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THESIS

Differential Susceptibility and Firstborn Child Adjustment After the Arrival of a Second Child

Firstborn Child's Temperament as a Moderator

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Abstract

The number of studies examining parenting-by-temperament interactions is rapidly growing, however most of these studies focused either on negative or positive predictors, and child adjustment. Therefore, the current longitudinal study (N = 77 two-parent families) examined whether parental warmth as well as parental hostility is related to the developmental outcomes (internalizing, externalizing and prosocial behavior) of firstborn children after the transition to siblinghood and whether this relation is affected by temperament traits of the firstborn child. Two of the most influential models were tested against each other: the differential susceptibility hypothesis (increased sensitivity of an individual to both supportive and negative environments) and diathesis-stress model (increased sensitivity of an individual to negative environments). Parenting was assessed using both self-reports and video-observations. No support for the differential susceptibility hypothesis and the diathesis-stress model was found. However, results showed that children with a more difficult temperament – compared to those with a less difficult temperament – did not seem to benefit from maternal warmth and expressed higher levels of internalizing problem behavior.

Keywords: parenting, difficult temperament, differential susceptibility, diathesis-stress, developmental outcomes, siblinghood

Introduction

Problem behavior evident during early childhood can persist later in life (e.g., Masten et al., 2005; Olson, Bates, Sandy, & Lanthier, 2000; Pepler & Rubin, 1991). Previous research on precursors of children's later problem behavior has shown that infants who were perceived as difficult, were at higher risk for later problem behavior (e.g., Olson, Bates, Sandy, & Lanthier, 2000; Sanson, Hemphill, & Smart, 2004). Moreover, externalizing problem behavior in childhood undermines academic achievement during adolescence, which subsequently has a negative effect on internalizing problem behavior in young adulthood (Masten et al., 2005). Therefore, it is important to examine the precursors of children's problem behavior (both internalizing and externalizing). The present longitudinal study, which was conducted on a Dutch sample, focuses on the adjustment of firstborn children during and a year after the arrival of a second child. Parental self-reports and observations are used to assess the parenting skills of the second-time parents and parental reports were used to assess the temperament of the firstborn child and firstborn child's adjustment.

Parenting as Precursor of Firstborn Children's Developmental Outcomes

The match between parenting and child temperament – sometimes referred to as the 'goodness of fit' – is found to be related to the developmental outcomes of children (Chess & Thomas, 1999). When there is a match between child temperament and parenting, optimal development is possible (Chess & Thomas, 1999). Parental warmth (tendency to show affection and support) has a positive influence on the developmental outcomes of a child (Baumrind, 1991; Kerig, Ludlow, & Wenar, 2012; Leman et al., 2012; MacDonald, 1992). Meanwhile, child adjustment is negatively affected by hostility of parents (Parke, 2004).

Not only parenting but also child temperament is important for the developmental outcomes of a child. Children with a difficult temperament are more negative and unpredictable, which in turn might negatively influence the parent's ability to care for their

'difficult' child (Holmes, 2010). To emphasize, a review about temperament and social development reveals that no clear evidence is found in studies which did examine indirect or transactional associations between parenting, temperament and developmental outcomes (Sanson, Hemphill, & Smart, 2004[1]). Therefore, it is important to examine the potential moderation of temperament between parenting and firstborn child adjustment.

Firstborn Child's Temperament as a Moderator of Child Adjustment

Children respond differently to the same rearing environments (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007). Prior research findings propose that children with a difficult temperament are more vulnerable to their rearing environment (Pluess & Belsky, 2009). For quite some time a variety of theoretical models is created to explain the interaction between parenting and child adjustment. The diathesis-stress model and the differential susceptibility hypothesis are the most influential models regarding this subject (Slagt et al., 2016) and therefore examined in this study. The diathesis-stress model proposes that some children are more affected by 'negative' rearing practices than other children (Zuckerman, 1999). Meanwhile, the model suggests that those children are not affected by 'positive' rearing practices (Beaver, Hartman, & Belsky, 2015). It is suggested that some children possess certain vulnerabilities (diatheses), such as a difficult temperament, and these vulnerabilities could be activated by a stressful event (stressor) (van der Molen, Perreijn, & van den Hout, 2006). In this case, it means that children with a difficult temperament in combination with 'negative' rearing practices are at risk for 'negative' child adjustment. According to the differential susceptibility hypothesis, some children are more susceptible to both 'negative' rearing practices and supporting environments (Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007). Findings of a seven-wave longitudinal study about differential susceptibility and the prediction of adolescent psychopathy support the differential

[1] For a detailed review about temperament and social development

susceptibility hypothesis more than they support the diathesis-stress model (Beaver, Hartman, & Belsky, 2015). Findings of a meta-analysis emphasize that the results of prior studies only partly support the differential susceptibility hypothesis or the diathesis-stress model (Slagt et al., 2016). Moreover, until recently, many of prior studies examined either 'negative' or 'positive' parenting and emphasized either 'negative' or 'positive' child adjustment (Pluess, Stevens, & Belsky, 2013; Slagt et al., 2016[2]). To test the models against each other, the examination of associations between both 'positive' and 'negative' parenting and both 'positive' and 'negative' child adjustment is necessary.

