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The Role of Temperament by Family Environment Interactions in Child Maladjustment

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Abstract

In order to advance our understanding of the etiology of individual differences in child maladjustment (i.e., conduct and emotional problems), we tested hypotheses about the statistical interactions between child temperament and two aspects of the family environment: maternal negativity and positivity, and household chaos (e.g., crowding, noise, lack of routines). Mothers (*n* = 149) reported on their child's effortful control, negative affect, surgency, and behavioral/emotional problems. The age range of the children was 3 to 7 years old and half of the sample was girls. Observers rated maternal negativity and positivity based on brief structured interaction tasks in the laboratory. Child temperament moderated the association between maternal negativity/positivity and child maladjustment. Maternal negativity and child problem behavior were associated only for those children who also were high in surgency or negative affectivity. Maternal positivity was associated with less child problem behavior for those high in surgency. Child effortful control interacted with both maternal negativity and chaos. Maternal negativity and child problem behavior were most strongly associated for children who were low in effortful control and living in chaotic homes. The results point to distinct transactions between child temperament and maternal negativity/positivity that depend in part on the dimensions of temperament and parenting behavior in question.

Keywords

child temperament; parenting; home chaos; maladjustment; interaction effects

The parent-child relationship is dyadic and mutually engaging in nature (Bell, 1968; Stice & Berrera, 1995). On the one hand, parenting is an important socialization force in the development of children, while on the other hand, the individual characteristics of each child shape parenting behavior and moderate the effects of parental behavior on that child's development (Maccoby, 1999). Furthermore, parent-child dyads develop and function in a broader family and household context, whereby their relationship and child developmental outcomes are also shaped by the characteristics of the family environment (Davis-Kean, 2005). The development of the child is influenced by multiple factors, from children's individual attributes to the parenting environment to broader home contextual features. These various factors also may interact with each other. However, very few previous studies

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have investigated the additive and interactive effects of child, parenting and home context factors together (Paterson & Sanson, 1999). To achieve a more comprehensive understanding of child development in the family system, the current study used a socioeconomically diverse sample to examine the differential statistical effects of interactions between child temperament, maternal negativity and positivity toward the child, and levels of household chaos — three of the strongest and most consistent correlates and statistical predictors of individual differences in children's emotional and behavioral problems.

Parenting and Child Temperament

Child temperament reflects biologically influenced individual difference in emotional, motor and attentional reactivity to stimulation and its regulation, and is the antecedent and fundament of adult personality (Rothbart & Bates, 2006). Past studies have shown that child temperamental features such as negative affectivity are associated with child internalizing and externalizing problems (Bates, 2001; Coplan, Bowker & Cooper, 2003). Also, as part of bidirectional child and parent effects within parent-child interactions, child temperament characteristics also have been shown to be related to variance in warm, supportive and harsh, negative parenting behaviors directed at the child (Brown, McBride, Bost & Shin, 2011; Coplan, Reichel & Rowan, 2009).

Further, individual difference in temperament impacts the way children respond to environmental influences. The differential susceptibility hypothesis states that individuals with different temperamental characteristics will show different susceptibility to socializing influences, such as parenting (Belsky, 2005). Generally, children with difficult temperaments are more susceptible to their rearing environment and it is claimed that difficult temperaments reflect high neural sensitivity to both positive and negative environmental influences. Thus, these children are more penalized by negative parenting while at the same time benefitting more from warm and sensitive parenting practice. The differential susceptibility hypothesis has been supported in studies showing a statistical moderating effect of child temperament on the association between parenting and child maladjustment. Much of the work follows from an early study showing that harsh caregiving in early childhood predicted subsequent child externalizing problems primarily for children with high levels of negative affect, while positive fathering predicted more inhibition (Belsky, Hsieh, & Crnic, 1998). A similar study showed that the association between maternal psychological control and child internalizing problems was stronger for children high in irritable distress, and the association between maternal hostility and child externalizing problems was accentuated for those children high in irritable distress and low in effortful control (Morris et al., 2002). In another study, Lengua (2006) found that the association between inconsistent discipline and child externalizing problems was mitigated by high levels of child effortful control, but exacerbated by high levels of child frustration/anger.

One of the gaps in this literature is that most of the studies examining the role of child temperament as a moderator of links between the parenting environment and children's maladjustment have focused on fairly broad measures of global difficult temperament using

composites across indicators, and have not examined different temperament dimensions separately that address distinct aspects of behavioral/emotional approach, avoidance, and regulation (Lengua, 2006). For example, the often used construct “difficult temperament” is comprised of characteristics such as high negative emotional reactivity, low adaptability, high activity and low regulation (Chess & Thomas, 1989), and the operationalization of difficult temperament tends to vary across studies as different combinations and measures are used to represent this construct. This creates difficulty in comparing and integrating the study results. Also, this gap is a concern because temperament theory and research has made clear that the distinct dimensions of temperament represent etiologically different behavioral and emotional response repertoires that describe how children function in their social environments. The correlations between different dimensions are modest to moderate in size, confirming the fact that each dimension reflects more unique behavioral/emotional response tendencies rather than a global pattern (Lengua, 2006).

Three major dimensions of temperament form the basis for the current investigation: negative affect, surgency/extraversion, and effortful control (Putnam & Rothbart, 2006). Negative affect includes sadness, anger, fear, discomfort, and soothability, and represents individual differences in reactive negative emotion tendencies in response to the environment. Surgency includes activity level, high intensity pleasure, impulsivity and low shyness, reflecting individual difference in reactive emotional and behavioral tendencies to environmental stimuli. Finally, effortful control includes attentional control, inhibitory control, perceptual sensitivity and low intensity pleasure that together reflect regulation of emotional and behavioral responses to the environment (Rothbart & Bates, 2006).

