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This study examined the role of attachment security in the development of children's cognitive skills and academic achievement. Of particular interest was whether these associations were moderated by gender, parenting stress, SES, and child IQ. The current sample utilized data from 45 boys and 55 girls who are part of an ongoing longitudinal study. A series of hierarchical regression models were conducted to explore the associations between 2-year olds' attachment security and their cognitive and academic functioning when they were 7-years old. Results indicated that attachment security alone predicted academic achievement, but not specific cognitive skills. Attachment security interacted with SES and child IQ, however, to predict impulsivity and goal maintenance. These results confirm the necessity for educators and mental health professionals working with children to pay attention to the environmental influences on cognitive development.

EARLY ATTACHMENT SECURITY: RELATIONS WITH COGNITIVE SKILLS
AND ACADEMIC ACHIEVEMENT

By

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CHAPTER I

INTRODUCTION

The notion that the mother-child relationship is an important predictor of children's emotional development is a well-accepted idea in contemporary psychology. However, less is known about the link between this relationship and children's cognitive development. Theories of cognitive development propose that the child's environment plays an important role in the child's emerging cognitive skills (Vygotsky, 1978; Piaget, 1967). Children prosper in environments that are filled with various types of mental stimulation and new experiences. Also, children who are comfortable in their relationship with their caregiver are better able to adapt to and explore a rich environment (Piaget, 1967). Therefore, the quality of the relationship between the child and caregiver may be integrally related to the child's cognitive development. In addition, caregivers likely facilitate their children's cognitive development in a number of complex ways such as playing games, helping them solve problems, and facilitating independent exploration of the environment (Parke, Burks, & Carson, 1994).

CHAPTER II

REVIEW OF THE LITERATURE

The Development of Attachment

Attachment theory provides an explanation of how the parent-child relationship emerges and influences subsequent development. According to Bowlby (1969), an attachment is an enduring affective bond demonstrated through the tendency of the child to seek proximity to a specific caregiver, especially under stressful conditions. This relationship develops as a result of biological instincts in both the infant and the caregiver. The child behaves in ways that elicits contact or proximity to the caregiver. When a child experiences heightened arousal, he/she signals their caregiver. Crying, smiling, and, locomotion, are examples of these signaling behaviors. Instinctively, caregivers respond to their children's behavior creating a reciprocal pattern of interaction. The child is dependent on the caregiver's response to meet his or her need and reduce arousal. Over time, the child begins to internalize this interaction pattern. Depending on the appropriateness of the caregiver's response, children develop expectations about whether or not their needs will be met. This internal representation becomes the basis for subsequent interactions in numerous domains, and it sets the stage for the child's internal-regulation skills later in development (Bowlby, 1969).

The attachment relationship develops by the end of the first year in nearly all

normally developing children regardless of the quality of care they receive (Bowlby, 1969). Because quality of care varies between caregiver-child dyads, the nature of the attachment relationship, or security, varies as well (Ainsworth, Blehar, Waters, & Wall, 1978). These differing relationship styles have been classified as “secure” or “insecure” (Ainsworth, Blehar, Waters, & Wall, 1978). Through these patterns of reciprocal interaction, children learn to employ behaviors that help them adapt to the environment that the caregiver creates (Bowlby, 1969).

A secure attachment relationship develops when the caregiver responds appropriately to the child’s signals (Berschied & Reis, 1998). In a secure relationship, the caregiver’s interpretation of the child’s signals is accurate and the caregiver responds appropriately, reducing the child’s arousal. This creates a safe and predictable environment in which the child can explore during times of minimal stress, and seek proximity and comfort during distress. According to Teti and Teti (1996), when infants perceive that their behavior has an impact on the environment and is determined by caregiver responsiveness, they tend to have an overall positive affect and are more motivated to explore and master their environment.

If children’s attachment systems are continually aroused but their signals to their caregivers are ignored or responded to inappropriately, children learn to ignore or suppress the thoughts, feelings, and behaviors that would normally activate proximity-seeking behavior (Bowlby, 1969). As a result, an insecure attachment relationship develops. To compensate for the uncertainty in their environment, these children

typically react in one of two ways. They either stay distressed for longer periods of time in hopes of getting the caregiver's attention, or they avoid interaction with the caregiver and hold back expressions of negative affect to ensure proximity without threatening the relationship (Cassidy, 1994).

Attachment and Cognitive Skills

The security of the attachment relationship may be related to a child's developing cognitive skills for several reasons. For infants in secure attachment relationships, the attachment system, or the biological processes that initiate child proximity-seeking behavior, is aroused less often (Bowlby, 1969). Thus, securely attached infants have more opportunities to activate other behavioral systems that are important for cognitive development, such as the exploration-play and affiliation systems (Bowlby, 1969). Because the attachment system of insecurely attached children is aroused quite often, these other behavioral systems are not employed (Bowlby, 1988). According to Karrass and Braungart-Rieker (2003), infants who habitually experience greater levels of arousal are too focused on the internal stimulation caused by their emotions to process input from the environment. Because these children must focus on the attachment relationship, the arousal associated with an insecure attachment relationship may interfere with normal exploratory behavior, limiting opportunities for exploration and cognitive development. In sum, the development of inhibitory control, attention focusing, and working memory skills are thwarted until basic biological needs are met (Vygotsky, 1978).

There are several ways in which a caregiver and the emerging caregiver-child

relationship might play a role in cognitive outcomes. According to Parke, Burks, and Carson, (1994) a caregiver plays three roles in a child's cognitive development: a provider of opportunities, a direct instructor, and an interactive partner. Through these roles caregivers shape the child's social, emotional, and cognitive skills (Parke, Burks, & Carson, 1994). The quality of the caregiver-child interaction directly affects how the caregiver fulfills all three of these roles.

As a child becomes more interested in exploring the environment, available learning and teaching opportunities are dependent on the caregiver. Children of caregivers who are non-responsive may not have as many opportunities to interact with their parents or others to learn the skills necessary to thrive across different settings. Specifically, these interactions may be important for the child's cognitive development. Higher cognitive functioning requires skills such as attention-focusing, appropriate inhibitory control, and working memory (Zelazo, Muller, Frye, & Marcovitch, 2003). Early attachment relationships shape a child's ability to perform skills related to cognitive functioning and academic achievement, such as attention to and management of tasks, participation in school, and motivation to succeed (Entwisle, 1995). Through reciprocal conversations, pretend-play, and games that engage others, children are able to practice cognitive skills, such as memory and attention, and receive feedback about their behavior from others. The cognitive skills needed to succeed in an academic setting may suffer if the caregiver does not provide appropriate feedback to the child in response to the child's desire to learn from the environment.

