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How Children Remember the Strange Situation: The Role of Attachment

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Running head: CHILDREN'S MEMORY

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Abstract

This study tested important predictions from Bowlby's attachment theory about children's memory and suggestibility. Young children (3 to 5 years old, $N = 88$; 76% Caucasians) and their parents took part in the Strange Situation Procedure, a moderately distressing event and "gold standard" for assessing children's attachment quality. The children were then interviewed about what occurred during the event. Children's age and attachment-security scores positively predicted correct information in free recall and accuracy in answering specific questions. For children with higher (compared to lower) attachment-security scores, greater distress observed during the Strange Situation Procedure predicted increased resistance to misleading suggestions. In addition, for children who displayed relatively low distress during the Strange Situation Procedure, significant age differences in memory and suggestibility emerged as expected. However, for children who displayed greater distress during the Strange Situation Procedure, younger and older children's memory performance was equivalent. Findings suggest that attachment theory provides an important framework for understanding facets of memory development with respect to attachment-related information and that distress may alter assumed age patterns in memory development.

How Children Remember the Strange Situation: The Role of Attachment

According to attachment theory, early in life, infants form internal working models (IWMs) based on the degree to which their caregivers are available and provide support in times of distress (Bowlby, 1969). IWMs are viewed, theoretically, as fairly stable mental representations of self and close relationships. Based on infants' behavior in the Strange Situation, Ainsworth and colleagues (Ainsworth, Blehar, Waters, & Wall, 1978) identified three main patterns of attachment: secure, avoidant, and anxious. Secure infants view their caregivers as available and responsive when needed. They generally cope effectively with distress and seek proximity, contact, and communication with their caregivers during reunions. Avoidant infants view their caregivers as unwilling or unable to soothe negative affect and thus tend to avoid or ignore the caregivers despite experiencing distress. Anxious infants represent their caregivers as inconsistently available or inconsistently supportive and thus sometimes cling excessively to a caregiver to avoid separation, and display angry, resistant behavior upon reunion following a separation. A fourth attachment pattern (i.e., disorganized) was added years after Ainsworth's original work (Main & Solomon, 1990). Disorganized infants see their caregivers as fear-inducing, and the infants' behavior show signs of fear during reunions (e.g., freezing). Similar attachment patterns have been identified in children at preschool age (Main, Kaplan, & Cassidy, 1985).

Some attachment researchers, instead of using the discrete-categorical approach to measurement, have assessed the underlying attachment security versus insecurity dimension (e.g., NICHD Early Child Care Research Network, 1997; van IJzendoorn, Vereijken, Bakersman-Kranenburg, & Riksen-Walraven, 2004; Waters & Deane, 1985). Fraley and Spieker (2003) concluded, after analyzing attachment data from over 1,000 children in the NICHD Study

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4 of Early Child Care, that attachment patterns are appropriately conceptualized in terms of
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6 continuous dimensions. As Waters and Deane (1985) pointed out, measuring security on a
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8 continuum permits researchers to tap meaningful differences within what would otherwise be
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10 viewed as homogenous categories, thus increasing precision and statistical power with respect to
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12 the security dimension.
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16 The present study used a measure of the security dimension to provide an important
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18 empirical test of predictions from attachment theory in relation to research regarding children's
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20 memory performance, including their suggestibility. Theoretically, the attachment system
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22 motivates children to seek close physical and/or emotional proximity to their primary caregivers
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24 in order to reduce fear, anxiety, and distress (Bowlby, 1969, 1973, 1980). A child's attachment
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26 system is activated (that is, a set of attachment-related expectations and emotion regulation
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28 strategies start to affect and/or guide behavior) particularly under conditions of threat or stress,
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30 causing the child to look to caregivers for both protection and help in understanding the situation
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32 (Mikulincer & Shaver, 2016; Thompson, 2008). Of special concern here, the level of attachment-
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34 system activation elicited by an event can bring into play attachment-related mechanisms that
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36 influence information processing and memory about a distressing experience (Bowlby, 1980,
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38 1987; Dykas & Cassidy, 2011). Ainsworth's Strange Situation Procedure, used to assess
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40 attachment patterns, is (by design) moderately distressing for young children. This allows us to
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42 determine whether attachment security is related to memory for and suggestibility concerning
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44 experiences in the Strange Situation.
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52 **Attachment and Children's Memory and Suggestibility**

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55 Several possible links between attachment orientations and memory in children have
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57 been proposed (Chae, Goodman, & Edelstein, 2011; Chae, Ogle, & Goodman, 2009; Dykas &
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Cassidy, 2011; Dykas, Ehrlich, & Cassidy, 2011). According to Dykas and Cassidy (2011), individuals process social information in different ways as a function of their attachment orientations. Those with more secure IWMs process positive and negative attachment-related social information in a relatively open and accurate manner, whereas individuals with less secure IWMs tend to be biased or defensive, and these tendencies are reflected in the rules used to process such information. For example, insecure individuals may prohibit attachment-related information from entering conscious awareness. Deficits in information processing, including in memory, may result. Indeed, adolescents higher (vs. lower) in insecure-dismissing attachment take longer to recall emotionally salient childhood events, report events that occurred at older ages, and remember fewer negative adjectives describing their parents (Dykas, Woodhouse, Jones, & Cassidy, 2014). Chae et al. (2011) emphasized that attachment orientations reflect emotion-regulation processes that affect memory. Attachment orientations include, or are associated with, mental strategies that act as affective and cognitive filters when distressing information is encountered. For example, securely attached children, who have generally experienced sensitive and responsive care, are thought to explore emotionally evocative events and are generally able to manage their own emotions (Thompson, 2008). When faced with a challenging or stressful situation that activates the attachment system, secure children's ability to regulate emotions effectively may help them focus on, accurately encode, and retain details of the event. In contrast, insecure individuals, who have experienced less responsive or less consistent care, may be less able to cope with their emotions and therefore are less able to effectively rehearse what happened, thereby reducing later memory accuracy.

Despite the theoretical predictions about memory performance that can be derived from attachment theory, there is relatively little empirical evidence concerning relations between

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4 children's attachment orientations and their memory for distressing life events. In a number of
5
6 prior studies, parents' romantic attachment styles have been measured rather than their children's
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8 attachment orientations. Yet, connections with the children's memory performance have been
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10 noted. For example, children whose parents scored higher (as opposed to lower) on a self-report
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12 measure of avoidant attachment were less accurate in recalling their experiences of invasive
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14 medical procedures (e.g., Alexander et al., 2002; Goodman, Quas, Batterman-Faunce,
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16 Riddlesberger, & Kuhn, 1997). Other studies have examined children's own attachment
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18 orientations in relation to their memory. These studies have focused primarily on children's
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20 memory for affectively laden experimental stimuli and have produced inconsistent findings.
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22 Kirsh and Cassidy (1997), for example, found significant associations between children's
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24 attachment orientations and memory for stories in which mothers' reactions to their children's
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26 requests for help following a minor injury corresponded to different patterns of caregiving. (For
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28 example, in the responsive stories, the mother responded to her child's bid for care with
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30 sensitivity; in the rejecting stories, the mother rejected her child's bid for care; and in the
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32 exaggerated response stories, the mother overreacted to her child's minor injury by crying herself
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34 and carrying the child home.) Secure children recalled both responsive and rejecting stories
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36 better than did insecure children. Similarly, Alexander et al. (2010) reported that children's
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38 attachment security predicted more accurate memory for negative picture-story stimuli that were
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40 relevant to attachment (e.g., separation). However, in a study by Belsky, Spritz, and Crnic
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42 (1996), where children were exposed to positive and negative puppet shows (e.g., receiving a
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44 birthday present, spilling juice), children with secure attachment histories remembered positive
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46 events more accurately than negative events, whereas children with insecure attachment histories
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48 remembered negative events better than positive ones.
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Associations between children's own attachment patterns and memory performance should be more robust in the case of distressing life experiences than in response to pictures and puppet shows. One relevant study examined the relation between, on the one hand, children's narrative representations of attachment relationships measured by the Attachment Story Completion Task (ASCT; Bretherton, Ridgeway, & Cassidy, 1990) and, on the other hand, memory accuracy for distressing life events (Chae et al., 2014). In the ASCT, an examiner acts out and narrates attachment-relevant story stems (concerning, e.g., separation or fear) using props, such as family figures. The examiner says to the child, "Show me and tell me what happens next." Children's mental representations of attachment are then evaluated from their responses. In the Chae et al. (2014) study, children with more (vs. less) positive representations of parents (e.g., as protective, warm, affectionate, and helpful) evinced better memory for a painful medical procedure. Because children with positive representations of parents are more likely to be securely attached (e.g., Dubois-Comtois, Cyr, & Moss, 2011), they may be better able to process and recount a distressing experience. In the present study we extend existing research by measuring children's attachment security in the somewhat distressing Strange Situation Procedure.

