggs & Peterson, 2000; Riggs et al., 1998) have all studied these variables under the assumption that counterfactual reasoning ability affects the ability to understand false beliefs and mental states. These studies, however, were interested in a younger age group, where the ability to reason counterfactually is based on understanding more physical, concrete situations with alternatives, as opposed to the addition of understanding how this reasoning affects people's emotions. The current study assumes the opposite direction between these two variables because intuitively, the basic ability to think about someone else's thoughts, or in this case someone's thoughts about someone else's thoughts, is necessary for understanding why two people who experience the same outcome would

feel differently. It is possible that processes involved in understanding people's mental states and the ability to reason about abstract possibilities develop together over childhood interacting with one another to develop a more sophisticated social cognition.

The present findings beg that important question of what it is that is developing between the ages of 5 and 9 years to allow children to make sophisticated judgments of another person's feelings based on their mental activities. While previous studies (Amsel et al., 2003; Guttentag & Ferrell, 2004; Meehan & Byrne, 2005) have shown that children as young as 5 and 6 years are able to understand both how an event can be mentally mutated and how they and others would feel if this alternative event had occurred, they are still unable to understand how people's emotions are affected by these mental mutations. While perspective taking as measured by the second order TOM task was found to be predictive of performance in understanding these counterfactual emotions, it does not fully explain the difficulties children at these ages have with understanding other people's counterfactual emotions since children by this age are able to correctly understand the false beliefs of others.

Bradmetz and Schneider (1999) proposed with false belief tasks that while children are able to correctly perform a false belief task by 4 years of age, it is not until 7-8 years of age that children are able to form a coherent, logical understanding of the concept of a false belief. They state that between the ages of 4 to 8 years, although children may be able to separately understand emotions, beliefs, and desires, children still show contradictory judgments about these states. Particularly, young children can show the understanding that a character may hold a false belief, and demonstrate they know

what that false belief is despite knowing the true situation. However, when asked to describe the emotion the character with that false belief is experiencing, they respond based on the true belief of which they are aware but is unknown to the character. For example, the younger participants understood that Little Red Riding Hood thinks that her grandmother is in the house, even though they knew that actually the Big Bad Wolf was really in the house. However when asked how Little Red Riding Hood would feel before going into the house, the younger participants seemed to ignore the false belief of Little Red Riding Hood and instead use their own knowledge to respond that she would feel scared. Bradmetz and Schneider suggest that it is not until after 7 years of age that they gain a “third-person structure” that allows them to overcome these contradictions and coordinate these judgments. This third-person structure moves children from a second-person structure of being aware of mental states and being able to represent these mental states to coordinating all this knowledge around 7-8 years of age. In relation to the current study, it may not be just coordination of false belief tasks that must develop, but an overall coordination of all of the steps needed as outlined by Gleicher et al. (1990). The idea of a change in coordination and use of representations has also been suggested by Meehan and Byrne (2005). They state that 6-year-olds may have difficulty updating their representation of the real events with their representation of the counterfactual event.

It is possible, therefore, that performance on tasks where children are required to understand people’s emotions due to their differing mental activities is the result of both separately developing social and cognitive skills and the overall ability to coordinate all

these abilities. Looking back at the modified model derived from Gleicher et al. (1990) (see Figure 1), while children may have the abilities to perform each step of this model, it may be the coordination of all these processes that is causing difficulty. If these abilities are not fully developed, however, it seems possible to provide support, as was shown with the salience manipulation in the present study, to boost these lacking abilities so that participants (such as many of the 8-year-olds in the present study) are able to show an adult-like pattern of performance on the task. Younger children however, may need more support to coordinate these parts of the model, or support for the separate abilities needed for the different steps in the process of understanding counterfactual emotions.

Future Directions

A fairly direct follow-up to the present study might be to provide participants with knowledge of characters' emotions and ask them to justify why the characters feel this way. For example, participants might be told that Allison, who would have won the big prize if she had chosen the other box, feels worse than Britney, who would have won nothing no matter which box she chose. Thus, instead of requiring participants to generate judgments of emotional responses based upon the details of the situations, they would be provided the presumably simpler task of figuring out which features of the situation were responsible for the emotions that the participant has been told that the characters felt. The provision of the information about a character's emotional response would presumably instigate an active search for any features of the situation than might produce such a response. As such, this kind of task might be hypothesized to provide

maximum support for the child's reflection on the effects of "what might have been" on emotional responses.

A potentially instructive direction for future research might also be to use Gleicher et al.'s model to investigate whether there are age differences at other steps of the process of making counterfactual-reasoning-base emotions judgments other than at step one. For example, what role does the judged likelihood of the counterfactual outcome play in children's judgments of emotional responses. Are children even able to weigh the effects of a relatively more likely counterfactual vs. a less likely counterfactual?

