The importance of sensitive parenting: A longitudinal adoption study on maternal sensitivity, problem behavior, and cortisol secretion

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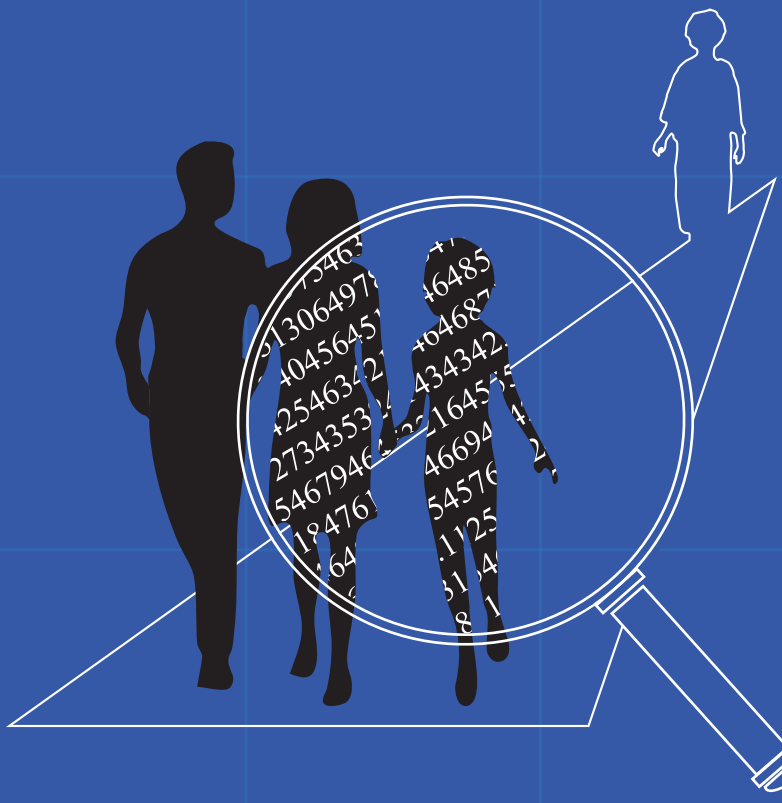

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Outline of the thesis

The current thesis focuses on the longitudinal development of early-adopted children and is part of the Leiden Longitudinal Adoption Study (LLAS). In the LLAS, children were followed from infancy until young adulthood. In Chapter 1 we discuss the role of sensitive parenting and the precursors and developmental outcomes of attachment security. In the empirical study in Chapter 2 we report on the concurrent as well as longitudinal relations between maternal sensitivity, child temperament, and externalizing behavior. In the second empirical study that is outlined in Chapter 3, we follow this line of enquiry and investigate concurrent and longitudinal relations between maternal sensitivity, child temperament, and internalizing behavior. Chapter 4 reports on the final empirical study of this thesis, and focuses on the associations between both maternal sensitivity and attachment in infancy, and the diurnal cortisol curve in young adulthood. To conclude, in Chapter 5 we discuss the longitudinal adoption design, some methodological challenges, and some implications based on the results of our empirical studies.

1

General introduction

Sensitive parenting is the foundation for secure attachment relationships and positive social-emotional development of children

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Abstract

The quality of the attachment relationship between children and their parents is important for children's social-emotional development and can have profound consequences for adaptational processes in later life. The aim of this article is to give an overview of our current knowledge about sensitive parenting and its role in affecting infants' attachment security, and developmental outcomes of attachment. We end with a brief discussion of evidence-based interventions aimed at improving sensitive parenting and the attachment relationship between children and parents. We refer to meta-analyses as quantitative reviews in which all available studies conducted on a particular subject (such as maternal sensitivity and attachment) are included. We conclude that numerous empirical studies and meta-analyses have confirmed the importance of sensitive parenting and attachment security for children's social-emotional development, providing a robust evidence base for translation, implementation, and intervention in practice.

Keywords: Adoption, Attachment, Intervention, Behaviour problems, Sensitive parenting, Social competence

1. What is attachment?

In the first volume of his well-known trilogy *Attachment and Loss* Bowlby (1969) submitted that from an evolutionary perspective children and their parents form an attachment relationship that optimizes chances of child survival. It is especially salient when children face situations that cause fear or distress. Parents act as a safe haven and make it easier for children to regulate their emotions when feeling anxious or distressed (Bowlby, 1969). Most children are securely attached to their parent(s), and experience their parent as a secure base from which they can explore the world (in this article parents can be mothers, fathers, or other caregivers). However, not all children are securely attached and this may have (long-term) implications for their development.

1.1 Measuring attachment

The quality of the attachment relationship can be assessed with the Strange Situation Procedure (SSP; Ainsworth, Blehar, Waters, & Wall, 1978). In the SSP parent and child are observed in a standardized procedure that takes place in an unfamiliar playroom. The parent is asked to leave the child twice and to return within a brief period of time. The behaviour of the child upon the parent's return informs us about the quality of the attachment relationship. The labeling of the classifications as secure and insecure was based on extensive naturalistic home observations of mother-child interactions; associations were found between maternal sensitivity independently assessed at home and child behaviour in the SSP (Ainsworth et al., 1978). When reunited with their parent, secure infants (B) actively seek interaction, and feel comforted by the contact with their parent. They soon return to exploration and play. Avoidant infants (A) do not show much response when their parent leaves. On reunion these infants avoid their parent and continue to play. Ambivalent infants (C) show negative emotions when their parent leaves, and a combination of contact-seeking and resistant behaviour on reunion. They are difficult to comfort following stress (Ainsworth et al., 1978).

Main and Solomon (1986) noted that a minority of children could not easily be classified with the A/B/C classifications. These children did not show an organized, coherent pattern during the SSP, but displayed (short moments of) strikingly deviant behaviours. Children who display these behaviours are coded as disorganised (D; Main & Solomon, 1990). Because disorganised behaviour typically occurs in the presence of an underlying insecure or secure strategy, the D classification is always assigned in addition to a secondary best-fitting A, B, or C classification (Main & Solomon, 1990). In normative populations the attachment distribution is 62% B, 15% A and 9% C, and 15% D (see the meta-analysis by Van IJzendoorn, Schuengel, & Bakermans-Kranenburg, 1999). In high risk groups the distribution may differ substantially from the normative distribution. For example, the percentage of the disorganised category may be as high as 51% for maltreated children (derived from Cyr, Euser, Bakermans-Kranenburg, & Van

IJzendoorn, 2010; see Van IJzendoorn et al., 2011), 25% for children from lower class families (Van IJzendoorn et al., 1999) and 43% for children from mothers that abuse alcohol or drugs (Van IJzendoorn et al., 1999).

The SSP was originally developed for 1-year-old children (Ainsworth et al., 1978) and modified SSPs were subsequently used for toddlers and preschoolers (Cassidy & Marvin, 1992). It also has been adapted for older children such as 6–year-olds (Main & Cassidy, 1988).

The Adult Attachment Interview (AAI; George, Kaplan, & Main, 1985) is the gold standard to assess attachment representations of (young) adults. The AAI is a semi-structured interview that lasts about one hour and assesses an individual's current state of mind with respect to attachment. Respondents are asked to talk about and reflect upon their childhood and their experiences of trauma and loss. The AAI does not assess the quality of attachment to a specific person, but rather the ability to reflect upon attachment-related experiences in a coherent way (Hesse, 2008). Based on the coding of this extensive qualitative interview, adults are classified as autonomous, dismissing, preoccupied or unresolved. These four AAI classifications reflect a representational parallel to, and are associated with respectively infant secure, avoidant, ambivalent, and disorganised attachment (Hesse, 2008).

1.2 Attachment across cultures

Children become attached to their primary caregivers in diverse cultures and contexts. Although specific behaviours indicative of proximity and contact seeking may be different, e.g., more physical contact in one culture compared to more distal interaction in another culture, attachment relationships seem to have universal features. First, professionals and caregivers across the world appear to have a preference for the secure child as defined by attachment theory: descriptions of the optimally secure child are very similar across cultures (Posada et al., 1995; Posada et al., 2013). Second, secure patterns of attachment seem to develop in the majority of children across cultural contexts. Finally, in many contexts maternal sensitivity has been shown to promote secure attachment and increase the likelihood for better child developmental outcomes (Ainsworth et al., 1978; Mesman, Van IJzendoorn, & Bakermans-Kranenburg, 2012; Posada et al., 2013; Van IJzendoorn & Sagi-Schwartz, 2008).

2. The role of sensitive parenting

Attachment does not denote a fixed trait of a child. The quality of a child's attachment is affected by the way the parent and child relate to each other and specifically the way the parent relates to the child. Changes in parenting behaviour may induce changes in the quality of the attachment relationship.

2.1 Sensitive parenting

Mary Ainsworth has shown that sensitive parenting is crucial for developing secure attachment relationships. Sensitive parents are able to pick up signals of the child, to interpret them correctly and to act on them promptly and adequately (Ainsworth et al., 1978). In a series of meta-analyses it was confirmed that maternal sensitivity is an important predictor of infant attachment security. A significant, moderate effect size of r = .24 was found (De Wolff & Van IJzendoorn, 1997). The causal role of sensitivity for the development of secure attachment relationships was substantiated in another meta-analysis: Interventions that were more effective in promoting sensitivity also promoted more attachment security (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003). Sensitivity can be measured with Ainsworth et al.'s 9-point sensitivity rating scale (Ainsworth, Bell, & Stayton, 1974) and with other comparable, but not necessarily equivalent instruments (for an overview see Mesman & Emmen, 2013). Apart from maternal sensitivity, several other parenting behaviours have been associated with attachment security. For instance, it has been found that parents need to be able to acknowledge the child's mental state and foresee his or her psychological needs. This ability of reflective functioning has shown to be predictive of secure attachment relationships (Fonagy & Target, 1997).

2.2 Frightening and frightened parenting behaviour

Main and Hesse (1990) hypothesized that frightened and frightening maternal behaviour might contribute to the disorganised behaviours shown by infants in the SSP. Confirmatory evidence was later reported (e.g., Schuengel, Bakermans-Kranenburg, & Van IJzendoorn, 1999). Frightened en frightening parenting behaviour may occur when parents have suffered unresolved loss or traumatic experiences. The upbringing of their child may bring back negative memories and associations, and parents may unconsciously dissociate from these feelings (Hesse & Main, 2006). Examples of dissociative parenting behaviour are altered facial expressions and attack postures. Children who are confronted with frightening or frightened parenting behaviour face an unresolvable dilemma referred to as 'fright without solution': they are afraid of the caregiver who is also their safe haven (Hesse & Main, 2006; Main & Hesse, 1990).

2.3 Intergenerational transmission

The parents' state of mind with respect to attachment and their ability to discuss their childhood experiences and loss and trauma in a reflective, open way is an important predictor of the attachment relationship with their own offspring. In a meta-analysis (Madigan, Bakermans-Kranenburg, Van IJzendoorn, Moran, Pederson, & Benoit, 2006) the associations between unresolved representations of attachment of parents, anomalous parenting behaviours (such as frightening parenting behaviour) and disorganised attachment were studied. Unresolved loss of the parent was moderately

associated with children's disorganised attachment (r = .30) and this association was partly mediated by anomalous parenting (r = .09). These outcomes were comparable to results found for attachment security: the association between parent's attachment representation and infant attachment security (r = .47) was suggested to be partly mediated by parental responsiveness (r = .11; Van IJzendoorn, 1995). In both meta-analyses the relation between attachment representation of the parent and attachment security of the child was not completely explained by parenting behaviours. Clearly, a 'transmission gap' (Van IJzendoorn, 1995, p. 398) was found that needs further explanation.

Could it be that genetic factors play a role in the intergenerational transmission of attachment as is the case with for example temperament? Studies that focused on main genetic effects do not support this suggestion. Bokhorst, Bakermans-Kranenburg, Fonagy, and Schuengel (2003) found a negligible role of genetics for attachment security and disorganisation. Luijk and colleagues (2011) included two large cohorts and found very few evidence for gene-effects on attachment security or disorganisation. Apart from main effects, gene-environment interactions might play a role, for example in terms of differential susceptibility: susceptible children may benefit more from sensitive parenting, but also suffer more from insensitive or frightening parenting behaviour than less susceptible children (Bakermans-Kranenburg & Van IJzendoorn, 2007; Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007). Studies on gene-environment interaction effects have not revealed consistent results. Some studies have shown gene-environment interaction effects involving parental behaviour (e.g., Barry, Kochanska, & Philibert, 2008; Spangler, Johann, Ronai, & Zimmermann, 2009) or attachment representation (Van IJzendoorn & Bakermans-Kranenburg, 2006). Luijk and colleagues (2011) however found no consistent evidence for any interaction effect between six candidate genes and observed maternal sensitivity in their study on two large cohorts. More studies are needed that combine large samples with carefully measured attachment and environmental factors together with genes or genetic pathways. Perhaps that will contribute to bridging the transmission gap between parental attachment representation and infant-parent attachment.

3. Attachment of children in deprived situations

Children who are maltreated or live in an institution are mostly deprived of opportunities to form a secure attachment relationship with a stable sensitive caregiver. One might wonder whether these children get a chance to become securely attached at all. Adopted children form a special group because they often experienced deprivation but after adoption they may recover from their adverse experiences.

3.1 Maltreatment

It is almost impossible for children not to form an attachment relationship with their caregiver. Even children who are abused by their parents become attached, although this attachment often is not secure and organized (Cyr et al., 2010). In a series of meta-analyses that included 456 maltreated children in 10 different samples, maltreatment was found to be a very large risk for the development of insecure (Cohen's *d* = 2.10) and disorganised (Cohen's *d* = 2.19) attachment patterns (Cyr et al., 2010). A situation of maltreatment clearly creates 'fright without solution' for a child (Hesse & Main, 2006; Main & Hesse, 1990; see section on frightening and frightened parenting behaviour), which is detrimental to the development of secure, organized attachment relationships.

3.2 Institutional care

Institutional care is often characterized by large group sizes with very few caregivers, a constant change of these caregivers, and a lack of sensitive caregiving creating structural neglect (Van IJzendoorn et al., 2011; but see St. Petersburg-USA Orphanage Research Team, 2008 as an illustration of how institutional care can be improved). Institutionalized children have experienced separation from their birthparent(s) and usually are deprived of opportunities to form stable and continuous attachment relationships with one or a few important caregiver(s). Several studies have indicated that institutionalized children are at high risk for developing insecure and disorganised attachment relationships (e.g., Zeanah, Smyke, Koga, & Carlson, 2005). In 6 studies, only 17 % of institutionalized children were classified as secure while 73% were classified as disorganised (compared to 62% and 15% in the normative population, respectively; Van IJzendoorn et al., 2011).

3.3 Adoption

Many adopted children have experienced neglect and deprivation in their birth family or in institutional care. After adoption, these children are taken care of by new parents and get chances for recovery (see for a pioneering study, Yarrow, 1964). Van den Dries, Juffer, Van IJzendoorn, and Bakermans-Kranenburg (2009) analyzed the attachment of 772 adopted children from 17 different studies. Compared to the normative distribution of attachment (62% B and 15% D), adopted children showed fewer secure attachments (47% B) and more disorganised attachments (31% D). Children who were adopted after their first birthday showed more insecure attachment relationships than their non-adopted peers (Cohen's *d* = 0.80), whereas the children adopted before their first birthday were as securely attached as non-adopted children. Regardless of their age at adoption, adopted children were at risk for developing disorganised attachment (Cohen's *d* = 0.36). Compared to the normative population, they were twice as likely to be disorganised (31% vs.15%). It is however important to keep in mind that this percentage is much lower than the 73% disorganised attachments found in

institutionalized children (Van IJzendoorn et al., 2011). Compared to institutionalized children, adopted children seem to show a remarkable catch-up in attachment security which confirms the protective role of adoption and the ability of children to profit from corrective attachment experiences (Van IJzendoorn & Juffer, 2006).

4. Developmental outcomes of attachment

The quality of the attachment relationship between a parent and a child can have profound consequences for children's development. Insecure and disorganised children may bring their negative attachment experiences into their new social interactions and therefore may show more adaptational problems in the social and behavioural domains.

4.1 Social competence

According to attachment theory children develop so called working models that constitute relationship expectations based on previous experiences. These models will guide their future social interactions (Bowlby, 1973; Bretherton, 1999; Bretherton & Munholland, 2008). Children who are securely attached develop positive working models based on their experiences with sensitive caregivers. They encounter new social situations with a basic sense of trust. In contrast, children with insecure attachment relationships tend to develop a model of the self as incompetent (Bowlby, 1973) and their experiences with an insensitive caregiver may influence their beliefs and expectations regarding future relationships (Bretherton, 1999; Bretherton & Munholland, 2008; Thompson, 2008). In a meta-analysis on 80 samples (N = 4,441) attachment security robustly predicted children's social competence with peers (Cohen's d = 0.39). Results on the specific attachment classifications revealed that avoidance, resistance, and disorganisation all predicted less social peer competence (d = 0.17; d = 0.29; d = 0.25, respectively; Groh et al., 2014).

4.2 Behaviour problems

Insensitive parenting and insecure and disorganised attachments are also risk factors for developing problem behaviours. Insecurely attached children are less able to regulate their emotions which puts them at risk of developing feelings of fear and anger (Thompson, 2008). Attachment insecurity and attachment disorganisation were both shown to be predictors of externalising problems as reported by mothers in a series of meta-analyses on 69 studies (N = 5,947; Cohen's d = 0.31 and d = 0.34, respectively; Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010). These findings support the notion that insecurity in general is related to externalising behaviour, while they partially confirm earlier findings that emphasized the role of disorganised attachment in the development of externalising problems and

later psychopathology (for a review see Green & Goldwyn, 2002; for a meta-analysis see Van IJzendoorn et al., 1999).

A series of meta-analyses on internalising behaviour problems (42 studies, N = 4,614) revealed that attachment insecurity and specifically avoidance were related to internalising problems (Cohen's d = 0.15 and d = 0.17, respectively; Groh, Roisman, Van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012). It should be noted that internalising problem behaviour is more difficult to identify for both parents and teachers than externalising problem behaviour. On the whole, attachment insecurity and attachment disorganisation are linked to behaviour problems, but more clearly to the development of externalising problems than to internalising problems. For a more complete understanding of these results we need more knowledge about underlying mechanisms and possible causational chains (Fearon et al., 2010).

4.3 Social and behavioural outcomes in an adoption sample

In many studies the associations between parental sensitivity, attachment security, and child behaviour may be confounded with genetic make-up. Studying adoption samples (with no genetic links between adoptive parents and adopted children) enables us to disentangle environmental from genetic effects. In the Leiden Longitudinal Adoption Study (LLAS) 160 early-adopted children, 75 boys and 85 girls, were followed from infancy to adolescence. The children were adopted from Sri-Lanka (n = 86), South Korea (n = 49), and Colombia (n = 25). All children were adopted at a very young age (mean age at adoption 11 weeks) and taken care of by Caucasian adoptive parents. Maternal sensitivity was measured longitudinally in infancy, middle childhood, and adolescence. The Erickson scales (Erickson, Sroufe, & Egeland, 1985) were used and adapted to be age appropriate, e.g., it was taken into account that the interaction between mother and child becomes more verbal and less physical when children get older. Over time, maternal sensitivity was moderately stable, with no stability from infancy to middle childhood.

It was shown that a secure attachment relationship with the mother and more maternal sensitivity (in infancy, middle childhood, and adolescence) were both important predictors for beneficial outcomes in the domain of social development in middle childhood and adolescence (Jaffari-Bimmel, Juffer, Van IJzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006; Stams, Juffer, & Van IJzendoorn, 2002). Also, the association between parental sensitivity and children's problem behaviour was (at least partly) confirmed. Maternal sensitivity in adolescence predicted less delinquent behaviour (but not aggressive behaviour) in adolescence even when controlling for temperamental predispositions (Van der Voort, Linting, Juffer, Bakermans-Kranenburg, & Van IJzendoorn 2013). Maternal sensitivity in infancy and middle childhood predicted less inhibited behaviour of adopted adolescents and indirectly predicted less internalising problems (Van der Voort, Linting, Juffer, Bakermans-Kranenburg,

Schoenmaker, & Van IJzendoorn 2014). Finally, it was shown that sensitivity plays an important role in the continuity of attachment when genetic confounding is controlled for. In the LLAS, adopted children were more likely to show a stable secure attachment relationship when their adoptive mothers were sensitive in early childhood as well as in adolescence. When mothers were less sensitive in early childhood, but more sensitive in adolescence, adopted children were more likely to change from an insecure to a secure attachment relationship (Beijersbergen, Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2012). Together, these findings suggest that even in genetically unrelated parent-child dyads parental sensitivity may protect against the development of children's problem behaviour and that it is important to take into account early as well as concurrent factors (Lamb, Thompson, Gardner, Charnov, & Connell, 1985).

4.4 Neurobiological correlates

In the past few decades more studies have focused on the neurobiological correlates of early attachment. Of interest are studies on the Hypothalamic-Pituitary-Adrenal axis (HPA axis); the secretion of cortisol is linked to emotional and stress regulation. Cortisol follows a diurnal pattern with high levels in the morning, a peak 30-45 minutes after awakening, and decreasing levels during the day. In situations of acute stress cortisol levels may increase as an adaptation to the stressor (Bruce, Gunnar, Pearse, & Fisher, 2013). In general, securely and organized attached children seem to show smaller increases in cortisol levels when confronted with a challenge such as the Strange Situation Procedure (Luijk et al., 2010; Roisman et al., 2009; Van IJzendoorn et al., 1999). When studying daily cortisol curves, Luijk and colleagues (2010) found a flattened diurnal pattern of cortisol secretion in 14-month olds with a disorganised attachment compared to non-disorganised infants, which is consistent with the flattening curves found in institutionalized children (Gunnar & Vasquez, 2001). Interpersonal stressors in early life may result in hypocortisolism (down regulation of the system resulting in lower basal cortisol levels; Heim, Ehlert, & Hellhammer, 2000) in later life. Roisman and colleagues (2009) for example found that adolescents who had experienced maternal insensitive parenting in the first three years of life, had lower awakening cortisol levels than adolescents with more sensitive mothers. However, studies on cortisol do not reveal a simple process of hormonal adaptation but instead reveal a complex system. Establishing norms to specify (a)typical diurnal curves, and making cortisol assessments between studies more comparable, may clarify part of this complexity (Bruce et al., 2013).

5. Promoting secure attachment relationships

Promoting secure attachment relationships can have beneficial (long-term) outcomes for children. For instance, placement in a nurturing foster family appears to enhance the quality of attachment of formerly institutionalized children (Smyke, Zeanah, Fox, Nelson, & Guthrie, 2010: Bucharest Early Intervention Project). Studies have also shown that involving parents in attachment-based interventions can promote attachment security in children at risk, such as maltreated children (Bernard et al., 2012; Moss et al., 2011).

In two meta-analytical studies, the effects of attachment-based interventions were analyzed (Bakermans-Kranenburg et al., 2003; Bakermans-Kranenburg, Van IJzendoorn, Juffer, 2005). The first series of meta-analyses focused on interventions that aimed at promoting (observed) sensitivity and/or attachment security (70 studies, N = 7,636). Overall, randomized interventions were moderately successful in enhancing sensitivity (Cohen's d = 0.33) and attachment security (Cohen's d = 0.20). In particular short-term interventions that started after the child's age of 6 months and focused on maternal sensitivity, were successful in promoting sensitivity as well as attachment security (Bakermans-Kranenburg et al., 2003). The second series of meta-analyses included 15 studies that aimed at reducing attachment disorganisation. Interventions that started after 6 months of age and focused on maternal sensitivity succeeded in reducing attachment disorganisation (Cohen's d = 0.23 and d = 0.26, respectively; Bakermans-Kranenburg et al., 2005).

The Video-feedback Intervention to promote Positive Parenting and Sensitive Discipline (VIPP-SD; Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2008) is an intervention that meets the empirical criteria found in the meta-analyses. This brief, interaction-focused intervention aims at promoting positive parent-child relationships by focusing on sensitive parenting and sensitive discipline. Sensitive discipline refers to non-coercive responses to challenging child behaviours, such as explaining the consequences of the child's behaviour for others. Mother and child are videotaped in their home setting and afterwards episodes of the video are discussed with the mother. The intervener reinforces sensitive behaviours of the mother in order to increase the likelihood that this behaviour will be used more often (Juffer et al., 2008). The VIPP-SD has been used successfully in families with adopted children (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2005), mothers with an insecure attachment representation (Klein-Velderman, Bakermans-Kranenburg, Juffer, & Van IJzendoorn, 2006), insensitive mothers (Kalinauskiene et al., 2009), and families with children with externalising problems (Van Zeijl et al., 2006). It also has been proven to be effective in family child-care (Groeneveld, Vermeer, Van IJzendoorn, & Linting, 2011), and further studies of this intervention in various populations are in progress (for an overview see Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2014).

In sum, several interventions have shown that promoting sensitive parenting and parent-child relationships is possible. Brief, interaction-focused programs such as the VIPP-SD program are most promising.

6. Conclusions

Empirical studies and meta-analyses have confirmed the role of secure attachments for children's development and shown that parental sensitivity is an important predictor of secure attachment relationships. Insecure and disorganised children appear to be at risk for adaptational problems in the social and behavioural domains (e.g., externalising behaviour problems). When parenting behaviour is not optimal the development of a secure relationship is at risk. Parents' sensitive behaviour is partly determined by their own attachment representations: if parents have not come to terms with their own attachment history it is not impossible, but more difficult for them to be sensitive caregivers and this may affect the attachment relationship with their own child. In situations of adversity such as maltreatment or institutional care, children are likely to develop insecure and disorganised attachments. However, studies on adopted children (Van den Dries et al., 2009), formerly institutionalized children placed in foster families (e.g., Smyke et al., 2010) and maltreated children (Bernard et al., 2012; Moss et al., 2011) suggest that children are able to (partly) overcome their insecure attachment if they are taken care of by sensitive parents.

It is thus essential to promote sensitive parenting in early but also in later life. Numerous empirical studies and meta-analyses have confirmed the importance of sensitive parenting and attachment security for children's social-emotional development, providing a robust evidence base for translation, implementation, and intervention in practice. Brief, interaction-focused, evidence-based interventions aimed at improving sensitive parenting may be implemented more broadly in populations at risk for attachment-related problems to enhance optimal child outcomes.

7. Summary of implications for policy and practice

- Empirical studies and meta-analyses have confirmed the role of secure attachment relationships for children's development and shown that parental sensitivity is an important predictor of secure attachment relationships.
- Insecure and disorganised children appear to be at risk for problems in the social and behavioural domains (e.g. externalising behaviour problems).
- Brief, interaction-focused, evidence-based interventions aimed at improving sensitive parenting may be implemented more broadly in populations at risk for attachment-related problems to enhance optimal child outcomes.

References

Ainsworth, M.D.S, Bell, S.M. and Stayton, D. (1974), "Infant-mother attachment and social development", in Richards, M.P. (Ed.), *The Introduction of the Child into a Social World*, Cambridge University Press, London, pp. 99-135.

Ainsworth, M.D.S., Blehar, M.C., Waters, E. and Wall, S. (1978), *Patterns of Attachment. A Psychological Study of the Strange Situation*, Lawrence Erlbaum, Hillsdale, NJ.

Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2007), "Research review: genetic vulnerability or differential susceptibility in child development: the case of attachment", *Journal of Child Psychology and Psychiatry*, Vol. 48 No. 12, pp. 1160-73.

Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H. and Juffer, F. (2003), "Less is more: meta-analysis of sensitivity and attachment interventions in early childhood", *Psychological Bulletin*, Vol. 129 No. 2, pp. 195-215.

Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H. and Juffer, F. (2005), "Disorganized infant attachment and preventive interventions: a review and meta-analysis", *Infant Mental Health Journal,* Vol. 26 No. 3, pp. 191-216.

Barry, R.A., Kochanska, G. and Philibert, R.A. (2008), "G x E interaction in the organization of attachment: mothers' responsiveness as a moderator of children's genotypes", *Journal of Child Psychology and Psychiatry*, Vol. 49 No. 12, pp. 1313-20.

Beijersbergen, M.D., Juffer, F., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2012), "Remaining or becoming secure: parental sensitive support predicts attachment continuity from infancy to adolescence in a longitudinal adoption study", *Developmental Psychology*, Vol. 48 No. 5, pp. 1277-82.

Belsky, J., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2007), "For better and for worse differential susceptibility to environmental influences", *Current Directions in Psychological Science,* Vol. 16 No. 6, pp. 300-4.

Bernard, K., Dozier, M., Bick, J., Lewis-Morrarty, E., Lindhiem, O. and Carlson, E. (2012), "Enhancing attachment organization among maltreated children: results of a randomized clinical trial", *Child Development*, Vol. 83 No. 2, pp. 623-36.

Bokhorst, C.L., Bakermans-Kranenburg, M.J., Fonagy, P. and Schuengel, C. (2003), "The importance of shared environment in mother-infant attachment security: a behavioral genetic study", *Child Development*, Vol. 74 No. 6, pp. 1769-82.

Bowlby, J. (1969), *Attachment and Loss. Vol. 1: Attachment*, Basic Books, New York, NY.

Bowlby, J. (1973), *Attachment and Loss, Vol. 2: Separation*, Basic Books, New York, NY.

Bretherton, I. (1999), "Updating the 'internal working model' construct: some reflections", *Attachment & Human Development*, Vol. 1 No. 3, pp. 343-57.

Bretherton, I. and Munholland, K.A. (2008), "Models in attachment relationships: elaborating a central construct in attachment theory", in Cassidy, J. and Shaver, P.R. (Eds), *Handbook of Attachment: Theory, Research, and Clinical Applications*, 2nd ed., Guilford, New York, NY, pp. 102-30.

Bruce, J., Gunnar, M.R., Pears, K.C. and Fisher, P.A. (2013), "Early adverse care, stress neurobiology, and prevention science: lessons learned", *Prevention Science*, Vol. 14 No. 3, pp. 247-56.

Cassidy, J. and Marvin, R.S. With the MacArthur Working Group (1992), "*Attachment organization in preschool children: procedures and coding manual*", unpublished manuscript, University of Virginia, Charlottesvill, VA.

Cyr, C., Euser, E.M., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2010), "Attachment security and disorganization in maltreating and high-risk families: a series of meta-analyses", *Development and Psychopathology*, Vol. 22 No. 1, pp. 87-108.

De Wolff, M.S. and Van IJzendoorn, M.H. (1997), "Sensitivity and attachment: a meta-analysis on parental antecedents of infant attachment", *Child Development*, Vol. 68 No. 4, pp. 571-91.

Erickson, M.F., Sroufe, L.A. and Egeland, B. (1985), "The relationship between quality of attachment and behavior problems in preschool in a high-risk sample", in Bretherton, I. and Waters, E. (Eds), *Growing Points at Attachment: Theory and Research, Monographs of the Society for Research in Child Development*, Vol. 50 No. 209, pp. 147-66.

Fearon, R.P., Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H., Lapsley, A.M. and Roisman, G.I. (2010), "The significance of insecure attachment and disorganization in the development of children's externalizing behavior: a meta-analytic study", *Child Development*, Vol. 81 No. 2, pp. 435-56.

Fonagy, P. and Target, M. (1997), "Attachment and reflective function: their role in self-organization", *Development and psychopathology*, Vol. 9 No. 4, pp. 679-700.

George, C., Kaplan, N. and Main, M. (1985), "*Adult attachment interview*", unpublished manuscript, University of California, Berkeley, CA.

Green, J. and Goldwyn, R. (2002), "Annotation: attachment disorganisation and psychopathology: new findings in attachment research and their potential implications for developmental psychopathology in childhood", *Journal of Child Psychology and Psychiatry*, Vol. 43 No. 7, pp. 835-46.

Groeneveld, M.G., Vermeer, H.J., Van IJzendoorn, M.H. and Linting, M. (2011), "Enhancing home-based child care quality through video-feedback intervention: a randomized controlled trial", *Journal of Family Psychology*, Vol. 25 No. 1, pp. 86-96.

Groh, A.M., Fearon, R.P., Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H., Steel, R.D. and Roisman, G.I. (2014), "The significance of attachment security for children's social competence with peers. A meta-analytic study", *Attachment and Human Development*, Vol. 16 No. 2, pp. 103-36.

Groh, A.M., Roisman, G.I., van IJzendoorn, M.H., Bakermans-Kranenburg, M.J. and Fearon, R. (2012), "The significance of insecure and disorganized attachment for children's internalizing symptoms: a meta-analytic study", *Child Development*, Vol. 83 No. 2, pp. 591-610.

Gunnar, M.R. and Vasquez, D.M. (2001), "Low cortisol and a flattening of expected daytime rhythm: indices of risk in human development", *Development and Psychopathology*, Vol. 13 No. 2, pp. 515-38.

Heim, C., Ehlert, U. and Hellhammer, D.H. (2000), "The potential role of hypocortisolism in the pathophysiology of stress-related bodily disorders", *Psychoneuroendocrinology,* Vol. 25 No. 1, pp. 1-35.

Hesse, E. (2008), "The adult attachment interview: protocol, method of analysis, and empirical studies", in Cassidy, J. and Shaver, P.R. (Eds), *Handbook of Attachment: Theory, Research, and Clinical Applications,*2nd ed., Guilford, New York, NY, pp. 552-98.

Hesse, E. and Main, M. (2006), "Frightened, threatening, and dissociative parental behavior in low-risk samples: description, discussion, and interpretations", *Development and Psychopathology*, Vol. 18 No. 2, pp. 309-43.