A few studies have examined the distinct moderation role of one or more dimensions of temperament (Belsky et al., 1998; Lengua, 2006; Morris et al., 2002), and the results suggest that separate analysis of the moderating role of distinct dimensions offers unique information that could not be obtained if a global difficult temperament construct alone was used instead. However, no prior studies have simultaneously examined the moderating role of all three of Rothbart’s temperament dimensions in the link between parenting (i.e. positive and negative parenting) and child maladjustment in early childhood—a developmental period during which parenting is the major socialization source and regulatory aspects of temperament are developing most rapidly (Rothbart & Bates, 2006). Therefore, in the current study we investigated negative affect, surgency and effortful control as statistical moderators of the associations between parenting and indicators of maladjustment (including behavioral, emotional, peer-relationship problems and hyperactivity) in early childhood. We examined the presence of harsh maternal negativity as well as the lack of warm supportive parenting, given that both aspects of caregiving have been shown to be important in the etiology of child behavioral and emotional problems.

In light of the differential susceptibility hypothesis (Belsky, 2005), we expected that children with high levels of reactive temperament features (i.e. negative affect and surgency) would be more susceptible to harsh parenting as well as positive parenting. This would be reflected in stronger positive associations between greater maternal negativity and more child maladjustment, and stronger negative associations between greater maternal positivity and more child maladjustment, compared to children who were low in negative affect and

surgency. Furthermore, we anticipated that those with strong self-regulation capacity (i.e., high effortful control) would be less susceptible, reflected in a weak association between maternal negativity or positivity and child maladjustment, compared to those with low effortful control for whom the links between maternal negativity/positivity and maladjustment would be more substantial. We focused on the transition from early childhood through school entry, as this is a developmental period characterized by a large increase in self-regulatory capacity, along with the emergence of problem behaviors that are strongly related to difficulties in school readiness, academic failure, and peer problems (Rothbart & Bates, 2006; Webster-Stratton, Reid, & Stoolmiller, 2008).

The Broader Context: Household Chaos

The transactions between caregiving environments and children's temperaments are not presumed to operate independent of the broader family context, yet this presumption is rarely tested. In theory, person-environment transactions such as these are thought to operate within, and be moderated by, the broader family and household context in ways that alter their effects on developmental outcomes (Bronfenbrenner & Morris, 2006). According to the bio-ecological model of human development, progressively more complex proximal transactions over an extended period of time between the person and his/her immediate environment provide the impetus for development. The immediate environment includes other people the person interacts with, objects and symbols. The process and effect of this transactional experience on development are impacted by personal characteristics and environment features. Thus, our second aim was to extend the literature on child temperament-by-parenting effects by examining whether those statistical interactions are further moderated by salient aspects of the broader family context. In particular, we decided to focus on household "chaos", because of its proximal impact on developing systems of emotional and behavioral reactivity and self-regulation for children and caregivers alike (Evans & Wachs, 2009).

Chaos refers to high levels of noise, lack of household and family routines, and disorganization in the social and physical environment of the home. Household chaos promotes child maladjustment in part by disrupting the proximal interaction processes in parent-child relationships that otherwise would support healthy development (Bronfenbrenner & Evans, 2000). A number of studies have shown that a higher level of chaos is predictive of child behavioral, emotional and cognitive problems or deficits (Deater-Deckard et al., 2009; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005; Pike, Iervolino, Eley, Price, & Plomin, 2006). These findings reflect the role of chaos as a disruptor of behavioral and emotional reactivity and self-regulation processes, evidenced in elevated stress reflected in higher cortisol and poorer executive function capacity—effects that in the long term can impair brain systems that are critical to adequate regulation of reactive thoughts, emotions and behaviors (Boyce & Ellis, 2005; Deater-Deckard, Wang, Chen, & Bell, 2012; Evans & Wachs, 2009).

In addition to its direct influences on child maladjustment, home chaos may moderate the link between parenting and child developmental outcomes in conjunction with child temperament. This has not been explored before. Therefore, our second aim was to test for a

potential three-way interaction between child temperament, negativity/positivity in parenting, and household chaos in the statistical prediction of variance in child maladjustment. According to the bio-ecological model, in a disadvantaged environment the effect of proximal processes such as maternal negativity and positivity in the parent-child interactions should have more pronounced effects in child maladjustment (Bronfenbrenner & Morris, 2006). Household chaos is a major component of socio-ecological disadvantage, with broad implications for children's developmental outcomes (Evans & Wachs, 2009). Thus, we anticipated that a chaotic environment would strengthen the effects of the hypothesized interactions between proximal parenting environments (i.e., maternal negativity and positivity) and child temperament dimensions in the statistical prediction of child maladjustment. It is precisely under the conditions of chronic household disorganization, uncertainty, and noise that the reactive and regulatory capacities of the child along with high levels of maternal negativity toward the child will in combination best explain variance in child behavioral and emotional problems. On a flip side, we also expected that positive parenting would be more strongly associated with fewer problem behaviors for highly reactive children living in chaotic homes compared to those living in calm homes.

Methods

Participants

A community sample of 162 mother-child dyads participated in the current study. Inclusion criteria including being the mother caring for a 3 to 7 year old child, and being conversationally fluent and able to read basic text in English. 13 mothers did not complete the questionnaire or observational protocol during the laboratory visit. This resulted in a sample of 149 mother-child pairs with complete observational and questionnaire data for the current study. The age range for the mothers was 21 to 49 years old (M = 32.74, SD = 6.29), and the age range for the target children was 33 to 88 months old (M = 57.57, SD = 15.59; 50% female). Two-thirds of the families participated in our laboratory in a small urban area (n = 106), after being recruited through community agencies and advertisements (e.g., flyers distributed in schools and common areas in the community; university website and email announcements). The other third of the sample was in a cohort of families from an ongoing longitudinal community study, who participated in a visit to a nearby rural university laboratory. Participants from the two sites showed significant differences on only two study variables, with those at the urban site reporting more socioeconomic risks present (t = 23.31, df = 111.07, p < .001) and older children (t = 4.61, df = 121.13, p < .001). Participants from both sites were combined in our analyses, but we controlled for child age and socioeconomic risks in the analyses.

