Infant and Child Development
Inf. Child. Dev. **25**: 302–324 (2016)
Published online 24 August 2015 in Wiley Online Library
(wileyonlinelibrary.com). DOI: 10.1002/icd.1929

Differential Susceptibility to Parenting in Middle Childhood: Do Impulsivity, Effortful Control and Negative Emotionality Indicate Susceptibility or Vulnerability?

Meike Slagt*, Judith Semon Dubas and Marcel A. G. van Aken
Utrecht Center for Child and Adolescent Studies, Utrecht University, Utrecht, The Netherlands

In this longitudinal study, we examined whether children differ in their susceptibility to harsh and responsive parenting as reflected in their externalizing and prosocial behaviour two years later. We focused on three potential susceptibility markers assessed during middle childhood: Negative emotionality, impulsivity, and effortful control. Participants were 120 Dutch children (6–11 years old; 54% girls). Parenting was assessed using both observations and self-report questionnaires. Parental responsiveness predicted decreased externalizing behaviour two years later among children high on impulsivity (in case of observed responsiveness) or low on effortful control (in case of observed and self-reported responsiveness) but not among children low on impulsivity or high on effortful control. Observed harsh parenting predicted decreased prosocial behaviour, especially among children with average or high negative emotionality. The findings support a diathesis–stress model more than they do a differential susceptibility model. High impulsivity seemed to be a vulnerability factor, predicting increased externalizing behaviour when parents lacked responsiveness. Also, high negative emotionality served as a vulnerability factor, predicting decreased prosocial behaviour when parents were harsh, while low negative emotionality served as a protective factor, buffering against decreased prosocial behaviour. Finally, low effortful control might operate as a vantage-sensitivity factor, predicting decreased externalizing behaviour when parents were responsive. Copyright © 2015 John Wiley & Sons, Ltd.

*Correspondence to: Meike Slagt, Utrecht Center for Child and Adolescent Studies, Utrecht University, P.O. Box 80.140, 3508 TC Utrecht, The Netherlands. E-mail: M.I.Slagt@uu.nl

Key words: parenting; temperament; middle childhood; differential susceptibility; diathesis–stress

Parents often observe that 'what works for one child doesn't work for the other'. The idea that different children respond differently to the same parenting efforts has been voiced in both the dual-risk model (Sameroff, 1983) and the diathesis–stress model (Zuckerman, 1999). These models state that some children are more 'vulnerable' to adverse parenting than others. Belsky (Belsky, 1997a, 1997b, 2005; Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2007; Ellis, Boyce, Belsky, Bakermans-Kranenburg, & van IJzendoorn, 2011) expanded the notion of vulnerability by proposing that not only are some children disproportionally affected by adverse parenting experiences but also these same children disproportionally benefit from supportive parenting experiences; this idea is now known as the differential susceptibility hypothesis.

Early attempts to identify potential susceptibility markers called attention to negative emotionality or difficult temperament (Belsky, 1997b, 2005; Belsky, Hsieh, & Crnic, 1998). Children with a difficult temperament appeared to be more susceptible to parenting and other environmental influences (Belsky & Pluess, 2009; Pluess & Belsky, 2010a), yet some crucial questions remain. First, these studies indicate that not all parenting-by-child temperament interactions reflect a differential susceptibility pattern (see also Kiff, Lengua, & Zalewski, 2011). Instead, several support a diathesis–stress model. Second, temperament in these studies has usually been measured during infancy, and it is uncertain whether temperament also functions as a susceptibility marker later in childhood. Finally, difficult temperament is operationalized differently across studies and it remains unclear which aspects of temperament are markers for children's susceptibility. In this study, we investigate whether support for the differential susceptibility hypothesis or diathesis–stress model can be found in middle childhood, by examining several potential susceptibility markers.

Diathesis–stress and Differential Susceptibility

According to the diathesis–stress model, some individuals possess characteristics that make them disproportionately vulnerable to stressors in their environment. When these predisposing 'diatheses' (e.g. a difficult temperament) are activated by a stressor, they can 'transform the potential of predisposition into the presence of psychopathology' (Monroe & Simons, 1991, p. 406). The diathesis–stress model predicts that vulnerable children are adversely affected by harsh, low-quality parenting, whereas more resilient children remain relatively unaffected by these same parenting practices (Sameroff, 1983; Zuckerman, 1999). In harsh parenting environments, vulnerable children will function less optimally than resilient children, while in supportive environments, vulnerable and resilient children will differ little in their functioning.

The differential susceptibility hypothesis is founded on evolutionary logic. According to this line of reasoning, early parenting experiences can prepare children for their future environment, in which they will have to survive and reproduce. This way, parenting can optimize children's chances of survival and reproduction later in life. However, using childhood experiences to regulate adolescent and adult development only pays off when childhood environments are reliably related to adult environments (West-Eberhard, 2003; Pigliucci, 2001). Yet the future for which children are prepared is inherently uncertain. This means occasionally a developmental mismatch will occur, in which children are prepared for the 'wrong' environment, diminishing their chances of survival and reproduction.

DOI: 10.1002/icd

Therefore, the differential susceptibility hypothesis poses that, as a form of bet hedging against an uncertain future, natural selection would have shaped parents to bear children varying in susceptibility, with some children being more affected by the parenting they experience than others (Belsky, 1997a, 1997b, 2005). In this way, less susceptible children are protected from parenting that turns out to be ill-suited to their later environment, while more susceptible children benefit from parenting that proves to match their future environment.

The differential susceptibility hypothesis thus predicts that children differ in their general susceptibility to rearing. Moreover, the same children that are most vulnerable to harsh and low-quality parenting are thought to benefit most from warm and supportive parenting —they are susceptible 'for better and for worse' (Belsky, 1997a, 1997b, 2005; Belsky et al., 2007). In harsh environments, susceptible children will function less optimally than non-susceptible children (similar to diathesis–stress), while in supportive environments, susceptible children will excel over non-susceptible children (unlike diathesis–stress).

These models —diathesis–stress and differential susceptibility— are partly overlapping, and selection of a restricted range of environments and outcomes (e.g. a harsh environment and problem behaviour) renders them indiscernible. Only a focus on the full range of environments and outcomes, from negative (i.e. risk-promoting) to positive (i.e. development-enhancing), reveals the difference between these models. Yet most individual studies on parenting-by-temperament interactions do not meet this requirement: They focus on a restricted range of environments and on a restricted range of developmental outcomes, oftentimes emphasizing the negative end of the spectrum (Ellis et al., 2011). By focusing on the negative and the positive end of the spectrum, we can find out which of these models of parenting-by-temperament interactions is best supported by our data.