Jaffari-Bimmel, N., Juffer, F., Van IJzendoorn, M.H., Bakermans-Kranenburg, M.J. and Mooijaart, A. (2006), "Social development from infancy to adolescence: longitudinal and concurrent factors in an adoption sample", *Developmental Psychology*, Vol. 42 No. 6, pp. 1143-53.

Juffer, F., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2005), "The importance of parenting in the development of disorganized attachment: evidence from a preventive intervention study in adoptive families", *Journal of Child Psychology and Psychiatry,* Vol. 46 No. 3, pp. 263-74.

Juffer, F., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2008), *Promoting Positive Parenting: An Attachment Based Intervention,* Taylor & Francis, New York, NY.

Juffer, F., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2014), "Attachment-based interventions: sensitive parenting is the key to positive parent-child relationships", in Holmes, P. and Farnfield, S. (Eds), *The Routledge Handbook of Attachment: Implications and Interventions,* Routledge, London.

Kalinauskiene, L., Cekuoliene, D., Van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., Juffer, F. and Kusakovskaja, I. (2009), "Supporting insensitive mothers: the Vilnius randomized control trial of video feedback intervention to promote maternal sensitivity and infant attachment", *Child: Care, Health & Development*, Vol. 35 No. 5, pp. 613-23.

Klein Velderman, M., Bakermans-Kranenburg, M.J., Juffer, F. and Van IJzendoorn, M.H. (2006), "Effects of attachment-based interventions on maternal sensitivity and infant attachment: differential susceptibility of highly reactive infants", *Journal of Family Psychology*, Vol. 20 No. 2, pp. 266-74.

Lamb, M.E., Thompson, R.A., Gardner, W., Charnov, E.L. and Connell, J.P. (1985), *Infant Mother Attachment: The Origins and Developmental Significance of Individual Differences in Strange Situation behavior,* Lawrence Erlbaum, Hillsdale, NJ.

Luijk, M.P., Roisman, G.I., Haltigan, J.D., Tiemeier, H., Booth-LaForce, C., van IJzendoorn, M.H., Belsky, J., Uitterlinden, A.G., Jaddoe, V.W., Hofman, A., Verhulst, F.C., Tharner, A. and Bakermans-Kranenburg, M.J. (2011), "Dopaminergic, serotonergic, and oxytonergic candidate genes associated with infant attachment security and disorganization? In search of main and interaction effects", *Journal of Child Psychology and Psychiatry*, Vol. 52 No. 12, pp. 1295-307.

Luijk, M.P., Saridjan, N., Tharner, A., van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., Jaddoe, V.W., Hofman, A., Verhulst, F.C. and Tiemeier, H. (2010), "Attachment, depression, and cortisol: deviant patterns in insecure-resistant and disorganized infants", *Developmental Psychobiology,* Vol. 52 No. 5, pp. 441-52.

Madigan, S., Bakermans-Kranenburg, M.J., Van IJzendoorn, M.H., Moran, G., Pederson, D.R. and Benoit, D. (2006), "Unresolved states of mind, anomalous parental behavior, and disorganized attachment: a review and meta-analysis of a transmission gap", *Attachment & Human Development,* Vol. 8 No. 2, pp. 89-111.

Main, M. and Cassidy, J. (1988), "Categories of response to reunion with the parent at age 6: predictable from infant attachment classifications and stable over a 1-month period", *Developmental Psychology,* Vol. 24 No. 3, pp. 415-26.

Main, M. and Hesse, E. (1990), "Parents' unresolved traumatic experiences are related to infant disorganized attachment status: is frightened and/or frightening parental behaviour the linking mechanism?", in Greenberg, M.T., Cicchetti, D. and Cummings, E.M. (Eds), *Attachment in the Preschool Years: Theory, Research, and Intervention,* The University of Chicago Press, Chicago, IL, pp. 161-82.

Main, M. and Solomon, J. (1986), "Discovery of an insecure-disorganized/disoriented attachment pattern", in Yogman, M. and Brazelton, T.B. (Eds), *Affective Development in Infancy*, Ablex, Norwood, NJ, pp. 95-124.

Main, M. and Solomon, J. (1990), "Procedures for identifying infants as disorganized/disoriented during the Ainsworth strange situation", in Greenberg, M.T., Cicchetti, D. and Cummings, E.M. (Eds), *Attachment in the Preschool Years: Theory, Research, and Intervention*, The University of Chicago Press, Chicago, IL, pp. 121-82.

Mesman, J. and Emmen, R.A.G. (2013), "Mary Ainsworth's legacy: a systematic review of observational instruments measuring parental sensitivity", *Attachment & Human Development*, Vol. 15 Nos 5-6, pp. 485-506.

Mesman, J., van IJzendoorn, M.H. and Bakermans-Kranenburg, M.J. (2012), "Unequal in opportunity, equal in process: parental sensitivity promotes positive child development in ethnic minority families", *Child Development Perspectives*, Vol. 6 No. 3, pp. 239-50.

Moss, E., Dubois-Comtois, K., Cyr, C., Tarabulsy, G.M., St-Laurent, D. and Bernier, A. (2011), "Efficacy of a home-visiting intervention aimed at improving maternal sensitivity, child attachment, and behavioral outcomes for maltreated children: a randomized control trial", *Development and Psychopathology*, Vol. 23 No. 1, pp. 195-210.

Posada, G., Gao, Y., Wu, F., Posada, R., Tascon, M., Scho¨ elmerich, A., Sagi, A., Kondo-Ikemura, K., Haaland, W. and Synnevaag, B. (1995), "The secure-base phenomenon across cultures: children's behavior mothers' preferences, and experts'concepts", *Monographs of the Society for Research in Child Development,* Vol. 60 Nos 2-3, pp. 27-48.

Posada, G., Lu, T., Trumbell, J., Kaloustian, G., Trudel, M., Plata, S.J., Pen˜ a, P.P., Perez, J., Tereno, S., Dugravier, R., Coppola, G., Constantini, A., Cassibba, R., Kondo-Ikemura, K., No´ blega, M., Haya, I.M., Pedraglio, C., Verissimo, M., Santos, A.J., Monteiro, L. and Lay, K.L. (2013), "Is the secure base phenomenon evident here, there, and anywhere? A cross-cultural study of child behavior and experts' definitions", *Child Development*, Vol. 84 No. 6, pp. 1896-1905.

Roisman, G.I., Susman, E., Barnett-Walker, K., Booth-LaForce, C., Owen, M.T., Belsky, J., Bradley, R.H., Houts, R. and Steinberg, L. (2009), "Early family and child-care antecedents of awakening cortisol levels in adolescence", *Child Development*, Vol. 80 No. 3, pp. 907-20.

Schuengel, C., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (1999), "Frightening maternal behavior linking unresolved loss and disorganized infant attachment", *Journal of Consulting and Clinical Psychology,* Vol. 67 No. 1, pp. 54-63.

Smyke, A.T., Zeanah, C.H., Fox, N.A., Nelson, C.A. and Guthrie, D. (2010), "Placement in foster care enhances quality of attachment among young institutionalized children", *Child Development,* Vol. 81 No. 1, pp. 212-23.

Spangler, G., Johann, M., Ronai, Z. and Zimmermann, P. (2009), "Genetic and environmental influence on attachment disorganization", *Journal of Child Psychology and Psychiatry*, Vol. 50 No. 8, pp. 952-61.

St. Petersburg-USA Orphanage Research Team (2008), "The effects of early social-emotional and relationship experience on the development of young orphanage children", *Monographs of the Society for Research in Child Development*, Vol. 73 No. 3, pp. 1-262, 294-95.

Stams, G.J.J., Juffer, F. and van IJzendoorn, M.H. (2002), "Maternal sensitivity, infant attachment, and temperament in early childhood predict adjustment in middle childhood: the case of adopted children and their biologically unrelated parents", *Developmental Psychology*, Vol. 38 No. 5, pp. 806-21.

Thompson, R.A. (2008), "Early attachment and later development. Familiar questions, new answers", in Cassidy, J. and Shaver, P.R. (Eds), *Handbook of Attachment: Theory, Research, and Clinical Applications,* 2nd ed., Guilford, New York, NY, pp. 348-65.

Van den Dries, L., Juffer, F., Van IJzendoorn, M.H. and Bakermans-Kranenburg, M.J. (2009), "Fostering security? A meta-analysis of attachment in adopted children", *Children and Youth Services Review,* Vol. 31 No. 3, pp. 410-21.

Van der Voort, A., Linting, M., Juffer, F., Bakermans-Kranenburg, M.J. and Van IJzendoorn, M.H. (2013), "Delinquent and aggressive behaviors in early-adopted adolescents: longitudinal predictions from child temperament and maternal sensitivity", *Children and Youth Services Review,* Vol. 35 No. 3, pp. 439-46.

Van der Voort, A., Linting, M., Juffer, F., Bakermans-Kranenburg, M.J., Schoenmaker, C. and Van IJzendoorn, M.H. (2014), "The development of adolescents' internalizing behavior: longitudinal effects of maternal sensitivity and child inhibition", *Journal of Youth and Adolescence,* Vol. 43 No. 4, pp. 528-40.

Van IJzendoorn, M. (1995), "Adult attachment representations, parental responsiveness, and infant attachment: a meta-analysis on the predictive validity of the Adult Attachment Interview", *Psychological Bulletin*, Vol. 117 No. 3, pp. 387-403.

Van IJzendoorn, M.H. and Bakermans-Kranenburg, M.J. (2006), "DRD4 7-repeat polymorphism moderates the association between maternal unresolved loss or trauma and infant disorganization", *Attachment & Human Development*, Vol. 8 No. 4, pp. 291-307.

Van IJzendoorn, M.H. and Juffer, F. (2006), "The emanuel miller memorial lecture 2006: adoption as intervention. meta-analytic evidence for massive catch-up and plasticity in physical, socio-emotional, and cognitive development", *Journal of Child Psychology and Psychiatry*, Vol. 47 No. 12, pp. 1228-45.

Van IJzendoorn, M.H., Palacios, J., Sonuga-Barke, E.J., Gunnar, M.R., Vorria, P., McCall, R.B., Le Mare, L., Bakermans-Kranenburg, M.J., Debrova-Krol, N.A. and Juffer, F. (2011), "Children in institutional care: delayed development and resilience", *Monographs of the Society for Research in Child Development,* Vol. 76 No. 4, pp. 8-30.

Van IJzendoorn, M.H. and Sagi-Schwartz, A. (2008), "Crosscultural patterns of attachment: universal and contextual dimensions", in Cassidy, J. and Shaver, P.R. (Eds), *Handbook of Attachment: Theory, Research, and Clinical Applications*, Guilford, New York, NY, 2nd ed., pp. 880-905.

Van IJzendoorn, M.H., Schuengel, C. and Bakermans-Kranenburg, M.J. (1999), "Disorganized attachment in early childhood: meta-analysis of precursors, concomitants, and sequelae", *Development and Psychopathology*, Vol. 11 No. 2, pp. 225-50.

Van Zeijl, J., Mesman, J., Van IJzendoorn, M.H., Bakermans-Kranenburg, M.J., Juffer, F., Stolk, M.N. and Alink, L.R.A. (2006), "Attachment-based intervention for enhancing sensitive discipline in mothers of 1- to 3-year-old children at risk for externalizing behavior problems: a randomized controlled trial", *Journal of Consulting and Clinical Psychology*, Vol. 74 No. 6, pp. 994-1005.

Yarrow, L.J. (1964), "Separation from parents during early childhood", in Hoffman, M. and Hoffman, L. (Eds), *Review of Child Development Research*, Sage Foundation, New York, NY, Vol. 1, pp. 89-136.

Zeanah, C.H., Smyke, A.T., Koga, S.F. and Carlson, E. (2005), "Attachment in institutionalized and community children in Romania", *Child Development*, Vol. 76 No. 5, pp. 1015-28.

2

Delinquent and aggressive behaviors in early-adopted adolescents: Longitudinal predictions from child temperament and maternal sensitivity

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Abstract

Background: 160 early-adopted children were followed from infancy to adolescence. Central question was whether early and concurrent parenting and child temperament predicted adolescent delinquent and aggressive behaviors. *Methods:* Structural equation modeling was used to test the relations between early and concurrent observed maternal sensitivity, mother reported effortful control and teacher reported delinquent and aggressive behaviors. *Results:* This longitudinal adoption study showed that lower effortful control, concurrent as well as 7 years earlier, predicted higher levels of delinquency in adolescence and aggression in middle childhood and in adolescence. Lower levels of effortful control in infancy predicted higher levels of maternal sensitivity in adolescence which in its turn predicted less adolescent delinquent behavior. *Conclusions:* The findings suggest that effortful control is an important predictor of both aggressive and delinquent behaviors. Maternal sensitivity also plays a role in the development of delinquent behavior, buffering a lack of effortful control, but is not related to aggression at age 14. It is important to note that these relations were found in a sample of parents and their genetically unrelated adopted children.

Keywords: Adoption, Delinquency, Aggression, Sensitive parenting, Temperament

1. Introduction

Developmental roots and trajectories of children's externalizing behavior problems such as delinquency and aggression are widely debated (e.g., Loeber, Burke, & Pardini, 2009; De Haan, Prinzie, & Deković, 2010). The etiology of these problems is complex and both the interactional processes between environmental and constitutional factors (e.g., Belsky, Hsieh, & Crnic, 1998; De Haan et al., 2010; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2011) and developmental processes starting early in life (Sroufe, 2000) should be taken into account. In this longitudinal study we focus on the development and course of delinquent and aggressive behaviors examining constitutional as well as early and concurrent environmental factors in adoptive families, ruling out shared genetics between parents and their early-adopted children.

To some degree externalizing behaviors in childhood and adolescence seem age-normative, but high levels of these behaviors are indicative of serious adaptational problems in later life (Loeber & Hay, 1997). Externalizing behaviors can be distinguished by age of onset (Moffitt, 1993) or categorized in behavioral subtypes (Burt, Donnelan, Lacono, & McGue, 2011; Eley, Lichtenstein, & Moffit, 2003; Stanger, Achenbach, & Verhulst, 1997), such as aggressive and delinquent behaviors. The aggressive subtype denotes more overt externalizing behaviors including bullying and yelling, the delinquent subtype points to more covert rule breaking behaviors such as stealing and lying (De Haan et al., 2010; Stanger et al., 1997). There are several reasons to examine the etiology and course of aggression and delinquency separately. First, these behaviors show interrelated, but differential developmental paths (e.g., De Haan et al., 2010; Stanger et al., 1997). Second, differences in correlates of aggressive and delinquent behaviors have been reported for child personality (De Haan et al., 2010) and heart rate reactivity (Bimmel, Van IJzendoorn, Bakermans-Kranenburg, Juffer, & De Geus, 2008). Third, it has been suggested that the behavioral classification is a better predictor of later antisocial problems than age-of-onset (Burt et al., 2011).

1.1 Contributing Factors: Temperament and Sensitivity

Temperament is generally viewed as a set of largely constitutionally based traits affecting self-regulation and reactivity (Rothbart & Bates, 2006). Links between early temperament in general and later disruptive behaviors have been found (Caspi & Silva,1995; Loeber et al., 2009), but research on specific early temperamental traits and associations with distinct later behavioral problems is less well developed (Loeber et al., 2009; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005). Effortful control is a specific dimension of temperament that refers to a person's ability to control behavior and attention and to inhibit a dominant response in order to perform a subdominant response (Rothbart & Bates, 2006; Rothbart, Sheese, & Posner, 2007). Children with low levels of effortful control are more likely to develop externalizing behavior problems in

later life (Eisenberg et al., 2005; Oldehinkel, Hartman, De Winter, Veenstra, & Ormel, 2004; Olson et al., 2005). They have less self regulating capacities and therefore may find it more difficult to restrain themselves and comply with demands that do not deliver immediate gratification (Kochanska & Knaack, 2003).

Besides temperament, parenting has been associated with externalizing problems in children (Hoeve et al., 2009; Rothbaum & Weisz, 1994). Sensitive parenting in particular has been shown to predict beneficial developmental outcomes (Jaffari-Bimmel, Juffer, Van IJzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006; Sroufe, Egeland, Carlson, & Collins, 2005). When a caregiver is able to perceive a child's signals correctly and to respond in a prompt and adequate way, the child is likely to develop a secure attachment relationship with this caregiver (Ainsworth, Blehar, Waters, & Wall, 1978). Securely attached children bring positive working models of relationships into their future relationships, promoting social development (Bowlby, 1973). Sensitive parents may also stimulate optimal development through helping their children to regulate their emotions and by modeling empathic behavior (Kawabata, Alink, Tseng, Van IJzendoorn, & Crick, 2011).

Temperament and sensitivity may not be independent predictors of externalizing behaviors. According to the differential susceptibility hypothesis (Belsky et al., 1998) children with a difficult temperament tend to profit more from good, but also suffer more from bad parenting (Bakermans-Kranenburg & Van IJzendoorn, 2006; Ellis et al., 2011). Although empirical evidence for differential susceptibility mainly has been found for negative emotionality and inhibition (Van IJzendoorn & Bakermans-Kranenburg, 2012), executive functioning, that is closely related to effortful control, also has been found to moderate environmental influences on child behavior (Bierman, Nix, Greenberg, Blair, & Domitrovich; 2008). Temperament and parenting may also indirectly affect later adjustment through mediating processes (Eisenberg et al., 2005) or transactional processes that start in early life (Sameroff & Mackenzie, 2003; Sroufe et al., 2005). The behavioral manifestation of the child's temperament evokes specific parenting behaviors which in turn affect the child's behavior over time (Patterson, 1982; Rothbart & Bates, 2006). A focus on the interplay between temperament and sensitive parenting in the prediction of externalizing behaviors is therefore essential.

1.2 Externalizing Problem Behavior of Adopted Children

Examining the relations between parental sensitivity, child temperament and externalizing problems in an adoptive sample may not only shed light on the development of delinquent and aggressive behaviors in general, it may also lead to suggestions on how to protect adopted children from developing externalizing problems. Although adoption appears to be an effective intervention in children's lives compared to prolonged institutional care (Van IJzendoorn & Juffer, 2006) and most international adoptees are well adjusted, adopted children are at risk of developing behavior

problems (e.g., Rosnati, Montirosso, & Barni, 2008; Verhulst, Althaus, & Versluis-den Bieman, 1990; for a meta-analysis see Juffer & Van IJzendoorn, 2005). Gaining insight in the mechanisms underlying the development of externalizing problems may give clues on how to prevent these problems and how to support adoptive families.

In previous studies on the same sample we found that according to mother report the adopted children showed significantly more externalizing problem behavior in middle childhood than children from the general population, although teacher report did not reveal significant differences (Stams, Juffer, Rispens, & Hoksbergen, 2000). At 14 years of age the children showed fewer problem behaviors than at 7 years, but still significantly more than their non-adopted peers (Jaffari-Bimmel, Juffer, Van IJzendoorn, & Bakermans-Kranenburg, 2004).

1.3 The Present Study

The present study is part of the prospective Leiden Longitudinal Adoption Study in which the social-emotional and cognitive development of early-adopted children is examined from infancy to young adulthood. The aim of this present study is to gain insight in the emergence and development of adopted children's delinquent and aggressive behaviors. We specifically focus on the contributions of children's effortful control and observed sensitive parenting. Two important methodological challenges are met in this study. First, the longitudinal design over a period of fourteen years allows for the inclusion of transactional processes between early as well as concurrent parenting and child factors. Second, the adopted children in our study do not share any genetic basis with their adoptive parents. When genetically related children and parents are studied, effects of parenting on child behavior are confounded with their common genetic make-up, and therefore it is hard to make causal statements about the associations between parenting and child behavior (Haugaard & Hazan, 2003; Moffitt, 2005; Rowe, 1993). In this adoption study the possible associations between parenting and child behavior are disentangled from any common genetic make-up.

We hypothesize that low levels of effortful control predict higher levels of aggressive and delinquent behaviors, and that these effects are both transactional and concurrent. Furthermore, we hypothesize that more sensitive parenting predicts less aggression and delinquency. Finally, based on the differential susceptibility hypothesis, we expect that especially in children with low levels of effortful control insensitive parenting is related to high levels of externalizing behaviors and sensitive parenting is related to low levels of externalizing behaviors.

2. Method

2.1 Participants

We followed 160 internationally adopted children, 75 boys and 85 girls, from infancy to adolescence. The children and their families originated from two samples of early-adopted children. The first sample involved 90 families without biological children (Juffer, 1993), the second sample involved 70 families who already had one or more biological or adopted children (Rosenboom, 1994).

All adoptive families were randomly recruited through Dutch adoption organizations. The children came from different countries: 86 children from Sri Lanka, 49 from South Korea, and 25 from Colombia. In Korea and Colombia children were in private children's homes prior to adoption, children from Sri Lanka remained with their birth mother until the adoption. The children's mean age at arrival was 10.76 weeks (*SD*=5.53). The health condition at arrival of 124 children was good, 29 children displayed a mediocre health, and seven children were in poor health (Juffer, 1993; Rosenboom, 1994).

All children were placed in Caucasian families with predominantly middle-class or upper-class backgrounds and in all families the mother was the primary caregiver (for more details, see Juffer, 1993; Rosenboom, 1994; Stams, Juffer, & Van IJzendoorn, 2002). When the children were between 6 and 9 months of age, 50 randomly selected families received a moderately effective short-term intervention to promote maternal sensitive responsiveness (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2005). In the current analyses we controlled for the short-term intervention effects on maternal sensitivity in infancy (see section 2.4.3).

2.2 Procedure

During infancy we visited the families at home to administer questionnaires, observe mother-child interactions, and implement the intervention if applicable. The participants came to the laboratory to assess the quality of mother-child interactions and the attachment relationship. At age 7, we visited families at home to observe mother-child interactions, to interview the mother, and to administer questionnaires. We visited the children's schools and asked the teacher to complete a questionnaire. At age 14, we visited the families at home again to observe mother-child interactions, to interview the adolescent and the adoptive parents, and to administer questionnaires. Teachers received a questionnaire by mail. Ethical guidelines were followed throughout the study and all participants gave informed consent prior to their inclusion in the study.

2.3 Attrition

Of the 160 families that participated in infancy 146 families participated in middle childhood and 145 families participated in adolescence. Only three families participated neither in middle childhood nor in adolescence. Lack of time, death of the adoptive

mother, disinterest, and health problems in the family were among the reasons for attrition (for details see Jaffari-Bimmel et al., 2006; Stams et al., 2002). Bonferroni corrected tests confirmed the absence of selective attrition with respect to background variables and core constructs such as temperament and sensitivity.

2.4 Measures

Whenever possible, measures at prior points in time were repeated to support the longitudinal design. If necessary, instruments were adapted to assure age-appropriateness. The main variables in our model were rated in different ways and by different people to avoid common instrument variance and reporter bias; sensitivity was rated by trained coders, temperament was reported by the mother and problem behavior was reported by the teacher.

2.4.1 Delinquency and aggression. When the children were 7 and 14 years old, teachers completed the Teacher Report Form (TRF). The TRF contains 113 descriptions of problem behavior that can be rated on a three-point scale (Achenbach, 1991; Verhulst, Van der Ende, & Koot, 1997). Two syndromes were derived from the TRF: aggressive behavior (sum of 25 items) and delinquent behavior (sum of 9 items). The aggressive scale contains items such as 'fights a lot', 'yells a lot', and 'easily frustrated'. Examples for the delinquent scale are 'does not feel guilty' and 'truancy'. Cronbach's alpha values for aggression and delinquency were .95 and .67 respectively at 7 years, and .94 and .75 at 14 years. TRF scales were log-transformed to reduce skewness. The transformed scores of aggression ranged from 0 to 1.57 (M = 0.58, SD = 0.50, N = 124) at 7 years and from 0 to 1.57 (M = 0.54, SD = 0.49, N = 118) at 14 years. The transformed scores of delinquency ranged from 0 to 1.00 (M = 0.21, SD = 0.27, N = 124) at 7 years and from 0 to 1.05 (M = 0.25, SD = 0.32, N = 118) at 14 years.

2.4.2 Effortful control. At 12, 18, and 30 months, temperament was assessed with the Dutch Temperament Questionnaire (DTQ; Kohnstamm, 1984), an adaptation of the Infant Characteristics Questionnaire (Bates, Freeland, & Lounsbury, 1979). Mothers rated their child's behavior on nineteen 7-point rating scales. For this study we were especially interested in the three items that focused on the lack of ability to control behavior: the child (1) touches forbidden things (2) persistently tries to do forbidden things, and (3) needs supervising. We used the averaged raw scores on these three items at 12, 18, and 30 months. Cronbach's alpha for effortful control in infancy was .87.

At 7 and 14 years, mothers completed an age-adapted version of the Dutch Temperament Questionnaire, consisting of 27 items. At these ages, the three items that measured effortful control focused on attention control: the child (1) is able to finish a task, (2) is distracted easily, and (3) is not able to choose an activity and stick with it.

Cronbach's alphas were .70 at 7 years and .73 at 14 years. In our model the individual items of effortful control were used as indicators with high scores representing high levels of perceived effortful control. There was no content overlap between items for effortful control and items for delinquent and aggressive behaviors.

2.4.3 Maternal sensitivity. At 12, 18, and 30 months, mother's sensitive behavior was assessed during structured tasks (building a tower or solving puzzles) both in the home and in the laboratory. The Egeland/Erickson 7-point rating scales (Egeland, Erickson, Clemenhagen-Moon, Hiester, & Korfmacher, 1990; Erickson, Sroufe, & Egeland, 1985) were used to rate supportive presence, intrusiveness, sensitivity and timing, and clarity of instruction. The averaged Cohen's kappa's for agreement within one scale point were .91 (12 months), .90 (18 months), and .97 (30 months) (see Stams et al., 2002). For this study of children's delinquent and aggressive behaviors we were especially interested in maternal supporting and structuring behavior represented by the scales supportive presence, sensitivity and timing, and clarity of instruction. All scales were based on the average of the raw scores at 12, 18, and 30 months.

In infancy 50 randomly selected families received a short-term intervention to promote maternal sensitive responsiveness (Juffer et al., 2005). We controlled for the intervention effect by regressing maternal sensitivity on a dummy variable indicating intervention versus control group. The residual scores were used in further analyses.

To make the sensitivity assessments at 7 and 14 years age-appropriate we used more difficult tasks (e.g., Tangram puzzles) and took into account the more verbal interaction between mother and child at these ages, compared to the more physical interaction in infancy (see Stams et al., 2002 and Jaffari-Bimmel et al., 2006). Kappas ranged from .92 to .96 at age 7 (Stams et al., 2002), intraclass correlations ranged from .91 to .95 at age 14 (Jaffari-Bimmel et al., 2006).

2.5 Statistical Analyses

We tested separate structural equation models for delinquent and aggressive behaviors with EQS 6.1 for Windows (Bentler, 1995). First, we tested full models with future predictive relations between all latent variables and concurrent predictions from sensitivity and perceived effortful control to problem behavior. After testing the full models, non-significant structural paths were removed and the more parsimonious models were tested. If applicable, latent variables that were not related to other constructs were retained in the final models in order to test the plausibility of the absence of such relations.

The key predictors of the model (sensitivity and effortful control) are represented as latent variables with multiple indicators. We analyzed sum scores of delinquent and aggressive behaviors instead of using TRF items as indicators to avoid specifying too large a model in relation to sample size. For the sake of uniformity we analyzed these

manifest variables as latent variables with one indicator. When comparable indicators were used over time we allowed the residuals of these variables to correlate. Because the data approximated multivariate normality the models were tested with regular ML estimation. To assess model fit the ratio between χ^2 and degrees of freedom is reported. A ratio smaller than 2.0 indicates a good model fit (Tabachnick & Fidell, 2001). Second, the NNFI and the CFI are reported. If the values of these indices exceed .95 the data fit the model well. Lastly, the RMSEA and its 90% confidence interval are reported. RMSEA values lower than .05 indicate good model fit (Byrne, 2006; Tabachnick & Fidell, 2001).

2.6 Missing Data

Missing data on indicator-level were handled with multiple (10-fold) imputations based on predictive mean matching. Although 91.2% of the families took part in middle childhood and 90.6% took part during adolescence not all data were complete for these groups. The percentage of missing data for the final sample ranged from 0% (measures in infancy) to 26% (TRF, adolescence).

We based the imputation models of the three core constructs of our model on a) background variables such as gender b) indicators or mean of the indicators of all latent model variables, and c) comparable constructs at different points in time or reported by different raters[1].

We calculated the pooled *p*-values of path coefficients according to Rubin (1987). Standardized coefficients and fit-indices were averaged across imputed data sets. The results of the multiple imputation analyses were cross-checked with results based on complete cases only. For results see section 3.2.2 and 3.2.3.

3. Results

3.1 Preliminary Analyses

Preliminary analyses were performed to check for outliers and extreme skewness and kurtosis. One multivariate outlier was removed from the sample prior to imputation and further analysis. This outlier concerned a child that was placed out of the adoptive family at a young age. Table 1 displays the descriptive statistics for the main model variables for the final sample of 159 children. Before performing the central analyses we inspected the correlation matrices of all latent variables for delinquency and aggression (Table 2) and tested the measurement models. We constrained the error-variance of the item 'being distracted easily' (effortful control, middle childhood) and the corresponding error covariance at zero. All indicators loaded on the latent variables of interest and model fit was satisfactory.

[1] Appendix is available upon request from the authors

Table 1. *Descriptives of main model variables N=159*

	Infancy			Middle Childhood			Adolescence		
	M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Sensitivity [a]									
Supportive presence	3.62	1.16	159	2.48	1.63	136	4.76	1.19	128
Clarity of instruction	3.47	1.05	159	2.91	1.62	136	4.09	1.22	128
Sensitivity and timing	3.72	1.09	159	2.71	1.72	136	4.31	1.19	128
Temperament									
Item 12[c] Needs supervising	3.98	1.13	159						
Item 15[c] Touching forbidden things	4.01	1.21	159						
Item 16[c] Trying forbidden things	3.60	1.17	159						
Item 2[c] Distracted easily				4.39	1.39	145	4.73	1.47	137
Item 15[c] Does not stick with activity				5.53	1.20	142	5.59	1.14	136
Item 23 Finishes task				4.13	1.64	142	3.79	1.44	136
Problem behavior [b]									
Delinquency				0.98	1.60	123	1.47	2.33	118
Aggression				5.95	8.25	123	5.55	7.45	118

[a] Not controlled for experimental condition. [b] Not log-transformed. [c] Reversed for sake of interpretation.

Table 2. *Correlation matrix: mean correlations based on 10 imputations*

Variable		1	2	3	4	5	6	7	8	9
Maternal sensitivity	1. Infancy									
	2. Middle childhood	.11								
	3. Adolescence	.28	.23							
Effortful control	4. Infancy	.01	-.09	-.23						
	5. Middle childhood	.00 [a]	-.06	-.12 [a]	.30					
	6. Adolescence	.10	.02	-.17	.37	.70 [a]				
Delinquency	7. Middle childhood	-.02	-.05	.04	-.02	-.07	-.14			
	8. Adolescence	-.06	-.06	-.16	-.10	-.14	-.36	.08		
Aggression	9. Middle childhood	-.04	.01	.10	-.22	-.31	-.35	.54 [b]	.13 [b]	
	10. Adolescence	-.09	-.09	-.10	-.00	-.21	-.48	.16 [b]	.73 [b]	.22

[a] Based on model for delinquency, rounded off correlations for the model for aggression were of maximum .02 lower.
[b] Based on pooled statistics in SPSS.

3.2 Model Testing

3.2.1 Full models. Standardized factor loadings for the latent variables sensitivity and effortful control ranged from .43 to .98[2]. The independence models that tested the hypothesis that the variables were uncorrelated were rejected. Mean fit indices indicated that the full models fitted the data well, for delinquency χ^2/df = 1.33, NNFI = .96, CFI = .97, RMSEA = .05 and for aggression χ^2/df = 1.39, NNFI = .96, CFI = .97, RMSEA = .05 (Table 3). To test for possible moderator effects of gender and level of effortful control in infancy, we calculated Box's M statistics. Results did not indicate any differences in covariance matrices; thus models were similar for boys and girls, and effortful control did not moderate the association between sensitive parenting and externalizing behavior. Therefore no further multiple group analyses were performed.

*3.2.2 Final model delinquency.*The more parsimonious model for delinquency (Figure 1) represented the data well, χ^2/df = 1.28, NNFI = .97, CFI = .98, RMSEA = .04 (Table 3). According to the model a high level of maternal sensitivity in infancy as well as in middle childhood predicted a high level of maternal sensitivity in adolescence. Children's effortful control showed stability over time. Less effortful control in infancy predicted more maternal sensitivity in adolescence. Higher levels of delinquency in adolescence were concurrently predicted by less maternal sensitivity and less effortful control.

Indirectly, more effortful control in middle childhood predicted less delinquent behavior in adolescence through more effortful control in adolescence. There was also an indirect positive path from effortful control in infancy through effortful control in middle childhood to effortful control in adolescence. Across imputed data sets, on average 17% of the variance in delinquency in adolescence was accounted for by the final model. The final model based on multiple imputation was comparable to the final model based on complete cases only.

*3.2.3. Final model aggression.*The more parsimonious model for aggression (Figure 2) represented the data moderately well, χ^2/df = 1.45, NNFI = .95, CFI = .96, RMSEA = .05 (Table 3). According to the model more maternal sensitivity in infancy and in middle childhood both predicted more maternal sensitivity in adolescence. Effortful control showed stability over time. Low levels of effortful control in infancy predicted more maternal sensitivity in adolescence. More effortful control in middle childhood and adolescence both predicted less concurrent aggressive behavior.

