THE DEVELOPMENT OF BELIEF-BASED EMOTION UNDERSTANDING

by

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A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Psychology

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ABSTRACT

Theory of mind (ToM) and emotion knowledge (EK) are important socio-emotional skills that contribute to adaptive social functioning. Yet, research in these domains has lacked a systematic examination of emotion false beliefs, which is the ability to correctly attribute emotions given a false belief. The present study investigated the development of emotion false beliefs in 85 4- and 6-year-olds. It improved upon previous investigations by controlling for memory performance, EK understanding, and verbal ability. It also compared performance across four discrete emotions and used a within-subject design to compare emotion false belief with false belief development. As expected, 6-year-olds performed significantly better on emotion false belief tasks than 4-year-olds, though performance did not vary by discrete emotion. The data supported a developmental precedence of false beliefs before emotion false beliefs, as children were more likely to pass false belief questions than emotion false belief questions. Extending findings from previous literature, false belief performance did not uniquely contribute to emotion false belief performance. False belief and emotion false belief appear to develop along different trajectories, which further supports the idea that attributing emotions to beliefs represents a conceptual change in emotion understanding. These conclusions are discussed in terms of socio-emotional development and clinical applications.

Chapter 1

INTRODUCTION

Theory of mind (ToM) research has contributed to our understanding of typical and atypical social development. ToM or understanding mental states like beliefs and desires enables children to explain behavior (Doherty, 2009), while poor ToM is associated with problem behaviors, autism, and schizophrenia (Baron-Cohen, Leslie, & Frith, 1985; Brüne, 2005; Capage & Watson, 2001). Children apparently acquire levels of ToM in stages (Wellman & Liu, 2004). Much of the research on ToM has focused on the development of false belief understanding because false belief attainment may signify when children are able to mentally represent thoughts (and beliefs and desires) about their social environment (Wellman & Woolley, 1990; Wimmer & Perner, 1983). Identifying children's ToM understanding at different developmental periods reveals their knowledge of social surroundings, as well as limitations of that knowledge.

Similarly, children's level of emotion knowledge (EK) is predictive of social, academic, and clinical outcomes (Brüne, 2005; Denham & Brown, 2010; Denham et al., 2002; Trentacosta & Izard, 2007). There is an abundance of literature that investigates EK (Denham, 1998; Izard, 1991), but it appears to be limited to a situation-based understanding of emotions rather than a mentalistic understanding. That is, children are able to match emotions to specific situations (e.g., Denham &

Couchoud, 1990b), but it is unclear whether they have the understanding to attribute emotions to people's thoughts. Researchers need to go beyond the situation-based understanding of emotions to map the normative development of EK more completely.

Despite the wealth of research on ToM and EK development, few studies have examined children's understanding of emotion false beliefs or children's ability to attribute an emotion given an inaccurate belief. Children's acquisition of emotion false belief may represent a conceptual change from a situation-based to representation-based understanding of emotions. Studies have revealed mixed accounts of its development across emotions and in comparison to false beliefs (e.g., Bradmetz & Schneider, 1999; Wellman & Banerjee, 1991). The present study aimed to systematically examine the relation between false beliefs and emotion false beliefs.

Theory of Mind

ToM enables children to understand people (both self and others) as purposeful beings (Meltzoff, Gopnik, & Repacholi, 1999). This understanding elicits an interest in people's motivation and internal states. Mental representations are mental models of reality, the past, future, and hypothetical situations. Mental models may be correct or incorrect, and individuals may not be aware of their accuracy. Consequently, mental representations make interpretations of social situations independent from their context so that interpretations may change by person or over time for the same situation. Children without mental representations (i.e., without fully formed mental models) may *attach* specific meaning (e.g., what people will do or feel) to social situations (Doherty, 2009). Put another way, mental representations provide the

flexibility to interpret different behavioral and emotional responses from the same situations (Gnepp, 1989). Children's ability to understand the mental states of others predicts children's social relationships and behavior, and more generally, their ability to adapt to their social environment (Brown, Donelan-McCall, & Dunn, 1996; Watson, Nixon, Wilson, & Capage, 1999).

Mental state understanding does not occur all at once. It grows in sophistication as children increase their ability to make inferences about others. Children first acquire an understanding of desires, then beliefs, and then belief-desire understanding (Leslie & Polizzi, 1998; Wellman & Liu, 2004; Wellman & Woolley, 1990). Researchers provide different accounts of why development occurs in this way. For instance, some researchers relate development to the amount of mental-state language, while other researchers claim that development involves greater amounts of executive functioning (J. Dunn, Brown, Slomkowski, Tesla, & Youngblade, 1991; Leslie & Polizzi, 1998). Despite this disagreement, there is a general consensus that ToM changes the way children think about themselves and others. Many researchers agree that ToM depends on some type of mental representation (whether it be a mental representation of a theory or mental simulations of situations) that grows in complexity across development (Gopnik, 1996; Gopnik & Wellman, 1992; Harris, 1992; Perner, 1991).

Development

Around age 3, children are able to accurately attribute emotion and behavior to desires (Meltzoff et al., 1999; Stein & Levine, 1989; Wellman & Woolley, 1990; Yuill, 1984). This understanding of desire-based emotion may lack vital knowledge that emotions can be independent from context. Children's desire understanding may be "objective" in that the desire is about the state of the world (Doherty, 2009). With an objective understanding of desire, emotions are attributed to objects or situations (Doherty, 2009; Gnepp, 1989). In contrast, an adult understanding of desire is "subjective" in that it is a mental representation of the association between desire (and emotion) and an object or situation (Doherty, 2009).

The literature reveals mixed findings regarding when children develop this understanding, depending on the task and interpretation. Toddlers show an understanding that people can have different desires, such as Tommy liking cookies and Sally liking lollipops (Repacholi & Gopnik, 1997; Wellman & Liu, 2004). This scenario may not provide evidence for subjective desire as desire could be a property of a person (Doherty, 2009). Instead, children's ability to comprehend that the same situation may elicit different desires and emotions, such as Tommy and Sally may feel differently in response to seeing a dog, may provide stronger evidence for subjective desire understanding. The literature presents inconsistent findings about when children can attribute different emotions to the same situation. where Some studies reveal that children as young as 3-years-old can correctly attribute different emotions to the same situation, but other studies suggest that children do not pass this task until around age 4 or 5- years when they acquire false belief understanding (Doherty, 2009; Moore et al., 1995; Rakoczy, Warneken, & Tomasello, 2007). Also, tasks that test this

understanding often inform children of the characters' desires, so it is likely that they are repeating what they heard (Doherty, 2009).

False Beliefs

Beliefs may accurately or inaccurately reflect reality. False beliefs are the inaccurate representation of reality. False belief tasks present children with a scenario in which a character's belief changes from accurate to inaccurate. In a classic example of a false belief task (Wimmer & Perner, 1983), Maxi helps his mother unpack groceries and places chocolate in a green cupboard. Maxi leaves and while he is gone his mother takes the chocolate out of the green cupboard and then she returns it to the blue cupboard. Children are asked where Maxi will look for his chocolate (or where he thinks his chocolate is located). The target question assesses children's awareness that Maxi will have a false belief about the location of the chocolate and search in its previous location . Most 3-year-olds do not pass this task, responding that Maxi will go to where the chocolate really is, whereas most 4-year-olds understand that Maxi will not know the true location of the chocolate. (Wellman, Cross, & Watson, 2001). Prior to false belief understanding, children appear to struggle with the idea that someone's beliefs can be inaccurate.

Many researchers believe that it is not until children understand false beliefs, around 4-years-old, that they demonstrate an ability to mentally represent internal states and their targets independently from reality (Gopnik & Astington, 1988; Wimmer & Perner, 1983). This developmental process may represent a "conceptual change" in children's thinking (Gopnik & Wellman, 1992; Perner, 1991; Perner, Leekam, & Wimmer, 1987; Wellman et al., 2001). Most alterations to false belief stories do not affect performance, and children's performance on multiple versions of

the same tasks is generally consistent (Wellman et al., 2001). The robustness of children's performance emphasizes that children either do or don't understand false beliefs.

False belief understanding appears to signify a developmental milestone in children's belief understanding. Despite disagreements about when children attain different ToM skills, the developmental differences between ToM skills appear to be robust (Wellman & Liu, 2004). Children pass unconfirmed belief tasks, i.e., a belief with unknown accuracy, before false belief tasks (Harris, Johnson, Hutton, Andrews, & Cooke, 1989; Wellman & Bartsch, 1988). Ultimately, the change in thinking associated with false belief may allow for a flexible perspective on social situations that incorporates environmental and mental state information.

Emotion Knowledge

In contrast to the relatively recent development of ToM research, emotional development has a long research history. This vast literature highlights the importance of children's identification of emotions in self and others. Children with greater EK have more friends and do better in school (Izard et al., 2001; Trentacosta & Izard, 2007), while poor EK appears to be a risk factor for problem behaviors (Trentacosta & Fine, 2010). EK promotes social understanding, which may direct children to select appropriate behaviors (Izard et al., 2008). Thus, EK includes the appropriate utilization of emotion understanding that facilitates adaptive social functioning (Izard, Fine, Mostow, Trentacosta, & Campbell, 2002).

Differential Emotions Theory (DET; Izard, 1977, 1991) explains the utility of EK from a functional perspective. According to DET, basic emotions serve unique functions in response to emotion eliciting situations. Emotions are associated with

unique expressions and feeling states that motivate behavior aligned with their function. For example, anger occurs in response to an injustice or impedance to achieve a goal while sadness occurs in response to loss (Izard, 1991). Anger may also provide a sense of energy, which can be used to help solve a problem, and sadness is experienced as a lack of energy that helps people pause from busy lives to learn and recover from loss. The universality of distinct emotion expressions, the agreement among emotion-eliciting situations, as well as the observed adaptive roles that emotions play are used as evidence in support of the theory (Abe & Izard, 1999; Izard, 1971; Izard et al., 1995).