The lack of ability to understand counterfactual emotions in the childhood years may also be related to brain development in the areas needed to understand such complex emotions. Because the orbitofrontal cortex is important in the role of cognitive and emotional factors influencing decision making, such as counterfactual reasoning and regret, it may be a lack of neurological development affecting the problems young children have with understanding counterfactual emotions such as regret, disappointment, and relief.

Another direction for future research might involve more direct assessments of how children actually feel in the kinds of situations in which adults typically experience regret and relief, and whether children of different ages who have begun to feel regret in certain situations make decisions about possible courses of action based upon the anticipation of regret. It is known that the anticipation of regret can have potent influences on adult decision making. Recent studies have shown that children as old as 9

and 10 years of age do not seem to understand how the anticipation of regret and disappointment influence people's decisions (Ferrell & Guttentag, in press).

Interestingly, these findings are consistent with research suggesting that the anticipation of regret is based upon the use of brain regions that are not fully mature until well into the teen years. Camille et al. (2004) found that adult patients who had orbitofrontal cortex lesions exhibited a pattern of decision making in gambling task that was not reflective of the kind of "avoidance of regret" decisions that are made by individual without such lesions (resulting, interestingly, in the patients actually making more statistically normative judgments than did normal participants). These findings raise the interesting possibility that anticipation of regret may not serve as a significant factor influencing decision making until individuals are well into their teen years.

Summary

These results overall show that understanding counterfactual emotions, such as regret, can be affected by both task demands of salience and individual differences. While younger children may not typically show understanding that a character's counterfactual reasoning affects their emotional response to an outcome, they may be able to show this ability to understand if they are provided with certain cues such as stating how a character is thinking about an alternative. Based on the effect of the explicitness of the alternative and the predictive quality of the second order theory of mind task, perhaps younger children do not respond like adults when given counterfactual emotion reasoning tasks because although they can think about other

people's thoughts and emotions, and have the ability to reason counterfactually, they have difficulty combining these skills.

REFERENCES

- Amsel, E., Robbins, M., Tumarkin, T., Janit, A., Foulkes, S., & Smalley, J.D. (2003).
The card not chosen: The development of judgments of regret in self and others.
Manuscript submitted for publication.
- Arsenio, W., & Lover, A. (1995). Children's conceptions of sociomoral affect: Happy victimizers, mixed emotions, and other expectancies. In M. Killen & D. Hart (Eds.). *Morality in everyday life: Developmental perspectives*. (pp. 87-128). New York, NY: Cambridge University Press.
- Astington, J. W., Harris, P. L., & Olson, D. R. (1988). *Developing theories of mind*. New York: Cambridge University Press.
- Berti, A., Garattoni, C., & Venturini, B. (2000). The understanding of sadness, guilt, and shame in 5-, 7-, and 9-year-old children. *Genetic, Social, and General Psychology Monographs, 126*, 293-318.
- Bradmetz, J. & Schneider, R. (1999). Is Little Red Riding Hood afraid of her grandmother? Cognitive vs. emotional response to a false belief. *British Journal of Developmental Psychology, 17*, 501-514.
- Bradmetz, J., & Schneider, R. (2004). The role of the counterfactually satisfied desire in the lag between false-belief and false-emotion attributions in children aged 4-7. *British Journal of Developmental Psychology, 22*, 185-196.

- Byrne, R. M. J., Segura, S., Culhane, R., Tasso, A., & Berrocal, P. (2000). The temporality effect in counterfactual thinking about what might have been. *Memory & Cognition, 28*, 264-281.
- Camille, N., Coricelli, G., Sallet, J., Pradat-Diehl, P., Duhamel, J.-R., & Sirigu, A. (2004). The involvement of the orbitofrontal cortex in the experience of regret. *Science, 304* (5674), 1167-1170.
- Denham, S. (1998). *Emotional Development in Young Children*. New York, NY: Guilford Press.
- Denham, S. A., & Couchard, E. A. (1990). Young preschoolers' understanding of emotions. *Child Study Journal, 20*, 171-192.
- Fabes, R. A., Eisenberg, N., Nyman, M., & Michaelieu, Q. (1991). Young children's appraisals of others' spontaneous emotional reactions. *Developmental Psychology, 27*, 858-866.
- Ferrell, J. M., & Guttentag, R. E. (in press). Children's understanding of anticipatory regret and disappointment. *Cognition and Emotion*.
- German, T. P., & Nichols, S. (2003). Children's counterfactual inferences about long and short causal chains. *Developmental Science, 6*, 514-523.
- Gleicher, F., Kost, K. A., Baker, S. M., Strathman, A. J., Richman, S. A., & Sherman, S. J. (1990). *Personality and Social Psychology Bulletin, 16*, 284-295.
- Guajardo, N. R. & Turley-Ames, K. J. (2004). Preschoolers' generation of different types of counterfactual statements and theory of mind understanding. *Cognitive Development, 19*, 53-80.