Indirectly, more effortful control at seven years predicted less aggression in adolescence through effortful control in adolescence. Effortful control in infancy predicted effortful control in adolescence indirectly through effortful control in middle

[2] Appendix is available upon request from the authors

Table 3. *Fit indices for two structural equation models on delinquency and aggression based on 10 imputations*

Model	*Df*	χ^2		NNFI		CFI		RMSEA		RMSEA 90% CI
		mean	min-max	mean	min-max	mean	min-max	mean	min-max	min – max[a]
Delinquency										
Independence model	193	1960.53	1898.48 – 1992.34							
Model 1 full model	137	181.84	163.62 – 202.22	.96	.95 - .98	.97	.96 - .99	.05	.04 - .06	.00 - .07
Model 2 all non-significant paths eliminated	154	196.85	176.49 – 218.23	.97	.96 - .98	.98	.96 - .99	.04	.03 - .05	.00 - .07
Aggression										
Independence model	193	2004.96	1957.54 - 2037.89							
Model 3 full model	137	190.07	171.43 – 210.63	.96	.94 - .97	.97	.96 - .98	.05	.04 -.06	.02 - .07
Model 4 all non-significant paths eliminated	154	222.89	206.21 – 237.51	.95	.94 - .96	.96	.95 - .97	.05	.05 - .06	.03 - .07

Note. NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; CI = confidence interval. [a] Minimum of lower bound and maximum of upper bound.

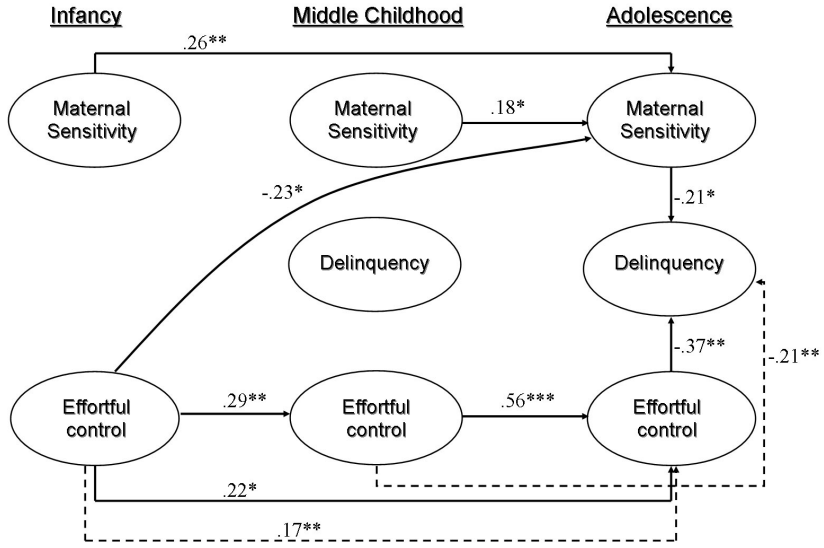

Figure 1. Final structural equation model for delinquency (*N* = 159, 10 imputations)
All non-significant structural paths have been removed from the full model. For the sake of clarity indicators and error covariances are not presented. Delinquency in middle childhood and adolescence are based on one indicator. Dotted lines represent indirect effects. Standardized coefficients are shown.
*p < .05; **p < .01; ***p < .001 (two-tailed).

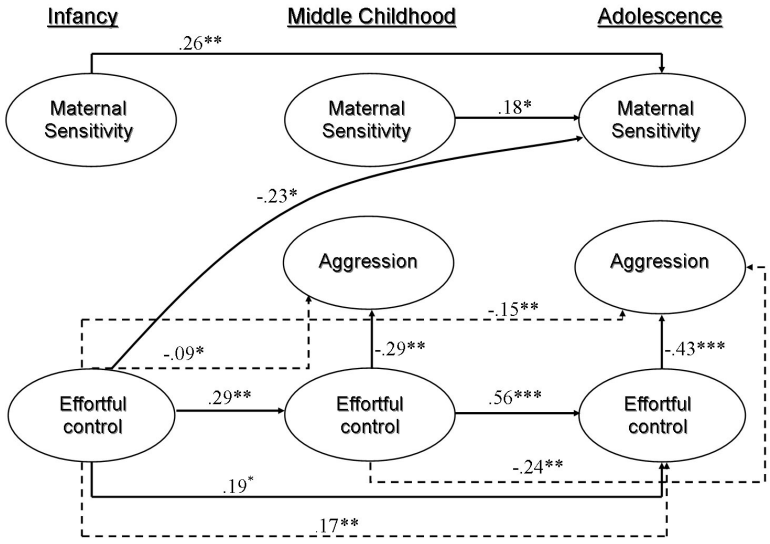

Figure 2. Final structural equation model for aggression (*N* = 159, 10 imputations)
All non-significant structural paths have been removed from the full model. For the sake of clarity indicators and error covariances are not presented. Aggression in middle childhood and adolescence are based on one indicator. Dotted lines represent indirect effects. Standardized coefficients are shown.
*p < .05; **p < .01; ***p < .001 (two-tailed).

childhood. Finally, more effortful control in infancy predicted less aggression in middle childhood, and less aggression in adolescence indirectly through effortful control in middle childhood and adolescence. Across imputed data sets, the final model on average accounted for 19% of the variance in aggression during adolescence. The final model for aggression based on multiple imputation differed slightly from analyses based on complete cases only. The complete data showed a negative relation between sensitivity in adolescence and concurrent aggression, but across the imputed datasets this relation demonstrated some instability and was not significant (p = .11).

4. Discussion

In this longitudinal adoption study we investigated the interplay between children's effortful control and sensitive parenting on the development of aggressive and delinquent behaviors. We found that higher levels of aggressive behavior in middle childhood and both delinquent and aggressive behaviors in adolescence were directly predicted by concurrent lower levels of effortful control and indirectly by lower levels of effortful control seven years earlier. These findings are consistent with the notion that at least some externalizing behavior problems derive from temperamental differences (e.g., Eley et al., 2003; Loeber et al., 2009; Oldehinkel et al., 2004; Olson et al., 2005). In addition, higher levels of concurrent maternal sensitivity predicted less delinquent behavior in adolescence when controlled for the other variables in the model.

Contrary to concurrent sensitivity, earlier sensitivity did not predict delinquency in adolescence, which illustrates the importance of taking concurrent as well as early determinants into account (Lamb, Thompson, Gardner, Charnov, & Connell, 1985), although it complicates the investigation of causality. Associations between concurrent sensitivity and externalizing problems may be predominant because reciprocal processes between parent and child emerge and parent and child get better attuned to each other over time (Sroufe, 2000). This reasoning may apply specifically to adoptive families because there is no genetic resemblance between parent and child.

Aggressive behavior was not associated with parental sensitivity when we took effortful control into account. The more overt aggressive behaviors may be more constitutionally based whereas the more covert delinquent behaviors may be less heritable and more prone to environmental influences (Eley et al., 2003; Stanger et al., 1997). Parenting may thus have more effects on delinquent behavior than on aggressive behavior. In previous studies relations between parenting behaviors and aggression might have been partly explained by genetic resemblance (Moffitt, 2005; Rowe, 1993), a factor that was not present in our sample. Whether the development of aggression and delinquency are really different from each other has yet to be established. In accordance with the literature we decided to analyze the trajectories for aggression

and delinquency separately, thus the models are not nested and statistical conclusions concerning the difference between the models cannot be formulated. Our results however suggest different developmental paths in terms of the role of parenting, with adolescent delinquent behavior but not aggressive behavior being associated with concurrent parental sensitivity. Further research is needed to confirm these findings.

Lower levels of effortful control in infancy predicted more maternal sensitivity in adolescence. Evocative gene-environment correlation may explain this relation: children with less capacity to control their behavior may evoke more sensitive parenting including high quality parental supporting and structuring behaviors, because they need more guidance than children who are able to restrain themselves. Adoptive parents in particular may be more inclined to give this guidance in a situation when a child shows negative behavior because they have been involved in courses and assessments to prepare them for the adoption of a child with possible behavioral difficulties.

Although the indirect effect between effortful control in infancy and delinquency in adolescence in this study was not significant, it is notable that sensitivity may partly serve as a buffer for the effect of low levels of effortful control and difficult temperament in general, on delinquent behavior. This view is consistent with some previous studies (e.g., Jaffari-Bimmel et al., 2006) and supports the idea that good parenting practices can compensate for difficult temperament (Van IJzendoorn & Bakermans-Kranenburg, 2012; Loeber et al., 2009; Sroufe, 1985). It has yet to become clear why this buffering effect would be more stable over a longer period than over a shorter period of time. Increasing reciprocity over time again may explain this delayed attunement.

Children's problem behavior and parental sensitivity in middle childhood did not show the expected stability across time. The observed bivariate correlation between aggressive behavior in middle childhood and adolescence that was present was overruled by the predictive power of concurrent effortful control. This may be further explained by the fact that problem behavior in middle childhood and adolescence were rated by different teachers (Verhulst et al., 1997). Verhulst and colleagues (1997, p. 67) for example found a modest stability of delinquency (r = .25) when a time interval of 8 years was used. It may also be the case that middle childhood is a qualitatively different and understudied developmental period in which child and parenting dimensions may have been operationalized less adequately than at earlier and later assessments. Especially in attachment theory and research there is a deplorable lack of age-adequate validated measures for middle childhood (Solomon & George, 2008).

Effortful control did not mediate the relation between sensitivity and externalizing behaviors. It is possible that a mediating process such as reported by Eisenberg and colleagues (2005) is confounded with genetic make-up, a factor ruled out in our adoption study. When interpreting the lack of differential models for children with low versus high levels of effortful control, we should keep in mind that previous studies on differential susceptibility mainly paid attention to other dimensions of temperament

such as inhibition and irritability (Van IJzendoorn & Bakermans-Kranenburg, 2012).

Boys and girls did not show distinctive developmental models of aggression and delinquency. It is not surprising that parenting and effortful control have similar effects on externalizing behaviors for both genders (Eisenberg et al., 2005; Olson et al., 2005), regardless of the mean level differences between boys and girls on externalizing behaviors that often have been found (e.g., De Haan et al., 2010; Eisenberg et al., 2005; Stanger et al., 1997) and that were also present in our study.

Several limitations of our study should be mentioned. First, our adoptive sample may not be representative of the general population. Yet, our primary goal was to unravel non-genetic associations between parent and child behavior. Although no comparison group of non-adopted children was available, our findings suggest a relation between sensitivity and delinquency and this relation may be seemingly stronger in normative populations due to genetic ties between parents and children. Additionally, some of the demonstrated associations are supported by previous research (e.g., Hoeve et al., 2009; Olson et al., 2005). Second, although the longitudinal design allowed us to draw solid conclusions regarding the direction of associations, it is still possible that parental behavior was affected by the concurrent delinquent behavior of the child (Loeber et al., 2009) instead of the other way around. However, previous research on externalizing behaviors has suggested that child effects may be less strong than parent effects (Eisenberg et al., 2005). In addition, our measures did not reflect direct interactions between parent and child, because child behavior was based on teacher report. Sensitive parenting may have a more profound and cross-contextual effect on child behavior than vice versa for example through support of emotion regulation and the modeling of emphatic behavior (Kawabata et al., 2011; Van IJzendoorn, 1997). Finally, effortful control was based on mother report and not measured with behavioral observations. Future studies can reveal whether observational measures and parent report of effortful control yield comparable outcomes.

5. Conclusion

We conclude that lower levels of effortful control in children predict more symptoms of delinquency as well as aggression. In addition to temperamental factors, maternal sensitive parenting in adolescence seems to lower the risk for the development of delinquent behavior even when common genetics between parents and their children are absent (as was the case in this adoption study). Sensitive parenting may therefore not only be important in early years when children are forming attachment relationships with their primary caregivers, but also in later life for the prevention or reduction of antisocial behaviors. Preventive interventions for at risk groups and adoptive families may incorporate this insight illustrating the need for continuous family support from

early childhood to adolescence. In many countries, adoptive families receive some support prior to and during the first period of the adoption process, but it may be important to continue this support throughout the years. Specifically, in adolescence brief interventions promoting parental sensitivity may be effective to prevent delinquent behavior of the adopted child.

6. Highlights

- Low effortful control predicts externalizing problems in (adopted) adolescents.
- Less effortful control in infancy predicts more parental sensitivity in adolescence.
- Sensitive parenting may lower the risk of delinquency for (adopted) adolescents.

References

Achenbach, T. M. (1991). *Manual for the Teacher's Report Form and 1991 profiles*. Burlington, VT: University of Vermont, Department of Psychiatry.

Ainsworth, M. D., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment. A psychological study of the Strange Situation.* Hillsdale, NJ: Erbaum.

Bakermans-Kranenburg, M. J. & Van IJzendoorn, M. H. (2006). Gene-environment interaction of the dopamine D4 receptor (DRD4) and observed maternal insensitivity predicting externalizing behavior in preschoolers. *Developmental Psychobiology, 48*, 406-409. doi:10.1002/dev.20152

Bates, J. E., Freeland, C. A. B., & Lounsbury, M. L. (1979). Measurement of infant difficultness. *Child Development*, *50*, 794-803.

Belsky, J., Hsieh, K. H., & Crnic, K. (1998). Mothering, fathering, and infant negativity as antecedents of boys' externalizing problems and inhibition at age 3 years: Differential susceptibility to rearing experience? *Development and Psychopathology*, *10,* 301-319.

Bentler, P. M. (1995). *EQS structural equations program manual*. Encino, CA: Multivariate Software, Inc.

Bierman, K. L., Nix, R. L., Greenberg, M. T., Blair, C., & Domitrovich, C. E. (2008). Executive functions and school readiness intervention: Impact, moderation, and mediation in the Head Start REDI program. *Development and Psychopathology, 20,* 821-843.

Bimmel, N., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Juffer, F., & De Geus, E. J. C. (2008). Problem behavior and heart rate reactivity in adopted adolescents: Longitudinal and concurrent relations. *Journal of Research on Adolescence, 18*, 201-213.

Bowlby, J. (1973). *Attachment and Loss. Vol. 2: Separation.* New York: Basic Books.

Burt, S. A., Donnellan, M. B., Iacono, W. G., & Mcgue, M. (2011). Age-of-onset or behavioral sub-types? A prospective comparison of two approaches to characterizing the heterogeneity within antisocial behavior. *Journal of Abnormal Child Psychology, 39,* 633-644. doi:10.1007/s10802-011-9491-9

Byrne, B. M. (2006). *Structural Equation Modeling with EQS, basic concepts, applications and programming* (2nd edition). Thousand Oaks, CA: Sage

Caspi, A. & Silva, P. A. (1995). Temperamental qualities at age-3 predict personality-traits in young adulthood - longitudinal evidence from a birth cohort. *Child Development, 66,* 486-498.

De Haan, A. D., Prinzie, P., & Deković, M. (2010). How and why children change in aggression and delinquency from childhood to adolescence: moderation of overreactive parenting by child personality. *Journal of Child Psychology and Psychiatry, 51,* 725-733. doi:10.1111/j.1469-7610.2009.02192.x

Egeland, B., Erickson, M. F., Clemenhagen-Moon, J., Hiester, M. K., & Korfmacher, J. (1990). *24 months tools coding manual*. Project STEEP-revised 1990 from mother-child project scales.

Eisenberg, N., Zhou, Q., Spinrad, T. L., Valiente, C., Fabes, R. A., & Liew, J. (2005). Relations among positive parenting, children's effortful control, and externalizing problems: A three-wave longitudinal study. *Child Development, 76,* 1055-1071.

Eley, T. C., Lichtenstein, P., & Moffitt, T. E. (2003). A longitudinal behavioral genetic analysis of the etiology of aggressive and nonaggressive antisocial behavior. *Development and Psychopathology, 15,* 383-402.

Ellis, B. J., Boyce, W. T., Belsky, J., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2011). Differential susceptibility to the environment: An evolutionary-neurodevelopmental theory. *Development and Psychopathology, 23*, 7-28. doi:10.1017/S0954579410000611

Erickson, M. F., Sroufe, L. A., & Egeland, B. (1985). The relationship between quality of attachment and behavior problems in preschool in a high-risk sample. In I. Bretherton & E. Waters (Eds.), Growing points at attachment: Theory and research. *Monographs of the Society for Research in Child Development*, *50*, 147-166. Chicago, IL: University of Chicago Press.

Haugaard, J. J. & Hazan, C. (2003). Adoption as a natural experiment. *Development and Psychopathology, 15*, 909-926.

Hoeve, M., Dubas, J.S., Eichelsheim, V. I., Van der Laan, P. H., Smeenk, W., & Gerris, J. R. M. (2009). The relationship between parenting and delinquency: A meta-analysis. *Journal of Abnormal Child Psychology, 37*, 749-775. doi:10.1007/s10802-009-9310-8

Jaffari-Bimmel, N., Juffer, F., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Mooijaart, A. (2006). Social development from infancy to adolescence: Longitudinal and concurrent factors in an adoption sample. *Developmental Psychology, 42*, 1143-1153. doi:10.1037/0012-1649.42.6.1143

Jaffari-Bimmel, N., Juffer, F., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2004) *Problem behavior of internationally adopted adolescents: Do behavior problems in middle childhood predict later maladjustment?* Poster presented at the SRA Biennial Meeting, Baltimore, MD.

Juffer, F. (1993). *Verbonden door adoptie. Een experimenteel onderzoek naar hechting en competentie in gezinnen met een adoptiebaby*. (Attached through adoption. An experimental study on attachment and competence in families with an adopted baby.) Amersfoort, The Netherlands: Academic Press.

Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2005). The importance of parenting in the development of disorganized attachment: Evidence from a preventive intervention study in adoptive families. *Journal of Child Psychology and Psychiatry, 46*, 263-274. doi:10.1111/j.1469-7610.2004.00353.x

Juffer, F., & Van IJzendoorn, M. H. (2005). Behavior problems and mental health referrals of international adoptees. *JAMA, Journal of the American Medical Association, 293,* 2501- 2515.

Kawabata, Y., Alink, L. R. A., Tseng, W. L., Van IJzendoorn, M. H., & Crick, N. R. (2011). Maternal and paternal parenting styles associated with relational aggression in children and adolescents: A conceptual analysis and meta-analytic review. *Developmental Review, 31*, 240-278. doi:10.1016/j.dr.2011.08.001

Kochanska, G. & Knaack, A. (2003). Effortful control as a personality characteristic of young children: Antecedents, correlates, and consequences. *Journal of Personality, 71*, 1087-1112.

Kohnstamm, G. A. (1984, April 4-7). *Bates' Infant Characteristics Questionnaire (ICQ) in the Netherlands*. Paper presented at the fourth biennial International Conference on Infant Studies, New York, NY.

Lamb, M. E., Thompson, R. A., Gardner, W., Charnov, E. L., & Connell, J. P. (1985). *Infant-mother attachment: The origins and developmental significance of individual differences in Strange Situation behavior.* Hillsdale, N.J.: Lawrence Erlbaum.

Loeber, R., Burke, J. D., & Pardini, D. A. (2009). Development and etiology of disruptive and delinquent behavior. *Annual Review of Clinical Psychology, 5*, 291-310. doi:10.1146/annurev.clinpsy.032408.153631

Loeber, R. & Hay, D. (1997). Key issues in the development of aggression and violence from childhood to early adulthood. *Annual Review of Psychology, 48,* 371-410.

Moffitt, T. E. (1993). Adolescence-limited and life-course-persistent antisocial behavior: A developmental taxonomy. *Psychological Review, 100*, 674-701.

Moffitt, T. E. (2005). The new look of behavioral genetics in developmental psychopathology: Gene-environment interplay in antisocial behaviors. *Psychological Bulletin, 131*, 533-554.

Oldehinkel, A. J., Hartman, C. A., de Winter, A. F., Veenstra, R., & Ormel, J. (2004). Temperament profiles associated with internalizing and externalizing problems in preadolescence. *Development and Psychopathology, 16*, 421-440. doi:10.1017/S0954579404044591

Olson, S. L., Sameroff, A., Kerr, D. C. R., Lopez, N. L., & Wellman, H. M. (2005). Developmental foundations of externalizing problems in young children: The role of effortful control. *Development and Psychopathology, 17*, 25-45. doi:10.1017/S0954579405050029

Patterson, G. R. (1982). *A social learning approach, Vol 3: Coercive family process.* Eugene, OR: Castalia Publ.

Rosenboom, L. G. (1994). *Gemengde gezinnen, gemengde gevoelens? Hechting en competentie van adoptiebaby's in gezinnen met biologisch eigen kinderen.* (Mixed families, mixed feelings? Attachment and competence of adopted babies in families with biological children). Doctoral dissertation, Utrecht University, Utrecht, The Netherlands.

Rosnati, R., Montirosso, R., & Barni, D. (2008). Behavioral and emotional problems among Italian international adoptees and non-adopted children. Father's and mother's reports. *Journal of Family Psychology, 22,* 541-549. doi: 10.1037/0893-3200.22.3.541

Rothbart, M. K. & Bates, J.E. (2006). Temperament. In W. Damon, R. Lerner, & N. Eisenberg (Eds.), *Handbook of child psychology. Vol. 3: Social, emotional, and personality development* (6th edition, pp. 99-166). New York: Wiley.

Rothbart, M. K., Sheese, B. E., & Posner, M. I. (2007). Executive attention and effortful control: Linking temperament, brain networks, and genes. *Child Development Perspectives, 1*, 2-7.

Rothbaum, F. & Weisz, J. R. (1994). Parental caregiving and child externalizing behavior in nonclinical samples - A meta-analysis. *Psychological Bulletin, 116*, 55-74.

Rowe, D. C. (1993). Genetic perspectives on personality. In R. Plomin & G. E. McClearn (Eds.), *Nature, nurture, and psychology* (pp. 179–195). Washington, DC: American Psychological Association.

Rubin, D. B. (1987). *Multiple imputation for nonresponse in surveys*. New York: Wiley.

Sameroff, A. J. & MacKenzie, M. J. (2003). Research strategies for capturing transactional models of development: The limits of the possible. *Development and Psychopathology, 15,* 613-640. doi:10.1017/S0954579403000312

Solomon, J., & George, C. (2008). The measurement of attachment security and related constructs in infancy and early childhood. In J. Cassidy & P.R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 552–598). New York: Guilford Press.

Sroufe, L. A. (1985). Attachment classification from the perspective of infant-caregiver relationships and infant temperament. *Child Development, 56*, 1-14.

Sroufe, L. A. (2000). Early relationships and the development of children. *Infant Mental Health Journal, 21,* 67-74.

Sroufe, L. A., Egeland, B., Carlson, E. A., & Collins, W. A. (2005). *The development of the person: The Minnesota study of risk and adaptation from birth to adulthood*. New York, NY: Guilford Publications.

Stams, G. J. J. M., Juffer, F., Rispens, J., & Hoksbergen, R. A. C. (2000). The development and adjustment of 7-year-old children adopted in infancy. *Journal of Child Psychology and Psychiatry, 41,* 1025-1037.

Stams, G. J. J. M, Juffer, F., & Van IJzendoorn, M. H. (2002). Maternal sensitivity, infant attachment, and temperament in early childhood predict adjustment in middle childhood: The case of adopted children and their biologically unrelated parents. *Developmental Psychology, 38,* 806-821. doi:10.1037//0012-1649.38.5.806

Stanger, C., Achenbach, T. M., & Verhulst, F. C. (1997). Accelerated longitudinal comparisons of aggressive versus delinquent syndromes. *Development and Psychopathology, 9,* 43-58.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Boston: Allyn & Bacon.

Van IJzendoorn, M. H. (1997). Attachment, emergent morality, and aggression: Toward a developmental socioemotional model of antisocial behavior. *International Journal of Behavioral Development, 21*, 703-727.

Van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2012). Integrating temperament and attachment: The differential susceptibility paradigm. In Zenter, M., Shiner, R. L. (Eds.), *Handbook of temperament.* New York: Guilford Press.

Van IJzendoorn, M. H., & Juffer, F. (2006). The Emanuel Miller Memorial Lecture 2006: Adoption as intervention. Meta-analytical evidence for massive catch-up and plasticity in physical, socio-emotional, and cognitive development. *Journal of Child Psychology and Psychiatry, 47,* 1228-1245. doi: 10.1111/j.1469-7610.2006.01675.x

Verhulst, F. C., Althaus, M., & Versluis-den Bieman, H. J. M. (1990). Problem behavior in international adoptees: I. An epidemiological study. *Journal of American Academy of Child and Adolescent Psychiatry, 29,* 94-103.

Verhulst, F. C., Van der Ende, J., & Koot, H. M. (1997). *Handleiding voor de Teacher's Report Form-TRF*. (Manual for the Teacher's Report Form-TRF, Dutch version.) Rotterdam, The Netherlands: Erasmus University Rotterdam.

3

The development of adolescents' internalizing behavior: Longitudinal effects of maternal sensitivity and child inhibition.

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Abstract

Internalizing symptoms such as withdrawn and anxious-depressed behavior are common in adolescence. This prospective longitudinal study helps to gain insight into the development of internalizing behavior, focusing on the role of early parent-child interaction while ruling out genetic similarity as a confounder. More specifically, the central question addressed in this study was whether parental sensitivity and child inhibited temperament predict children's withdrawn and anxious-depressed behavior in middle childhood and adolescence. We followed 160 early-adopted children (53% girls) from infancy to adolescence. Structural equation modeling was used to test relationships both prospectively and concurrently. The results revealed that more sensitive parenting in infancy and middle childhood predicted less inhibited behavior in adolescence, which in turn predicted fewer internalizing problems in adolescence. The findings suggest that maternal sensitivity lowers adolescents' inhibited behavior and decreases the risk for adolescents' internalizing problem behavior indirectly through lower levels of inhibition. Supporting sensitive parenting in the years before adolescence may protect children from developing inhibited behavior and internalizing behavior problems in adolescence.

Keywords: Withdrawn behavior, anxious-depressed behavior, internalizing problems, sensitive parenting, inhibition, adoption, adolescence.

1. Introduction

Internalizing behavior problems often have been associated with biological origins because of their considerable degree of stability over time (Burgess, Rubin, Cheah, & Nelson, 2005) and high heritability estimates in behavioral genetic studies (e.g., Boomsma, Beijsterveldt, & Hudziak, 2005; Hoekstra, Bartels, Hudziak, Van Beijsterveldt, & Boomsma, 2008). However, stability and heritability estimates are far from perfect and environmental factors such as parenting seem to contribute to developmental changes in internalizing behavior problems as well. The mechanisms underlying the relationship between parenting and internalizing problems have not yet been uncovered completely, and longitudinal research may shed more light on the direction of the effects, and the time lapse between them. Importantly, in such studies one should take into account that genetic similarity of biological parent-child dyads could act as a confounding variable (see for reviews Rubin, Coplan, & Bowker, 2009; Wood, McLeod, Sigman, Hwang, & Chu, 2003). In the current longitudinal study covering the time span from infancy to adolescence, we investigated the development of children's internalizing behavior, including early as well as concurrent child temperamental inhibition and maternal sensitivity. By examining adoptive families we ruled out shared genetics between parents and children.

Internalizing symptoms are common in childhood and tend to increase in adolescence (Buck & Dix, 2012; Degnan, Almas, & Fox, 2010). Children with high levels of internalizing behavior are characterized by anxious, shy, withdrawn and depressed behavior and are at risk for developing serious adaptational problems in later life (Colman, Wadsworth, Croudace, & Jones, 2007). Two categories of internalizing behavior often are distinguished: withdrawn behavior and anxious-depressed behavior (Achenbach, 1991; Verhulst, Van der Ende, & Koot, 1997). The former denotes more shy and detached behavior, the latter points to fearfulness and feelings of sadness. Previous research has demonstrated that it is beneficial to study these specific types of internalizing problems separately (e.g., Booth-LaForce & Oxford, 2008; Lamb et al., 2010). Therefore, in order to better understand the development of internalizing problems of adolescents, we decided to investigate withdrawn and anxious-depressed behavior independently instead of using a broadband measure of internalizing behavior.

1.1 Predictors of Internalizing Problems: Temperamental Inhibition

One way to shed light on the development of withdrawn and anxious-depressed behavior is the examination of associations with specific temperamental traits (e.g., Klein, Dyson, Kujawa, & Kotov, 2012). Behavioral inhibition is the temperamental disposition to be wary and fearful when encountering unfamiliar situations. It is a relatively broad construct that encompasses inhibition toward unfamiliar children and adults, in situations of separation, and in unfamiliar situations and environments

(Kagan, 2012; Zentner & Bates, 2008). Behavioral inhibition is one of the most stable individual characteristics in personality development and may be a precursor of withdrawn and anxious behavior later in life. Behaviorally inhibited children seem to be at risk for developing anxiety disorders (see for a review Degnan et al., 2010). However, studies unraveling the role of temperament in the development of anxiety and mood disorders during adolescence are scarce (Fox, Henderson, Marshall, Nichols, & Ghera, 2005). In the current study, we examined the role of behavioral inhibition in the development of internalizing problems in adolescence.

1.2 Predictors of Internalizing Problems: Parental Sensitivity

In addition to temperamental characteristics, environmental factors may contribute to the development of children's internalizing behavior problems. Parenting is one of the most salient environmental factors in a child's life, and in particular (in-) sensitive parenting may be of interest when studying the development of internalizing problems. Sensitive caregivers are able to perceive their child's signals in an accurate way and react promptly and adequately, and thereby promote a secure attachment relationship with their child (Ainsworth, Blehar, Waters, & Wall, 1978). Sensitive parenting has been shown to predict positive developmental outcomes in the social-emotional domain (Jaffari-Bimmel, Juffer, Van IJzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006; Roisman & Frailey, 2012a; Sroufe, Egeland, Carlson, & Collins, 2005) and in the cognitive domain (Roisman & Fraley, 2012a) and has been associated with fewer internalizing problems in children (Kok et al., 2013). Sensitive parents may buffer the development of children's internalizing behavior by helping their child cope with feelings of anxiety and the tendency to withdraw in threatening situations (Gillissen, Koolstra, Van IJzendoorn, Bakermans-Kranenburg, & Van der Veer, 2007). In addition, children with insensitive parents are more likely to form an insecure attachment relationship with their parents. They tend to develop negative self-perceptions and are more unpredictable in their future relationships (Sroufe et al., 2005). The continuous quality of the relationship with the parent and the child's internal working model of that relationship both may consolidate the development of internalizing problems (Booth-LaForce & Oxford, 2008).

Although results from pertinent studies confirm an association between less optimal parenting and lower levels of children's internalizing behavior problems, the strength of this association seems to be modest. In two meta-analyses, parenting explained 4% of the variance of childhood anxiety (McLeod, Wood, & Weisz, 2007) and 8% of the variance of childhood depression (McLeod, Weisz, & Wood, 2007), and the relationship between internalizing problems and parenting varied between different parenting dimensions. Research that focused on the effects of sensitive parenting found small to modest associations with internalizing problems (Kok et al., 2013; Roisman & Fraley, 2012b). It is important to shed more light on the relationship between sensitive

parenting and internalizing problems and to unravel underlying mechanisms that explain this association.

1.3 Predictors of Internalizing Problems: The Interplay between Sensitivity and Temperamental Inhibition

Inhibited temperament and parenting can be seen as two separate factors that contribute to the development of children's internalizing behaviors, but their interplay also may be important (Burgess et al., 2005). It seems plausible that parenting does not affect children's internalizing problems directly, but indirectly through behavioral inhibition that is a precursor of more serious internalizing problems. Although inhibited behavior is a relatively stable personality trait, it has become clear that it is open to change over time, and that environmental factors such as parenting do affect child inhibition (Bates, Schermerhorn, & Petersen, 2012; Kagan, 2012; Rubin et al., 2009). One of the main challenges for children with a history of behavioral inhibition is to learn to regulate their emotions (Fox et al., 2005). Sensitive parents support the process of emotion regulation in their children (Kawabata, Alink, Tseng, Van IJzendoorn, & Crick, 2011). On top of that, sensitive parents show their children that communication is a reciprocal and responsive process. They model interactional skills (Weinfield, Sroufe, Egeland, & Carlson, 2008) that are essential for preventing or overcoming inhibited behavior. Although sensitive parenting is associated with less child inhibition, over-solicitous parenting behavior may maintain the inhibited behavior of a child. The bottom line seems to be that sensitive parents are aware that it is important to stimulate children to master their environment whenever possible and appropriate, and to support and structure their behavior when needed. In doing exactly this, sensitive parents encourage and support their child and stimulate the child's independence (Degnan et al., 2010; Fox et al., 2005).

Apart from indirect effects from parental sensitivity to internalizing behavior through behavioral inhibition, transactional processes starting early in life should be considered (Sameroff & MacKenzie, 2003; Sroufe et al., 2005). The inhibited behavior of a child may evoke more (often well-intended) high-control parenting strategies such as over-involved, insensitive and over-controlling parenting, which reinforces the insecurity of the child (Burgess et al., 2005; Rubin et al., 2009). Therefore, it is essential to include the interplay between parenting behaviors and temperamental inhibition in studies of the development of internalizing behavior problems.

2. The Present Study

The aim of the Leiden Longitudinal Adoption Study is to examine the effects of the early parent-child relationship on the development of children. By studying parent-

child dyads without a biological relation, we are able to rule out genetic resemblance as a confounder. All children in our sample were adopted at a very young age (mean age at arrival 10.76 weeks; SD = 5.53), which means that effects of early deprivation are minimized. A previous study conducted on this sample focused on developmental outcomes in middle childhood (Stams, Juffer, & Van IJzendoorn, 2002). This study reported that early mother-infant interactions predicted later social-emotional and cognitive development, over and above the effect of infant temperament. In more recent work, we focused on developmental outcomes in adolescence, such as social development (Jaffari-Bimmel et al., 2006) and externalizing problems (Van der Voort, Linting, Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2013). The aim of the current study is to expand this body of research by examining the precursors of internalizing behavior in adolescence. We specifically focus on the contributions of children's temperamental inhibition and observed sensitive parenting.