Attachment theory also has implications for children's yielding to misinformation – that is, being suggestible – during memory interviews. Suggestibility in the face of misleading questions is often affected by socioemotional, rather than simply memory, factors (e.g., Paz-Alonso, Goodman, & Ibabe, 2013). Because insecurely attached children may be more nervous, more approval seeking, and/or less comfortable than more secure children in social interactions with an unfamiliar adult, they may be more susceptible to demand characteristics inherent in the interview situation, such as social pressure to agree with an interviewer (Quas, Qin, Schaaf, &

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4 Goodman, 1997). Hence, even when such children have relatively intact memories and do not
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6 suffer from memory deficits per se, they may still be more suggestible than securely attached
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8 children. They might also be particularly suggestible about attachment-related, distressing
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10 events, because they might not want to access their true (painful) memories and, thus, may be
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12 more likely to affirm false suggestions.
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16 Little research has been published on the potentially important role of child attachment in
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18 understanding children's suggestibility. Based on correlational analyses, Clarke-Stewart, Malloy,
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20 and Allhusen (2004) observed a relation between children's less secure attachment to their
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22 mothers and the children's greater suggestibility about experiences not directly related to
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24 attachment (e.g., administration of standard developmental assessments). However, this
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26 correlation appeared only when the interview was highly pressuring and suggestive, not when it
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28 was less pressuring and the questions were only mildly leading. Moreover, because regression
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30 analyses with the interrelated variables were not conducted, the unique contribution of children's
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32 attachment orientations to their suggestibility proneness remains unclear. In a study by Schaaf,
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34 Alexander, and Goodman (2008), children's attachment was not significantly associated with
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36 their suggestibility about true and false life events, which might not have activated the
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38 attachment system (e.g., receiving a big stuffed giraffe as a present). However, Chae et al. (2014)
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40 found that children with more positive representations of parents better resisted misleading
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42 suggestions about a painful medical procedure. In the current study, we assessed the quality of
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44 children's attachment using a modified Strange Situation Procedure for preschool-aged children
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46 to investigate relations of attachment with memory and suggestibility. Given the children's
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48 young ages, the Strange Situation Procedure was expected to elicit distress.
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Attachment, Distress, and Children's Memory and Suggestibility

Consideration of the role of attachment orientations in children's memory and suggestibility may help to resolve contradictory views of the association between distress and memory. Overall, from an evolutionary perspective, humans are thought to remember distressing events particularly well for survival reasons (Chae et al., 2011; McKinnon et al., 2015; Nairne, 2014). The ability to retain such experiences in memory may help individuals avoid high risk situations and thus increase their chances of survival. Studies with adults have consistently shown preferential attentional processing of negative emotional or distressing information (e.g., Christianson, 1992; LoBue & Deloache, 2010; Phelps, Ling, & Carrasco, 2006; Talmi, Schimmack, Peterson, & Moscovitch, 2007). However, findings concerning children's memory and suggestibility are seemingly inconsistent. Several studies indicate that children's memory is particularly accurate, and resistance to false suggestions is particularly strong, for distressing events (e.g., Goodman, Hirschman, Hepps, & Rudy, 1991). For instance, in an experimental paradigm, high levels of arousal during a laboratory stress task predicted enhanced recall for the experience (Quas, Rush, Yim, & Nikolayev, 2014). Children's arousal at the time of encoding positively predicted their memory about a fear eliciting video as well (Quas & Lench, 2007). Furthermore, parents are more likely to ask open-ended questions and talk about causes when reminiscing about negative than positive events with their children, which may enhance the children's understanding of and memory for negative experiences (Sales, Fivush, & Peterson, 2003). However, there is also evidence that memory is particularly incomplete for highly distressing incidents (e.g., Merritt, Ornstein, & Spicker, 1994). Deffenbacher, Bornstein, Penrod, and McGorty (2004) proposed that, in children and adults, defensive processes are often activated to diminish memory for highly distressing experiences.

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4 One proposed reason for the discrepancies concerns individual differences in attachment
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6 quality (Chae et al., 2011; Goodman & Melinder, 2007). Enhanced memory for distressing
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8 events may be less likely among children with insecure attachment. Based on Bowlby's (1980)
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10 notion of defensive mental strategies, insecure children who have learned to associate
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12 attachment-system activation with rejection and inconsistent care are thought to use non-
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14 conscious emotion regulation strategies that impair accurate processing of and memory for
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16 experiences that cause psychological pain. Specifically, insecure-avoidant children may
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18 defensively exclude from further processing information that is likely to activate the attachment
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20 system, and insecure-anxious children may be preoccupied with attachment-related needs. These
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22 two strategic patterns associated with insecure attachment may both have negative effects on
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24 memory. If potentially upsetting information is not fully or not accurately processed, emotional
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26 pain or discomfort may be reduced but at the same time memory may be impaired.
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34 There is indirect evidence for this theoretical idea regarding young children's memory. In
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36 particular, there are enticing hints in studies on the moderating role of parental attachment in the
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38 relation between distress and children's memory. In such studies, although children's memory
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40 was, in general, particularly strong for highly distressing events, parents' attachment-related
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42 avoidance was associated with defensive processes (e.g., avoidance of discussion) that can
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44 reduce the beneficial effects of distress on memory (Edelstein et al., 2004; Goodman, Quas,
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46 Batterman-Faunce, Riddlesberger, & Kuhn, 1994). Alexander et al. (2002) and Chae et al. (2014)
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48 found that young children's distress during painful medical procedures was positively associated
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50 with memory accuracy only among children whose parents scored low in avoidance. For children
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52 whose parents scored high in avoidance, distress was negatively related to memory accuracy.
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58 Less secure parents may model or coach emotion regulation strategies that inhibit their children's
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4 open and accurate processing of distressing information. However, it is important for theory
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6 testing to examine the relation between distress and memory as a function of children's own
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8 attachment orientations, rather than from relying indirectly on assessments of their parents. In the
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10 present study, we examined the moderating effect of children's own attachment orientations on
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12 the relation between distress and memory.
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15 16 **Age and Children's Memory and Suggestibility** 17

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19 An additional strong predictor of children's memory performance is age. Age differences
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21 in children's memory and suggestibility have been consistently demonstrated using a variety of
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23 question types and target events (e.g., Alexander et al., 2002; Schaaf et al., 2008). Children
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25 undergo marked developmental changes in encoding, knowledge base, and memory strategies,
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27 and these changes may affect memory storage and production, including during the preschool
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29 years (Bjorklund & Causey, 2017). As a result, compared to older children, younger children
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31 typically recall less information in response to free recall and open-ended questions (e.g., "What
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33 happened that time?"), and they make more errors in response to specific questions (e.g., "What
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35 color was his hair?"). Furthermore, young children are more likely than older ones to have
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37 difficulty source monitoring and resisting false suggestions (e.g., "Your mom yelled at you when
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39 you cried, didn't she?" when in fact she did not), increasing error rates and suggestibility (e.g.,
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41 Ceci & Bruck, 1993; but see Brainerd, Reyna, & Ceci, 2008; Otgaar, Howe, Brackmann, & van
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43 Helvoort, in press). In the present study, we expected to find typical age trends in children's
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45 memory and suggestibility.
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52 53 **The Present Study** 54