The ethnically and socioeconomically diverse sample was generally representative of the region compared to 2007 US Census data. Most were Caucasian (74%), 12% African American, 1% Asian, 8% multiple races, 1% other, and 4% not specified. The population percentages in the region were 82% Caucasian, 11% African American, 3% Asian, and 4% multiple races (from the 2005–2007 American Community Survey data, located at the US Census Bureau website, http://www.census.gov/acs). About two-thirds were two-parent

households, with the other families headed by single mothers who either were divorced or had never married. About half had a diploma/GED or some college coursework completed, with the other half having a bachelor or advanced degree. One quarter of the sample lived in higher density housing (apartment, duplex, townhouse, mobile home), and about one-fifth of fathers were unemployed. See Deater-Deckard et al. (2012) for more details on the sample.

Procedures

Following recruitment, informed consent was conducted by telephone prior to a scheduled visit to the laboratory, and reviewed again at the beginning of the visit. Signed consent was provided by the mother, and assent was provided by the child. Participating families received an honorarium of 100 dollars. Mothers completed a set of questionnaires prior to the visit. At the beginning of the lab visit, the mother and the child were seated at a small table and were video recorded while completing three tasks together. These included an Etch-A-Sketch drawing toy task, a puzzle task, and a task to build a Duplo blocks model. Each task took 4 to 5 minutes. For the Etch-A-Sketch drawing task, the parent and child each was assigned a control knob and was not allowed to touch each other's knob. The mother-child dyad was asked to work together to make one simple line drawing (a square) and then one complex line drawing (a smiling face). For the puzzle task, the dyad was asked to piece up a puzzle of animals together. For the task of Duplo blocks, the mother was asked to show the Duplo castle model to the child and instructed him/her to build a same one. During the task, the mother and the child were not allowed to touch each other's Duplos.

Measures

Socioeconomic risk—We measured five indicators that captured aspects of socioeconomic resources that are known to be important in psychological research ("Report of the APA task force on socioeconomic status", American Psychological Association, 2007). Because each indicator is measured using different scales (some of them binary), we used an additive "multiple risk index" to represent the distribution of socioeconomic resources and stressors in the sample. This approach is preferred because it generates a continuous scale that is readily interpretable and efficiently represents the cumulative statistical effect of its multiple covarying indicators (e.g., Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). The five binary indicators (0 = risk absent, 1 = risk present) were: single mother (1 [29% of sample], vs. 0 = married or cohabiting with child's father), low maternal education (1 = high school/GED or less [20% of sample], vs. 0 = some college or higher education), low paternal education (1 = high school/GED or less [30% of sample], vs. 0 = some college or higher education), housing (1 = apartment, townhouse, duplex, mobile home [26% of sample] vs. 0 = separated single family home), and paternal unemployment (1 = unemployed [17% of sample], vs. 0 = employed). These indicators have been shown to contribute to variance in a wide range of psychological outcomes (Deater-Deckard, Chen, Wang, & Bell, 2012). In addition to the inclusion of the standard indicators of parental education and employment, we also included housing type because of its distinct association with the immediate and nearby ecology of the home and neighborhood (Diez-Roux et al., 2001), and single mother status because of its strong links with family poverty and barriers to employment and education ("Report of the APA task force on socioeconomic status", American Psychological Association, 2007). The indicators covaried (Spearman rho from .

26, $p < .01$ to .44, $p < .001$). Overall, the distribution was: 0 risks (43% of sample), 1 risk (23%), 2 risks (12%), 3 risks (13%), 4 risks (6%), and 5 risks (3%).

Household Chaos—Mothers reported the level of chaos vs. calm in the household using a modified version of the Chaos, Hubbub and Order Scale (CHAOS, Matheny, Wachs, Ludwig, & Phillips, 1995) that has six items, that has been used in several studies in the UK (Coldwell, Pike & Dunn, 2006, α = .56; Pike et al., 2006, α = .63) and the US (Deater-Deckard et al., 2009, inter-rater and test-retest reliabilities in .6 to .8 range). An example items is "You can't hear yourself think in our home". Scale reliability in the current study is consistent with prior studies (α = .65), with alpha coefficients somewhat attenuated due to the small number of items in the scale.

Maternal Negativity and Positivity—Maternal negativity was measured using observers' ratings. Trained coders used the PARCHISY global ratings system (Deater-Deckard & Dodge, 1997) to rate mothers' behavior during the three structured tasks with the child, using the instrument's 7-point Likert-type scales (1 = no occurrence of the behavior, to 7 = continual occurrence of the behavior). During training, two raters rated the sample video independently. For items with a discrepancy score (difference in rating scores) greater than 1 on the 7-point scale, the two raters would discuss the item and resolve the discrepancy. For every mother-child dyad, consensus coding was used whereby two coders watched the interaction together without interacting, completed independent ratings, and then discussed their scores and resolved any discrepancies. Scores were averaged across the three tasks.

To calculate the reliability of coding, we randomly selected 20% of families that were coded by all raters. Discrepancies of 1 point or less on the 7-point scale were treated as agreements (just as done in the derivation of the consensus-based ratings used to compute the actual scores). Individual rating scores were treated as items and used to calculate the reliability for each item across raters, based on their original ratings (i.e., pre-consensus scoring) so as to not artificially inflate reliability estimates. This can be done using generalizability theory by estimating coefficient α for each item, which represents the overall covariance between raters while accounting for within-rater variance: the higher the α coefficient, the more reliable the ratings of that item (Bakeman & Gottman, 1986, pp. 92–96). In the current study we examined observed maternal negative affect (e.g. rejecting, frowning, cold/harsh tone; α = .96), and observed negative control (e.g. use of criticism, physical control of the dials, physical control of the child's hand/arm/body; α = .83). Negative control and negative affect were substantially inter-correlated (r = .62). Because our goal was to derive a parenting behavior composite variable that was as reliable as possible, we averaged the control and affect variables to yield a single maternal negativity score. Similarly, based on observers' ratings on maternal positive affect (e.g. smiling, laughing, α = .94) and positive control (e.g. use of praise, explanation, α = .79), a composite score representing maternal positivity was computed.