Transition to Siblinghood

In 2015, 170.510 children were born in the Netherlands of which 62.811 second born children, indicating that thousands of families are experiencing a normative life event such as the arrival of a second child (CBS, 2016). It was shown that firstborn child's adjustment changes during the arrival of a second child. (Kolak & Volling 2013; Szabó, 2012). According to the family systems theory, a family is an organized system that is able to adapt to changes and relationships between family members are interdependent (Cox & Paley, 2003; Holmes, 2010; Kerig, Ludlow, & Wenar, 2012; Szabó, 2012). Therefore, the theory suggests that the arrival of a second child affects all family members, including the firstborn child. Prior research pointed out that firstborn children vary widely in their adjustment during this transition (Volling, 2012). It is important to examine determinants which differentiate firstborn children with adjustment problems from firstborn children which do not have adjustment problems during the transitional period (Volling, 2012). Besides, until recently, not many studies examined the parenting and difficult temperament interaction in relation to firstborn child adjustment during the transition to siblinghood (Kolak & Volling, 2013).

[2] For an overview of the shortcomings of such an approach

Present Study

The overarching purpose of this study was to examine whether parenting is related to the adjustment of firstborn children after the arrival of a second child, depending on the temperament traits of the firstborn child. Based on the existing literature, the following hypothesis is addressed. If the differential susceptibility hypothesis is true, I expect stronger associations between 'positive' parenting (warmth) and 'positive' child adjustment (prosocial behavior), as well as stronger associations between 'negative' parenting (hostility) and 'negative' child adjustment (both internalizing and externalizing problem behavior) for firstborn children with a difficult temperament. If the diathesis-stress model is true, I only expect associations to be stronger between 'negative' parenting (hostility) and 'negative' child adjustment (both internalizing and externalizing problem behavior) for firstborn children with a difficult temperament. In the present study 'positive' parenting is conceptualized as warmth and 'negative' parenting refers to hostility. In addition, 'negative' child adjustment is referred to as internalizing and externalizing problem behavior. Finally, 'positive' child adjustment refers to prosocial behavior.

Method

Participants

The data for this study was collected during a longitudinal investigation on the changes that occur within a family after the arrival of a second child (Szabó, 2012). The data was gathered during four waves of which three home visits. The first home visit was conducted while the mother was expecting their second child (T1), the second home visit was conducted one month after the birth of the second child (T2) and the third home visit took place one year after the birth of the second child (T3). The fourth wave (T4) was conducted two years after the birth of the second child and consisted of a follow-up questionnaire. In the present study data of T1 and T3 is used (see figure 1). Participants were included if they met

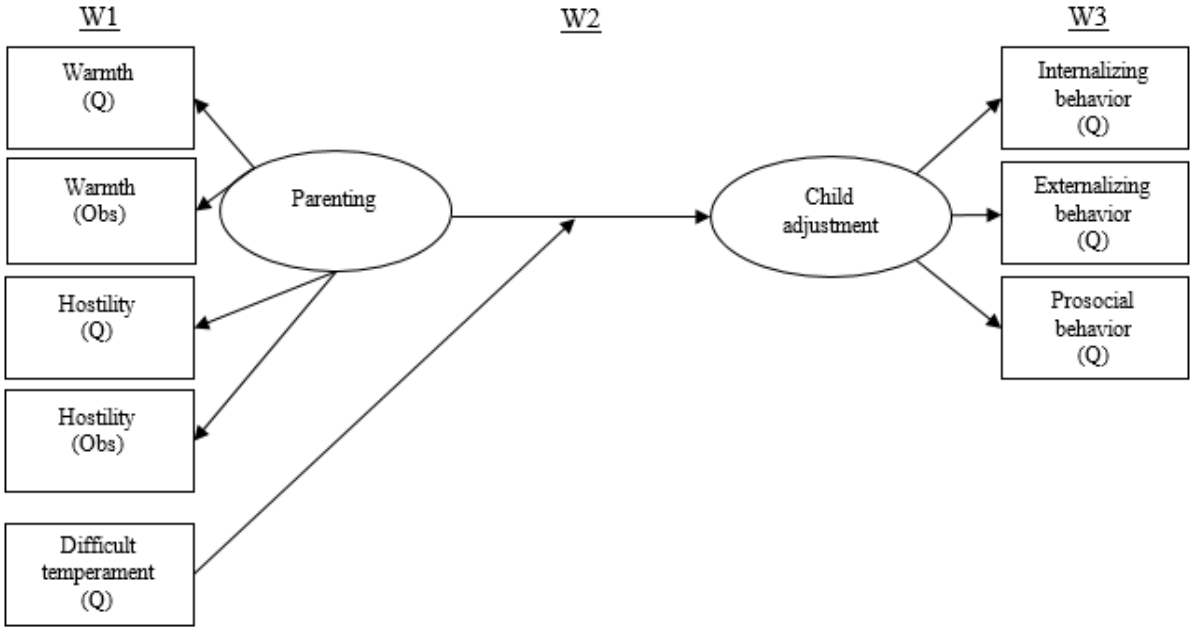
the following criteria: the parents were married or living together, they had a biological child together and mother was pregnant with their second child. At the start of the study 93 families were included, however 16 families were excluded from the dataset since there was (almost) no data available for those families. The families dropped out because of different reasons such as: moving to another place, divorce, not being able to contact the families and certain families did not fill in the questionnaires at T3 but only participated during the observations at T3. To determine whether there were differences between the families who were omitted and the families who were included in the dataset an attrition analysis was performed. No differences were detected between the families, and therefore no bias is expected due to the exclusion of the 16 families.

