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Prediction of Toddlers' Expressive Language From Maternal Sensitivity And Toddlers' Anger Expressions: A Developmental Perspective

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Abstract

Despite evidence for the importance of individual differences in expressive language during toddlerhood in predicting later literacy skills, few researchers have examined individual and contextual factors related to language abilities across the toddler years. Furthermore, a gap remains in the literature about the extent to which the relations of negative emotions and parenting to language skills may differ for girls and boys. The purpose of this longitudinal study was to investigate the associations among maternal sensitivity, children's observed anger reactivity, and expressive language when children were 18 (T1; *n* = 247) and 30 (T2; *n* = 216) months. At each age, mothers reported on their toddlers' expressive language, and mothers' sensitive parenting behavior was observed during an unstructured free-play task. Toddlers' anger expressions were observed during an emotion-eliciting task. Using path modeling, results showed few relations at T1. At T2, maternal sensitivity was negatively related to anger, and in turn, anger was associated with lower language skills. However, moderation analyses showed that these findings were significant for boys but not for girls. In addition, T1 maternal sensitivity and anger positively predicted expressive language longitudinally for both sexes. Findings suggest that the relations between maternal sensitivity, anger reactivity and expressive language may vary depending on the child's developmental stage and sex.

Keywords

expressive language; toddlers' negative emotions; anger; maternal sensitivity; child sex

The first three years of life have been identified as a period of significant growth in language and cognitive abilities (Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991; Wetherby, Goldstein, Cleary, Allen, Kublin, & Goldstein, 2002). In addition, there are substantial individual differences in expressive language, and the rate of language growth during these early years has been shown to predict later language/reading skills (Bates, Dale, & Thal, 1995). Thus, understanding the early predictors of individual differences in language skills has clear importance. The purpose of this study was to investigate the relations of child

characteristics (i.e., anger reactivity, child sex) and family-level characteristics (i.e., mothers' sensitivity) to children's expressive language at 18 and 30 months of age.

The Relations of Emotional Reactivity to Children's Language Development

According to the Yerkes-Dodson Law (Yerkes & Dodson, 1908), high levels of arousal may hinder attentional processes and overload the cognitive resources that are needed for learning and performance on cognitive tasks (e.g., problem solving tasks). The negative relation between high levels of arousal (e.g., negative emotional expressions) and cognitive processes, suggested by Yerkes and Dodson (1908), has been supported by previous research in both adults and children (Andesron, 2000; Bell & Fox, 2003; Blair & Dennis, 2010; Burbridge, Larsen, & Barch, 2005; van der Staay, Schuurman, Van reenen, & Korte, 2009). For instance, there is compelling empirical evidence that shows children's experience and expressions of negative emotions, particularly anger, may be detrimental for learning (e.g., free recall, working memory tasks; Burbridge, Larsen, & Barch, 2005; Furnham & Stephenson, 2007), academic functioning, performance on IQ tests, mental and arithmetic reasoning, and literacy skills (Graziano, Reavis, Keane & Calkins, 2007; Gumora & Arsenio, 2002; Valiente, Lemery-Chalfant, & Swanson, 2010).

Despite the aforementioned evidence, few researchers have attempted to examine how children's negative emotionality during early childhood relates to emergent language skills (e.g., oral/expressive language), which have obvious implications for later literacy skills (e.g., Kubick & Emde, 2012; Spira, Bracken, Storch, & Fischel, 2005, Storch & Whitehurst, 2001). The results of the few studies that do exist generally agree that children's negative emotionality relates to relatively low language skills (Fish & Pinkerman, 2002; Friend, 2001; Kubick & Emde, 2012; Moreno & Robinson, 2005). For example, Salley and Dixon (2007) found that mothers' ratings of children's dispositional negative affectivity were negatively related to measures of language development (e.g., total vocabulary and mean length of utterance) at 21 months of age, which supports the argument that negative emotional reactivity taxes the cognitive attention essential for learning language (Bloom & Capatides, 1987). In one recent investigation, Kubick and Emde (2012) found that, compared to early talkers, late talkers had higher levels of maternal-reported dispositional anger as toddlers.

In the current study, we focused on the prediction of language from situational measures of anger reactivity during the toddler years. Focusing on situational measures of anger reactivity is important for two reasons. First, anger reactivity that occurs in response to a given situation may involve some cognitive processes (e.g., interpretation of situation; Eisenberg et al., 1994), which may result in taxing and subsuming cognitive resources that are needed for learning. Thus, children who are reactive in response to a situation may be particularly at high risk for learning difficulties. Second, parents' reports of children's emotionality often do not correlate with what is observed in laboratories (Seifer, Samaeroff, Barrette, & Krafchuk, 1994) perhaps because parents often do not have a comparison level when reporting about their children's reactivity (e.g., what may be considered reactivity to one parent may not be considered reactivity to another parent; Siegler, DeLoache, & Eisenberg, 2003). Given that temperamental characteristics (e.g., negative emotionality) have shown to be stable across different contexts/situations (Rothbart & Bates, 1998), assessing children's patterns of responses in specific situations may provide researchers with a relatively objective measure of reactivity.

The specific emotion of anger was considered because anger has been related to activation in the amygdale (brain region responsible for processing emotional information), and hence, triggering a fight-or flight response and creating high levels of arousal (as indicated by

increase in the blood pressure and pulse as well as subjective experiences of bodily conditions; Bodenhausen, Sheppard, & Kramer, 1994). As a result, compared to other negative emotions, such as fear and sadness, anger has been found to be more strongly related to individuals' poor performance on cognitive tasks and attentional processes (Litvak, Lerner, Tiedens, & Shonk, 2010). Indeed, the findings of several studies indicate that infants' irritability and proneness to anger may hinder their ability to attend to environmental stimuli (Lemelin, Tarabulsy, & Provost, 2002, 2006), which is found to hamper the learning processes (Salley & Dixon, 2007; Usai, Garello, &Viterbori, 2009). Thus, in the current study, we expected anger reactivity to be negatively related to children's expressive language ability.

