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Anger and Positive Reactivity in Infancy: Effects on Maternal Report of Surgency and Attention Focusing in Early Childhood

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We examined two aspects of temperamental approach in early infancy, positive reactivity and anger, and their unique and combined influences on

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maternal reports of child surgency and attention focusing at 4 years of age. One hundred and fourteen infants were observed for their positive reactions to novel stimuli at 4 months, and their anger expressions during arm restraint at 9 months. Child surgency and attention focusing at age 4 years were assessed by maternal report. Infants who expressed more anger to restraint were rated higher in surgency during early childhood relative to infants who expressed less anger. The effects of positive reactivity to novelty on attention focusing were moderated by anger to restraint. These findings suggest that infant temperamental approach tendencies are multifaceted and have both unique and combined influences on later maternal report of attention and social behavior.

Many studies have considered direct and linear effects of temperament on behavioral development (e.g., Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002; Rothbart, 1988). In recent years, there has been an increased focus on factors that moderate the magnitude or direction of the relations between temperament and behavioral outcomes (Rothbart & Bates, 2006). In addition to studying environmental factors that serve as moderators (e.g., Calkins, 2002; Kochanska, 1991), several recent studies have focused on temperament \times temperament interactions (e.g., Eisenberg, Cumberland, & Spinrad, 2001). One temperament trait may heighten the effect of another temperament trait on behavioral outcomes (e.g., high negative emotionality with poor attentional control predicting behavioral problems (Eisenberg et al., 2009). It may also be the case that one temperament trait protects against, or buffers, the risks associated with another temperament trait (e.g., fearfulness serves a protective factor, preventing aggressive tendencies, for temperamentally exuberant infants (Rothbart, 1994). Using this conceptual framework, we focused on two indices of temperamental approach (anger and positive reactivity) in infancy, and their independent and interactive effects on maternal reports of surgency and attention focusing in the preschool years.

ANGER AND POSITIVE REACTIVITY AS INDICES OF TEMPERAMENTAL APPROACH

Based on a motivational systems perspective, the approach system underlies responses to reward and positive stimuli, while the withdrawal system responds to punishment and negative stimuli (Gray, 1987). Although anger can be thought of as a marker of negative emotionality (Rothbart & Bates, 2006), it has been shown to be associated with the approach motivational system at both behavioral and physiological levels (Carver & Harmon-Jones, 2009; He et al., 2010). Indeed, a body of research has documented the association between anger and approach tendencies (Derryberry &

Rothbart, 1997; Fox, 1989; Kochanska, Coy, Tjebkes, & Husarek, 1998). For example, anger-prone infants exhibited more approach behaviors of arm pulling in order to overcome an obstacle during goal blockage (Lewis, Sullivan, Ramsay, & Alessandri, 1992). Moreover, anger-prone infants with a corresponding profile of resting left frontal electroencephalogram (EEG) asymmetry, a physiological pattern associated with approach tendencies (Carver & Harmon-Jones, 2009; Pizzagalli, Sherwood, Henriques, & Davidson, 2005), displayed more approach behaviors toward an unpredictable toy (He et al., 2010).

Infants who exhibit high levels of positive reactivity (positive affect coupled with motor activity) to novel auditory and visual stimuli exhibit more approach behaviors to puppets and a pattern of left frontal EEG asymmetry (Degnan et al., 2011; Hane, Fox, Henderson, & Marshall, 2008). As well, an approach bias in infancy was associated with subsequent behavioral approach and positive affect to positive stimuli (puppet play), but not anger during a frustration task (arm restraint; Hane et al., 2008). Thus, anger to restraint and positive reactivity to novelty may both be *approach-related* behaviors, but they are not necessarily cotemporaneous. Consistent with the notion of temperament-by-temperament interactions, this suggests that anger to restraint and positive reactivity to novelty may be distinct and have both unique and combined roles in shaping social and regulatory behaviors over time. However, few researchers have examined approach-eliciting emotions and reactivity together, and few have explored temperament-by-temperament interactions in relation to social functioning, as suggested by Rothbart and Bates (2006).