In total 77 middleclass families participated both in T1 and T3. These families consisted of a mother, father and firstborn child (30 girls, 46 boys)[3] at T1. The mean age at T1 regarding the firstborn children was 24.32 months (SD_{age} = 4.28 months, age range: 17-35), the mean age of the mothers was 31.87 years (SD_{age} = 3.79 years, age range: 25-41) and the fathers' mean age was 34.10 years (SD_{age} = 4.38 years, age range: 25-48). At T1 the second born children were not born yet, therefore their age was calculated at the second wave (T2) (M_{age} = 1.29 months, SD_{age} = 0.44 months, age range: 1-3). At the third wave (T3) firstborn children's mean age was 39.4 months (SD_{age} = 4.89 months, age range: 31-54) and the mean age of the second born children was 13.97 months (SD_{age} = 1.99 months, age range: 11-24). The sample consisted mostly of Dutch participants: 93.5% of the mothers and 96.1% of the fathers indicated their nationality as Dutch. Seventy-five percent of the parents was married, 20% lived together without being married, 1% was divorced in the past and remarried with the current partner and 3% was identified as not otherwise specified. Concerning the educational background of the mothers, 39% completed university, 46% of the mothers

[3] One family did not report the gender of their firstborn child. Regarding the age 1 to 8 families did not report the parent's age or children's age.

earned a higher college degree, 9% received a moderate college degree and the rest only completed a high school degree. Regarding the fathers, 39% completed a university degree, 36% completed a higher college degree, 20% a moderate college degree and 1% only a high school degree. Twenty-five percent of the families had an annual family income of 45.000-55.000 euros, the rest of the annual family incomes ranged from 15.000-25.000 to 155.000-205.000 euros.

Figure 1. *Conceptual Model of the Proposed Relations Between all Study Variables*



Note. Q = reported parenting *Obs* = observed parenting

Procedure

In total – as noted above – three home visits were conducted. At T1 triadic play sessions as well as dyadic interactions were recorded and later observed, of which warmth and hostility were coded. During the nine triadic sessions (see Appendix 1), the firstborn children and both their parents participated. The parents received instructions about what they should do during the play sessions. In two sessions, they could play with their child as they normally did, but in the other seven sessions both parents received the instruction to ignore the child or one parent did not participate in the play session and was instructed to watch the other parent

play with the child. During the five dyadic play sessions, the interaction between one parent and the firstborn child was observed on different tasks, such as: building 'lego-blocks', puzzling or the parent needed to play with a baby doll, while the firstborn child played with other toys[4]. At T1 as well as at T3 parents were also asked to answer questionnaires about themselves, their partner and their child(ren).

Measures

A number of measures were used to assess the parenting, difficult temperament and child adjustment of the firstborn child during and after the transitional period. Parenting (warmth and hostility) was assessed using video observations at T1 and parental self-reports on warmth and hostility (T1). Difficult temperament (T1) and child adjustment (T3) were assessed using questionnaires. The video-observations were coded by trained coders.

Parenting

Reported warmth. Warmth was reported by the parents on the 'Affection and Attachment scales' (adapted version of the Parenting Stress Index: de Brock, Vermulst, Gerris, & Abidin, 1992) at T1. Both scales contain 4 items each, such as 'I make sure that my child often notices that I care about him/her'. The parents could answer on a Likert-type scale with answers ranging from *completely not true* (1) to *completely true* (7). The total score was based on the average of the eight items. Cronbach's alpha was .76 regarding the mothers and .82 regarding the fathers.