Examining the relations between children's negative reactivity and cognitive abilities during toddlerhood is particularly important due to the rapid developmental changes in regulatory and cognitive abilities that occur during the first three years of life (Calkins, 2007). For example, around the second year, children start to learn how to regulate their negative emotions, communicate through expressive language, and to control their attention to maintain engagement with the features of environment (Abe & Izard, 1999; Ruff & Rothbart, 1996). Thus, anger expressions during late toddlerhood may be viewed as more problematic than in early toddlerhood because older toddlers are expected to have the ability to regulate their negative emotions/overarousal and show improvements in attentional control (Gaertner, Spinrad, & Eisenberg, 2008). Thus, although we expected a negative relation between children's anger reactivity and expressive language at both ages, we predicted the relation between aforementioned variables to be particularly strong for older toddlers.

The Relations of Parenting to Children's Emotional Reactivity and Language

According to the intentionality model of Bloom and Thinker (2002), much of children's language ability is achieved through interpersonal interactions. Thus, parent-child interactions may provide a crucial foundation for children's language production. Among parenting factors that have been associated with children's language production are joint attention (Baldwin, 1995; Charman et al., 2000) and mothers' sensitivity/responsiveness (Landry, Smith, Swank, Assel, & Vellet, 2001; Leigh, Nievar, & Nathans, 2011; Paavola, Kemppinen, Kumpulainen, Moilanen, & Ebeling, 2006). Sensitivity, which includes a range of mothers' affective and behavioral characteristics (i.e., warmth, contingent responsiveness to the child's needs, wants and emotions), has been consistently associated with children's higher linguistic abilities across time (Baumwell, Tamis-LeMonda, & Bornstein, 1997; Karrass & Braungart-Rieker, 2003; Paavola et al., 2006; Tamis-Lemonda, Bornstein, & Baumwell, 2001). For instance, Baumwell et al. (1997) found that mothers' verbal sensitivity toward their nine-month-old infants -- assessed as mothers' attuned verbal behaviors to children's vocal signals-- predicted relatively high language production at 13 months of age, especially for those children who initially had lower language skills. Similarly, Leigh et al. (2011) and Pungello, Iruka, Dotterer, Mills-Koonce, and Reznick (2009) found that mothers' sensitivity (conceptualized as maternal positive regard and supportive and contingent responses to the child's emotions, desires, needs and requests during mother-child interactions), was positively related to children's expressive language and rate of growth in receptive language during early childhood, respectively. In contrast, parenting styles that are low in sensitivity (i.e., restricting, punishing, and controlling) have been negatively related to children's language abilities (Landry et al., 1997; Pungello et al., 2009), and this negative relation is thought to be stronger prior to the age of 4 than at older ages (Hubbas-Tait, Culp, Culp, & Miller, 2002).

In addition to the relations of sensitive parenting to children's cognitive and language abilities, researchers have found negative associations between sensitive parenting and children's expression of anger and distress (Conway & McDonough, 2006; Spinrad & Stifter, 2002). Although individual differences in irritability and anger expression are thought to have some biological basis and to be relatively stable over time (Rothbart, Ahadi, & Evans, 2000), there is also evidence that children's emotionality and temperamental characteristics can be modified by parenting (e.g., Conway & McDonough, 2006; Spinrad & Stifter, 2002). Indeed, researchers have suggested that warm, supportive, and sensitive parenting may reduce children's intensity and expression of negative emotions over time, particularly irritability and anger, and sensitive parenting may help children to better regulate their negative emotions (Feldman, Dollberg, & Nadam, 2011; Van den Broom, 1994). When parents are responsive to their children's needs, children are less likely to express distress and anger during emotionally challenging situations and are better able to return to neutral affective states after experiencing stressful situations (Tarabulsy et al., 2003).

Overall, research indicates that maternal sensitivity during the first years of life plays a significant role in predicting children's emotional competencies over time, including their ability to regulate emotions (Eisenberg et al., 2010). Thus, we expected maternal sensitivity to negatively predict children's anger expressions, concurrently and over time. Furthermore, considering the potential significance of maternal sensitivity in decreasing children's anger and irritability, we anticipated that maternal sensitivity would be indirectly related to language skills through its contribution to children's anger expressions.

Moderating Role of Child's Sex

In this study, we also explored the moderating role of children's sex in the relations between children's anger and language, and between maternal sensitivity and anger. Sex differences in language skills and levels of emotionality have been reported. Specifically, girls are found to reach language millstones, including expressive language, and to develop language at a faster rate than boys (for a review, see Gleason & Ely, 2005). In addition, girls tend to be rated as showing lower levels of negative emotions and are typically seen as more emotionally regulated than are boys (Buss & Kiel, 2004; Else-Quest et al., 2006; Karrass, Braungart-Rieker, Mullins, & Lefever, 2002).