- Guttentag, R. E. & Ferrell, J. M. (2004). Reality compared with its alternatives: Age differences in judgments of regret and relief. *Developmental Psychology, 40*(5), 764-775.
- Harris, P. L., German, T., & Mills, P. (1996). Children's use of counterfactual thinking in causal reasoning. *Cognition, 61*, 233-259.
- Harris, P. L., Johnson, C. N., Hutton, D., Andrews, G., & Cooke, T. (1989). Young children's theory of mind and emotion. *Cognition and Emotion, 3*, 379-400.
- Harris, P. L., Olthof, T., Terwoft, M. M., & Hardeman, C. E. (1987). Children's knowledge of the situations that provoke emotion. *International Journal of Behavioral Development, 10*, 319-343.
- Harter, S., & Whitesell, N. R. (1989). Developmental changes in children's understanding of single, multiple, and blended emotion concepts. In C. Saarni & P. Harris (Eds.), *Children's understanding of emotion*. (pp. 81-116). New York, NY: Cambridge University Press.
- Kahneman, D., & Miller, D. T. (1986). Norm theory: Comparing reality to its alternatives. *Psychological Review, 93*(2), 136-153.
- Kahneman, D., & Tversky, A. (1982). The simulation heuristic. In D. Kahneman, P. Slovic, & A. Tversky (Eds.), *Judgment under uncertainty: Heuristics and biases* (pp. 201-208). New York: Cambridge University Press.
- Kasimatis, M., & Wells, G. L. (1995). Individual differences in counterfactual thinking. In Roese, N. J., & Olson, J. M. (Eds.), *What might have been: The social*

- psychology of counterfactual thinking* (pp.81-101). Mahwah, NJ: Lawrence Erlbaum Associates.
- Landman, J. (1987). Regret and elation following action and inaction: Affective responses to positive versus negative outcomes. *Personality and Social Psychology Bulletin, 13*, 524-536.
- Meehan, J. E., & Byrne, R. M. J. (2005). Children's counterfactual thinking. Manuscript submitted for publication. University of Dublin, Trinity College.
- Miller, D. T., & Gunasegaram, S. (1990). Temporal order and the perceived mutability of events: Implications for blame assignment. *Journal of Personality and Social Psychology, 59*, 1111-1118.
- Nunner-Winkler, G., & Sodian, B. (1988). Children's understanding of moral emotions. *Child Development, 59*, 1323-1328.
- Perner, J., Sprung, M., & Steinkogler, B. (2004). Counterfactual conditionals and false belief: a developmental dissociation. *Cognitive Development, 19*, 179-201.
- Perner, J., & Wimmer, H. (1985). "John thinks that Mary thinks that...": Attribution of second-order beliefs by 5- to 10-year-old children. *Journal of Experimental Child Psychology, 39*, 437-471.
- Peterson, D. M., & Riggs, K. J. (1999). Adaptive modeling and mindreading. *Mind & Language, 14*, 80-112.
- Pons, F., Lawson, J., Harris, P. L., & deRosnay, M. (2003). Individual differences in children's emotion understanding: Effects of age and language. *Scandinavian Journal of Psychology, 44*, 347-353.

- Riggs, K. J., & Peterson, D. M. (2000). Counterfactual thinking in pre-school children: Mental state and causal inferences. In Mitchell, P., & Riggs, K. J. (Eds.). *Children's reasoning and the mind* (pp. 87-99). Hove, England: Psychology Press/ Taylor & Francis.
- Riggs, K. J., Peterson, D. M., Robinson, E. J., & Mitchell, P. (1998). Are errors in false belief tasks symptomatic of a broader difficulty with counterfactuality? *Cognitive Development, 13*, 73-90.
- Roese, N. J., & Olson, J. M. (1995). Counterfactual thinking: A critical overview. In Roese, N. J., & Olson, J. M. (Eds.), *What might have been: The social psychology of counterfactual thinking* (pp.1-55). Mahwah, NJ: Lawrence Erlbaum Associates.
- Sullivan, K., Zaitchik, D., & Tager-Flusberg, H. (1994). Preschoolers can attribute second-order beliefs. *Developmental Psychology, 30*(3), 395-402.
- Strayer, J. (1986). Children's attributions regarding the situational determinants of emotion in self and others. *Developmental Psychology, 22*, 649-654.
- Thompson, R. A. (1987). The development of children's inferences of the emotions of others. *Developmental Psychology, 23*, 124-131.
- Walsh, C. R., & Byrne, R. M. J. (2004). Counterfactual thinking: The temporal order effect. *Memory & Cognition, 32*, 369-378.
- Wellman, H. M. (1992). *The child's theory of mind*. Cambridge, MA: The MIT Press.
- Wells, G. L., & Gavinski, I. (1989). Mental simulation of causality. *Journal of Personality and Social Psychology, 56*, 806-820.