EFFECTS OF ANGER AND POSITIVE REACTIVITY ON SURGENCY

Surgency or extraversion is a temperamental characteristic associated with active, sociable, pleasant, and approach behaviors (Rothbart, Ahadi, Hershey, & Fisher, 2001). Overall, both positively reactive and anger-prone approach-oriented infants appear to follow unique developmental trajectories toward surgency compared to other infants. For example, in previous studies, frustration/anger observed in the laboratory at 10 months was related to high parent-reported approach, pleasure, and activity at age 10 years, all of which are components of surgency (Derryberry & Rothbart, 2001). Similarly, in a concurrent study of temperament and response to competition, surgent preschoolers displayed more angry affect when they failed in a competition (Donzella, Gunnar, Krueger, & Alwin, 2000).

Infants who express high levels of positive affect and motor reactivity in response to novel stimuli show high and stable levels of pleasure and

sociability across early childhood (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). In addition, infants displaying high and stable exuberance (positive reactivity, approach, and sociability) across early childhood continue to show high levels of surgency in parental report at 5 years of age (Degnan et al., 2011). However, it remains unknown whether the indices of temperamental approach (anger and positive reactivity to novelty) act independently or in concert to magnify each other's effects on surgency.

EFFECTS OF ANGER AND POSITIVE REACTIVITY ON ATTENTION FOCUSING

Attention focusing on tasks and goals is suggested to be an important mechanism in the development of social-emotional competence (Pérez-Edgar et al., 2011), so it is important to understand what factors contribute to its own development. Children at 3 years of age who exhibited more focused attention during a spatial conflict task were rated by their parents as less impulsive and less prone to frustration (Derryberry & Rothbart, 1997). Moreover, anger is associated with poor attention focusing both in children with Attention-deficit hyperactivity disorder (ADHD; Harty, Miller, Newcorn, & Halperin, 2009) and in typically developing children (Deater-Deckard, Petrill, & Thompson, 2007; Zhou, Lengua, & Wang, 2009). Relative to typically developing adolescents, adolescents diagnosed with ADHD reported higher levels of aggression associated with anger (Harty et al., 2009).

There is also evidence that children who are high in approach and activity level have difficulty filtering out non-relevant stimuli and thus demonstrate poor attention focusing (González, Fuentes, Carranza, & Estévez, 2001). Furthermore, infants who were reported by mothers as more positive looked away from presented toys more frequently (Rothbart, Posner, & Hershey, 1994). In contrast, 13.5-month-old infants' higher attention focusing during sustaining play for a toy was associated with their lower approach and less pleasure at 7 years of age (Rothbart, Derryberry, & Hershey, 2000). Taken together, strong approach tendencies supporting high levels of anger and positive reactivity may constrain the development of attention focusing.

Nevertheless, emotion theory has suggested that when experiencing anger, attention is focused, and there is a desire to strike-out and attack the source of anger (Darwin, 1872; Ekman, 1998). A recent study reported that anger did not compromise the overall ability of attention. Rather, it facilitated the selective allocation of attention resources toward appetitive/rewarding information versus defensive/threatening information (Ford et al., 2010). Furthermore, positive or approach-related states in adults

reduced attention interference and thus improved attention focus during Stroop and 2-back tasks (Friedman & Forster, 2005; Kuhl & Kazen, 1999). Thus, anger and positive reactivity may in some instances facilitate the development of attention focusing.