Development

Children show an understanding of the unique functions of emotions. At a young age, children use emotions to interpret their environment (J. Dunn, Brown, & Beardsall, 1991; Moses, Baldwin, Rosicky, & Tidball, 2001). Beginning in preschool, children are able to identify happy, sad, mad, and fear expressions, label them, and state their causes and consequences (Denham, 1986; Denham & Couchoud, 1990b; Morgan, Izard, & King, 2010). Children provide similar causal explanation of emotions as adults (Denham, 1998; Wellman & Woolley, 1990). These skills demonstrate children's understanding about the unique function of emotions, and their typical relations to situations and behavior.

Normative EK development reveals that children acquire knowledge about discrete emotions at different ages. Infants show signs of identifying happiness before they identify other emotions (Ludemann & Nelson, 1988). Preschoolers learn to identify happiness and sadness before anger and fear (Camras & Allison, 1985; Stifter & Fox, 1987). Among happiness, sadness, anger, and fear, fear appears to be the most

difficult to identify, perhaps due to its complex facial expression and infrequent exposure (Brody & Harrison, 1987). Emotions also do not appear to develop linearly. Children are better at identifying happy and sad over angry expressions, but they are better at identifying causes of anger. This change in developmental trajectory may be due to the salience of anger-eliciting experiences (Denham, 1998).

Situation-based EK

Studies reveal that both adults and children typically rely on situational cues to identify emotions in others (Denham, 1998). Thus, it is not surprising that EK in 3- to 6-year-olds is generally defined by the ability to identify emotion expressions, attach emotion labels to expressions, and associate emotion to causal situations (Denham, 1986; Izard, 1971; Morgan et al., 2010). All of these tasks depend on environmental cues. Current understanding of normative EK development appears to be limited to situation-based EK.

Yet, the interpretation of complex social situations requires children to use EK in a flexible manner. For instance, although preschoolers can acknowledge that others may have different emotional responses to the same situation, they struggle with this conclusion when the situation would typically evoke a specific reaction, like a non-fearful response to a snake (Denham & Couchoud, 1990a; Moore et al., 1995). Similarly, limitations of situation-based EK are apparent when expressive and situational cues are incongruent (e.g., smiling while getting a shot). Studies reveal that 3- and 4-year-olds resolve this conflict by changing the reality of the situation (e.g., saying that the shot wouldn't hurt), which emphasizes their dependence on context (Denham & Couchoud, 1990a; Gnepp, 1989). In everyday situations, children must infer emotional states without access to emotion expression or concrete situational

cues. When people try to hide their emotions, children need to understand that psychological states and personal information (e.g., memories) may elicit emotions (Gnepp, 1989). Representation-based EK (i.e., emotions associated with internal states) would allow children to identify emotions across situations that are not necessarily consistent with a prototype of emotion-eliciting situations.

Emotion False Beliefs

Children's ability to attribute emotions to false beliefs may mark a change in their EK: it may change from a situational to a representational understanding of emotions. Instead of objects or situations inherently eliciting an emotional state (i.e., as in situation-based EK), emotions are dependent on other personal information such as beliefs (i.e., as in representation-based EK). This ability goes beyond understanding that others may have different feelings attached to the same situation. A representational understanding of emotions would allow children to accurately attribute emotions to individuals with incorrect knowledge. This ability may promote empathy in situations in which there is a misunderstanding.

The limited number of studies investigating the development of emotion false belief understanding has resulted in inconsistent findings. Harris et al. (1989) were the first to investigate children's development of emotion false beliefs. They found that the ability to correctly associate happiness and sadness to a character's false belief increased from age 4 to 6. Other researchers have investigated the belief basis of surprise because of its association with people's expectations or beliefs. To be surprised, the situation is different than expected. Some researchers who investigated the belief-basis of surprise found that children's understanding developed concurrently with false belief understanding at around age 4 (Wellman & Banerjee, 1991), whereas

other researchers found that an understanding of surprise developed after false belief understanding at around age 5 or 6 (Hadwin & Perner, 1991; MacLaren & Olson, 1993).

Other researchers argue that children demonstrate some knowledge of the relation between emotions and mental states at an early age, as shown by their ability to explain someone's emotion based on a cued-memory (Lagattuta & Wellman, 2001; Lagattuta, Wellman, & Flavell, 1997). Yet, children were significantly better at predicting emotions based on a cue from the original event (i.e., an object from the original situation) than a cue that would remind someone of the original event (i.e., a representation of the original event), which suggests that children may have relied on situation-based cues rather than associating emotions with mental representations (Lagattuta et al., 1997). Additionally, even these studies identified a marked change in children's abilities between ages 3 through 6.

A growing number of studies have identified a lag between acquiring false belief and emotion false belief understanding. Ruffman & Keenan (1996) investigated 4-8-year-old children's understanding of false belief and surprise. All children demonstrated successful performance on false belief, but only 7-8-year-olds were above chance on predicting surprise. Another study that included 5-7-year-olds found that they were better at false beliefs than emotion false beliefs, even when they were predicting their own emotions (Bender, Pons, Harris, & de Rosnay, 2010). Studies that investigated belief-based understanding of fear and happiness (Bradmetz & Schneider, 1999) and sadness and happiness (de Rosnay, Pons, Harris, & Morrell, 2004; Parker, MacDonald, & Miller, 2007) similarly found a later acquisition of belief-based emotion understanding than false belief understanding. Bradmetz & Schneider (1999)

uniquely used a within-subject comparison between ascribing behavior and emotion to a false belief. In five experiments, they found emotion false belief questions to be more difficult than explicit false belief questions (predicting behavior from false beliefs). This developmental difference provides evidence that understanding about EK undergoes a shift at a different time than beliefs. Children's difficulty in predicting emotions from false beliefs may represent a normative process in which children learn to associate emotions with mental representations rather than situations.

A major limitation of the emotion-false belief literature is that studies have not examined the impact of false beliefs on emotion false beliefs. In addition, a majority of this literature exclusively examines the belief basis of happiness and surprise rather than including and comparing performance across a range of emotions (e. g., Hadwin & Perner, 1991). Inconsistencies across experiments that vary by emotion are difficult to interpret (Bradmetz & Schneider, 1999; Wellman & Banerjee, 1991). Finally, many studies fail to account for confounding variables such as EK, memory performance, and verbal ability. These critiques underscore the need for a systematic examination of belief-based emotion development.

Developmental Trajectory

The literature does not present a clear picture as to the relationship between false belief and emotion false belief acquisition. To address this question, the lag in children's understanding of false beliefs and emotion false beliefs needs to be replicated using a within-person design to corroborate the sequence of development (Bradmetz & Schneider, 1999; de Rosnay et al., 2004). It also is important to examine whether false belief understanding statistically contributes to emotion false belief

performance. Results would reveal whether false belief understanding provides a foundation for emotion false belief development.

This examination would help to clarify the relation between emotion and ToM development. Researchers disagree as to whether EK and ToM share a developmental path, are separate but impact each other (and how), or if they are independent processes (J. Dunn, 2000). Thus far, this theoretical question has not been examined using emotion false belief tasks.

Discrete Emotions

Consistent with DET, children's emotion understanding does not develop at the same time across emotions (Denham, 1998). Consequently, there is reason to believe that emotion false belief development would depend on emotion. Belief-based emotions may differentially develop in two ways: 1) they may develop in parallel to, and after, situation-based EK. In this case, happiness develops first, then sadness, anger, and fear, with situation-based EK developing first, followed by belief-based EK or 2) situational and representational EK for each emotion may develop sequentially such that situation-based happiness and then belief-based happiness develops first, and then situation-based sadness and then belief-based sadness, etc. To initially examine this question, emotion false belief tasks need to target different discrete emotion one at a time and compare performance to situation-based EK.

Verbal Ability

Language rapidly develops between ages 3 to 6, similar to false belief and EK development. This similarity in timing is not a coincidence, but appears to reflect the impact of language on false belief and EK. Many studies demonstrate that verbal

ability uniquely contributes to children's performance on false belief and EK tasks (e.g., Cassidy, Werner, Rourke, Zubernis, & Balaraman, 2003). While false belief and EK tasks tend to rely heavily on language, researchers theorize that language may be fundamental for false belief and EK development (Astington & Jenkins, 1999; Cassidy et al., 2003; Colle, Baron-Cohen, & Hill, 2007; Ruffman, Slade, Rowlandson, Rumsey, & Garnham, 2003).

False belief and EK development appear to depend on the amount, type, and quality of language to which children are exposed. The amount of maternal discourse and mental state language predict children's level of emotion and false belief understanding (de Rosnay et al., 2004; J. Dunn, Bretherton, & Munn, 1987; J. Dunn, Brown, & Beardsall, 1991). Lack of language exposure negatively impacts mental state understanding, as shown by studies with deaf children from hearing families (Peterson & Siegal, 2000). Language development and involvement in conversations provide children with mental state vocabulary, syntactic skills to imbed thoughts, and practice with perspective-taking (see Harris, de Rosnay, & Pons, 2005 for a review). Hence, verbal ability is likely an important factor in emotion false belief development.

The Proposed Study

The primary goal of the present study was to explore the development of emotion false beliefs. Similar to the theorized conceptual change in belief understanding that occurs when children understand false beliefs, children's knowledge about emotions may conceptually change as they understand emotion false beliefs. Children may initially understand emotions in terms of situations and then learn to associate emotions with internal states such as beliefs. Emotion false belief development is unclear, such that it may develop before or after acquisition of false

belief understanding, though a majority of the literature suggests a later development compared to false beliefs (Bender et al., 2010). Also, development may depend on the targeted emotion. In order to clarify this developmental process, the present study evaluated systematically 4- and 6-year-old's performance on emotion false belief tasks that vary by discrete emotion.