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56 The overall goal of this study was to explore connections between young children's
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58 attachment security, on the one hand, and their memory and suggestibility concerning a
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4 distressing event, on the other hand. This study examined the role of children's own attachment
5 security (rather than that of their parents) in their memory and suggestibility for an emotionally
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7 distressing, personally experienced event that is clearly attachment related. Specifically,
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9 children's memory was tested for the Strange Situation Procedure, which consists of a series of
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11 caretaker departures and reunions in a laboratory setting. This procedure, created and first used
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13 by Ainsworth et al. (1978) in studies of infant-mother dyads, was later extended by Cassidy and
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15 Marvin (1992) for use with preschool children. The Strange Situation Procedure is meant to
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17 arouse uncertainty and distress to levels sufficient to activate children's attachment systems to
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19 reveal individual differences in their emotion regulation strategies relevant to attachment,
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21 including strategies that affect information processing. As such, the procedure was expected to
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23 unveil individual differences in children's memory and suggestibility. The Strange Situation
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25 Procedure, as one of the "gold standards" for identifying individual differences in children's
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27 attachment security, was considered an important to-be-remembered event, allowing us to
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29 explore relations between attachment security and memory in children.
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38 To examine the possibly unique role of attachment in children's memory, we statistically
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40 controlled for the potentially confounding subject variables of temperament, behavior problems,
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42 and short-term memory ability, measured by either teachers (or daycare providers) or
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44 researchers. Attachment security may relate at least somewhat to broader personality traits or
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46 temperament (Shaver & Brennan, 1992; Vaughn, Lefever, Seifer, & Barglow, 1989) and to
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48 verbal intelligence (Newcombe & Reese, 2004). A large body of research reveals links between
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50 attachment insecurity and externalizing and internalizing behavior problems (e.g., Kochanska &
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52 Kim, 2013; Moss et al., 2006). Furthermore, children's memory and suggestibility are sometimes
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54 attributed to verbal intelligence, temperament, and behavioral difficulties (e.g., Chae & Ceci,
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2005; Endres, Poggenpohl, & Erben, 1999). In most previous studies, those potentially confounding subject variables were measured by parent ratings (e.g., Alexander et al., 2002; Schaaf et al., 2008), whereas we obtained the information from independent sources in order to avoid parents' potential reporting biases. We expected attachment security to predict children's memory and suggestibility beyond the contributions of such measures.

Specifically, based on previous theory and research, we advanced the following hypotheses:

- (1) Children with higher attachment security scores would evince more accurate memory and less suggestibility about the Strange Situation Procedure (Chae et al., 2011; Dykas & Cassidy, 2011).
- (2) Although greater distress in children during the Strange Situation Procedure would predict better memory and decreased suggestibility for the event overall, distress and attachment orientations would interact such that higher distress in more securely attached children would predict better memory and less suggestibility, whereas for less securely attached children, greater distress would predict memory deficits and heightened suggestibility.
- (3) Consistent with a large literature (Bauer & Fivush, 2014), older children would report more complete and accurate memories and be less suggestible than younger children.

Method

Participants

Eighty-eight 3- to 5-year-olds ($M = 4.08$ years, $SD = .78$; 55 girls) participated. Approximately 76% of the children were Caucasian (non-Hispanic), 8% were Hispanic, 3% were Asian, 1% were African-American, and 11% fell in the "other" (e.g., multi-ethnic) category. The

families were generally middle- to upper-middle-class in socio-economic status and resided in a Western area of the United States. Families were recruited from those who had signed up for university research and had indicated that the children were English speaking without known developmental or medical disabilities. Initially, 91 children participated in the study, but three were dropped for failure to complete all of the procedure: Two children were too inattentive to complete the memory interview, and one mother declined further participation after the first separation in the Strange Situation Procedure, thus leaving a sample of 88 children.

Measures

Demographic questionnaire. A parent-report demographic questionnaire concerned children's age and ethnicity, parents' occupations and education, and household income.

Preschool Attachment Classification System. The Preschool Attachment Classification System, a modified Strange Situation Procedure designed to assess 2.5- to 5-year-olds' attachment status, is considered moderately distressing for children of preschool age (Cassidy & Marvin, 1992). It consists of five episodes, including two brief separations from and reunions with a parent. In this procedure, the parent and child are invited to make themselves comfortable in a playroom (Episode 1). After 5 minutes, the parent is signaled to leave (Episode 2). The first separation lasts for 5 minutes, unless the child becomes highly distressed, in which case the parent rejoins the child early. Following the separation, the parent is asked to return to the playroom but receives no specific instructions concerning the reunion (Episode 3). After the 5-minute reunion, the parent leaves again, and the second separation lasts for 5 minutes, unless the child becomes highly distressed (Episode 4). The assessment is terminated after 5 minutes of the second reunion (Episode 5). During both separations, the child is left alone.

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4 Based on videotapes of the session showing the child's behavior during the separations
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6 and reunions, attachment security is rated on a 9-point scale (Cassidy & Marvin, 1992; NICHD
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8 Early Child Care Research Network, 2001). For example, a score of 1 (highly insecure) is given
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10 when the child is either highly avoidant (e.g., not involved with the parent), highly anxious (e.g.,
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12 ambivalent in relation to the parent), highly controlling (e.g., punitive, hostile), highly
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14 disorganized (e.g., strong avoidance followed by strong proximity-seeking), or shows a
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16 combination of more than one such strategy. A score of 3 (insecure) is given when the child is
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18 either avoidant, anxious, controlling, or disorganized, but not highly so. A score of 5 (probably
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20 secure) is given when there are clear signs of neither security nor insecurity or when there are
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22 signs of both security and insecurity, but there is some slight indication of security within the
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24 child's relationship with the parent. A score of 7 (secure: responsive) is given when the child is
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26 responsive to the parent, and indicates in any of a variety of ways that this is a special
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28 relationship. There is some reason, however, that the highest score is not given: perhaps a bit of
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30 initial reserve, or slight attempts to control the parent. A score of 9 (highly secure: initiating) is
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32 given to children who initiate interaction, proximity, or contact with complete ease and lack of
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34 ambivalence. The child indicates that his/her relationship with the parent is a special one. The
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36 child is particularly calm, yet at the same time clearly pleased, on reunion. Scores of 2, 4, 6, and
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38 8 are also given.
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48 Two independent coders, blind to hypotheses and memory and suggestibility scores,
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50 individually scored 28% of the cases (randomly selected) to check their reliability of coding. The
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52 coders were trained by the MacArthur Working Group on Preschool Attachment, and passed the
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54 preschool attachment test administered by Cassidy and Marvin. The intraclass correlation
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56 coefficient for their coding of security was .76. Discrepancies were resolved, and one coder
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4 scored the remaining cases. To avoid “coding drift,” the coder referred to the coding manual
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6 while coding each case (the MacArthur system; Cassidy & Marvin, 1992).
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9 **Distress measure.** As part of the attachment coding, children's distress levels during the
10 two separations from their parents were coded on a 5-point scale (1 = no distress, child continues
11 playing; 2 = minimal-low distress, child plays at lower level or plays with brief searching; 3 =
12 low-moderate distress, child waits without playing or searches for parent, minimal crying, or
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14 intermittent and low level crying; 4 = moderate-high distress, child crying, distress is increasing,
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16 separation may be terminated early; 5 = high distress, child has high level crying and separation
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18 is terminated immediately or parent cannot leave) and averaged. The level of distress was taken
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20 into account in understanding whether the child used the parent as a secure base. Twelve percent
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22 of the tapes (randomly selected) were coded by two independent coders who were blind to
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24 hypotheses and memory/suggestibility scores. The intraclass correlation coefficient across the
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26 coders for the subsample was .97. One of the coders scored all remaining tapes.
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36 **Memory questionnaire.** A questionnaire was constructed for the current study to assess
37 children's memory for the Strange Situation Procedure. The memory questionnaire begins with a
38 free-recall section including 6 prompts (e.g., “What happened when you were in the playroom?”
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40 “What happened next?”), and then proceeds with a mix of 24 specific and 24 misleading
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42 questions, each with 12 wh-questions and 12 yes/no questions. Specific questions refer to factual
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44 information about the Strange Situation Procedure (e.g., “Did your mom leave the playroom
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46 while you were still in there?” “What did your mom tell you when she left the playroom?”),
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48 whereas misleading questions suggest details that are incorrect regarding the event (e.g., “Your
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50 mom didn't come back to the playroom when you were still in there, did she?” “Why did your
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52 mom scream in the playroom?”). These questions are in semi-random order so that no more than
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two consecutive questions are misleading. Specific and misleading yes/no questions were designed to yield equal numbers of “yes” and “no” correct answers to control for possible response bias.