The "tend-and-befriend" versus "fight-or-flight" response model (Taylor, et al., 2000), posits that females and males may have different neural and physiological sensitivity to stress reactivity (e.g., Kajantie & Philips, 2006; Whittle, Yücel, Yap, & Allen, 2011). Specifically, stressors may result in a "tend-and-befriend" response in females (e.g., seeking and providing social support) and a "fight-or-flight" response in males (e.g., increase in vigilance and negative emotions, or withdrawal; Taylor et al., 2000). This theory has been supported by both behavioral and neuroendocrine evidence. For instance, a number of studies have shown that females may seek social support from others to cope with stress and negative emotions, whereas males' coping mechanisms are more likely to be characterized by avoiding the situation or actively confronting the problem (Tamres, Janicki, & Helgeson, 2002). Further evidence shows that males exhibit greater activation of sympathetic nervous system and prefrontal cortex in response to stressors than do females, supporting the fight-or-flight notion in males (Wang et al., 2009). On the other hand, females have been shown to produce oxytocin (a hormone that plays an important role in pair bonding and attachment-caregiving processes) in response to stress (Taylor et al., 2000). Given heightened arousal, stressors may potentially have greater negative effects on males', than females', cognitive systems. Indeed, empirical evidence suggests that the experience and expression of negative emotions, particularly anger, may be related to boys', but not girls', learning and cognitive

outcomes (Doctoroff et al., 2006). Thus, based on this previous research, we explored whether the relations between anger and language ability would be stronger for boys than girls.

Furthermore, evidence shows that the child's sex may moderate the relation between positive and negative parenting practices and children's functioning/adjustment (Cassano, Perry-Parrish, & Zeman, 2007; Chaplin, Cole, & Zahn-Waxler, 2005; Davies & Lindsay, 2002). Specifically, boys have been found to be more vulnerable to negative parenting practices (e.g., punitive reactions, negative family risk factors, parental conflicts) than are girls (Davies & Lindsay, 2002). In addition, boys have been found to benefit more from positive parenting practices than girls (Fagan, 2011; Tung, Li, & Lee, 2012). Thus, in the present study, we also explored whether the relations of parenting practices to children's anger reactivity would be stronger for boys than girls.

The Present Study

The goal of this investigation was to examine whether early childhood anger reactivity observed in response to emotion-eliciting tasks and maternal sensitivity predicted toddlers' expressive language. We predicted that children's anger expression would be negatively related to children's expressive language, particularly by later toddlerhood, when children should have developed more sophisticated regulatory and attentional abilities. In addition, we examined whether anger would predict change in expressive language occurring between 18 and 30 months—an important developmental period of growth in language and emotion regulation skills. Furthermore, we predicted that maternal sensitively would indirectly relate to children's expressive language through children's expressions of anger. Finally, the moderating role of sex in the relations among maternal sensitivity, anger, and language skills was explored.

The present study is unique because we focused on children's anger expressions rather than focusing on global negative emotionality. Moreover, instead of using mothers' reports of children's negative emotionality, we used observational data of children's anger expressions. Given the data available, we were able to test the relations among variables of interest at two time points, 18 and 30 months. Examining the associations of emotions and parenting to cognitive processes such as language during this period is important due to large developmental changes that occur in children's regulation and cognitive processes (e.g., language, attention) during the first four years of life (Choudhury & Gorman, 2000; Rothbart, Posner, Kieras, 2006).

Method

Participants

The children and families who participated in this study were part of a larger longitudinal study of toddlers' emotions, emotion regulation, and social competence (Blinded for review). Participants were recruited at birth from three local hospitals in a southwestern metropolitan area in the United States. Mothers and toddlers came to a university laboratory when toddlers were 18 and 30 months of age (T1 and T2, respectively). Although some additional families participated in the study by only filling out questionnaires (*n*s = 9 and 14, for T1 and T2, respectively), for the purpose of this investigation, only those families that participated in the laboratory assessments (at either T1 or T2) were included. The final sample used in this study included 247 children (137 males, 110 females; *M* age in months = 17.79, S*D* = .52) at T1 and 216 children (119 males, 97 females; *M* age in months = 29.77, *SD* = .65) at T2. A total of 212 children participated at both time points (i.e., 4 children participated at T2 but not at T1).

At T1, most of children were non-Hispanic (77%), with 23% of Hispanic origin, and the majority were Caucasians/Non-Hispanic (66.7%), although African American (7.0%), Asian (1.8%), and Native-American (5.3 %) were also represented, with 7.0% identifying themselves as "other" and 12.2% did not report race. At T1, annual family income ranged from less than $15,000 to over $100,000, with a median income of $45,000–60,000. Mothers' and fathers' education ranged from 8th grade to a doctoral degree, with the average of some college or two-year degree for both mothers and fathers. Approximately 60% of the mothers and 95% of the fathers were employed at T1. Most of the parents in the sample were married (85.1% married, 8.7% cohabiting, 3.3% single, and 1.7% divorced), and the average length of marriage was approximately 6 years (M = 5.9 years, SD = 3.78). Mothers' age at the child's birth ranged from 19 to 44 years (M = 29.17 years, SD = 5.59), and fathers' age ranged from 18 to 53 years (M = 31.06, SD = 5.74). Forty-eight percent of children in the sample had at least one sibling.

Procedure

Mothers were mailed a packet of questionnaires prior to the laboratory visit, and they were asked to complete a number of questionnaires during the laboratory visit, including a checklist of toddlers' expressive vocabulary. Toddlers participated in a series of structured tasks designed to assess effortful control and proneness to negative emotions; each laboratory visit lasted approximately 1½ to 2 hours. Mothers were also observed during a dyadic interaction task with their toddlers (i.e., free play). The laboratory visits were videotaped and coded later. Participants were paid at the end of each session, and the toddlers received age-appropriate toys and a t-shirt. Procedures were identical at T1 and T2.

Measures

Children's expressive language—At each time point, mothers completed the short form of the Macarthur Communicative Development Inventory (CDI- Level II; Fenson et al., 2000). This measure contains 100- word vocabulary production checklist and has demonstrated good validity and reliability (α = .97; Fenson et al., 2000). Because some parents in our sample were bilingual, a sum of toddlers' spoken words in either English or Spanish was calculated.