Appendix A. Tables and Figures

Table 1

Means (and Standard Deviations) by Age Group for Individual Difference Measures

	6-year-olds	7-year-olds	8-year-olds	Adults
K-ABC	10.63 (2.07)	11.72 (1.97)	12.75 (2.06)	--
PPVT	89.82 (11.41)	107.97 (14.65)	123.89 (10.44)	--
M-space	2.33 (0.89)	3.25 (1.05)	3.75 (1.02)	--
2 nd ToM	3.48 (1.23)	3.42 (1.32)	4.33 (1.24)	--
Cf. Emo.	0.33 (0.82)	0.36 (0.87)	0.97 (1.30)	2.61 (1.23)

Table 2

Correlations of Age (in Months) and Tasks Measuring Individual Differences with
 Correlations with Age in Months Partialled out in Parentheses

	1	2	3	4	5	6
1. Age (months)		.40***	.73***	.51***	.24*	.24*
2. K-ABC span task			.42*** (.21*)	.36*** (.19*)	.27** (.20*)	.10 (.01)
3. PPVT				.49*** (.22*)	.45*** (.41***)	.28** (.16)
4. M-space span task					.13 (.00)	.20* (.09)
5. 2 nd Order ToM task						.25** (.21*)
6. Counterfactual Emotion task						

*p < .05
 **p < .01
 ***p < .001

Table 3

Summary of Stepwise Regression Analysis of Individual Difference Task Scores as a Predictor of Performance on the Counterfactual Emotion Reasoning Task

Variable	Step	Action	<i>SeqSS</i>	R^2	ΔR^2	<i>p-value</i>
Age	1	added	6.61	.058	--	.015
2 nd ord. ToM	2	added	4.86	.100	.042	.033*
PPVT	3	added	.66	.106	.006	.430
M space	4	added	.66	.111	.005	.431
K-ABC	5	added	.46	.115	.004	.512

Note. Age = Age of participants in months (excluding adult participants); 2nd ord. ToM = scores on the Second order Theory of Mind task (as adapted from Sullivan, Zaitchik, & Tager-Flusberg, 1994); PPVT = Peabody Picture Vocabulary Test, 3rd edition scores; M space = M space span task scores (as adapted from Case, Kurland, and Goldberg, 1982); K-ABC = K-ABC Number Recall task scores

Figure 1. Depiction of model as proposed by Gleicher et al. (1990) in bold lines, with added aspects of steps needed to judge two characters' emotions from counterfactual reasoning in dashed lines.