Our first aim is to examine whether temperamentally susceptible children will be more affected by 'negative' and 'positive' parenting, as reflected in both 'negative' and 'positive' child behaviours. That is, we examine how parenting and child temperament interact in predicting externalizing behaviour and prosocial behaviour. Further, we examine interactions between harsh parenting and child temperament and between responsive parenting and child temperament. Harsh parenting is characterized by coercive acts and negative emotion expressions and comprises behaviours such as yelling, frequent negative commands, name calling, overt expressions of anger, and physical threats and aggression (Chang, Schwartz, Dodge, & McBride-Chang, 2003). Parental responsiveness is characterized by the presence of highly affective, positive engagement to the child, and sensitive and contingent responses to the child's needs (Landry, Smith, Swank, Assel, & Vellet, 2001). In sum, we aim to distinguish susceptibility from vulnerability effects.

Differential Susceptibility in Middle Childhood

The differential susceptibility hypothesis was originally developed to explain susceptibility in early childhood but has been suggested to extend across the lifespan (Ellis et al., 2011). Evidence supporting differential susceptibility has mainly been found in studies that have measured temperament during infancy and toddlerhood (Belsky & Pluess, 2009). To date, less is known about differential susceptibility later in childhood. We address this knowledge gap by examining differential susceptibility to parenting in middle childhood, among children aged 6 to 11 years. Among others, middle childhood is a developmental period when children enter a wider social world, show strong increases in cognitive abilities, and start to have more diverse and complex social interactions (Collins, Madsen, & Susman-Stillman, 2002).

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Six studies have addressed differential susceptibility among children whose temperament was measured during middle childhood, with mixed results. Harsh parenting predicted externalizing problems especially strongly among highly frustrated (Lengua, 2008), fearful (Colder, Lochman, & Wells, 1997), and impulsive children (Lengua, Wolchik, Sandler, & West, 2000), and also among children low on positive emotionality (Lengua et al., 2000), agreeableness, and conscientiousness (de Haan, Prinzie, & Deković, 2010). In contrast, harsh parenting predicted lower levels of externalizing problems among highly self-regulated and inhibited children, while it did not predict externalizing problems among children low on self-regulation and inhibition (Lengua, 2008; Leve, Kim, & Pears, 2005). These studies indicate diathesis–stress more than they do differential susceptibility: Those children most vulnerable to harsh parenting did not benefit most from parental acceptance and involvement. Only one study among school-aged children has found tentative support for differential susceptibility: highly impulsive children increased in externalizing problems when parenting was harsh, and decreased in externalizing problems when parenting was not harsh (Leve et al., 2005).

While some of these studies on differential susceptibility in middle childhood did measure positive, development-enhancing, aspects of parenting (Colder et al., 1997; Kiff, Lengua, & Bush, 2011; Lengua et al., 2000; Lengua, 2008), they failed to find any interactions between positive parenting and child temperament resembling a differential susceptibility pattern. However, each of these studies focused on problem behaviours as an outcome. Perhaps positive parenting mainly interacts with child temperament in predicting positive outcomes, thus representing the 'for better' side of the 'for better and for worse' effects proposed by differential susceptibility (Belsky et al., 2007). Studies on differential susceptibility in middle childhood that cover negative (i.e. risk-promoting) and positive environments and outcomes are therefore needed.

Additionally, individual differences in susceptibility, as well as the best markers we can use for them (e.g. temperament traits), might differ depending on age (Belsky & Pluess, 2013). Some argue that it is during the early years of life that human development is most susceptible to environmental influences, both harsh and supportive (e.g. Ganzel & Morris, 2011). Developmental plasticity might be greatest when biological systems are being laid down. Indeed, much of the empirical support for differential susceptibility has been found in studies that measured temperament in infancy and toddlerhood (e.g. Bradley & Corwyn, 2008; Dopkins Stright, Cranley Gallagher, & Kelley, 2008; Pitzer, Jennen-Steinmetz, Esser, Schmidt, & Laucht, 2011). On the other hand, one could argue that, while much support for differential susceptibility has been found in studies that measured temperament during the first three years of life, this is also the time when temperament is least stable, with test–retest correlations being lowest (Roberts & DelVecchio, 2000). After this, temperament becomes much more stable and may therefore become a more reliable marker for differences in susceptibility (Kiff et al., 2011). Thus, a second aim of this study is to investigate temperament traits as markers of differential susceptibility in middle childhood.

Temperament Markers of Differences in Susceptibility

Temperament has been defined as 'constitutionally based individual differences in reactivity and self-regulation, in the domains of affect, activity, and attention' (Rothbart & Bates, 2006, p. 100).[1] Reactivity refers to the arousability of motor, affective, and sensory response systems (Rothbart & Bates, 2006) and includes

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reactivity at a behavioural level and reactivity at an emotional level. Emotionally reactive children have a strong tendency to display intense emotions, for instance, negative emotions (negative emotionality). Behaviourally reactive children have the tendency to show strong behavioural reactions to their environment, for instance, by being impulsive. Impulsivity entails spontaneous approach behaviour and is defined as the speed of response initiation (Rothbart, Ahadi, Hershey, & Fisher, 2001). Impulsive children can let their behaviour be guided by desires and potential rewards without thinking. Self-regulation refers to processes that modulate reactivity, such as effortful control. Effortful control entails children's ability to inhibit a dominant response to perform a subdominant response (Rothbart & Bates, 2006). With development, children's growing effortful control increasingly modulates the effects of reactivity on overt behaviour (Derryberry & Rothbart, 1997). By middle childhood then, children become increasingly capable of regulating their negative emotionality and impulsivity (Murphy, Eisenberg, Fabes, Shepard, & Guthrie, 1999). Thus, while effortful control may play a small role as susceptibility marker during infancy, it may play a more important role by middle childhood.

Studies that have found support for the differential susceptibility hypothesis frequently used a composite measure of difficult temperament (a combination of temperament traits) to mark differences in susceptibility (Bradley & Corwyn, 2008; Dopkins Stright et al., 2008; Mesman et al., 2009; Pitzer et al., 2011; Pluess & Belsky, 2010b; van Aken, Junger, Verhoeven, van Aken, & Deković, 2007). They found that infants with a difficult temperament, compared to infants with an easy temperament, showed higher levels of externalizing behaviours if raised by mothers who relied heavily on harsh control and who lacked sensitivity, and lower levels of externalizing behaviours when mothers were highly sensitive and showed little harsh control (Bradley & Corwyn, 2008; Mesman et al., 2009; Pitzer et al., 2011; van Aken et al., 2007). Further, children with difficult temperaments showed higher levels of social skills and academic adjustment than children with easier temperaments when parenting quality was high and lower levels of adjustment when parenting quality was low (Dopkins Stright et al., 2008; Pluess & Belsky, 2010b).