Maternal sensitivity—At T1 and T2, mothers were observed in an unstructured free-play episode that lasted 3 minutes. During this segment, mothers were provided with a basket of age-appropriate toys and were instructed to play with their toddlers as they normally would at home. Maternal sensitivity was coded to reflect mothers' attentive responses to children's emotions, behaviors and interests. High sensitivity reflected mothers' providing an appropriate level of stimulation, facilitating and encouraging the child's efforts without exerting control, pacing timing to infant's interest and arousal level, acknowledging and responding to child's affect, having contingent vocalization and giving the child time to explore objects. Maternal sensitivity was rated every 15 seconds on a 4-point scale (1 = *no evidence of sensitivity* to 4 = *high evidence of sensitivity*) by two trained research assistants, and then averaged across the intervals. Reliabilities were conducted on 25–30% of data and were .81 and .86 (ICCs), at T1 and T2, respectively. The free-play task that was used in the current study was relatively shorter than other free play tasks used in studies of maternal sensitivity (3 minutes versus 5 or 10 minutes). Although a shorter duration than some studies, the measure of maternal sensitivity included in our analyses has been related in predicted ways to children's effortful control, children's adjustment and other components of parenting behaviors (Blinded for review). Furthermore, maternal sensitivity in this dataset was stable across time, providing further validity for the measure (Blinded for review).

Anger reactivity—Toddlers' expressions of anger were assessed using *toy removal* (LAB-TAB: Locomotor Version, Goldsmith & Rothbart, 1999) at T1 and T2. In this task, toddlers were presented with an attractive toy and were allowed to play with it. After 1 minute, the mothers were instructed to place the toy in a clear container with its lid loosely on top. The toddlers were then given the container and were allowed to remove the toy (1 minute). In the next segment, the mothers were instructed to put the lid on tightly, so that the child could see, but not access, the toy. The *lid tight* segment lasted 2 minutes or 20 seconds of hard crying, whichever occurred first. Children's anger during the lid tight episode, which is the most evocative segment of toy removal task, was considered in the current study. Toddlers' expressions of anger were coded in 5-second intervals on a 4-point scale (1= *no anger observed* to 4 = *intense anger*). Indicators of anger included downward eyebrows, squared and/or open mouth, tensed and raised cheeks, kicking, hitting, and crying. The reliabilities (Pearson correlations) for anger expressions during toy removal at T1 and T2, computed for 25% of data, were .72 and .94, respectively.

Family socioeconomic status (SES)—Parents reported on their levels of education (1= "*grade school*" to 7 = "*Ph.D, J.D., or MD*"), and mothers reported on their family annual income (1 = "*less than $15k*" to 7 = "*Over at $100k*"). A composite of family socioeconomic status (SES) was computed by standardizing mothers' and fathers' educational level and mother-reported family income (equally weighted) and then averaging them. The correlation between SES at T1 and T2 was close in magnitude, $r(243) = .95$, $p < .001$; thus, only T1 SES was included in the current study.

Results

Attrition Analyses

Families who participated at both T1 and T2 ($n = 212$) were compared to those who attrited from T1 to T2 ($n = 35$) based on demographic (mothers' and fathers' age at the time of childbirth, family socioeconomic status, child's sex, race, ethnicity and age at the time of lab visit) and study variables. Mothers and fathers who attrited were younger (*M*s = 26.32 and 28.00 years old) than those who participated at both times (*M*s = 29.63 and 31.59 years; *t*s (243, 236) = 3.26 and 3.50, *p*s < .01, respectively). No other significant differences were found.

Preliminary Analyses

The means and standard deviations of all study variables are presented in Table 1. Sex differences were examined using *t*-tests; at T2, girls had higher scores on expressive vocabulary compared to boys. No other significant sex differences were found. In addition to sex differences, the racial and ethnic group differences for all the study variables were examined using the analyses of variance (ANOVA). No significant group differences were found for any of the study variables.

Correlations between demographics (i.e., SES, mothers' and fathers' age, and number of older siblings) and the study variables were also examined. Family SES was positively related to T1 and T2 maternal sensitivity, *rs*(235, 204) = .29 and .26, *ps* < .01. In addition, mothers' age was negatively related to T1 maternal sensitivity, $r(243) = .18$, $p < .05$. Fathers' age and number of older siblings were unrelated to any of the study variables. Because SES was consistently related to maternal behaviors at both ages, it was used as a control variable in primary analyses.

Paired sample *t*-tests were conducted to examine change in study variables from T1 to T2. As expected, expressive language and maternal sensitivity significantly improved from T1

to T2, *ts* (211, 211) = −33.46 and −7.39, *ps* < .01. There were no changes in children's observed expressions of anger over time.

Primary Analyses

Correlations within and across time are presented in Table 2. In terms of concurrent relations at T1, no significant correlations were found within the study variables at T1. At T2, children's expressions of anger were negatively related to T2 expressive language and T2 maternal sensitivity. Across time, T1 anger and T1 maternal sensitivity were associated with higher T2 language ability. Moreover, maternal sensitivity and expressive language were stable over time, although children's observed anger was not.