Children’s responses to free recall questions were scored for units of information using a coding system that was adapted from previous studies (e.g., Chae et al., 2014). For example, the statement “I played dinosaur with mom,” was scored as four units of information: three correct for “I,” “played,” and “dinosaur,” and one incorrect for “mom” (if the child did not play with the mother). This system focuses on units of information rather than number of words per se, such that two sentences may receive the same number of units despite one sentence having more words (e.g., “It was a red dinosaur” and “Dinosaur was red” each would receive 2 units). Two independent coders scored 13% of the free recall data. Proportion of agreement was .82. One of the coders scored all remaining free recall responses.

Responses to specific and misleading questions were categorized as correct answers, commission errors, omission errors, or “don’t know” replies. Commission errors refer to answers indicating something occurred or was present during the Strange Situation Procedure when it did not or was not. For example, in response to the misleading question “Why did your mom scream in the playroom?”, a child’s false statement, “I popped out and I scared her,” was categorized as a commission error. Omission errors refer to information about the experience that the children failed to disclose or confirm when directly asked during the interview. “Don’t know” replies and unscorable answers were also coded. Unscorable information included statements that were not relevant to the event (e.g., “I got ice cream yesterday”). Coders were blind to children’s attachment scores as well as scores on other measures.

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4 **Memory for Sentences.** The Memory for Sentences subtest of the Stanford-Binet
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6 Intelligence Scale-4th edition (Thorndike, Hagen, & Sattler, 1986) measures short-term memory
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8 abilities and served as an index of verbal intelligence. The examiner speaks brief phrases or
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10 sentences that the child must repeat from memory. The Memory for Sentences subtest is
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12 standardized for 2- to 10-year-olds.
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16 **Temperament Assessment Battery for Children.** The Temperament Assessment
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18 Battery for Children (TABC) is a standardized questionnaire, to be completed by adults (e.g.,
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20 teachers), regarding 3- to 7-year-olds' temperament (Martin, 1988). For the current study, three
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22 subscales were selected: Adaptability (e.g., "Child will quickly adjust to a game if others want to
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24 play in a different way"), Approach/Withdrawal (e.g., "Child immediately gets involved in new
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26 learning situations"), and Emotional Intensity (e.g., "Child lets other children know by yelling or
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28 fighting when s/he does not like something"). The three subscales have been related to children's
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30 memory and suggestibility in previous studies (e.g., Geddie, Fradin, & Beer, 2000; Gordon et al.,
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32 1993). Each subscale consists of 8 items to which adults are asked to respond using a 7-point
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34 scale. Studies have indicated adequate internal consistencies (alphas = .86 for Adaptability, .86
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36 for Approach/Withdrawal, and .69 for Emotional Intensity) and test-retest reliabilities ($r_s = .69$
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38 for Adaptability, .87 for Approach/Withdrawal, and .76 for Emotional Intensity) over a 6-month
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40 interval (Martin, 1988).
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48 **Caregiver-Teacher Report Form.** The Caregiver-Teacher Report Form (C-TRF)
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50 assesses children's behavioral and emotional problems (Achenbach, 1997). On a 3-point scale,
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52 teachers or daycare providers indicate how true each of 99 statements is when applied to a
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54 particular child. Scores are computed for two dimensions of problem behavior—Internalizing
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(Emotionally Reactive, Anxious/Depressed, Somatic Complaints, and Withdrawn subscales) and Externalizing (Attention Problems and Aggressive Behavior subscales)—and Total Problems.

The test-retest reliability of the Internalizing scale is .77, and for the Externalizing scale, it is .89 (Achenbach, 1997).

Procedure

The study was approved by the university's Institutional Review Board. Interested parents and their children visited a university laboratory. After parental consent and child assent were obtained, the parent and child were escorted to a playroom for the Strange Situation Procedure, and the event was videotaped from behind one-way screens. After the procedure, the parent completed the demographic questionnaire, and reviewed and approved the memory questionnaire. In a separate room, the child first engaged in distractor tasks, and then the Memory for Sentences subtest was administered, creating an approximately 1 hour delay from the Strange Situation Procedure to the memory interview. Next, a third experimenter interviewed the child about the Strange Situation Procedure. It was explained that the child could respond "I don't know" for any question s/he could not answer. The memory interview was videotaped and later transcribed for coding. Finally, the child was debriefed and told that sometimes adults might think something happened to a child and that sometimes the adult could be wrong. Also, the experimenter said that some of the questions could refer to occurrences that did not transpire (e.g., "I was making that part up to see what you would say"). The parent was paid \$20, and the child received a small trinket. With parental permission, teachers or daycare providers were asked to complete the TABC and the C-TRF. They received \$5 for completing the questionnaires.

Results

The main memory measures coded were correct and incorrect units of information provided in free recall and proportion correct and commission errors to specific and misleading questions, calculated with correct, incorrect (commission and omission), and don't know answers as the denominator. Most children ($n = 56$) did not produce any incorrect units during free recall ($M = 2.02$, $SD = 5.80$, range = 0-48), and there were no significant findings in analyses of omission errors (specific questions, $M = .12$, $SD = .08$, range = 0-.47; misleading questions, $M = .09$, $SD = .06$, range = 0-.25). These kinds of errors are therefore not considered further.

Descriptive statistics and correlations for the individual-difference and memory variables appear in Table 1. Because of missing data for some variables, the number of participants varied across analyses. Three children did not experience the second separation from their parents during the Strange Situation Procedure because they were too distressed to let the parents leave them again. Distress scores were not obtained for those children, but their memory data were included as possible in analyses. Also, only 79 teachers (or daycare providers) completed the questionnaires, and several teachers omitted answering some of the items on the questionnaires; thus, scores on behavior problem and/or temperament variables were not available for those children.

The free recall correct variable was positively skewed ($M = 12.66$, $SD = 10.12$, range = 0-49), and thus transformed by the logarithm function. The attachment security variable was negatively skewed ($M = 5.95$, $SD = 1.47$, range = 3-8). Thus, it was transformed by the reflect and square root function and then reflected again to restore the original order of the variable. Because several extreme scores were detected for some memory measures, statistical analyses without the outliers included (i.e., data points ≥ 3 standard deviations from the means; Osborne

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4 & Overbay, 2004) were conducted. All significant effects are reported and are based on two-
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tailed tests.

As can be seen from the correlations in Table 1, overall, with age, children provided more units of correct information in free recall, and a higher proportion of correct answers and a lower proportion of commission errors to specific and misleading questions. Children's distress during the Strange Situation Procedure was correlated with children's higher proportion of correct answers to specific questions and misleading suggestions. Higher ratings of the children's security were associated with lower ratings of children's distress during the Strange Situation Procedure, although the proportion of variance accounted for (the correlation squared) by the relation was small (.11). None of the confounding subject variables (i.e., short-term memory ability; TABC adaptability, approach/withdrawal, and emotional intensity; C-TRF internalizing and externalizing problem behavior) were significantly correlated with children's attachment or distress variables. Externalizing problem behavior was negatively related to proportion correct to specific questions and positively related to proportion commission errors to specific questions. Emotional intensity was negatively related to proportion correct to specific questions. The other variables were not significantly correlated with children's memory or suggestibility.

