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**Title:** The importance of sensitive parenting: a longitudinal adoption study on maternal sensitivity, problem behavior, and cortisol secretion  
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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, Montiroso, & 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 ‘truancty’. 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 $\chi^2$ 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 raters1.

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

<table>
<thead>
<tr>
<th></th>
<th>Infancy</th>
<th>Middle Childhood</th>
<th>Adolescence</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>n</td>
</tr>
<tr>
<td>Sensitivity (^a)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supportive presence</td>
<td>3.62</td>
<td>1.16</td>
<td>159</td>
</tr>
<tr>
<td>Clarity of instruction</td>
<td>3.47</td>
<td>1.05</td>
<td>159</td>
</tr>
<tr>
<td>Sensitivity and timing</td>
<td>3.72</td>
<td>1.09</td>
<td>159</td>
</tr>
<tr>
<td>Temperament</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 12c  Needs supervising</td>
<td>3.98</td>
<td>1.13</td>
<td>159</td>
</tr>
<tr>
<td>Item 15c  Touching forbidden things</td>
<td>4.01</td>
<td>1.21</td>
<td>159</td>
</tr>
<tr>
<td>Item 16c  Trying forbidden things</td>
<td>3.60</td>
<td>1.17</td>
<td>159</td>
</tr>
<tr>
<td>Item 2c  Distracted easily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 15c  Does not stick with activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Item 23  Finishes task</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Problem behavior (^b)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency</td>
<td>0.98</td>
<td>1.60</td>
<td>123</td>
</tr>
<tr>
<td>Aggression</td>
<td>5.95</td>
<td>8.25</td>
<td>123</td>
</tr>
</tbody>
</table>

\(^a\) 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

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal sensitivity</td>
<td>.11</td>
<td>.28</td>
<td>.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Effortful control</td>
<td></td>
<td>.01</td>
<td>-.09</td>
<td>-.23</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Delinquency</td>
<td>-.02</td>
<td>-.05</td>
<td>.04</td>
<td>-.02</td>
<td>-.07</td>
<td>-.14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggression</td>
<td>-.04</td>
<td>.01</td>
<td>.10</td>
<td>-.22</td>
<td>-.31</td>
<td>-.35</td>
<td>.54</td>
<td>.13</td>
<td>.22</td>
</tr>
</tbody>
</table>

\(^a\) 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. 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 $\chi^2/df = 1.33$, NNFI = .96, CFI = .97, RMSEA = .05 and for aggression $\chi^2/df = 1.39$, 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, $\chi^2/df = 1.28$, 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, $\chi^2/df = 1.45$, 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*

<table>
<thead>
<tr>
<th>Model</th>
<th>Df</th>
<th>$\chi^2$</th>
<th>NNFI</th>
<th>CFI</th>
<th>RMSEA</th>
<th>RMSEA 90% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Delinquency</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 1 full model</td>
<td>137</td>
<td>181.84</td>
<td>163.62 – 202.22</td>
<td>.96</td>
<td>.95 - .98</td>
<td>.97 - .99</td>
</tr>
<tr>
<td>Model 2 all non-significant paths</td>
<td>154</td>
<td>196.85</td>
<td>176.49 – 218.23</td>
<td>.97</td>
<td>.96 - .98</td>
<td>.98 - .99</td>
</tr>
<tr>
<td>eliminated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.04 - .05</td>
</tr>
<tr>
<td><strong>Aggression</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independence model</td>
<td>193</td>
<td>2004.96</td>
<td>1957.54 - 2037.89</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model 3 full model</td>
<td>137</td>
<td>190.07</td>
<td>171.43 – 210.63</td>
<td>.96</td>
<td>.94 - .97</td>
<td>.97 - .98</td>
</tr>
<tr>
<td>Model 4 all non-significant paths</td>
<td>154</td>
<td>222.89</td>
<td>206.21 – 237.51</td>
<td>.95</td>
<td>.94 - .96</td>
<td>.96 - .97</td>
</tr>
<tr>
<td>eliminated</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.05 - .06</td>
</tr>
</tbody>
</table>

*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