THE CURRENT STUDY

Using a longitudinal design, the current study aimed to explore the relations between infant anger to restraint and positive reactivity to novelty and their independent and combined contributions to later maternal reports of surgency and attention focusing. First, the relation between observed positive reactions to novelty at 4 months, and anger during a gentle arm restraint procedure at 9 months, was examined. Given that both positive reactivity and anger are considered approach-related behaviors, it was hypothesized that they would be positively associated with one another. Second, we examined how each aspect of infant temperament, as well as their interaction, predicted maternal reports of surgency and attention focusing at 4 years of age. It was hypothesized that infants displaying high levels of both approach tendencies, positive reactivity to novelty and anger to restraint, would be rated as the most surgent as preschoolers. It was also hypothesized that combined higher levels of positive reactivity and anger would be associated with poorer attention focusing, since over the course of development, these strong approach tendencies might perturb attention focusing processes (e.g., Hartly et al., 2009; Rothbart et al., 2000). However, the opposite is also reasonable, given that anger and positive reactivity were reported to be positively related to attention focusing in previous work (Ford et al., 2010; Friedman & Forster, 2005). The current study aimed to test these competing hypotheses regarding the roles of positive reactivity and anger on the development of attention focusing.

METHOD

Participants

Participants were drawn from an ongoing longitudinal study of the role of temperament in the development of social competence. At 4 months of age, 291 of 779 healthy and full term infants were selected using a reactivity screening task involving emotional and motor reactivity to novel visual and auditory stimuli. Details of the screening criterion are described elsewhere (Fox et al., 2001; Hane et al., 2008). They were selected into positive reactivity ($n = 103$), negative reactivity ($n = 105$), and control ($n = 83$) groups.

Of the 234 infants who subsequently participated in the 9-month laboratory visit, 80 infants did not have valid anger data during arm restraint due to technical difficulties with the video collection, infant refusal, or mother's ineffective arm restraint (i.e., soothing infants, not putting infant's hands at sides). Infants who dropped out in arm restraint were not significantly different from those who remained in the study in terms of positive reactivity, $p = .22$. When children were 4 years of age, their mothers completed the Children's Behavior Questionnaire (CBQ; Rothbart et al., 2001) and the Colorado Childhood Temperament Inventory (CCTI; Buss & Plomin, 1984). For this study, 114 children (50 boys and 64 girls) who had complete data on 4-month positive reactivity during the screening paradigm, 9-month anger elicited by arm restraint, and 4-year surgency and attention focusing measured by the CBQ and CCTI were included as participants. Forty infants with both 4- and 9-month data were dropped from analyses because of failure to return 4-year maternal report measures. Comparisons between the children who were included versus excluded from the analyses due to missing data indicated no differences on any key variables (i.e., 4-month positive reactivity to novelty, 9-month anger to restraint, and 4-year surgency and attention focusing; $ps > .38$). The ethnicity of the 114 infants was Caucasian (72.8%), African American (12.3%), and others (14.9%). In addition, most mothers were at least college educated (80.7%), and the others (19.3%) had at least a high school education.

Procedure

Infants were measured on positive reactivity to novelty at 4 months. Subsequently, infants underwent a gentle arm restraint procedure for anger elicitation during the 9-month visit. When the children were 4 years old, mothers were asked to report on children's surgency and attention focusing. Details of each assessment procedure are described below.

Measures

Positive reactivity to novelty (4 months)

Infants were presented with several sets of novel sights (colored mobiles) and sounds (taped sentences and nonsense syllables) during a reactivity screening paradigm (Fox et al., 2001; Hane et al., 2008). Infants' responses were coded for the frequency of positive affect (smiling and positive vocalizations), and gross motor movements (arm waves and leg kicks $> 45^\circ$ from resting positions, bursts of two or more arm and leg movements, back arches and hyper extensions). A team of independent coders achieved intra-class

correlation coefficients (ICC) of .92 for the frequency of positive affect, and .80 for the frequency of motor movements. A *positive reactivity to novelty* score was created by averaging the standardized frequencies of positive affect and motor reactivity.

Anger to gentle arm restraint (9 months)

Although anger is thought to emerge developmentally around 4 months of age (Stenberg & Campos, 1990), it is more clearly displayed as infants become stronger and more autonomous by 9 months of age (Lemerise & Dodge, 2000). To elicit anger in the current study, an arm restraint task was used (Goldsmith & Rothbart, 1999; Stifter & Fox, 1990). Infants were placed in a car seat, and mothers sat behind the infants and were asked to gently hold their infants' forearms down to their sides. Mothers were also instructed to refrain from verbally and behaviorally interacting with the infants. The task was divided into three trials of 30 seconds each. In addition, the infants were allowed to play with an attractive toy before each trial. After 30 seconds of arm restraint at each trial, or if the infants became very distressed, mothers released infants' forearms and soothed the infants, if necessary.