The unique contribution of our study is that three important methodological challenges are met. First, the longitudinal design covering early infancy to adolescence allows for the inclusion of transactional processes between preceding and concurrent parenting and child factors. Second, because the adopted children in our study are not genetically related to their adoptive parents, associations between parenting and child behavior are not confounded with common genetic make-up. Third, maternal sensitivity is measured through behavioral observations, which means that we were able to exclude rater covariance between parenting behavior and child behavior.

We hypothesize that higher levels of children's behavioral inhibition are associated with concurrent and future higher levels of withdrawn as well as anxious-depressed behavior. We also expect that more maternal sensitivity predicts lower levels of withdrawn and anxious-depressed child behavior, and that this prediction is partly explained by an indirect effect through the ameliorating effect of maternal sensitivity on behavioral inhibition.

3. Method

3.1 Participants

We followed 160 internationally adopted children, 75 boys and 85 girls, from infancy to adolescence. The children and their families originated from two samples of early-adopted children. The first sample involved 90 families without biological children (Juffer, 1993), the second sample involved 70 families who already had one or more biological or adopted children (Rosenboom, 1994).

All adoptive families were randomly recruited through Dutch adoption organizations. The children were born in Sri Lanka (n = 86), South Korea (n = 49), or Colombia (n = 25). In Korea and Colombia children were in private children's homes prior to adoption,

children from Sri Lanka remained with their birth mother until the adoption. The children's mean age at arrival was 10.76 weeks (*SD* = 5.53). For 124 children the health condition at arrival was good, 29 children displayed a mediocre health, and seven children were in poor health (Juffer, 1993; Rosenboom, 1994).

All children were placed in Caucasian families with predominantly middle-class or upper-class backgrounds with the adoptive mother as the primary caregiver (for more details, see Juffer, 1993; Rosenboom, 1994; Stams et al., 2002). When the children were between 6 and 9 months of age, 50 randomly selected families received a short-term intervention that promoted maternal sensitivity (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2005) and predicted fewer internalizing behavior problems at 7 years (Stams, Juffer, Van IJzendoorn, & Hoksbergen, 2001). In the current analyses we controlled for the short-term intervention effects on maternal sensitivity and internalizing behavior (see below) as we did in previous reports on this sample (e.g., Van der Voort et al., 2013).

3.2 Procedure

During infancy, we visited the families at home to administer questionnaires, and implement the intervention for the intervention group. The participants came to the laboratory and we assessed maternal sensitivity during mother-child interaction. At age 7 years, we visited families at home to observe mother-child interaction, to interview the mother, and to administer questionnaires. At age 14 years, we visited the families at home again to observe mother-adolescent interaction, to interview the adolescent and the adoptive parent, and to administer tasks and questionnaires. Ethical guidelines were followed throughout the study.

3.3 Attrition

Of the 160 families that participated in infancy 146 families participated in middle childhood and 146 families participated in adolescence. Only three families participated neither in middle childhood nor in adolescence. Lack of time, death of the adoptive mother, lack of interest, and health problems in the family were amongst the reasons for attrition (for details see Jaffari-Bimmel et al., 2006; Stams et al., 2002). Bonferroni corrected tests confirmed the absence of selective attrition with respect to background variables and core constructs such as temperament and sensitivity (see Jaffari-Bimmel et al., 2006).

3.4 Measures

3.4.1 Maternal sensitivity. At 12, 18, and 30 months, mother's sensitive behavior was assessed during structured tasks with the child (building a tower or solving puzzles) in the laboratory. The Egeland/Erickson 7-point sensitivity rating scales (Egeland, Erickson, Clemenhagen-Moon, Hiester, & Korfmacher, 1990; Erickson, Sroufe, & Egeland, 1985)

were used to rate supportive presence, intrusiveness, sensitivity and timing, and clarity of instruction. The averaged Cohen's kappa's for agreement within one scale point were .91 (12 months), .90 (18 months), and .97 (30 months) (Stams et al., 2002). For the current study on children's withdrawn and anxious-depressed behavior we were interested in maternal supporting and structuring behavior represented by the scales supportive presence, sensitivity and timing, and clarity of instruction (see also Van der Voort et al., 2013). All scales were based on the average of the raw scores at 12, 18, and 30 months.

To ensure age-appropriateness of the sensitivity assessments at 7 and 14 years we used more difficult tasks (e.g., Tangram puzzles) and took into account the more verbal nature of the interaction between mother and child at these ages, compared to the more physical interaction in infancy (Jaffari-Bimmel et al., 2006; Stams et al., 2002). Kappas ranged from .92 to .96 at 7 years (Stams et al., 2002), intraclass correlations ranged from .91 to .95 at 14 years (Jaffari-Bimmel et al., 2006). To control for the intervention effect (Juffer et al., 2005) we regressed maternal sensitivity on the experimental variable (experimental versus control group). The residual sensitivity scores centered at the original mean were used in further analyses.

3.4.2 Behavioral inhibition. At 12, 18, and 30 months, temperament was assessed with the Dutch Temperament Questionnaire (Kohnstamm, 1984), an adaptation of the Infant Characteristics Questionnaire (Bates, Freeland, & Lounsbury, 1979). Mothers rated their child's behavior on 19 seven-point rating scales. For this study we were especially interested in the three items that focused on inhibited behavior: (A) being shy in reaction to unfamiliar people, (B) being shy in reaction to a novel environment without the presence of mother or father, and (C) finding it difficult to adapt to new circumstances. For each of these three items, we used the average of the raw scores from the 12, 18, and 30 month measurements. Cronbach's alpha for behavioral inhibition in infancy was .83.

At 7 and 14 years, mothers completed age-adapted versions of the DTQ, consisting of 27 items. At these ages, the three items that measured behavioral inhibition were: (D) is friendly to, and easily approaches unfamiliar visitors (reversed), (E) easily approaches unfamiliar children / youth (reversed), and (F) is shy in the presence of unfamiliar children / people. Cronbach's alphas for the inhibition scales were .72 at 7 years and .84 at 14 years. In our model the individual items of behavioral inhibition were used as indicators, with high scores representing high levels of inhibited behavior. In the case of three adolescents, mother report was not available, but father report was, and therefore father report was used.

*3.4.3 Internalizing behavior***.** When the children were 7 and 14 years old, mothers completed the Child Behavior Checklist (CBCL). The CBCL contains 113 descriptions of

problem behavior that are rated on a three-point scale (Achenbach, 1991; Verhulst et al., 1997). Two syndromes were derived from the CBCL: withdrawn behavior (sum of 9 items) and anxious-depressed behavior (sum of 14 items). The CBCL internalizing scales differed from the inhibition scales. The items of behavioral inhibition point to reactions to unknown persons or novel situations, for example: 'easily approaches unfamiliar children' (reversed). The withdrawn and anxious items of the CBCL point to internalizing behavior in general, for example: 'prefers to be alone'. Cronbach's alphas for withdrawn and anxious-depressed behavior were .59 and .81, respectively, at 7 years, and .76 and .87 at 14 years. According to the CBCL manual, one item (feeling sad and unhappy) belonged to the withdrawn as well as the anxious-depressed scale (Verhulst et al., 1997). We decided to keep the item in both syndrome-scales for comparability with other studies. In the case of five adolescents, mother report was not available, but father report was, and therefore father report was used. In our study, boys showed significantly more internalizing problems than girls in middle childhood (Stams, Juffer, Rispens, & Hoksbergen, 2000). We did not find significant mean differences between adolescent boys and girls, $p > .05$.

CBCL scale scores were log-transformed to reduce skewness. The transformed scores of withdrawn behavior ranged from 0 to 0.95 ($M = 0.41$, $SD = 0.27$, $N = 146$) at 7 years and from 0 to 1.04 ($M = 0.43$, $SD = 0.32$, $N = 146$) at 14 years. The transformed scores of anxious-depressed behavior ranged from 0 to 1.34 ($M = 0.51$, $SD = 0.34$, $N = 146$) at 7 years and from 0 to 1.30 ($M = 0.49$, $SD = 0.37$, $N = 146$) at 14 years.

To control for the intervention effect on internalizing problems (Stams et al., 2001), we regressed internalizing problems on the experimental variable (experimental versus control group). The residual scores were used in further analyses.

3.5 Statistical Analyses

We tested structural equation models for maternal sensitivity, behavioral inhibition and internalizing behavior with EQS 6.1 for Windows (Bentler, 1995). We first tested the basic model for maternal sensitivity and child behavioral inhibition. Based on this model, we then formulated two separate models for children's withdrawn behavior and anxious-depressed behavior. All models were tested in two stages. In the first stage, full models were tested with predictive relations between all constructs and, if applicable, concurrent predictions from maternal sensitivity and behavioral inhibition to problem behavior. In the second stage, non-significant structural paths were removed and the more parsimonious models were tested.

The key predictors of the model were latent variables with multiple indicators. When comparable indicators were used over time we allowed the residuals of these variables to correlate. To avoid the specification of a too large model in relation to our sample size, we analyzed withdrawn and anxious-depressed behavior as manifest variables (sum scores across items) instead of using separate items as indicators. The

data did not show significant multivariate kurtosis; therefore regular ML estimation was used. Any meaningful difference in significance of paths between robust estimation and regular ML estimation is reported. To assess model fit, the χ^2 and the ratio between χ^2 and degrees of freedom are reported. A ratio smaller than 2.0 indicates a good model fit (Tabachnick & Fidell, 2001). Also the NNFI and the CFI are reported. If the values of these indices exceed .95 the data fit the model well. Lastly, the RMSEA and its 90% confidence interval are reported. RMSEA values < .05 indicate good model fit (Byrne, 2006; Tabachnick & Fidell, 2001). To compare nested models, we used the χ^2 difference test, *p*-values > .05 indicate that there is no significant difference between two nested models (Byrne, 2006; Tabachnick & Fidell, 2001).

Missing data on indicator-level were handled with ML imputation in EQS. To ensure the appropriate parameter estimates for the sample size we used observed values to estimate standard errors instead of expected values (Savalei, 2010). The percentage of missing data for the final models ranged from 0% (measures in infancy) to 20% (sensitivity in adolescence) (see Table 1).

Table 1. *Descriptives of Model Variables N = 160*

		Infancy			Middle Childhood			Adolescence		
		M	*SD*	*n*	*M*	*SD*	*n*	*M*	*SD*	*n*
Sensitivity										
Supportive presence		3.60	1.16	160	2.48	1.63	136	4.76	1.19	128
Clarity of instruction		3.45	1.06	160	2.91	1.62	136	4.09	1.22	128
Sensitivity and timing		3.71	1.09	160	2.71	1.72	136	4.31	1.19	128
Temperament										
Item A	Shy reaction strangers	3.11	1.07	160						
Item B	Shy reaction novel environment	3.84	1.21	157						
Item C	Difficult to adapt to new circumstances	2.17	0.87	160						
Item D[1]	Easily approaches strangers				2.90	1.67	146	3.18	1.64	137
Item E[1]	Easily approaches unfamiliar children / youth				3.37	1.67	144	3.58	1.67	138
Item F	Shy in presence of unfamiliar people				3.30	1.61	143	3.45	1.75	138
Problem behavior										
Withdrawn behavior					2.04	1.85	146	2.49	2.64	146
Anxious depressed behavior					3.37	3.46	146	3.45	4.00	146

[1] Reversed for sake of interpretation.
Note. Descriptives for sensitivity and problem behavior are based on original (untransformed and uncorrected) values.

4. Results

4.1 Preliminary Analyses

Table 1 represents the descriptive statistics of all main model variables. Preliminary analyses were performed to check for outliers and examine skewness and kurtosis. Prior to analyses we detected one multivariate outlier that was however retained because it was no longer an outlier after missing imputation. Final analyses performed with and without this participant revealed similar results. Before performing the central analyses we inspected the correlation matrix of all variables (Table 2) and tested the measurement models. All indicators loaded on the latent variables of interest and model fit was satisfactory. To test for possible moderator effects of gender and level of behavioral inhibition in infancy, we calculated Box's M statistics. Results did not indicate any differences in covariance matrices for anxious-depressed behavior for boys and girls, p = .66, nor for more and less inhibited children (median split on behavioral inhibition in infancy) p = .65. Covariance matrices for withdrawn behavior were not different for boys and girls, p = .052, nor for more and less inhibited children, p = .61.

4.2 Model Testing

4.2.1 Behavioral inhibition. With Model 1 (Figure 1) the relationships between maternal sensitivity and child behavioral inhibition were tested without the modeling of internalizing behavior. Standardized factor loadings for the latent variables sensitivity and behavioral inhibition ranged from .51 to .97. The independence model that tested the hypothesis that the variables were uncorrelated was rejected. Fit indices (Table 3) indicated that the full model fitted the data well, χ^2 (df = 109, N = 160) = 126.91, p = .12, χ^2/df = 1.16, NNFI = .96, CFI = .97, RMSEA = .05, CI (RMSEA) = .04 – .07. The final model with all non-significant paths removed also fitted the data well, χ^2 (df = 115, N = 160) = 133.86, p = .11, χ^2/df = 1.16, NNFI = .96, CFI = .97, RMSEA = .05, CI (RMSEA) = .04 – .07 (Table 3). The analysis revealed that there was no significant difference in fit between the two models, χ^2dif (6) = 6.95, p = .33, and therefore the more parsimonious model was preferred. The final model showed that higher levels of maternal sensitivity in adolescence were predicted by higher levels of maternal sensitivity in infancy and middle childhood. Behavioral inhibition showed stability: behavioral inhibition in infancy predicted behavioral inhibition in middle childhood which in turn predicted behavioral inhibition in adolescence. Furthermore, more maternal sensitivity in infancy and more maternal sensitivity in middle childhood predicted less behavioral inhibition in adolescence, although in the robust solution the former path was not significant, p = .061. All direct standardized paths are displayed in Figure 1. In addition, more behavioral inhibition in infancy indirectly predicted more behavioral inhibition in adolescence through more behavioral inhibition in middle childhood, β = .26, p < .001.

Table 2. *Correlation Matrix of Model Variables*

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Maternal Sensitivity[a]																							
1	Infancy	SP																					
2		CI	.77**																				
3		ST	.75**	.86**																			
4	Middle childhood	SP	.12	.09	.03																		
5		CI	.11	.13	.05	.69**																	
6		ST	.09	.15	.08	.73**	.85**																
7	Adolescence	SP	.31**	.30**	.21*	.16	.19*	.14															
8		CI	.26**	.31**	.24**	.19*	.26**	.20*	.82**														
9		ST	.28**	.27**	.21*	.17	.21*	.17	.87**	.89**													
Behavioral Inhibition																							
10	Infancy	A	.00	.03	-.03	-.00	.01	.02	.14	.22*	.20*												
11		B	.03	.01	-.04	-.05	-.01	-.05	.06	.12	.05	.75**											
12		C	-.06	-.08	-.11	-.08	-.07	-.08	.17	.18*	.11	.53**	.60**										
13	Middle childhood	D[b]	.06	-.01	.04	-.14	-.20*	-.16	.05	.08	.08	.37**	.33**	.12									
14		E[b]	.05	.10	.09	.02	.05	-.01	.17	.10	.06	.35**	.31**	.10	.40**								
15		F	.05	-.00	-.01	-.09	-.05	-.04	.09	.03	.04	.32**	.29**	.13	.40**	.61**							
16	Adolescence	D[b]	-.11	-.10	-.08	-.24**	-.26**	-.24**	-.01	.01	-.06	.21*	.22*	.16	.40**	.38**	.42**						
17		E[b]	-.06	-.09	-.02	-.20*	-.19*	-.22*	.09	.08	.03	.11	.14	.08	.32**	.42**	.40**	.60**					
18		F	-.15	-.18*	-.09	-.18*	-.19*	-.18	-.03	.04	-.03	.10	.11	.10	.29**	.30**	.40**	.65**	.68**				
Withdrawn Behavior[ac]																							
19	Middle Childhood		.14	.07	.06	.06	.01	.02	.21*	.25**	.23*	.16*	.18*	.13	.24**	.18*	.29**	.23**	.29**	.35**			
20	Adolescence		.05	.03	.02	-.11	-.03	-.07	.18*	.22*	.19*	.11	.07	.13	.10	.14	.20*	.35**	.45**	.42**	.56**		
Anxious Depressed Behavior[ac]																							
21	Middle Childhood		.05	.07	.01	.05	.07	.01	.14	.19*	.17	.15	.15	.14	-.01	.11	.14	.14	.11	.25**	.66**	.46**	
22	Adolescence		.03	.00	.01	.01	-.00	.01	.11	.16	.14	.05	.01	.23**	-.01	.04	.10	.29**	.28**	.38**	.47**	.64**	.45**

Note: SP= Supportive Presence, CI= Clarity of Instruction, ST=Sensitivity and Timing; [a] Variables were corrected for the intervention; [b] Items were reversed for the sake of interpretation; [c] Problem behavior scores are log-transformed; *$p < .05$; **$p < .01$; Matrix is based on non-imputed data

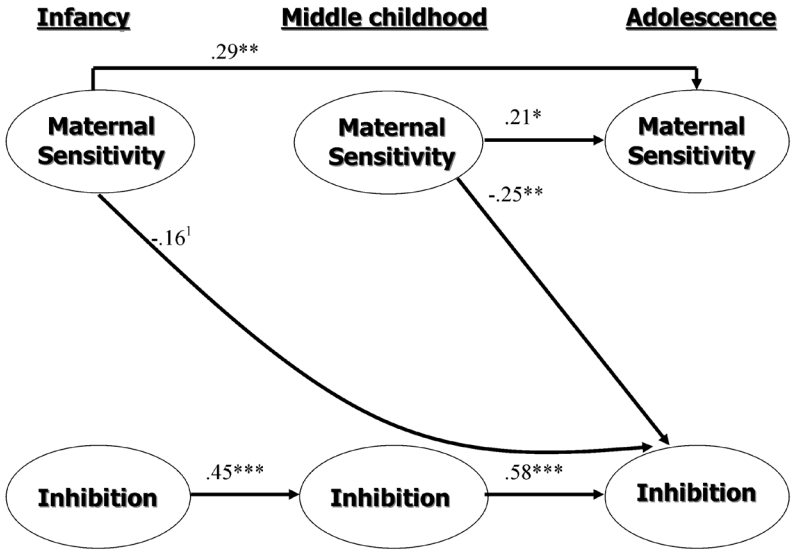

Figure 1. Final Structural Equation Model 1 for sensitivity and behavioral inhibition (*N* = 160). Only significant standardized coefficients are shown. For the sake of clarity indicators and error covariances are not presented.

[1] This path was significant ($p < .05$) in the regular solution, but not in the robust solution of the final model.

*$p < .05$; **$p < .01$; ***$p < .001$ (two-tailed).

4.2.2 Withdrawn behavior. In Model 2 (Figure 2), we tested the relationships between maternal sensitivity, child behavioral inhibition, and withdrawn behavior in middle childhood and adolescence. The independence model that tested the hypothesis that the variables were uncorrelated was rejected. The full model represented the data well, χ^2 (*df* = 133, *N* = 160) = 150.01, *p* = .15, χ^2/df = 1.13, NNFI = .95, CFI = .97, RMSEA = .05, CI (RMSEA) = .03 – .07 (Table 3). The more parsimonious model with all non-significant paths removed also represented the data well, χ^2 (*df* = 147, *N* = 160) = 164.81, *p* = .15, χ^2/df =1.12, NNFI = .96, CFI = .97, RMSEA = .05, CI (RMSEA) = .03 – .07 (Table 3), and revealed no significant difference of fit compared with the full model, χ^2dif (14) = 14.80, *p* = .39. All paths between maternal sensitivity and behavioral inhibition that were found in Model 1 were still significant in Model 2. The path from sensitivity in infancy to inhibition in adolescence was significant not only in the normal solution but also in the robust solution. Withdrawn behavior showed moderate stability over time. More behavioral inhibition in middle childhood and adolescence predicted more concurrent withdrawn behavior. More withdrawn behavior in middle childhood predicted more maternal sensitivity and more behavioral inhibition in adolescence (all direct standardized paths are displayed in Figure 2).

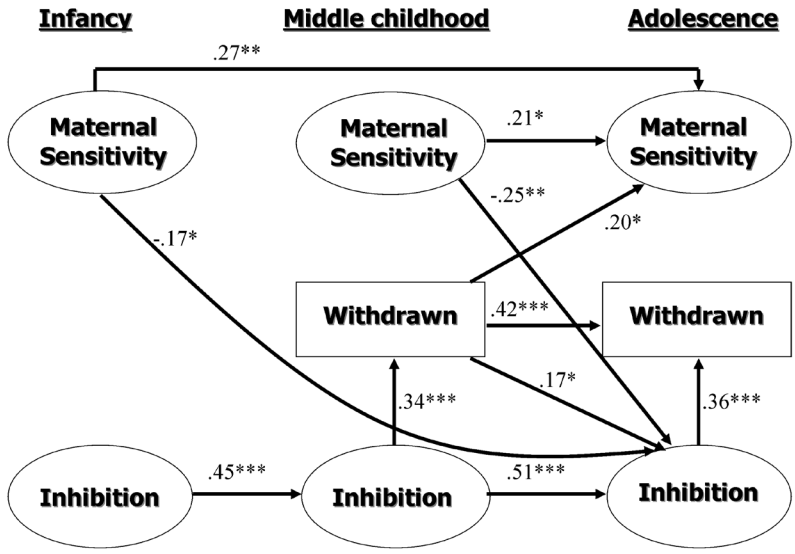

Figure 2. Final Structural Equation Model 2 for sensitivity, behavioral inhibition and withdrawn behavior (*N* = 160). Only significant standardized coefficients are shown. For the sake of clarity indicators and error covariances are not presented.
**p* < .05; ***p* < .01; ****p* < .001 (two-tailed)

Table 3. *Fit Indices for Three Structural Equation Models; Behavioral Inhibition, Withdrawn Behavior, and Anxious Depressed Behavior*

Model	*df*	χ^2	χ^2/df	NNFI	CFI	RMSEA	RMSEA 90% CI	$\Delta\chi^{2*}$
Model 1: Behavioral inhibition								
Independence model	153	1750.34						
Full model	109	126.91	1.16	.96	.97	.05	.04-.07	
Parsimonious model	115	133.86	1.16	.96	.97	.05	.04-.07	6.95 (6), *p* = .33
Model 2: Withdrawn behavior								
Independence model	190	1877.02						
Full model	133	150.01	1.13	.95	.97	.05	.03-.07	
Parsimonious model	147	164.81	1.12	.96	.97	.05	.03-.07	14.80 (14), *p* = .39
Model 3: Anxious-depressed behavior								
Independence model	190	1842.40						
Full model	133	155.27	1.17	.95	.96	.05	.04-.07	
Parsimonious model	149	176.43	1.18	.95	.96	.06	.04-.07	21.16 (16), *p* = .17

Note. NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; * Compared to full model

Withdrawn behavior in adolescence was predicted indirectly in more than one way. First, more maternal sensitivity in infancy and middle childhood predicted less withdrawn behavior in adolescence through less behavioral inhibition in adolescence, β = -.06, p < .05 and β = -.09, p < .05. The indirect path from sensitivity in infancy to withdrawn behavior in adolescence was significant in the regular ML solution, p = .041, but not in the robust solution, p = .071. Second, more behavioral inhibition in infancy and middle childhood predicted more withdrawn behavior in adolescence through behavioral inhibition at later points in time and withdrawn behavior in middle childhood, β = .16, p < .01 and β = .34, p < .001. To conclude, in the robust solution withdrawn behavior in middle childhood predicted more withdrawn behavior in adolescence through behavioral inhibition in adolescence, β = .06, p < .05. This path was not significant in the regular ML solution, p = .059. The final model explained 41% of the variance in withdrawn behavior in adolescence.

4.2.3 Anxious-depressed behavior. In Model 3 (Figure 3), we tested the relationships between maternal sensitivity, child behavioral inhibition, and anxious-depressed behavior in middle childhood and adolescence. The independence model that tested

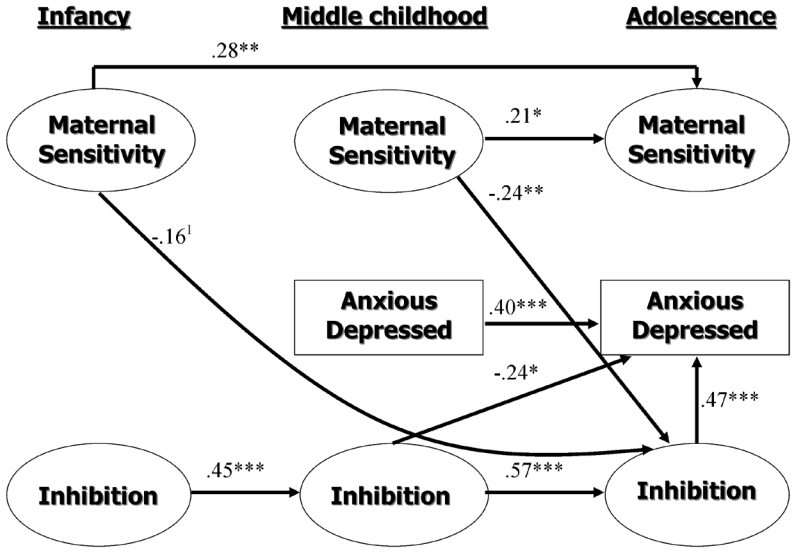

Figure 3. Final Structural Equation Model 3 for sensitivity, behavioral inhibition and anxious-depressed behavior (N = 160). Only significant standardized coefficients are shown. For the sake of clarity indicators and error covariances are not presented.

[1] This path was significant (p < .05) in the regular solution, but not in the robust solution of the final model.

*p < .05; **p < .01; ***p < .001 (two-tailed).

the hypothesis that the variables were uncorrelated was rejected. The full model represented the data well, χ^2 (*df* = 133, *N* = 160) = 155.27, *p* = .09, χ^2/df = 1.17, NNFI = .95, CFI = .96, RMSEA = .05, CI (RMSEA) = .04 – .07 (Table 3). The more parsimonious model with all non-significant paths removed represented the data moderately well, χ^2 (*df* = 149, *N* = 160) = 176.43, *p* = .06, χ^2/df = 1.18, NNFI = .95, CFI = .96, RMSEA = .06, CI (RMSEA) = .04 – .07 (Table 3), and revealed no significant difference of fit with the full model, χ^2dif (16) = 21.16, *p* = .17. All paths between sensitivity and behavioral inhibition that were found in Model 1 were also significant in Model 3. Anxious-depressed behavior in adolescence was predicted directly and positively from anxious-depressed behavior in middle childhood and behavioral inhibition in adolescence. More behavioral inhibition in middle childhood predicted less anxious-depressed behavior in adolescence (all standardized direct paths are displayed in Figure 3). In contrast, indirectly, more behavioral inhibition in middle childhood predicted more anxious-depressed behavior in adolescence through behavioral inhibition in adolescence, β = .27, *p* < .001. The total effect of behavioral inhibition in middle childhood on anxious-depressed behavior in adolescence was not significant. Finally, more maternal sensitivity in middle childhood predicted less anxious-depressed behavior in adolescence indirectly through less behavioral inhibition in adolescence, β = -.11, p < .05. The indirect path from maternal sensitivity in infancy to anxious-depressed behavior through inhibition in adolescence was not significant, *p* = .057. The final model explained 31% of the variance in anxious-depressed behavior in adolescence.

5. Discussion

In this longitudinal study covering infancy to adolescence, we investigated the interplay between children's inhibited temperament and maternal sensitivity on the development of children's withdrawn and anxious-depressed behavior. By examining adoptive families we ruled out shared genetics between parents and children. We found that child inhibition was an important predictor of anxious-depressed behavior in adolescence and of withdrawn behavior in middle childhood and adolescence. More maternal sensitivity in infancy and middle childhood predicted less inhibited behavior in adolescence and had a small, protective, indirect effect on withdrawn behavior in adolescence through reduced inhibited behavior. Anxious-depressed behavior also was predicted indirectly by maternal sensitivity in middle childhood but not by maternal sensitivity in infancy.

Maternal sensitivity showed a direct protective effect on children's inhibited behavior and an indirect protective effect on children's internalizing problems. The finding that sensitive parenting has a direct effect on the supposedly more constitutionally based inhibited behavior of a child is supported by previous research. Inhibited behavior is

a personality trait that is affected by environmental factors such as parenting (Bates et al., 2012; Fox et al., 2005). Sensitive parenting reinforces the secure-base behavior of children. Children with sensitive parents feel free to explore the world, knowing that their attachment figure is available when needed (Bowlby, 1973; Cassidy, 2008). Sensitive parenting has proven to be of importance for the development of emotion regulation (Kawabata et al., 2011; Weinfield et al., 2008), which is an important challenge for inhibited children. Emotion regulation capacities serve as a protective factor for the development of later psychopathology (Carlson, 1998; Groh, Roisman, Van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012). Also, children with sensitive parents experience communication as a reciprocal and responsive process, and may develop behavioral reciprocity and more optimal interaction skills (Weinfield et al., 2008). The lack of these specific skills may form the foundation of inhibited behavior that ,in turn, forms the foundation for internalizing problems. Although the indirect effect of maternal sensitivity on internalizing behavior in our study is small, it supports this line of reasoning. In previous research, comparably small effect sizes have been found, even in genetically related samples that were followed for a shorter period of time (Kok et al., 2013). Also, it should be realized that indirect effects are based on a multiplication of direct effects and therefore often will be small in magnitude. Qualifications of effect sizes are open to debate and small effect sizes may have important implications for large populations (McCartney & Rosenthal, 2000).

In this study, we did not find strong transactional processes in which children's behavior at different points in time elicited parental behavior and vice versa. First, we found that sensitive parenting in infancy and middle childhood predicted less inhibited behavior in adolescence, but not inhibited behavior in middle childhood. In previous research, it has been suggested that some children display inhibited, withdrawn behavior in adolescence as a reaction to the specific stresses of this period, and that this behavior may be a risk factor for depression (Buck & Dix, 2012). Sensitive parenting may protect specifically against the development of these age-specific sequelae of inhibited temperament. Second, we found that children who showed more withdrawn behavior in middle childhood tended to have more sensitive mothers at age 14. Mothers may respond to their children's withdrawn behavior by supporting them with more sensitive parenting. Yet, we did not find evidence for a stronger transactional process starting in earlier years. This is in line with our previous study on the development of externalizing behavior (Van der Voort et al., 2013). It should be noted that the lack of genetic ties between the children and their adoptive mothers in the current study might have decreased the associations between parenting and child outcomes compared to studies on genetically related families (Kok et al, 2013; Roisman & Fraley, 2012b).

Bögels and Perotti (2011) argue that we should be careful to interpret transactional processes only in light of the mother-child dyad. Increase in maternal care may be not only a function of mother-child interaction, but also can be affected by the father:

paternal socially anxious behavior elicits child socially anxious behavior, in which case mothers try to compensate for the anxious paternal role model by increasing their own care. It is argued that this increase in care might reinforce the child's anxious behavior (Bögels & Perotti, 2011), but we did not find evidence for this idea. Nevertheless, in future studies paternal sensitivity should be assessed to examine the influence of the parental interplay on the development of internalizing behavior.

We found a negative direct relationship between inhibition in middle childhood and anxious-depressed behavior in adolescence. Statistically, this path may be explained by the very strong indirect positive path between these constructs. The fact that the total effect of inhibition in middle childhood on anxious-depressed behavior in adolescence was not significant supports this conclusion. In theory, it is possible that children who do not show stability in inhibition and anxious depressed behavior are the children who learn to deal with their wariness in middle childhood and this accomplishment may enhance their later self-esteem and confidence.

In line with earlier studies (Booth-La Force et al., 2008; Groh et al., 2012; Verhoeven, Bögels, & Van der Bruggen, 2012), we did not find evidence for differential developmental models of internalizing behavior for boys and girls. Neither did we find that the development of internalizing behavior differs between children with low levels versus children with high levels of inhibition. In several studies, temperamental differences were found to be of importance when examining relationships between parenting and child behavior (e.g., Belsky et al., 1998; Mesman et al., 2009). However, we should keep in mind that in our study differences that we looked at were based on the level of inhibited behavior and that most effects in other studies have been found for higher order traits such a difficult temperament (e.g., Van Zeijl et al., 2007) or negative emotionality (e.g., Belsky et al., 1998).

Several limitations of this study should be mentioned. First, internalizing behavior problems and child temperament were reported by the mother, which may artificially increase correlations between these constructs. On the other hand, mothers seem to be a more reliable source of information on internalizing problems than for example teachers, because internalizing behaviors are not always readily observable (Stanger & Lewis, 1993) Also, mothers' reports may be a better indicator of long-term poor outcome than teachers' reports (Ferdinand, Van der Ende, & Verhulst, 2006). Second, we modeled concurrent relationships from temperament and maternal sensitivity to internalizing problems. However, the effects actually might be in the opposite direction; internalizing behavior may have an effect on children's inhibition, comparable to the effect we found from withdrawn behavior in middle childhood to inhibited behavior in adolescence. We argue that this direction of concurrent effects is less plausible because temperamental inhibition as a constitutional trait is more likely a precursor of internalizing problems than a consequence (Degnan et al., 2010; Klein et al, 2012). Finally, our sample size was rather small for the models that were tested, potentially

limiting the generalization of our results. Our results seem, however, consistent with earlier findings, and future replications may document the robustness of our models.