Temperament—We used the Child Behavior Questionnaire Short Form to measure the three dimensions of child temperament (Putnam & Rothbart, 2006). The questionnaire uses a 7-point Likert scale and is filled out by mothers. The questionnaire has 94 items in total,

which fall into 15 subscales and three broad dimensions: effortful control, negative affect and surgency. We averaged the scores of the items from each subscale and then averaged the correspondent subscale scores to get dimensional scores. Effortful control (α =.81) was the average of the following subscale scores: attention focusing, inhibitory control, perceptual sensitivity and low intensity pleasure. The negative affect score (α =.87) was derived from the average of anger, fear, discomfort, sadness and reversed score of falling reactivity and soothability. The average of activity level, high intensity pleasure, impulsivity and the reversed score for shyness constituted the dimensional score for surgency (α =.86).

Child maladjustment—Child maladjustment was measured using the Strengths and Difficulties Questionnaire (Goodman, 2001), which uses a 3-point scale for mothers to report the frequency of various problematic and prosocial behaviors seen in their children. We used the 20-item total behavior problems scale (α =.77 in the current sample), that included indicators of four subscales representing child conduct problems, emotional problems, hyperactivity/inattention, and peer relationship difficulties. This total difficulty score was used as the outcome measure as it had the highest reliability compared to its constituting subscales. Principal component analysis also confirmed that only one factor underlied the four subscales and this factor explained 45.3% of the total variance in the four subscales.

Results

For data analyses, we began by computing descriptive statistics and bivariate correlations. Then we tested hypotheses using a series of hierarchical regression equations predicting child maladjustment separately for child effortful control, negative affect, and surgency. These equations included tests of additive and two-way/three-way interaction effects, i.e., main effects of maternal negativity/positivity, child temperament and home chaos, and moderating effects of child temperament and chaos on the link between maternal negativity and child maladjustment.

Descriptive Statistics

Descriptive statistics and bivariate correlations are shown in Table 1(n = 149). The average household had just over one socioeconomic risk present, with wide variation. Chaos was somewhat skewed toward the “calmer” end of the distribution, with the mean below the mathematical midpoint of “3” on the 5-point scale. However, the distribution of household chaos scores spanned nearly the entire range of the scale, with one standard deviation represented as two-thirds of a point. Maternal positivity, the three child temperament dimensions, and the child maladjustment scores all were normally distributed. Maternal negativity was positively skewed, with the mean well below the midpoint of “4” on the 7-point scale. Transformation to normalize the distribution had no effect on results, so the untransformed data were used.

As the correlation matrix showed, girls were higher in effortful control and lower in surgency compared to boys. Families with more socioeconomic risks also were higher in chaos, child negative affectivity, maternal negativity and lower in maternal positivity. Higher levels of chaos, less effortful control, more negative affectivity, and more child

maladjustment were significantly associated. Higher child negative affectivity and maladjustment, higher maternal negativity, and lower maternal positivity were significantly associated.

Testing Hypotheses

To test hypotheses, we used hierarchical regression to examine the additive and interactive effects of maternal negativity or positivity, child temperament and chaos in the prediction of child maladjustment. We began with maternal negativity. Separate equations were estimated for each of the three temperament factors, and the results are shown in columns of Table 2. Regarding the details of the hierarchical regression, in step 1 of each equation, we included child age, sex and socioeconomic risk as covariates; in step 2, we entered the main effect terms for the temperament factor, home chaos, and maternal negativity; in step 3, we entered all two-way interaction terms; in step 4, we entered the three-way interaction term between temperament, chaos, and maternal negativity. Predictors that were included in statistical interaction terms were first standardized for centering purposes.

As shown in Table 2, for the hypothesized three-way interaction effect (temperament by parenting by household chaos) only one of the three estimated terms was significant: child effortful control by maternal negativity by chaos. For the hypothesized two-way interaction effects, two of the three hypothesized two-way interactions between temperament and maternal negativity were significant: child surgency by maternal negativity and child negative affect by maternal negativity. We followed the same procedure for examining maternal positivity. Results are shown in Table 3. The only significant interaction term was that between child surgency and maternal positivity.

Overall, of the covariates we considered, only socioeconomic risk was significant; children in higher-risk households had more maladjustment. However, this significant effect became non-significant in subsequent steps of the equations. Other significant additive effects in the prediction of child adjustment problems included: lower effortful control, higher negative affectivity, higher maternal negativity, and higher levels of household chaos.

Post-hoc Probing of Statistical Interactions

Given that the ultimate emphasis of the current paper was on the role of household chaos, and higher-order interactions subsume the effects of lower-order interactions and main effects, we first focused the post-hoc analyses on the significant three-way interaction between maternal negativity, household chaos, and child effortful control. We conducted post-hoc probing using estimation of simple slopes (Holmbeck, 2002) at 1 *SD* above and 1 *SD* below the sample mean on the statistical moderators for each equation. Child effortful control and chaos were examined as the moderators of the link between maternal negativity and child maladjustment problems. Thus, we examined the association between maternal negativity and child maladjustment for children at 1 SD above or below the means for both effortful control and household chaos.

Results are shown in Figure 1. The link between maternal negativity and child maladjustment was moderate and significant only for children with poor effortful control

living in chaotic homes, $\beta = .43$, $p < .001$. The association was not significantly different from zero for all other sub-groups of children. This pattern of the simple slopes corresponds with the hypothesis that in chaotic homes (i.e., a disadvantaged environment compared to calm, predictable homes), expressed maternal negativity during parent-child interaction would have the most substantial association with variance in child maladjustment among those with the poorest self-regulation capacity (i.e., low effortful control).