Concurrent relations—Two separate path models using full information maximum likelihood estimation with *M*plus version 6.0 (Muthén, & Muthén, 1998–2010) were performed to test for the concurrent relations among the study variables at T1 and T2. The direct paths in the models included paths from 1) maternal sensitivity to children's anger expressions and expressive language, and 2) anger expressions to expressive language. Family SES was used as a control variable. The resulting models fit the data well, x^2 (1, 1) = 1.54 and 2.06, *ps* = .22 and .15 (non-significant chi-squares indicate good fit; Klein, 2010), CFI = .97 and .97 (values close to 1 show good fit), RMSEA = .05 and .06, and SRMR = .02 and .03 (values closer to zero indicate good fit for RMSEA and SRMR; Klein, 2010) for T1 and T2, respectively. In terms of T1 concurrent relations, consistent with the correlational analyses, maternal sensitivity was positively predicted by family SES, *b* = .20, *p* < .01. T1 maternal sensitivity did not predict children's concurrent anger expressions or language, and T1 anger expression was unrelated to concurrent language. In terms of T2 concurrent relations, T1 SES positively predicted T2 maternal sensitivity, T2 high maternal sensitivity predicted children's low anger expressions, and children's low anger expressions predicted children's high expressive language, *bs* =.16 (*p* <.01), −.07 (*p* < .05) and −21.35 (*p* < .01), respectively. The direct relation of T2 maternal sensitivity to language was not significant, *b* = 2.95, *p* < .33.

To test the mediating role of anger in the relations of sensitivity to language, two requirements need to be met: 1) maternal sensitivity must significantly predict the mediator (anger expressions), 2) the mediator must significantly predict the outcome (expressive language). Thus, only the mediating role of children's T2 anger expressions in the concurrent relation between maternal sensitivity and expressive language was examined. The mediation was tested using the MODEL INDIRECT command in *M*plus and the confidence intervals (CIs) method, which appropriately handles problems associated with the nonnormal distributions of the indirect effect (MacKinnon, Lockwood, & Williams, 2004; MacKinnon, 2008). According to MacKinnon et al., (2004), the null hypothesis indicating that the conditional indirect effect does not exist may be rejected if the CI contains no zero values. The result of mediation analysis was marginally significant, *b* = 1.45, *p* = .07 (97% CI: .14, 2.75).

Predictions of children's language growth—A path analysis was performed to test for the relations of T1 maternal sensitivity and children's anger expressions to growth in children's expressive language from T1 to T2. In order to test for growth in language, autoregressive paths controlling for the stability of variables across two time points were included, and thus, paths to T2 language were essentially predicting growth in T2 language. In addition, the within-time correlations among maternal sensitivity, children's anger expressions and expressive language were included in the model (Cole & Maxwell, 2003). SES also was used as a control variable on T1 and T2 maternal sensitivity. The resulting model fit the data well, x^2 (5) = 9.16, *p* = .10, CFI = .97, RMSEA = .06, and SRMR = .03.

Children's T2 language was predicted by T1 high maternal sensitivity and by children's high T1 anger expressions, even after controlling for T1 language, *bs* = 7.77 (p <.01) and 4.88 (p = .05). Children's expressive language and maternal sensitivity were stable across time, *bs* = .54 and .33, *ps* < .001, respectively. Children's observed anger expressions were not stable across time, b = .01, p = .67 (see Figure 1). It should be noted that given the possibility of bidirectional relations among variables, paths from T1 anger predicting T2 maternal sensitivity and from T1 language predicting T2 anger reactivity were tested. The relations of T1 anger to T2 maternal sensitivity and of T1 language to T2 anger were not significant, *bs* = −.07 and .00, *ps* = .26 and .07, respectively, and including the aforementioned paths did not significantly improve the model fit, Δx^2 (2) = 4.46 (p = .11).

The moderating role of sex—To test the moderating role of children's sex in the concurrent associations, three separate multi-group path analyses were performed using full information maximum likelihood estimation with *M*plus version 6.0 (Muthén, & Muthén, 1998–2010). The original path models (aforementioned models) were used as the base model for testing these multi-group analyses. The multi-group analyses in testing the moderating effect has several advantages including allowing researchers to compare path coefficients as well as means between two groups (Sauer & Dick, 1993).

In each model, first, all of the path coefficients were constrained to be equal across groups (constrained model). As suggested by the fit indices, the fit of the 18-month constrained model was adequate but the fit of 30-month model was not, x^2 (5 and 5) = 3.86 and 13.17, *ps* = .57 and .02, CFI = 1.00 and .79, RMSEA = .00 and .11, and SRMR = .07 and .09, for T1 and T2 models, respectively. These models were then compared to the unconstrained models, in which the paths that were hypothesized to be different across groups were let to be freely estimated. These paths included 1) paths from maternal sensitivity to children's anger expressions, and 2) paths from children's anger expression to expressive language. The fit of unconstrained models were adequate, x^2 (6, 9) = 3.96 and 4.80, *ps* = .68 and .19, CFI = 1.00 and .96, RMSEA = .00, and .07, SRMR = .03 and .04, for T1 and T2 models, respectively. The results of chi-square difference tests was only significant for T2 model, Δ x2 (1 and 2) = .11 (p = .68) and 8.37 (p < .01), for T1 and T2 models, respectively. These results indicated that for the T2 model only, the fit of unconstrained model was significantly better than the fit of constrained model, suggesting that, sex moderated the relations between hypothesized paths at T2. Because the result of modification indices for the concurrent T2 model suggested that the relation between family SES and maternal sensitivity may be different across groups (i.e., males versus females), these paths were allowed to be freely estimated across the two groups within T2 model (these paths were constrained to be equal in the concurrent T1 model). For T2 concurrent relations, maternal sensitivity predicted boys', but not girls', low anger expressions, *bs* = −.10 and −.02, *ps* = .009 and .73, for boys and girls, respectively. In addition, boys', but not girls', expressive language was predicted by low anger expressions, *bs* = −37.92 and −4.95, *ps* = .00 and .54, for boys and girls, respectively. No significant relations were found for girls, except that the relation between family SES and maternal sensitivity was positive and significant for girls, but not boys, *bs* = .22 and .11, *ps* = .00 and .10, for girls and boys, respectively. The MODEL INDIRECT computation indicated that boys' T2 anger expressions significantly mediated the concurrent relation between maternal sensitivity and boys' expressive language, b = 3.66, p = .03; CI (. 36, 6.96).

