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Title: The role of maternal attachment in children's attachment and cognitive executive functioning: A preliminary study.

Authors: von der Lippe, Anna (a.v.d.lippe@psykologi.uio.no)
Eilertsen, DagErik ()
Hartmann, Ellen ()
Killèn, Kari ()

Source: Attachment & Human Development. Sep2010, Vol. 12 Issue 5, p429-444. 16p. 4 Charts.

Document Type: Article

Subjects: ANALYSIS of variance
ATTACHMENT behavior
CHI-squared test
CHILD development
COGNITION
COMPUTER software
CORRELATION (Statistics)
FACTOR analysis
INTERGENERATIONAL relations
MOTHER-child relationship
MOTHERHOOD
PARENTING
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PSYCHOLOGY
REGRESSION analysis
RESEARCH evaluation
RESEARCH funding
SOCIAL skills
THEORY
DATA analysis
INTERVIEW schedules
SCALE items
TEACHING methods
INTER-observer reliability
CHILDREN

Abstract: The influence of maternal attachment on children's attachment and executive functioning skills through maternal sensitivity and decentered tutoring were studied in 40 middle-class mother-child dyads. Infant attachment security in the Strange Situation Procedure was related to maternal attachment security, evaluated with the Adult Attachment Interview. When the children were six-seven months of age, maternal sensitivity was evaluated. When the child was six years old, maternal decentered tutoring and the children's executive functioning were evaluated. Regression analyses indicated that maternal tutoring accounted for the association between maternal attachment and child cognitive functioning, whereas maternal sensitivity accounted for the association between maternal and child attachment. [ABSTRACT FROM AUTHOR]

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ISSN: 1461-6734

DOI: 10.1080/14616734.2010.501967

Accession Number: 52976131

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The role of maternal attachment in children's attachment and cognitive executive functioning: A preliminary study.

The influence of maternal attachment on children's attachment and executive functioning skills through maternal sensitivity and decentered tutoring were studied in 40 middle-class mother–child dyads. Infant attachment security in the Strange Situation Procedure was related to maternal attachment security, evaluated with the Adult Attachment Interview. When the children were six–seven months of age, maternal sensitivity was evaluated. When the child was six years old, maternal decentered tutoring and the children's executive functioning were evaluated. Regression analyses indicated that maternal tutoring accounted for the association between maternal attachment and child cognitive functioning, whereas maternal sensitivity accounted for the association between maternal and child attachment.

Keywords: intergenerational attachment; executive cognitive functioning; maternal sensitivity; maternal tutoring; maternal secure attachment

Introduction

van IJzendoorn ([61]), generalizing from numerous studies, concluded that trans-generational transmission of attachment was "an empirical fact": An infant's attachment relationship with a specific caregiver, reflected in the child's behavior upon reunion in the Strange Situation (Ainsworth, Blehar, Waters & Wall, [2]), could be reliably predicted from the caregiver's cognitive representations of early attachment relationships assessed in the Adult Attachment Interview (Main, Hesse & Goldwyn, [46]; Main, Kaplan & Cassidy, [47]). The 1985 seminal report of Main et al. in developmental psychology was later corroborated (e.g. Benoit & Parker, [6]; Fonagy, Steele & Steele, [18]; Grossmann, Fremmer-Bombik, Rudolph & Grossmann, [24]). A central and intriguing task of attachment research is to identify mechanisms through which early attachment experiences of the parents affect the child's behaviors. Whereas research has been particularly focused on the predictive power of maternal attachment representations on the child's attachment through maternal social and affective responsiveness in caregiving (e.g. van IJzendoorn, [60]), less attention has been paid to the impact of maternal attachment on the child's cognitive development through her tutoring behaviors.