Several empirical studies explore the relation between attachment security and the development of cognitive skills, and provide limited support for the hypothesis that early attachment security influences cognitive development. It has been proposed that differences in children's individual behavioral repertoires, including interaction skills, creativity, and language, may emerge as a function of maternal emotional and physical availability (Field, 1994; Petrill & Deater-Deckard, 2004; Tamis-LeMonda, Cristofaro, Rodriguez, & Bornstein, 2006). For example, Muris and Maas (2004) found that insecurely attached children displayed higher levels of overall developmental difficulties and fewer overall strengths when compared to securely attached children. Specifically, a mother's sensitivity to her child's cues and responsiveness to child distress were found to be related to infant cognitive test scores controlling for socioeconomic status, maternal psychopathology, and English proficiency (Cabrera, Shannon, West, & Brooks-Gunn, 2006).

To date, few studies have directly examined the effect that early attachment security has on specific higher order cognitive skills in later childhood. However, several studies have found that attachment security does affect early cognitive skills, findings that may support a link between attachment security and cognitive skills emerging later in childhood. For example, when considering the effects of attachment on language, Honig (2000) found that language adequacy was significantly related to parental variables. The mother's ability to respond appropriately to her child's cues, which is characteristic of secure attachment relationships, was identified as an important predictor of optimal

versus delayed language development. Specifically, 28 percent of the infants whose mothers reported optimal relationships had language problems, whereas 48 percent of infants had language problems if the mother reported a poor parent-child relationship (Honig, 2000). These results showed that appropriate maternal responsiveness to the child's cues predicted cognitive development.

In addition to predicting language skills, it has been proposed that attachment security may also be related to inhibition, planning, and problem-solving. In a test of this hypothesis Dennis (2006) found that parental warmth and approachability, characteristics of mothers in secure dyads, were related to better child inhibitory control, as measured by compliance with caregiver demands, less child frustration, and greater persistence on difficult tasks. Similarly, Schieche and Spangler (2005) investigated the influence of attachment on toddlers' behavior during a challenging problem-solving task. They reported that, at 22 months of age, quality of attachment predicted the child's behavioral organization. These findings showed that having a secure attachment relationship predicted task orientation, help-seeking behavior, and an attachment-exploration balance (Schieche & Spangler, 2005). More generally, a secure attachment relationship creates an environment in which the child's basic needs are met, allowing the child to focus on independent exploration and mastery of the environment.

Although research in the area of early cognitive development primarily evaluates developmental differences in language and overall intelligence (Zelazo, Muller, Frye, & Marcovitch, 2003), few studies consider the influence that the mother-child relationship

has on the child's development of specific cognitive skills. The current study aimed to address these limitations by evaluating cognitive abilities later in childhood and across a wider range of cognitive processes. Based on previous research findings suggesting links between attachment security and different cognitive skills, it is important to explore this influence further. It is possible that, in addition to the age-related changes, the mother-child relationship also influences specific developing cognitive processes.

Attachment and Academic Achievement

In addition to influencing specific cognitive skills, the early attachment relationship may also affect real-world functioning that is dependent on those skills, such as academic achievement. There are several ways that the parent-child attachment relationship may affect academic achievement. First, children in insecure relationships may have limited cognitive skills necessary to succeed in an academic setting. For example, children who have had less experience with a responsive caregiver are less likely to have developmentally appropriate cognitive skills (Cabrera, Shannon, West, & Brooks-Gunn, 2006; Field, 1994; Muris and Maas, 2004; Petrill & Deater-Deckard, 2004; Tamis-LeMonda, Cristofaro, Rodriguez, & Bornstein, 2006). It is possible that a lack of these important cognitive skills would directly affect school performance.

A second way in which the attachment relationship may influence academic achievement is that a secure attachment may foster a sense of autonomy in the child. Bowlby's (1969) theory postulates that a child internalizes early mother-child interactions, and this internal working model serves as a guide for later functioning across

various domains. In the academic domain, securely attached children may be more likely to complete work independently and also ask a teacher for help when necessary (Jacobsen & Hoffman, 1997; Moss & St-Laurent, 2001). Specifically, Joussemet, Koestner, Lokes, and Landry (2005) found that autonomy support was positively related to academic adjustment and reading achievement in third grade.

In addition, a secure attachment has also been found to predict mastery motivation in middle childhood, which, according to Moss and St-Laurent (2001), parallels competent exploratory behavior in early childhood. As a result, children in secure attachment relationships performed better in math and language subjects at age 8. These data suggest that attachment security provides flexibility and openness in the processing of information, which is very important for problem-solving and critical thinking (Moss & St-Laurent, 2001).

Moderators of the Attachment-Cognition Relation

Although it is possible that attachment security exerts a direct effect on cognitive outcomes, it is also possible that this relation is moderated by other important factors including child gender, socioeconomic status, parenting stress, and child intelligence. The impact that the attachment relationship has on cognitive development is influenced, either positively or negatively, by other characteristics of the child or the environment.

Child Gender. It is important to consider gender differences because, in general, research shows differential effects of secure versus insecure parenting on males and females, with boys more sensitive to disruptions in the parent-child relationship (Van

Ijzendoorn, Moran, Belsky, Pederson, Bakersman-Kranenburg, & Kneppers, 2000). Similarly, research has shown that boys typically develop higher order cognitive skills more slowly than girls (Espy & Kaufmann, 2002; Zelazo, Muller, Frye, & Marcovitch, 2003). A more secure attachment relationship may be more important for cognitive development in boys until their skills are fully developed. Based on these findings, it is reasonable to assume that the influence of attachment security on cognitive outcomes will vary depending on the child's gender.

Socioeconomic Status. It is important to consider socioeconomic-status as a moderator of the relation between attachment security and cognitive skills. Attachment theory posits that maternal sensitivity is the most important predictor of attachment security (Bowlby, 1969). However, the influence of attachment security on later development may depend on the family's social class. For example, there may be limited opportunities for appropriate caregiver-child interactions in low-income families. This could result from several factors including single-parenting, poor quality child care, or less time together due to maternal factors, such as depression and long work schedules, all of which are related to low SES (Borman & Overman, 2004).