Regression analyses were conducted to examine unique contributions of the hypothesized subject variables (i.e., age, attachment security, and distress) and hypothesized interaction effects in predicting children's memory performance (Table 2). In each regression analysis, child age, attachment security, and distress during the Strange Situation Procedure (all centered) were entered in a first model. The Attachment Security x Distress interaction (centered) was then added in a second model. To detect possible multicollinearity problems, variance inflation factor (VIF) values were obtained. The largest VIF among all of the independent variables was 1.15,

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4 which is within the recommended VIF levels (Rogerson, 2001). All significant findings are
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6 reported. To detect possibly extraneous influences, the regression analyses were conducted again
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8 with each of the confounding subject variables entered separately. Each was then examined to
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10 see if the findings regarding memory in relation to age, attachment security, and distress would
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12 hold. Given the large number of confounding subject variables, they could not be entered
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14 simultaneously. Analyses conducted with the confounding variables are reported when
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19 significant.

20 21 **Free Recall**

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23 The regression model predicting free recall correct units was significant. Age and
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25 attachment security were significant predictors, with older children and more securely attached
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27 children providing a higher number of correct units of information.
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30 31 **Specific Questions: Correct and Commission Error Proportions**

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33 The model predicting proportion correct to specific questions was also significant. Age,
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35 attachment security, and distress were significant predictors, such that older children, more
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37 securely attached children, and children who were more distressed during the Strange Situation
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39 Procedure were more accurate in response to specific questions. When children's externalizing
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41 problem behavior was added to the model, it negatively predicted proportion correct to specific
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43 questions, $\beta = -.31$, $t = -3.02$, $p = .004$, and the regression model was also significant, $F(4, 70) =$
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45 8.27 , $p < .001$, $R^2 = .32$. The findings regarding memory in relation to age, attachment security,
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48 and distress remained significant, $ps \leq .04$. The regression model for proportion commission
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51 errors to specific questions was not significant.
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Misleading Questions: Correct and Commission Error Proportions

The regression model for proportion correct to misleading questions was significant. Age was a significant predictor, such that compared with younger children, older children answered misleading questions with greater accuracy.

The regression model predicting proportion commission errors to misleading questions was also significant. Compared with older children, younger children made a higher proportion of commission errors. The regression with the Attachment Security x Distress interaction variable included produced a significant model, and the Attachment Security x Distress interaction was significant (Figure 1). To interpret the significant interaction, the significance of the simple slope of each regression line was assessed using simple slope tests (Aiken & West, 1991). Specifically, the significance of the relations between distress and proportion commission errors to misleading questions was examined separately for high- and low-security groups (i.e., one standard deviation above and below the mean, respectively). Simple slope tests indicated that, as more securely attached children's distress levels increased, they produced a lower proportion of commission errors, $\beta = -.66, t(79) = -2.83, p = .006$. For less secure children, the relation was not significant, $\beta = -.05, t(79) = -.48, ns$. Hence, greater distress was related to greater resistance to false suggestion only for children with more secure attachment.

Age and Distress Interactions

Regression models were tested including age, attachment security, and distress in the first model, and adding the Age x Distress interaction in the second model. The first models duplicated those reported above and in Table 2. The second models permitted examinations of a possible Age x Distress interaction effect on memory and suggestibility for the Strange Situation Procedure. The second models, $F_s(4, 77-80) \geq 3.55, p_s \leq .01, \Delta R^2_s \geq .06$, and the interactions, β_s

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4 $\geq .28$], $ps \leq .02$, were significant for proportion of commission errors to specific questions and
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6 proportion of correct answers and commission errors to misleading questions (Figures 2-4). The
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8 R^2 changes were significant, $ps \leq .02$. Simple slope tests revealed that greater distress was
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10 significantly related to reduced commission errors to specific and misleading questions, $\beta s \leq$
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12 $-.48$, $ts(77, 79) \leq -2.40$, $ps \leq .02$, and increased correct answers to misleading questions, $\beta = .57$,
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14 $t(80) = 3.03$, $p = .003$, for younger children, but not for older children, $\beta s \leq .12$], $ts(77-80) \leq$
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16 $.90$], *ns*. The younger children's accuracy was equivalent to that of the older children when
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18 greater distress was manifest during the Strange Situation Procedure. The Age x Distress
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20 interaction remained significant even when significant confounding subject variables were
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22 included, $ps \leq .04$. No other interaction effects (i.e., Age x Attachment Security and Age x
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24 Attachment Security x Distress) were significant in predicting memory performance, although
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26 the limited sample size likely precluded detecting a significant three-way interaction.
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33 Discussion

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36 Our study tested hypotheses regarding children's memory and suggestibility derived from
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38 Bowlby's attachment theory by using the Strange Situation Procedure, a "gold standard"
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40 measure for assessing attachment quality. The Strange Situation Procedure is considered
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42 moderately distressing for children. The findings reveal significant relations between child's age,
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44 attachment security, and distress, on one hand, and child's memory and suggestibility, on the
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46 other, and these associations were not explained by short-term verbal memory, behavior
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48 problems, or temperament factors. The results provide insights into the power of attachment
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50 theory as a framework for understanding young children's memory for and suggestibility about
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52 distressing events (Chae et al., 2009). The findings also raise important theoretical questions
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54 about the sources of age differences in the memory performance of young children.
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Attachment and Children's Memory and Suggestibility

We hypothesized that the accuracy of children's memory about the Strange Situation Procedure would be greater in the context of more secure attachment. Consistent with this prediction, children who scored higher on attachment security were more accurate in answering free recall and specific questions. That this result emerged for memory of the Strange Situation Procedure itself avoids past concerns as to whether or not the to-be-remembered stimuli (e.g., stories and medical procedures) activated the attachment system (Alexander et al., 2010; Chae et al., 2014; Kirsh & Cassidy, 1997) and thus helps to show specifically that attachment security contributes to children's correct memory for affectively laden, attachment-related information. These findings fit well with Bowlby's (1980) claim that the attachment-system is activated in distressing situations and that IWMs of attachment play a role in children's information processing.

Based on that view, one interpretation of our findings is that children with more secure attachment relationships with their parents (i.e., children who have presumably received sufficient parental support and comfort in past times of distress) may effectively cope with new distress by directing attention toward the event. Subsequently, they are likely to develop relatively detailed and accurate memories of the experience. In contrast, more insecurely attached children may not encode distressing experiences sufficiently to produce as complete and accurate memory reports. Although a direct test of this interpretation requires a measure of attention and encoding that we lacked, this interpretation is consistent with recent formulations of attachment theory in terms of emotion regulation strategies that can affect attention and memory (Mikulincer & Shaver, 2016).

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4 Also, parents of more secure children might have been more engaged and better at
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6 providing explanations when talking about previous distressing experiences with their children
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8 (Newcombe & Reese, 2004). That is, such children may have had more and better opportunities
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10 to think coherently about emotions and to practice open communication (Laible & Thompson,
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12 2000). Although in this study there was no chance for the children to discuss the Strange
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14 Situation Procedure with their parents before the memory interview, the benefits of daily
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16 experience of open and fluent parent-child conversations about emotionally salient events,
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18 possibly including attachment-related ones, may have been internalized by the children. Through
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20 conversations with their parents, children can learn the skills necessary to produce their own
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22 narratives in the context of interactions with unfamiliar adults (Fivush, Haden, & Reese, 2006;
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24 Jack, MacDonald, Reese, & Hayne, 2009). Indeed, empirical research has shown that parental
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26 behavioral support (e.g., respect for autonomy, quality of instruction) during reminiscing about
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28 personal events positively predicts children's independent recall with an experimenter about
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30 undiscussed, new events (Larkina & Bauer, 2010).
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38 In addition, when asked to recall what was experienced during a distressing event, more
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40 securely attached compared to less securely attached children may feel at liberty to produce
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42 elaborative statements. More securely attached children may also have greater trust in adults in
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44 general, and thus feel sufficiently comfortable and supported to talk about even emotionally
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46 distressing attachment-related events in an unfamiliar setting. Such tendencies may help them
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48 voluntarily produce more information, and under certain conditions, to resist false suggestions
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50 (e.g., Quas & Lench, 2007). In contrast, more insecurely attached children, who are likely more
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52 distressed with an adult interviewer, might be particularly reluctant to share emotionally
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4 distressing attachment-related experiences. Further research is needed to examine these
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6 possibilities.