*Observed warmth***.** An altered version of the 'Coparenting and Family Rating System' (CFRS: McHale, Kuersten-Hogan, & Lauretti, 2000) was used to code the observed parental warmth. Warmth is defined as the affection of a parent towards the child (McHale et al., 2000). Scores were assigned for every 15 seconds of each scene, thus in total six scores were

[4] At T3 observations of play sessions were also conducted. This data is not needed for examination of this study´s research question and therefore not used in this study, but the description of the procedure is available upon request.

given per scene (see Appendix 1). Observed warmth was coded on a 7-point scale ranging from *absence of parents' affection towards the child* (1) to *very clear indications of parents' affection towards the child* (7). Two coders coded the videotaped records at T1. The analysis of the interrater reliability was performed on approximately 20% of the data using intra-class correlations, which were .79 and .75 for mothers and fathers, respectively. The observed total warmth score was based on an average of three triadic and two dyadic play sessions at T1.

*Reported hostility***.** Self-reported hostility of both parents was assessed at T1 using the 'Punishment and Corporal Punishment scales (altered version of the Parenting Stress Index: de Brock, Vermulst, Gerris, & Abadin, 1992). The punishment scale comprises 7 items and the corporal punishment scale consists of 1 item. Parents needed to answer items such as: 'I send my child to his room as a punishment' on a Likert-type scale with answers ranging from *completely not true* (1) to *completely true* (7). The scores of the punishment scale and the score of the corporal punishment scale were combined in an averaged total score. Cronbach's alpha regarding the mothers was .50 and regarding the fathers .57.

*Observed hostility***.** An adapted version of the 'rating scales for the observation of parent-child interactions during instruction tasks' (Erickson, Sroufe, & Egeland, 1985) was used to code the observed parental hostility. Hostility is referred to as e.g. clear rejection of the child, expression of anger and blaming their child for their lack of success (Szábo, 2012). The videotaped records were coded on a 7-point scale ranging from *no rejection of the child / no communication of hostility towards the child* (1) to *frequent expressions of anger towards the child accompanied by strong barely controlled emotions* (7) every 15 seconds of each play session. In total six scores were given per play session. Hostility was coded in three triadic and three dyadic situations. The scores of those play sessions were averaged in a total observed hostility score. Intra-class correlations regarding the interrater reliability were .72 and .92 for mothers and fathers, respectively.

Temperament of the Firstborn Child

Both parents were asked to complete an adapted version of the 'Early Childhood Behavior Questionnaire' (ECBQ: Putnam, Gartstein, & Rothbart, 2006) to assess the temperament of the firstborn child at T1. The questionnaire contains 18 scales, of which 4 were used for the current study, respectively: the activity level scale (7 items), the frustration scale (9 items), the inhibitory control scale (14 items) and the soothability scale (14 items). The answers on the Likert-type scale ranged from *never* (1) to *always* (7). Regarding both the mothers and the fathers Cronbach's alpha was .87.

Developmental Outcomes of the Firstborn Child

The firstborn's problem behavior (child adjustment) was assessed by the 'Strengths and Difficulties Questionnaire' (SDQ: Goodman, 1997) at T3. The SDQ contains 25 items with answers on a Likert-type scale ranging from *not true* (0) to *certainly true* (2). In total, there are 5 scales, 5 items each: emotional symptoms, conduct problems, peer problems, hyperactivity and prosocial scales. The items are scored reversely regarding 5 items. The internalizing problem behavior score was based on the scores of the emotional symptoms scale (e.g. 'many fears, easily scared'). The externalizing problem behavior score was calculated by averaging the scores of the conduct problems scale (e.g. 'often fights with other child or bullies them'), the hyperactivity scale (e.g. 'restless, overactive, cannot stay still for long') and the peer problems scale (e.g. 'has at least one good friend'). Finally, the prosocial behavior score was based on the scores of the prosocial scale (e.g. 'takes other people's feelings into account'). Cronbach's alphas were .56 and .40 regarding internalizing problem behavior, .60 and .61 regarding externalizing problem behavior and .65 and .58 regarding prosocial behavior for mothers' and fathers' respectively.

Results

Missing data

The data analysis was conducted in SPSS 24.0. Certain data was missing due to item non-response. The Chi-square test of MCAR (Little, 1988) showed that the variables were missing at random (χ^2 (21051) = 15.30, p = 1.000). The multiple imputation procedure (Schafer & Graham, 2002[5]) was used to address the missing item responses. By means of the multiple imputation procedure, ten (additional) datasets were created, each with a different set of imputed values. These different imputed values were by SPSS combined into a 'pooled' score. Regarding the current study the pooled scores were used, when no pooled scores were available the range of the imputed values (lowest to highest) was reported.