Turning to other significant interaction terms, results for the two-way interaction between maternal negativity and child negative affect are shown in Figure 2. The association between maternal negativity and child maladjustment was positive and significant for children with high levels of negative affect, but was negligible and non-significant for those with low levels of negative affect. Regarding the significant two-way interaction between child surgency and maternal negativity (Figure 3), the link between maternal negativity and child maladjustment was moderate for children with high levels of surgency, but negligible and non-significant for those with low levels of surgency. The simple slope analyses suggested that for children with high levels of negative affect or surgency, there was a strong association between maternal negativity and child maladjustment—a statistical effect that was not evident for children who were low in reactive negativity and surgency. Finally, for maternal positivity, the only significant interaction was between parenting and child surgency. Results are shown in Figure 4. Among children who were high in surgency, there was a significant association between greater maternal positivity and less child maladjustment ($r = -.22$, $p < .05$)—an association that was non-significant for those who were low in surgency ($r = .14$).

In a final step of our analyses, we considered item overlap between the temperament and behavior problems measures. This is always a concern when examining associations between these two constructs in the same statistical models (Lemery, Essex, & Smider, 2002). To rule out the possibility that item overlap contributed to the statistical interaction pattern found in the current study, we removed the potentially overlapping items in the temperament and maladjustment measures by pairing up each dimension of the Child Behavior Questionnaire and the Strength and Difficulties Questionnaire, using exploratory factor analysis to check for item overlap between these two scales, and excluding those items with loadings lower than .3 on the correct factor and loadings higher than .3 on the wrong factor (Oldehinkel, Hartman, Ferdinand, Verhulst & Ormel, 2007). After the exclusions, we reran the analyses and the results did not change, ruling out item overlap as a concern in interpreting these results; detailed results are available on request. This was consistent with the study by Lemery et al. (2002) that showed that overlap had virtually no effect on their findings.

Discussion

Reactive and regulatory aspects of child temperament have been established as important components of individual variation in behavioral and emotional problems. In the current study, we found moderate-sized associations, with children high on effort control and low on negative affect showing less maladjustment. These direct associations between temperament and behavioral/emotional problems corresponded with what has been found in many past

studies (Karreman, de Haas, van Tuijl, van Ahen, & Deković, 2010; Olson, Sameroff, Kerr, Lopez, & Wellman, 2005; Putnam, Sanson & Rothbart, 2002).

Our overall goal in the current study was to go beyond zero-order correlations, and to examine higher-order transactions between temperament, the parenting environment, and household chaos. Turning first to the two-way interactions, our first hypothesis was that the link between more negative/positive caregiving and child maladjustment would be stronger for children who were more reactive and less well regulated—that is, higher in negative affect, higher in surgency, and lower in effortful control. Two of the three anticipated interaction effects involving maternal negativity were found. For temperamental dimensions that represented individual differences in emotional and behavioral reactivity to the environment (Rothbart & Bates, 2006), i.e. negative affect and surgency, children who were high on these two dimensions were more vulnerable to the negative influences of harsher parenting, as indexed by stronger links between maternal negativity and child maladjustment —links that were not significantly different from zero for those who were low in negative affect and surgency.

Based on the current results and findings from prior studies, the literature continues to point to the role of affective reactivity (positive and negative) as a risk factor for the development of behavioral and emotional problems in the face of harsher caregiving (Kiff, Lengua & Zalewski, 2011)—an important feature of differential susceptibility theory. Maternal negativity tends to elicit more negative feelings for those children high on negative affect, and these feelings can further contribute to externalizing problems and internalizing problems, with anger leading to more aggressive behaviors, and fear and sadness leading to more emotional problems associated with anxiety and depression. Our findings also echoed previous studies of similar temperament constructs. For instance, Belsky et al. (1998) found that harsher caregiving was a strong predictor of child externalizing problems for children high in negative affect as infants. In a more recent longitudinal study of the development of rumination, a risk factor for mood disorders, Hilt, Armstrong and Essex (2012) found a stronger association between over-controlling parenting in preschool and rumination in early adolescence for those youth who were high in negative affect. From ours and others' findings, it is clear that when children are exposed to emotionally harsher parenting, temperament-based negative affect is a risk factor for a range of maladjustment problems, probably across a wide developmental span.

Turning to maternal positivity, one of the three anticipated two-way interactions—maternal positivity by child surgency—was statistically significant. Post-hoc probing of that interaction led to results that were consistent with a differential susceptibility perspective. It was the children who were highest in surgency that showed the anticipated association between greater maternal positivity and fewer child behavioral and emotional problems. Surgency reflects a strong tendency to psychologically and physically approach potential rewards in the environment, and a weak tendency to inhibit inappropriate behavior even in the face of potential punishment (Rothbart & Bates, 2006). When experiencing emotionally aversive parenting, surgent children may be even less likely to inhibit impulsive reactions to this environment which in turn may contribute to a coercive cycle within parent-child interactions that leads to growth in conduct problems if it becomes chronic—a pattern found

in many families of children diagnosed with impulsive behavioral disorders such as oppositional defiant disorder and attention deficit/hyperactivity disorder (Campbell, 2006; Patterson, DeBarsyshe, & Ramsey, 1989).

At the same time, children with high levels of surgency may benefit the most from maternal positivity, precisely because they are so sensitive to reward. For instance, in one prior study, children who were "fearless"—a temperament characteristic similar to surgency that indexed low levels of inhibition and high levels of novelty seeking and impulsivity—also showed decreases in conduct problems over time if their mothers were warm and responsive (Lahey et al., 2008). In another study, highly surgent children were protected from elevated internalizing problems if their parents were low in depressive symptoms themselves (Jessee, Mangelsdorf, Shigeto & Wong, 2012)—a pattern suggestive of a crucial role of parental positivity and warmth for surgent children's healthy functioning.