When examining attachment security in a low SES, rural Appalachian sample, Fish (2001) found that the distribution of attachment security among this sample was significantly different from that reported in non-risk samples. Specifically, 61.7 percent of non-risk infants were securely attached, whereas only 50.5 percent of the at-risk sample was securely attached (Fish, 2001). It is also important to note that this

distribution was statistically similar to other low SES groups.

One study reported that SES influences the development of the attachment relationship between a caregiver and a child. For example, low income was reportedly related to maternal insensitivity, which directly affected the quality of the infant-mother attachment relationship (Bakermans-Kranenburg, van IJzendoorn, & Kroonenberg, 2004). The quality of this relationship may be particularly important for children in lower SES families (Borman & Overman, 2004; Petrill & Deater-Deckard, 2004). Unlike children from higher SES families, these children are not exposed to as many other opportunities that foster cognitive development and academic achievement, such as tutoring or having a computer in the home. Because of these financial limitations, interactions with caregivers are the main source of early learning for these children. Children in higher SES families, however, may be able to overcome the cognitive effects of an insecure attachment because they have other learning resources available.

Parenting Stress. When examining the relations between parenting stress and attachment security, several studies have found that higher levels of parenting stress correspond with a greater likelihood of an insecure attachment relationship (Davila & Sargent, 2003; Hadadian, 1996). This relation was also supported with similar findings in a low SES sample (Diener & Nievar, 2003). The effect of parenting stress on the attachment relationship may have implications for later cognitive outcomes as well. For example, if a caregiver is under a great deal of stress, interactions with the children may not be appropriate for teaching cognitive skills and processes needed for later academic

success. A mother who is feeling very distressed may attempt to alleviate her own stress in lieu of responding to the child's needs. This is an important factor when evaluating mother-child relationships. How a mother feels and perceives these feelings affects how she behaves toward her child.

Child IQ. While some research has reported that environmental influences account for little or no variation in adolescent and adult IQ (Jensen, 1997), other work indicates that child IQ at earlier ages is more susceptible to environmental influences (Plomin, Fulker, Corley, & DeFries, 1997). Because it would be nearly impossible to separate biological and environmental influences on cognitive outcomes in early childhood, it is important to evaluate how these factors interact or influence one another. Previous research has found some limited support for the hypothesis that genetics and environmental quality interact to account for a significant portion of variance in infant IQ (Van Bakel & Riksen-Walvaren, 2002). This interaction may influence the development of cognitive skills and later academic achievement. For example, children with lower IQ scores may benefit from a secure attachment relationship more than children with higher IQ scores. Less intelligent children may be less motivated to explore or unable to understand the environment without appropriate feedback from caregivers, whereas more intelligent children may not be as dependent on this relationship.

CHAPTER III

GOALS AND HYPOTHESES

In sum, a small number of studies suggest relations between attachment security and skills related to cognitive development and academic achievement. However, few studies have examined these relations longitudinally in large or representative samples of young children. Moreover, no study has included multiple indices of cognitive and academic skills.

The goal of this study was to examine whether attachment security in toddlerhood was related to cognitive skills at age seven. It was predicted that children with a more secure attachment at two years of age would have better planning, impulse control, cognitive inflexibility, and goal maintenance skills at age seven. It was also predicted that children with a more secure attachment at two years old would have higher academic achievement at age seven.

This study also examined moderators of the relation between attachment and cognitive skills and academic success. It was predicted that factors such as gender, socioeconomic status, parenting stress, and child intelligence would moderate the relation between attachment security and cognitive skills and academic achievement. Specifically, it was predicted that the relation between attachment security and successful cognitive outcomes will be stronger for males than for females. In addition, it was also predicted that the cognitive outcomes of children from lower SES families would be more dependent on the security of the attachment relationship than cognitive outcomes of

children from higher SES families. It was predicted that the attachment relationship would be more strongly related to cognitive outcomes in families that are experiencing lower levels of parenting stress. Finally, it was predicted that children with higher IQ scores would be less dependent on attachment security as a predictor of cognitive outcomes than children with lower IQ scores.

CHAPTER IV

METHODS

Participants

The current sample utilized data from one cohort of children who are part of an ongoing longitudinal study. The goal for recruitment was to obtain a sample of children who were at risk for developing future externalizing behavior problems that was representative of the surrounding community in terms of race and socioeconomic status (SES). All participants were recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children (WIC) program. Potential participants were recruited at 2-years of age (2000-2001) and screened using the Child Behavior Checklist (CBCL 2-3; Achenbach, 1992) completed by the mother in order to over-sample for externalizing behavior problems. Children were identified as being at risk for future externalizing behaviors if they received an externalizing T-score of 60 or above. Efforts were made to obtain approximately equal numbers of males and females.

For this cohort, 492 children were screened initially. Seventy-three percent of these families were European American, twenty-four percent were African American, and three percent were biracial. Seventy-three percent of the families were classified as middle class, fifteen percent as lower class, and twelve percent as upper class. From this larger sample, 153 children were selected. Forty-eight of the children had externalizing scores on the CBCL in the clinical or borderline clinical range (t-scores of 60 or above),

twenty-four of the children had both externalizing and internalizing score above the clinical or borderline clinical range, and eighty-one of the children scored below the clinical or borderline clinical range for both internalizing and externalizing subscales. The final sample of children selected for this cohort was racially and economically diverse (23% African American, 68% European American, 9% Other; mean Hollingshead score = 39.7), primarily from intact families (84%), and 71 were male and 82 were female.

The families were contacted by mail and telephone and asked to participate in a series of follow-up visits when the children were four, five, seven, and ten years old. The current study focused only on the two and seven year assessments. Of the original 153 parent-child dyads, 117 agreed to participate in the seven year follow-up visit and relevant data was available for 100 (45 males and 55 female). In most cases, attrition was due to the family relocating from the area, but a small number of families chose not to continue in the study or could not be located. More families with boys discontinued participation; however, there were no differences in race or SES between the subjects who continued participating in the study and those who did not.

Procedure and Measures

Mothers completed the CBCL (CBCL 2-3, Achenbach, 1992) and were then contacted to bring their children into the laboratory to complete a battery of tasks and questionnaires at ages two, four, five, seven, and ten years of age. This particular study focused only on the two and seven year visits. At these ages, mother-child dyads were

asked to complete a series of tasks designed to measure child temperament and the mother-child relationship.