Some studies examined specific traits and found children high on aspects of negative emotionality to be more susceptible to harsh and neglectful parenting. They showed lower levels of adjustment compared to their peers low on negative emotionality when parents were harsh and higher levels of adjustment when parents were not harsh. This held true for fearful children in predicting depression (Colder et al., 1997) and rule compatibility (Kochanska, Aksan, & Joy, 2007), for anger-prone toddlers in predicting externalizing behaviours (Smeekens, Riksen-Walraven, & van Bakel, 2007) and for irritable infants in predicting sociability (Stupica, Sherman, & Cassidy, 2011). One study found children with high levels of impulsivity to be more susceptible to harsh discipline in developing externalizing problems (Leve et al., 2005). Finally, as to effortful control, studies reveal mixed results, with some showing children low on effortful control to respond more strongly to socialization influences (de Haan et al., 2010; Pitzer et al., 2011; Poehlmann et al., 2011) and others showing children high on effortful control to respond more strongly (Halpern, Garcia Coll, Meyer, & Bendersky, 2001).

In sum, previous studies have used a variety of temperament dimensions as susceptibility markers, although most studies did not compare several temperament dimensions in one study. Instead, many studies have used 'difficult temperament' in general as a susceptibility marker, combining several temperaments traits into a general 'difficultness' score. Consequently, it remains unclear which aspects of temperament are markers for children's susceptibility.

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Our third aim is to study three possible markers of susceptibility among school-age children: negative emotionality (to indicate emotional reactivity), impulsivity (to indicate behavioural reactivity), and effortful control. These potential markers cover distinct aspects of temperament (Rothbart & Bates, 2006) and are well-established by middle childhood (Nigg, 2006; Roberts & DelVecchio, 2000). Negative emotionality, impulsivity, and low effortful control have been related directly to externalizing behaviour, while low negative emotionality and high effortful control have been related to prosocial behaviour (Rothbart & Bates, 2006; Sanson, Hemphill, & Smart, 2004).

Apart from predisposing children to developing externalizing or prosocial behaviours, these temperament traits may also render children especially susceptible to their environment, as has been suggested by previous studies on differential susceptibility (Belsky & Pluess, 2009). Children high on negative emotionality could be more susceptible because their temperament is thought to reflect a highly sensitive nervous system, on which experiences from the environment register especially strongly (Aron, Aron, & Jagiellowicz, 2012; Ellis et al., 2011). Highly impulsive children could be more susceptible because they are relatively sensitive to immediate rewards, making them react to their parenting environment more strongly (Derryberry & Rothbart, 1997). Sensitivity to rewards is one of the potential mechanisms that is hypothesized to underlie differences in susceptibility (Belsky & Pluess, 2009; Ellis et al., 2011). Finally, children low on effortful control are less able to control their approach tendencies and the way they initially react to environmental stimuli (Derryberry & Rothbart, 1997; Rothbart & Bates, 2006), making them relatively sensitive to immediate rewards and the pursuit of short-term goals (MacDonald, 2008). This may make them more susceptible to their environment. Alternatively, children high on effortful control are better able to direct attention to information in the environment (Derryberry & Rothbart, 1997), facilitating a thorough processing of this information (Aron et al., 2012), which may make them more susceptible to their environment.

The Current Study

In sum, we study differences in susceptibility to parenting among school-aged children, by focusing on three potential susceptibility markers: negative emotionality, impulsivity, and effortful control. To distinguish differential susceptibility findings from diathesis–stress findings, we measure both positive and negative aspects of parenting and child behaviours. In line with both differential susceptibility and diathesis–stress, we expect harsh parenting will predict child externalizing behaviour especially strongly among children higher on negative emotionality, impulsivity, and either higher or lower on effortful control. Further, as to the association between responsive parenting and prosocial behaviour, we pit two competing hypotheses against each other. First, in line with differential susceptibility, we might expect that responsive parenting predicts prosocial behaviour especially strongly among higher on negative emotionality, impulsivity, and either higher or lower on effortful control. Second, in line with diathesis–stress, we might expect that the association between responsive parenting and prosocial behaviour is similar regardless of children's negative emotionality, impulsivity, and effortful control.

Finally, in the wider child development literature, a significant body of research suggests that there are differential effects of parenting between boys and girls (e.g. Crick & Zahn-Waxler, 2003). Whether parenting also differentially affects susceptible boys versus susceptible girls is an open question, although some articles

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suggest this may be the case (e.g. Lengua, 2008; Leve et al., 2005; Ramchandani, van IJzendoorn, & Bakermans-Kranenburg, 2010). On a purely theoretical basis, however, it would be surprising if the supposed fitness benefits of variation in susceptibility would apply only to male or only to female. For exploratory reasons, we tested gender as a moderator of differences in susceptibility to parenting in preliminary analyses.

METHOD

Participants

Families were recruited via 4th or 5th-grade children attending public elementary schools in the Netherlands. Children were told about the study and were given letters describing the study and consent forms to take home to their parents. Parents could return signed consent forms via post or by having their children bring the forms to school. We invited parents and their child to participate. In total, 120 children, 116 mothers, and 91 fathers participated at Time 1 (T1). Two years later we followed up these families (T2). This time, 85 children, 82 mothers, and 60 fathers took part in the study.

At T1, children (54% girls) were 8.17 years old on average ($SD = 1.16$, range 6–11). Mothers were 39.74 years old ($SD = 3.81$, range 28–47), and fathers 42.32 years old ($SD = 4.72$, range 32–54). The majority of mothers (91%) and fathers (95%) were married or cohabiting, and most mothers (98%) and fathers (96%) had a Dutch ethnicity. The annual family income was low (<€25 000) for 8% of families, moderate (€25 000 to €65 000) for 60% of families, and high (>€65 000) for 32% of families. The respective percentages of mothers and fathers with various educational levels were as follows: high school (23%, 19%), intermediate vocational education (20%, 12%), higher vocational education (30%, 36%), and university (27%, 33%).

Families with complete data on study variables at T1 (78% of the 120 families that agreed to participate) and families with incomplete data (i.e. for whom a score on one or more study variables could not be calculated because all items used to measure that study variable were missing) did not differ on any of the background variables (age, gender, marital status, or educational level). Similarly, families with complete data on study variables at T2 (71% of 120 families) and families with incomplete data generally did not differ on background variables or study variables at T2. The only exception concerned families with complete data at T2 being more responsive towards children at T1 compared to families with incomplete data at T2, $M_{\text{complete}} = 3.41$ ($SD = .44$), $M_{\text{missing}} = 3.12$ ($SD = .42$), t (85) = 2.88, $p = .01$, $d = .67$. Little's MCAR test (Little, 1988) indicated that missing values were missing completely at random, $\chi^2(37, N = 120) = 29.33$, $p = .81$. To maximize sample size, we imputed missing values with the expected-maximization algorithm (Schafer & Graham, 2002).