It is not apparent why the other two anticipated interaction effects (involving child negative affect and effortful control) with maternal positivity were not present. The lack of consistency across temperament dimensions and parenting dimension in the current study pointes to the importance of considering multiple components of child and parenting environment risk factors, given that findings from any particular study may be specific to aspects of temperament and the environment being studied. For example, if a number of studies in future show that child temperament interacts with parental negativity but not positivity in the prediction of maladjustment, this might lead to a clearer understanding of the salience of parents' negative emotions (as opposed to the absence of positive emotions) in the elicitation of distress and the reinforcement of behavioral and emotional problems in their children. Similarly, if a number of studies in future demonstrated that child surgency (but not affect or regulatory capacity) consistently interacts with both negative and positive features of parenting behavior, it may lead to clarification in theories and treatments that address the role of harsh and supportive parenting in the growth of maladjustment among children who are highly active and impulsive.

A Role for Household Chaos?

Our second aim was to test the hypothesis that the temperament-by-parenting interactions identified in the first aim would be further moderated by levels of household chaos. Specifically, we expected that the anticipated temperament-by-parenting effects would be strongest in high-chaos homes, and negligible in low-chaos homes. Overall, there was little support for the hypothesized three-way interactions; it was statistically significant in only one of the six regression equations estimated. Nevertheless, the one significant three-way interaction (for chaos, maternal negativity and child effortful control) yielded interesting results that were consistent with the hypothesis.

Specifically, the link between harsher maternal negativity and child maladjustment was present only for those children who were living in chaotic households and who also had low levels of effortful control. This pattern was consistent with the theory that proximal developmental processes (in this case, the transaction between harsher parenting and lower child effortful control statistically predicting variance in child problem behaviors) are strongest in the most disadvantaged home contexts (Bronfenbrenner & Morris, 2006).

Effortful control represents individual differences in regulatory capacities and is closely related to the effective use of attentional resources for individuals to adapt well to the requirement or challenges posed by the environment. Consistently, children with high levels of effortful control were found to show less externalizing behavior problems under conditions of punitive or hostile parenting (Lengua, 2006; Morris et al., 2002), but children with low level of effortful control were more vulnerable to harsh caregiving (Kiff et al., 2011). The underlying mechanism may be that children high in effortful control are more able to inhibit their reactive emotional and behavioral responses to harsher parenting, and engage attention in ways that regulate their behavior to ensure compliance with parental expectations.

Why should chaos be important, in regard to child effortful control in particular? Household chaos represents the level of disorganization, noise and lack of routine in the household settings, and a high level of chaos is related to child cognitive, behavioral and emotional problems, and harsher parent-child interactions (Evans & Wachs, 2009). Chaos may be linked to these child developmental and family processes in part through its debilitating effect on the self-regulation capacities of family members. For example, studies have shown that higher levels of home chaos are associated with poorer executive function skills/self-regulation among low-SES children and their mothers alike (Deater-Deckard et al., 2012; Evans et al., 2005). If replicated, the current findings suggest that it is precisely in the most chaotic environments that children's effortful control (i.e., self-regulation capacity) becomes a critical modulator of the link between more negative caregiving and more behavioral problems—a moderating process that is not as important in calm, ordered households. To this point, one previous study showed that home chaos moderated the link between paternal ADHD symptoms and inconsistent parenting, with the link between paternal ADHD symptoms and inconsistent parenting found only in chaotic homes (Mokrova, O'Brien, Calkins, & Keane, 2010).

Caveats and Conclusions

There are several caveats to bear in mind. First, given the correlational and cross-sectional study design, it was not possible to draw inferences regarding causality or temporal ordering of effects. The regression coefficients of parenting on child maladjustment represent the correlations between those two variables under conditions with different levels of child temperament characteristics and home chaos. We have emphasized interpretations of the hypothesized interaction terms with respect to parenting as a statistical predictor of child maladjustment, but the findings also may implicate "child effects" in the parent-child relationship process, whereby mothers' parenting reflects reactions to child behavior problems (Bell, 1968). Children's behavioral problems may be stronger elicitors of harsher caregiving when the children also are higher in surgency and negative affectivity, and lower in effortful control. Furthermore, the moderating effect of household chaos suggests that elicited harsh parenting may be a particularly powerful process in homes that are noisy and unpredictable, perhaps because caregiving under such conditions is more likely to be reactive and poorly regulated. When the child effect on parenting is considered in future studies, it will also be necessary to include some parental characteristics, such as parental temperament, efficacy, and self-regulation, to better understand the transactions between

child attributes and home environment features in accounting for variation in harsher, reactive parenting behavior.

Second, we tested for the hypothesized effects by spanning methods—observers' reports of maternal negativity, and mothers' reports of child maladjustment. Before considering the limitations of the use of observers' ratings, consider the advantages. In addition to minimizing any effects of common or shared method variance that would be present if only self-reports or observer ratings were used, the observed parenting behavior variable permits less subjective inferences (compared to mothers' self-reports) regarding proximal social interaction processes between the mother and child. Nevertheless, although it may be reasonable to consider the observed parent-child interaction process as typical of the dyad's daily interaction patterns, we did not test this assumption nor did we have longitudinal data to examine whether observed maternal negativity was stable over time. Furthermore, the observations were based on constrained, brief interactions in a laboratory environment. Therefore, the observed parenting behaviors may not generalize to other situations or measures of the caregiving environment. Along the same lines, we relied exclusively on maternal perceptions of household chaos and child temperament, as well as child maladjustment. Although the mothers' interpretation of child behavior and the household context is critically important information, without more objective indicators of child behavior and household chaos it is difficult to know how representative the mothers' reports are of the phenomena in question. Also, in the current study, the reliability of the short version of home chaos scale is relatively low, future studies may consider to use the complete scale or even add more items to the scale to increase reliability of this measure (Evans et al., 2005; Matheny et al.. 1995). Finally, the processes we examined may function differently for father-child relationships. Because we did not have father-child dyads assessed in the current study, we were not able to test this important possible distinction in family processes.