Intercorrelations

Correlational analysis was performed to assess the relation among all study variables. The correlations, means, and standard deviations are included in table 1. The relations between the fathers' and mothers' reports were assessed. Temperament of the firstborn child reported by mothers was significantly correlated with temperament of the firstborn child reported by fathers (r = .56, p < .001). Reported (r = .62, p < .001) as well as observed (r = .23, p < .100) maternal and paternal hostility were also (marginal) significantly correlated with each other. In addition, maternal and paternal reports of internalizing problem behavior (r = .52, p < .001), externalizing problem behavior (r = .88, p < .001) and prosocial behavior (r = .58, p < .001) of the firstborn child after the arrival of the second child were also significantly correlated. No significant correlations were found between both observed and reported maternal and paternal warmth. For the intercorrelations between the other study variables see Table 1.

[5] For an overview about the multiple imputation method

Table 1. *Summary of Intercorrelations (pooled), Means (pooled) and Standard Deviations (range) for All Study Variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	M	SD
1. Difficult temperament ♀	-																3.05	.48 - .49
2. Reported maternal warmth ♀	-.15	-															6.53	.53
3. Observed maternal warmth	.18	.03	-														4.16	.31
4. Reported maternal hostility ♀	.05	-.26*	.19	-													3.44	.70 - .71
5. Observed maternal hostility	.00	.04	-.04	.10	-												1.04	.06 - .07
6. Internalizing problem behavior ♀	-.16	.22×	-.07	-.04	-.08	-											1.38	.36
7. Externalizing problem behavior ♀	.29	-.06	.08	.07	-.03	.19×	-										1.39	.21
8. Prosocial behavior ♀	-.21×	.13	.08	.11	.16	-.02	-.33**	-									2.46	.35
9. Difficult temperament ♂	.56***	-.01	.11	-.07	.17	.04	.30**	-.17	-								3.17	.52 - .53
10. Reported paternal warmth ♂	-.27*	.10	-.01	.15	.06	.07	-.06	.22×	-.28*	-							6.38	.60
11. Observed paternal warmth	-.09	.09	.11	.13	.04	.09	.00	-.02	-.12	.27*	-						3.90	.47
12. Reported paternal hostility ♂	.06	-.14	.17	.62***	.06	-.13	-.02	.10	-.13	.18	.02	-					3.29	.81 - .82
13. Observed paternal hostility	-.03	.11	-.08	.02	.23×	-.15	-.08	.06	.14	-.02	.05	-.04	-				1.07	.06 - .07
14. Internalizing problem behavior ♂	-.13	-.07	-.23*	-.13	-.19	.52***	-.02	-.15	.03	-.01	-.02	-.20×	-.19×	-			1.36	.29 - .30
15. Externalizing problem behavior ♂	.23*	.02	.05	.10	-.03	.22×	.88***	-.30**	.32**	-.05	.03	.00	-.14	-.01	-		1.41	.19
16. Prosocial behavior ♂	-.22×	.11	.03	.11	-.00	-.05	-.19×	.58***	-.25*	.24*	.10	.05	.12	-.14	-.30**	-	2.44	.34

Note. $N = 77$. ♀ = reported by mothers, ♂ = reported by fathers. × $p < .10$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Internalizing problem behavior[6]

To test the hypothesis, hierarchical multiple regression analyses were performed. The internalizing problem behavior of the firstborn child reported by the parents was the dependent variable. In the first step, the centered values of positive parenting (warmth), negative parenting (hostility), either observed or self-reported, and difficult temperament of the firstborn child were entered. In the second step the interaction between the parenting variables, either observed or self-reported, and difficult temperament was added. The analysis was repeated for both the self-reported parenting scores and the observed parenting scores and was conducted separately for mothers and fathers. In total 4 hierarchical regression analyses were performed. To avoid 'shared method variance' (Putnam, Sanson, & Rothbart, 2002) the score of fathers' reports on firstborn child temperament was entered during the first step and in the interaction in the second step of the hierarchical regression analyses of the data concerning the mothers and the score of mothers' reports on firstborn child temperament was entered in the analysis of the fathers. This choice was based on the assumption that parents' actual parenting might be integrated into their reports of child temperament. Therefore, the report of the other parent on firstborn temperament was likely to be a more objective measure of difficult temperament. The results of the analyses are presented in Table 2 (reported parenting) and Table 3 (observed parenting). The interaction terms between the self-reported warmth and difficult temperament of the firstborn child were not significant for the internalizing problem behavior. However, the results have shown a marginally significant interaction effect of observed maternal warmth and firstborn child's difficult temperament in relation to firstborn child's internalizing problem behavior (B = .50, $SE\ B$ = .30, β = .13 - .25, p < .100). Mothers of firstborn children with a more difficult temperament reported higher

[6] The interaction effects are only interpreted in the text, because that is the focus of the study. The other results are also included in the tables, but not interpreted in the text.

levels of internalizing problem behavior of their firstborn child at T3, even though these mothers displayed high levels of warmth during the video-observations.