Two-Year Assessment. During the course of the two year visit, the mothers were asked to complete a set of questionnaires assessing a wide range of functioning including the Attachment Behavior Q-Set, Version 3.0 (AQS-Version 3; Waters, 1987, see Appendix A). The AQS is composed of 90 items designed to assess secure base and exploratory behavior in children from one to five years of age. The items are sorted into a fixed distribution from the least to the most characteristic of the child being observed. Secure base behavior as measured by the AQS has been found to be significantly related to Strange Situation classifications (Vaughn & Waters, 1990).

Following from the procedure of Waters (1995), mothers were mailed a copy of the items in the AQS, approximately two weeks prior to their visit to the laboratory. When families were initially informed about the study, mothers were told that the items were to be used to provide a description of their children's behavior in the home and were asked to familiarize themselves with each of the items. In order to help decrease the effects of the child's current behavior in the laboratory on the mother's Q-sort, the experimenter emphasized throughout the mothers' completion of the Q-sort that we were particularly interested in the child's behavior in the home. The experimenter worked with the mothers to make nine equal piles of ten cards each as the mothers sorted the cards into a continuum from "most like my child" to "least like my child." The mothers worked on the AQS during a break in the middle of the laboratory visit and completed the

Q-set at the end of the visit. Completion of the Q-sort took, on average, 30 to 40 minutes. This measure yields an attachment score on a continuum ranging from insecure to secure. Cut-off scores are provided if dichotomization is necessary.

Seven-Year Assessment. The tasks of interest at the seven year assessment visits included an *attention task*, in which children were asked to play a computer game for an unspecified length of time (15 min) and two *executive function tasks*, in which the child completed the Stroop Task (10 min) and the Tower of Hanoi (20 min). At a separate laboratory visit at age seven, the Wechsler Intelligence Scale for Children-Third edition (WISC-III) and the Wechsler Individual Achievement Test (WIAT-II) were administered to obtain the participant's IQ and achievement scores (Wechsler, 2003; Wechsler, 2001).

Cognitive Skills. To measure cognitive skills, three measures were used. The Continuous Performance Test (CPT) was used to measure overall attention difficulties at age seven by assessing omissions, commissions, perseverations, and response style (Conners, 2000). Children were presented with a series of random letters at three different interval speeds and asked to press the space bar for every letter except a target letter, which is the letter X. The omission score represents the number of failures to respond to a target letter (any non-X). The commissions score refers to a response given to a non-target letter (the letter X). A perseveration error was defined as any reaction time that was less than 100 ms (these could be slow responses to preceding stimuli, anticipatory responses, random responses, or responses without consideration of the task). Finally, the response style score represents an individual's response tendency.

High scores represent a cautious style (emphasis on avoiding commission errors by responding less often in order to respond correctly), while lower scores represent a response to most or all targets (less concern about commission errors).

The Delis-Kaplan Executive Function Scale (D-KEFS) Color Word Interference Test was designed to measure child regulatory control (Delis, Kaplan, & Kramer, 2001). The Color-Word Interference Test is a shortened version of the Comalli et al. (1962) Stroop Test with an additional switching task. During this task, the child was asked to inhibit or stop one response and say or do something else according to a rule. The current study used the error scores from the inhibition and inhibition/switching trials of the task. A higher score in each trial represents a less flexible cognitive style.

The Delis-Kaplan Executive Function Scale (D-KEFS) Tower Test was designed to assess ability to utilize working memory to generate a successful strategy (Delis, Kaplan, & Kramer, 2001). This task requires that the child move disks varying in size from small to large across three pegs to build a specified tower in the fewest number of moves possible. Points are deducted if the child fails to follow two rules: 1) move only one disk at a time, and 2) never place a larger disk over a smaller disk. Two scores from this task were used in the current study. The total achievement score reflected the number of moves used to complete the task. A higher score was indicative of successful planning because fewer moves were needed to succeed. The child's move accuracy ratio was recoded so that higher scores represented a more efficacious plan or strategy.

Academic Achievement. Academic achievement at age seven was measured using

subscale composite scores from the WIAT-II, which was individually administered during a laboratory visit. These subscales include a Reading Composite score and a Mathematics Composite score. Once again, higher scores represent better academic achievement.

Socioeconomic Status. Socioeconomic status of an individual was estimated using the Hollingshead (1975). This status score was calculated by combining information on sex, marital status, education, and occupation.

IQ. The Wechsler Intelligence Scales for Children-Third Edition (WISC-III) was used to measure overall child IQ. This test is composed of 10 subtests that combine to create four index scores. The test provides a Verbal Comprehension Index (Similarities, Vocabulary, and Comprehension), a Perceptual Reasoning Index (Block Design, Picture Concepts, and Matrix Reasoning), a Working Memory Index (Digit Span and Letter-Number Sequencing), and a Processing Speed Index (Coding and Symbol Search). These four indices were combined to generate the child's Full Scale IQ score (Mean = 100; SD = 15). The Full Scale IQ score will be used in the current study.

Parenting Stress. The Parenting Stress Index Short Form (Abidin, 1995), a 36-item questionnaire designed to measure stress in the parent-child system was administered to mothers at the seven year laboratory visit. A total parenting stress score can be derived from the questionnaire. This score provides an indication of the overall level of parenting stress an individual is experiencing including stress related to parental distress, parent-child dysfunctional interactions, and having a difficult child.

CHAPTER V

RESULTS

Preliminary Analyses

Given the different assessments and the varying procedures for data collection, the number of participants varied across measures. For each analysis, all available data were used (see Table 1 for exact N values and descriptive statistics). Preliminary analyses examined race differences on all study measures. These analyses indicated that there were race differences on attachment security, child IQ, and socioeconomic status. Specifically, the mean attachment score of Caucasian children was significantly higher than that of mixed children ($F = 3.72, p < .05$). The mean IQ score for Caucasian children was also significantly higher than the mean IQ score for African American children ($F = 4.13, p < .01$). Finally, Caucasian children had significantly higher SES scores than both African American and mixed children ($F = 8.30, p < .01$). Based on these results, race was added as a covariate in all subsequent analyses.