Procedure

At T1, all families were visited twice in their homes by two trained masters students studying developmental psychology. Each student had participated in a 2–3 hours training during which the entire study protocol was rehearsed. The home visits were three days apart. The first home visit lasted on average 1.5 hours, and the second home visit lasted 30 to 45 minutes. During the first home visit at T1,

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parents provided information on their children's temperament and behaviour and on their own parenting behaviour by completing several questionnaires.

During the second home visit at T1, parents were observed in how they spontaneously interacted with their children. During this visit, parents and children completed several research tasks (not relevant for this study). There were no structured parent–child interaction tasks; instead, both observers paid attention to how parents interacted with their child during the entire time they were at the home. This included whether and how the parent introduced the child to the observer, how the parent and child interacted during the explanation of research tasks, whether the parent reprimanded the child for anything, and how parent and child interacted with each other before and after the research tasks. Immediately following the visit, the two observers independently completed a questionnaire that assessed the quality of parent–child interactions.

Children received t-shirts for participating in the first wave of data collection. In addition, participating families were entered in a drawing in which a weekend vacation or dinner gift certificates were given as prizes. Two years later (T2), parents again filled out a mailed questionnaire concerning their children's behaviour.

Measures

Child temperament

Parents reported on their children's *impulsivity* using the 13-item Impulsivity Scale from the Children's Behavior Questionnaire (CBQ; Rothbart et al., 2001). The items (e.g. 'Usually rushes into an activity without thinking about it') were answered on a 7-point scale ranging from 1 (*extremely untrue of your child*) to 7 (*extremely true of your child*), with higher scores indicating higher impulsivity. Cronbach's alphas were .80 for mothers and .83 for fathers. Children's *effortful control* was measured using the 9-item Attentional Focusing scale (e.g. 'When picking up toys or other jobs, usually keeps at the task until it's done') and the 13-item Inhibitory Control scale (e.g. 'Can lower his/her voice when asked to do so') of the CBQ. *Negative emotionality* was based on the 11-item Anger/Frustration scale (e.g. 'Has temper tantrums when (s)he doesn't gets what (s)he wants') from the CBQ and the 8-item Negative Moods and Intensity scale (e.g. 'My child's emotions are usually more intense than those of other children';Eisenberg et al., 1995). Responses to the latter were provided on a 7-point scale ranging from 1 (*never*) to 7 (*always*), with higher scores indicating more intense negative moods. Because effortful control and negative emotionality are each indicated by multiple scales, we created a composite score for these temperament dimensions following the strategy advised by Dishion, Patterson, Stoolmiller, and Skinner (1991). For both constructs, exploratory factor analysis indicated that scales could be combined into a composite score, with standardized factor loadings ranging from .82 to .86. Cronbach's alphas of the combined effortful control scale were .86 for mothers and .84 for fathers. Cronbach's alphas of the combined negative emotionality scale were .81 for mothers and .84 for fathers. For all three temperament dimensions mother and father scores were combined into a single score (intercorrelations: .49 to .69, $ps < .001$)

Parenting behaviour

To reduce shared method bias, we used observations of parenting made during the home visit as our main parenting measure. Parental display of responsiveness towards their children was observed by two trained, independent observers using two items from the HOME inventory (Bradley, Corwyn, McAdoo, & García Coll,

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2001), describing responsiveness and affection on a 4-point scale (e.g. 'To what extend did the parent display responsiveness to the needs of the child'; 1 = *frequent display of behaviour* to 4 = *absence of behaviour*). The observers were blind to the study's hypotheses. During the training for the home visits, examples of parenting behaviours for each of the constructs were presented and discussed. Reliability between observers was not assessed prior to the home visits and was only assessed afterwards instead. During the visit, both observers assessed responsiveness, yielding two observations of maternal responsiveness and two of paternal responsiveness. In each case, the two items loaded on a single factor, for both observers' reports and for mothers and fathers (standardized factor loadings ranged from .89 to .94). Cronbach's alphas for observations by observer 1 and observer 2 were .73 and .80 for mothers and .73 and .85 for fathers, respectively. As judged by intraclass correlations (ICC), inter-rater reliability was moderate for maternal responsiveness and paternal responsiveness (ICCs = .50 and .55, respectively).[2] We calculated a single responsiveness score by combining the scores from the two observers about both parents (intercorrelations between mothers and fathers: .45 to .65, ps $< .001$).

Harsh parenting was observed using three items from the HOME inventory, describing restrictive, harsh, and power assertive behaviour (e.g. 'To what extend did the parent display restrictive or strict behavior towards the child'). The items loaded on a single factor, for both observers' reports and for mothers and fathers (standardized factor loadings ranged from .69 to .88). Cronbach's alphas were .69 and .59 for mothers and .76 and .77 for fathers. Inter-rater reliability was moderate for both maternal harshness and paternal harshness (ICCs = .48 and .66, respectively). We collapsed the scores into a single score (intercorrelations between mothers and fathers: .68 to .79, ps $< .001$).

In addition to observations of parenting, we used self-reports of parenting to try and replicate the findings obtained using observations. To this end, we focused on affection and harsh discipline. Parental affection was assessed using three items from the Nijmegen Parenting Questionnaire (e.g. 'I often let my child know I love him/her'; Gerris et al., 1992), adapted to a 7-point scale (1 = *not at all true* 7 = *very true*). Cronbach's alphas were .85 for mothers and .81 for fathers; we collapsed mothers' and fathers' scores into a single score. Observed parental responsiveness was positively associated with parent self-reports of affection towards their child ($r = .25$, $p < .01$).

Harsh discipline was assessed using four items from the Alabama Parenting Questionnaire (e.g. 'You yell or scream at your child when he/she has done something wrong' Shelton, Frick, & Wootton, 1996), adapted to a 7-point scale (1 = *not at all true* 7 = *very true*). Cronbach's alphas were .66 for mothers and .59 for fathers; we collapsed the scores into a single score. Observed harsh parenting positively correlated with parental self-reports of harsh discipline ($r = .27$, $p < .01$).