The systems of attachment and exploration in attachment theory

Central in attachment theory is that the child is born with a need for safety provided by a special caretaker when feeling threatened and a need to explore and gain knowledge about the environment (Ainsworth et al., [2]; Bowlby, 1969/[10]). Bowlby especially focused on the motivational behavior systems of attachment and exploration and assumed them to be separate but related and a balance between them was a hallmark of security. These are examined in the present study, although they are not regarded as exclusive interactional systems relevant for attachment such as the fear and sociable systems (Cassidy, [11]; Greenberg & Marvin, [23]). Research efforts have emphasized the caretaker's role in the child's development of different attachment strategies, in what Grossmann, Grossmann, and Zimmermann ([27]) calls the narrow view of attachment and exploration. They propose a widened view, where the security of the exploration system is equally important in the attachment/exploration balance. They suggest "security of exploration" as an integral part of the concept of security of attachment. Attachment theory postulates that proximity seeking takes precedence over exploration when the attachment system is aroused most intensely in the child's early formative years. Since the attachment system is easily activated in the insecurely attached, it leads insecure children to be impeded in their attention and absorption in exploration and learning; the avoidant children due to their extensive efforts to deactivate the attachment system and the ambivalently attached through their angry preoccupation with the caregiver's availability and responsiveness. Secure attachment, on the other hand, promotes exploratory competence because secure children feel confident that someone will rescue them, should they experience distress while exploring (e.g. Grossmann et al., [27]; Larose, Bernier & Tarabulsy, [42]).

There is reason to expect that the subsequent learning dispositions, particularly the development of executive cognitive functions necessary for success in school (e.g. Diamond, Barnett, Thomas & Munro, [14]), will suffer in insecurely attached children. Research on the empirical relation has supported that the two domains of development (attachment and emerging cognitive functioning) are related in similar ways throughout development (e.g. Jacobsen, Edelstein & Hoffmann, [36]; Moss & St.-Laurent, [49]; Teo, Carlson, Mathieu, Egeland & Sroufe, [58]).

The primary caretaker of the infant, most often the mother, is regarded as a *secure base*, i.e. a stronger and wiser person to turn to when the attachment system is aroused. The prerequisite for being a secure base has been thought to be the caretaker's own representations of early relationships as secure. Her attachment related behavior toward her child will be influenced by her own attachment experiences and will influence her child's development of attachment strategies. The transmission mechanism in attachment theory has primarily been thought to be the sensitivity and responsiveness to the infant's attachment signals of distress. In Grossmann and collaborators' wider view of attachment, responsiveness to the child's signals of exploratory distress is as important as the sensitivity to signals of proximity needs in forming a secure base. The child comes to feel worthy of help and the quality of guidance determines the infant's exploratory competence (Bowlby, 1969/[10]), exploration being the cradle of curiosity, learning, and cognitive development. Grossmann et al. ([27]) specifically point to limitations in attachment research resulting from lack of focus on the quality of parental guidance.

The role of maternal sensitivity

van IJzendoorn ([60]) and De Wolff and van IJzendoorn ([13]) found considerable support for the importance of maternal sensitivity in the intergenerational transmission of attachment. However, as 77% of the variance in child attachment was still unexplained by maternal sensitivity, they suggested both refinement of sensitivity measures and inclusion of other domains of parental behavior. The role of maternal sensitivity in the cognitive development of children has received little attention, but is suggested as a predictor by Stams, Juffer, and van IJzendoorn ([57]).

The role of maternal tutoring

The effect of maternal tutoring on children's cognitive performance has long been recognized (Bickhard, [8]; Hartmann & Haavind, [32]; Hess & Shipman, [33]; Klein & Feuerstein, [40]; Laosa, [41]; Wood & Middleton, [68]). When assessing mothers' assistance of young children in various sorts of tasks, games, and problem solving, results have shown that: children improve their ability to independently solve complex tasks when mothers (a) offer help only after the child has tried but failed to succeed and asks for help, (b) calibrate the appropriate help to the feedback from the child's performance, (c) avoid intrusion, and (d) insure positive feedback and encouragement. Children showing lower levels of cognitive development have been demonstrated to have mothers who interfere with exploration and provide poorer interaction quality characterized by communicative difficulties and poor attunement and reciprocity (e.g. George & Solomon, [22]; Lyons-Ruth, Bronfman & Parons, [45]; Meins, 1997a). Hartmann, Eri, and Skinstad ([31]) found that the quality of maternal tutoring strategies, assessed in a teaching task when the child was six years, was a strong predictor of children's school achievement in 1st grade; it was in fact a stronger predictor than the children's own executive functioning. Both factors were long term predictors of the children's later school performance and their autonomy and well being as adults (Hartmann, [30]).