Data Reduction

Given the large number of dependent measures, preliminary analyses were used to reduce the number of variables to be used in subsequent analyses. A factor analysis was performed on the 8 observed measures of cognitive skills: move accuracy, tower achievement, commission errors, omission errors, perseveration errors, inhibition,

inhibition/switching, response style. Four factors emerged, which explained 71% of the variance, cumulatively. The first factor (eigenvalue = 1.83) loaded highly and positively on tower move accuracy, while loading negatively on tower achievement (factor loadings were .82 and -.85, respectively). This factor reflects the child's ability to utilize working memory ability to generate a successful strategy and is called "*planning*" in subsequent analyses. Higher scores on this factor represent better planning abilities. The second factor (eigenvalue = 1.45) loaded highly and positively on CPT commission and CPT perseveration (factors loadings were .80 and .82, respectively). This factor is named "*impulsivity*," and it reflects the child's ability to inhibit both behavioral and cognitive responses. Higher scores on this factor reflect more impulsive behavior, or less impulse control. The third factor (eigenvalue = 1.28) loaded highly and positively on inhibition errors and inhibition/switching errors (factors loadings were .83 and .82, respectively). In subsequent analyses, this factor is named "*cognitive inflexibility*," and it represents the child's ability to adapt to changes in task rules. Lower score represent more flexible cognitive styles. The fourth factor (eigenvalue = 1.12) loaded highly and positively on CPT omissions and CPT response style (factors loadings were .83 and .79, respectively). This factor reflects the child's ability to follow rules and develop goal-directed strategies when solving problems. In subsequent analyses, this factor is named "*goal maintenance*." Higher scores represent better ability to maintain a specific goal. The weighted factors scores were computed for each participant and were used in all subsequent analyses. Descriptive statistics for the factor scores are presented in Table 2.

Bivariate Analyses

Correlations between all measures were examined (Table 3). The 2-year attachment score was significantly and positively correlated with reading achievement, math achievement, child IQ, and socioeconomic status at age seven. Attachment security was significantly and negatively correlated with parenting stress. So, children in secure attachment relationships had higher IQ and achievement scores, were in a higher socioeconomic class, and had parents who were reporting less stress related to parenting. Child IQ was positively correlated with achievement scores, SES, and cognitive inflexibility. Children with higher IQ scores had higher achievement and cognitive inflexibility scores. Parenting stress was negatively related to the cognitive inflexibility and both achievement scores, meaning that children of parents who were experiencing low stress performed better on some cognitive and achievement tasks.

Moderators of Attachment Security and Cognitive Outcomes

A series of hierarchical regression models were conducted to explore the associations between 2-year olds attachment security and their cognitive/academic functioning when they were 7 years old. Gender, parenting stress, SES, and child IQ were examined as moderators. All continuous variables were centered around the mean. Centered variables were multiplied to create the interaction terms that were included in the model. Post-hoc analyses of significant interactions were conducted according to the guidelines outlined by Aiken & West (1991). First, continuous variables were plotted at high (+1 SD) and low (-1 SD) values of the variables. Next, simple slopes analyses were

conducted to determine whether the slope of the plotted simple regression lines for the high and low groups were significantly different from zero. The simple slopes analysis indicates whether there was a significant difference in the association between the predictor and the dependent variables for children at high and low levels of each moderating variable (Frazier, Tix, & Barron, 2004; Aiken & West, 1991).

The variables were entered into the model in the following order (step 1) race, (step 2) attachment security and moderating variable, and (step 3) interaction between attachment and moderator. For each outcome variable, four separate regression models were tested (Tables 4 & 5).

Planning. No direct effect of attachment security at age 2 on planning abilities at age 7 was found. However, socioeconomic status and child IQ at age 7 accounted for a significant amount of the variance in observed planning abilities at age 7. Children with higher IQ scores, as well as children from families reporting a higher SES, had higher scores on tasks assessing planning abilities. Parenting stress and child gender did not significantly contribute to the model. Similarly, interaction terms did not add significantly to the amount of variance accounted for by the model.

Impulsivity. Once again, no direct effect of attachment security at age 2 on impulsivity at age 7 was found. Socioeconomic status and child IQ once again accounted for a significant amount of the variance in impulsivity at age 7. The interaction terms also added significantly to the model. The significant attachment security x SES interaction indicated that the association between attachment security at age 2 and

impulsivity at age 7 was different for those children who were from a lower socioeconomic class compared to those who were from a higher class (Figure 1). Simple slopes analyses revealed that the line representing children from lower SES families was significantly different from zero ($b = 1.65, p < .01$), as was the line representing children from higher SES families ($b = -1.39, p < .05$). This indicates that a more secure attachment relationship is associated with greater levels of impulsivity for children from lower SES families, but lower levels of impulsivity for children from higher SES families. The significant attachment security x child IQ interaction indicated that the association between attachment security and impulsivity differed for those children who had higher IQ scores compared to those who had lower IQ scores (Figure 2). Simple slopes analyses revealed that the line representing children with lower IQ scores was significantly different from zero ($b = 2.58, p < .01$), as was the line representing children with higher IQ scores ($b = -1.54, p < .01$). This indicates that a more secure attachment relationship is associated with greater levels of impulsivity for children with lower IQ scores, but lower levels of impulsivity for children who had higher IQ scores.

Cognitive Inflexibility. No direct effect of attachment security at age 2 on cognitive inflexibility at age 7 was found. However, socioeconomic status and child IQ at age 7 accounted for a significant amount of the variance in observed cognitive inflexibility at age 7. Children from families reporting a higher SES performed more poorly on tasks assessing cognitive inflexibility than children from lower SES families. Children with higher IQ scores performed better on cognitive inflexibility tasks than

children with lower IQ scores. Parenting stress and child gender did not significantly contribute to the model. Similarly, interaction terms did not add significantly to the amount of variance accounted for by the model.

Goal Maintenance. Once again, no direct effect of attachment security at age 2 on goal maintenance at age 7 was found. However, child IQ at age 7 accounted for a significant amount of the variance in observed goal maintenance at age 7. Children with higher IQ scores performed better on tasks assessing goal maintenance than children with lower IQ scores. Parenting stress, child gender, and socioeconomic status did not significantly contribute to the model. However, the significant attachment security x SES interaction indicated that the association between attachment security at age 2 and goal maintenance at age 7 differed for those children who were from a lower socioeconomic class than those who were from a higher class (Figure 3). Simple slopes analyses revealed that the line representing children from lower SES families was significantly different from zero ($b = -1.83, p < .01$), whereas the line representing children from higher SES families was not ($b = .97, ns$). This indicates that there was a negative association between children's attachment security and their goal maintenance abilities, but only for children in lower SES families.

Reading Achievement. A significant and direct effect of attachment security was found when predicting reading achievement. Children in more secure attachment relationships at age 2 had higher reading achievement scores at age 7. Parenting stress also produced a significant effect when predicting reading achievement. Children of

parents reporting less parenting stress had higher reading achievement scores than those of parents reporting more stress. Children from families reporting a higher SES performed better on tasks assessing reading achievement than children from lower SES families. Similarly, children with higher IQ scores performed better on these tasks than children with lower IQ scores. Child gender did not significantly contribute to the model. Similarly, interaction terms did not add significantly to the amount of variance accounted for by the model.