Goal 1: Replicate the Developmental Progression of Emotion False Belief Understanding

The first objective was to replicate a developmental progression in emotion false belief performance, where 6-year-olds perform significantly better on attributing emotions to false beliefs than 4-year-olds.

Goal 2: Examine the Role of Discrete Emotion

The first objective was to replicate a developmental progression in emotion false belief performance, where 6-year-olds perform significantly better on attributing emotions to false beliefs than 4-year-olds.

Goal 3: Examine the Relations Between Emotion False Beliefs and False Beliefs

The final objective was to explore systematically the developmental relation between emotion false belief and false belief understanding. The literature suggests that children will be more likely to pass false belief questions than emotion false belief questions, though it is unclear how false belief understanding impacts emotion false belief understanding. These findings would inform a conceptual change model of belief-based emotion development.

Chapter 2

METHOD

Participants

Recruitment occurred at local preschools and elementary schools (school n = 7). Children who were not 4- or 6-years-old at the time of consent, had special education services (n = 4), or had a primary language other than English (n = 3) were excluded from the study. One child was dropped from the study due to administrator error. The final sample included 85 children, of which 43 were 4-years-old and 42 were 6-years-old. Parent-reported demographics identified 65 European American children, 8 Hispanic American children, 7 African American children, 6 Asian American children, and 7 children whose parents identified more than one race. The sample included approximately equal numbers of boys and girls (boys n = 44). According to the U.S. Census Bureau (2013), from 2007-2011, 10.7% of individuals lived below the poverty level within the recruitment region.

Procedures and Measures

With permission from the schools, consent forms and demographic questionnaires were sent home for parents to review, complete, and return. Children whose parents consented then provided verbal assent. Trained research assistants who were blind to the study aims interviewed the children with a standardized measure of verbal ability and an assessment of emotion false beliefs (sixteen emotion false belief tasks altogether). Research assistants assessed children across three sessions to

decrease strains on attention. They assessed children's verbal ability and four of the emotion false belief tasks in the first session. Research assistants administered the remaining twelve emotion false belief tasks across the last two sessions. Each child received a random presentation order of the emotion false belief tasks. The first visit lasted approximately 30 minutes and the second and third visits lasted approximately 20 minutes each. Interviews occurred at the children's school. Children received stickers for their participation.

Demographic Questionnaire

Parents completed a demographic questionnaire concerning their child's background and education. Questions included date-of-birth, sex, ethnic/racial background, primary language, and whether the child receives special education services (i.e., a 501 plan or Individualized Education Program).

Verbal Ability

The Peabody Picture Vocabulary Test-Third Edition (PPVT-III; L. M. Dunn & Dunn, 1997, $\alpha = .94$) served as the measure of verbal ability. The measure assesses receptive vocabulary skills, and correlates significantly with other verbal ability and intelligence tests (Carvajal, Parks, Logan, & Page, 1992; L. M. Dunn & Dunn, 1981). It also correlates positively with ToM (Carlson & Moses, 2001). Children are verbally presented with a word, and they are asked to identify one of four pictures that best graphically represents the meaning of the word. Standard scores are obtained based on age norms. Analyses included verbal ability as a covariate.

Emotion False Belief

The children received sixteen emotion false belief tasks that are based on the stories from Bradmetz and Schneider (1999) and Harris et al. (1989). The tasks include memory questions (n = 2-3 per story), EK questions (n = 2 per story), an explicit false belief question, and an emotion false belief question imbedded in the stories. Similar to Bradmetz and Schneider (1999), the design includes an explicit false belief question to evaluate the discrepancy between explicit and emotion false belief understanding. Previous studies did not find an effect for presentation order of explicit false belief and emotion attribution question (Bradmetz & Schneider, 1999), so the explicit false belief question was asked first.

Modifications to the original stories addressed the stories' limited examination of different emotions. The changes included adding additional stories and focusing on one emotion per story. The modified stories target four different emotions: happiness, sadness, anger, and fear. Story development was sensitive to DET, such that stories targeted different emotions by eliciting discrete emotion functions. For instance, sad stories centered on loss. Additionally, EK and memory questions were included to control for situation-based EK and memory/attention skills, respectively, that might affect performance.

The emotion false belief battery included four stories about each emotion. Correct answers for two stories of each emotion reflected when the character experienced the target emotion, e.g., "Anne really likes her music box. She really likes to listen to the music from her music box! She keeps her music box in this drawer. But now, when Anne tries to play her music box, it won't play! It is broken. […] Now Anne goes to a different room. Mickey the Monkey decides to play a nice trick on Anne. […] He takes the broken music box and place the new music box in Anne's

drawer. Before she [Anne] sees what is in the drawer, does Anne feel sad: yes or no?" Whereas correct answers for the remaining two stories reflected when the character did not feel the target emotion, e.g., "Jack really likes to play his whistle. Playing his whistle is his favorite thing to do. He keeps his whistle in his room. […] Now Jack goes to school. Mickey the Monkey decides to play a trick on Jack. Mickey moves Jack's whistle to the basement. […] Before he [Jack] opens the door to his room, does Jack feel sad: yes or no?" EK questions similarly assessed children's ability to identify both the presence and non-presence (e.g., sad or not sad) of the discrete emotion in each story. This questioning approach was in contrast to prior study designs which asked children to choose between two emotions (e.g., Does the character feel happy or sad?).

Prior to the start of administration of the emotion false belief battery, interviewers administered a receptive emotion matching task, which asked children to match verbal labels to their respective emotion expression picture. These pictures were previously validated on their unique discrete emotion expressiveness (obtained from the Emotion Matching Task; Morgan et al., 2010). Typically, 4- and 6-year-olds can accurately identify emotion expressions (Denham, 1998), thus it was expected that children would complete this task with ease. This procedure served as a prerequisite for the task and as a warm up. Incorrect responses were corrected and asked again until the child provided a correct response.

Research assistants assessed the children using an interactive storybook format. Each story included a different character and Mickey the Monkey who likes to play nice or mean tricks. From the examples described above, Mickey played a mean trick when he moved Jack's whistle from his room to the basement, and he played a

nice trick on Anne by replacing the broken music box with a new music box. The literature suggests that children's performance may depend on type of trick, that is, type of deception described in the story (Hughes, Dunn, & White, 1998). Mickey the Monkey plays two nice and two mean tricks per discrete emotion.

Each type of question was scored independently. Total scores for the control questions reflect a sum of correct trials across stories, resulting with a possible memory score with range from 0 – 42 and EK score with range from 0-32. Children received one point for correctly answering the explicit false belief question and one point for correctly answering the emotion false belief question. Total scores for false belief and emotion false belief questions were calculated in two ways, continuously (points added across stories with a range 0-16) or dichotomously (where a total score across stories from 0-8 was rescored as 0 and a total score from 9-16 was rescored as 1). The continuous scoring approach accounts for performance variability (due to extraneous factors), while the dichotomous scoring approach more accurately reflects performance according to theory (that is that children either understand or do not understand these concepts). The internal consistency for performance across false belief questions (α = .94), emotion false belief questions (α = .85), EK questions (α = .86), and memory questions (α = .70) was good. Appendix A contains the 16 stories, and Table 1 presents the frequency of scores, 0-16, for explicit false belief and emotion false belief performance.

Table 1 Frequency of Scores on False Belief and Emotion False Belief Questions (Collapsed Across Age and Discrete Emotion)

	False Belief		Emotion False Belief	
Score	Frequency	Percent	Frequency	Percent
0	7	8.2	2	2.4
1	7	8.2	1	1.2
2	7	8.2	8	9.4
3	2	2.4	6	7.1
4	2	2.4	6	7.1
5	1	1.2	7	8.2
6	3	3.5	7	8.2
7	5	5.9	7	8.2
8	2	2.4	7	8.2
9	3	3.5	1	1.2
10	2	2.4	7	7.1
11	4	4.7	2	2.4
12	4	4.7	7	8.2
13	5	5.9	6	7.1
14	13	15.3	4	4.7
15	13	15.3	5	8.2
16	5	5.9	2	9.4

N = 85.

Chapter 3

RESULTS

Data Analytic Strategy

Preliminary analyses examined the data for anomalous scores and biases due to extraneous factors, such as demographic variables and measurement construction. The primary analyses addressed the three study goals through a combination of approaches. Analyses included both within- and between-subject design. Parsimonious models were identified through exploring the role of control variables, such as EK and memory performance, on emotion false belief performance. Additionally, the data analytic strategy took advantage of two scoring approaches to the outcome variable. One approach treated the emotion false belief score as a continuous outcome (0-16 score). The second approach used a binary score or count score for emotion false belief performance, which reflects the pass-fail nature of the construct. These two approaches allowed for different models. That is, some models assessed for significant predictors that contributed to performance while other models reveal the probability of passing emotion false belief questions.

Preliminary Analyses

Initially models examined scores as continuous outcomes. Table 2 presents the means and standard deviations by age group for: total emotion false belief performance, emotion false belief performance for each of the four emotions, total false belief performance, verbal ability, EK performance, and memory performance.

According to mean performance, 4- and 6-year-olds demonstrated a different pattern of performance from one another across happy, sad, mad, and scared emotion false belief stories, which contradicts the idea that development of discrete emotion false belief understanding occurs along a standard trajectory. Goal 2 further examines the statistical differences between these means. On average, verbal ability fell within the Average range (90-110), although the sample reflects abilities from the Borderline (70-79) through Very Superior range (130+) (Wechsler, 2003). Children performed close to ceiling on the measures of EK and memory, which helps to support the validity of the emotion false belief tasks for this age range. Independent sample t-tests revealed no differences across sex or race (European American versus Not European American).