9 **Attachment, Distress, and Children's Memory and Suggestibility**

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11 Based on theoretical and empirical work (e.g., Baumeister, Bratslavsky, Finkenauer, &
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13 Vohs, 2001; Nairne, 2014), we expected that greater distress in children during the Strange
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15 Situation Procedure would be linked to better memory for the event. Consistent with this
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17 hypothesis, in regression analyses, greater distress significantly predicted greater accuracy in
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19 answering specific questions. Although the children's distress in our study was not extreme, our
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21 findings add to previous evidence that distressing events are particularly well retained in memory
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23 (e.g., Christianson, 1992; Peterson & Whalen, 2001).

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28 Furthermore, our prediction that attachment orientations would moderate the relation
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30 between distress and children's suggestibility was supported. Attachment security and distress
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32 significantly interacted, such that distress was related to greater resistance to false suggestions
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34 among more securely attached children only. That is, when children were highly distressed by
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36 the separations from their parents, attachment security was associated with a lower proportion of
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38 commission errors to misleading questions during the memory interview. However, the
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40 beneficial effect of distress on resistance to false suggestions did not extend to children with less
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42 secure attachment: Less secure children produced similar proportions of commission errors to
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44 misleading questions regardless of their distress levels. This interaction effect may be due, at
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46 least in part, to attachment-related differences in parents' previous reactions to their children's
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48 experiences and expressions of distress. Securely attached children, who may have learned over
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50 time that their parents are available and supportive when needed, may remember their
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52 experiences especially well if they were highly distressed, because such events are likely to
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4 evoke a high level of arousal. Their ability to self-regulate negative emotions once aroused then
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7 frees the cognitive resources needed for accurately encoding, storing, and/or reporting the event.
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10 Their superior memory for the attachment-related stressors may further help them overcome
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12 social pressure to falsely agree with the interviewer. In contrast, children with insecure
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14 attachment whose parents may have been unresponsive, hostile, or inconsistent in times of need
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16 are unlikely to develop particularly detailed or accurate memories for highly distressing
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18 experiences due to their difficulty in confronting and coping with negative emotions, and/or
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20 unlikely to have developed sufficient trust to counter false suggestions even about distressing
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22 events (Chae et al., 2011). The significant Attachment Security x Distress interaction reported in
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24 the present study is similar to findings of previous research conducted in a variety of situations
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26 but that did not assess young children's own attachment orientations (Alexander et al., 2002;
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28 Edelstein et al., 2005). By examining children's own attachment quality and its relation to their
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30 memory and suggestibility for a moderately distressing event, we demonstrated the broad
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32 generality of the moderating role attachment plays in the relation between distress and memory.
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38 **Age and Children's Memory and Suggestibility**

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41 Overall, older compared to younger children evinced better memory and reduced
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43 suggestibility about the Strange Situation Procedure, as would be expected based on previous
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45 developmental research (e.g., Bauer & Fivush, 2014; Poole & Lindsay, 2002). In general,
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47 children's abilities to produce accurate accounts of previous events and resist misleading
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49 suggestions tend to improve with age, likely due to the development of various cognitive and
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51 social skills (e.g., Bjorklund & Causey, 2017; Ghetti & Alexander, 2004; Gordon, Baker-Ward,
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53 & Ornstein, 2001; Schaaf et al., 2008). However, significant age differences in accuracy when
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55 answering specific and misleading questions largely disappeared for children who were more
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4 distressed during the Strange Situation Procedure. In fact, the accuracy of the younger children
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6 who had been highly distressed during the Strange Situation Procedure was indistinguishable
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8 from that of older children who showed relatively low or high distress during the attachment
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10 assessment, with the younger children reaching the accuracy that the older children obtained. Of
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12 importance, these findings imply that age differences in the type of memory and suggestibility
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14 tapped by our questions—age differences that are otherwise consistently found (e.g., in 3- vs. 5-
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16 year-olds; Goodman & Aman, 1990)—may be less likely to emerge in children's memory
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18 reports of a distressing as opposed to a nondistressing experience across this age range. Although
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20 further research is needed to examine this possibility, the implications are significant for theory
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22 and application (e.g., to legal situations). For example, for theory, encoding, storage, and
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24 retrieval of distressing information may be comparable across preschool ages (see Cordon,
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26 Melinder, Goodman, & Edelstein, 2013, for similar results for older children vs. adults). With
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28 respect to legal applications, memory for neutral events may underestimate young children's
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30 memory accuracy and resistance to suggestion regarding distressing separation events (e.g.,
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32 maternal murder; McWilliams, Narr, Goodman, Ruiz, & Mendoza, 2013). However, further
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34 research with larger sample sizes to detect possibly significant Age x Attachment Security x
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36 Distress interactions is warranted.
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45 **Caveats**

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48 This study provides valuable new information about the role of attachment security in
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50 children's memory and suggestibility, but several limitations need to be acknowledged. First,
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52 although we assessed the quality of children's attachment using the preschool version of the
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54 Strange Situation Procedure, the different dimensions of insecure attachment (i.e., avoidance and
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56 anxiety) were not separately analyzed. Avoidantly attached individuals are thought to use a
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4 deactivating emotion regulation strategy, whereas anxiously attached individuals use a
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6 hyperactivating emotion regulation strategy (Mikulincer & Shaver, 2016). Avoidant children are
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8 likely to limit elaboration of distressing experiences and suppress or distort the details with the
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10 goal of regulating their emotions. They may minimize activation of their attachment system, in
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12 part by not attending to, not thinking about, not discussing, or not recalling distressing incidents.
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15 In contrast, anxious children may excessively focus on the stressors and the concerns for
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17 themselves (Chae et al., 2009, 2011). Given these potentially countervailing tendencies, our
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19 attachment measure may have provided a conservative test of attachment and memory relations.
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22 Future research should seek to determine how avoidant children and anxious children differ in
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24 terms of their memory and suggestibility about emotionally distressing incidents. Second, our
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26 participants were predominantly from middle- to upper-middle-class families, limiting the
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28 generalizability of our findings. Significant relations between high socio-economic status,
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30 positive parenting behavior, and secure attachment exist (e.g., Evans, Gonnella, Marcynyszyn,
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32 Gentile, & Salpekar, 2005; NICHD Early Child Care Research Network, 1997; van IJzendoorn,
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34 Schuengel, & Bakersman-Kranenburg, 1999). Indeed, a majority of our participants obtained
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36 relatively high attachment-security scores. Third, children's attachment security could contribute
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38 to their experiences during the Strange Situation Procedure (e.g., degree of separation protest)
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40 and hence shape their memory for the event. That is, attachment security could possibly be
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42 confounded with experiences during the Strange Situation. Fourth, although too few children
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44 produced inaccuracies in free recall to permit relevant statistical analysis, it would be of interest
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46 in future research to identify reasons for inaccurate free recall in preschoolers (e.g., one child in
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48 our study said, "Tigger went in the room...The Winnie the Pooh had Tigger in his mouth,"
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50 which was not true). Fifth, our measure of distress was observational, and although the observed
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4 level of distress was generally not rated on average as notably high, we cannot be certain of the
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6 actual level of distress the children experienced. Our results furthermore indicate a need for
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8 memory development research in which attachment-system activation by threats or stressors
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10 systematically varies. Given these caveats, caution is advised in application of our findings to
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12 real-world settings (e.g., to legal situations). That said, further research, informed by our
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14 findings, could provide important new knowledge concerning children's memory and
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16 suggestibility for distressing life experiences of interest to application.
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21 **Conclusion**