There are also findings suggesting that maternal tutoring and children's security are related. Meins (1997a) found that secure children of three years had mothers showing superior quality of teaching, emphasizing positive feedback and encouragement of independence, whereas mothers of avoidant children were intrusive, did not encourage independence, and gave orders. Grossmann, Scheuerer-Englisch, and Loher ([28]) also found that secure infants' parents evidenced behaviors like non-interference and only helped when the infant signaled discontentment in play. In a low income area in Cairo, a positive relationship between secure attachment in six-year-old children and the quality of maternal tutoring was also found (Lippe & Crittenden, [43]). The evidence is at present that secure children have caretakers who master effective tutoring, but not that adequate teachers necessarily develop secure children.

We hypothesized that in the present pilot study of the relationship between maternal attachment and the child's attachment and executive cognitive functioning, observed effects would be consistent with a hypothesis of sensitivity and maternal tutoring acting as mediators in trans-generational transmission.

The study design

The study was not longitudinal in any strict sense. Maternal sensitivity was assessed when the child was six–seven months old; child attachment at approximately one year and child cognitive measures, maternal tutoring, maternal attachment, and maternal verbal ability at six–seven years old. Maternal attachments should logically have been assessed before or at the same time as child attachment behaviors were observed. There is reason to believe, however, that maternal attachment representations are fairly stable and that assessment of the mother when the child was an infant would have been highly correlated. Evidence for this assumption has been given by Howard Steele, cited in Hesse ([34], p. 575). Stability of child attachment in the first years of life has also been documented in stable environments (e.g. Grossmann et al., [27]).

Methods

Participants

From a larger sample of 106 middle class, white families, 40 mother–six-year-old child dyads were selected. The dyads had previously been investigated longitudinally (Killèn, Klette & Arnevik, [39]) and scored with the Ainsworth coding system (Ainsworth, Bell & Stayton, [1]; Ainsworth et al., [2]) at one year of age. Of the 20 boys and 20 girls selected, 16 (40%) were scored as securely attached and 24 (60%) as insecurely attached in the Ainsworth's Strange Situation Procedure (Ainsworth et al., [1], [2]). Fifteen (37.5%) of the insecure children were scored as anxious-avoidant and six (15.5%) as anxious-resistant, whereas three (7%) were scored as disorganized (the child used both avoidant and resistant strategies upon reunion). Four families declined to participate and were replaced by four dyads with the same child attachment scores. In the total sample, 54% were coded secure, 23% anxious-avoidant, 10% anxious-resistant, and 5% disorganized. The distributions of infant attachment types were approximately equal across gender (χ^2 [3] = 2.99, ns).

Procedures

The families were approached in several community well-baby clinics, where infants receive regular health checks. They were observed in four waves: at three–four months and six–seven months for maternal sensitivity observations, at one year for attachment observations, and at six years after entry into elementary school for the present study. The six–seven month assessment of maternal sensitivity was carried out in the home and the Strange Situation at the clinic. The six year assessments were conducted in the family home. Mothers and children were separately assessed in the home, the mothers when the children were not home. The parent signed an informed consent and the study was approved by the Data Inspectorate and the National Committees for Regional Ethics in Norway (www.etikkom.no).

The mothers averaged 38 years of age (range: 22–44 years), with an average education of 15 years (range: 10–22 years). Nearly all families lived in their own home in safe and economically advantaged neighborhoods. Most mothers were employed, some part time and some with a home office adjusted to the needs of their under-age children.

Measures when the child was an infant

Maternal sensitivity

At six–seven months the children were observed at home in a play situation with their mothers. The mothers were instructed to play with the child with a set of toys provided by the researchers. Mother and child were placed on the floor with comfortable access to each other and videotaped for three–five minutes. The mothers were scored on sensitivity and responsiveness to the infant's signals with the *Care Index* (Crittenden, [12]). *Maternal sensitivity* was defined as "any pattern of behavior that pleases the infant, increases the infant's comfort and reduces its distress" (Crittenden, [12], p. 12). Facial and vocal expressions, position and body contact, expressions of affection, contingent turn taking, control, and choice of activity (temporal contingencies) were each evaluated as maternally sensitive, controlling, or passive. Sensitivity was scored by two independent observers trained by Crittenden. The observers reached 85% agreement with Crittenden's scores on each element scored and agreement among observers varied between 80 and 95%. Disagreements were resolved by group consensus.