Table 2. *Hierarchical Multiple Regression Analyses Predicting Internalizing Problem Behavior of the Firstborn Child (Using Self-reports of Parenting)*

	Internalizing problem behavior					
	Reported by mothers			Reported by fathers		
Predictor	*B* (pooled)	SE *B* (pooled)	β (range)	*B* (pooled)	SE *B* (pooled)	β (range)
Reported warmth	.15×	.08	.22 - .23	-.01	.06	-.04 - .00
Reported hostility	.01	.06	.02 - .03	-.07	.04	-.20 - -.17
Difficult temperament	.02	.08	.02 - .05	-.07	.07	-.13 - -.10
R^2 (range)		.05			.05	
F (3, 73) (range)		1.23 - 1.30			1.16 - 1.38	
Reported warmth	.15×	.08	.22 - .23	-.01	.06	-.05 - -.00
Reported hostility	.01	.06	.02 - .03	-.07	.04	-.20 - -.17
Difficult temperament	.03	.08	.03 - .07	-.07	.08	-.13 - -.09
Reported warmth x DT	-.05	.13	-.06 - -.03	-.03	.15	-.07 - -.01
Reported hostility x DT	-.13	.11	-.15 - -.13	.07	.09	.09 - .12
R^2 (range)		.01 - .02			.01	
F (2, 71) (range)		.54 - .78			.31 - .55	

Note. $N = 77$. × $p < .10$. * $p < .05$. *DT* = Difficult Temperament.

Table 3. *Hierarchical Multiple Regression Analyses Predicting Internalizing Problem Behavior of the Firstborn Child (Using Observations of Parenting)*

	Internalizing problem behavior					
	Reported by mothers			Reported by fathers		
Predictor	*B* (pooled)	SE *B* (pooled)	β (range)	*B* (pooled)	SE *B* (pooled)	β (range)
Observed warmth	-.09	.14	-.10 - -.06	-.02	.07	-.05 - .00
Observed hostility	-.49	.72	-.13 - -.05	-.79	.50	-.21 - -.14
Difficult temperament	.03	.08	.03 - .07	-.08	.07	-.14 - -.11
R^2 (range)		.01 - .02			.04 - .06	
F (3, 73) (range)		.20 - .59			.97 - 1.61	
Observed warmth	-.08	.14	-.09 - -.05	-.02	.07	-.05 - .00
Observed hostility	-.66	.77	-.18 - -.07	-.79	.55	-.22 - -.01
Difficult temperament	.02	.08	.01 - .06	-.10	.08	-.18 - -.13
Observed warmth x DT	.50×	.30	.13 - .25	.16	.18	.08 - .14
Observed hostility x DT	1.16	1.80	.01 - .20	.13	1.14	-.01 - .05
R^2 (range)		.02 - .07			.01 - .02	
F (2, 71) (range)		.71 - 2.70			.34 - .68	

Note. $N = 77$. × $p < .10$. * $p < .05$. *DT* = Difficult Temperament.

Externalizing problem behavior

The similar hierarchical regression analyses – as described above – were performed, but now the externalizing problem behavior was entered as the dependent variable. The results are reported in Table 4 (reported parenting) and Table 5 (observed parenting). No significant interaction effects were found.

Prosocial behavior

Finally, the hierarchical regression analyses were performed with prosocial behavior as the dependent variable. The results are presented in Table 6 (reported parenting) and Table 7 (observed parenting). No significant interaction effects were found.

Table 4. *Hierarchical Multiple Regression Analyses Predicting Externalizing Problem Behavior of the Firstborn Child (Using Self-reports of Parenting)*

	Externalizing problem behavior					
	Reported by mothers			Reported by fathers		
Predictor	*B* (pooled)	SE *B* (pooled)	β (range)	*B* (pooled)	SE *B* (pooled)	β (range)
Reported warmth	-.02	.05	-.05 - -.03	-.01	.05	-.00 - -.03
Reported hostility	.02	.04	.07 - .08	-.03	.03	-.12 - -.07
Difficult temperament	.12*	.04	.30 - .32	.09×	.05	.18 - .23
R^2 (range)		.10 - .11			.04 - .06	
F (3, 73) (range)		2.63 - 2.99×			1.00 - 1.65	
Reported warmth	-.02	.05	-.05 - -.03	.02	.05	.04 - .08
Reported hostility	.02	.04	.07 - .08	-.02	.03	-.09 - -.07
Difficult temperament	.12*	.05	.28 - .31	.13*	.06	.26 - .32
Reported warmth x DT	-.06	.08	-.11 - -.09	-.17	.11	-.22 - -.19
Reported hostility x DT	.00	.06	-.01 - .01	-.05	.06	-.11 - -.09
R^2 (range)		.01			.05 - .06	
F (2, 71) (range)		.29 - .43			1.87 - 2.48	

Note. $N = 77$. × $p < .10$. * $p < .05$. *DT* = Difficult Temperament.