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23 The present study examined children's memory and suggestibility about a mildly
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25 distressing event, the Strange Situation Procedure, in relation to individual differences in
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27 children's attachment security. More (compared to less) securely attached children provided a
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29 higher number of correct units of information in free recall and answered a higher proportion of
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31 specific questions correctly, thereby demonstrating more complete and accurate memories about
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33 separation- and reunion-related events with parents. Children who were more (vs. less) distressed
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35 when separated from their parents answered a higher proportion of specific questions correctly.
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37 For children with higher attachment-security scores, greater distress predicted fewer memory
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39 errors to misleading questions, whereas for less secure children, higher distress levels were not
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41 associated with resisting misleading suggestions, perhaps because of defensive processes that
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43 dampen such memories or because of socioemotional factors that affect suggestibility. Although
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45 typical age effects were observed overall in memory and suggestibility performance, younger
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47 children's accuracy in answering specific and misleading questions was equivalent to that of
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49 older children if the younger children had shown relatively high distress during the attachment
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51 test. The roles of attachment, distress, and age in children's memory and suggestibility were
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4 beyond the contributions of children's short-term verbal memory skills, temperament, and
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6 behavior problems. This study offers an empirical test of important predictions from attachment
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8 theory and shows attachment-related processes that contribute to how children remember
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10 distressing, attachment-related life events. Our findings indicate that, to the extent that
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12 attachment system activation is important for information processing, the relation between
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14 distress and memory, as well as distress and suggestibility, can be affected by attachment
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16 orientations. Findings obtained from this study add light to issues debated for decades about
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18 distress and memory, and they advance scientific understanding of how children's attachment
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20 security may affect their memory and suggestibility.
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Table 1. *Descriptive statistics and correlations for individual-difference variables and memory/suggestibility variables*

	<i>Mean</i>	<i>SD</i>	<i>Range</i>	1	2	3	4	5	6	7	8	9
Individual-difference variables												
1. Age (<i>N</i> = 88)	4.08	.78	3-5	--								
2. Security (<i>N</i> = 88)	1.67	.36	1-2.24	-.12	--							
3. Distress (<i>N</i> = 85)	1.91	.74	1-5	.19	-.33**	--						
4. Memory for Sentences (<i>N</i> = 85)	51.86	6.50	39-73	-.12	-.002	-.11	--					
5. Adaptability (<i>N</i> = 71)	5.23	.90	3.13-7	.11	-.10	-.11	.06	--				
6. Approach/Withdrawal (<i>N</i> = 76)	5.00	1.12	2.25-7	-.04	-.05	-.19	-.03	.71***	--			
7. Emotional intensity (<i>N</i> = 74)	4.13	.89	2.13-6.63	-.25*	.07	-.01	-.19	-.33**	.12	--		
8. Internalizing problems (<i>N</i> = 79)	45.63	10.30	34-72	-.12	-.07	.07	.06	-.66***	-.53***	.25*	--	
9. Externalizing problems (<i>N</i> = 79)	46.44	9.08	36-69	-.14	-.05	.14	-.02	-.55***	-.15	.60***	.66***	--
Memory variables												
Free recall correct (<i>N</i> = 88)	.96	.48	0-1.7	.31**	.20	-.01	.15	-.13	-.13	-.22	-.002	-.13
Proportion specific correct (<i>N</i> = 87)	.69	.14	.24-.92	.40***	.09	.26*	.04	-.04	-.11	-.23*	-.11	-.32**
Proportion specific commission (<i>N</i> = 85)	.08	.09	0-.35	-.22*	.21	-.16	-.08	-.11	-.09	.10	.19	.25*
Proportion misleading correct (<i>N</i> = 88)	.69	.21	.16-1	.27*	-.11	.24*	.09	.01	.12	-.07	-.13	-.03
Proportion misleading commission (<i>N</i> = 87)	.12	.14	0-.56	-.37***	.08	-.18	-.18	-.03	-.03	.05	.12	.04

Note. Free recall correct = free recall correct transformed by the logarithm function. Security = attachment security transformed by the reflect and square root function and reflected again. Distress = Child's distress during Strange Situation Procedure.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2. Age, security, distress, and the interaction between security and distress predicting memory for the Strange Situation

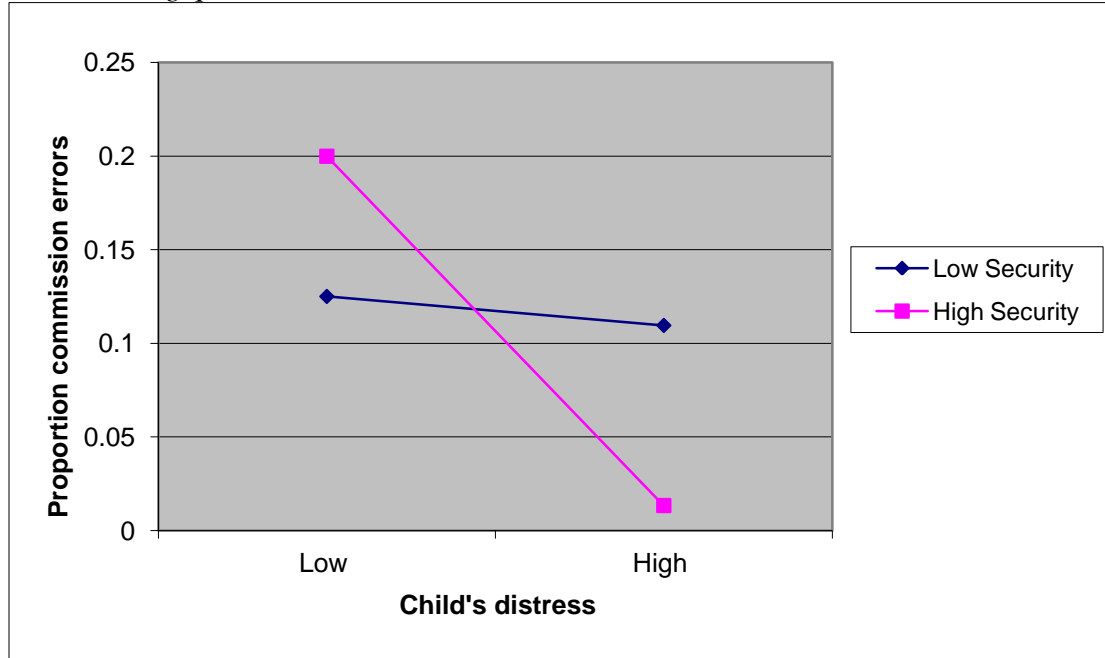
Procedure

	Free correct		Proportion specific correct		Proportion specific commission		Proportion misleading correct		Proportion misleading commission	
	β	t	β	t	β	t	β	t	β	t
Model 1										
Age	.33	3.18**	.37	3.71***	-.19	-1.69	.23	2.17*	-.34	-3.27**
Security	.24	2.18*	.22	2.10*	.17	1.42	-.02	-.19	.01	.05
Distress	.01	.07	.26	2.45*	-.06	-.55	.19	1.67	-.12	-1.03
	$\Delta R^2 = .15^{**}$		$\Delta R^2 = .23^{***}$		$\Delta R^2 = .09$		$\Delta R^2 = .11^*$		$\Delta R^2 = .15^{**}$	
	$F(3, 81) = 4.69$		$F(3, 80) = 8.07$		$F(3, 78) = 2.44$		$F(3, 81) = 3.34$		$F(3, 80) = 4.60$	
Model 2										
Age	.34	3.25**	.37	3.65***	-.20	-1.82	.25	2.38*	-.37	-3.62**
Security	.25	2.29*	.22	2.04*	.14	1.24	.01	.11	-.04	-.36
Distress	.09	.65	.24	1.73	-.20	-1.32	.37	2.54*	-.35	-2.52*
Security x Distress	.13	.93	-.03	-.19	-.20	-1.40	.27	1.92	-.35	-2.63*
	$\Delta R^2 = .01$		$\Delta R^2 < .001$		$\Delta R^2 = .02$		$\Delta R^2 = .04$		$\Delta R^2 = .07^*$	
	$F(4, 80) = 3.73$		$F(4, 79) = 5.99$		$F(4, 77) = 2.34$		$F(4, 80) = 3.51$		$F(4, 79) = 5.43$	

Note. Free correct = Free recall correct transformed by the logarithm function. Security = Attachment security transformed by the reflect and square root function and reflected again. Distress = Child's distress during Strange Situation Procedure.