6. Conclusions and Practical Implications

Internalizing behavior problems are less visible and often less readily acknowledged than externalizing problems, but they may cause serious adaptational problems in later life. In this study, we examined the development of adolescent internalizing problems. We observed genetically unrelated mother-child dyads in order to disentangle environmental and genetic effects. We conclude that children's inhibited temperament and sensitive parenting are both predictors of adolescent internalizing behavior. First, inhibited temperament is an important predictor of withdrawn and anxious-depressed behavior. This supports the idea that inhibited behavior may be a risk factor for the development of internalizing disorders (see also Degnan et al., 2010). Second, early parental sensitivity is an important protective factor against the development of adolescent behavioral inhibition. Inhibited behavior may be especially salient in adolescence (Buck & Dix, 2012). Early sensitive parenting seems to promote the interpersonal skills that children need in order to cope with the vicissitudes of adolescence and to protect them from developing withdrawn and anxious-depressed behavior. Parent training to promote sensitive parenting in the years before adolescence may thus contribute to protect children from developing inhibited behavior in their adolescent years and decrease the risk of internalizing problems. This knowledge may support social workers, clinicians and counselors, and policy makers in serving all parents and adolescents.

References

Achenbach, T. M. (1991). *Manual for the Child Behavior Checklist and 1991 profiles*. Burlington, VT: University of Vermont, Department of Psychiatry.

Ainsworth, M. D., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment. A psychological study of the Strange Situation.* Hillsdale, NJ: Erbaum.

Bates, J. E., Freeland, C. A. B., & Lounsbury, M. L. (1979). Measurement of infant difficultness. *Child Development*, *50*, 794-803.

Bates, J. E, Schermerhorn, A. C., Petersen, I. T. (2012). Temperament and parenting in developmental perspective. In Zenter, M., Shiner, R. L. (Eds.), *Handbook of temperament.* New York: Guilford Press.

Belsky, J., Hsieh, K. H., & Crnic, K. (1998). Mothering, fathering, and infant negativity as antecedents of boys' externalizing problems and inhibition at age 3 years: Differential susceptibility to rearing experience? *Development and Psychopathology*, *10,* 301-319.

Bentler, P. M. (1995). *EQS structural equations program manual*. Encino, CA: Multivariate Software, Inc.

Bögels, S. M. & Perotti, E. C. (2011). Does father know best? A formal model of the paternal influence on childhood social anxiety. *Journal of Child and Family Studies, 20*, 171-181.

Boomsma, D. I., Van Beijsterveldt, C. E. M., & Hudziak, J. J. (2005). Genetic and environmental influences on anxious/depression during childhood: a study from the Netherlands Twin Register. *Genes Brain and Behavior*, *4*, 466-481.

Booth-LaForce, C. & Oxford, M. L. (2008). Trajectories of social withdrawal from grades 1 *to 6: Prediction from early parenting, attachment, and temperament. Developmental Psychology, 44,* 1298-1313.

Bowlby, J. (1973). *Attachment and Loss, Vol. 2: Separation.* New York: Basic Books.

Buck, K. A. & Dix, T. (2012). Can developmental changes in inhibition and peer relationships explain why depressive symptoms increase in early adolescence? *Journal of Youth and Adolescence, 41,* 403-413.

Burgess, K. M., Rubin, K. H., Cheah, C. S. L., & Nelson, L. J. (2005). Behavioral inhibition , social withdrawal, and parenting. In Crozier, W. R., Alden, L. E. (Eds.), *The essential handbook of social anxiety for clinicians.* New York: Wiley and sons.

Byrne, B. M. (2006). *Structural Equation Modeling with EQS, basic concepts, applications and programming* (2nd edition). Thousand Oaks, CA: Sage

Carlson, E. A. (1998). A prospective longitudinal study of attachment disorganization/ disorientation. *Child Development, 69*, 1107-1128.

Cassidy, J. (2008). The nature of the child's ties. In J. Cassidy & P.R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 552–598). New York: Guilford Press.

Colman, I., Wadsworth, M. E. J., Croudace, T. J., & Jones, P. B. (2007). Forty-year psychiatric outcomes following assessment for internalizing disorder in adolescence. *American Journal of Psychiatry, 164,* 126-133.

Degnan, K. A., Almas, A. N., & Fox, N. A. (2010). Temperament and the environment in the etiology of childhood anxiety. *Journal of Child Psychology and Psychiatry*, 51, 497-517.

Egeland, B., Erickson, M. F., Clemenhagen-Moon, J., Hiester, M. K., & Korfmacher, J. (1990). *24 months tools coding manual*. Project STEEP-revised 1990 from mother-child project scales.

Erickson, M. F., Sroufe, L. A., Egeland, B. (1985). The relationship between quality of attachment and behavior problems in preschool in a high-risk sample. In I. Bretherton & E. Waters (Eds.), Growing points at attachment: Theory and research. *Monographs of the Society for Research in Child Development*, *50*, 147-166. Chicago, IL: University of Chicago Press.

Ferdinand, R. F., Van der Ende, J., Verhulst, F.C. (2006) Parent-teacher disagreement regarding psychopathology in children: a risk factor for adverse outcome? *Acta Psychiatrica Scandinavica 115* :48–55

Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: Linking biology and behavior within a developmental framework. *Annual Review of Psychology, 56,* 235-262.

Gilissen, R., Koolstra, C. A., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Van der Veer, R. (2007). Physiological reactions of preschoolers to fear-inducing film clips: Effects of temperamental fearfulness and quality of the parent-child relationship. *Developmental Psychobiology, 49,* 187-195.

Groh, A. M., Roisman, G. I., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. P. (2012). The significance of insecure and disorganized attachment for children's internalizing symptoms: A meta-analytic study. *Child Development, 83,* 591-610.

Hoekstra, R. A., Bartels, M., Hudziak, J. J., Van Beijsterveldt, T. C. E. M., & Boomsma, D. I. (2008). Genetic and environmental influences on the stability of withdrawn behavior in children: A longitudinal, multi-informant twin study. *Behavior Genetics, 38,* 447-461.

Jaffari-Bimmel, N., Juffer, F., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Mooijaart, A. (2006). Social development from infancy to adolescence: Longitudinal and concurrent factors in an adoption sample. *Developmental Psychology, 42*, 1143-1153.

Juffer, F. (1993). *Verbonden door adoptie. Een experimenteel onderzoek naar hechting en competentie in gezinnen met een adoptiebaby*. (Attached through adoption. An experimental study on attachment and competence in families with an adopted baby.) Amersfoort, The Netherlands: Academic Press.

Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2005). The importance of parenting in the development of disorganized attachment: Evidence from a preventive intervention study in adoptive families. *Journal of Child Psychology and Psychiatry, 46*, 263-274. doi:10.1111/j.1469-7610.2004.00353.x

Kagan, J. (2012). The biography of behavioral inhibition. In Zenter, M., Shiner, R. L. (Eds.), *Handbook of temperament.* New York: Guilford Press.

Kawabata, Y., Alink, L. R. A., Tseng, W. L., Van IJzendoorn, M. H., & Crick, N. R. (2011). Maternal and paternal parenting styles associated with relational aggression in children and adolescents: A conceptual analysis and meta-analytic review. *Developmental Review, 31*, 240-278.

Klein, D. N., Dyson, M. W., Kujawa, A. J., & Kotov, R. (2012). Temperament and internalizing disorders. In Zenter, M., Shiner, R. L. (Eds.), *Handbook of temperament.* New York: Guilford Press.

Kohnstamm, G. A. (1984, April 4-7). *Bates' Infant Characteristics Questionnaire (ICQ) in the Netherlands*. Paper presented at the fourth biennial International Conference on Infant Studies, New York, NY.

Kok, R., Linting, M., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Jaddoe, V.W.V., Hofman, A., Verhulst, F.C, Tiemeier, H. (2013). Maternal sensitivity and internalizing problems: evidence from two longitudinal studies in early childhood. *Child Psychiatry Human Development.* doi: 10.1007/s10578-013-0369-7

Lamb, D. J., Middeldorp, C. M., Van Beijsterveldt, C. E. M., Bartels, M., Van der Aa, N., Polderman, T. J. C. et al. (2010). Heritability of anxious-depressive and withdrawn behavior: Age-related changes during adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 49,* 248-255.

McCartney, K., Rosenthal, R. (2000) Effect size, practical importance, and social policy for children. *Child Development 71*: 173-180.

McLeod, B. D., Wood, J. J., & Weisz, J. R. (2007). Examining the association between parenting and childhood anxiety: A meta-analysis. *Clinical Psychology Review, 27,* 155-172.

McLeod, B. D., Weisz, J. R., & Wood, J. J. (2007). Examining the association between parenting and childhood depression: A meta-analysis. *Clinical Psychology Review*, *27*, 986-1003.

Mesman, J., Stoel, R., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Juffer, F., Koot, H. M. et al. (2009). Predicting growth curves of early childhood externalizing problems: Differential susceptibility of children with difficult temperament. *Journal of Abnormal Child Psychology*, *37*, 625-636.

Roisman, G. I., & Fraley, R. C. (2012a). A behavior-genetic study of the legacy of early caregiving experiences: Academic skills, social competence, and externalizing behavior in kindergarten. *Child Development*, 83, 728-742.

Roisman, G. I., & Fraley, R. C. (2012b). The legacy of early interpersonal experience. In J.B. Benson (Ed.), *Advances in Child Development and Behavior* (Vol. 42, pp. 79-112). Burlington: Academic Press.

Rosenboom, L. G. (1994). *Gemengde gezinnen, gemengde gevoelens? Hechting en competentie van adoptiebaby's in gezinnen met biologisch eigen kinderen.* (Mixed families, mixed feelings? Attachment and competence of adopted babies in families with biological children). Doctoral dissertation, Utrecht University, Utrecht, The Netherlands.

Rubin, K. H., Coplan, R. J., & Bowker, J. C. (2009). Social withdrawal in childhood. *Annual Review of Psychology*, *60*, 141-171.

Sameroff, A. J. & MacKenzie, M. J. (2003). Research strategies for capturing transactional models of development: The limits of the possible. *Development and Psychopathology, 15,* 613-640.

Savalei, V. (2010). Expected versus observed information in SEM with incomplete normal and nonnormal data. *Psychological Methods*, *15,* 352-367.

Sroufe, L. A., Egeland, B., Carlson, E. A., & Collins, W. A. (2005). *The development of the person: The Minnesota study of risk and adaptation from birth to adulthood*. New York, NY: Guilford Publications.

Stams, G. J. J. M., Juffer, F., Rispens, J., & Hoksbergen, R. A. C. (2000). The development and adjustment of 7-year-old children adopted in infancy. *Journal of Child Psychology and Psychiatry, 41,* 1025-1037.

Stams, G. J. J. M, Juffer, F., & Van IJzendoorn, M. H. (2002). Maternal sensitivity, infant attachment, and temperament in early childhood predict adjustment in middle childhood: The case of adopted children and their biologically unrelated parents. *Developmental Psychology, 38,* 806-821. doi:10.1037//0012-1649.38.5.806

Stams, G. J. J. M., Juffer, F., Van IJzendoorn, M. H., & Hoksbergen, R. A. C. (2001). Attachment-based intervention in adoptive families in infancy and children's development at age 7: Two follow-up studies. *British Journal of Developmental Psychology*, *19*, 159-180.

Stanger, C. & Lewis, M. (1993). Agreement among parents, teachers, and children on internalizing and externalizing behavior problems. *Journal of Clinical Child Psychology, 22,* 107-115.

Tabachnick, B.G., & Fidell, L.S. (2001). *Using multivariate statistics*. Boston: Allyn & Bacon.

Van der Voort, A., Linting, M., Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2013). Delinquent and aggressive behaviors in early-adopted adolescents: Longitudinal predictions from child temperament and maternal sensitivity. *Children and Youth Services Review, 35,* 439-446.

Van Zeijl, J., Mesman, J., Stolk, M. N., Alink, L. R. A., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Juffer, F., & Koot, H. M. (2007). Differential susceptibility to discipline: The moderating effect of child temperament on the association between maternal discipline and early childhood externalizing problems. *Journal of Family Psychology*, *21*, 626-636.

Verhoeven, M., Bögels, S. M., & Van der Bruggen, C. C. (2012). Unique roles of mothering and fathering in child anxiety; Moderation by child's age and gender. *Journal of Child and Family Studies, 21,* 331-343.

Verhulst, F. C., Van der Ende, J., & Koot, H. M. (1997). *Handleiding voor de Child Behavior Checklist-CBCL*. (Manual for the Child Behavior Checklist-CBCL, Dutch version.) Rotterdam, The Netherlands: Erasmus University Rotterdam.

Weinfield, N. S., Sroufe, A., Egeland, B., & Carslon, E (2008). Individual differences in infant-caregiver attachment: conceptual and empirical aspects of security. In J. Cassidy & P.R. Shaver (Eds.), *Handbook of attachment: Theory, research, and clinical applications* (pp. 552–598). New York: Guilford Press.

Wood, J. J., Mcleod, B. D., Sigman, M., Hwang, W. C., & Chu, B. C. (2003). Parenting and childhood anxiety: theory, empirical findings, and future directions. *Journal of Child Psychology and Psychiatry, 44,* 134-151.

Zentner, M., Bates, J. E. (2008) Child temperament: An integrative review of concepts, research programs, and measures. *European Journal of Developmental Science, 2,* 7–37.

4

More than two decades after adoption: Associations between infant attachment, early maternal sensitivity and the diurnal cortisol curve of adopted young adults

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Abstract

The focus of this study was on the longitudinal relation between infant attachment, early maternal sensitivity and the diurnal cortisol curve of adopted young adults. 86 adoptees (mean age at adoption 11 weeks) were followed from infancy to young adulthood. Attachment quality and maternal sensitivity were observed in infancy. When the adoptees were 23 years of age saliva samples were collected at six time points across the day, on two different days. To assess compliance to the instruction the Medication Event Monitoring System (MEMS) was used. The data were analyzed with growth models using multilevel analyses (Day 1) and structural equation modeling (as a more confirmatory approach, Day 2). Results revealed no associations between early attachment security, attachment disorganization, maternal sensitivity and the diurnal cortisol curve more than two decades later. Attachment experiences (in the normative range) may not induce changes in the later diurnal cortisol curve in the same way as severe chronic stressors do. Alternatively, adoption related experiences may dampen associations between attachment experiences and the diurnal cortisol curve in later life.

Keywords: adoption; sensitive parenting; attachment; cortisol

1. Introduction

Early caregiving experiences affect the Hypothalamic-Pituitary-Adrenal axis (HPA axis) that is involved in the secretion of cortisol (Hostinar & Gunnar, 2013). Adoptees have experienced a major separation from at least one primary caregiver early in their lives, and have often lived in adverse circumstances before adoption (Van IJzendoorn & Juffer, 2006). However, in their adoptive families adoptees get chances for new positive experiences. Although the effects of social relationships on the stress-system in early childhood have been widely documented, less is known about the effects of observed attachment related experiences in early life on the functioning of the HPA-axis in later life (see for reviews Hostinar & Gunnar, 2013; Hostinar, Sullivan, & Gunnar, 2014). In this study we examine these long-term effects in a sample of young adults who were adopted at an early age.

1.1 Development of Adoptees

Many studies have highlighted the protective factors and the risks associated with adoption. In general, adoption appears to be a successful intervention. Several meta-analyses have shown that adopted children are able to at least partly redress the balance for incurred delays in areas such as physical development, cognitive development, self-esteem, and attachment security and disorganization (Van IJzendoorn & Juffer, 2006). Although these results provide an optimistic picture on the developmental outcomes of adopted children, it seems that these children do not catch up on all accounts. For example, compared to their non-adopted current peers, adopted children are at risk of developing insecure or disorganized attachment relationships (Van den Dries, Juffer, Van IJzendoorn, & Bakermans-Kranenburg, 2009) and problem behavior (Juffer & Van IJzendoorn, 2005), especially when they have experienced higher levels of deprivation. It might be the case that the (re)programming of biological processes through early experiences is associated with these developmental risks (Nelson, Fox, & Zeanah, 2014). It is clear that more knowledge of the long-term interplay between early negative experiences, possible corrective experiences and neurobiological processes that play a role in the development of adoptees is needed (Palacios & Brodzinsky, 2010).

1.2 The Attachment Relationship and Stress Regulation

The quality of the attachment relationship with the (adoptive) parent is of crucial importance for early and later child outcomes. Securely attached children experience their parent as a safe haven from which they can explore the world (Bowlby, 1969). Secure attachment relationships have proven to be predictive of beneficial developmental outcomes such as better social development (see for a meta-analysis Groh et al., 2014), and fewer externalizing and internalizing behavior problems (see for two meta-analyses Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, &

Roisman, 2010; Groh, Roisman, Van IJzendoorn, Bakermans-Kranenburg, & Fearon, 2012).

In general, securely attached children are better able to cope with stress. They usually have a history of sensitive caregiving and learn to rely on the availability of their parent (Ainsworth, Blehar, Waters, & Wall, 1978). Several studies have documented the buffering effect of sensitive parenting and secure attachment relationships on the biological reactions to stressors (e.g., Luijk et al; 2010; Oosterman, De Schipper, Fisher, Dozier, & Schuengel, 2010; Spangler & Schieche, 1998).

1.3 Stress Regulation Through HPA-axis Functioning

The effects of early attachment experiences on the stress-system can be examined by measuring cortisol levels in saliva or blood. The HPA- axis is the biological system that regulates the secretion of cortisol. In general, the diurnal cortisol curve shows relatively high levels of cortisol in the morning that rapidly increase even more in the first half hour after awakening. This increase is known as the Cortisol Awakening Response (CAR: e.g., Fries, Dettenborn, & Kirschbaum, 2009). During the rest of the day cortisol levels decrease (Hostinar & Gunnar, 2013). Apart from this diurnal pattern of cortisol secretion, cortisol levels rise in reaction to stressful situations in order to mobilize energy (Hostinar & Gunnar, 2013). Abnormal patterns of cortisol secretion during the day (e.g., Fries et al., 2009) as well as in response to stress are associated with physical problems (Miller, Chen, & Zhou, 2007) and negative behavioral and psychological outcomes such as problem behavior (e.g. Alink et al., 2008; McBurnett, Lahey, Rathouz, & Loeber, 2000) and psychopathology (Buitelaar, 2013).

Deviant patterns of cortisol secretion may be induced by early experiences of stress (see for a meta-analysis Miller et al., 2007) such as the deprivation and separations that many adoptees have gone through. Several explanations for the effects of chronic stress on HPA-axis functioning have been put forward. It has been proposed that chronic stress contributes to increased levels of cortisol and that this increase results in illnesses and psychological problems

However, in the last decades several studies found that experiences of stress were related to *lower* levels of cortisol, or so-called 'hypocortisolism' (Heim, Ehlert, & Hellhammer, 2000). Early (over-)stimulation of the HPA-axis due to negative experiences may lead to a down-regulation over time, with lower basal cortisol levels and a less steep decline of cortisol levels during the day mostly resulting from lower morning levels (see for a review Gunnar & Vazquez, 2001). Hypercortisolism may be relevant when examining short-term effects of stress, while hypocortisolism may be more applicable to long-term effects of stress on the HPA-axis functioning (Miller et al., 2007).

1.4 Early Experiences and HPA-axis Regulation in (Early) Childhood

Adopted children with experiences of severe deprivation often show lower basal levels of cortisol and flatter diurnal slopes (Gunnar & Vasquez, 2001). Kroupina and colleagues (2012) found lower cortisol morning levels (30 min after awakening) for post-institutionalized toddlers (one month after adoption) compared to data from normative children. A follow-up assessment revealed that the morning cortisol values of these children had increased significantly after six months. However, not all studies report results in the same direction. Van den Dries and colleagues investigated the diurnal curves of girls adopted from foster care or institutional care in China when they were between 11 and 16 months old. Hardly any differences in diurnal curves were found between former foster children, previously institutionalized children, and non-adopted children, and cortisol patterns did not change between the assessments 2 and 6 months after arrival (Van den Dries, Juffer, Van IJzendoorn, & Bakermans-Kranenburg, 2010). A Ukrainian sample of 3 to 6-year-olds did not show differences in the cortisol pattern over the day between family-reared and institution-reared children either, but temporarily stunted children showed higher levels of cortisol production than family-reared or chronically stunted children (Dobrova-Krol, Van IJzendoorn, Bakermans-Kranenburg, Cyr, & Juffer, 2008). Gunnar, Morison, Chisholm, and Schuder (2001) followed a sample of school-age children who were raised in Romanian orphanages for at least the first 8 months of their lives. Their cortisol levels during the day were elevated compared to children adopted at an earlier age. The more time the children had spent in the institution, the higher the levels of cortisol were. Kertes, Gunnar, Madsen, and Long (2008) also found higher levels of cortisol for children aged 7 - 11 years who had experienced deprivation and showed growth delays at adoption.

In sum, most studies confirm that experiences of early deprivation affect the diurnal cortisol curve of young children. Flatter slopes and lower basal cortisol levels have been found, but also higher basal cortisol levels and non-deviant curves. When interpreting these results, one should keep in mind the developmental changes in basal cortisol levels (Gunnar & Donzella, 2002; Gunnar, Wewerka, Frenn, Long, & Griggs, 2009). Also timing, chronicity, specificity, controllability and severity of the negative experiences may specifically induce hypocortisolism or hypercortisolism and can therefore explain the different results that have been found (Miller et al., 2007).

1.5 Early Experiences and HPA-axis Regulation in Adolescence and Adulthood

It is evident that early negative experiences put adopted children at risk for maladaptive biological stress management in early life. Long-term effects that become evident in adolescence and adulthood may be different due to hormonal changes in the body (Gunnar, Wewerka, Frenn, Long, & Griggs, 2009) and possible adaptation of the stress system over time (Hostinar & Gunnar, 2013). Several studies have confirmed associations between severe adverse circumstances, such as maltreatment, and later

HPA-axis functioning (Hostinar & Gunnar, 2013). One longitudinal adoption study in the Netherlands has demonstrated that experiences of early neglect or abuse affected the cortisol curve of international adoptees in adulthood (Van der Vegt, Van der Ende, Kirschbaum, Verhulst, & Tiemeier, 2009). Severe neglect and abuse were associated with lower morning cortisol levels and severe neglect also with a flatter slope. Moderately severe abuse however was associated with higher morning cortisol levels and steeper slopes. Rearing experiences after adoption (as reported by the adoptee) did not change these results (Van der Vegt et al., 2009), but retrospective self-reports of experienced parenting may not fully reflect the reality of parenting practices.

1.6 The Present Study

To our knowledge, no studies have examined the long-term effects of early attachment relationship quality and maternal sensitivity on the daily cortisol curve of adopted adults. Studying this development from deprivation via adoption into early adulthood might clarify the contribution of childhood experiences on the functioning of the HPA-axis of adoptees. In this longitudinal adoption study we examined the effects of early attachment security and disorganization, and observed maternal sensitivity in early childhood on the daily cortisol curves of young adopted adults aged 23 years. All adoptees were adopted before the age of 6 months which makes it possible to study the effects of early attachment experiences without the confounding of long-term severe deprivation. We hypothesize that attachment security, attachment disorganization, and maternal sensitivity are associated with the height and slope of the diurnal cortisol curve, and the Cortisol Awakening Response (CAR) at age 23. Because of divergent results in the literature and the lack of outcomes on adopted adults we refrain from formulating specific expectations about the direction of these associations.

2. Method

2.1 Participants

In this longitudinal study, 86 internationally adopted young adults, 34 men and 52 women, participated in the collection of saliva when they were 23 years of age (mean age at adoption 11.23 weeks, *SD* = 5.16). They were born in Sri Lanka (*n* = 43), South Korea (*n* = 31), or Colombia (*n* = 12), and originated from a sample of 160 adopted children who were followed from infancy to young adulthood. All children in this study were adopted before the age of six months and were placed in Caucasian adoptive families with mainly middle-(upper)class backgrounds. The adoptive families were randomly recruited through Dutch adoption organizations. Some families did not have any (biological) children at the time of adoption (*n* = 46; Juffer, 1993), other families already had one or more biological or adopted children (*n* = 40; Rosenboom, 1994). In

all cases the mother was the primary caregiver (for more details see Stams, Juffer, & Van IJzendoorn, 2002). When their children were between 6 and 9 months of age, 26 of them were part of a randomly selected group of 50 families that received a short-term intervention aimed at promoting maternal sensitivity (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2005).

2.2 Procedure

In infancy home visits were made at several points in time to administer questionnaires and observe mother-child interaction. Also, at 12, 18, and 30 months mother and child participated in lab sessions in which mother-child interaction was observed. At 7 and 14 years of age home and lab sessions were administered. At age 23, the adopted young adults visited the university to complete various assessments. They completed several questionnaires and collected saliva at home on two separate days.

2.3 Attrition

Of the 160 families who participated in infancy, 146 families participated in middle childhood, and a partly overlapping group of 146 families participated in adolescence. At 23 years of age 109 adult adoptees agreed to participate in the study again. Lack of time, death of the adoptive mother, time constraints, lack of interest, and health problems in the family were the main reasons for attrition in the different stages of the study (for details see Jaffari-Bimmel, Juffer, Van IJzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006; Schoenmaker et al., 2013; Stams et al., 2002). Of the 107 participants at 23 years of age, 86 adoptees participated in the collection of saliva. Bonferroni-corrected tests confirmed the absence of selective attrition in the earlier stages of the study (Jaffari-Bimmel et al., 2006; Stams et al., 2002). In the current study, we confirmed the absence of selective attrition with respect to gender, social economic status, experimental condition, maternal sensitivity, and attachment security and organization for the group of 21 participants who did not collect saliva at age 23.

2.4 Measures

2.4.1 Attachment security and disorganization at 12 months. When the children were 12 months of age their attachment security and disorganization were assessed with the Strange Situation Procedure (SSP; Ainsworth et al., 1978). Interrater reliability for the main attachment classifications (Cohen's kappa) ranged from .80 to 1.0 (n = 155; see Stams et al., 2002). Of all the participants of the current study 76% were classified as secure (n = 65), 23% as avoidant (n = 20), and 1% as resistant (n = 1). Eleven participants were disorganized (13%) and 75 organized (87%). In order to improve the power of our study, we used continuous scores for both security of attachment (see Stams et al., 2002) and disorganized attachment. The scores for attachment security were derived from the sub-classifications from the SSP (Main, Kaplan, and Cassidy, 1985;

Van IJzendoorn, Sagi, and Lambermon, 1992). The most insecure infants (A1 and C2) were assigned the score of 1. The A2 and C1 infants were assigned the score of 2, the B4 infants the score of 3, and the B1 and B2 infants scored a 4. The most secure infants, classified as B3, were assigned the score of 5. Intercoder reliability was satisfactory; intraclass correlations ranged from .81 to .95, using four pairs of raters (see Stams et al., 2002). The scores for attachment disorganization were based on the nine-point-rating scale derived from Main and Solomon (1990) with higher scores pointing to more disorganization. In order to reduce the skewness of the distribution of disorganization we used a root transformation of the scores.

2.4.2 Maternal sensitivity at 12, 18, and 30 months. Maternal sensitivity was based on measures at 12, 18, and 30 months. At all three occasions, mother's sensitive behavior was assessed during structured tasks (building a tower or solving puzzles) in the laboratory. The Egeland/Erickson scales (Egeland, Erickson, Clemenhagen-Moon, Hiester, & Korfmacher, 1990; Erickson, Sroufe, & Egeland, 1985) were used to rate emotional support, structure and limit setting, respect for autonomy, hostility, and quality of instruction. In addition, cooperation and sensitivity (Ainsworth, Bell, & Stayton, 1974) were coded in the child's home at 12 months, and in the laboratory at 30 months. On each of the three time points, principal component analyses revealed a one-dimensional solution in which all sensitivity measures were included (explained variance 44%, 59%, and 49%, respectively; see Stams et al., 2002). For the final aggregated score, the three standardized scores for maternal sensitivity were combined into one overall score for infancy with an explained variance of 58% (see Stams et al., 2002).

2.4.3 Daily curve cortisol at age 23. When the adopted adults reached the age of 23 we assessed their daily salivary cortisol curves on two separate days (Kirschbaum & Hellhammer, 1994). The young adults were asked to take a saliva sample at 6 points during the day: immediately after waking up, half an hour after waking up, at noon, at 3 p.m., 5.30 p.m., and in the evening just before going to sleep. The saliva was collected by keeping a cotton ball in the mouth for one minute. We asked the young adults not to eat anything for half an hour prior to the assessment and to rinse their mouth 10 min before assessment. Also, the subjects were asked to choose two regular workdays or schooldays on which no special stress-inducing events, such as an exam or an important interview, occurred. The time at which the assessments were done were reported by the young adults themselves, and also through means of the Medication Event Monitoring System (MEMS). The MEMS is a cap that can be screwed on a bottle with the cotton balls in it. Each time the bottle is opened the exact date and time are registered. The MEMS report made it possible to detect non-compliance that might affect the reliability of the cortisol assessments (Kudielka, Broderick, & Kirschbaum, 2003).

The salivary cortisol concentration (nmol/l) was determined using a time-resolved fluorescence immuno-assay. The intra-assay coefficient of variation was between 4.0% and 6.7%, and the corresponding inter-assay coefficients of variation were between 7.1% and 9.0% (Dressendörfer, Kirschbaum, Rohde, Stahl, Strasburger, 1992). In order to reduce the skewness of the cortisol distributions, we used the natural log-transformation of the cortisol values (after adding a constant of 1 to avoid having negative values). Correlations between transformed cortisol values of the first and second day varied between .20 and .50 at the different points in time. Cortisol values that exceeded 3 standard deviations from the mean at a particular point in time were winsorized (Tabachnick & Fidell, 2001). The correlations between the different time points according to self-report and according to the report of the MEMS on the first day ranged from .66 to .80. On the second day correlations ranged from .49 to .92. There were mean level differences with the MEMs time being later than the time according to self report on three time points at both days with a maximum difference of 24 min. When registration by the Medication Event Monitoring System (MEMS) was available, we used this as time of measurement, as we expected it to be more reliable than the self-reported time. We only used self-report when the MEMS time was missing. This was the case for 15% of the cortisol measurements. 86 participants collected cortisol samples at Day 1 one and 84 participants had cortisol samples at Day 2. Ten participants were excluded from the analyses for Day 1 and seven for Day 2 because of unreliable measurements due to: a) non-compliant time reports b) incompatible reports of time between MEMS and self. The mean transformed cortisol values for the final groups were 1.59 (*SD* = 0.70; Day 1) and 1.58 (*SD* = 0.72; Day 2). In Table 1 the descriptives of the predictor variables for these groups are given.

2.4.4. Weight for age at birth. To obtain an indication of infants' weight for age , adoption records were searched for the earliest available information about the child's weight. In order to get comparable scores, z-scores were calculated for these weights with the help of the program WHO Antro 2005 (WHO Anthro, 2005) which relies on weight-for-age calculations on a norm group (*N* = 8440) from diverse cultural backgrounds. Gender and preterm birth were taken into account when comparing the scores of the adoptees to the norm (Schoenmaker et al., 2013). For children who were born prematurely, the number of weeks of prematurity was subtracted from their chronological age. The continuous z-scores were included in the analyses. To reduce skewness of the distribution, outliers were winsorized with preservation of order (Tabachnick & Fidell, 2001).

Table 1. *Descriptives of the predictor variables for the final sample of Day 1 (n = 76) and Day 2 (n = 77)*

	Day 1				Day 2			
	mean	*sd*	*min*	*max*	*mean*	*sd*	*min*	*max*
Security continuous[a]	3.36	1.32	1	5	3.38	1.32	1	5
Disorganized continuous[ab]	2.56	1.67	1	7.5	2.67	1.80	1	8
Maternal sensitivity[a]	0.05	0.71	-2.04	1.38	0.02	0.70	-2.04	1.38
Weight for age[a]	-1.12	1.12	-3.87	0.63	-1.12	1.14	-3.78	1.63
	n	*%*			*n*	*%*		
Gender female	46	60.5			48	62.3		
Organized attachment	68	89.5			67	87.0		
Secure attachment	57	75.0			59	76.6		
Experimental condition	23	30.3			22	28.6		

[a] not centered
[b] not transformed

2.5 Analytical Strategy

We analyzed the data of Day 1 with multilevel modeling that can handle repeated measures data with unbalanced data and different time intervals. In stage one we tested multilevel growth models that focused on the effects of maternal sensitivity together with a) attachment security and b) attachment disorganization on the daily curve of cortisol. We used three different level 1 predictors: Time, time squared and a coding that modeled the Cortisol Awakening Response (CAR). For our first time predictor of Day 1 we used the mean time intervals that were present in the final sample: 0, 0.48, 3.64, 6.81, 9.31, and 14.02 h. For the second time predictor we squared the first time predictor. The third time predictor distinguished the second measurement from the other ones in order to capture the CAR, and was coded as 0,1,0,0,0,0. The main level 2 predictors were attachment security and maternal sensitivity in the first model, and attachment disorganization and maternal sensitivity in the second model. We examined whether the level 2 predictors could explain variation in a) the initial cortisol level at time of awakening, and b) the slope of the cortisol daily curve, and c) the awakening response. All level 2 predictors were centered around the mean. The predictors did not correlate significantly with each other. To control for possible covariates we repeated the analyses including gender, weight for age, first time point (time of awakening) and experimental condition, indicating if the parents of the adoptees received the intervention in infancy. All models were estimated with Full Maximum Likelihood which made it possible to compare nested models by inspecting the deviances (-2 log-likelihood). To compare nested models we used the χ^2 difference test, where

p-values larger than .05 indicate that there is no significant difference between two models (Tabachnick & Fidell, 2001). As common in the multilevel context we report unstandardized weights β.