Table 2 Means, Standard Deviations, and Range of All Variables Grouped by Age

	4-year-olds			6-year-olds			
	M	SD	Range	M	SD	Range	Max
EFB	5.56	2.84	0 – 13	10.19	4.52	0 – 16	16
Happy EFB	1.37	0.95	0 – 4	2.62	1.36	0 – 4	4
Sad EFB	1.33	0.99	0 – 3	2.52	1.19	0 – 4	4
Mad EFB	1.56	1.08	0 – 4	2.40	1.23	0 – 4	4
Scared EFB	1.30	1.06	0 – 4	2.64	1.34	0 – 4	4
False Belief	5.74	4.81	0 – 15	12.45	4.39	1 – 16	16
Verbal Ability	107.91	12.97	70 – 134	106.26	13.27	71-131	N/A
EK	30.16	2.98	17 – 32	31.45	0.92	28 – 32	32
Memory	39.86	2.36	33 – 42	41.52	1.06	37 – 42	42

Note. *N* for 4-year-olds = 43, *N* for 6-year-olds = 42. EFB = Emotion False Belief, EK = Emotion Knowledge questions, Memory = Memory questions.

Descriptively, 6-year-olds performed better on the emotion false belief and false belief questions than 4-year-olds. Independent sample t-tests indicated that performance varied by age for emotion false belief scores, t (68.71[1]) = -5.64, $p < .01$, and false belief scores, t (83) = -6.71, $p < .01$. According to a pass/fail cut point at 8, 4-year-old children failed the emotion false belief stories 88% of the time, which is significantly more often than predicted by chance, exact binomial p (2-tailed) < .01. Similarly, 4-year-old children failed the false belief stories 72% of the time, which is significantly more than by chance, exact binomial p (2-tailed) < .01. Children at age 6 performed significantly better than chance on both emotion false belief and false belief stories, exact binomial p (2-tailed) = .02 and p (2-tailed) < .01, respectively. Considering a more conservative pass/fail cut-point (at about top and bottom 38 %, cut-points 6 and 11), 4-year-olds failed the emotion false belief stories more frequently than expected by chance, exact binomial p (2-tailed) = .03, whereas they failed the false belief stories at a rate equivalent to chance, exact binomial p (2-tailed) = .54. According to this more conservative criteria, 6-year-olds passed the false belief stories at a significantly greater than chance occurrence, exact binomial p (2-tailed) < .01, but they did not pass the emotion false belief stories at greater than chance occurrence, exact binomial p (2-tailed) = .89.

In the present sample of 4-year-olds, a greater number of children failed the false belief questions than expected given previous research. According to Wellman et al.'s (2001) meta-analysis, children at around age 3.6 correctly answer false belief questions 50% of the time, and children after that age become increasingly more

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[1] Levine's test of equal variances for emotion false belief was rejected, $F = 9.03$, $p < .01$

accurate. While ToM tasks tend to develop in a specific order (Wellman & Liu, 2004), studies with different samples (such as varying by culture or socio-economic status) indicate that ToM acquisition such as false belief understanding occurs at different ages (Naito & Koyama, 2006; Wellman et al., 2001). An independent sample t-test identified verbal ability as a possible differentiating factor between the subset of 12 four-year-old children who "passed" false belief questions (according to a 8-point cut off) and the 31 four-year-old children who "failed," t (41) = -1.98, p = .05. These 12 children who passed had a mean verbal ability of 114, which compared to a mean verbal ability of 105.55 for the remaining 31 children who failed. The literature consistently identifies verbal ability as an important predictor of false belief acquisition (Milligan, Astington, & Dack, 2007). Yet, these 12 children did not perform significantly better on emotion false belief questions than the other children, t (14.98[2]) = -.73, p = .48. The group of 12 children earned a mean score of 6.17, and the remaining children earned a mean score of 5.32.

Table 3 presents the intercorrelations among the number of correctly answered emotion false belief stories and age, verbal ability, false belief performance, EK performance, and memory performance. The correlations provide initial evidence that age positively relates to emotion false belief performance. As expected, verbal ability had a positive relation to emotion false belief performance. Memory performance but not EK performance positively correlated with emotion false belief performance. Children's EK was measured multiple times within and across the stories; hence, the few errors that occurred may not reflect deficits in EK. In contrast, the memory

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[2] Levine's test of equal variances for emotion false belief was rejected, F = 4.30, p < .05.

questions were specific to each story, and an error on a question may more accurately reflect strains on attention and missing information about the story.

Table 3 Intercorrelations Among Emotion False Belief Performance and Age, False Belief Performance, Verbal Ability, Emotion Knowledge Questions, and Memory Questions

Variable	1	2	3	4	5	6
1. Age	-	.60**	-.08	.39**	.42**	.51**
2. False Belief		-	.02	.22*	.28**	.37**
3. Verbal Ability			-	.06	.19	.22*
4. EK Questions				-	.56**	.11
5. Memory Questions					-	.25*
6. Emotion False Belief						-

**p< .01. *p < .05. EK = Emotion Knowledge. False belief scored 0 - 16; EK Questions scored 0 - 32; Memory Questions scored 0 - 42, Emotion false belief scored 0 – 16, Age reflects age in months.

Analyses tested the data for biases across age groups as well as differences in performance due to task construction. Independent sample t-tests revealed no significant differences between age groups on sex, race, and verbal ability.. A paired t-test revealed no effect of type of trick (nice, mean) on emotion false belief performance.

Although performance between stories where the emotion was present (e.g., sad) compared to stories where the emotion was absent (e.g., not sad) was moderately correlated, $r = .50$, $p < .01$, a paired t-test revealed a significant difference between present and absent emotion story performance, t (84) = -2.16, $p = .03$. Contrary to expectation, children performed better on questions when the character did not

experience the target emotion, *M* present = 3.62, *M* absent = 4.22, demonstrating a bias towards answering no.

Additionally, the control EK questions were designed to test the child's ability to detect both the presence and absence of the emotion within each story. Performance on the EK questions between emotion present versus absent questions revealed a different pattern, with children performing similarly across emotion absent and present questions, *M* present = 15.72, *M* absent = 15.08. The lack of replication across EK performance suggests that children's differing performance across "absent or present" emotion false belief questions may be a spurious finding. The data for the main analyses collapsed across these measurement conditions.

Primary Analyses

Goal 1: Test the Effect of Age on Children's Ability to Understand Emotion False Beliefs

Initially, a hierarchical linear regression was conducted to determine the importance of memory performance as a potential confound on children's emotion false belief score. As shown in Table 3, memory performance related significantly and positively to emotion false belief performance (scored on a continuous scale, 0-16), so it was included in Block 2 (with age in months, verbal ability, and false belief performance included in Block 1) of a hierarchical regression model. Memory performance did not predict a significant amount of variance in emotion false belief performance after the main variables of age, verbal ability, and false belief were accounted for, β = -.02, t = -0.02, p = .85. The full model explained 33% of variance. The addition of memory performance accounted for less than 1 percent of the model's variance, which was not significant (p = .85). Memory performance was no longer

considered as a substantial factor of emotion false belief performance, and it was not included in later models.

The final hierarchical regression model included verbal ability and false belief performance in Block 1 and age in Block 2. Table 4 presents the results of this final model. In support of Hypothesis 1, a standard deviation increase in age resulted in a .49 increase in emotion false belief performance. Verbal ability also uniquely predicted emotion false belief performance, where children with a standard deviation increase in verbal ability achieved a .26 increase in emotion false belief score. Age uniquely explained 18% of variance in the model, and verbal ability uniquely explained 9% of the variance. False belief performance did not uniquely contribute to emotion false belief performance after accounting for age and verbal ability.

Table 4 Hierarchical Regression Analysis Predicting Emotion False Belief from Verbal Ability, False Belief, and Age

Predictors	*B*	*SE*	ß	Squared Semi-partial *r*
Intercept	-13.45	4.2	---	---
Verbal Ability	.09	.03	.26**	.09
False Belief	.05	.09	.07	<.01
Block 2				
Age	.18	.04	.49**	.18

Note. R^2 for Block 1 = .18, Total R^2 = .33, and change in R^2 is significant at $p < .01$. Age reflects age in months.
**$p < .01$. *$p < .05$.

Additional analyses that tested Hypothesis 1 accounted for the pass/fail nature of the emotion false belief questions. A one-sample Kolmogorov-Smirnov test

assessed the fit of emotion false belief outcome with a poisson distribution. The test was significant, rejecting the null hypothesis that the data fit a poisson distribution. The variance of emotion false belief performance (σ = 19.36) is greater than the mean (M = 7.85), which suggests that the data are overdispersed (Sheskin, 2004). A Lagrange Multiplier Test was run on a negative binomial regression model with the ancillary parameter set to 0 to test for the presence of overdispersion (IBM Corp., 2012). The test was significant, z = 2.22, p = .01 (parameter > 0), rejecting the null hypothesis that the negative binomial distribution ancillary parameter equals 0, which suggests that the data are overdispersed. Hence, a negative binomial regression estimated the impact of age, verbal ability, and false belief performance on incrementally passing emotion false belief stories. The model fit the data significantly better than the intercept only model, Likelihood Ratio X^2 (3)= 8.12, p = .04. Table 5 presents the results of the negative binomial regression. Similar to earlier results, age significantly predicted the number of emotion false belief stories passed. According to the odds ratio, 6-year-olds were 77% more likely to pass additional emotion false belief tests than 4-year-olds. Neither verbal ability nor false belief performance significantly predicted increases in the number of emotion false belief tests passed.

Table 5 Negative Binomial Regression Analysis Predicting the Number of Emotion False Belief Stories Passed from Verbal Ability, False Belief, and Age

Predictors	B	SE	Wald X^2	Odds Ratio
Intercept	.62	.96	0.41	1.85
Verbal Ability	.01	.01	1.26	1.01
False Belief	.01	.03	0.05	1.01
Age	.57	.29	3.79*	1.77

Note. Age = 6-year-olds.
*p < .05.