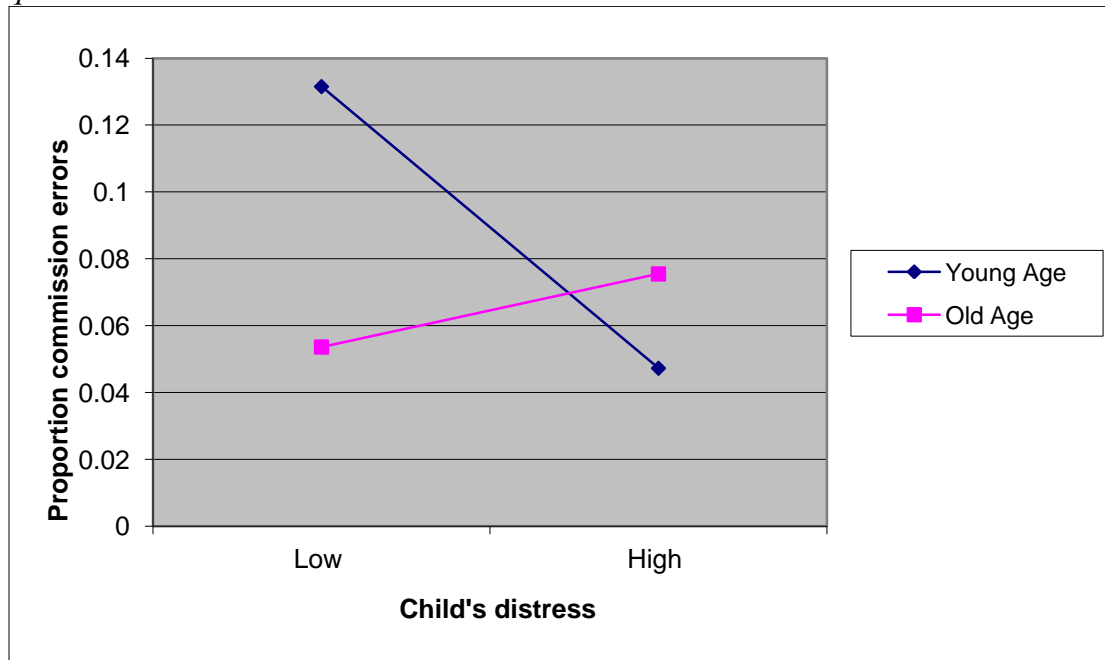
* $p < .05$, ** $p < .01$, *** $p < .001$.

Figure 1. *Interaction between attachment security and distress for proportion commission errors to misleading questions*

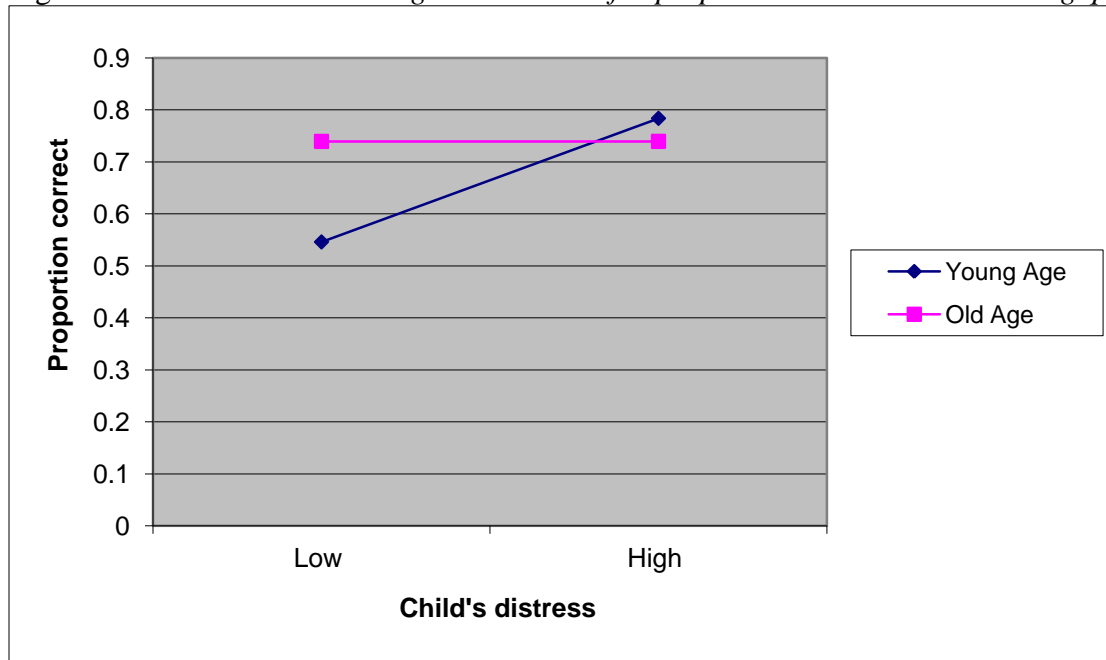


Note. Attachment security and distress are plotted in terms of 1 standard deviation above and below the mean, respectively.

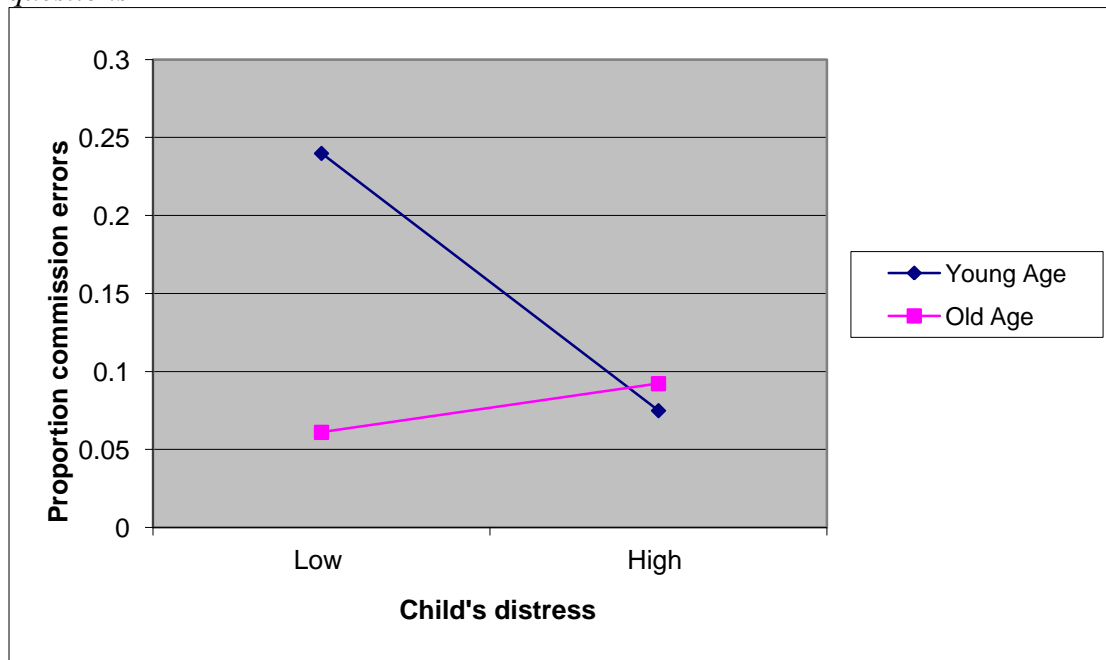
Figure 2. *Interaction between age and distress for proportion commission errors to specific questions*



Note. Age and distress are plotted in terms of 1 standard deviation above and below the mean, respectively.

Figure 3. *Interaction between age and distress for proportion correct to misleading questions*

Note. Age and distress are plotted in terms of 1 standard deviation above and below the mean, respectively.

Figure 4. *Interaction between age and distress for proportion commission errors to misleading questions*

Note. Age and distress are plotted in terms of 1 standard deviation above and below the mean, respectively.

Attachment security predicted recall and specific question accuracy about the Strange Situation.

Young children showing high Strange-Situation distress were as accurate as older ones.

Attachment theory provides a framework for understanding facets of memory development