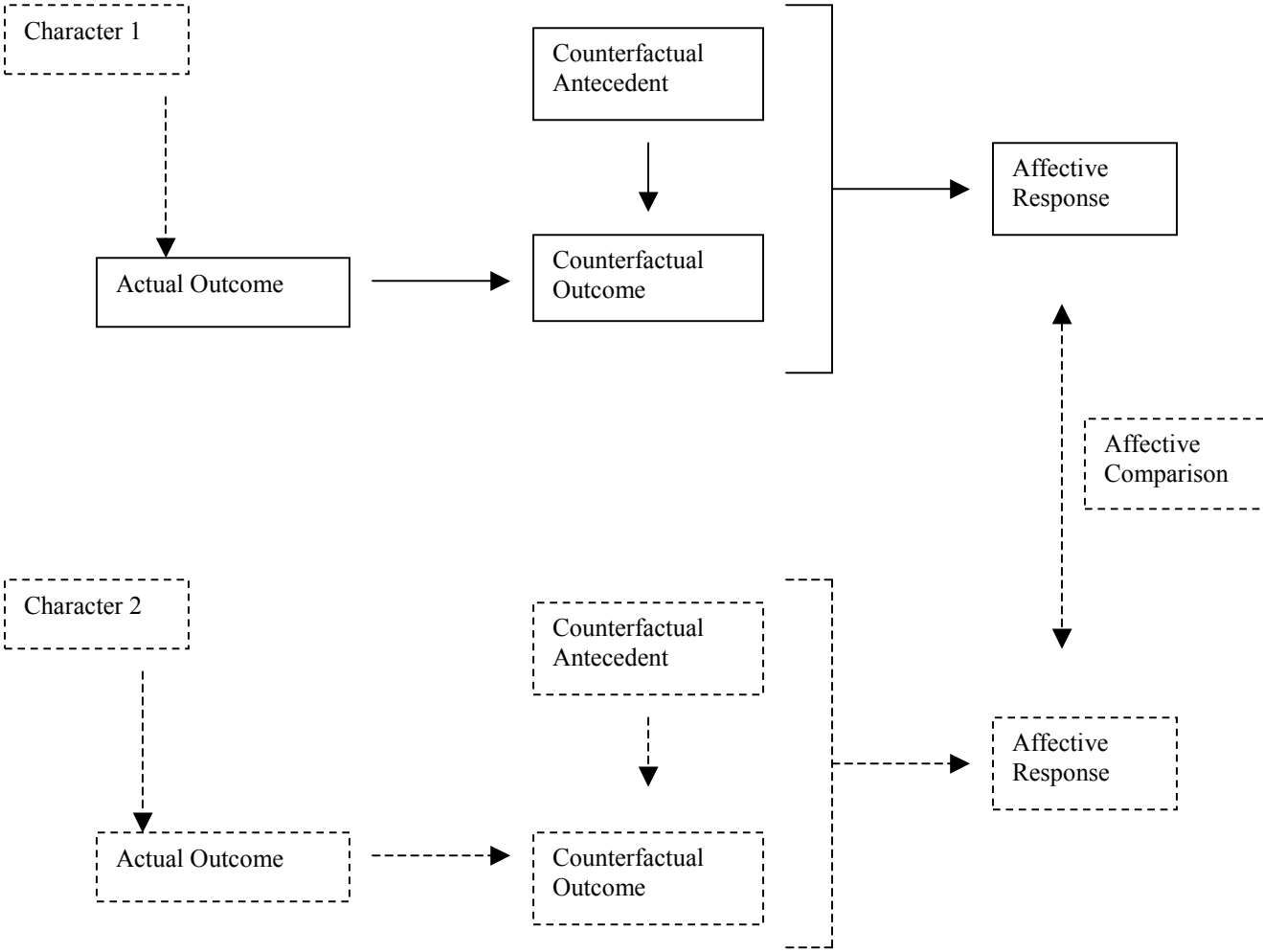
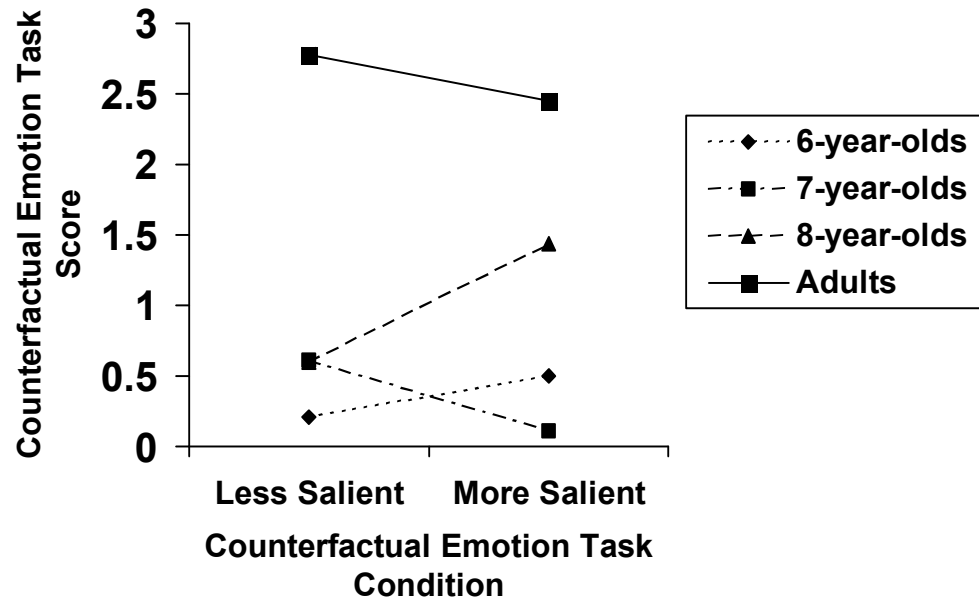


Figure 2. Mean counterfactual emotion task scores for Age X Explicitness Condition.



Appendix B. Second Order Theory of Mind Stories

Birthday Puppy story- 2nd order theory of mind task (from Sullivan, Zaitchik, & Tager-Flusberg, 1994)

Tonight is Peter's birthday and Mom is surprising him with a puppy. She has hidden the puppy in the basement. Peter says, "Mom, I really hope you get me a puppy for my birthday." Remember, Mom wants to surprise Peter with a puppy. So, instead of telling Peter she got him a puppy, Mom says, "Sorry Peter, I did not get you a puppy for your birthday, I got you a really great toy instead."