Goal 2: Test the Independence of Discrete Emotion on Performance

A 2 (age) x 4 (discrete emotion) repeated analysis of covariance (ANCOVA) that controlled for verbal ability estimated the unique effects of age and discrete emotion and their interaction. The model revealed no main effect of discrete emotion, F (3, 246) = 1.70, p = .17. Additionally, results revealed no significant interaction between age and performance on the four different emotion false belief stories, F (3, 246) = 1.55, p = .20. Thus, the data did not support the hypothesis that children acquire knowledge of emotion false belief progressively, one at a time. Rather it appears that they acquire this knowledge collectively. The evidence to accept the null hypothesis invalidated the need to further examine the data to obtain probability statistics (i.e., using a chi-square). Remaining analyses collapsed performance across emotion false belief questions of different discrete emotions.

Goal 3: Examine the Relations Between Correctly Attributing Behavior Versus Emotion to False Beliefs

According to results from the Goal 1 hierarchical regression model (see Table 4), false belief performance after controlling for age and verbal ability did not uniquely contribute to emotion false belief performance. Additional hierarchical regression models found no significant interactions of false belief with age or verbal ability, false belief by age β = .16, t = 1.15, p = .25, and false belief by verbal ability β = .04, t = .41, p = .69. These findings provide initial evidence for the independence of false belief and emotion false belief development.

False belief and emotion false belief data were rescored to provide each child with a pass or fail total score: children who earned a score of 9 through 16 "passed" the battery, and children who earned a score of 0 through 8 "failed" the battery (MacLaren & Olson, 1993). Table 6 presents a contingency table that displays the number of children across the four possible pass-fail scenarios between the two constructs. Of interest is the scenario of passing one task but failing the other task. Nineteen children passed false belief but failed emotion false belief while only 4 children passed emotion false belief and failed false belief. A McNemar exact binomial test examined the marginal frequencies of within-subjects measures (Agresti, 2002), and Table 6 presents these results. An exact test of binomial distribution was applied to account for the small sample size (Sheskin, 2004). The McNemar test revealed a significant difference between the probabilities of passing one test while failing the other. About 22% of children passed false belief questions and failed emotion false belief questions; whereas, about 5% of children passed emotion false belief questions and failed false belief questions. According to the odds ratio (Sheskin, 2004), children were 4.75 times more likely to pass the false belief tests and fail the emotion false belief tests than pass the emotion false belief tests and fail the false belief tests.

Table 6 Contingency Table and McNemar Test of the Relation Between Pass/Fail Performance on False Belief and Emotion False Belief

Count		False Belief		
		Fail	Pass	Total
Emotion False Belief	Fail	32	19	51
	Pass	4	30	34
	Total	36	49	85

Note. McNemar test with binomial distribution $X^2 = 9.78$, $p < .01$

To further explore this effect, Table 7 displays contingency tables of performance by age. McNemar tests using an exact test of binomial distribution resulted in a significant difference for 4-year-olds between the likelihood of passing one test and failing the other. About 19% of 4-year-olds passed the false belief questions and failed the emotion false belief questions, but about 2% of 4-year-olds passed the emotion false belief questions and failed the false belief questions. This outcome revealed that 4-year-olds were 8 times more likely to pass the false belief tests and fail the emotion false belief tests than pass the emotion false belief tests and fail the false belief tests. The McNemar test revealed findings that were trending towards significance for 6-year-old's performance. About 26% of 6-year-olds passed the false-belief questions and failed the emotion false belief questions; whereas, about 7% of 6-year-olds passed the emotion false-belief questions and failed the false belief questions. The odds ratio of passing one test and failing the other estimates that 6-year-olds were 3.67 times more likely to pass the false belief tests and fail the emotion

false belief tests than pass the emotion false belief tests and fail the false belief tests. Overall, the contingency tables highlight a general age effect where about 9% of 4-year-olds passed both tests (and about 70% failed both tests) and 62% of 6-year-olds passed both tests (and about 5% failed both tests). That is, 4-year-olds were 7.5 times more likely to fail both tests than pass both tests, and 6-year-olds were 13 times more likely to pass both tests than fail both tests.

Table 7 Contingency Tables and McNemar Test of Pass/Fail Performance on False Belief and Emotion False Belief by Age

Count		False Belief					
	Age	4			6		
		Fail	Pass	Total	Fail	Pass	Total
Emotion False Belief	Fail	30	8	38	2	11	13
	Pass	1	4	5	3	26	29
Total		31	12	43	5	37	42

Note. McNemar test with binomial distribution for 4-year-olds $X^2 = 5.44$, $p = .04$. McNemar test with binomial distribution for 6-year-olds $X^2 = 4.57$, $p = .06$.

Chapter 4

DISCUSSION

The present study explored the development of emotion false belief understanding across a sample of 4- and 6-year-olds. It examined children's ability to attribute four discrete emotions to false beliefs, and compared this performance with performance on explicit false belief questions. Generally, the study replicated developmental effects of age and emotion false belief timing in relation to false beliefs. The rigorous and systematic investigation of emotion false belief development in the present study improved upon prior study designs by accounting for memory performance, EK knowledge, and verbal ability, comparing different emotions, and including a within-subject design to compare false belief performance. The inclusion of these factors helps to clarify prior conclusions.

Goal 1 sought to replicate and extend previous findings of an age effect on emotion false belief performance. The data demonstrated strong support for this hypothesis, as age explained 18 % of the variance in emotion false belief performance. Additionally 6-year-olds were 77% more likely to pass a greater number of emotion false belief stories than 4-year-olds. These findings are not surprising, as considerable research indicates that EK and ToM abilities depend on age (Camras & Allison, 1985; Denham, 1998; Wellman & Liu, 2004). More specifically, these findings replicate the previously identified age effect on emotion false belief development and continue to highlight the developmental period between ages 4 and 6 as a crucial time when this development occurs (Bradmetz & Schneider, 2004; de Rosnay et al., 2004; Hadwin &

Perner, 1991; Harris et al., 1989). Findings extend previous conclusions by demonstrating an age effect on emotion false belief understanding across four discrete emotions. A majority of the literature focuses on happiness, sadness, and surprise (Bradmetz & Schneider, 1999; de Rosnay et al., 2004; Harris et al., 1989; Parker et al., 2007), whereas the present study examined performance across the four discrete emotions of happiness, sadness, anger, and fear in a novel way.

One strength of this study was its inclusion of verbal ability. Age predicted performance after controlling for effects of verbal ability, which suggest that other maturational processes besides language impact emotion false belief development. As expected from previously shown relations between verbal ability and EK and ToM development (Ruffman et al., 2003), verbal ability generally had a significant positive effect on emotion false belief performance. The emotion false belief stories may have required a certain level of language skills, but the effect of verbal ability likely represents some association between exposure to and understanding of mental state language, as suggested by other theorists (Harris et al., 2005). Similarly, verbal ability explained individual differences in 4-year-olds' acquisition of false beliefs. Interestingly, the subset of 4-year-olds who tended to pass the false belief questions and had higher verbal ability were not more likely to pass emotion false belief questions. This finding demonstrates the importance of verbal ability, while emphasizing that it is not the primary contributor to EK and false belief development.

The results corroborate previous findings that children's ability to attribute emotion to a false belief develops between ages 4 through 6, which identifies a developmental milestone. The present findings successfully replicated prior results using similar methods. It found similar relations to expected variables such as age and

verbal ability. Additionally, 4-year-old's poor performance was not an artifact of the measure or due to poor memory or lack of EK. These outcomes support the reliability and validity of emotion false belief measures. A majority of (situation-based) EK literature focuses on outcomes in infancy through elementary school (e.g., Fine, Izard, & Trentacosta, 2006), so the concurrent and longitudinal relations of EK in adulthood are not well understood. Emotion false belief tasks provide an important contribution to the study of emotional development, as they assess children's emotional development beyond a situation-based understanding of emotions. Hence, emotion false belief tasks provide the ability to examine EK in populations older than preschool and also provide a platform for creating more advanced measurements of EK.

Goal 2 explored the potential impact of four discrete emotions on emotion false belief development. The EK literature reveals that children gain knowledge of some emotions before others, typically: happiness, sadness, anger, and then fear (Camras & Allison, 1985; Denham, 1998; Denham & Couchoud, 1990b). Some research suggests that emotion false belief understanding occurs first for negative emotions then positive emotions (Parker et al., 2007), while other research has found that fear evokes belief-based more than desire-based language (Rieffe, Terwogt, & Cowan, 2005). None of these developmental progressions were mirrored in the emotion false belief development in the current sample. Instead, there was no significant difference in performance between stories that targeted different emotions. This null finding adds to the literature in important ways. Few studies have compared the development of more than two emotions (e.g., happy versus sad), which limits conclusions (Hadwin & Perner, 1991; Parker et al., 2007). Additionally, prior

investigations tend to juxtapose the two emotions (e.g., Is Sally feeling happy or sad?; Parker et al., 2007). This measurement approach confounds conclusions about developmental timing because children may use their knowledge of one emotion to rule out the other. The present study addressed this concern by focusing on one emotion per story. Hence, the failure to find an effect suggests that differences in children's performance between emotion false belief tasks that tested different emotions *across* studies may be due to other experimental factors. Emotion false belief understanding may occur simultaneously across (discrete) emotions. Developmentally, once children have a basic level of emotion understanding, acquisition of emotion false beliefs may not depend on emotion but rather on the (potential) conceptual change from emotions based on situational factors to emotions based on internal factors. However, these conclusions are contingent upon addition research and replication of these findings.