In the next stage, we validated the findings from Day 1 by reformulating the growth model as a structural equation model (SEM), using EQS 6.2 (Bentler, 1995), and estimating this model on data from Day 2 (Hox & Stoel, 2005). This reformulation allowed us to take a confirmatory approach. We used several indices to test model fit. NNFI and CFI values that exceed .95 and RMSEA values lower than .05 indicate good model fit (Byrne, 2006; Tabachnick & Fidell, 2001). In order to test the plausibility of absences of relations between variables we compared models with and without predictive paths through means of the χ^2 difference test.

In order to examine the robustness of our results, analyses of both days were rerun excluding another group of participants who showed irregularities between MEMS and self-report or showed very irregular cortisol curves (Day 1, n = 6; Day 2, n = 5). We also reran our analyses excluding one pregnant participant because pregnancy may influence the diurnal cortisol curve (Kirschbaum & Hellhammer, 1994). If results yielded differences in significance of predictors, these differences are reported. Six participants indicated that they used medication on one or two days. Preliminary analyses showed that there were no differences in cortisol production between the participants using and not using medication. Therefore, these participants were not excluded from the analyses.

2.6 Missing Data

In total, there were 26 (3%) missing cortisol values across 15 participants. Also, 16 participants measured their awakening response more than an hour after waking up. Their cortisol values on the second measurement point were handled as missing data. The data from Day 1 were analyzed with a multilevel approach (see previous section) that is particularly efficient for handling missing data on level 1 (i.e., missing cortisol data on one or more measurement occasions). The data of Day 2 were analyzed using a SEM approach that is not specifically designed to handle unbalanced data. Therefore we decided to impute missing data on the third to sixth measurement point (16 data points) with a curve fitting procedure in SPSS 19. Missing data that concerned the first or second measurement (and therefore had an effect on the CAR) were imputed with the individual CAR of the other day and if not available, the mean CAR of the group on the same day. Of all level 2 predictors in our model, only one had missing values: two participants did not have weight-for-age data. These missing values were imputed with the grand mean.

3. Results

3.1. Day 1

The observed cortisol curve displayed the expected decline across the day and the expected cortisol awakening response. In the first step we specified an unconditional growth model (see Table 2), entering time, time squared and the CAR coding. The time variable predicted the cortisol levels in the expected way. The estimate for the linear slope showed that there was a decreasing pattern of cortisol values over the day, β = -.11, *SE* = .02, $p < .001$. Also, the CAR coding revealed that (on top of this decreasing pattern) on average the cortisol values increased from awakening up to half an hour after awakening (β = .27, *SE* = .06, $p < .001$). The time squared variable did not predict the cortisol curve significantly, but was maintained because of its theoretical function in the model. Figure 1 shows the observed and predicted daily cortisol curve for the final group. The conditional intraclass correlation (ICC) indicated that 19% of the variation in cortisol values stemmed from inter-individual differences, after accounting for the time effect (see also Hruschka, Kohrt, & Worthman, 2005). Deviance statistics revealed that including random slopes of time as well as time-squared improved the model significantly, χ^2dif (5) = 15.43, $p = .009$. Therefore these slopes were specified as random effects in the models including level 2 predictors.

3.1.1 Attachment security. In the next models we investigated the effects of attachment security and maternal sensitivity on the diurnal cortisol curve. In models 1 to 5 (Table 2) we included the main effects, and the interactions of attachment security and maternal sensitivity with time, time squared, and the CAR coding.

Models 1, 2, and 3 did not reveal significant main effects of attachment security or sensitivity, nor interaction effects with time, or time squared. Model 4 revealed a significant cross-level interaction between the CAR and attachment security (β = -.099, *SE* = .04, $p = .022$) with more secure children showing a less steep incline in cortisol levels between awakening and half an hour after awakening in young adulthood. Figure 2 shows the cortisol curves based on a median split on attachment security. The most parsimonious model (5) that only retained the significant predictors improved the unconditional growth model significantly, χ^2dif (2) = 6.90, $p = .032$. To control for possible covariates we reran our analyses with inclusion of gender, time of first assessment, experimental condition, and weight for age. Results of these analyses were similar. The only covariate that contributed significantly was gender, β = .13, *SE* = .07, $p = .048$, with females showing higher initial levels of cortisol than males.

3.1.2 Attachment disorganization. In models 6 to 10 (Table 3) we entered main effects of attachment disorganization and maternal sensitivity, and interactions between these variables and time, time squared and the CAR coding. Models 6, 7, and 8 did not

Table 2. *Main multilevel models of the cortisol curve on Day 1 predicted by attachment security and maternal sensitivity (n = 76)*

Model		Unconditional growth model	Model 1 Security and sensitivity	Model 2 Security and sensitivity interaction time	Model 3 Security and sensitivity interaction time squared	Model 4 Security and sensitivity interaction CAR	Model 5 Security interaction CAR
Fixed effects							
Initial status	Intercept	2.087**	2.087**	2.087**	2.087**	2.087**	2.087**
	Security		0.033	-0.017	0.004	0.045	0.044
	Sensitivity		-0.005	0.027	0.028	-0.006	
Rate of change	Time	-0.108**	-0.108**	-0.108**	-0.108**	-0.108**	-0.108**
	Time squared	0.001	0.001	0.001	0.001	0.001	0.001
	CAR	0.272**	0.272**	0.271**	0.272**	0.269**	0.269**
	Security *time			0.007			
	Sensitivity*time			-0.004			
	Security *time squared				0.000		
	Sensitivity*time squared				-0.000		
	Security *CAR					-0.099*	-0.099*
	Sensitivity*CAR					0.006	
Variance components							
Level 1	Within person, residual	0.158**	0.158**	0.158**	0.158**	0.157**	0.157**
Level 2	Initial status	0.124**	0.130**	0.122**	0.124**	0.123**	0.123**
	Rate of change time	0.009*	0.009*	0.009*	0.009*	0.009*	0.009*
	Rate of change time squared	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
Goodness-of-fit							
Deviance		587.828	586.096	582.332	583.365	580.913	580.933
Parameters		11	13	15	15	15	13
$\Delta \chi^2$ [a]			1.732 (2)	5.496 (4)	4.463 (4)	6.915 (4)	6.895 (2)*

Note. CAR = Cortisol Awakening Response. Unstandardized coefficients are reported.
* $p < .05$; ** $p < .01$
[a] compared to unconditional growth model

Table 3. *Main multilevel models of the cortisol curve on Day 1 predicted by attachment disorganization and maternal sensitivity (n = 76)*

Model		Unconditional growth model	Model 6 Disorganization and sensitivity	Model 7 Disorganization and sensitivity Interaction time	Model 8 Disorganization and sensitivity Interaction time squared	Model 9 Disorganization and sensitivity Interaction CAR	Model 10 Disorganization Interaction CAR
Fixed effects							
Initial status	Intercept	2.087**	2.087**	2.087**	2.087**	2.087**	2.087**
	Disorganization		0.014	-0.052	-0.038	-0.014	-0.013
	Sensitivity		0.001	0.019	0.024	-0.003	
Rate of change	Time	-0.108**	-0.108**	-0.108**	-0.108**	-0.108**	-0.108**
	Time squared	0.001	0.001	0.001	0.001	0.001	0.001
	CAR	0.272**	0.272**	0.272**	0.272**	0.272**	0.272**
	Disorganization*time			0.009			
	Sensitivity*time			-0.003			
	Disorganization*time squared				0.001		
	Sensitivity*time squared				-0.000		
	Disorganization*CAR					0.242*	0.235*
	Sensitivity*CAR					0.025	
Variance components							
Level 1	Within person, residual	0.158**	0.158**	0.158**	0.158**	0.154**	0.154**
Level 2	Initial status	0.124**	0.124**	0.124**	0.124**	0.127**	0.127**
	Rate of change time	0.009*	0.009*	0.009*	0.009*	0.009*	0.010*
	Rate of change time squared	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
Goodness-of-fit							
Deviance		587.828	587.782	586.613	586.132	583.867	583.959
Parameters		11	13	15	15	15	13
$\Delta \chi^2$ [a]			.05 (2)	1.22 (4)	1.70 (4)	3.96 (4)	3.87 (2)

Note. CAR = Cortisol Awakening Response. Unstandardized coefficients are reported.
* $p < .05$; ** $p < .01$
[a] compared to unconditional growth model

reveal any significant main effects or interaction effects. Model 9 revealed a significant interaction between the CAR coding and (the transformed values of) attachment disorganization (β = .24, *SE* = .12, *p* = .047) with more disorganized children showing a steeper incline in cortisol levels between awakening and 0.5 h after awakening in young adulthood. However, this interaction proved unstable, as the most parsimonious model (10) that only retained significant predictors did not improve the unconditional growth model significantly, χ^2dif (2) = 3.87, *p* =.144. Also, removal of the suspect cortisol cases led to non-significance. In order to inspect this difference more carefully without relying too much on the p-value in a smaller sample we compared the standardized effects. The standardized weight was .04 in the total group and .03 in the smaller group. To control for possible covariates we reran our analyses with inclusion of gender, time of first assessment, experimental condition and weight for age. Results were similar. No covariate contributed significantly to the model.

3.2 Day 2

3.2.1 Attachment security. In the first latent growth model (Table 4, LGM 1) we tested the cortisol curve predicted by time, time squared and the CAR (see Figure 1 for observed and predicted values). In order to validate the results of Day 1, we explicitly tested the plausibility of the absence of relations by leaving out the predictive paths from attachment security, sensitivity, and gender to the cortisol curve. Fit indices (Table 4, LGM 1) indicated that the first model did not show good fit, χ^2 (*df* = 32, *n* = 77) = 39.05, *p* = .182, χ^2/df = 1.22, NNFI = .86, CFI = .89, RMSEA = .05, and CI (RMSEA) = .00 - .11. All time variables predicted the cortisol curve significantly. In the second step we added a predictive path from gender to the model, as it was a significant covariate on Day 1, and this improved model fit significantly, χ^2dif (1) = 7.29, *p* = .006. Fit indices (Table 4, LGM 2) indicated good model fit, χ^2 (*df* = 31, *n* = 77) = 31.76, *p* = .428, χ^2/df = 1.02, NNFI = 1.00, CFI = 1.00, RMSEA = .00, and CI (RMSEA) = .00 – .09 (see Table 4). In the next three models (see Table 4, LGMs 3,4, and 5) we added main effects of attachment security and maternal sensitivity and the interactions of attachment security and maternal sensitivity with time, time squared and the CAR. No significant effects were found, and none of the proposed models improved model fit significantly compared to the model that only included gender (see Table 4; Figure 2 shows the cortisol curves based on a median split on attachment security).

3.2.2 Attachment disorganization. In the first step (LGM 6) we tested the cortisol curve predicted by time, time squared and the CAR. Predictive paths from attachment disorganization, sensitivity, and gender to the cortisol curve were left out. All time-related variables predicted the cortisol curve significantly but the model did not show good fit (see Table 4), χ^2 (*df* = 32, *n* = 77) = 38.59, *p* =.196, χ^2/df = 1.21, NNFI = .87, CFI = .89, RMSEA = .05, and CI (RMSEA) = .00 – .10. In the second step (LGM 7) we

added a predictive path from gender to the initial cortisol level to the model and this improved model fit significantly χ^2dif (1) = 7.29, p = .007. Fit indices (Table 4) indicated good model fit, χ^2 (df = 31, n = 77) = 31.30, p =.451, χ^2/df = 1.01, NNFI = 1.00, CFI = 1.00, RMSEA = .00, and CI (RMSEA) = .00 – .09 (see Table 4). In the next three LGMs (LGMs 8, 9, and 10) we added main effects of attachment disorganization and maternal sensitivity and the interactions of attachment disorganization and maternal sensitivity with time, time squared and the CAR. No significant effects were found, and none of these models improved model fit significantly (see Table 4).

Table 4. *Fit indices for latent growth models Day 2: Security and disorganization as predictors of cortisol*

Latent Growth Model	*df*	χ^2	χ^2/df	NNFI	CFI	RMSEA	RMSEA 90% CI	$\Delta\chi^2$
Security								
Independence model	36	90.19	2.51					
1 Model without predictions [a]	32	39.05	1.22	.86	.89	.05	.00-.11	51.14 (4), $p < .01$ [b]
2 Model including gender	31	31.76	1.02	1.00	1.00	.00	.00-.09	7.29 (1), $p < .01$ [b]
3 ABC and sensitivity * time	27	30.32	1.12	.94	.96	.04	.00-.10	1.44 (4), $p = .84$ [c]
4 ABC and sensitivity * time squared	27	28.78	1.07	.98	.98	.02	.00-.10	2.98 (4), $p = .56$ [c]
5 ABC and sensitivity * CAR	27	29.66	1.10	.95	.97	.03	.00-.10	2.10 (4), $p = .72$ [c]
Disorganization								
Independence model	36	89.73	2.45					
6 Model without predictions [a]	32	38.59	1.21	.87	.89	.05	.00-.10	51.14 (4), $p < .01$ [b]
7 Model including gender	31	31.30	1.01	1.00	1.00	.00	.00-.09	7.29 (1), $p < .01$ [b]
8 DIS and sensitivity * time	27	29.46	1.09	.96	.97	.03	.00-.10	1.84 (4), $p = .77$ [d]
9 DIS and sensitivity * time squared	27	29.95	1.11	.95	.96	.03	.00-.10	1.35 (4), $p = .85$ [d]
10 DIS and sensitivity * CAR	27	29.75	1.10	.95	.97	.03	.00-.10	1.55 (4), $p = .82$ [d]

Note. NNFI = non-normed fit index; CFI = comparative fit index; RMSEA = root mean square error of approximation; ABC = security; DIS = disorganization; CAR = Cortisol Awakening Response
[a] Predictors are modeled as unrelated variables in this model; [b] Compared to previous model; [c] Compared to model 2; [d] Compared to model 7

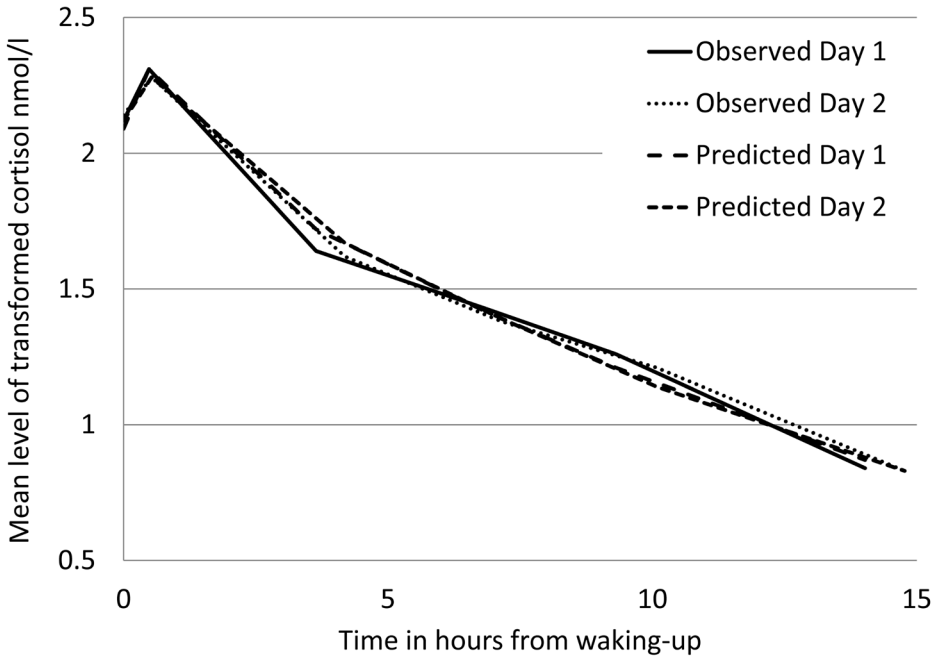

Figure 1. Observed and predicted diurnal cortisol curve (transformed values) for Day 1 (*n* = 64 - 75) and Day 2 (*n* = 77)

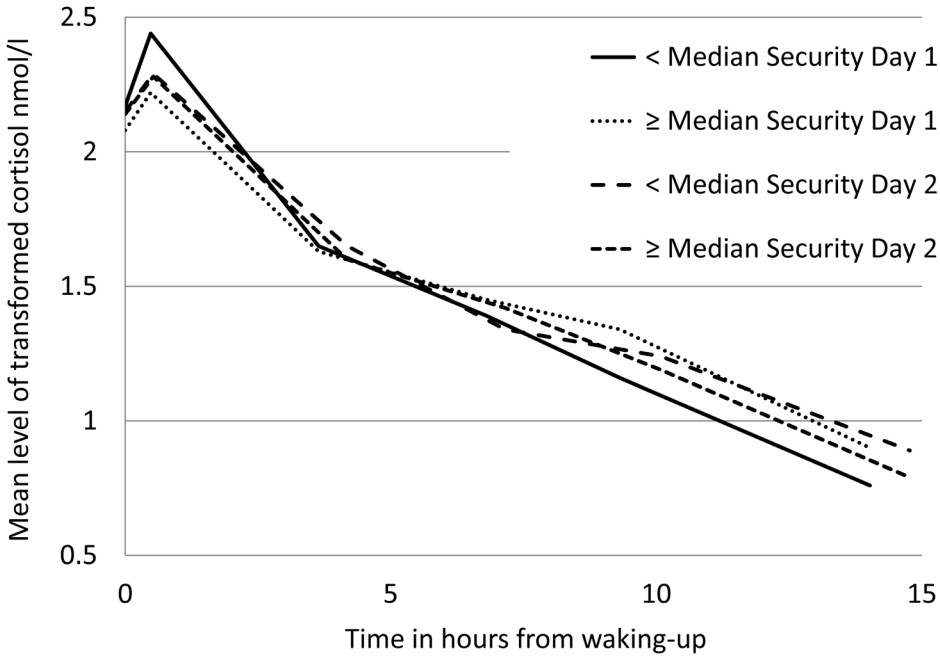

Figure 2. Observed transformed cortisol values of Day 1 and Day 2 for a median split on Security

4. Discussion

In this longitudinal study we investigated the interplay between adopted children's attachment security and disorganization, sensitivity of the adoptive mother, and the diurnal cortisol curves of the adoptees at age 23 years. With our growth models we were able to describe the observed cortisol curves quite well. We found no consistent evidence for effects of infant attachment and maternal sensitivity in early childhood on the diurnal cortisol curve or the Cortisol Awakening Response (CAR) of adoptees some twenty years later. Day 1 revealed a significant two-level interaction effect with more secure children showing less increase in the CAR, but this result was not replicated on Day 2.

Although several studies have demonstrated that early stressors can lead to changes in the functioning of the HPA-axis such as a down regulation over time (Gunnar & Vazquez, 2001; Miller et al., 2007), we did not find evidence for effects of early attachment experiences on later HPA-axis functioning in this adoption sample. These findings may be of importance, particularly because to our knowledge, the longitudinal associations between early observed attachment experiences and later HPA-functioning in adoptees have not been studied before.

While early attachment quality and sensitive parenting behavior may affect functioning of the HPA-axis in early life (through stress-buffering), it is possible they do not have a direct effect on the diurnal cortisol curve in later life. This apparent absence of the link between early experiences of stress and HPA-axis functioning may be explained by several stressor and person characteristics (Miller et al., 2007). First, in our study, the time elapsed since the onset of the stressor is more than 20 years. It may be that effects simply do not endure across such a long time-frame. In addition, we may wonder about the strength of the stressor. Examples of severe and chronic stressors that affect HPA-axis functioning in later life mentioned in the literature are: the death of important people (Meinlschmidt & Heim, 2005; Nicolson, 2004), divorce of parents (Meinlschmidt & Heim, 2005), and child abuse (e.g., Tricket, Nol, Susman, Shenk, & Putnam, 2010). It is not clear whether insecure and disorganized attachment are actually comparable to these quite severe examples. It may be possible to partly overcome early negative attachment experiences.

Contrary to our findings, Roisman and colleagues (2009) found that maternal insensitivity in childhood predicted lower awakening levels of cortisol in adolescence, albeit with a small effect size. The difference in results may be explained by the fact that in the Roisman et al. (2009) study genetically-related parent-child dyads were investigated. Although until now no evidence has been found for a genetic base for attachment security and attachment disorganization (e.g., Bokhorst et al., 2003; Luijk et al., 2011), we should keep in mind that genetic resemblance between parents and children may explain variation in quality of the attachment relationship and maternal

sensitivity, as well as in the diurnal cortisol curve. It may also be plausible that, in the general population, attachment security and parental sensitivity affect the diurnal cortisol curves in later life, but that the specific adoption experiences of our sample dampen these effects. Although all of our adoptees were adopted at a very young age, it still is possible that prenatal and perinatal problems set the stage for HPA-axis functioning (Gunnar & Fisher, 2006). This is consistent with evidence that the prenatal and perinatal periods are of importance for child development (e.g., Laurent, Ablow, & Measelle, 2011; Talge, Neil, & Glover, 2007). In our sample, the birthmothers of the adoptees may have been at a relatively high risk for depression, stress, malnutrition and other (maternity) problems. This assumption is supported by the fact that at birth, the adopted children were less healthy than normative new-borns in terms of weight for age. Of course, making definite statements regarding this issue without having studied a control group of non-adopted adults is not possible.

Another line of thinking may point to more positive specific adoption experiences. Miller and colleagues (2007) found that the controllability of stressors may have an effect on the associations between these stressors and the HPA-axis functioning. Although certain experiences specific to adoptees have been shown to be developmental risk factors, the majority of adoptees do not show behavior problems (Juffer & Van IJzendoorn, 2005) and their level of self-esteem is comparable to that of non-adoptees (Juffer & Van IJzendoorn, 2007). Relatively many adoptees are referred to special services and receive support that may be helpful in coming to terms with their adoptive status (Juffer & Van IJzendoorn, 2005; Van IJzendoorn, Juffer, & Klein Poelhuis, 2005). A positive appraisal of the adoptive status (see Storsbergen, Juffer, Van Son, & 't Hart, 2010) and the ability to overcome negative early experiences may counterbalance enduring negative effects on HPA-axis functioning. Gunnar, Frenn, Wewerka, & Ryzin (2009) even explore the possibility that experiencing some degree of early adversity may make children more resilient against later stress exposure. Future longitudinal studies that include both adoptees and non-adoptees and precise measures of early deprivation could further test these hypotheses.

Apart from the lack of a control group, this study has some other limitations. First, some of the variables studied showed limited range. Many adoptees in our sample were securely attached to their adoptive mother and all were adopted at a very young age. This homogeneity of the sample may have been a disadvantage in terms of detecting relations between attachment or early deprivation and the cortisol curve. On the other hand, homogeneity in early adversity made it possible to detect effects of early attachment experiences of the adoptees per se without the confounding with long periods of deprivation. Also, studying a small window of child adversity makes it possible to add to the body of evidence that can detect possible sensitive or critical periods for HPA-axis development (Hostinar & Gunnar, 2013). Second, cortisol measures were only done on two days. Measurements across more days would have

improved the reliability of our findings. In order to improve the reliability of our cortisol measures we used the Medication Event Monitoring System (MEMS) which made it possible to monitor the ability or willingness of participants to follow the instructions. Results indicated that it is difficult for participants to measure their cortisol at the exact requested times and also that self-reports of time may not always be accurate. This may especially be the case for young adults because in general they have not reached optimal stability and structure in their lives yet. Finally, we did not include sensitivity and attachment measurements beyond childhood. We specifically focused on the associations between early attachment experiences and the diurnal cortisol curve in young adulthood.

In conclusion, although positive parenting and attachment experiences in the early lives of adoptees have shown to predict beneficial outcomes in several developmental areas, early maternal sensitivity and attachment security and disorganization do not seem to be associated with the diurnal cortisol curve and Cortisol Awakening Response of adopted young adults. Despite the lack of associations between early experiences and adult cortisol secretion, it is remarkable how the average cortisol curve of adult adoptees appears to show the typical pattern to be expected of healthy, uncompromised individuals. In this sense we may suggest the current study illustrates the positive effect of adoption as social intervention.

5. Highlights

- Adopted young adults appear to show a normative diurnal cortisol curve
- Early maternal sensitivity is not associated with adoptees' cortisol production
- Infant attachment quality does not predict adopted adults' diurnal cortisol curve

References

Ainsworth, M. D. S, Bell, S. M., & Stayton, D. J. (1974). Infant-mother attachment and social development. In M.P. Richards (Ed.), *The introduction of the child into a social world* (pp. 99-135). London: Cambridge University Press

Ainsworth, M. D., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of attachment*. *A psychological study of the Strange Situation.* Hillsdale, NJ: Erbaum.

Alink, L. R. A., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Mesman, J., Juffer, F., & Koot, H. M. (2008). Cortisol and externalizing behavior in children and adolescents: Mixed meta-analytic evidence for the inverse relation of basal cortisol and cortisol reactivity with externalizing behavior. *Developmental Psychobiology*, *50*(5), 427-450. doi: 10.1002/dv.20300

Bentler, P. M. (1995). *EQS structural equations program manual*. Encino, CA: Multivariate Software, Inc.

Bokhorst, C. L., Bakermans-Kranenburg, M. J., Fearon, P., Van IJzendoorn, M. H., Fonagy, P., & Schuengel, C. (2003). The importance of shared environment in mother-infant attachment security: A behavioral genetic study. *Child Development, 74*(6), 1769-1782.

Bowlby, J. (1969, 1982). *Attachment and Loss. Vol. 1: Attachment*. New York: Basic Books.

Buitelaar, J. K. (2013). The role of the HPA-axis in understanding psychopathology: cause, consequence, mediator, or moderator? *European Child & Adolescent Psychiatry*, *22*(7), 387-389. doi: 10.1007/s00787-013-0441-7

Byrne, B. M. (2006). *Structural Equation Modeling with EQS, basic concepts, applications and programming* (2nd edition). Thousand Oaks, CA: Sage

Dobrova-Krol, N. A., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Cyr, C., & Juffer, F. (2008). Physical growth delays and stress dysregulation in stunted and non-stunted Ukrainian institution-reared children. *Infant Behavior and Development*, *31*(3), 539-553. doi: 10.1016/j.infbeh.2008.04.001

Dressendörfer, R. A., Kirschbaum, C., Rohde, W., Stahl, F., & Strasburger, C. J. (1992). Synthesis of a cortisol-biotin conjugate and evaluation as a tracer in an immunoassay for salivary cortisol measurement. *The Journal of Steroid Biochemistry and Molecular Biology*, *43*(7), 683-692.

Egeland, B., Erickson, M. F., Clemenhagen-Moon, J., Hiester, M. K., & Korfmacher, J. (1990). *24 months tools coding manual*. Project STEEP-revised 1990 from mother-child project scales.

Erickson, M. F., Sroufe, L. A., Egeland, B. (1985). The relationship between quality of attachment and behavior problems in preschool in a high-risk sample. In Bretherton, I. & Waters, E. (Eds.), Growing points at attachment: Theory and research. *Monographs of the Society for Research in Child Development*, *50*, 147-166. Chicago, IL: University of Chicago Press.

Fearon, R. P., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Lapsley, A. M., & Roisman, G. I. (2010). The significance of insecure attachment and disorganization in the development of children's externalizing behavior: A meta-analytic study. *Child Development*, *81*(2), 435-456. doi: 10.1111/j.1467-8624.2009.01405.x

Fries, E., Dettenborn, L., & Kirschbaum, C. (2009). The cortisol awakening response (CAR): facts and future directions. *International Journal of Psychophysiology*, *72*(1), 67-73. doi: 10.1016/j.ijpsycho.2008.03.014

Groh, A. M., Fearon, R. P., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Steel, R. D., Roisman, G. I. (2014) The significance of attachment security for children's social competence with peers. A meta-analytic study. *Attachment & Human Development*, *16*(2), 103-136. doi: 10.1080/14616734.2014.883636

Groh, A. M., Roisman, G. I., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. (2012). The Significance of Insecure and Disorganized Attachment for Children's Internalizing Symptoms: A Meta-Analytic Study. *Child Development*, *83*(2), 591-610. doi: 10.1111/j.1467-8624.2011.01711.x

Gunnar, M. R., & Donzella, B. (2002). Social regulation of the cortisol levels in early human development. *Psychoneuroendocrinology*, *27*(1), 199-220.

Gunnar, M. R., & Fisher, P. A. (2006). Bringing basic research on early experience and stress neurobiology to bear on preventive interventions for neglected and maltreated children. *Development and Psychopathology*, *18*(03), 651-677. doi: 10.1017/S0954579406060330

Gunnar, M. R., Frenn, K., Wewerka, S. S., & Van Ryzin, M. J. (2009). Moderate versus severe early life stress: associations with stress reactivity and regulation in 10–12-year-old children. *Psychoneuroendocrinology*, *34*(1), 62-75. doi: 10.1016/j.psyneuen.2008.08.013

Gunnar, M. R., Morison, S. J., Chisholm, K. I. M., & Schuder, M. (2001). Salivary cortisol levels in children adopted from Romanian orphanages. *Development and psychopathology*, *13*(03), 611-628.

Gunnar, M. R., & Vazquez, D. M. (2001). Low cortisol and a flattening of expected daytime rhythm: Potential indices of risk in human development. *Development and Psychopathology*, *13*(03), 515-538.

Gunnar, M. R., Wewerka, S., Frenn, K., Long, J. D., & Griggs, C. (2009). Developmental changes in hypothalamus–pituitary–adrenal activity over the transition to adolescence: normative changes and associations with puberty. *Development and psychopathology*, *21*(01), 69-85. doi:10.1017/S0954579409000054

Heim, C., Ehlert, U., & Hellhammer, D. H. (2000). The potential role of hypocortisolism in the pathophysiology of stress-related bodily disorders. *Psychoneuroendocrinology, 25*(1), 1-35.

Hostinar, C. E., & Gunnar, M. R. (2013). Future Directions in the Study of Social Relationships as Regulators of the HPA Axis Across Development. *Journal of Clinical Child & Adolescent Psychology, 42*(4), 564-575. doi**:** 10.1080/15374416.2013.804387

Hostinar, C. E., Sullivan, R. M., & Gunnar, M. R. (2014). Psychobiological mechanisms underlying the social buffering of the hypothalamic–pituitary–adrenocortical axis: A review of animal models and human studies across development. *Psychological Bulletin, 140*(1), 256-282. doi: 10.1037/a0032671

Hox, J. J. & Stoel, R. D. (2005). Multilevel and SEM approaches to growth curve modeling. In B. S. Everitt & D. C. Howell (eds.). *Encyclopedia of Statistics in Behavioral Science* (pp. 1296-1305). Chicester, UK: Wiley.

Hruschka, D. J., Kohrt, B. A., & Worthman, C. M. (2005). Estimating between-and within-individual variation in cortisol levels using multilevel models. *Psychoneuroendocrinology*, *30*(7), 698-714. doi: 10.1016/j.psyneuen.2005.03.002

Jaffari-Bimmel, N., Juffer, F., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Mooijaart, A. (2006). Social development from infancy to adolescence: Longitudinal and concurrent factors in an adoption sample. *Developmental Psychology, 42*(6), 1143-1153. doi: 10.1037/0012-1649.42.6.1143

Juffer, F. (1993). *Verbonden door adoptie. Een experimenteel onderzoek naar hechting en competentie in gezinnen met een adoptiebaby*. (Attached through adoption. An experimental study on attachment and competence in families with an adopted baby.) Amersfoort, The Netherlands: Academic Press.

Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2005). The importance of parenting in the development of disorganized attachment: Evidence from a preventive intervention study in adoptive families. *Journal of Child Psychology and Psychiatry, 46*(3), 263-274. doi: 10.1111/j.1469-7610.2004.00353.x

Juffer, F., & Van IJzendoorn, M. H. (2005). Behavior problems and mental health referrals of international adoptees: a meta-analysis. *JAMA, 293*(20), 2501-2515. doi:10.1001/jama.293.20.2501.

Juffer, F., & Van IJzendoorn, M. H. (2007). Adoptees do not lack self-esteem: A meta-analysis of studies on self-esteem of transracial, international, and domestic adoptees. *Psychological Bulletin*, *133*(6), 1067-1083. doi: 10.1037/0033-2909.133.6.1067

Kertes, D. A., Gunnar, M. R., Madsen, N. J., & Long, J. D. (2008). Early deprivation and home basal cortisol levels: A study of internationally adopted children. *Development and Psychopathology*, *20*(02), 473-491. doi: 10.1017/S0954579408000230

Kirschbaum, C., & Hellhammer, D. H. (1994). Salivary cortisol in psychoneuroendocrine research: recent developments and applications. *Psychoneuroendocrinology*, *19*(4), 313-333.