Child secure attachment

The Strange Situation Procedure (SSP) was administered when the child was approximately one year of age at the well-baby clinic. SSP is a standard situation, where mother and child are brought together into a room with toys. After some time a stranger appears and the mother leaves the room. After a couple of minutes the mother reappears and the child's reactions at the reunion are scored. Both assistants and observers were trained by Crittenden. All children were scored by two observers and disagreements were resolved by group consensus. Inter-observer agreement ranged from 80 to 95%. In addition, agreement with the Bielefeld research group (Karin Grossmann, 30 protocols) and the Swedish Uppsala group (Gunilla Bohlin, 10 protocols) was established on the basis of videotapes of the SSP. Agreement on the four Ainsworth categories ranged from 80 to 90%.

The child categories were converted to a quasi-quantitative measure of *security of attachment*. The procedure suggested by Main, Kaplan and Cassidy ([47]), van IJzendoorn, Sagi, and Lambermon ([61]), and Stams, Juffer, and van IJzendoorn ([57]) was chosen. The scale builds on the logic that Type-*B* pattern (secure children) do better than the remaining *A* (dismissive), *C* (resistant), and *D* (disorganized) patterns; that *A, B, C* patterns do better than *D*; and that the *A* and *C* patterns are differentiated not from each other, but from the severity of their sub-patterns. The *B* sub-patterns were also differentiated in the scoring. The behavior pattern known as B_3 was consequently scored as 5, B_1 and B_2 as 4, A_2 and C_1 as 3, A_1 and C_2 as 2, and *D* as 1. No child was given a B_4 score.

Measures when the child was six years of age

Maternal secure attachment

The *Adult Attachment Interview* (George, Kaplan & Main, [21]) assesses the mothers' representations of early relationships with important attachment figures and the mothers' internal working models guiding social behavior. The emphasis is on how the adult organizes and integrates abstract judgments and specific memories of attachment relationships (Main, Kaplan & Cassidy, [45]; see also Hesse, [34], for review). An essential part of the scoring is the evaluation of the coherence of the narratives describing these relationships. Their strategies for dealing with attachment issues are also scored (state of mind regarding attachment). Scoring followed the procedure previously described in the literature (e.g. Bakermans-Kranenburg & van IJzendoorn, [4]; Main et al., [46]; Slade, Belsky, Aber & Phelps, [55]) using an observer who had extensive training with two certified coders from Main and Hesse's training courses. The observer was uninformed about the purpose of the study. Sixteen protocols were double scored with 14 protocols receiving the same sub-score classification (88%).

Coherence of the mother's internal working model of her attachment experiences in childhood has proven to be central in adult attachment measurement and its quantitative measure. Coherence of the AAI transcript regarding attachment issues (for brevity later labeled maternal security) was chosen as an indicator of mother's security of attachment. Coherence of transcript (our measure of security) was in this study highly correlated with a dichotomous scale with categories secure/autonomous (type F) and insecure, where dismissive (type Ds) and insecure preoccupied (type E) were combined (r = .92). In a principal-components analysis of the state of mind variables in our sample, the first unrotated component showed highest loading on coherence of transcript and lowest and negative loadings on dismissive and preoccupied variables. It was also the measure that showed the highest correlation with child security in the present study as in the Main, Kaplan and Cassidy study (1985). Fyffe and Waters ([20]) (in Handbook of Attachment, second edition, chapter 26, p.606) found coherence of transcript correlating.96 with the security function.

In the current paper we decided to use continuous measures of both child and maternal secure attachment. Given the ongoing taxonicity/dimensionality debate in attachment theory, this is not a trivial decision. Our choice is however supported by two studies in which Fraley et al. examined the taxonicity of both SSP and AAI by MAXCOV analyses in large samples (Fraley & Spieker, [19]; Roisman, Fraley & Belsky, [54]). They argued in favor of a dimensional conceptualization of security of attachment and also pointed to methodological problems arising if continuously distributed phenomena are measured by qualitative measures, especially in small samples. A continuous dimensional measure of secure attachment would have the benefit of higher statistical power in a small sample study, especially where the hypotheses necessitate multivariate analyses.