Math Achievement. A significant and direct effect of attachment security was also found when predicting math achievement. Children in more secure attachment relationships at age 2 also had higher math achievement scores. Parenting stress also produced a significant effect when predicting reading achievement. As with reading achievement, children of parents reporting less parenting stress had higher math achievement scores than those of parents reporting more stress. Additionally, children with higher IQ scores performed better on these tasks than children with lower IQ scores. Socioeconomic status and child gender did not significantly contribute to the model. Similarly, interaction terms did not add significantly to the amount of variance accounted for by the model.

CHAPTER VI

DISCUSSION

Existing literature has found that attachment security plays a part in the development of children's cognitive abilities and academic achievement. The goal of this study was to expand on previous work by addressing this issue in a longitudinal sample and to include multiple measures of cognitive outcomes. In addition, this study examined possible moderators of these relations. Specifically, it was hypothesized that a more secure attachment relationship at age two would predict better cognitive and academic outcomes at age seven. In addition, it was hypothesized that characteristics of the child (gender and IQ), the mother (parenting stress), and the environment (socioeconomic status) would moderate these relations. These questions were addressed using regression analyses.

Contrary to the hypothesis, attachment security did not have a significant direct effect on measures of cognitive ability measured in this. These included planning, impulsivity, cognitive inflexibility, and goal maintenance. Being in a secure attachment relationship did not improve performance on various tests of these cognitive skills. However, attachment security was a significant predictor of both reading and math achievement. Children in more secure attachment relationships had significantly higher reading and math achievement scores. One explanation for this pattern of results could be that cognitive abilities are fully developed by early childhood (Zelazo, Muller, Frye, & Marcovitch, 2003). Once developed, these particular abilities may not be as malleable.

Performance in an academic setting, however, may be more susceptible to environmental influences, such as practice and repetition. Responsive caregiving may give children opportunities to learn strategies for successful functioning in an academic setting (Moss & St-Laurent, 2001). For example, responsive caregivers may be more likely to notice and take action if their child is struggling academically. Providing opportunities for the child to practice difficult skills, such as hiring a tutor or working directly with the child on homework, teaches the child that they can succeed if they persist on difficult tasks. A non-responsive caregiver, on the other hand, may not understand or acknowledge the need to provide these opportunities for extra practice when their child is struggling. Cognitive abilities being equal, the child in the secure attachment relationship would have better academic performance than the insecure child as a result of parental involvement (Moss & St-Laurent, 2001).

This study also aimed to examine factors that may interact with a child's attachment security to predict cognitive and academic outcomes. Specifically, it has been shown that disruptions in the attachment relationship are more influential on boys than girls (Van Ijzendoorn et al., 2000). Socioeconomic status has also been found to influence both parental sensitivity and child outcomes in various domains (Borman & Overman, 2004; Fish, 2001; Petrill & Deater-Deckard, 2004). Similarly, higher levels of parenting stress have been found to correspond to an insecure attachment relationship (Davila & Sargent, 2003). Because this study addressed cognitive outcomes, the relations between attachment security and child IQ were also examined. Plomin, Fulker,

Corely, & DeFries (1997) reported that child IQ at early ages is more susceptible to environmental influences, suggesting that the quality of attachment and child IQ may interact to predict child cognitive outcomes.

When examining possible moderators of the association between attachment security and cognitive outcomes, results varied across outcomes. Specifically, when predicting *planning* ability, it was hypothesized that child gender, parenting stress, socioeconomic status, and child IQ would interact with attachment security. While the interactions between attachment security and the moderating variables did not add significantly to the models, socioeconomic status and child IQ had direct effects on planning abilities. As predicted, children from higher SES families did better on measures of planning than children from lower SES families. Similarly, children with higher overall IQ scores performed better on tasks evaluating planning abilities.

While attachment security did not have a significant direct effect on *impulsivity*, socioeconomic status and child IQ did. The interactions of attachment security and these variables also accounted for significant variance in these models. Less securely attached children from lower SES families were less impulsive than more securely attached children in this social class. One explanation for this may be that, due to the instability of the environment and quality of care, it is adaptive for these children to approach problems and new situations cautiously. The opposite was true, however, for children from higher SES families. For this group, more securely attached children were less impulsive than less securely attached children. There was also an interaction between attachment

security and child IQ when predicting impulsivity. More securely attached children with lower IQ scores were more impulsive than less securely attached children with lower IQ scores. Once again, the opposite was true for children with higher IQ scores. These children had lower impulsivity scores when they were in more secure attachment relationships.

Taken together, these interactions suggest that the development of impulse control abilities may serve as coping mechanisms for children from lower SES families or with lower IQ scores in less secure attachment relationships. Less securely attached children have learned that they can not depend on their caregivers to respond to their basic needs appropriately. This environmental uncertainty may be compounded by other risk factors such as low SES and IQ leading to either resilience or learned helplessness. The resilient child may be able to overcome these risk factors and learn to use his/her own abilities to master the environment through trial and error. In this case, the child has learned that acting impulsively is not the most appropriate way to navigate the environment. On the other hand, the child who continually and unsuccessfully tries to interact with environment may simply stop trying after many failures. Because the actions of the child are not serving to meet his/her needs, the child may appear less impulsive as an artifact of learned helplessness. In both instances, the children may be forced to rely on their own abilities rather than depending on the caregiver to meet their needs.

Attachment security, parenting stress, and child gender did not have direct effects on *cognitive inflexibility* in this study. Socioeconomic status and child IQ, however, did

have direct effects on this outcome. Specifically, children from lower SES families did better on tasks assessing cognitive inflexibility. One explanation for this may be that the ability to shift from one situation to another is adaptive for children from less stable environments. Children from a higher social class may not have to adjust their ways of adapting to the environment on a regular basis since their environment is more stable than lower SES children. As predicted, more intelligent children had better scores on tasks assessing cognitive inflexibility. In other words, these children were able to shift between rule sets better than children with lower IQ scores.