Probe Question 1: "Did Mom really get Peter a toy for his birthday?"

Probe Question 2: "Did Mom tell Peter she got him a toy for his birthday?"

Probe Question 3: "Why did Mom tell Peter that she got him a toy for his birthday?"

Now, Peter says to Mom, "I'm going outside to play." On his way outside, Peter goes down to the basement to fetch his roller skates. In the basement, Peter finds the birthday puppy! Peter says to himself, "Wow, Mom didn't get me a toy, she really got me a puppy for my birthday." Mom does not see Peter go down to the basement and find the birthday puppy.

Nonlinguistic control question: "Does Peter know that his Mom got him a puppy for his birthday?"

Linguistic control question: "Does Mom know that Peter saw the birthday puppy in the basement?"

Now, the telephone rings, ding-a-ling! Peter's grandmother calls to find out what the birthday party is. Grandma asks Mom on the phone, "Does Peter know what you really got him for his birthday?"

Second-order ignorance question: "What does Mom say to Grandma?"

Memory aid: Now remember, Mom does not know that Peter saw what she got him for his birthday.

Then Grandma says to Mom, "What does Peter think you got him for his birthday?"

Second-order false belief question: "What does Mom say to Grandma?"

Justification question: "Why does Mom say that?"

Chocolate Bar story- 2nd order theory of mind task

John and Mary's mom leaves a chocolate bar on the table and goes out to the store. John puts the chocolate bar in a drawer and tells Mary, his sister, that the chocolate bar is in the pantry because he wants to keep it all for himself.

Probe Question #1: Is the chocolate bar really in the pantry?

Probe Question #2: Did John tell Mary that the chocolate bar is in the pantry?

Probe Question #3: Why did John tell Mary that the chocolate bar is in the pantry?

Later, John decides to eat a piece of the chocolate bar and takes it out of the drawer and puts it back in the drawer. Mary is peeking behind the corner and sees John take the candy bar out of the drawer, but John doesn't see Mary there watching him.

Nonlinguistic control question: "Does Mary know that the chocolate bar is in the drawer?"

Linguistic control question: "Does John know that Mary saw that the chocolate bar is in the drawer?"

Now, Mom comes home. Mom asks John, "Does Mary know where the chocolate bar is?"

Second-order ignorance question: "What does John say to Mom?"

Memory aid: Now remember, John does not know that Mary saw him take a piece of the chocolate bar out of the drawer.

Then Mom says to John, "Where does Mary think the chocolate bar is?"

Second-order false belief question: "What does John say to Mom?"

Justification question: "Why does John say that?"

Appendix C. Counterfactual Emotion Reasoning Stories

OK Outcome/ Most Explicit

Allison and Britney are in different kindergarten classes at the same school. Today Allison and Britney both get chosen to play the game in their classes. In this game, the teacher brings out a big barrel that has lots of small boxes inside it. Some of the small boxes have a really nice prize in them, but others have nothing. To play the game, a child first picks two small boxes from the barrel. Then the child gets to choose which of those two she wants to keep. If the one she picks has a prize, she gets the prize. If it has nothing, the child gets nothing.

Allison shuts her eyes and picks two boxes from the barrel- a red box and a blue box. Then after thinking for a long time, she picks the blue box as the one she wants to keep. She opens it and it has nothing in it. The teacher then opens the red box to show Allison that the red box that Allison didn't choose had the big prize in it. Allison thinks about how if she had only picked the red box instead of the blue box, she would have won the big prize instead of winning nothing.

Britney shuts her eyes and picks two boxes from the barrel in her classroom. She picks a green box and an orange box. Then, after thinking for a long time, Britney decides to keep the green box. She opens it and it has nothing in it. The teacher then opens the orange box and shows Britney that it didn't have anything in it either. Britney thinks about how even if she had kept the other box, she wouldn't have won anything anyway.

So, each girl picked two boxes from the barrel, each got to keep just one of the two boxes, and each girl ended up with a box that didn't have a prize in it. Both Britney and Allison feel a bit bad about not winning anything. Do you think one of them feels worse than the other?

Allison, who thought about how she would have won the big prize if she'd kept the other box,

Or Britney, who thought about how she would have won nothing no matter which box she kept at the end,

Or do you think they'd feel the same?

Why?

OK Outcome/ Least Explicit

Allison and Britney are in different kindergarten classes at the same school. Today Allison and Britney both get chosen to play the game in their classes. In this game, the teacher brings out a big barrel that has lots of small boxes inside it. Some of the small boxes have a really nice prize in them, but others have nothing. To play the game, a child first picks two small boxes from the barrel. Then the child gets to choose which of those two she or he wants to keep. If the one she has a prize, she gets the prize. If it has nothing, the child gets nothing.