Maternal tutoring strategies and child executive cognitive functioning

These were evaluated with a test designed for six–seven year old children by Hartmann and Haavind for their earlier research on maternal teaching and children's cognitive development named Running Horses Game Test (RHGT) that primarily test executive functioning skills (Hartmann & Haavind, [32]).The test is a competitive game with each player having two horses advancing toward a goal with many rules concerning routes, short cut routes, and potential set-backs which require rule-understanding, planning, and making choices. The game construction was guided by the theories of Hunt on intelligence and experience (Hunt, [35]), Piaget on decentration in cognitive development (Piaget & Inhelder, 1969), and Vygotsky on scaffolding of learning in the child's zone of proximal development (Vygotsky, [63]). Decentering in tutoring refers to the ability to take the perspective of the child, i.e. to adjust the adult–child dialogue to the child's cognitive level, emotional state. and present behavior to create an appropriate developmental challenge to encourage cognitive competence.

Although, an earlier control study has demonstrated that maternal style of tutoring was similar whether she tutored her own child or tutored a child not her own (Haavind & Hartmann, [31]; average r = .89; range.77–.98 for the 10 variables), an essential logical requirement of the RHGT is prevention of dependence between the measures of mother and child at the time of RHGT testing. The children are to be tested under the same conditions, i.e. with optimal tutoring by an assistant. As a consequence, mother and child were tested separately. The target child was tested when learning the game with optimal scaffolding from a trained assistant without the mother being present. The mother was taught the game by the assistant researcher in the same manner, and after a few days a child approximately the same age as her own (a non-targeted child) from the neighborhood and known to the mother was brought to the home to be taught the game by the mother. The non-targeted child was used only once. The mothers were scored on the variables informing, anticipating, demonstrating alternatives, seeking feedback, spontaneous commands, restricting behaviors, and imperative feedback (teaching functions that have been defined and observed as scaffolding; Meins, [48]; Wood, Bruner & Ross, [67]). Scores on these variables were summated with negatively correlated items reversed to form an additive index of *maternal decentered tutoring*.

The children's behaviors when learning to play the game were scored on rule mastery, decision-making, planning, adequate interest, inadequate reaction, passivity, competing, and adequate emotion, aspects usually associated with executive functions, defined as inhibitory control (resisting distraction), working memory (mentally holding information), and cognitive flexibility (adjustment to change) (Diamond et al., [14]). Executive functioning has been found to be more predictive of school readiness than IQ or entry levels in reading and math skills (Diamond et al., [14]).

The children's scores were subjected to a principal-components analysis. One component explained 46% of the variance in the variables, and all variables had substantial loadings on this component. This is consistent with findings from earlier studies with the instrument (Hartmann, Eri & Skinstad, [31]; Hartmann & Haavind, [32]; Lippe & Hartmann, [44]). Scores on the first principal-component was used as a measure of *child executive functioning*. The protocols were audio-taped and double scored by a research assistant (Ingjerd Yousef) and one of the authors (Hartmann), both of whom were blind to the attachment codes of the participants and disagreements were resolved through discussion.

Maternal verbal ability

Maternal verbal ability was evaluated with the *Vocabulary* test of the Wechsler Adult Intelligence Test (Wechsler, [65]). This measure was included for control purposes as intellectual abilities were expected to influence some maternal measures and thereby obscure relationships. Maternal tutoring and codes of coherence in maternal attachment interviews might be especially sensitive to such influences, whereas maternal sensitivity based on observation might be less influenced. Several studies have, however, not reported substantial correlations between maternal intelligence (including verbal ability) and adult attachment status (van IJzendoorn, [60]).

The California Child Q-set (CCQ)

This measure (Block, [9])[1] consists of 100 descriptive statements of a child's personality printed on individual cards. The items are sorted into a forced nine category rectangular distribution ranging from *extremely characteristic* (1) to *extremely uncharacteristic* (9). The Q-sorts were completed by the child's elementary school teacher after six months of daily observation of the child. The teachers were uninformed about the purpose of the project, hypotheses, or other measures or results.