Child behaviour

Parents reported on their children's externalizing behaviours (e.g. 'Often has temper tantrums or hot tempers') and prosocial behaviours (e.g. 'Considerate of other people's feelings') using two subscales of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 2001). These subscales —conduct problems and prosocial behaviour— were administered both at T1 and T2. Each subscale consists of 5 items, measured on a 3-point scale (1 = *not true* to 3 = *definitely true*). A scale score is generated by summing the item scores of each scale. Cronbach's alphas for mother-reported externalizing behaviour and prosocial behaviour were

DOI: 10.1002/icd

.55 and .75 at T1 and .50 and .68 at T2. Cronbach's alphas for father-reported externalizing behaviour and prosocial behaviour were .54 and .73 at T1 and .57 and .80 at T2. Mother and father scores were collapsed (intercorrelations at T1 and T2: .50 to .66, $ps < .001$).

Analyses

Hierarchical multiple regression analyses were performed using SPSS 22. We employed a bootstrap procedure (with $n = 1000$ bootstrap resamples) to obtain robust standard errors, given the relatively small sample size and the slight non-normality of the outcome measures (skewness = 1.76 and −.71 for externalizing behaviour and prosocial behaviour at T2, respectively, and kurtosis = 3.76, and −.18; Davison & Hinkley, 1997).[3]

Two separate regressions were performed, using externalizing behaviour at T2 and prosocial behaviour at T2 as dependent variables. Predictors were centred prior to computing interaction terms (Cohen, Cohen, West, & Aiken, 2003). We entered control variables (the outcome variable at T1, gender, and child age) in step 1, followed by the two parenting behaviours and the three temperament dimensions in step 2. In step 3, we added interactions between parenting and each of the three temperament traits in three separate regressions (3a, 3b, and 3c). To replicate our results, we re-ran the regression analyses using self-report measures of parenting (affection and harsh discipline) instead of observed parenting. Significant interactions were followed by estimating the relation between the predictor and the outcome at temperament values plus, exactly at, or minus one *SD* from the sample mean (Cohen et al., 2003).

Furthermore, to demonstrate a differential susceptibility effect, susceptible children should do 'worse' than their less susceptible counterparts when receiving little responsiveness and high levels of harsh parenting from their parents and 'better' when receiving high levels of responsiveness and little harsh parenting. To examine this in more detail, we calculated the region of significance with respect to the predictor (i.e. parenting) in case of a significant interaction (Preacher, Curran, & Bauer, 2006; Roisman et al., 2012). This region identifies the range of predictor values for which regression lines estimated at different temperament values (or more precisely, point estimates on these lines) significantly differ from each other. When differential susceptibility is warranted, these lines should differ significantly both at low values ($M - 2$ *SD*) of the predictor ('for worse') and at high values ($M + 2$ *SD*) of the predictor ('for better'). This distance of 2 *SD* from the mean of parenting is suggested as the range of interest for evaluating differential susceptibility effects (Roisman et al., 2012). If diathesis–stress is warranted, these lines should differ only at the 'for worse' side of the predictor (i.e. low levels of responsive parenting and high levels of harsh parenting).

In addition, we examined child gender as a moderator of all hypothesized effects in a series of preliminary analyses. These interactions were primarily non-significant (41 of 42 interactions) and dismissed from further consideration.

RESULTS

Descriptive statistics and correlations are presented in Table 1. Parental responsiveness was related to higher levels of prosocial behaviour, while harshness was

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Table 1. Correlations, means, and standard deviations for measures of child behaviour, parenting, and temperament

	1	2	3	4	5	6	7	8	*M*	*SD*
1. Externalizing behaviour T1	—								6.25	1.37
2. Externalizing behaviour T2	.83***	—							6.10	1.30
3. Prosocial behaviour T1	−.23*	−.15	—						13.13	1.78
4. Prosocial behaviour T2	−.34***	−.29**	.74***	—					12.95	1.72
5. Responsiveness	−.07	−.05	.27**	.32***	—				3.32	.40
6. Harshness	.32***	.22*	.01	−.16	−.21*	—			1.41	.38
7. Impulsivity	.29**	.32***	.18	.22*	.12	.16	—		4.12	.74
8. Effortful control	−.40***	−.35***	.01	−.01	.07	−.28**	−.67***	—	4.76	.73
9. Negative emotionality	.56***	.47***	−.34***	−.28**	−.25**	.23*	.23*	−.41***	3.61	.66

Note. $N = 120$; T1, Time 1; T2, Time 2. The possible range of scores for externalizing behaviour and prosocial behaviour was 5–15, for responsiveness and harshness 1–4, and for impulsivity, effortful control, and negative emotionality, it was 1–7.
*$p < .05$; **$p < .01$; ***$p < .001$.

related to higher levels of externalizing behaviour. The results of the hierarchical regression analyses are presented in Table 2.

Main Effects of Temperament and Parenting

Child behaviour at T1 significantly predicted child behaviour at T2, indicating that children's externalizing behaviour and prosocial behaviour were characterized by high relative stability (step 1). Child gender and age did not predict any of the child behaviours. In step 2 of the analyses, harsh parenting predicted children's prosocial behaviour, but not their externalizing behaviour. Children whose parents displayed more harsh parenting decreased in prosocial behaviour. No main effects of parental responsiveness or of children's temperament traits were found.

Moderation of Observed Parenting by Temperament

Interactions involving the three temperament traits were examined next. Specifically, interactions involving impulsivity, effortful control, and negative emotionality were added separately, in steps 3a, 3b, and 3c, respectively. Both impulsivity and effortful control interacted with responsiveness in predicting externalizing behaviour. Negative emotionality interacted with harshness in predicting prosocial behaviour.

Probing Significant Interactions

Following the significant interactions, we examined simple slopes. As illustrated in Figure 1A and 1b, among children high on impulsivity and low on effortful

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Table 2. Hierarchical regression analysis predicting child externalizing and prosocial behaviour at T2 using temperament, parenting, and age and gender at T1