Goal maintenance was not directly predicted by attachment security, socioeconomic status, child gender, or parenting stress. As hypothesized, however, children with higher IQ scores did better on tasks assessing goal maintenance. Despite a lack of direct effects on goal maintenance, the interaction between attachment security and socioeconomic was significant. Children from lower SES families had higher scores on tasks assessing goal maintenance when their mothers reported insecure attachment relationships. It is possible that these children have learned that they can not depend on their caregiver to meet their needs, so they have developed a superior ability to focus on and maintain a goal as a coping mechanism that creates environmental stability (Ainsworth, Blehar, Waters, & Wall, 1978). Children from higher SES families, however, benefit from having a secure relationship. Securely attached children performed better on tasks assessing their ability to maintain a particular goal.

While attachment security was not predictive of specific cognitive skills, it did predict academic achievement. Securely attached children had higher *academic achievement* scores. As predicted, children with higher IQ scores also had higher academic achievement scores. While the interaction of the variables was not significant, parenting stress had direct effects on both reading and math achievement. Children of mothers reporting higher levels of parenting stress had lower academic achievement scores. One reason for this finding may be that mothers experiencing a great deal of parenting stress are less focused on their children's needs. Once again, a mother who is feeling very distressed may attempt to alleviate her own stress in lieu of processing and responding to the child's needs (Davila & Sargent, 2003). When a family is experiencing marked distress, regardless of the source, the child's needs may be secondary to that of the family's. Less time spent talking with the child about things that are occurring in the environment, answering the child's questions, and helping with academics may lead to poorer performance in school despite cognitive abilities.

The current study predicted that the attachment relationship would be more influential for boys than for girls. This hypothesis, however, was not supported. One reason for this finding may be that, by age seven, both boys and girls have learned to adapt to the environment the caregiver has created (Bowlby, 1969). Similarly, while it has been shown that boys develop the measured cognitive skills more slowly than girls (Espy & Kaufmann, 2002; Zelazo, Muller, Frye, & Marcovitch, 2003), by age seven these differences may no longer exist.

Limitations and Implications

Results of this study indicated that child, maternal, relational, and environmental factors are related to cognitive outcomes. Since children are continually faced with cognitive challenges in day to day life, it is important to understand how the skills necessary to solve these problems develop. While this study added to the literature by examining these factors in a diverse longitudinal sample, there were some limitations. One limitation of this study was that it examined the relation between attachment security and cognitive outcomes across a relatively large time span. Future work should attempt to examine the continuity of this relation by including measurements at more points in development. It is possible that the attachment relationship is more influential at earlier or later ages, depending on environmental circumstances. Also, it is possible that the quality of the attachment relationship could change from age two to seven. Another limitation of this study is the use of maternal self-report of attachment security. Mothers who have a positive or negative view of themselves and their children may have been biased in responses to this measure. Finally, although several of the proposed relations were found to be significant, the range of variance accounted for by the proposed models ranged from 2 to 21 percent. Because the significant interactions were not in the expected direction, replication of these results is critical. Other factors, such as maternal and child psychopathology may also play a role in determining the influence of the attachment relationship on cognitive outcomes. Future work should examine these possibilities.

These results confirm the necessity of educators and mental health professionals working with children to pay attention to the environmental influences on cognitive development. The implications for a child who does not develop effective cognitive skills are well-documented and have an impact on the well-being of families, educational institutions, and other places where children are the focus. While these results imply that the attachment relationship may not be imperative for the development of appropriate cognitive skills, there is evidence that this relationship is influential in determining academic success. Focusing on this element of the attachment relationship's influence may shed light on why educational interventions, such as tutoring, work for some children and not others. These implications highlight the need for educators to stay informed not only of the latest educational interventions, but of the developmental research that informs their work with children and families.

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APPENDIX A. TABLES

Table 1

Descriptive Statistics for Study Variables

<i>Measures</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Predictor					
2-year Attachment:	100	.42	.19	-.10	.79
Outcomes					
CPT Omissions	104	57.78	19.53	39.90	159.67
CPT Commissions	104	52.56	8.96	26.66	66.69
CPT Perseverations	104	70.85	43.44	41.14	284.01
CPT Response Style	104	50.58	6.12	38.57	84.63
C-W Inhibition Errors	103	9.31	3.18	1.00	16.00
C-W Inhibition/Switching Errors	104	9.50	3.94	1.00	15.00
Tower Achievement	104	9.54	3.24	3.00	20.00
Tower Move Accuracy	104	8.62	3.08	2.00	16.00
Reading Achievement:	100	110.56	15.89	76.00	143.00
Math Achievement:	100	105.57	14.91	80.00	147.00
Moderators					
Full Scale IQ:	100	08.39	14.68	63.00	139.00
Parenting Stress:	97	64.68	16.35	36.00	111.53
SES:	94	45.65	11.66	14.00	66.00

Table 2

Descriptive Statistics for Factor Analysis

<i>Measure</i>	<i>N</i>	<i>M</i>	<i>SD</i>	<i>Min</i>	<i>Max</i>
Planning	100	.01	1.00	-2.37	2.28
Impulsivity	100	-.01	1.01	-1.78	3.59
Cognitive Inflexibility	100	-.03	.99	-2.39	1.79
Goal Maintenance	100	.02	1.01	-1.70	4.05

Table 3

Zero Order Correlation Matrix for Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
1. 2-year Attachment	-									
2. Reading Achievement	.31*	-								
3. Math Achievement	.22*	.66**	-							
4. Full Scale IQ	.25*	.71**	.59**	-						
5. Parenting Stress	-.27**	-.30**	-.24*	-.23*	-					
6. SES	.29*	.43**	.24*	.54**	-.20	-				
7. Planning	.08	.17	.21*	.33**	.02	.24*	-			
8. Impulsivity	.05	-.08	-.05	-.13	.14	-.11	-.01	-		
9. Cognitive Inflexibility	.13	.32**	.23*	.25*	-.24*	.24*	-.04	-.05	-	
10. Goal Maintenance	-.17	-.27	-.36**	-.32**	.16	-.21*	.19	-.03	-.08	-

†p<.10; *p < .05; **p < .01

Table 4

Cognitive Skills: Attachment Security and Moderating Variables

Predictors	Planning		Impulsivity		Cognitive Inflexibility		Goal Maintenance	
	<i>B</i>	<i>R</i> ²	<i>B</i>	<i>R</i> ²	<i>B</i>	<i>R</i> ²	<i>B</i>	<i>R</i> ²
<u>Step 1</u>								
Race	-.06	.00	-.08	.00	-.20	.02	.22	.03
<u>Step 2</u>								
Attachment Security	.40	.01	.20	.01	.53	.03	-.71	.05
Parenting Stress	.00	.01	.01	.03	-.01	.07	.01	.06
Child Gender	-.13	.01	-.18	.01	.09	.03	-.42	.09
SES	.02[†]	.06	-.02*	.04	.02*	.07	-.01	.07
Child IQ	.02**	.11	-.02*	.02	-.02*	.07	.02**	.14
<u>Step 3</u>								
Attach x SES	-.05	.07	-.13**	.12	.05	.08	.12*	.14
Attach x IQ	-.03	.12	-.14**	.21	.02	.08	.05	.14