With these limitations considered, the current study showed that child temperament moderated the link between parenting and child maladjustment, and for certain aspects of temperament features (i.e. child effortful control), the benefit of being self-regulated was most evident in the most stressful circumstances—that is, chaotic homes with harsh caregiving environments. The results pointed to the importance of targeting children's self-regulation capacities (Blair & Diamond, 2008) and considering household chaos as well as harsh caregiving (Evans & Wachs, 2009), in prevention and intervention efforts.

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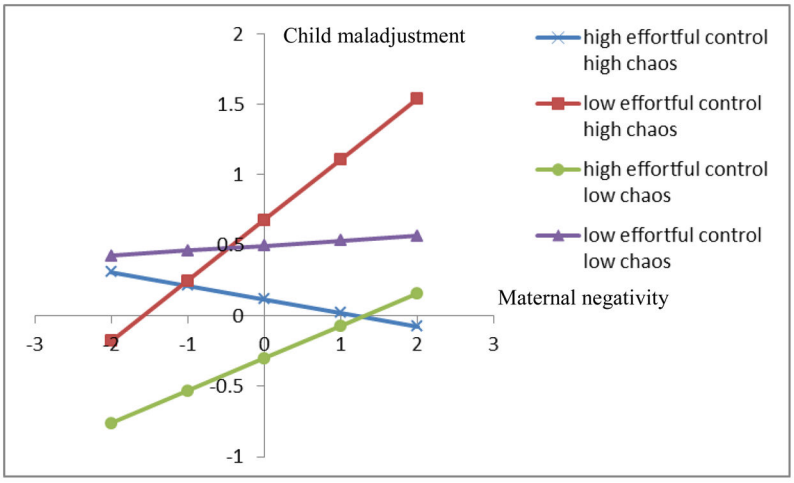

Figure 1.

Simple standardized slopes for the association between maternal negativity and child maladjustment with child effortful control and household chaos as moderators ("high" = one standard deviation above mean, "low" = one standard deviation below the mean).

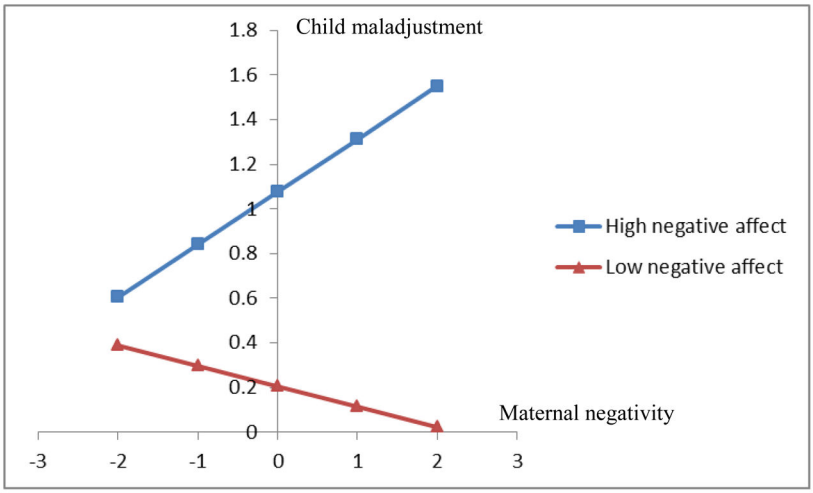

Figure 2.

Simple standardized slopes for the association between maternal negativity and child maladjustment with child negative affectivity as the moderator ("high" = one standard deviation above mean, "low" = one standard deviation below the mean).

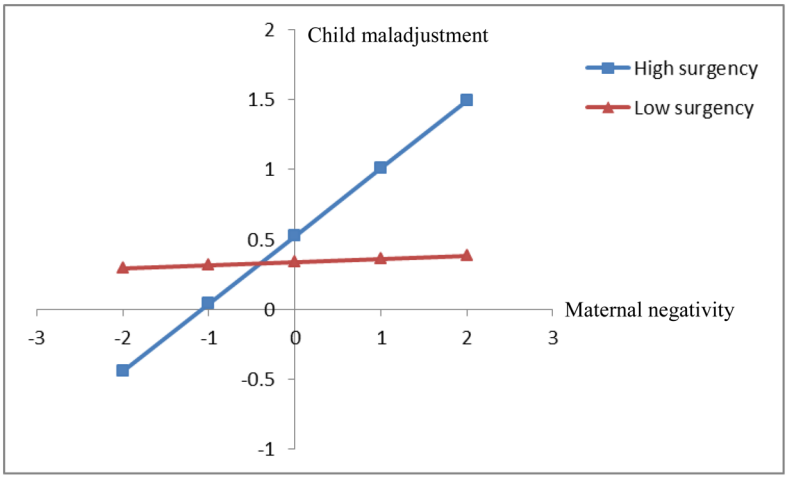

Figure 3.

Simple slopes for the association between maternal negativity and child maladjustment with child surgency as the moderator ("high" = one standard deviation above mean, "low" = one standard deviation below the mean).