		Externalizing behaviour T2				Prosocial behaviour T2			
	Predictor	ΔR^2	*B*	95% CI[a]	β	ΔR^2	*B*	95% CI[a]	β
Step 1	Dependent variable at T1	.69***	.78	[.65, .89]	.83***	.55***	.72	[.57, .89]	.74***
	Gender		.08	[−.18, .35]	.03		−.07	[−.50, .39]	−.02
	Age		−.04	[−.14, .06]	−.04		−.02	[.18, .11]	−.02
Step 2	Impulsivity	.01	.21	[−.03, .46]	.12	.05*	.28	[−.14, .67]	.12
	Effortful control		.06	[−.27, .44]	.04		.02	[−.43, .46]	.01
	Negative emotionality		.00	[−.25, .25]	.00		−.03	[−.36, .34]	−.01
	Responsiveness		−.11	[−.46, .22]	−.03		.37	[−.13, .85]	.09
	Harshness		−.18	[−.61, .34]	−.05		−.78	[−1.55, −.20]	−.17*
Step 3a	Impulsivity *responsiveness	.02*	−.63	[−1.25, −.04]	−.14*	.02*	−.91	[−1.73, .07]	−.15
	Impulsivity*harshness		−.08	[−.60, .39]	−.02		−.54	[−1.56, .62]	−.09
Step 3b	Effortful control *responsiveness	.02*	.61	[.06, 1.16]	.14*	.00	.31	[−.73, 1.35]	.05
	Effortful control *harshness		.09	[−.52, .90]	.02		.33	[−.60, 1.33]	.06
Step 3c	Negative emotionality *responsiveness	.01	.14	[−.39, .61]	.03	.03*	−.23	[−1.04, .56]	−.04
	Negative emotionality *harshness		.56	[−.57, 1.15]	.10		−1.41	[−2.66, −.62]	−.20*

Note. $N = 120$; CI, confidence interval; T1, Time 1; T2, Time 2.
[a]Bias-corrected accelerated
*$p < .05$; **$p < .01$; ***$p < .001$.

control, more parental responsiveness predicted decreased externalizing problem behaviour ($\beta = .11$, $p = .03$ and $\beta = -.16$, $p = .03$, respectively). In contrast, for those low on impulsivity or high on effortful control, parental responsiveness was not related to externalizing behaviour ($\beta = -.17$, $p = .16$ and $\beta = .10$, $p = .19$, respectively). Similarly, for those with average impulsivity or effortful control, parental responsiveness was not related to externalizing behaviour ($\beta = -.03$, $p = .52$ and $\beta = -.03$, $p = .51$, respectively). Thus, parental responsiveness was associated with less externalizing behaviour only among children with high impulsivity or low effortful control.

As displayed in Figure 2, for children scoring low on negative emotionality, harsh parenting did not predict prosocial behaviour ($\beta = .07$, $p = .48$), while for children with average or high negative emotionality, harsh parenting predicted decreased prosocial behaviour ($\beta = -.13$, $p = .04$ and $\beta = -.33$, $p < .001$, respectively). Thus, harsh parenting predicted less prosocial behaviour among children with average or high levels of negative emotionality.

Next, we examined whether children high on impulsivity or low on effortful control would be susceptible to both the detrimental effects of low levels of responsiveness and the beneficial effects of high levels of responsiveness (Figure 1). We did the same for children high on negative emotionality with respect to high and low levels of harsh parenting (Figure 2). To this end, we calculated regions of significance for responsiveness and harsh parenting (see Preacher et al., 2006). Vertical lines in each plot indicate the region of significance for parenting. We

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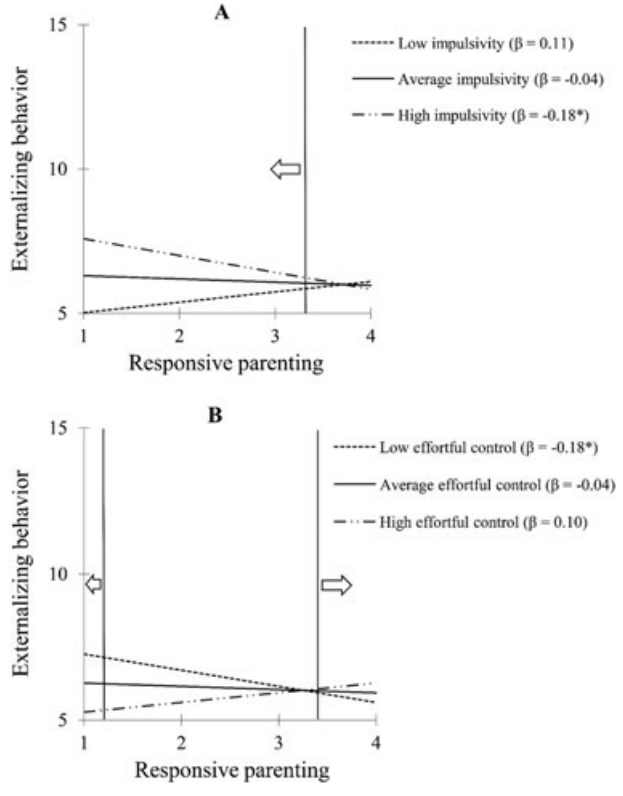

Figure 1. Linear relation between responsive parenting and externalizing behaviour, computed at one standard deviation below the mean (low), the mean (average), and one standard deviation above the mean (high) of impulsivity (A) and effortful control (B). Vertical lines in each plot indicate the predictor values at which *differences among* (point estimates on) slopes for different temperament values become significant, with the arrow denoting the side of the line to which differences among slopes are significant. * $p < .05$.

reportonly those region boundaries that fall within the measured range of temperament, parenting, and outcome variables.

The association between impulsivity and externalizing behaviour was significant at values of responsiveness lower than the mean. At low values of responsiveness, highly impulsive children displayed higher levels of externalizing behaviour compared to less impulsive children, whereas at high values of responsiveness, children displayed similar levels of externalizing behaviour regardless of their level of impulsivity (Figure 1A).

The association between effortful control and externalizing behaviour was significant at values of responsiveness lower than $M - 5.30$ *SD* and higher than $M + .30$ *SD*. At extremely low values of responsiveness, children low on effortful control displayed higher levels of externalizing behaviour compared to children high on effortful control. At high values of responsiveness, children low on effortful control displayed lower levels of externalizing behaviour compared to children high on effortful control (Figure 1B). Though the lower bound of this region of significance ($M - 5.30$ *SD*) falls within the theoretical range of our responsiveness measure, it does not fall within the observed range of responsiveness nor within

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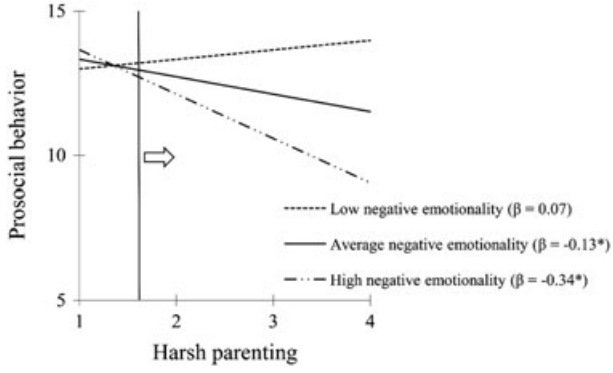

Figure 2. Linear relation between harsh parenting and prosocial behaviour, computed at one standard deviation below the mean (low), the mean (average), and one standard deviation above the mean (high) of negative emotionality. Vertical lines in each plot indicate the predictor values at which *differences among* (point estimates on) slopes for different temperament values become significant, with the arrow denoting the side of the line to which differences among slopes are significant. * $p < .05$.

the suggested range of interest for evaluating differential susceptibility effects: 2 *SD* from the mean of parenting. Therefore, children low on effortful control do not appear to be more susceptible to both low and high levels of responsiveness compared to children high on effortful control. Instead, children low on effortful control appear more sensitive to high levels of responsiveness only.