Kroupina, M. G., Fuglestad, A. J., Iverson, S. L., Himes, J. H., Mason, P. W., Gunnar, M. R., ... & Johnson, D. E. (2012). Adoption as an intervention for institutionally reared children: HPA functioning and developmental status. *Infant Behavior and Development*, *35*(4), 829-837. doi: 10.1016/j.infbeh.2012.07.011

Kudielka, B. M., Broderick, J. E., & Kirschbaum, C. (2003). Compliance with saliva sampling protocols: electronic monitoring reveals invalid cortisol daytime profiles in noncompliant subjects. *Psychosomatic Medicine*, *65*(2), 313-319. doi: 10.1097/01.PSY.0000058374.50240.BF

Laurent, H. K., Ablow, J. C., & Measelle, J. (2011). Risky shifts: How the timing and course of mothers' depressive symptoms across the perinatal period shape their own and infant's stress response profiles. *Development and Psychopathology*, *23*(2), 521. doi: 10.1017/S0954579411000083

Luijk, M. P., Roisman, G. I., Haltigan, J. D., Tiemeier, H., Booth-LaForce, C., van IJzendoorn, M. H., ... & Bakermans-Kranenburg, M. J. (2011). Dopaminergic, serotonergic, and oxytonergic candidate genes associated with infant attachment security and disorganization? In search of main and interaction effects. *Journal of Child Psychology and Psychiatry*, *52*(12), 1295-1307. doi: 10.1111/j.1469-7610.2011.02440.x

Luijk, M. P., Saridjan, N., Tharner, A., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Jaddoe, V. W., ... & Tiemeier, H. (2010). Attachment, depression, and cortisol: Deviant patterns in insecure-resistant and disorganized infants. *Developmental Psychobiology, 52*(5), 441-452. doi: 10.1002/dev.20446

Main, M., Kaplan, N., & Cassidy, J. (1985). Security in infancy, childhood,and adulthood: A move to the level of representation. In Bretherton, I. & Waters, E. (Eds.), Growing points of attachment: Theory and research. *Monographs of the Society for Research in Child Development*, *50*(1–2, Serial No. 209), 66–104.

Main, M., & Solomon, J. (1990). Procedures for identifying infants as disorganized/disoriented during the Ainsworth Strange Situation. In M. T. Greenberg, D. Cicchetti, & E. M. Cummings (Eds.), *Attachment in the preschool years: Theory, research, and intervention* (pp. 121–160). Chicago: University of Chicago Press.

McBurnett, K., Lahey, B. B., Rathouz, P. J., & Loeber, R. (2000). Low salivary cortisol and persistent aggression in boys referred for disruptive behavior. *Archives of General Psychiatry*, *57*(1), 38-43. doi:10.1001/archpsyc.57.1.38.

Meinlschmidt, G., & Heim, C. (2005). Decreased cortisol awakening response after early loss experience. *Psychoneuroendocrinology*, *30*(6), 568-576. doi: 10.1016/j.psyneuen.2005.01.006

Miller, G. E., Chen, E., & Zhou, E. S. (2007). If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. *Psychological Bulletin, 133*(1), 25. doi: 10.1037/0033-2909.133.1.25

Nelson, C. A., Fox, N. A., & Zeanah, C. H. (2014). *Romania's abandoned children. Deprivation, brain development, and the struggle for recovery.* Harvard University Press.

Nicolson, N. A. (2004). Childhood parental loss and cortisol levels in adult men. *Psychoneuroendocrinology*, *29*(8), 1012-1018. doi: 10.1016/j.psyneuen.2003.09.005

Oosterman, M., De Schipper, J. C., Fisher, P., Dozier, M., & Schuengel, C. (2010). Autonomic reactivity in relation to attachment and early adversity among foster children. *Development and psychopathology*, *22*(01), 109-118. doi: 10.1017/S0954579409990290

Palacios, J., & Brodzinsky, D. (2010). Review: Adoption research: Trends, topics, outcomes. International Journal of *Behavioral Development, 34*(3), 270-284. doi: 10.1177/0165025410362837

Roisman, G.I., Susman, E., Barnett-Walker, K., Booth-LaForce, C., Owen, M.T., Belsky, J., ... & Steinberg, L. (2009). Early family and child-care antecedents of awakening cortisol levels in adolescence. *Child Development*, *80*(3), 907-920. doi: 10.1111/j.1467-8624.2009.01305.x

Rosenboom, L.G. (1994). *Gemengde gezinnen, gemengde gevoelens? Hechting en competentie van adoptiebaby's in gezinnen met biologisch eigen kinderen.* (Mixed families, mixed feelings? Attachment and competence of adopted babies in families with biological children). Doctoral dissertation, Utrecht University, Utrecht, The Netherlands.

Schoenmaker, C., Juffer, F., Van IJzendoorn, M. H., Van den Dries, L., Linting, M., Van der Voort, A., & Bakermans-Kranenburg, M. J. (2013). *Cognitive and health-related outcomes after exposure to early malnutrition: The Leiden Longitudinal Adoption Study.* Paper submitted for publication.

Spangler, G., & Schieche, M. (1998). Emotional and adrenocortical responses of infants to the strange situation: The differential function of emotional expression. *International Journal of Behavioral Development*, *22*(4), 681-706. doi: 10.1080/016502598384126

Stams, G. J. J. M, Juffer, F., & Van IJzendoorn, M. H. (2002). Maternal sensitivity, infant attachment, and temperament in early childhood predict adjustment in middle childhood: The case of adopted children and their biologically unrelated parents. *Developmental Psychology, 38*(5), 806-821. doi: 10.1037//0012-1649.38.5.806

Storsbergen, H. E., Juffer, F., Van Son, M. J., & 't Hart, H. T. (2010). Internationally adopted adults who did not suffer severe early deprivation: The role of appraisal of adoption. *Children and Youth Services Review, 32*(2), 191-197. doi: 10.1016/j.childyouth.2009.08.015

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Boston: Allyn & Bacon.

Talge, N. M., Neal, C., & Glover, V. (2007). Antenatal maternal stress and long-term effects on child neurodevelopment: how and why? *Journal of Child Psychology and Psychiatry, 48*(3-4), 245-261. doi: 10.1111/j.1469-7610.2006.01714.x

Trickett, P. K., Noll, J. G., Susman, E. J., Shenk, C. E., & Putnam, F. W. (2010). Attenuation of cortisol across development for victims of sexual abuse. *Development and Psychopathology*, *22*(01), 165-175. doi: 10.1017/S0954579409990332

Van den Dries, L., Juffer, F., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2009). Fostering security? A meta-analysis of attachment in adopted children. *Children and Youth Services Review*, *31*(3), 410-421. doi: 10.1016/j.childyouth.2008.09.008

Van den Dries, L., Juffer, F., van IJzendoorn, M. H., & Bakermans-Kranenburg, M. J. (2010). Infants' physical and cognitive development after international adoption from foster care or institutions in China. *Journal of Developmental & Behavioral Pediatrics*, *31*(2), 144-150. doi: 10.1097/DBP.0b013e3181cdaa3a

Van der Vegt, E. J. M., van der Ende, J., Kirschbaum, C., Verhulst, F. C., & Tiemeier, H. (2009). Early neglect and abuse predict diurnal cortisol patterns in adults: A study of international adoptees. *Psychoneuroendocrinology, 34*(5), 660-669. doi: 10.1016/j.psyneuen.2008.11.004

Van IJzendoorn, M. H., & Juffer, F. (2006). The Emanuel Miller Memorial Lecture 2006: Adoption as intervention. Meta-analytic evidence for massive catch-up and plasticity in physical, socio-emotional, and cognitive development. *Journal of Child Psychology and Psychiatry*, *47*(12), 1228-1245. doi: 10.1111/j.1469-7610.2006.01675.x

Van IJzendoorn, M. H., Juffer, F., & Klein Poelhuis, C. W. K. (2005). Adoption and cognitive development: a meta-analytic comparison of adopted and nonadopted children's IQ and school performance. *Psychological Bulletin*, *131*(2), 301. doi: 10.1037/0033-2909.131.2.301

Van IJzendoorn, M. H., Sagi, A., & Lambermon, M. W. E. (1992). The multiple caretaker paradox: Some data from Holland and Israel. In R. C. Pianta (Ed.), *New directions in child development: Relationships between children and non-parental adults* (pp. 5–24). San Francisco: Jossey-Bass.

WHO Anthro 2005, Beta version Feb 17th, 2006: Software for assessing growth and development of the world's children. Geneva: WHO. Available at: http://www.who.int/childgrowth/software/en/

5

General discussion

General discussion

Throughout history, orphans or abandoned and relinquished children have been cared for by non-related adults. In the twentieth century the legalization of this adoption process became wide-spread and many children were adopted domestically or internationally worldwide. In the Netherlands adoption was legalized in 1956, and in 1965 the first legal international adoptions were registered. Since then, more than 40,000 foreign children were adopted into the Netherlands (CBS, 2014). Studying the development and well-being of these adopted children and their adoptive families is beneficial in several ways. First, it is of critical importance to generate knowledge that can help support adopted children and their families. Second, studying adoptive families generates fundamental information that contributes to the nature-nurture debate, because associations between parent and child behavior are not intertwined with genetic relatedness.

In the series of studies presented in this thesis, adopted children were followed from infancy until young adulthood. We specifically focused on the importance of early caregiving experiences in the adoptive family for the development of externalizing and internalizing behavior in adolescence, and for physiological stress regulation in young adulthood. In this chapter we discuss the merits of our longitudinal design, the methodological challenges we met, and some implications based on the results.

1. The merits of a longitudinal adoption design

1.1 Longitudinal studies

Several longitudinal studies have examined the effects of early experiences on the development of children over time. Jack and Jeanne Block (2006) initiated a well-known longitudinal study and followed a cohort of children from California over more than 30 years. They started their longitudinal study in 1968 and followed 128 children from 3 years on into young adulthood. The study generated a wealth of information with a special focus on ego-control and ego-resiliency (Block, 1971), two core constructs that share notions with the temperamental trait effortful control that was used in our study in Chapter 2, and behavioral inhibition that was used in our study in Chapter 3. The longitudinal venture of Jack and Jeanne Block encountered many criticisms, such as being sprawling, untidy, and costly (Block & Block, 2006, p. 325), but they argued that despite the more or less founded nature of these criticisms, longitudinal studies contribute accumulatively to developmental science (Block & Block, 2006). Indeed, in the first stages of a longitudinal study it is difficult to focus and hard to refrain from including (too) many measurements in light of promising future possibilities. Self-reflection, peer criticism and ethical awareness may be important beacons in the search for boundaries.

Another well-known longitudinal study is the Minnesota Study of the Developing Person, rolled out by Alan Sroufe and his colleagues (Sroufe, 2005; Sroufe, Egeland, Carlson, & Collins, 2005). In this study, Bowlby's attachment theory was the central point of departure. Important issues that were addressed are the precursors and developmental sequelae of attachment relationships and the dynamic nature of developmental processes. The longitudinal study started in the mid-1970's and concerned a sample of mothers at risk for parenting problems due to poverty. The Minnesota longitudinal study has shown that infant attachment, although not a unique predictor of certain outcomes in later life, is

[…] *critical, both because of its place in initiating pathways of development and because of its connection with so many critical developmental functions - social relatedness, arousal modulation, emotional regulation, and curiosity, to name just a few. Attachment experiences remain, even in this complex view, vital in the formation of the person.* (Sroufe, 2005, p. 365)

Together with other important longitudinal studies such as the Christchurch Health and Development Study (Fergusson, Boden, & Horwood, 2014), the ongoing longitudinal Dunedin study that started in 1975 (Moffit & Caspi, 2001; Silva, 1990), the early childcare study initiated in the early 90s by the National Institute of Child Health and Human Development (NICHD, 2005), and the recently started and ongoing Generation R study (Jaddoe et al., 2006), the fore mentioned studies generated enormous amounts of information. However, not all developmental questions are tackled satisfactorily in such designs. A major problem in all (longitudinal) research on biologically related parent-child dyads is the confounding of genetics and environment: the same underlying genetic constitution may underlie parent behavior as well as child behavior and therefore increase associations between parent and child outcomes.

1.2 The longitudinal study of adoption

Longitudinal adoption studies give insight into human developmental issues, apart from genetic relatedness between parents and children (see for an overview of longitudinal adoption studies, Juffer et al., 2011). Together with twin-studies, which give insight into the other end of the spectrum (i.e., perfect genetic relatedness), adoption studies can inform us on the unique and interactive contributions of environmental and genetic factors on human development. The longitudinal adoption design however does not only enrich our fundamental knowledge, it also enhances knowledge on the trajectory following adoption which will be relevant to policymakers and practitioners supporting adoptive families.

Several research groups studied the longitudinal development of domestically adopted children. In 1968, Tizard started a pioneering longitudinal study in the United Kingdom. They monitored a group of children who had lived in institutional care in early life and were domestically adopted (or returned to their biological parents) later

on (Hodges & Tizard, 1989a, 1989b). In 1979, more than 240 domestically adopted children together with their birth mothers and their adoptive families entered the Colorado Adoption Project of John DeFries and Robert Plomin. They were followed into adulthood (Rhea, Bricker, Corley, DeFries, & Wadsworth, 2013). Grotevant and colleagues (Grotevant, McRoy, Wrobel, & Ayers-Lopez, 2013) followed a sample of domestic adoptees with different contact arrangements to examine the effects of closed or more open adoptions in the United States of America. The Metera Study from Greece investigated domestic adoptees from infancy to adolescence and compared them with a non-adopted comparison group (Vorria, Ntouma, & Rutter, 2014).

Only a few research groups have studied international adoptees longitudinally. In the Rotterdam Longitudinal Study that started in 1986, internationally adopted adolescents were followed into adulthood (Van der Vegt, Van der Ende, Kirschbaum, Verhulst, & Tiemeier, 2009; Verhulst, 2000). Matt McGue and Bill Iacono started their Sibling Interaction and Behavior Study (SIBS) in 1999. They followed adolescent siblings in 400 domestic or international adoptive families and 200 non-adoptive families over 6 years (Matteson, McGue,& Iacono, 2013). Another well-known project, the English and Romanian Adoptee study (ERA), was initiated in 1993 by Michael Rutter and Thomas O'Connor. They focused on the developmental outcomes of children who experienced severe deprivation in institutional care in Romania and were adopted into the United Kingdom in the early 90's (O'Connor & Rutter, 2000). These children were followed together with a group of non-deprived domestically adopted children and the most recent data were gathered in adolescence (Kumsta et al., 2010). A similar Canadian study initiated by Elinor Ames in 1991 (The Romanian Adoption Project) also followed children who experienced severe deprivation in Romanian institutions. These children were adopted into Canada and have been followed to the age of 17 together with a non-adopted, and an early-adopted control group (Ames, 1997; Chisholm, Carter, Ames, & Morison,1995; Le Mare & Audet, 2011).

1.3 The Leiden Longitudinal Adoption Study

The Leiden Longitudinal Adoption Study (LLAS) was initiated in 1985 and is unique when considering the early start, the intensiveness of the (observational) assessments and the long time span covered. The children participating in the LLAS were internationally adopted and originated from two companion studies. The first was a study on adoptive parents without any biological children (Juffer, 1993). The second sample originated from a study on adoptive families including one or more biological or previously adopted children (Rosenboom, 1994). The first assessments took place in infancy when the focus adopted children were 6, 12, 18, and 30 months of age. In middle childhood, at 7 years of age, a second wave of assessments took place, and 30 additional and comparable adoptive families entered the study based on the same inclusion criteria as before (Stams, Juffer, Rispens, & Hoksbergen, 2000). When the

adoptees were respectively 14 and 23 years of age, the third and fourth waves of the study were carried out (e.g., Jaffari-Bimmel, Juffer, Van IJzendoorn, Bakermans-Kranenburg, & Mooijaart, 2006; Schoenmaker et al., 2013). The aim of the LLAS was to examine correlates and sequelae of sensitive parenting and children's attachment security in a sample of parents and children without genetic relatedness (see Chapter 1 for a review of research on sensitivity and attachment; see Figure 1 for an overview of the design and measurements of the LLAS).

All children in the LLAS were adopted before the age of six months. The mean age at adoption of the children in the current series of studies (N = 160) is 10.19 weeks (SD = 5.04), which means that the period of deprivation (if any) is limited for all children. Children with extended experiences of deprivation in an institution usually show more problems in the area of attachment (e.g., O'Connor & Rutter, 2000), in visual memory and attention (Loman et al., 2013; Pollak et al., 2010), and in cortisol production (e.g., Kertes, Gunnar, Medsen, & Long, 2008). When examining the effects of parenting on the development of problem behavior and cortisol secretion in an adopted sample with long-term early deprivation, predictors as well as response variables can be affected by the experiences of deprivation, making associations between parent behavior and child behavior more difficult to interpret. Because all children in the LLAS were adopted at an early age, this study makes it possible to examine associations between parenting and developmental outcomes of children apart from effects of long-term extreme deprivation.

In this thesis we reported results from three empirical studies from the LLAS that assessed the longitudinal associations between parenting experiences in early and later life, child characteristics across the years, problem behavior in middle childhood and adolescence (Chapters 2 and 3), and cortisol secretion in young adulthood (Chapter 4). Multivariate analyses were performed to capture the longitudinal and multivariate nature of these data.

2. Structural equation modeling as a tool for analyzing longitudinal data.

The empirical studies on the data of the LLAS as presented in Chapters 2, 3, and 4 of this thesis were predominantly analyzed with Structural Equation Modeling (SEM). In the last decades , structural equation modeling has become a popular technique to analyze cross sectional as well as longitudinal data (Tomarken & Waller, 2005). The technique has major advantages, but challenges have also become clear. In this section some of these issues are addressed from an applied point of view. This section is not meant as a statistical guideline, but as an overview of practical challenges and potential considerations.

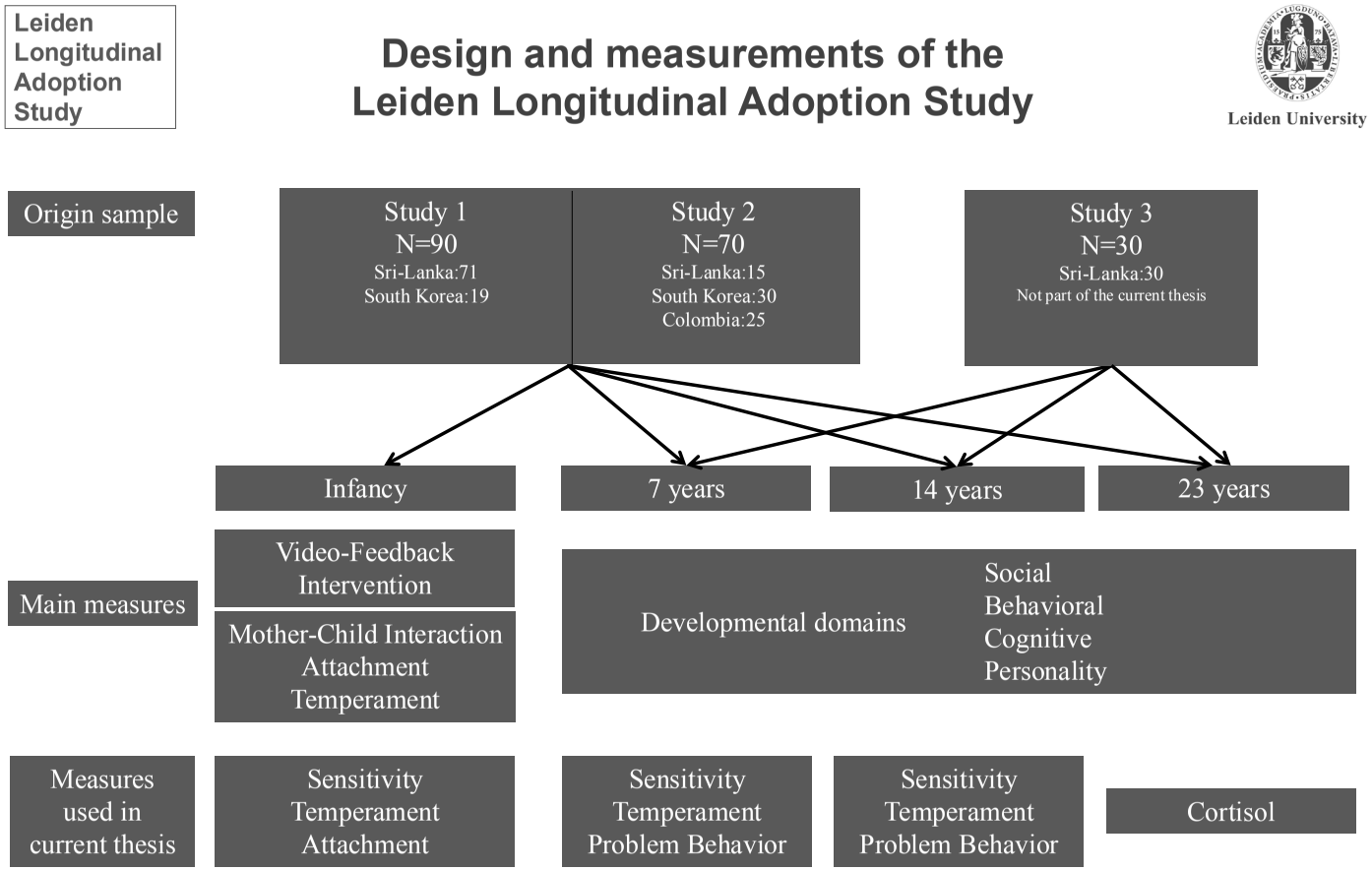

Figure 1. Design and measurements of the Leiden Longitudinal Adoption Study

2.1 Strengths of Structural Equation Modeling

In a Structural Equation Model (SEM) associations between psychological and behavioral constructs can be modeled and estimated. SEM is often presented as a confirmatory method, used to evaluate whether an a priori hypothesized model fits the data (Byrne, 2006). In SEM, theoretical constructs can be defined as latent variables reflected in multiple observed indicator variables (Byrne, 2006; Tomarken & Waller, 2005). For example, in Chapter 2 of this thesis the latent variable *effortful control* was based on three measured variables; items from a questionnaire. A major advantage of this procedure is that measurement error is explicitly modeled and therefore, compared to techniques like multiple regression, estimates of relations between latent constructs are less biased (Byrne, 2006; Tomarken & Waller, 2005). In the last decades, SEM has become a very popular data-analytical approach for psychological research, which is reflected in the large number of publications that use SEM and the large number of books and papers that discuss SEM (Tomarken & Waller, 2005). Apart from the reduction of measurement error, several other strengths of SEM may have contributed to its popularity. First, SEM is a very flexible analytical method. Many hypothesized multivariate models can be tested. Second, SEM enables a confirmative approach to theory testing. Third, several measures are available to assess model fit in order to test model plausibility (Byrne, 2006; Tomarken & Waller, 2005). In practice, however, these advantages bring their own challenges.

2.2 Challenges when using SEM

2.2.1 Flexibility. SEM is a very flexible analytical method. Hypothesized models may exist of more than two waves in time, are not restricted to one specific outcome variable and can specify several transactional processes. On top of that, and in contrast to many other analytic methods, it is possible to model error components in different ways. One may want to allow error components to correlate over time, and it is also possible to constrain error variances to be equal over time. The flexibility of SEM is very useful because it enables researchers to test very detailed theoretical models. At the same time however, this flexibility is one of the major caveats when using SEM, because making choices when you have a lot to choose from is not easy. Like other statistical methods, SEM allows for the specification of models that do not make sense theoretically and cannot test directionality and causality of hypothesized associations. Therefore it is important to carefully evaluate the theoretical and methodological soundness of the hypothesized model and to explicitly report which choices were made and why. As an example, in our study we allowed error variances of the same instruments used at different points in time to correlate. When (slightly) different measures were used, correlations over time were set at zero. Such an approach is quite common in longitudinal studies using SEM, and is theoretically founded.

2.2.2. Confirmative versus exploratory testing. As discussed above, SEM cannot test the theoretical plausibility of models. Without a sound theoretical base, the risk of making Type I errors increases, which is especially a problem when many parameters are estimated. A strictly confirmative approach in which few parameters are to be estimated may seem a solution to this problem, but in practice proves difficult to achieve. In our studies, the models for externalizing and internalizing behavior (Chapters 2 and 3) were tested in several steps. First, full models were estimated with predictive relations between all latent variables and concurrent predictions from sensitivity and temperament to problem behavior. In a second step, non-significant structural paths were removed and the more parsimonious models were compared to the full models. One could argue that this approach is not confirmative, but more data driven and exploratory in nature. It may increase capitalization on chance and enhance the risk for Type I errors. Another option would be to begin with a more parsimonious model in which only very strong theoretically based paths are estimated. Although this approach seems more confirmatory, there are some downsides that need to be considered. First, especially in longitudinal research, theory mostly does not provide specific expectations about relations in specific time-periods. In our models for example, it seemed to be theoretically plausible that maternal sensitivity affected problem behavior at all concurrent and future time points. Second, when researchers do start with a more parsimonious model, they can add more parameters (e.g., using the Lagrange Multiplier Test) in order to improve model fit (Byrne, 2006). In other words, starting with a more parsimonious model may lead to model construction by adding significant paths instead of removing non-significant paths. This approach ultimately has the same problem of chance-capitalization. No straightforward solution to these issues is at hand. Obviously, resampling techniques and cross validation in two subsamples can tackle this problem, but few studies have large enough samples for the latter procedure. In our opinion, researchers should try to keep their models theoretically plausible, validate final findings with results from earlier studies, and report the problems they encountered explicitly.

2.2.3 Fit indices. In SEM several fit-indices are provided that assess overall model fit and that also allow for a comparison between two nested models. Although the availability of fit-indices can be very helpful, it is not easy to choose from all the options available. Often suggested fit indices include the Comparative Fit Index (CFI), the Non Normed Fit Index (NNFI) and the Root Mean Square Error of Approximation (RMSEA). The Chi-square value is also a commonly used fit-index, however, this index is very sensitive to a large sample size (e.g. Iacobucci, 2010) and to many degrees of freedom of the model (Kenny & McCoach, 2003). In our models of externalizing behavior (Chapter 2) all Chi-square values were significant, which would indicate insufficient model fit. However, all the other fit-indices, such as the NNFI and the CFI were satisfactory to good. It has been

proposed not to report the *p*-value of the Chi-square, but to inspect the ratio between the chi-square and degrees of freedom. If this ratio does not exceed 2, the model-fit is adequate (Byrne, 2006; Tabachnick & Fidell, 1996). Nevertheless, this ratio is still sensitive to the number of variables in the model (Kenny & McCoach, 2003) and in very large samples, the Chi-square value may be completely non-informative.

Even if an informed choice of fit-indices has been made, one might wonder whether overall adequate fit always is an essential criterion for the validation of a specified model. In a multiple regression analysis for example, researchers simply focus on the magnitude of associations or on the total amount of variance explained. Also, one should be aware that in SEM fit indices are strongly affected by paths that are not estimated (but should have been due to high correlations). It may be very informative to retain variables in the model that do not relate significantly with other variables (without specifying path estimates) in contrast to deleting these variables completely. A small, non-significant drop in fit-indices may indicate the plausibility of the absence of relations. For that reason we decided to not delete (latent) variables from our models when they did not relate significantly to any other (latent) variable (see for example Chapter 2: delinquency at 7 years of age).

To conclude, good model fit does not necessarily mean that all important variables are included in the model. Fit indices are not always sensitive to omitted variables (Tomarken & Waller, 2005) and one might falsely have the impression that the model reflects reality. It is very important to keep track of the amount of explained variance in main outcome variables.

2.2.4 Defining latent variables. In our study, we made use of the major advantage of SEM and defined the central constructs with multiple indicators. Maternal sensitivity was indicated by three observed variables: supportive presence, clarity of instruction, and sensitivity and timing. The underlying (latent) sensitivity construct loaded highly on all three variables, and measurement error was reduced. This way, the sensitivity construct is defined more precisely compared to using composite scores or single variables. The optimal level of correlations between indicators is under debate (e.g., Hertzog & Nesselroade, 2003; Little, Lindenberger, & Nesselroade, 1999). In our studies, the different sensitivity indicators at the same time-point were highly correlated (between .75 en .86, as expected when coded by the same person). This property is sometimes suggested to be a good thing from a purely statistical point of view, but content wise, one might wonder whether the high correlations among indicators imply that we defined sensitivity too narrowly (Little et al., 1999). When indicators correlate only moderately in SEM, fit-indices of the measurement model may drop dramatically, especially when they also correlate moderately (or highly) with indicators of other latent variables in the model. Making theoretical choices and check their statistical feasibility seems to make the most sense.

2.3 Limitations of SEM

2.3.1 Moderation effects. Although SEM is a very flexible method, it is not easily suited for testing moderation. In our models we were interested in possible interaction effects between temperament and parenting on the development of problem behavior (Chapters 2 and 3). It may be that children with more difficult temperament benefit more from good parenting but also suffer more from bad parenting than children with an easy temperament, in accordance with the theory of differential susceptibility (Belsky, Bakermans-Kranenburg, & Van IJzendoorn, 2007). In the SEM context it is difficult to test such moderation effects (Tomarken & Waller, 2005). Several suggestions have been put forward (e.g., Lee, Song, & Poon, 2004), but these suggestions are not straightforward and often are difficult to adapt to the aims of the average user. We decided to use the BoxM test in SPSS 19 (IBM corp., 2010) as an indicator of differential covariance matrices between groups of categorical variables (gender and median split in temperament). Our preliminary results indicated that there were no differences in covariance matrices and that further investigation of moderation was not warranted. However, when the covariance matrices do differ according to the BoxM test, more rigorous analyses are needed in order to find out how the moderation looks like. A way of testing moderation in SEM is making use of multi-group comparison. When interested in categorical variables such as gender, researchers can test the model specifically on different subsamples and evaluate whether constraining parameter estimates to be the same across groups is tenable. However, this method is only appropriate for large sample sizes, not suited to investigate interactions between continuous variables, and often yields results difficult to interpret.

2.3.2 Stability coefficients. Another drawback of a structural model for longitudinal data (such as the models we used when examining problem behavior of adopted adolescents in Chapters 2 and 3), is that in many cases constructs show high stability over time, especially when they are corrected for measurement error. In fact, comparable constructs over time may explain so much variation among each other, that it is difficult to detect possible effects of other variables. On top of that, the stability coefficients do not assess change directly (Hertzog & Nesselroade, 2003). Latent growth modeling (which may be performed with SEM, see Chapter 4), and more specific, latent change modeling may be a solution to these problems, because in this method intercepts and slopes (change scores if two waves are used) are specified as latent variables (Hertzog & Nesselroade, 2003). However, this technique is only applicable in longitudinal studies that use the exact same measurements over time in exactly the same manner. Of course, in our longitudinal developmental models (Chapters 2 and 3) this is not the case and using the exact measurements in this context might not always be preferable. When examining development of children, researchers should be aware of the ongoing developmental process that may only be captured by (slightly) different measurements.

2.3.3 Sample size. SEM in general is most suitable for analyzing relatively large sample sizes. Different suggestions have been made regarding the appropriate sample size. It is proposed that ideally the ratio of sample size to the number of estimated parameters is 20 to 1 (Kline, 2011), but this suggestion does not seem realistic at all. Even the more realistic but ad hoc 10 to 1 rule (see for a discussion Westland, 2010) is difficult to obtain for most studies, including our own. Also, such rules may have led researchers to limit the number of estimated parameters by selecting a smaller number of indicators per latent variable. This approach is not advisable, because it has been suggested that more indicators per latent variables reduces the need for a large sample size (Westland, 2010). Others proposed less stringent rules of thumb, such as a ratio between sample size and free parameters of 5 to 1 (Bentler & Chou, 1987) or a minimum sample size of 200 for any SEM (Weston & Gore, 2006). In the Leiden Longitudinal Study the basic sample consisted of 160 people (Chapters 3 and 4), and the number of young adults that participated in the cortisol study (Chapter 4) measurements was smaller. Thus, we did not meet the criteria proposed above. The stability and power of the models would have been better with a larger sample. However, it is very difficult to obtain large samples in longitudinal adoption studies, especially when intensive observational measures are used such as in the Leiden Longitudinal Adoption Study.

3. Implications of the Leiden Longitudinal Adoption Study

The Leiden Longitudinal Adoption Study (LLAS) has generated a wealth of information regarding the effects of maternal sensitivity and attachment on the development of adopted children. In earlier publications it was reported that adoptive mothers who received a short-term attachment-based intervention were more sensitive than control mothers. Their children were less likely to be classified as having a disorganized attachment in infancy (Juffer, Bakermans-Kranenburg, & Van IJzendoorn, 2005). When the adopted children were seven years of age, long-term positive effects of early maternal sensitivity and the quality of the attachment relationship were found; both variables predicted better social and cognitive development (Stams, Juffer, & Van IJzendoorn, 2002). At this time, adoptive mothers showed less maternal sensitivity than non-adoptive mothers (Stams et al., 2002). When the children were 14 years of age, maternal sensitivity of the mother, current as well as previous, predicted better social development for the adopted adolescent. Also, it seemed to be that maternal sensitivity buffered against a difficult temperament. A more difficult temperament at 7 years of age predicted more maternal sensitivity at 14 years of age which in its turn predicted better concurrent social development (Jaffari-Bimmel et al., 2006).

In the studies of the LLAS discussed in this thesis the above mentioned line of inquiry was continued. First, the protective effects of maternal sensitivity on the development

of problem behavior were investigated from infancy to adolescence. As described in Chapter 2, maternal sensitivity at 14 years of age predicted less delinquent behavior of the adopted adolescent. Second, as described in Chapter 3, maternal sensitivity in infancy and middle childhood predicted less inhibited behavior of the adolescent which in its turn predicted less concurrent withdrawn and anxious behavior. These relations were found in a multivariate model in which temperament of the child was taken into account. It is suggested that maternal sensitivity early as well as later in life, is a protective factor for the development of problem behavior. This said, we also have to conclude that the associations we found were small in magnitude and that other environmental and constitutional factors will play a role. For instance, it may be that psychopathology of the adoptive as well as biological parents (e.g. Goodman et al., 2011) and adolescent peer relations (Deković, 1999) partly determine the absence or presence of problem behavior in adolescence. Also, other dimensions of parenting such as parental monitoring may be important (Dishion & McMahon, 1998; Fosco, Stormshak, Dishion, & Winter, 2011), especially in adolescence. We used a rather narrow measure of maternal sensitivity that primarily focused on the maternal supporting and structuring behavior in a task situation. However, these measures were selected on a strong theoretical base and use of such a dimension may be specifically informative and give better clues for preventive interventions than a broad dimension with more divergent components . Lastly, it may be that the relationship with the father plays an important role in the development of problem behavior (e.g., Bögels & Perotti, 2011; Fosco et al., 2011). Although in the LLAS adoptive fathers were involved in some assessments, no paternal sensitivity rates were available. In future studies we would like to involve the fathers more intensively.