Table 5. *Hierarchical Multiple Regression Analyses Predicting Externalizing Problem Behavior of the Firstborn Child (Using Observations of Parenting)*

	Externalizing problem behavior					
	Reported by mothers			Reported by fathers		
Predictor	*B* (pooled)	SE *B* (pooled)	β (range)	*B* (pooled)	SE *B* (pooled)	β (range)
Observed warmth	.02	.08	.02 - .06	-.00	.05	-.03 - .02
Observed hostility	-.28	.40	-.09 - -.07	-.23	.37	-.04 - .11
Difficult temperament	.13*	.05	.30 - .32	.09×	.05	.17 - .22
R^2 (range)		.90 - .11			.04 - .06	
F (3, 73) (range)		2.60 - 2.99×			.89 - 1.59	
Observed warmth	.03	.08	.02 - .06	-.00	.06	-.03 - .02
Observed hostility	-.11	.43	-.07 - .02	-.19	.41	-.10 - -.01
Difficult temperament	.13*	.05	.30 - .33	.09	.06	.17 - .23
Observed warmth x DT	.05	.17	.01 - .07	.01	.13	-.01 - .04
Observed hostility x DT	-1.17	.99	-.21 - -.13	.18	.86	-.01 - .06
R^2 (range)		.02 - .04			.00	
F (2, 71) (range)		.73 - 1.68			.00 - .13	

Note. $N = 77$. × $p < .10$. * $p < .05$. *DT* = Difficult temperament.

Table 6. *Hierarchical Multiple Regression Analyses Predicting Prosocial Behavior of the Firstborn Child (Using Self-reports of Parenting)*

	Prosocial behavior					
	Reported by mothers			Reported by fathers		
Predictor	*B* (pooled)	SE *B* (pooled)	β (range)	*B* (pooled)	SE *B* (pooled)	β (range)
Reported warmth	.11	.08	.16 - .18	.05	.08	-.28 - -.24
Reported hostility	.07	.06	.14 - .16	.43	.56	.13 - .16
Difficult temperament	-.10	.07	-.16 - -.13	-.15×	.08	.17 - .20
R^2 (range)		.06 - .07			.06 - .08	
F (3, 73) (range)		1.47 - 1.77			1.41 - 1.99	
Reported warmth	.12	.08	.16 - .18	.05	.08	-.25 - -.20
Reported hostility	.08	.06	.14 - .16	.72	.63	.16 - .17
Difficult temperament	-.10	.08	-.17 - -.15	-.11	.09	.16 - .19
Reported warmth x DT	.16	.13	.14 - .16	-.14	.20	-.14 - - .09
Reported hostility x DT	.16	.11	.16 - .20	1.42	1.29	.02 - .08
R^2 (range)		.03 - .04			.01 - .03	
F (2, 71) (range)		1.34 - 1.70			.48 - 1.06	

Note. $N = 77$. × $p < .10$. * $p < .05$. *DT* = Difficult Temperament.

Table 7. *Hierarchical Multiple Regression Analyses Predicting Externalizing Problem Behavior of the Firstborn Child (Using Observations of Parenting)*

	Prosocial behavior					
	Reported by mothers			Reported by fathers		
Predictor	*B* (pooled)	SE *B* (pooled)	β (range)	*B* (pooled)	SE *B* (pooled)	β (range)
Observed warmth	.13	.13	.10 - .13	.11	.07	.06 - .09
Observed hostility	1.09×	.66	.17 - .20	.01	.05	.05 - .11
Difficult temperament	-.13×	.08	-.22 - -.19	-.12	.08	-.24 - -.21
R^2 (range)		.06 - .07			.08 - .10	
F (3, 73) (range)		1.57 - 1.95			2.03 - 2.63×	
Observed warmth	.13	.13	.09 - .13	.07	.07	.05 - .09
Observed hostility	.90	.72	.11 - .19	.00	.05	.08 - .18
Difficult temperament	-.13×	.08	-.22 - -.18	-.17×	.09	-.19 - -.15
Observed warmth x DT	-.17	.28	-.10 - -.05	.22	.16	-.11 - -.06
Observed hostility x DT	1.26	1.62	.07 - .16	.09	.10	.09 - .17
R^2 (range)		.01 - .03			.04 - .05	
F (2, 71) (range)		.46 - 1.05			1.51 - 2.15	

Note. $N = 77$. × $p < .10$. * $p < .05$. *DT* = Difficult Temperament.