Results

Validity of the dependent measures

Attachment

Several studies have found that securely attached children show superior school adaptation (Easterbrook & Abeles, [15]; Jacobsen & Hoffman, [37]; Kerns, Klepac & Cole, [38]; Moss & St.-Laurent, [49]; Vygotsky, [62]). Correlations between the child's security and the entirely independent CCQ-sort descriptions completed by their teachers were obtained to examine this relationship in the present study. CCQ items positively related (r > .30) to the child's attachment security were: physically attractive and good looking; attentive and able to concentrate; neat and orderly; persistent in activities, does not give up easily; uses and responds to reason; and systematic and well organized. Items *negatively* related (r <–.30) were: stubborn; has a readiness to feel guilty; has bodily symptoms resulting from tensions; has an active fantasy life; restless and fidgety; self-critical; and inhibited and constricted. The teachers' descriptions of the securely attached child depict an academically well organized and functioning child, free of neurotic symptoms.

Executive functioning

Diamond et al. ([14]) report that executive cognitive functions are the best predictors of school performance. CCQ items *positively* related (r > .30) to the child's executive functioning (r > .30) were: verbally fluent; systematic and well organized; uses and responds to reason; self-reliant; confident; eager to learn; open to new impressions; competent and skillful; vital, energetic, and lively; recognizes the feelings of others; empathic; open and straightforward; respected and popular; gets along with other children; attentive and able to concentrate; is reflective, thinks and deliberates; and can assert himself. Items negatively correlated (r <–.30) were: has transient relationships; fickle; restless and fidgety; acts immaturely for age; has a tendency to destroy; prefers non-verbal methods of communication; is easily offended; is indecisive; and looks to adults for help and direction. The teachers' descriptions strongly support the concept of the child's executive functioning as measured here. The descriptions may again be what are likely to be a teacher's conception of the ideal student, and include cognitive considerations as well as social traits.

Examining relations between maternal and child variables

Maternal intelligence was considered to be a potential confounding variable. Variables showing positive correlations with maternal vocabulary were: maternal secure attachment (r = .45, p < .01), decentered tutoring (r = .37, p < .05), and their children's executive functioning (r = .38, p < .05). Correlations among variables controlled for mothers' vocabulary are shown in Table 1.

Table 1. Inter correlations among variables controlled for maternal vocabulary (n = 40).

Variables	MT	MS	CSA	CEF
M secure attachment (MSA)	.38*	.37*	.40*	.28
M tutoring (MT)		.12	.40*	.72**
M sensitivity (MS)			.69**	.28
C secure attachment (CSA)				.43**
C executive functioning (CEF)				

**p < .01; *p < .05.

As hypothesized, maternal secure attachment was related to child secure attachment, maternal sensitivity, and maternal decentered tutoring. Maternal sensitivity and tutoring were related to child secure attachment. There was a strong relation between maternal tutoring and children's executive functioning. Children's secure attachment and cognitive executive functioning were related, while maternal sensitivity and tutoring were unrelated.

Multivariate analyses of child characteristics dependent on maternal secure attachment, sensi...

Our hypotheses obviously imply causal links between maternal security and child characteristics with maternal sensitivity and tutoring as intervening variables. In observational (non-experimental) studies, such relationships can only be supported by showing that co-variation in observed data are consistent with such mechanisms. We applied Baron and Kenny's four-step procedure (Baron & Kenny, [5]) to examine possible statistical mediation. The first condition states that there should be a relationship between independent and dependent variables. The second and third conditions state that the mediators should be related to both the independent and the dependent variables. The fourth condition states that the relationship between independent and dependent variables should be zero (complete mediation) or be significantly reduced (partial mediation), when the mediators are controlled for.

In Tables 2 and 3, necessary information concerning statistical mediation is presented. All variables were standardized to zero mean and unit variance and all reported regression coefficients are standardized coefficients. The first three rows of the tables show direct effects of three variables. For example, the direct effect of *maternal security* on *child security* was.44 (Table 2). In the two rows following the direct effects, results from multiple regression analyses are presented. When including the possible mediator, in this case *maternal tutoring*, the effect of *maternal security* on *child security* was reduced to.32, and only a weak mediated effect was found. When controlling for *maternal sensitivity*, the regression coefficient was reduced from.44 to.19. For *child executive functions*, the effect of *maternal security* was reduced from.29 to.00 when controlling for *maternal tutoring*, indicating a strong indirect effect of maternal attachment through maternal tutoring. This effect was only reduced from.29 to.21 when controlling for *maternal sensitivity* (Table 3).

Table 2. Summary of regression analyses between maternal security and child security with (1) maternal tutoring, and with (2) maternal sensitivity as mediators. Maternal vocabulary controlled for.