In the third empirical paper of this dissertation (Chapter 4), we investigated the effects of attachment experiences on the HPA-axis functioning in young adulthood, at 23 years of age. Although in earlier studies of the LLAS maternal sensitivity and secure and organized attachment relationships have shown to predict better social development (Jaffari-Bimmel et al., 2006) and less problem behavior in adolescence (this thesis), no long-term associations were found with the HPA-axis functioning: the quality of the attachment relationship and maternal sensitivity in infancy did not predict the height or slope of the cortisol diurnal curve at age 23. The lack of associations may be explained by the long time-span, by overshadowing effects of possible positive as well as negative adoption-specific experiences such as prenatal problems, and by methodological issues. Our results do suggest that on average, the cortisol values of the adopted adults show the expected decline over the day. Although no comparison group was available, it seemed that the non-optimal start in early life did not alter the diurnal rhythm dramatically as has been found in studies of children with longer experiences of deprivation (Gunnar, Morison, Chisholm, & Schuder, 2006). This indication may specifically suggest the positive effects of early adoption, although

we should keep in mind that it does not provide us with any information on individual variation. Finally, the lack of significant associations may be due to the relatively small sample size. It will be interesting to see whether future studies reveal similar results.

In conclusion, (ongoing) effects of parenting practices on the development of adoptees are present, although not large and not equally substantial in all domains. Adoptive parents receive some preparation prior to the adoptive process, but it might be a good idea to offer more ongoing support in order to promote parental sensitive behavior. Social workers, clinicians and policy makers can try to concretize this idea when supporting adoptive parents and their adopted adolescents.

4. Conclusion

The main goal of this thesis was to unravel longitudinal associations between maternal sensitivity, child temperament, and problem behavior from infancy to adolescence, and to assess associations between early quality of attachment and the secretion of cortisol in young adulthood. Results revealed that the constitutionally based temperament of children is an important precursor of behavior problems. Maternal sensitive parenting at different points in time can be important for the beneficial development of children, even when genetic relatedness between mother and child is absent.

References

Ames, E. (1997). *The development of Romanian orphanage children adopted into Canada*. Final report to Human Resources Development Canada. Burnaby, Canada: Simon Fraser University.

Belsky, J., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2007). For better and for worse differential susceptibility to environmental influences. *Current Directions in Psychological Science*, *16*(6), 300-304.

Bentler, P. M., & Chou, C. P. (1987). Practical issues in structural modeling. *Sociological Methods & Research, 16*(1), 78-117.

Block, J. (1971) *Lives through time.* Berkely, CA: Bancroft Books.

Block, J., & Block, J. H. (2006). Venturing a 30-year longitudinal study. *American Psychologist*, *61*(4), 315-327.

Bögels, S. M. & Perotti, E. C. (2011). Does father know best? A formal model of the paternal influence on childhood social anxiety. *Journal of Child and Family Studies*, *20*, 171-181.

Byrne, B. M. (2006). *Structural Equation Modeling with EQS, basic concepts, applications and programming* (2nd edition). Thousand Oaks, CA: Sage

CBS (2014) Statline. *Adopties vanaf 1957; in Nederland en in het buitenland geboren kinderen (Adoptions from 1957; Children born in the Netherlands and abroad*). Downloaded from the internet on august 12th, 2014.

Chisholm, K., Carter, M. C., Ames, E. W., & Morison, S. J. (1995). Attachment security and indiscriminately friendly behavior in children adopted from Romanian orphanages. *Development and Psychopathology*, *7*, 283-294.

Deković, M. (1999). Risk and protective factors in the development of problem behavior during adolescence. *Journal of Youth and Adolescence*, *28*(6), 667-685.

Dishion, T. J., & McMahon, R. J. (1998). Parental monitoring and the prevention of child and adolescent problem behavior: A conceptual and empirical formulation. *Clinical Child and Family Psychology Review, 1*(1), 61-75.

Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2014). Bullying in childhood, externalizing behaviors, and adult offending: Evidence from a 30-year study. *Journal of School Violence, 13*(1), 146-164.

Fosco, G. M., Stormshak, E. A., Dishion, T. J., & Winter, C. E. (2012). Family relationships and parental monitoring during middle school as predictors of early adolescent problem behavior. *Journal of Clinical Child & Adolescent Psychology, 41*(2), 202-213.

Goodman, S. H., Rouse, M. H., Connell, A. M., Broth, M. R., Hall, C. M., & Heyward, D. (2011). Maternal depression and child psychopathology: a meta-analytic review. *Clinical child and family psychology review*, *14*(1), 1-27.

Grotevant, H. D., McRoy, R.G., Wrobel,G. M.,& Ayers-Lopez, S.(2013). Contact between adoptive and birth families: perspectives from the Minnesota/Texas Adoption Research Project. *Child Development Perspectives, 7*, 193–98.

Gunnar, M. R., Morison, S. J., Chisholm, K., & Schuder, M. (2001). Salivary cortisol levels in children adopted from Romanian orphanages. *Development and psychopathology*, *13*(03), 611-628.

Hertzog, C., & Nesselroade, J. R. (2003). Assessing psychological change in adulthood: an overview of methodological issues. *Psychology and Aging*, *18*(4), 639-657.

Hodges, J., & Tizard, B. (1989a). Social and family relationships of ex-institutional adolescents. *Journal of Child Psychology and Psychiatry*, *30*(1), 77-97.

Hodges, J., & Tizard, B. (1989b). IQ and behavioural adjustment of ex-institutional Adolescents. *Journal of Child Psychology and Psychiatry*, *30*(1), 53-75.

Iacobucci, D. (2010). Structural equations modeling: Fit indices, sample size, and advanced topics. *Journal of Consumer Psychology, 20*(1), 90-98.

IBM Corp. (2010). *IBM SPSS Statistics for Windows, Version 19.0*. Armonk, NY: IBM Corp.

Jaddoe, V. W., Mackenbach, J. P., Moll, H. A., Steegers, E. A., Tiemeier, H., Verhulst, F. C., ... & Hofman, A. (2006). The Generation R Study: design and cohort profile. *European Journal of Epidemiology*, *21*(6), 475-484.

Jaffari-Bimmel, N., Juffer, F., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Mooijaart, A. (2006). Social development from infancy to adolescence: Longitudinal and concurrent factors in an adoption sample. *Developmental Psychology*, *42*, 1143-1153.

Juffer, F. (1993). *Verbonden door adoptie. Een experimenteel onderzoek naar hechting en competentie in gezinnen met een adoptiebaby.* (Attached through adoption. An experimental study on attachment and competence in families with an adopted baby.) Amersfoort, The Netherlands: Academic Press.

Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2005). The importance of parenting in the development of disorganized attachment: Evidence from a preventive intervention study in adoptive families. *Journal of Child Psychology and Psychiatry*, *46*, 263-274.

Juffer, F., Palacios, J., Le Mare, L., Sonuga-Barke, E. J. S., Tieman, W., Bakermans-Kranenburg, M. J., Vorria, P., van IJzendoorn, M. H. and Verhulst, F. C. (2011), II. Development of adopted children with histories of early adversity. *Monographs of the Society for Research in Child Development, 76*, 31–61.

Kenny, D. A., & McCoach, D. B. (2003). Effect of the number of variables on measures of fit in structural equation modeling. *Structural Equation Modeling, 10*(3), 333-351.

Kertes, D. A., Gunnar, M. R., Madsen, N. J., & Long, J. D. (2008). Early deprivation and home basal cortisol levels: A study of internationally adopted children. *Development and psychopathology, 20*(02), 473-491.

Kline, R. B. (2011). *Principles and practice of structural equation modeling*. (3d ed.). New York: Guilford Press.

Kumsta, R., Stevens, S., Brookes, K., Schlotz, W., Castle, J., Beckett, C., ... & Sonuga-Barke, E. (2010). 5HTT genotype moderates the influence of early institutional deprivation on emotional problems in adolescence: evidence from the English and Romanian Adoptee (ERA) study. *Journal of Child Psychology and Psychiatry, 51*(7), 755-762.

Lee, S. Y., Song, X. Y., & Poon, W. Y. (2004). Comparison of approaches in estimating interaction and quadratic effects of latent variables. *Multivariate Behavioral Research, 39*(1), 37-67.

Le Mare, L. & Audet, K. (2011) Communicative openness in adoption, knowledge of culture of origin, and adoption identity in adolescents adopted from Romania, *Adoption Quarterly, 14*(3), 199-217.

Little, T. D., Lindenberger, U., & Nesselroade, J. R. (1999). On selecting indicators for multivariate measurement and modeling with latent variables: When "good" indicators are bad and "bad" indicators are good. *Psychological Methods, 4*(2), 192.

Loman, M. M., Johnson, A. E., Westerlund, A., Pollak, S. D., Nelson, C. A., & Gunnar, M. R. (2013). The effect of early deprivation on executive attention in middle childhood. *Journal of Child Psychology and Psychiatry, 54*(1), 37-45.

Matteson, L. K., McGue, M., & Iacono, W. G. (2013). Shared environmental influences on personality: A combined twin and adoption approach. *Behavior Genetics*, *43*(6), 491-504.

Moffitt, T. E., & Caspi, A. (2001). Childhood predictors differentiate life-course persistent and adolescence-limited antisocial pathways among males and females. *Development and Psychopathology*, *13*(02), 355-375.

NICHD Early Child Care Research Network (Ed.). (2005). *Child care and child development: Results from the NICHD study of early child care and youth development*. Guilford Press.

O'Connor, T. G., & Rutter, M. (2000). Attachment disorder behavior following early severe deprivation: Extension and longitudinal follow-up. *Journal of the American Academy of Child & Adolescent Psychiatry, 39*(6), 703-712.

Pollak, S. D., Nelson, C. A., Schlaak, M. F., Roeber, B. J., Wewerka, S. S., Wiik, K. L., Gunnar, M. R. (2010). Neurodevelopmental effects of early deprivation in post-institutionalized children. *Child Development, 81*(1), 224–236.

Rhea, S. A., Bricker, J. B., Corley, R. P., DeFries, J. C., & Wadsworth, S. J. (2013). Design, Utility, and History of the Colorado Adoption Project: Examples Involving Adjustment Interactions. *Adoption Quarterly*, *16*(1), 17-39.

Rosenboom, L.G. (1994). *Gemengde gezinnen, gemengde gevoelens? Hechting en competentie van adoptiebaby's in gezinnen met biologisch eigen kinderen*. (Mixed families, mixed feelings? Attachment and competence of adopted babies in families with biological children). Doctoral dissertation, Utrecht University, Utrecht, The Netherlands.

Schoenmaker, C., Juffer, F., Van IJzendoorn, M.H., Van den Dries, L., Linting, M., Van der Voort, A., & Bakermans-Kranenburg, M.J. (2013). *Cognitive and health-related outcomes after exposure to early malnutrition: The Leiden Longitudinal Adoption Study.* Paper submitted for publication.

Silva, P. A. (1990). The Dunedin multidisciplinary health and development study: a 15 year longitudinal study. *Paediatric and Perinatal Epidemiology, 4*(1), 76-107.

Sroufe, L. A. (2005). Attachment and development: A prospective, longitudinal study from birth to adulthood. *Attachment & human development*, *7*(4), 349-367.

Sroufe, L. A., Egeland, B., Carlson, E. A., & Collins, W. A. (2005). *The development of the person: The Minnesota study of risk and adaptation from birth to adulthood.* New York, NY: Guilford Publications.

Stams, G. J. J. M., Juffer, F., Rispens, J., & Hoksbergen, R. A. C. (2000). The development and adjustment of 7-year old children adopted in infancy. *Journal of Child Psychology and Psychiatry, 41*, 1025–1037.

Stams, G. J. J., Juffer, F., & van IJzendoorn, M. H. (2002). Maternal sensitivity, infant attachment, and temperament in early childhood predict adjustment in middle childhood: the case of adopted children and their biologically unrelated parents. *Developmental Psychology, 38*(5), 806-821.

Tabachnick, B. G., & Fidell, L. S. (2001). *Using multivariate statistics*. Boston: Allyn & Bacon.

Tomarken, A. J., & Waller, N. G. (2005). Structural equation modeling: Strengths, limitations, and misconceptions. *Annu. Rev. Clin. Psychol., 1*, 31-65.

Van der Vegt, E. J., van der Ende, J., Kirschbaum, C., Verhulst, F. C., & Tiemeier, H. (2009). Early neglect and abuse predict diurnal cortisol patterns in adults: A study of international adoptees. *Psychoneuroendocrinology*, *34*(5), 660-669.

Verhulst, F. C. (2000). Internationally adopted children: The Dutch longitudinal adoption study. *Adoption Quarterly*, *4*(1), 27-44.

Vorria, P., Ntouma, M., & Rutter, M. (2014). The cognitive development and school achievement of adopted adolescents: The Greek "Metera" study. *European Journal of Developmental Psychology*, doi: 10.1080/17405629.2014

Weston, R., & Gore, P. A. (2006). A brief guide to structural equation modeling. *The Counseling Psychologist, 34*(5), 719-751.

Westland, J. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications, 9*(6), 476-487.

Samenvatting (Summary in Dutch)

In de afgelopen decennia heeft onderzoek duidelijk gemaakt dat sensitief ouderschap een positieve bijdrage kan leveren aan de ontwikkeling van kinderen. Sensitief ouderschap verwijst naar het vermogen van ouders om de signalen van hun kind goed op te vangen, deze goed te interpreteren en er snel en correct naar te handelen (Ainsworth, Blehar, Waters, & Wall, 1978). In eerder onderzoek is sensitief ouderschap als een belangrijke voorspeller van een veilige gehechtheidsrelatie naar voren gekomen: als een kind sensitieve ouders heeft, is de kans groter dat het veilig gehecht raakt (Bakermans-Kranenburg, Van IJzendoorn, & Juffer, 2003; De Wolff & Van IJzendoorn, 1997). Het kind ervaart zijn ouder dan als een veilige haven in tijden van spanning en stress (Bowlby, 1969). In dit proefschrift wordt onderzocht en besproken in hoeverre sensitief ouderschap een mogelijk beschermende rol speelt op langere termijn. Lopen kinderen met sensitieve ouders minder risico op het ontwikkelen van gedragsproblemen in de basisschoolleeftijd en de adolescentie? En hangen sensitief ouderschap en een veilige gehechtheid samen met de dagelijkse cortisolcurve op jongvolwassen leeftijd? Aan de hand van een review en drie empirische studies wordt in dit proefschrift antwoord gegeven op deze vragen. De empirische studies maken deel uit van een longitudinaal adoptieonderzoek waardoor het mogelijk is om verbanden tussen het gedrag van ouders en kinderen te onderzoeken los van genetische gelijkenis. Daarnaast bieden de resultaten aangrijpingspunten voor de adoptiepraktijk.

Sensitiviteit en gehechtheid

De kwaliteit van de gehechtheidsrelatie tussen ouder en kind wordt veelal gemeten met de Vreemde Situatie Procedure (Ainsworth et al., 1978). In een speciaal ontwikkelde procedure verlaat de ouder tweemaal voor een korte periode de spelkamer waar ouder en kind zich bevinden. De reactie op de terugkomst van de ouder is vooral informatief als het gaat om de kwaliteit van de gehechtheidsrelatie. Afhankelijk van deze reactie worden kinderen gecodeerd als veilig gehecht (B: kind zoekt contact en vindt troost), onveilig vermijdend gehecht (A: reageert nauwelijks op terugkomst), of onveilig ambivalent gehecht (C: zoekt contact maar verzet zich er ook tegen). Los van de ABC-indeling wordt een kind ook geclassificeerd als georganiseerd of gedesorganiseerd (D: gebrek aan coherente strategie).

Om de sociaal-emotionele ontwikkeling van kinderen met een veilige of onveilige gehechtheid te onderzoeken zijn diverse meta-analyses uitgevoerd. In meta-analyses worden alle studies over één bepaald onderwerp samen genomen. Ze leveren als het ware overkoepelende resultaten op. Deze meta-analyses laten zien dat een veilige gehechtheid betere sociale competenties (Groh et al., 2014) en minder gedragsproblemen (Fearon, Bakermans-Kranenburg, Van IJzendoorn, Lapsley, & Roisman, 2010; Groh, Roisman, Van IJzendoorn, Bakermans-Kranenburg, & Fearon,

2012) voorspelt. Daarnaast suggereren resultaten van empirische studies (b.v. Luijk en collega's, 2010) dat er in de kindertijd verbanden zijn met het hormoon cortisol, ook wel stress-hormoon genoemd.

Mary Ainsworth stelde dat sensitiviteit van groot belang is voor de ontwikkeling van een veilige gehechtheidsrelatie tussen ouder en kind (Ainsworth et al., 1978). Dit uitgangspunt werd bevestigd in een meta-analyse waaruit sensitiviteit als voorspeller van een veilige gehechtheid naar voren kwam met een effectgrootte van r = 0.24 (De Wolff & Van IJzendoorn, 1997). In interventiestudies zijn deze bevindingen in experimentele onderzoeksopzetten bevestigd. Aangetoond werd dat het mogelijk is om de gehechtheidsrelatie en de sensitiviteit van ouders te verbeteren met behulp van korte programma's die gericht zijn op de interactie tussen ouder en kind (Bakermans-Kranenburg et al., 2003). Meer zicht op de korte- en langetermijneffecten van sensitief ouderschap kan het belang van dergelijke programma's onderstrepen.

De Leidse Longitudinale Adoptiestudie

In de Leidse Longitudinale Adoptiestudie (LLAS) worden 160 adoptiekinderen gevolgd van de vroege kindertijd tot aan de jongvolwassenheid. De adoptiekinderen werden aselect geworven via diverse adoptieorganisaties (Juffer, 1993; Rosenboom, 1994). De adoptiekinderen, 75 jongens en 85 meisjes, kwamen uit Sri-Lanka (n = 86), Zuid-Korea (n = 49) en Colombia (n = 25). In alle gezinnen was de moeder de belangrijkste verzorger van het kind.

Uniek aan de LLAS is dat alle adoptiekinderen geadopteerd zijn op zeer jonge leeftijd (gemiddelde leeftijd bij aankomst 11 weken). Hierdoor is het mogelijk om de gevolgen van de opvoedingservaringen in het nieuwe gezin op zichzelf in te schatten zonder de verstrengeling met ervaringen van langdurige en ernstige deprivatie. Mogelijke effecten worden dan niet vertroebeld door bijvoorbeeld een langdurig verblijf in een kindertehuis.

De LLAS geeft niet alleen hele nuttige en waardevolle informatie over het adoptieproces zelf, maar kan ook licht werpen op de effecten van opvoeding op het functioneren van kinderen zonder dat er genetische verwantschap tussen ouder en kind bestaat. Het is goed mogelijk dat er bij genetisch verwante ouders en kinderen verbanden zichtbaar zijn tussen ouder- en kindgedrag omdat genetische componenten beide deels bepalen. Om meer zicht te krijgen op de mogelijke effecten van sensitief ouderschap is er binnen de LLAS een reeks empirische studies opgezet. Een aantal daarvan wordt in dit proefschrift besproken.

Externaliserend probleemgedrag

In hoofdstuk 2 van dit proefschrift wordt een empirische studie naar de longitudinale ontwikkeling van externaliserend probleemgedrag besproken. In deze studie werden sensitiviteit van de moeder en temperament van het kind getoetst als mogelijke

voorspellers van agressief en delinquent gedrag, twee subschalen van externaliserend probleemgedrag. Agressief gedrag is meer open en naar buiten gericht (slaan, uitschelden) en delinquent gedrag verwijst naar meer stiekeme gedragingen (stelen, liegen). In een longitudinaal structureel model werden de gegevens van de vroege kindertijd (12-30 maanden), de basisschoolleeftijd (7 jaar) en de adolescentie (14 jaar) gemodelleerd. Agressief en delinquent gedrag werden gemeten met de Teacher Report Form, een gedragsvragenlijst die ingevuld wordt door de leerkracht (Verhulst, Van der Ende, & Koot, 1997a). Sensitiviteit van de moeder werd geobserveerd in een taaksituatie met behulp van de Erickson-schalen (Egeland, Erickson, Clemenhagen-Moon, Hiester, & Korfmacher, 1990). Tot slot werd op basis van een vragenlijst die door de moeder werd ingevuld bepaald in hoeverre een kind in staat is om zelf zijn of haar gedrag en aandacht te reguleren, een eigenschap die ook wel 'effortful control' wordt genoemd.

De resultaten tonen aan dat 'effortful control' een belangrijke voorspeller van externaliserend probleemgedrag is: kinderen met meer zelfcontrole lieten in verhouding minder agressief en delinquent gedrag zien. Daarnaast bleek de sensitiviteit van de moeder in de adolescentiefase van belang. Hoe sensitiever moeders met hun adolescent omgingen, hoe minder delinquent gedrag de jongere liet zien (β = -.21). Deze beschermende rol van sensitiviteit is mogelijk vooral van belang voor jongeren die minder zelfcontrole hebben en daardoor een verhoogde kans hebben om delinquent gedrag te ontwikkelen.

Internaliserend probleemgedrag

In hoofdstuk 3 wordt de studie naar de ontwikkeling van internaliserend probleemgedrag besproken. In een longitudinaal model werden inhibitie, of geremd temperament, van het kind en sensitiviteit van de moeder gemodelleerd als voorspellers van teruggetrokken en angstig-depressief gedrag, twee subschalen van internaliserend probleemgedrag. Teruggetrokken en angstig gedrag werden gemeten met de Child Behavior Checklist, een gedragsvragenlijst die door de moeder werd ingevuld (Verhulst, Van der Ende, & Koot, 1997b). De resultaten lieten zien dat inhibitie van het kind een belangrijke voorspeller was van internaliserende gedragsproblemen. Kinderen die in de basisschoolleeftijd en adolescentie wat meer geremd gedrag lieten zien in reactie op nieuwe situaties, lieten in verhouding ook vaker internaliserend gedrag zien in dezelfde periode. Daarnaast bleek de sensitiviteit van de moeder een rol te spelen: hoe sensitiever de adoptiemoeders in de vroege kindertijd en tijdens de basisschooltijd waren, hoe minder geremd hun adoptiekinderen waren in de adolescentiefase (β. = -.16 en β = -.25). Deze minder geremde adolescenten lieten minder internaliserende gedragsproblemen zoals teruggetrokken en angstig-depressief gedrag zien. Deze resultaten sluiten aan bij eerder onderzoek (Kok et al., 2013) en laten zien dat internaliserend gedrag van adolescenten deels (en indirect) voorspeld wordt door sensitief gedrag van de moeder.

Dagelijkse cortisolcurve

In hoofdstuk 4 worden de resultaten van een empirische studie naar effecten op lange termijn van vroege gehechtheid en sensitiviteit op de cortisolproductie in de jongvolwassenheid besproken. Sensitiviteit en gehechtheid werden gemeten in de vroege kindertijd en cortisol op 23-jarige leeftijd. Het hormoon cortisol wordt gedurende de hele dag in het lichaam afgescheiden en vertoont een patroon met hoge waarden in de ochtend en dalende waarden gedurende de rest van de dag. De respondenten namen op 2 dagen en op 6 momenten speeksel af. Om te controleren of de tijd die ze hiervoor rapporteerden overeenkwam met de echte tijd maakten we gebruik van de MEMS (Medication Event Monitoring System). De MEMS is een potje met een draaidop. In het potje zitten de watjes die nodig waren voor de cortisolafname en iedere keer als de MEMS wordt geopend, wordt de tijd geregistreerd.

Uit de studie bleek allereerst dat de tijden van de MEMS en de tijden van de zelfregistratie lang niet altijd overeenkwamen. In sommige gevallen waren er zodanige discrepanties dat metingen als niet betrouwbaar moesten worden gezien en daarom moesten worden verwijderd. De analyses van de cortisolgegevens toonden aan dat er op beide meetdagen een duidelijk patroon te zien was dat past bij de normatieve cortisolcurve. Hoge waarden bij ontwaken, nog hogere waarden een half uur na ontwaken en vervolgens een dalende curve. In de analyses werden geen consistente verbanden gevonden tussen veilige en gedesorganiseerde gehechtheid, sensitiviteit van de moeder en de cortisolcurve. Er zijn diverse verklaringen voor de afwezigheid van deze relaties mogelijk. In het algemeen leiden ingrijpende ervaringen, bijvoorbeeld kindermishandeling (o.a. Tricket, Nol, Susman, Shenk, & Putnam, 2010) en langdurige deprivatie (Gunnar & Vasquez, 2001) tot verandering van de curve. De door ons onderzochte gehechtheidservaringen lijken niet zo'n zwaar stempel te drukken. Daarnaast kan het zijn dat er bij deze groep geadopteerde jongvolwassenen geen relaties tussen de vroege gehechtheidservaringen en de latere cortisolcurve zijn gevonden omdat adoptie-ervaringen mogelijke verbanden overschaduwen. Pre- en perinatale problematiek kan hierbij een rol spelen maar ook positieve adoptie-ervaringen zoals het leren omgaan met het feit dat je geadopteerd bent, kunnen hier van belang zijn. Om een goed antwoord op deze en andere vragen te geven is toekomstig onderzoek nodig waarbij een niet-geadopteerde controlegroep wordt betrokken.

Conclusie

De empirische studies uit dit proefschrift laten zien dat sensitiviteit van de moeder op diverse momenten in de ontwikkeling van het kind een bijdrage kan leveren aan een positieve ontwikkeling. Een hogere mate van sensitiviteit van de moeder in de vroege kindertijd en in de basisschoolleeftijd voorspelt bij het kind minder geremd temperament in de adolescentiefase en daarmee minder internaliserend gedrag in dezelfde periode. Daarnaast voorspelt meer sensitiviteit in de adolescentiefase minder

delinquent gedrag bij pubers. Sensitiviteit en gehechtheid in de vroege kindertijd laten echter geen consistente associaties zien met de cortisolcurve op 23 jaar. Concluderend, sensitiviteit van de (adoptie)moeder door de jaren heen levert een positieve bijdrage aan het sociaal-emotionele functioneren van (adoptie) kinderen in de adolescentiefase.

Referenties

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment. A psychological study of the Strange Situation*. Lawrence Erlbaum, Hillsdale, NJ.

Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., & Juffer, F. (2003). Less is more: meta-analysis of sensitivity and attachment interventions in early childhood. *Psychological Bulletin, 129*(2), 195-215.

Bowlby, J. (1969). *Attachment and Loss. Vol. 1: Attachment*. Basic Books, New York, NY.

De Wolff, M. S. & Van IJzendoorn, M. H. (1997). Sensitivity and attachment: a meta-analysis on parental antecedents of infant attachment. *Child Development*, *68*(4), 571-91.

Egeland, B., Erickson, M. F., Clemenhagen-Moon, J., Hiester, M. K., & Korfmacher, J. (1990). *24 months tools coding manual*. Project STEEP-revised 1990 from mother-child project scales.

Fearon, R. P., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Lapsley, A.M., & Roisman, G.I. (2010). The significance of insecure attachment and disorganization in the development of children's externalizing behavior: a meta-analytic study. *Child Development*, *81*(2), 435-56.

Groh, A. M., Fearon, R. P., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Steel, R. D., & Roisman, G.I. (2014). The significance of attachment security for children's social competence with peers. A meta-analytic study. *Attachment and Human Development*, *16*(2), 103-36.

Groh, A. M., Roisman, G.I., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Fearon, R. (2012). The significance of insecure and disorganized attachment for children's internalizing symptoms: a meta-analytic study. *Child Development*, *83*(2), 591-610.

Gunnar, M. R., & Vazquez, D. M. (2001). Low cortisol and a flattening of expected daytime rhythm: Potential indices of risk in human development. *Development and Psychopathology*, *13*(3), 515-538.

Juffer, F. (1993). *Verbonden door adoptie. Een experimenteel onderzoek naar hechting en competentie in gezinnen met een adoptiebaby*. (Attached through adoption. An experimental study on attachment and competence in families with an adopted baby.) Amersfoort, The Netherlands: Academic Press.

Kok, R., Linting, M., Bakermans-Kranenburg, M. J., Van IJzendoorn, M. H., Jaddoe, V. W .V., Hofman, A., Verhulst, F.C, & Tiemeier, H. (2013). Maternal sensitivity and internalizing problems: evidence from two longitudinal studies in early childhood. *Child Psychiatry & Human Development, 44*(6), 751-765.

Luijk, M. P., Saridjan, N., Tharner, A., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Jaddoe, V.W., Hofman, A., Verhulst, F.C., & Tiemeier, H. (2010). Attachment, depression, and cortisol: deviant patterns in insecure-resistant and disorganized infants. *Developmental Psychobiology, 52*(5), 441-52.

Rosenboom, L. G. (1994). *Gemengde gezinnen, gemengde gevoelens? Hechting en competentie van adoptiebaby's in gezinnen met biologisch eigen kinderen.* (Mixed families, mixed feelings? Attachment and competence of adopted babies in families with biological children). Doctoral dissertation, Utrecht University, Utrecht, The Netherlands.

Trickett, P. K., Noll, J. G., Susman, E. J., Shenk, C. E., & Putnam, F. W. (2010). Attenuation of cortisol across development for victims of sexual abuse. *Development and Psychopathology*, *22*(1), 165-175.

Verhulst, F. C., Van der Ende, J., & Koot, H. M. (1997a). *Handleiding voor de Teacher's Report Form-TRF*. (Manual for the Teacher's Report Form-TRF, Dutch version.) Rotterdam, The Netherlands: Erasmus University Rotterdam.

Verhulst, F. C., Van der Ende, J., & Koot, H. M. (1997b). *Handleiding voor de Child Behavior Checklist-CBCL*. (Manual for the Child Behavior Checklist-CBCL, Dutch version.) Rotterdam, The Netherlands: Erasmus University Rotterdam.

Curriculum Vitae

Anja van der Voort werd geboren op 17 oktober 1968 te Zandvoort. Haar VWO-diploma behaalde zij aan het Eerste Christelijk Lyceum te Haarlem. Na haar middelbare schoolperiode startte zij een eigen bedrijf in de sport. In 2001 ging ze Pedagogiek studeren aan de Universiteit van Amsterdam en in 2005 behaalde zij daar haar doctoraal (cum laude) met als afstudeerrichting Opvoedingsondersteuning. Na haar afstuderen werkte Anja als inhoudelijk redacteur voor Teleac/NOT (met name voor PeuterTV) en Stichting Lezen. In 2006 werd ze achtereenvolgens onderwijsmedewerker en docent bij de afdeling Algemene en Gezinspedagogiek van de Universiteit Leiden. Zij doceert diverse cursussen op het gebied van statistiek zoals Onderzoekspracticum en SPSS. In 2013 werd haar de prijs voor Excellente Docent bij het Instituut Pedagogische Wetenschappen toegekend. In 2010 startte Anja met een promotietraject. De resultaten hiervan vindt u in dit proefschrift.

List of publications

Published manuscripts

Juffer, F., & **Van der Voort, A.** (2014). Achterstanden en herstelkansen van adoptiekinderen. In: Goudena, P., De Groot, R., & Janssens, J. (Red.), *Orthopedagogiek: State of the* art, pp. 201-215. Apeldoorn/Antwerpen: Uitgever Garant.

Van der Voort, A., Juffer, F., & Bakermans-Kranenburg, M. J. (2014). Sensitive parenting is the foundation for secure attachment relationships and positive social-emotional development of children. *Journal of Children's Services*, *9*(2), 165-176.

Van der Voort, A., Linting, M., Juffer, F., Bakermans-Kranenburg, M. J., Schoenmaker, C., & Van IJzendoorn, M. H. (2014). The development of adolescents' internalizing behavior: Longitudinal effects of maternal sensitivity and child inhibition. *Journal of Youth and Adolescence*, *43*(4), 528-540.

Van der Voort, A., Linting, M., Juffer, F., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2013). Delinquent and aggressive behaviors in early-adopted adolescents: Longitudinal predictions from child temperament and maternal sensitivity. *Children and Youth Services Review*, *35*(3), 439-446.

Van der Voort, A., Linting, M., Juffer, F., Schoenmaker, C., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2014). More than two decades after adoption: Associations between infant attachment, early maternal sensitivity and the diurnal cortisol curve of adopted young adults. *Children and Youth Services Review*. doi: 10.1016/j.childyouth.2014.08.022

Manuscripts under revision

Schoenmaker, C., Juffer, F., Van IJzendoorn, M. H., Van den Dries, L., Linting, M., **Van der Voort, A**., & Bakermans-Kranenburg, M. J. (2013). Cognitive and health-related outcomes after exposure to early malnutrition: The Leiden Longitudinal Adoption Study.

Schoenmaker, C., Juffer, F., Van IJzendoorn, M. H., Linting, M., **Van der Voort,** A., & Bakermans-Kranenburg, M.J. (2013). From maternal sensitivity in infancy to adult attachment representations: A longitudinal adoption study with secure base scripts.

Submitted manuscript

Schoenmaker, C., Huffmeijer, R., Van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., Van den Dries, L., Linting, M., **Van der Voort, A**., & Juffer, F. (2013). Attachment and physiological reactivity to infant crying in young adulthood: Dissociation between experiential and physiological arousal in insecure adoptees.