To test the moderating role of sex in predicting growth in language, a multi-group path analysis was performed to test the moderating role of sex in the longitudinal associations, x^2 (24) = 33.29, p = .10, CFI = .93, RMSEA = .06, SRMR = .07. Next, the unconstrained model was run in which the longitudinal paths that were hypothesized to be different across the two groups were let to be freely estimated across the two groups, x^2 (11) = 14.17, p = .

22, CFI = .98, RMSEA = .05, SRMR = .04. The results of chi-square difference test for the models was non-significant, Δx^2 (13) = 19.12, p= .12, suggesting that sex was not a significant moderator of these relations.

Discussion

The primary goal of this study was to examine the relations of family variables (i.e., maternal sensitivity) and children's anger expressions to their expressive language at 18 and 30 months of age. In addition, the moderating role of sex in these associations was examined. Support was found for the negative relation between children's anger reactivity and expressive language at 30 months of age, albeit only for boys. In addition, for boys only, the relations between maternal sensitivity and expressive language at 30 months were indirect through children's anger expressions. Overall, these findings suggest that, around 2.5 years of age, maternal sensitivity may be involved in facilitating boys' language acquisition through its inverse relation to children's expression of anger. In terms of longitudinal predictions, 18-month maternal sensitivity positively predicted children's later expressive language after controlling for earlier levels of maternal sensitivity and expressive language for both boys and girls. Despite our expectations, children's anger expressions at 18 months positively predicted later expressive language for both sexes. This result highlights the notion that anger expressions may have different meanings during younger versus later toddlerhood.

Negative Emotions and Language

Our results indicate that the relation between children's anger expressions and language may vary across development. Whereas 30-month anger expressions were negatively related to concurrent language, children's expressions of anger at 18 months of age predicted children's improvement in expressive language. These latter results, although unexpected, indicated that anger expressions during early versus late toddler years may have different implications for children's language learning. Indeed, there is evidence to show that anger expressions during early toddlerhood, when children have limited means to express themselves and when anger expressions is considered a developmentally adaptive response, may be beneficial for cognitive and language learning over time (e.g., Robinson & Acevedo, 2001). It is also important to consider the context in which anger expressions were measured in explaining these findings. In the current study, children's situational anger was measured in response to toy removal. Thus, children's anger expressions during early toddlerhood and before emergence of language may be indicative of children's self-assertion (to ask others for assistance during goal obstruction) and/or motivation to remove obstructions that block their goals, rather than dispositional anger (Stifter & Fox, 1999).

However, high levels of anger expressions in older toddlers—who would be expected to demonstrate better regulatory skills and have developed a variety of coping skills in response to a removed toy—may reflect difficulties in emotion regulation and proneness to emotional overarousal. Children at a disadvantage in terms of their regulatory skills may also have difficulty with cognitive skills and learning (Gumora & Arsenio, 2002). However, it should be noted that the negative association between language and anger at 30 months was moderated by sex, such that this result was only significant for boys.

Sex differences in various aspects of language including the expressive component, favoring girls, have been consistently reported by previous researchers (e.g., Bornstein, Hahn, & Haynes, 2004). These sex differences have been explained by various factors including differences in biological and neurological maturation between girls and boys (e.g., differences in maturation and activation of brain lateralization responsible for language learning; Galsworthy, Doinne, Dale, & Plomin, 2000) and social factors (e.g., differences in

verbal experience of boys and girls, differences in parents' socialization goals for males and females; Huttenlocher et al., 1991). Interestingly, in our study, we found not only mean level sex differences in language by 30 months, but also differences in the relation between girls' and boys' anger expressions and expressive language. That is, although language was consistently high for girls regardless of the level of anger, boys' expressive language ability was negatively predicted by anger expression at 30 months. Given that girls had higher expressive language than did boys at 30 months, it is possible that girls have reached a ceiling in language abilities at this age, leaving little room for prediction by anger. On the other hand, boys' overarousal appears to detrimentally relate to their vocabulary skills.

Language has been viewed as an important self-regulatory tool for children to communicate their needs, thoughts and feelings with others and to manage their emotions (Roben, Cole, & Armstrong, 2012; Vallotton & Ayoub, 2011). Thus, it is also possible that girls, who tend to acquire language skills earlier and at a faster rate than boys, also have better regulatory skill than boys. In fact, the results of a recent study by Vallotton and Ayoub (2011) indicated that children's expressive language at 24 months of age was predictive of rate of growth in self-regulation when children were 36 months of age. In addition, these researchers found that the association of expressive language to children's self-regulation was stronger for boys than girls. Thus, children, especially boys, with poor language ability may be at high risk for displaying and experiencing anger because they may have less ability to communicate their feelings in interactions.

Relations of Maternal Sensitivity to Children's Language and Anger Expressions

Our finding that maternal sensitivity at 18 months predicted children's language over time replicated previous research (Paavola et al., 2006; Smith, Landry, Swank, 2000), suggesting that early maternal sensitivity is important in language development. Indeed, it has been argued that maternal sensitivity motivates children to learn because they feel supported and guided (e.g., Landry, Smith, Miller-Loncar, & Swank, 1997). Thus, the relation between maternal sensitivity and children's language ability might be explained through the promotion of competence and independence in children. Sensitive mothers are also more likely to create stimulating environments for their children, to engage in joint attention, and to use more appropriate language (Bigelow et al., 2010; Moore & Dunham, 1995), creating an environment that encourages language use and cognitive stimulation.