Goal 3 examined the relation between children's ability to attribute emotion versus behavior to false beliefs. Research supports a lagged effect of emotion attribution compared to behavior attribution (Bradmetz & Schneider, 1999; de Rosnay et al., 2004; Parker et al., 2007; Ruffman & Keenan, 1996), and the results from this study continue to support this idea as demonstrated across and within age groups. Across age groups, children were 4.75 times more likely to pass false belief questions and fail emotion false belief questions than the reverse. Similar effects were found within age group, such that 4-year-olds were 8 times more likely to pass false belief tasks and fail emotion false belief tasks than the reverse and 6-year-olds were 3.67 times more likely to follow this pattern. The few previous studies that did not demonstrate a lagged effect either used a different, previously-critiqued measurement

approach (i.e., backwards reasoning; for a critique see Perner, Lang, & Kloo, 2002) and/or investigated different emotions such as surprise (Wellman & Bartsch, 1988). However, some studies did demonstrate a lagged effect despite these methodologies (Ruffman & Keenan, 1996). Together, there is accumulating evidence that children acquire the concepts of false beliefs and emotion false beliefs sequentially.

Emotion false beliefs may represent a conceptual change in emotion understanding in a similar way that false beliefs appear to represent a conceptual change in the way children think about beliefs (Perner et al., 1987; Wellman et al., 2001). Some researchers have suggested that children's shift from a 'desire psychology' to a 'belief psychology' may apply to emotion (Hadwin & Perner, 1991; MacLaren & Olson, 1993; Rieffe & Terwogt, 2000; Wellman, Harris, Banerjee, & Sinclair, 1995), although researchers have not thoroughly described this process. Alternatively, Bradmetz and Schneider (2004) posited that emotion false beliefs reflect children's difficulty associating desire with counterfactual information. However, the data indicated that understanding desire questions (based on counterfactual information) was not a requirement to pass emotion false belief questions and thus was not a necessary condition for emotion false belief accuracy. Compared with the latter argument, the present study provides stronger evidence for a gap in knowledge between situation-based EK and representation-based EK. Children were able to identify emotions with situation-based cues, as shown by their ability to pass a majority of EK questions. Furthermore, the results that children could pass false belief questions, but struggled to then attribute emotions to these false beliefs suggest that children's difficulty lies in their ability to associate emotions with a mental representation. This conclusion is stronger than arguments that children understand the

representational nature of emotions at an early age (e.g., Lagattuta & Wellman, 2001; Lagattuta et al., 1997). Children cannot link an emotional state to a situation in emotion false belief scenarios, but tasks used in prior experiments could not rule out the possibility that children associated emotional states to situational cues. The present findings that children demonstrate difficulty associating emotions with false beliefs, difficulty beyond understanding false beliefs, support the proposition that children's knowledge of emotions goes through a conceptual change from relying on a situational basis of emotions to a broader conceptualization that includes mental states.

Interestingly, false belief performance did not significantly contribute to emotion false belief performance after accounting for age and verbal ability. This finding combined with the significant difference in probabilities of passing each type of test suggests an independent development between emotion false belief and false belief. Emotion false belief may not be a progressive developmental step from false beliefs, as traditionally discussed in the emotion false belief literature (Wellman & Liu, 2004). Instead, this finding is consistent with deficits in clinical populations and studies that show different neural correlates associated with cognitive-based and emotion-based tasks. Clinical populations, including children suffering from sociopathy and autism, differentially exhibit deficits in cognitive- and emotion-based empathy tasks (Blair, 2005). Psychophysiological studies using functional magnetic resonance imaging (fMRI) and repetitive transcranial magnetic stimulation (rTMS) identified the ventromedial prefrontal cortex as important for affective ToM tasks (e.g., detecting irony and faux pas) while the dorsolateral prefrontal cortex is important for cognitive ToM tasks (e.g., false beliefs) (Kalbe et al., 2010; Shamay-Tsoory, Tomer, Berger, Goldsher, & Aharon-Peretz, 2005). These studies conclude

that affective ToM tasks differ qualitatively from cognitive ToM tasks. The idea that mental state understanding and emotion understanding follow different developmental trajectories allows for the idea that emotion false beliefs represents a conceptual change in the way children think about emotions at a different time than they undergo a conceptual change in belief understanding. Support for this theory highlights the independence of emotion processes from other thought processes. This conceptual framework impacts our understanding of social skills development. Children's emotional and cognitive interpretations of their environment may be at different levels.

Limitations and Future Directions

This study successfully replicated previous findings, and moreover, it contributed a novel understanding of emotion false belief development. The discussion highlighted strengths of the investigation. The conclusions drawn warrant some consideration of the study methodology, with suggestions for future research.

Modifications to previously used emotion false belief stories warrant additional testing of the measure's validity and reliability. The stories were modified to target specific discrete emotions according to DET; that is, the stories used the *functions* of emotions to maintain a focus on the correct emotion. These modifications helped to address the goals of the current study and concerns regarding the original measure. The modifications provided a more accurate way of testing the unique development of discrete emotions. Future research should continue to test that each story adequately targets each discrete emotion.

This method approach also necessitated the use of negation in the questions. Negation may impact children's answers, and children performed better on emotion

false belief questions where the character did not experience the target emotion than when the character did experience the target emotion. Yet, literature across cognitive psychology, developmental psychology, and linguistics provides evidence in opposition to this result, such that children should either demonstrate a "yes" response bias or no bias at all. Linguistically, "non-preposed negation" or questions like "Is Sally not happy" equally imply a yes or no response (Romero & Han, 2004). According to executive functioning accounts, negation language (e.g., do not) requires inhibitory processing and is more difficult to understand than language without negation (Carroll, Apperly, & Riggs, 2007). Typically, preschool children demonstrate a yes bias in terms of predicting behavior (Fritzley, Lindsay, & Lee, 2013). Furthermore, Moriguchi, Okanda, and Itakura (2008) showed that preschool children demonstrate a "yes" response bias to verbal ability and executive functioning tasks, but not to ToM tasks. A nay-saying bias is observed when memory (in preschool children) or incomprehensibility such as using unknown vocabulary (in older children) are issues. Neither of these appear to be factors in the present design, given children's excellent memory performance and increased accuracy with age (Fritzley & Lee, 2003; Fritzley et al., 2013). Hence the finding from the present study that children performed better on emotion false belief questions when the character did not experience the target emotion (e.g., was not sad) was unexpected and not supported by the literature. Additionally, children did not exhibit this tendency on the control EK questions, which were phrased the same way. Hence, while a "no" bias or preference to respond that a character did not feel an emotion is not supported by theory nor by children's performance on EK questions, researchers should continue to be aware of this possibility.

The study had a limited focus on the emotion false belief development of happiness, sadness, anger, and fear. These are the first emotions children understand (Camras & Allison, 1985; Denham & Couchoud, 1990b), and hence, they were included as the focus of this initial study. However, the emotion false belief development of other emotions, such as surprise, may result in different developmental patterns than the four discrete emotions currently investigated. Surprise false belief may developt later than age 6, though the evidence on when an understanding of surprise occurs is mixed (Ruffman & Keenan, 1996; cf. Hadwin & Perner, 1991; MacLaren & Olson, 1993). The association between surprise and false beliefs may be different than the emotions investigated here. Additionally, researchers have noted that moral emotions such as embarrassment, jealousy, pride, and guilt have an inherent relationship with mental state understanding (e.g., Yuill, Perner, Pearson, Peerbhoy, & van den Ende, 1996). It will be important to include moral emotions in future investigations to better understand children's concept of the relation between emotions and internal states.

While the study design took advantage of both within- and between-person comparisons, it was cross-sectional. A within-person, longitudinal design would strengthen the conclusions. A within-person design could also efficiently control for factors previously identified as important to EK and ToM development such as family environment and exposure to mental state language (Cutting & Dunn, 1999; J. Dunn et al., 1987; J. Dunn, Brown, & Beardsall, 1991). Future studies with either design should directly measure family language factors to determine how they may impact emotion false belief development. Additionally, greater support for the independence of false belief and emotion false belief development would come from a within-person

longitudinal examination of these constructs, as these developments may be examined as they occur.

The study offers additional support for a conceptual change account of EK as indicated by performance on emotion false belief tasks, but further research is needed to strengthen this conclusion. The model postulates that children initially understand emotions within a situation-based framework, and then their knowledge of emotions undergoes a conceptual change to reflect an ability to associate emotions with a mental representation. This model was examined through children's ability to associate emotions with a false belief, since false beliefs signify children's ability to mentally represent internal states (Perner et al., 1987). However, children's ability to associate emotions with beliefs and other internal states should be examined more broadly.

Presently, it is unclear whether children can associate emotions with beliefs outside of the context of false beliefs, which would not require mental representation. Possibly the only researchers to investigate this question were Harris and colleagues. Harris et al. (1989) examined 3- and 5-year-old's ability to predict emotions from beliefs when the belief did not explicitly contradict reality (i.e., it did not require mental representation). They found that children at both ages could pass these stories, but that performance improved with age. Children's ability to pass this task indicated that the difficulty with associating emotions with false belief lies in the requirement to incorporate mental representation. Unfortunately, they did not compare children's performance on an emotion attribution question to a behavior attribution question. Thus, it is unclear whether there would be a similar lag between emotion and behavior attribution understanding that parallels the emotion false belief literature. Future examination of this question would allow us to investigate whether emotion and belief

understanding develop along similar trajectories[3]. Collectively, it will be important for future research to include varying ages and use different tasks to clarify whether children's difficulty with emotion false beliefs results from the attribution of emotions to a mental representation rather than to a situation.