Finally, the association between negative emotionality and prosocial behaviour was significant at values of harsh parenting higher than $M + .71$ *SD*. Thus, at high values of harsh parenting, children higher on negative emotionality displayed lower levels of prosocial behaviour, whereas at low values of harsh parenting, children displayed similar levels of prosocial behaviour regardless of their level of negative emotionality (Figure 2).

Moderation of Self-reported Parenting by Temperament

To replicate these results, regression analyses were repeated using questionnaire measures of parenting. The results show that the effortful control-by-responsiveness interaction predicting externalizing behaviour was replicated ($B = .41$, $SE = .18$, $p = .02$, $\beta = .17$, 95% CI = [.08, .78]), while the impulsivity-by-responsiveness interaction predicting externalizing behaviour was not ($B = .05$, $SE = .15$, $p = .72$, $\beta = .02$, 95% CI = [−.26, .31]). For the negative emotionality-by-harsh parenting interaction predicting prosocial behaviour, coefficients were in the expected direction and of similar magnitude, although the interaction was no longer significant ($B = -.41$, $SE = .29$, $p = .11$, $\beta = -.10$, 95% CI = [−1.02, .14]).

DISCUSSION

We examined whether children differ in their susceptibility to harsh and responsive parenting, depending on three potential susceptibility markers assessed during middle childhood: impulsivity, negative emotionality, and effortful control. We found that observed parental responsiveness predicted lower levels of

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externalizing behaviour among children high on impulsivity and low on effortful control. Observed harsh parenting predicted lower levels of prosocial behaviour, especially among children with average or high negative emotionality.

These findings support a diathesis–stress model (Sameroff, 1983; Zuckerman, 1999) more than they do a differential susceptibility model. Like many previous studies among older children (e.g. Colder et al., 1997; Kiff et al., 2011; Prinzie et al., 2003), we found mainly 'for worse' effects instead of 'for better and for worse' effects —despite the focus on the positive end of the spectrum that was present in our study and that is necessary to be able to distinguish differential susceptibility from diathesis–stress. We found that children high on impulsivity were especially vulnerable to a lack of observed parental responsiveness. These children, compared to their less vulnerable peers, showed the highest levels of externalizing behaviour when parents lacked responsiveness, but they did not display the lowest levels of externalizing behaviour and the highest levels of prosocial behaviour when parents were highly responsive —thus lacking 'for better' effects. Likewise, children higher on negative emotionality were especially vulnerable to harsh parenting, displaying lower levels of prosocial behaviour in response. These children showed the lowest levels of prosocial behaviour when parents were harsh, but they did not display the highest levels of prosocial behaviour and the lowest levels of externalizing behaviour when parents were not harsh. These results do not indicate any 'for better' effects where those children most vulnerable to harsh parenting profited most from responsive parenting.

A recent review on parenting-by-child temperament interactions already suggested that 'the bulk of interaction findings are consistent with a diathesis–stress model for person-by-environment interactions' (Kiff et al., 2011, p. 269). Such is true for our study as well, despite the inclusion of both negative (risk-promoting) and positive (development-enhancing) environments and outcomes. High impulsivity might be a risk factor for developing externalizing behaviour in the context of unresponsive parenting, although this finding should be interpreted with some caution, as it was not replicated using self-reported parenting. Also, negative emotionality might serve as a risk factor for decreased prosocial behaviour in the context of harsh parenting, while low negative emotionality might serve as a protective factor, buffering a decrease in prosocial behaviour when parenting is harsh.

Considering Age in Studying Differential Susceptibility

That we did not find differential susceptibility effects might be because such effects have been found mainly among children whose temperament was measured during infancy or toddlerhood (Belsky & Pluess, 2009). When differential susceptibility is studied among older children, diathesis–stress effects are frequently obtained (e.g. Lengua, 2008; Kiff et al., 2011). This discrepancy between studies measuring temperament during infancy and studies measuring temperament later in life may be because temperament, although fairly stable, continues to develop during life (Janson & Mathiesen, 2008), being shaped by postnatal experiences (e.g. Blandon, Calkins, Keane, & O'Brian, 2010). When children are older, their temperament might therefore have changed compared to how it was during infancy (Roberts & DelVecchio, 2000). For instance, a negatively reactive temperament during infancy may indicate a general susceptibility to parenting (Belsky & Pluess, 2009; Ellis et al., 2011). However, if usually exposed to a supportive environment, this negatively reactive temperament might become less pronounced

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over the years (Blandon et al., 2010). If usually exposed to a harsh environment, this negatively reactive temperament might become more pronounced (Kiff et al., 2011), to the point where it becomes very hard for negatively reactive children to profit from supportive experiences so strongly that they excel over their less reactive peers.

Postnatal programming of prenatal susceptibility might thus continue during childhood as an adaptive process (Pluess & Belsky, 2011), fine-tuning the temperament of susceptible children to their (parenting) environment (see also Hall & Perona, 2012). This raises the issue of whether impulsivity, effortful control, and negative emotionality, despite being valid aspects of temperament, are susceptibility markers when measured at older ages (Kiff et al., 2011; Nigg, 2006). Studies examining these temperament traits as susceptibility markers at several ages (e.g. infancy, toddlerhood, and middle childhood) should be conducted to examine this possibility.

In addition, other traits could be studied as potential susceptibility markers later in childhood. For instance, our study suggested that negative emotionality later in life may no longer map onto increased susceptibility to both harsh and supportive environments. In contrast, during infancy, negative emotionality may sometimes reflect an experience-induced reaction to overstimulation by the environment. For those children for whom this is the case, it may not be their negative emotionality *per se*, but a highly sensitive nervous system that gives rise to negative emotionality early in life, which makes them susceptible to both harsh and supportive environments (Aron & Aron, 1997; Aron et al., 2012; Ellis et al., 2011). While their negative emotionality may decrease as they get older, their highly sensitive nervous system and its associated personality trait of sensory processing sensitivity may remain. Studies examining sensory processing sensitivity as a potential susceptibility marker later in childhood would be valuable in exploring this (Pluess et al., 2015; Pluess & Boniwell, 2015).