The relations between maternal sensitivity and children's anger expressions also were found to be dependent on the child's sex and developmental stage. For boys only, maternal sensitivity at 30 months was negatively related to concurrent anger expressions, after controlling for earlier levels of anger expressions and maternal sensitivity. However, maternal sensitivity at 18 months was not related to children's concurrent anger expressions, perhaps because children's anger expressions during infancy and early toddlerhood (prior to language development) are developmentally normal and adaptive. Overall, these results suggested that the effect of consistent and stable maternal sensitivity in decreasing children's anger expressions may emerge/be evident during late rather than early toddler years. Indeed, our results indicated that children of mothers who engage in responsive and sensitive style of interacting with their children may learn effective regulatory strategies by late toddlerhood.

However, the relation between 30-month maternal sensitivity and children's anger expressions was found for boys and not for girls. This result suggested that maternal sensitivity may have important implications for boys' regulation and reducing boys' anger expressions during late toddlerhood. Previous research has shown that boys display more anger expressions than do girls (Blandon, Calkins, Keane, & O'Brien, 2008; Sullivan & Lewis, 2011) and have been viewed as having lower emotion regulation skills than girls

(Raikes, Robinson, Bradley, Raikes, & Ayoub, 2007). In addition, Vallotton and Ayoub (2011) found that there were sex differences in the trajectories of children's emotion regulation between 24 and 36 months. That is, boys' self-regulation sharply declined until 2 years of age and then began to increase after the second year; whereas girls' self-regulation skills showed relatively stable increase over time. Boys have been found to be more dependent on their caregivers for regulating their negative emotions than girls, and thus, mothers may use more frequent strategies with their sons as compared to daughters (Weinberg, Tronick, Cohn, & Olson, 1999). Overall, the aforementioned findings suggest that additional scaffolding and sensitivity may be more beneficial for boys than girls, especially between the second and third year of life, to help them manage their negative emotions. Consistent with these results, our findings indicated that maternal sensitivity may be more effective in regulating and decreasing boys', than girls', anger expressions.

Our hypothesis that maternal sensitivity would be indirectly related to language through children's anger expressions was supported, and this relation was moderated by sex. For boys, sensitive parenting played an important role in reducing anger expression, which in turn was related to better language skills. Thus, sensitive mothers may find ways to lessen children's distress and teach their children effective regulation skills. In turn, these skills may help children remain at an optimal arousal level so that they can learn language skills.

It should be noted, that maternal sensitivity at both time points was positively predicted by family socioeconomic status. These findings were consistent with previous research demonstrating that mothers in families with higher annual income and parental educational attainment show greater sensitivity toward their children than mothers in families with lower SES (e.g., Bringin, 2000; Pungello et al., 2009). Thus, the results found in the current study highlight the importance of implementing intervention and prevention programs that may promote maternal sensitivity and effective parenting skills among low-SES families.

Strengths, Limitations and Future Directions

In the present study, we utilized a stronger methodological approach than used in most previous research to assess children's anger reactivity. Researchers examining the relations between language and emotion in the past have typically observed children during neutrally affective tasks or have asked mothers to report on their children's negative emotionality. In the current study, children's emotional reactivity was observed during an emotion-eliciting task, which allowed us to obtain a measure of children's emotional responding independent of mothers' reports of parenting and language. Further, in the current study, the association between anger reactivity and language was studied across toddlerhood, which has been a neglected developmental stage in studying aforementioned relations. Examining the relation between children's emotional responding and language during toddlerhood is especially important because during this period children's use of regulatory abilities is rapidly increasing (Posner & Rothbart, 2000). The change and increase in children's use of regulatory skills, in turn, may have important implications for linguistic abilities and how children's expressions of negative emotions are viewed by others. Furthermore, rather than asking mothers to report on their parenting practices, sensitive responding was assessed using a laboratory-based observational task in which mothers were asked to freely play with their children as they normally would in their homes.

Despite these strengths, the findings of this study should be interpreted with caution for a number of reasons. First, due to the homogeneity of the sample, which mostly consisted of European-American middle-class families, we were unable to test for cultural or subculture differences. Therefore, the result of this study cannot be generalized to other populations. Second, we focused on mothers' sensitivity towards their youngsters; however, children are embedded within the family context, and it is likely that the relationships with other family

members (e.g. fathers and siblings) contribute to children's cognitive and language development. Therefore, future research needs to examine the unique contribution of mothers and fathers in predicting children's language ability and negative emotionality. Furthermore, the free play period that was used in the current study to measure maternal sensitivity was relatively shorter than other free play measures (3 minutes versus 5 or 10 minutes). Although the short version of free play has been validated and successfully used in other studies (e.g., Blinded for review), future research needs to consider using longer versions of free play for assessing mothers' sensitivity. Third, we focused on understanding children's expressive language abilities. More work needs to be conducted to examine the results of this study using other language measures and testing for other aspects of language development (e.g., morphological sophistication), which perhaps may be more age-appropriate during the second and third years of life. Fourth, examining the longitudinal mechanisms by utilizing a third time point is a promising future direction that can greatly contribute to understanding of pathways through which maternal sensitivity relates to children's language development. Lastly, in the current study, we only focused on children's anger expression and excluded other types of negative emotions (e.g., sadness, fear), as well positive emotions. Recent research evidence has shown that perhaps some types of negative emotions, such as sadness, may be beneficial rather than detrimental for cognitive learning and attentional processes (Chepenik, Cornew, & Farah, 2007; Kreibig, Wilehlm, Rothd, & Gross, 2011). In addition, there are mixed findings regarding the associations between children's positive emotionality and language abilities (Bloom et al., 2001; Salley & Dixon, 2007). Thus, in the future, researchers need to consider including all types of negative emotions as well as positive emotions to examine the strength and direction of relations of distinct negative emotions and positive emotions to children's language abilities.