[†]*p* < .10; **p* < .05; ***p* < .01

Table 5

Academic Achievement: Attachment Security and Moderating Variables

Predictors	Reading Achievement		Math Achievement	
	<i>B</i>	<i>R</i> ²	<i>B</i>	<i>R</i> ²
<u>Step 1</u>				
Race	-4.60	.05	-2.37	.01
<u>Step 2</u>				
Attachment Security	22.40**	.12	15.34*	.07
Parenting Stress	-.22*	.16	-.20*	.08
Child Gender	1.01	.12	1.83	.06
SES	.53**	.21	.24	.08
Child IQ	.73**	.53	.58**	.36
<u>Step 3</u>				
Attach x PSI	-.45	.17	-.63	.12
Attach x Gender	4.83	.12	28.99	.09
Attach x SES	.40	.22	-.09	.08
Attach x IQ	.11	.53	-.28	.36

†*p* < .10; **p* < .05; ***p* < .01

APPENDIX B. FIGURES

Figure 1

Attachment Security and Socioeconomic Status Interaction as Predictors of Impulsivity

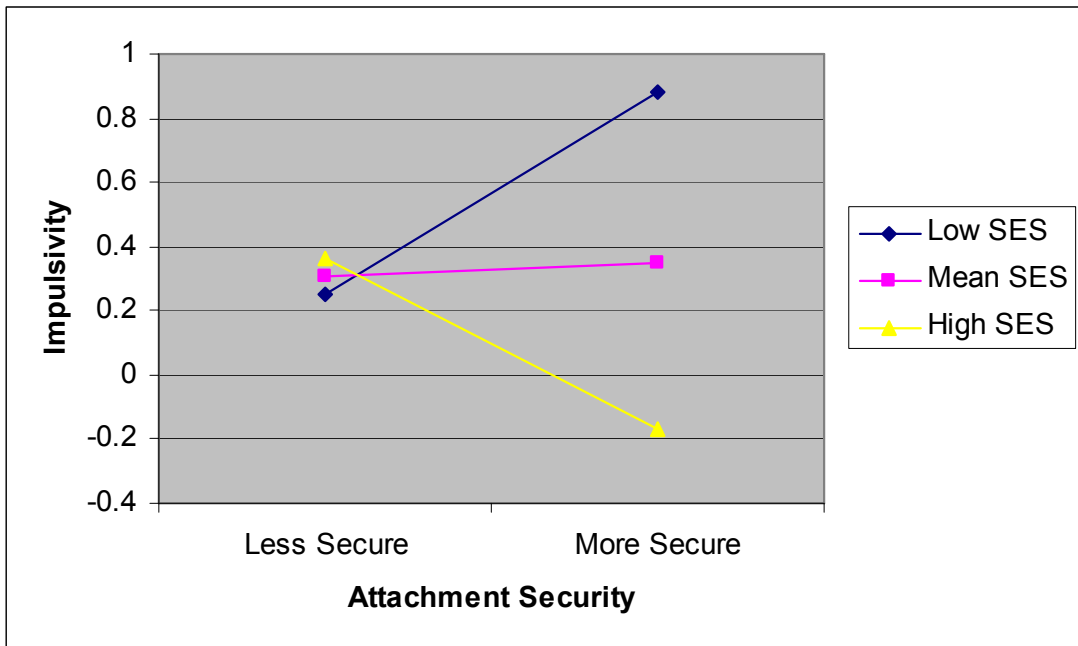


Figure 2

Attachment Security and Child IQ Interaction as Predictors of Impulsivity

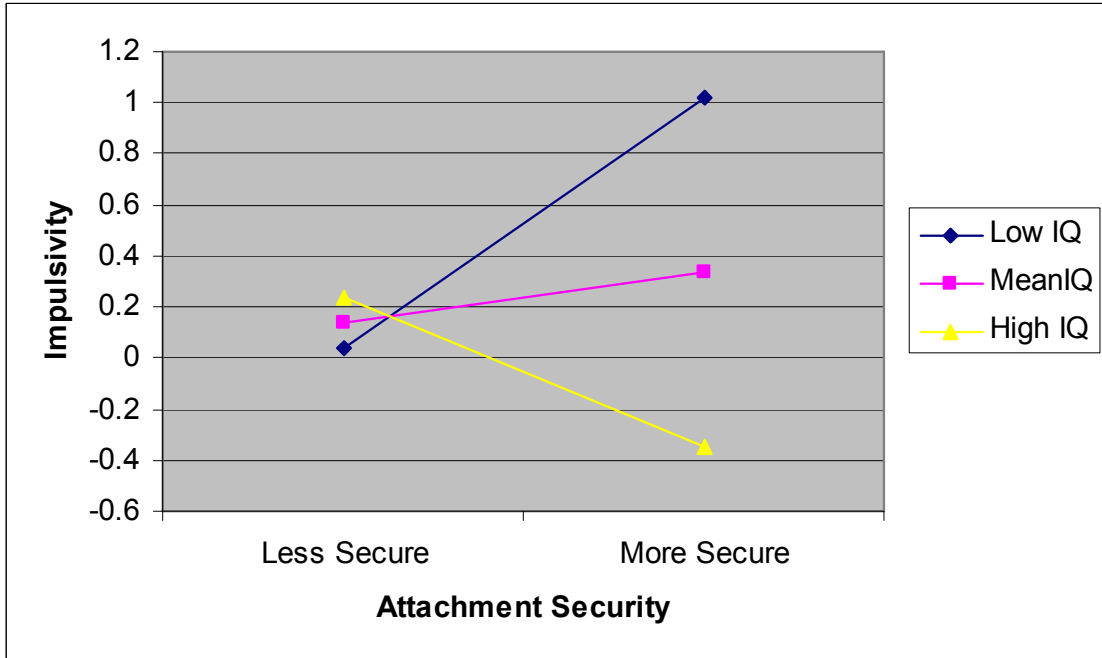


Figure 3

Attachment Security and Socioeconomic Status Interaction as Predictors of Goal Maintenance