Conclusion

This study advanced previous work by providing a clearer developmental picture of emotion false belief performance and its relation to false belief understanding. The reviewed findings have implications across basic and applied developmental science. Within basic science, emotion false belief provides an outlet to examine emotion-cognition interactions. The findings support independent processes between EK and ToM. The results also corroborate previous findings, providing measurement validity and reliability for subsequent studies wishing to examine typical and atypical development. Emotion false belief paradigms allow researchers to examine EK in children beyond situation-based knowledge. This change in thinking may represent a holistically different developmental stage in which children can associate emotions with mental representations, which helps to explain how EK and ToM evolve to help individuals understand complex social situations.

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[3] The author conducted a similar experiment to that of Harris et al. (1989) that attempted to address some of the discussed limitations. However, the results revealed no effect of age, which calls into question the measure's validity.

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Appendix A

EMOTION FALSE BELIEF STORIES

Happy

1. Andrea really likes cookies. Cookies are her favorite snack! Andrea keeps her cookies in the snack drawer. Today Andrea looks inside the snack drawer and finds no cookies left. She ate her last cookie! Only old crackers are left in the snack drawer.

   EK question: Does Andrea feel <u>happy</u> when she sees only crackers in the snack drawer and <u>no</u> cookies: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Andrea leaves for school. Mickey the Monkey decides to play a nice trick on Andrea. He knows that Andrea really likes cookies! He bakes more cookies and places them in the snack drawer. He takes out the old crackers and places them in the cabinet. *Memory question:* What is now in the snack drawer: cookies or old crackers? What is now in the cabinet: cookies or old crackers? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

   Andrea did not see what Mickey did. Andrea comes home from school and wants a snack. *Explicit FB question:* Where will Andrea look for the old crackers: the snack drawer or the cabinet? She is going to look inside the snack drawer. *Emotion attribution question:* <u>Before</u> she looks inside the snack drawer, does Andrea feel happy: yes or no? *Memory question:* What is really inside the snack drawer: cookies or old crackers?

   EK question: So Andrea looks inside the snack drawer and sees the cookies. Does she feel happy: yes or no?

2. Bertie really likes chocolate. Chocolate is his favorite snack. Bertie keeps his chocolate in this red box.

EK question: Does Bertie feel happy when he sees his red box full of chocolates: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

Now Bertie goes outside to play. Mickey the Monkey decides to play a trick on Bertie. He knows that Bertie really likes chocolates! He takes all of the chocolates and hides them in this blue box. He places rocks in the red box. *Memory question:* What is now in the red box: chocolates or rocks? What is now in the blue box: chocolates or rocks? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Bertie did not see what Mickey did. Bertie comes back inside and he is hungry. *Explicit FB question:* Where will Bertie look for his chocolates: the red box or the blue box? He is going to look inside his red box. *Emotion attribution:* Before he looks inside the red box, does Bertie feel happy: yes or no? *Memory question:* What is really inside the red box: chocolates or rocks?

EK question: So Bertie looks inside the red box and sees the rocks. Does he feel happy: yes or no?

3. Teddy really likes to paint. Painting is his favorite activity! Teddy keeps his toys in his toy chest. Teddy has been using his paints a lot and they are all gone! His toy chest only has a boring puzzle inside.

   EK control question: Does Teddy feel happy when he sees he has no paints and only a boring puzzle left in his toy chest: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Teddy leaves for school. Mickey the Monkey decides to play a nice trick on Teddy. He knows that Teddy really likes to paint! He buys Teddy a new paint set and places it in the toy chest. [Replace old paint set picture with new paint set picture.] He takes out the boring puzzle and places it in this cabinet. *Memory question:* What is now in the toy chest: paints or a puzzle? What is now in the cabinet: paints or a puzzle? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Teddy did not see what Mickey did. Teddy comes home from school and wants something to do. *Explicit FB question:* Where will Teddy look for the puzzle: the toy chest or the cabinet? He is going to look inside the toy chest. *Emotion attribution question:* Before he looks inside the toy chest, does Teddy feel happy: yes or no? *Memory question:* What is really inside the toy chest: paints or a puzzle?

EK control question: So Teddy looks inside the toy chest and sees a new paint set. Does he feel happy: yes or no?

4. Fran really likes this green shirt. This green shirt is her favorite shirt! Fran keeps her shirt in this red drawer.

   EK control question: Does Fran feel happy when she sees her shirt in her red drawer: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Fran leaves her room. Mickey the Monkey decides to play a trick on Fran. He knows that Fran really likes her green shirt! He takes the green shirt and places it in his blue drawer over here. He places an ugly ripped shirt in Fran's red drawer. *Memory question:* What is now in Fran's drawer: the green shirt or the ripped shirt? What is now in Mickey's drawer: the green shirt or the ripped shirt? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

   Fran did not see what Mickey did. Fran wants to wear her favorite green shirt. *Explicit FB question:* Where will Fran look for her green shirt: her red drawer or Mickey's blue drawer? She is going to look inside her red drawer. *Emotion attribution:* Before she looks inside her red drawer, does Fran feel happy: yes or no? *Memory question:* What is really inside her red drawer: the green shirt or the ripped shirt?

   EK control question: So Fran looks inside her red drawer and sees the ugly ripped shirt. Does she feel happy: yes or no?

Sad

1. Jack really likes to play his whistle. Playing his whistle is his favorite thing to do. He keeps his whistle in his room. *EK question:* Does Jack feel sad when he sees his whistle in his room: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Jack goes to school. [Character leaves scene.] Mickey the Monkey decides to play a trick on Jack. Mickey moves Jack's whistle to the basement. *Memory question:* Now where is the whistle: in Jack's room or in the basement? [If child gets the memory question incorrect, experimenter will repeat Mickey's actions once and re-ask the memory question.]

   Jack did not see what Mickey did. [Experimenter plays out scene with characters.] Jack comes home from school and he wants to play with his whistle. *Explicit FB question:* Where will Jack look for his whistle: in his bedroom or in the basement? Jack goes to his bedroom to look for his whistle. *Emotion attribution question:* Before he opens the door to his room, does Jack feel sad: yes or no? *Memory question:* Is the whistle really in Jack's room: yes or no?

   EK question: So Jack goes inside his room and can't find his whistle. Does he feel sad: yes or no?

2. Anne really likes her music box. She really likes to listen to the music from her music box! She keeps her music box in this drawer. But now, when Anne tries to play her music box, it won't play! It is broken.

   EK question: Does Anne feel sad when she tries to play music from her music box and it doesn't play: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Anne goes to a different room. Mickey the Monkey decides to play a nice trick on Anne. He knows that Anne really likes music boxes! He buys Anne a new music box just like her old one. He takes the broken music box and places the new music box in Anne's drawer. Memory question: What is now in the drawer: the broken music box or the new music box? What is now in the box: the broken music box or the new music box? [If child gets the memory

questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Anne did not see what Mickey did. Anne wants her old music box to see if she can fix it. Explicit FB question: Where will Anne look for her broken music box: the drawer or the box? She is going to look in the drawer for her broken music box. Emotion attribution question: Before he sees what is in the drawer, does Anne feel sad: yes or no? Memory question: What is really inside the drawer: the broken music box or the new music box?

EK question: So Anne looks inside the drawer and finds the brand new music box. Does she feel sad: yes or no?

3. Nat really likes tennis shoes. Tennis shoes are his favorite shoes to wear! Nat keeps his tennis shoes in his closet. He wears his tennis shoes so much that they now have a hole!

   EK control question: Does Nat feel sad when he sees the <u>hole</u> in his tennis shoes: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Nat goes to a different room. Mickey the Monkey decides to play a nice trick on Nat. He knows that Nat really likes tennis shoes! He buys Nat a new pair of tennis shoes just like his old pair. He takes the old pair of tennis shoes and places them under Nat's bed. Mickey places the new tennis shoes in the closet. *Memory question:* What is now in the closet: the new tennis shoes or the holey tennis shoes? What is now under the bed: the new tennis shoes or the holey tennis shoes? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

   Nat did not see what Mickey did. Nat wants to go outside and needs his tennis shoes. *Explicit FB question:* Where will Nat look for his old, holey tennis shoes: the closet or under his bed? He is going to look inside the closet for his <u>holey</u> shoes. *Emotion attribution question:* <u>Before</u> he sees what is inside the closet, does Nat feel sad: yes or no? *Memory question:* What is really inside the closet: the new tennis shoes or the holey tennis shoes?

EK control question: So Nat looks inside the closet and sees the <u>new</u> pair of tennis shoes. Does he feel sad: yes or no?

4. Shirley really likes her dog Spot. Shirley likes to say hello to Spot as soon as she gets home from school. Spot waits for her in the kitchen.

   EK control question: Does Shirley feel sad when she comes home from school and sees Spot waiting in the kitchen: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Shirley goes to school. Experimenter plays out scene with characters.] Mickey the Monkey decides to play a trick on Shirley. Mickey takes Spot for a walk outside so Spot is not home waiting for Shirley. *Memory question:* Now where is Spot, in the house or outside? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

   Shirley did not see what Mickey did. School has ended and Shirley wants to say hi to Spot. *Explicit FB question:* Where will Shirley look for Spot: in the house or outside? So Shirley walks to her house. *Emotion attribution question:* <u>Before</u> she opens the door to her house, does Shirley feel sad: yes or no? *Memory question:* Is Spot really in the house: yes or no?

   EK control question: So Shirley goes inside her house and can't find Spot. Does she feel sad: yes or no?

Mad

1. David's favorite toy is his soccer ball. He really likes to play with his soccer ball. He keeps it in the garage.

   EK question: Does David feel mad when he sees his favorite soccer ball in the garage: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   David goes outside to play. Mickey the Monkey decides to play a trick on David. He steals David's soccer ball and takes it to his house. Mickey leaves a soccer ball with a big hole in it in the garage with a mean note that says

"Haha." *Memory question:* What is now in the garage: David's soccer ball or the soccer ball with a hole and a mean note? What is now at Mickey's house: David's soccer ball or the soccer ball with a hole and a mean note? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

David did not see what Mickey did. [Experimenter plays out scene with characters.] David comes home and wants to play with his soccer ball. *Explicit FB question:* Where will David look for his soccer ball: in the garage or at Mickey's house? He is going to look in the garage for his soccer ball. *Emotion attribution question:* Before he sees what is inside the garage, does David feel mad: yes or no? *Memory question:* What is really inside the garage: his soccer ball or the soccer ball with a hole and a mean note?