Allison picks two boxes from the barrel- a red box and a blue box. Then after thinking for a long time, she picks the blue box as the one she wants to keep. She opens it and it has nothing in it. The teacher then opens the red box to show Allison that the red box that Allison didn't choose had the big prize in it.

Britney also picks two boxes from the barrel in her classroom. She picks a green box and an orange box. Then, after thinking for a long time, Britney decides to keep the green box. She opens it and it has nothing in it. The teacher then opens the orange box and shows Britney that it didn't have anything in it either.

So, each girl picked two boxes from the barrel, each got to keep just one of the two boxes, and each girl ended up with a box that didn't have a prize in it. Both Britney and Allison feel a bit bad about not winning anything. Do you think one of them feels worse than the other?

Allison,
Or Britney,
Or do you think they'd feel the same?

Why?

Bad Outcome, Most Explicit

Chris and Dave live in different neighborhoods and ride their bikes to school everyday. There are several paths to choose from to get to school, and usually all the paths take the same amount of time and are all easy routes to school.

There are two paths that are near Chris's house, one that goes past a pond and one that goes past a playground. Chris goes both ways equally to school. Today Chris decided to go on the path that goes past the pond. Today unfortunately a tree branch fell across the path that goes past the pond and Chris hit the branch, fell off his bike, and was late to school. When he got to school, he found out from another boy that the other path that goes past a playground was clear. Chris thinks about how if he had taken the path that goes past the playground instead of the path he took instead, he wouldn't have fallen off his bike and been late to school.

Dave has two different paths near his house too that he takes to school. One path goes past a stream of water, and the other path goes past a field of flowers. Dave decides to go on the path that goes past the flowers. A tree branch also fell on that path and he also hits the branch, falls off his bike and is late to school. When he gets to school, Dave finds out that there was a big branch that fell across the path that goes past the stream too. Dave thinks about how even if he chose the path that went past the stream, he still probably would have fallen off his bike and been late to school.

So, each boy has two paths to choose from to ride their bikes to school, each chose a certain path, and each boy hit a branch and fell off his bike, got hurt, and was late to school. Both Chris and Dave feel bad about falling off their bikes. Do you think one of them feels worse than the other?

Chris, who thought about how he wouldn't have hit a branch if he had chosen the other path that went past the playground,
Or Dave, who thought about how he would probably would have hit a branch no matter which path he chose
Or do you think they'd feel the same?

Why?

Bad Outcome, Least Explicit

Chris and Dave live in different neighborhoods and ride their bikes to school everyday. There are several paths to choose from to get to school, and usually all the paths take the same amount of time and are all easy routes to school.

There are two paths that are near Chris's house, one that goes past a pond and one that goes past a playground. Chris goes both ways equally to school. Today Chris decided to go on the path that goes past the pond. Today unfortunately a tree branch fell across the path that goes past the pond and Chris hit the branch, fell off his bike, and was late to school. When he got to school, he found out from another boy that the other path that goes past a playground was clear.

Dave has two different paths near his house too that he takes to school. One path goes past a stream of water, and the other path goes past a field of flowers. Dave decides to go on the path that goes past the flowers. A tree branch also fell on that path and he also hits the branch, falls off his bike and is late to school. When he gets to school, Dave finds out that there was a big branch that fell across the path that goes past the stream too.

So, each boy has two paths to choose from to ride their bikes to school, each chose a certain path, and each boy hit a branch and fell off his bike, got hurt, and was late to school. Both Chris and Dave feel bad about falling off their bikes. Do you think one of them feels worse than the other?

Chris,
Or Dave,
Or do you think they'd feel the same?

Why?

Bad Outcome/ Most Explicit

Faith and Emily go to different schools with different playgrounds. One day they are each at recess and want to swing on the swings.

Faith looks at the two swings that are there. She tries to decide between the two swings and then decides to go on the one on the left. After Faith gets on the swing, the swing breaks and Faith falls to the ground and gets a little bit hurt. She notices that the swing was already a little broken so that is why she fell. Then she looks at the other swing and notices that that swing was a little broken too. Faith thinks about how even if she had picked the other swing, she still would have fallen down because it was broken too.

On Emily's playground, Emily also goes to swing on the swingset with two swings. She decides to get on the one on the left on her swingset too. The swing that Emily decides to get on is also a little broken and the swing breaks and Emily falls down and gets hurt a little. Emily looks at the other swing and see that it was not broken. Emily thinks about if only she had gotten onto the other swing, she wouldn't have fallen down and gotten hurt.