Discussion

The current study investigated whether parental warmth as well as parental hostility (both reported and observed) is related to the developmental outcomes of firstborn children after the transition to siblinghood and whether this relation is affected by temperament traits of the firstborn child. The sample consisted of 77 two-parent middle-class families with a Dutch nationality. It was expected – based on the differential susceptibility hypothesis – that firstborn children with a difficult temperament would be more vulnerable for positive (warmth) and negative parenting (hostility) compared to firstborn children with an easy temperament. Negative and positive developmental outcomes were examined, namely internalizing and externalizing problem behavior, and prosocial behavior.

Prior research has shown that the match between parenting and child temperament is associated with the developmental outcomes of a child (Chess & Thomas, 1999). Although a marginally significant effect of difficult temperament of the firstborn child on the association

between observed maternal warmth and internalizing problem behavior was found in this study, no other significant interaction effects were found[7]. Children with a more difficult temperament – compared to those with a less difficult temperament – did not seem to benefit from maternal warmth and expressed higher levels of internalizing problem behavior. This result is contrary to earlier findings were children with a more difficult temperament were found to show less internalizing (and externalizing) behavior problems when the quality of parenting was high (e.g. Pluess & Belsky, 2009; Slagt et al., 2016). The finding of the current study may have arisen by chance (generally referred to as 'multiple testing problem'), because several regression analyses were performed, the chance is higher to observe at least one (marginally) significant finding (Sun, Reich, Cai, Guindani, & Schwartzman, 2014).

The present study has several strengths: first, both observations and parent's self-reports were used to assess parental warmth and parental hostility towards the child. Prior research has pointed out that interactions between parenting and child temperament are stronger when parenting was assessed using observations instead of self-reports (Slagt et al., 2016). Second, positive as well as negative predictors and developmental outcomes were assessed, which is necessary to compare the differential susceptibility hypothesis and diathesis-stress model. Future research should also focus on the full range of positive and negative parenting and positive and negative developmental outcomes to compare the diathesis-stress model and differential susceptibility hypothesis within the same population. Finally, both maternal and paternal reports were used in this study and current research pays attention to the developmental outcomes of a firstborn child during the transitional period of the arrival of a second child, which is a normative life event for many families.

[7] It was investigated if this might be due to the low Cronbach's alpha regarding internalizing and externalizing problem behavior. When the internalizing problem behavior items and externalizing problem behavior items were combined into one problem behavior score, Cronbach's alpha was higher (.63 for mothers and .62 for fathers). Therefore, the analyses were performed again - with the combined problem behavior scores as outcome variable – the results did not reveal any more significant results.

Even though the present study has several strengths, it also has some limitations. Only highly-educated middle-class families participated, which might have affected the levels of hostility which the parents displayed and/or reported. Future research should investigate whether families with a lower socio-economic status display higher levels of hostility and if these findings do support the differential susceptibility hypothesis. Second, the relatively small sample size might have influenced the results. Furthermore, no distinction was made regarding the gender of the siblings. Future research should investigate whether there is a difference in firstborn child's adjustment based on the gender of the second born child.

Despite the limitations, the present study contributes to a further understanding of the potential moderator role of difficult temperament of firstborn children in relation to parenting and the developmental outcomes of the firstborn child across the transition to siblinghood. The findings revealed no support for the differential susceptibility hypothesis or the diathesis-stress model regarding this Dutch middle-class population. A focus on the full range of both positive and negative predictors and developmental outcomes is needed across different populations.

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Appendix 1. *Chronological Overview of Observed Play Sessions at T1*

Interactions concerning triadic play			
No.	Type of interaction	Explanation	Coded variable
1a	Dyadic play within triadic interaction	One parent does not play with the firstborn child, but the other parent does.	Warmth & hostility
1b	Dyadic play within triadic interaction	The parent who did not participate during the first task, plays now with the child and the other parent does not participate.	Warmth & hostility
2	Firstborn child ignored by both parents	The firstborn child is ignored while the parents are talking with each other.	
3	Triadic	Both parents and the firstborn child participate in the play.	Warmth & hostility
4a	One parent plays with doll	One parent plays with the firstborn child, while the other plays with a baby doll.	
4b	Other parent plays with doll	Now the other parent plays with the firstborn child, while the other parent plays with the baby doll.	
5	Both parents play with doll	The parents play with the doll and have to ignore their child.	
6	Triadic play with doll	The parents and the child play together with the doll.	Warmth & hostility
7	Helping task	The child receives a present (banana in wrapping paper).	
Interactions concerning dyadic play			
No.	Type of interaction	Explanation	Coded variable
1	Dyadic	One parent plays with the child either with lego-blocks or a tea set.	Warmth & hostility
2	Parent plays with doll	One parent plays with a doll, while the child plays with toys.	
3	Dyadic	One parent and the child play together.	Warmth & hostility
4	Parent asked to fill in questionnaire	The child receives a box with raisins and needs help from the parent to open it, but the parent is instructed to fill in a questionnaire.	
5	Dyadic	One parent plays with the child either with a puzzle task or with dominos.	Warmth & hostility