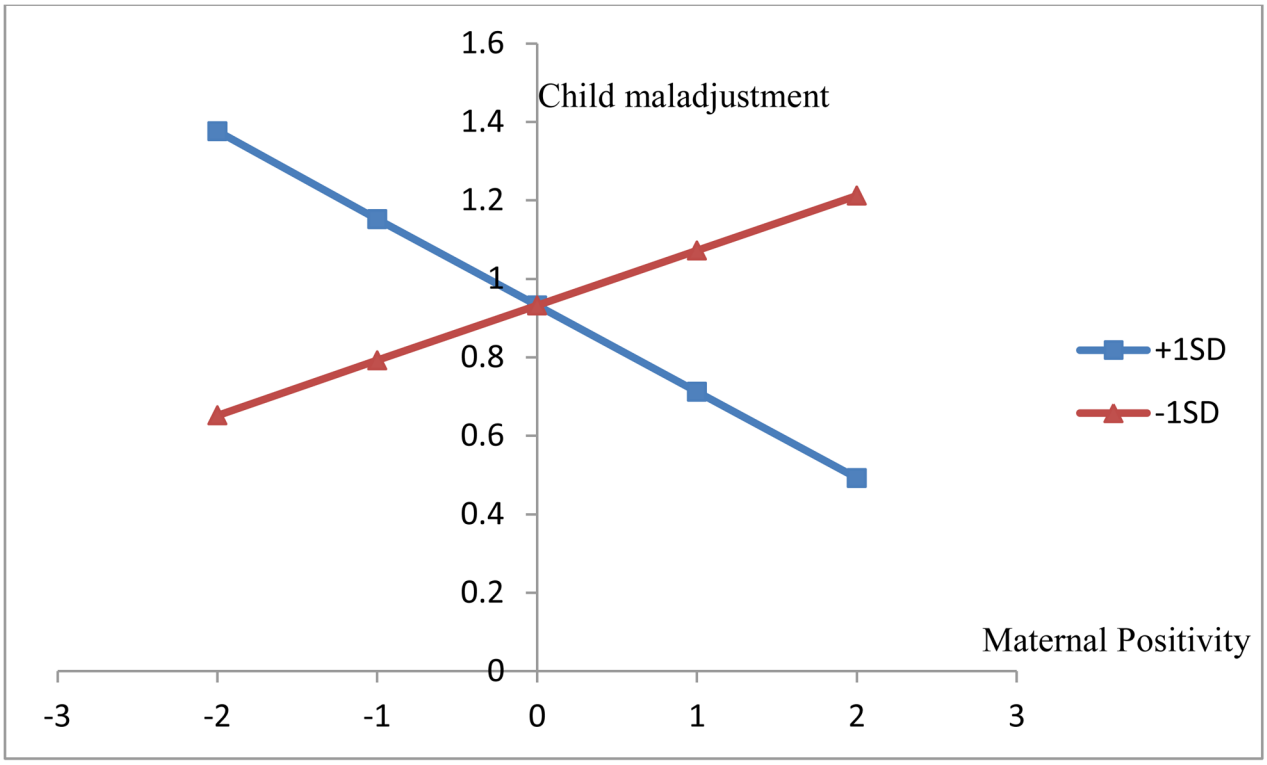

Figure 4.
Simple slopes for the association between maternal positivity and child maladjustment with child surgency as the moderator ("high" = one standard deviation above mean, "low" = one standard deviation below the mean).

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Table 1

Descriptive Statistics and Bivariate Correlations

	1	2	3	4	5	6	7	8	9	10
1. Sex (1 = male 2 = female)										
2. Age in months	−.24**									
3. Socioeconomic risks	−.11	.18*								
4. Chaos	.09	.07	.20*							
5. Effortful control	.24**	.05	.01	−.24**						
6. Surgency	−.25**	.03	.05	.15	−.13					
7. Negative affectivity	.04	.02	.19*	.25**	−.20*	−.03				
8. Maternal negativity	−.12	.06	.17*	.07	−.14	.08	.27**			
9. Maternal positivity	.19	−.08	−.39**	−.12	.08	−.15	−.18*	−.30**		
10. Child maladjustment	−.14	−.01	.22**	.33**	−.47**	.21*	.54**	.33**	−.19*	
Mean	1.49	57.85	1.26	2.23	5.22	3.94	4.74	1.37	3.06	9.36
SD	.50	15.72	1.44	.66	.61	.75	.76	.45	.69	4.96

Note. The ranges for these variables were:socioeconomic risks (0–5), chaos (1–4), effortful control (3.73–6.58), surgency (2.76–6.67), negative affectivity (1.73–5.80), maternal negativity and positivity (1.00–7.00), and child malajustment (0–26).

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 2

Regression Results (Standardized Regression Weights) for Maternal Negativity and Child Maladjustment

	Temperament Dimensions		
Variables	**Effortful Control (EC)**	**Negative Affect (NA)**	**Surgency (SU)**
Child sex	−.04	−.15	−.18
Child age	−.04	.00	.00
Socioeconomic risks	.10	.00	.10
Maternal Negativity (MN)	.15	.10	.25
EC/NA/SU	−.34***	.45***	.09
Home chaos (HC)	.15*	.22***	.24**
MN by EC/NA/SU	.07	.17*	.20*
MN by HC	.02	.00	.06
HC by EC/NA/SU	.06	.13	.04
MN by HC by EC/NA/SU	−.21*	.00	−.01

Note. To save space, only results from the last step of the hierarchical regression are shown. Results of the full regression results are available upon request.

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 3

Regression Results (Standardized Regression Weights) for Maternal Positivity and Child Maladjustment

	Temperament Dimensions		
Variables	**Effortful Control (EC)**	**Negative Affect (NA)**	**Surgency**
Child sex	−.05	−.18*	−.13
Child age	−.05	−.10	−.12
Socioeconomic risks	.13	.01	.11
Maternal Positivity (MP)	.02	−.02	−.04
EC/NA/SU	.08	.50***	.14
Home chaos (HC)	.20**	.20**	.27***
MP by EC/NA/SU	−.06	.00	−.17*
MP by HC	−.05	.09	.02
HC by EC/NA/SU	−.01	.13	.11
MP by HC by EC/NA/SU	.13	.04	.00

Note. To save space, only results from the last step of the hierarchical regression are shown. Results of the full regression results are available upon request.

* $p < .05$,

** $p < .01$,

*** $p < .001$