The findings of this study add to a growing body of research designed to understand the relations among children's anger reactivity, parenting, and language during the second and third years of life. Examining child characteristics and family variables that may facilitate language learning during phases of fast linguistic change is vital because these factors may be modified. The results of this study suggest that examining other positive parenting behaviors that may predict children's lower anger reactivity and better language ability should be an important area for future research.

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Highlights

- We investigated maternal sensitivity, anger reactivity, and expressive language
- The relations of anger to expressive language differed across development
- Mothers' sensitivity and toddlers' anger longitudinally predicted toddlers' language
- Evidence for mediation in later toddlerhood was found for boys, but not for girls

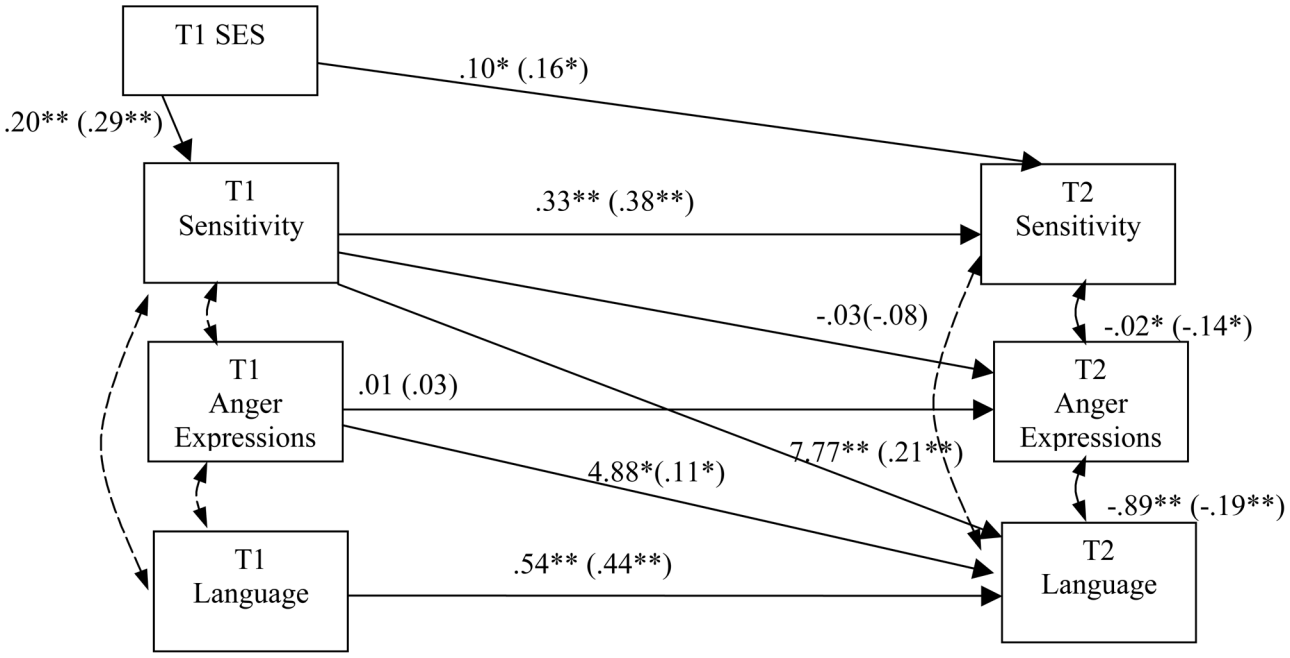

Figure 1.

Longitudinal relations among maternal sensitivity, anger expressions and expressive language.

Notes. **p* < .05. ***p* < .01; *x2* (5) = 9.16, p = .10; CFI = .97, RMSEA = .06, and SRMR = .03; Numbers inside and outside parentheses represent unstandardized and standardized coefficients, respectively; Dashed lines represent non-significant relations; SES was used as a control variable on T1 and T2 maternal sensitivity.

Table 1

Means, Standard Deviations and Sex Differences of Study Variables

	Total M(SD)	*Boys* M(SD)	Girls M(SD)	*T*
18 -month				
Observed anger	1.76(.53)	1.77(.53)	1.75(.53)	.37
Maternal sensitivity	2.52(.61)	2.45(.62)	2.60(.59)	−1.83†
Expressive language	22.69(18.36)	21.55 (19.23)	24.12(17.19)	−1.10
Family SES	−.01(.85)	.07 (.79)	−.10 (.91)	1.51
30 –month				
Observed anger	1.11(.24)	1.11(.23)	1.10(.25)	.46
Maternal sensitivity	2.83(.52)	2.77(.55)	2.90 (.47)	−1.87†
Expressive language	72.88(22.90)	69.26(24.87)	77.35(19.41)	−2.64**

Notes.

† $p < .10$,

** $p < .01$,; *n* range was 113 to 136 for boys and 94 to 110 for girls.

Table 2

Correlations among Study Variables at Time 1 and Time 2

Variables	1	2	3	4	5	6
1. T1 Observed Anger	-----	.09	.02	.03	−.02	.14*
2. T1 Maternal Sensitivity		-----	−.03	−.08	.42**	.19**
3. T1 Expressive Language			-----	−.11	−.09	.45**
4. T2 Observed Anger				-----	−.15**	−.22**
5. T2 Maternal Sensitivity					-----	.13†
6. T2 Expressive Language						-----

Notes.

† $p < .10$;

* $p < .05$.

** $p < .01$.