So, each girl chose a swing on their playground and their swings broke so both fell down and got hurt. Both Emily and Faith feel a bad about falling down. Do you think one of them feels worse than the other?

Faith, who thinks about if she picked the other swing she probably would have fallen no matter which swing she chose

Or Emily, who thought about how she wouldn't have fallen if she had picked the other swing

Or do you think they'd feel the same?

Why?

Bad Outcome/ Least Explicit

Faith and Emily go to different schools with different playgrounds. One day they are each at recess and want to swing on the swings.

Faith runs up to the swing set at her school and looks at the two swings that are there. She tries to decide between the two swings and then decides to go on the one on the left. After Faith gets on the swing, the swing breaks and Faith falls to the ground and gets a little bit hurt. She notices that the swing was already a little broken so that is why she fell. Then she looks at the other swing and notices that that swing was a little broken too.

On Emily's playground, Emily also goes to swing on the swingset with two swings. She decides to get on the one on the left on her swingset too. The swing that Emily decides to get on is also a little broken and the swing breaks and Emily falls down and gets hurt a little. Emily looks at the other swing and see that it was not broken.

So, each girl chose a swing on their playground and their swings broke so both fell down and got hurt. Both Emily and Faith feel a bad about falling down. Do you think one of them feels worse than the other?

Faith,
Or Emily,
Or do you think they'd feel the same?

Why?

OK Outcome, Most Explicit

Greg and Henry are in the same class at school and are going to lunch. The teacher tells them she has a special surprise- that all the kids get a piece of cake because it is her birthday, but all the pieces of cake are in little boxes that are the same size but are all different colors. Some pieces are big, some are little. Greg and Henry both like cake a lot. The teacher places two boxes in front of each child and they each pick one box.

Greg gets two boxes- a red one and a yellow one. He looks at both of them and decides to keep the red one. He opens it up and sees he got a small piece of cake. The teacher opens up the yellow box that he didn't pick and Greg sees that there was a big piece of cake in that one. Greg thinks about how if he had only kept the yellow box instead of the red box he would have had the big piece of cake.

Henry gets two boxes also- a blue one and a green one. He looks at both of them and decides to keep the blue one. He opens it up and sees that he also gets a small piece of cake. The teacher shows him that in the green box that he didn't pick, there was a small piece of cake in that box too, that is the same size as Henry's. Henry thinks about how if he had kept the green box, he would have still gotten a small piece of cake.

So, both boys chose between two boxes and got a small piece of cake. Greg and Henry are both a little sad that their pieces of cake are so small.

Do you think one of them feels worse than the other?

Greg, who thinks about how he would have gotten a big piece if had picked the other box
Or Henry, who thinks about how he would have gotten a small piece even if he had picked the other box
Or do you think they'd feel the same?

Why?

OK Outcome, Least Explicit

Greg and Henry are in the same class at school and are going to lunch. The teacher tells them she has a special surprise- that all the kids get a piece of cake because it is her birthday, but all the pieces of cake are in little boxes that are the same size but are all different colors. Some pieces are big, some are little. Greg and Henry both like cake a lot. The teacher places two boxes in front of each child and they each pick one box.

Greg gets two boxes- a red one and a yellow one. He looks at both of them and decides to keep the red one. He opens it up and sees he got a small piece of cake. The teacher opens up the yellow box that he didn't pick and Greg sees that there was a big piece of cake in that one.

Henry gets two boxes also- a blue one and a green one. He looks at both of them and decides to keep the blue one. He opens it up and sees that he also gets a small piece of cake. The teacher shows him that in the green box that he didn't pick, there was a small piece of cake in that box too, that is the same size as Henry's.

So, both boys chose between two boxes and got a small piece of cake. Greg and Henry are both a little sad that their pieces of cake are so small.

Do you think one of them feels worse than the other?

Greg,
Or Henry,
Or do you think they'd feel the same?

Why?

Appendix D. Comprehension Questions

Allison and Britney

How many girls are in the story?

In the game, how many boxes did each girl get to pick out the barrel at first?

How many boxes did each girl get to open?

Did either girl win the big prize?

Did either girl have the big prize in the box she didn't pick?

Chris and Dave

How many boys are in the story?

How many ways does each boy have to choose from to get to school?

What happened to each boy on his way to school?

Was the branch on both paths for each boy or just one boy?

Faith and Emily

How many girls are in the story?

How many swings do they have to choose from on their playground?

What happened when each girl sat on her chosen swing?

Was the other swing broken too for both girls or just one girl?

Greg and Henry

How many boys are in the story?

How many pieces of cake does each boy get to choose from?

What size cake did each boy get?

Was there a big piece of cake in the unchosen box for either boy?