Observations and Questionnaires

Importantly, parenting-by-temperament interactions were mostly found using observed measures of parenting, and fewer interactions emerged when using parental self-reports. Two explanations can be provided for this discrepancy. First, our findings are in line with meta-analyses on person-by-environment interactions, which have shown that studies using observation measures of the environment were more likely to find significant person-by-environment interactions than studies using self-reported questionnaire measures of the environment (Uher & McGuffin, 2010; Karg, Burmeister, Shedden, & Sen, 2011). Arguably, self-reported measures of parenting can take into account parenting across many contexts and over time. But they are also prone to biases, which can make them less reliable and more influenced by subjective states, including current mood and social desirability (Schwarz, 1999). What parents report as their parenting practices and what they actually do in real interactions with their children may not always correspond. Second, apart from the notion that observation and questionnaire measures may tap into different aspects of parenting, the reliability of our observed parenting measure was not optimal. This may also explain why some of the parenting-by-temperament interactions were replicated using questionnaire measures of parenting, and some were not. Therefore, our findings should be replicated in future studies using robust questionnaire and observation measures of parenting.

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Vantage Sensitivity

As to effortful control, children low on effortful control —compared to other children— seemed to benefit the most from responsive parenting, in that it predicted decreased externalizing problems. This was true both for both observations of responsive, affectionate parenting and self-reports of warm parenting. Notably, children low on effortful control were 'low' only in a relative sense: A score of 1 *SD* below the sample mean on effortful control (i. e. 4.03) was still slightly higher than the neutral midpoint of the scale (i. e. 3.50). That is, in absolute terms, relatively low effortful control in our sample still reflected moderate levels of effortful control. Possibly, among children with moderate levels of effortful control, highly responsive parenting can support children's regulation of their behaviours and emotions (Belsky, Pasco Fearon, & Bell, 2007; Chang, Olson, Sameroff, & Sexton, 2011), to the extent that it may contribute to lower levels of externalizing behaviours (Kochanska, Barry, Jimenez, Hollatz, & Woodard, 2009). This pattern seems most consistent with a recently developed vantage sensitivity hypothesis (Pluess & Belsky, 2013). Whereas the differential susceptibility hypothesis highlights the disproportionate susceptibility to both supportive and harsh environments in the same individuals, the vantage sensitivity hypothesis emphasizes individual differences in the tendency to benefit from supportive features of the environment only. These results suggest effortful control could operate as a vantage-sensitivity factor, where children with moderate levels of effortful control seem to benefit most from highly responsive parenting, showing the lowest levels of externalizing behaviour.

Strengths and Limitations

Among the strengths of this study are its longitudinal design and the availability of data from both mothers and fathers, which we aggregated to obtain more robust parenting measures. Also, we used observational measures of parenting which reduces shared method bias, as well as questionnaire measures of parenting to conceptually replicate our findings. Further, we examined both positive and negative parenting and child behaviours, allowing us to examine 'for better and for worse' effects. Finally, we chose to compare several temperament traits as potential susceptibility markers.

Despite these strengths, three limitations of this study have to be acknowledged. First, the sample was fairly high functioning, and 'harsh parenting' may not have reflected extremely adverse rearing circumstances among these families. The results may thus be limited to high-functioning samples, and it remains to be seen whether they can be generalized to more at-risk or diverse samples. Second, the reliability for externalizing behaviours was relatively low. Third, our measure of the environment was limited and may not have adequately captured the full range of responsive and harsh behaviours parents normally display to their children. Several issues contribute to this limitation. To start, parents were observed for a short period of time on a limited set of behaviours. Observers were carrying out other research tasks during the home visits as well, which may have affected their ability to observe harsh and responsive parenting behaviour. Furthermore, because the parenting observations were not structured, variability in what the observers have experienced likely exists. Future research should try to replicate these results using observations of multiple dimensions of the parenting behaviours of interest and on multiple occasions and using structured observations. Also, the parenting constructs we examined, harshness and responsiveness, were

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fairly broad. Examining a greater number of and more specific parenting behaviours would allow us to draw more nuanced and more definite conclusions regarding the relations between parenting and child outcomes for children with various temperaments. One interesting possibility, for instance, would be to distinguish between average levels of a parenting behaviour across time and variability or unpredictability in that parenting behaviour (Ellis, Figueredo, Brumbach, & Schlomer, 2009). In addition, future research could examine the different impact mothers and fathers may have on the development of their children's adjustment. A final remark about the parenting measures is that the reliability of the observed parenting measures was moderate. As an extra validation of our results, we reran our analyses using questionnaire measures of parenting, which partly replicated the results obtained using the observed measures of parenting. Future studies should ensure a higher reliability among observers of parenting behaviours.

In sum, in this study we found that parental responsiveness predicted lower levels of externalizing behaviour especially strongly among children high on impulsivity (in case of observed responsiveness) and low on effortful control (in case of observed and self-reported responsiveness). Harsh parenting predicted lower levels of prosocial behaviour, especially among children with average or high negative emotionality. High impulsivity and negative emotionality operated as vulnerability factors among children in middle childhood, while low negative emotionality operated as a protective factor, supporting a diathesis–stress model rather than a differential susceptibility model. Low effortful control appeared to operate as a vantage-sensitivity factor. These findings raise important questions about differential susceptibility and its development over time.

ACKNOWLEDGEMENTS

Support for this research was provided by the Netherlands Organisation for Scientific Research (NWO grant no. 406-11-030), and the ISSBD-JF Mentored Fellowship Program for Early Career Scholars.

Note

1. While we use Rothbart and Bates' view on temperament, other views on temperament exist as well, in particular those of Buss and Plomin (1975), Fox, Henderson, Rubin, Calkins, and Schmidt (2001), Goldsmith and Campos (1982), Kagan (1994), Strelau (1996), and Thomas and Chess (1977).
2. During the visit, one researcher was responsible for administering research tasks to the child (inhibition tasks, helping and sharing tasks, and a self-concept interview, all not relevant for this article). The other observer was responsible for administering an olfactory recognition task to the parents. Thus, while both observers were present during the entire visit and paid attention to how parents interacted with their child during that time, they each had their own additional research responsibilities. This may have led to slight discrepancies in what was observed by the different observers and contributed to the moderate ICCs.
3. The distribution of externalizing behavior was also slightly censored from below, whereas the distribution of prosocial behavior was slightly censored from above. Therefore we reran all our analyses using an alternative estimation

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method: Tobit regression for censored distributions in Mplus 6.0 (Long, 1997; Muthén & Muthén, 2010). Results obtained through these analyses were the same.

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