IV	DV	ß	Seß	p	R^2
(1) Maternal tutoring as mediator					
Direct effects (without mediator in regression model)					
M security	C security	.44	.17	.01	.16
M security	M tutoring	.40	.16	.02	.27
M tutoring	C security	.43	.16	.01	.16
Multiple regression with mediator in regression model					
M tutoring		.31	.17	.08	
M security	C security	.32	.18	.08	.23
(2) Maternal sensitivity as mediator					
Direct effects (without mediator in regression model)					
M security	C security	.44	.17	.01	.16
M security	M sensitivity	.40	.17	.02	.15
M sensitivity	C security	.70	.12	.00	.48
Multiple regression with mediator in regression model					
M sensitivity		.64	.13	.00	
M security	C security	.19	.14	.21	.50

Note: M = maternal, C = child, IV = independent variable, DV = dependent variable.

Table 3. Summary of regression analyses between maternal security and child executive cognitive functioning with (1) maternal tutoring, and with (2) maternal sensitivity as mediators. Maternal vocabulary controlled for.

IV	DV	ß	Seß	p	R^2
(1) Maternal tutoring as mediator					
Direct effects (without mediator in regression model)					
M security	C exec.func.	.29	.16	.09	.21
M security	M tutoring	.40	.16	.02	.27
M tutoring	C exec.func.	.72	.11	.00	.59
Multiple regression with mediator in regression model					
M tutoring		.72	.12	.00	
M security	C exec.func.	.00	.13	.99	.59
(2) Maternal sensitivity as mediator					
Direct effects (without mediator in the regression model)					
M security	C exec.func.	.29	.16	.09	.21
M security	M sensitivity	.40	.17	.02	.15
M sensitivity	C exec.func.	.26	.15	.08	.22
Multiple regression with mediator in regression model					
M sensitivity		.19	.16	.23	
M security	C exec.func.	.21	.17	.24	.25

Note: M = maternal, C = child, IV = independent variable, DV = dependent variable, exec.func. = executive functioning.

As a test of the statistical significance of the indirect effect, the "Sobel test" (Sobel, [56]) is commonly conducted. However, this test does not have optimal small sample properties, and in the present study a non-parametric bootstrap procedure was performed (Preacher & Hayes, [51]). To examine statistical significance, 1000 bootstrap replications were performed, and non-parametric confidence intervals based on the empirical sampling distributions were constructed. SPSS and a macro written by Preacher and Hayes (Preacher & Hayes, [51]) were used for the bootstrap procedure. Analyses were performed with child secure attachment and child executive functioning as dependent variables. Indirect effects and non-parametric standard errors and confidence intervals are presented in Table 4. Table 4 show strong and statistically significant indirect effects of maternal secure attachment on child secure attachment and child cognitive functioning as measured by partial standardized regression coefficients (.26 and.29, respectively).

Table 4. Indirect effects of independent variable (IV) on dependent variable (DV) through mediators. Bootstrap estimates of SEB and a 95% non-parametric confidence interval (1000 bootstrap replications). All variables were standardized to zero mean and unit variance.

IV	DV	Mediators	ß	Seß	Lower	Upper
M security	C security	M tutoring	.13	.064	.034	.293
M sensitivity	.26	.106	.083	.526		
M security	C exec.func.	M tutoring	.29	.131	.103	.688
M sensitivity	.08	.060	.007	.252		

Note: M = maternal, C = child, IV = independent variable, DV = dependent variable.

Discussion

As expected, maternal attachment was significantly linked to our measures of emotional responsiveness and of decentered tutoring, supporting that these phenomena may play a role in linking maternal attachment to child attachment and executive cognitive functioning. Taken together, the regression analyses (Tables 2 and 3) and the bootstrapped estimates (Table 4) support that maternal attachment does have substantial indirect effects on child attachment as well as on child executive functions. Maternal sensitivity accounted for the effect of maternal secure attachment on children's secure attachment, while the corresponding effect of maternal tutoring was weaker. This was not unexpected given results from earlier studies. Sensitivity to infants' distress signals, whether anticipated by the mother or aroused by safety concerns or cognitive frustrations, is likely to be the most salient maternal influence on experience of security in young infants. Maternal tutoring accounted for the association between maternal attachment and the children's executive cognitive functions. The corresponding effect of maternal sensitivity was weak.