EK question: So David looks inside the garage and finds the soccer ball with a hole and mean note. Does he feel mad: yes or no?

2. Sam really likes to bake pies. He works really hard to bake pies. He places his pie in the refrigerator to cool down so that he can eat it later. [Experimenter pretends that Sam places pie in refrigerator.] Sam's sister is not very nice. She eats all but one slice of Sam's pie!

EK question: Does Sam feel mad when he sees that his sister has eaten almost all of his pie: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

Now Sam goes outside to play. Mickey the Monkey decides to play a nice trick on Sam. He knows that Sam was really looking forward to eating his pie! Mickey the Monkey bakes another pie and places the new pie in the refrigerator. He takes out the single slice of the first pie and places it in the cabinet. *Memory question:* What is now in the refrigerator: the mostly eaten pie or the new whole pie? What is now in the cabinet: the mostly eaten pie or the new whole pie? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Sam did not see what Mickey did. [Experimenter plays out scene with characters.] Sam wants his mostly eaten pie to eat the last slice. *Explicit FB*

question: Where will Sam look for the last slice: the refrigerator or the cabinet? He is going to look in the refrigerator for the pie that his sister ate almost all of. *Emotion attribution question:* Before he sees what is in the refrigerator, does Sam feel mad: yes or no? *Memory question:* What is really in the refrigerator: the mostly eaten pie or the whole pie?

EK question: So Sam finds the new whole pie in the refrigerator. Does he feel mad: yes or no?

3. Emily really likes her picture book. She really likes to look at all of the pictures! She keeps the book on her bookshelf. Emily's brother is not very nice. He rips the book!

   EK control question: Does Emily feel mad when she sees that her brother tore her book: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Emily goes outside to play. Mickey the Monkey decides to play a nice trick on Emily. He knows that Emily really likes the picture book! He buys a new one and places it on the bookshelf. He takes the ripped one and puts it in a drawer. *Memory question:* What is now on the bookshelf: the ripped book or the new book? What is now in the drawer: the ripped book or the new book? [If child gets the memory question incorrect, experimenter will repeat Mickey's actions once and re-ask the memory question.]

   Emily did not see what Mickey did. Emily wants her ripped picture book to fix it. *Explicit FB question:* Where will Emily look for her ripped book: the bookshelf or the drawer? Emily is going to look on the bookshelf for her ripped book. *Emotion attribution question:* Before she sees what is on the shelf, does Emily feel mad: yes or no? *Memory question:* What is really on the bookshelf: the ripped book or the new book?

   EK control question: So Emily finds the new book on the bookshelf. Does she feel mad: yes or no?

   Stacy really likes donuts. Donuts are her favorite snack. Stacy keeps her donuts in this red box.

EK control question: Does Stacy feel mad when she sees her donuts in the red box: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

Stacy goes outside to play. Mickey the Monkey decides to play a trick on Stacy. Mickey steals Stacy's donuts and takes them to his house. Mickey leaves a mean note in Stacy's box that says "Haha, I stole your donuts!" *Memory question:* What is now in the box: donuts or a mean note? What is now at Mickey's house: donuts or a mean note? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Stacy did not see what Mickey did. Stacy comes home and wants to eat her donuts. *Explicit FB question:* Where will Stacy look for her donuts: in the box or at Mickey's house? She is going to look in the box for the donuts. *Emotion attribution question:* Before she sees what is inside the box, does Stacy feel mad: yes or no? *Memory question:* What is really inside the box: donuts or a mean note?

EK control question: So Stacy looks inside the box and finds the mean note that says Mickey stole her donuts. Does she feel mad: yes or no?

Scared

1. Janice likes to sleep with a nightlight on. Without a nightlight, it is dark and something bad can happen. Janice keeps her nightlight in her room.

   EK question: Does Janice feel scared when she has her nightlight: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Janice goes outside to play. Mickey the Monkey decides to play a trick on Janice. Mickey takes Janice's nightlight and puts it in his house. Memory question: Where is the nightlight now: in Janice's room or in Mickey's house? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Janice did not see what Mickey did. It is time for bed and Janice wants to turn on her nightlight. Explicit FB question: Where will Janice look for her nightlight: in her room or in Mickey's house? She is going to look in her room for her nightlight so that it is not dark. Emotion attribution question: Before she goes into her room, does Janice feel scared: yes or no? Memory question: Where is her nightlight really: in her room or at Mickey's house?

EK question: So Janice looks in her room and doesn't find the nightlight. It is dark. Does she feel scared: yes or no?

2. Andy likes to keep a lock on his closet door at night. When there is no lock, monsters are free to get out of the closet. Andy keeps the lock in his room.

   EK question: Does Andy feel scared when he has his lock on the closet door: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Andy goes outside to play. Mickey the Monkey decides to play a trick on Andy. Mickey takes Andy's lock and puts it in his house. Memory question: Where is the lock now: in Andy's room or in Mickey's house? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

   Andy did not see what Mickey did. [Experimenter plays out scene with characters.] It is time for bed and Andy wants to lock his closet. Explicit FB question: Where will Andy look for his lock: in his room or in Mickey's house? He is going to look in his room for his lock. Emotion attribution question: Before he goes into his room, does Andy feel scared: yes or no? Memory question: Where is his lock really: in his room or at Mickey's house?

   EK question: So Andy looks in his room and doesn't find the lock. There could be monsters. Does he feel scared: yes or no?

3. Sarah likes to bring her favorite teddy bear to bed. Her teddy bear gives her <u>good</u> dreams. Without her teddy bear she gets <u>bad</u> dreams. Sarah left her teddy bear at her friend's house. Sarah doesn't have her teddy bear to sleep with tonight!

EK control question: Does Sarah feel scared when she goes to sleep without her teddy bear: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

Now Sarah goes outside to play. Mickey the Monkey decides to play a nice trick on Sarah. He knows that Sarah really likes her teddy bear! He goes to Sarah's friend's house and gets the teddy bear and puts it in her room. Memory question: Where is the teddy bear now: at Sarah's friend's house or in her room? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Sarah did not see what Mickey did. It's time to go to bed. Explicit FB question: Where will Sarah go to get her teddy bear: her friend's house or her room? Sarah wants to go to her friend's house to get her teddy bear, but her mom said that they can't tonight. So she heads to her room to go to bed. Emotion attribution question: Before she sees if her teddy bear is in her room, does Sarah feed scared: yes or no? Memory question: Is her teddy bear really in her room: yes or no?

EK control question: So Sarah finds her teddy bear in her room. Does she feel scared: yes or no?

4. Seth likes to go to the park. He likes to bring his park bag that has games and doggy treats. When he brings doggy treats the big dogs at the park are nice. If he doesn't bring doggy treats, the big dogs are mean and they may bite him. But he ran out of doggy treats and needs to get more at the grocery store. He hasn't had time to get more doggy treats. He doesn't have any treats to give to the hungry dogs. The dogs will be mean!

   EK control question: Does Seth feel scared when he goes to the park without doggy treats: yes or no? [Experimenter will repeat this section once if child gets emotion knowledge question incorrect.]

   Now Seth goes outside to play. Mickey the Monkey decides to play a nice trick on Seth. He knows that Seth really likes to go to the park with doggy treats! Mickey goes to the grocery store and buys more doggy treats. He puts the

doggy treats in Seth's park bag. *Memory question:* Where are the doggy treats: the store or in Seth's park bag? [If child gets the memory questions incorrect, experimenter will repeat Mickey's actions once and re-ask the memory questions.]

Seth did not see what Mickey did. It's time to go to the park. *Explicit FB question:* Where will Seth go to get doggy treats: the store or his park bag? Seth wants to go to the store to get doggy treats, but he is running late and doesn't have time. So he heads to the park with his park bag. *Emotion attribution question:* Before he sees what is in his park bag, does Seth feel scared: yes or no? *Memory question:* What is really in his park bag: doggy treats or no doggy treats?

EK control question: So Seth finds the doggy treats in his park bag. He can feed the hungry dog. Does he feel scared: yes or no?

Appendix B

HUMAN SUBJECTS APPROVAL

RESEARCH OFFICE

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DATE:	June 29, 2012
TO:	Adina Seidenfeld, M. A.
FROM:	University of Delaware IRB
STUDY TITLE:	[354564-1] The Development of Belief-based Emotion Understanding
SUBMISSION TYPE:	New Project
ACTION:	APPROVED
APPROVAL DATE:	June 29, 2012
EXPIRATION DATE:	June 28, 2013
REVIEW TYPE:	Expedited Review
REVIEW CATEGORY:	Expedited review category # 7

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has APPROVED your submission. This approval is based on an appropriate risk/benefit ratio and a study design wherein the risks have been minimized. All research must be conducted in accordance with this approved submission.

This submission has received Expedited Review based on the applicable federal regulation.

Please remember that informed consent is a process beginning with a description of the study and insurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. Federal regulations require each participant receive a copy of the signed consent document.

Please note that any revision to previously approved materials must be approved by this office prior to initiation. Please use the appropriate revision forms for this procedure.

All SERIOUS and UNEXPECTED adverse events must be reported to this office. Please use the appropriate adverse event forms for this procedure. All sponsor reporting requirements should also be followed.

Please report all NON-COMPLIANCE issues or COMPLAINTS regarding this study to this office.

Please note that all research records must be retained for a minimum of three years.

Based on the risks, this project requires Continuing Review by this office on an annual basis. Please use the appropriate renewal forms for this procedure.