Our findings, although only suggestive given the small sample size, may imply that mothers' internal working models of attachment shape relational behaviors that impact not only the development of early attachment in children, but also the development of executive functions strongly related to performance in school (Diamond et al., [14]).

In a wider contextual view the current results, suggesting weak relations between sensitivity and tutoring and their different roles in linking maternal attachment to child attachment and executive cognitive functioning, support a conceptualization of maternal sensitivity to the child's emotional needs and responsiveness in a more instrumental tutoring situation as distinct phenomena. Studying two-year-olds in German families, Grossmann and Grossmann ([25]) did not find mothers' sensitive responsiveness to the child less than one year and her styles of interactions at two years related. When the latter were submitted to a principal-components analysis, three components were found, named leniency, playfulness, and educational orientation. Leniency as described by Grossman et al. seems close to the sensitivity variable as measured at six–seven months in the present study. This component has later been called *supported autonomy* (Grossmann, Grossmann, Kindler & Zimmermann, [26]) and was characterized by the mother taking a back seat in the interaction with no ambition to improve or interfere with the child's exploration, only to support him if needed. Grossman et al.' s educational orientation seems more closely related to our concept of tutoring. Only leniency was related to the child's attachment security.

We may also see the Grossmanns' concept of leniency and our concept of sensitivity in light of the child's earliest personality development. According to Erikson's influential psychosocial theory of development (Erikson, [17]), explicating partly overlapping stages of development, the child under one year is first at a psychosocial stage of development of the self where the overriding concern is with affective *trust* and what the child needs is a secure base of affective response, followed by a stage where autonomy or *independence* is beginning to be negotiated and it seems reasonable that the mother as a secure exploration base is especially sensitive to the child's autonomy motivation. In fact, several studies have found that secure toddlers have parents with a special focus on encouraging the child's autonomy efforts (Grossmann et al., [28]; Meins, [48]). As the child moves on beyond his concern with independence and later *initiative* and with emerging cognitive competence, *industry* is a strong motivation beginning at school age and doing things on his own is exchanged with the wish to learn. The more secure he is the more he is willing to comply with and accept instruction also from others than his caregivers. The mother's role at this stage of development is to scaffold the child's cognitive development in the zone of proximal development (Vygotsky, [63]), maximizing the child's performance through responsive tutoring and in this role educational assistance and emotional support come together. According to this theory, an educational emphasis does not seem relevant to the needs of the child under one year.

Most sensitivity measures in the literature are based on some form of problem solving in play with mother in a helping and teaching role (e.g. Erickson, Sroufe & Egeland, [16]; Meins, 1997a; Stams et al., [57]) and researchers (e.g. Grossmann & Grossmann, [25]; van IJzendoorn, [60]; Weinfield et al., 2008) have noticed a need for more nuanced discussions of the concept and for better measures. Studies have often produced modest relations between caregiver sensitivity and attachment security (e.g. Atkinson et al., [3]; Pederson, Gleason, Moran & Bento, [52]; Raval et al., [53]; Ward & Carlson, [64]). Differential weight on emotional and instrumental aspects of sensitivity may be a problem. For example, Stams and coworkers ([56]) used Erickson et al.' s measure of sensitivity with an emphasis on the mother's role as teacher when the child was 12 months and found it related to the child's cognitive competence at seven years, but unrelated to infant attachment.

In the present study we included two measures of responsiveness, one infant measure primarily oriented toward the mother's emotional role and one mid-childhood measure primarily oriented to her instrumental role in a tutoring task. Both were influenced by the mother's internal working models of attachment, but they predicted different aspects of the child's personality: security and cognitive competence. Decomposing the concept of sensitivity may be useful in the search for mechanisms that may explain the relationship between maternal attachment and child development. The present study may be a very modest illustration, but its small size precludes generalizations.

Acknowledgments

The study was supported by The Norwegian Council for Mental Health, Grant 1998/052. Ingjerd Yousef collected and scored the data on maternal teaching and children's cognitive regulation and Renate Sommerstad coded the AAI protocols with the greatest care and enthusiasm.

Notes

Footnotes

[1] *1. This is an earlier version than appendixed in Block ([9]).*

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