The expression of anger was coded in each 5-sec epoch of the arm restraint task, based on the Facial Action Coding System (FACS; Ekman, Friesen, & Hager, 2002). There are several prototypes and some variants of facial anger expression, and the main action units of anger prototypes are brow lower (AU4), upper lid raiser (AU5), lid tighten (AU7), lip tighten (AU23), or lips part (AU25)/jaw drop (AU26). As suggested by Ekman, only one action unit (such as a lower brow) may or may not reflect anger (Ekman et al., 2002). Therefore, we considered a specific expression (e.g., anger) to be displayed if there was a combination of action units for one prototype or variant of specific emotion (e.g., brow lower, upper lid raiser, lid tighten, and lip tighten) simultaneously co-occurring. In order to distinguish anger from other negative affect expressions, disgust and sadness were also coded using the prototypes and variants of facial sadness and disgust in FACS. The main action units of sadness were inner brow raiser (AU1), brow lower (AU4), nasolabial furrow deeper (AU11), and lip corner depressor (AU15). The main units of disgust were nose wrinkler (AU9), upper lip raiser (AU10), low lip depressor (AU16), chin raiser (AU17), and lips part (AU25)/jaw drop (AU26). Two independent coders overlapped on 20% of the sample. Inter-rater reliabilities by Cohen's kappas were .96 for anger, .82 for disgust, and .84 for sadness.

A frequency of anger score was calculated as an average of anger expressions across epochs and across trials. Each epoch was scored for presence or

absence of anger (yes/no). Although no data points of the frequency of anger score were equal to or more than 2 *SD* above or below, the mean and the skewness was $-.20$, a visual inspection showed that the data were bimodally distributed, so a median split (.58) was used to split the sample into two groups: high anger ($n = 57$) and low anger ($n = 57$).

Note that children who showed any sadness ($n = 25$) versus those who showed none ($n = 89$) did not differ in anger to restraint or positive reactivity to novelty ($ps > .12$). In addition, only 2 out of 114 children expressed disgust. Therefore, given the low frequencies of these expressions and the lack of relation to other indices of temperamental approach tendencies, sadness and disgust were not considered any further.

Surgency and attention focusing (4 years)

Mothers were asked to rate their child's temperament via the CBQ (Rothbart et al., 2001) and the CCTI (Buss & Plomin, 1984). Both questionnaires show high internal consistency and convergence with other similar measures (Buss & Plomin, 1984; Rothbart et al., 2001).

The CBQ is a parental assessment of children's temperament with 195-items (rated from 1 to 7) forming 15 subscales. For this study, the subscales of interest related to surgency as suggested by Rothbart (1994) were activity level (13 items; e.g., "Seems always in a big hurry to get from one place to another"; $a = .76$), high-intensity pleasure (13 items; e.g., "Likes going down high slides or other adventurous activities"; $a = .77$), impulsivity (13 items; e.g., "Usually rushes into an activity without thinking about it"; $a = .79$), and shyness (13 items, reversed; e.g., "Acts shy around new people"; $a = .93$). The other subscale of interest was attention focusing (9 items; e.g., "When picking up toys or other jobs, usually keeps at the task until it's done"; $a = .69$).

The CCTI is a 30-item parental report of children's temperament along six dimensions with individual items rated from 1 to 5. For this study, the dimensions of interest related to surgency were activity (5 items; e.g., "Child is always on the go"; $a = .72$), shyness (5 items; reversed; e.g., "Child takes a long time to warm up to strangers"; $a = .87$), and sociability (5 items; e.g., "Child likes to be with people"; $a = .66$). The dimension related to attention focusing was attention (5 items; e.g., "Child persists at a task until successful"; $a = .71$).

Finally, a principal component analysis (PCA) followed by a Varimax rotation of the above subscales from the CBQ and the CCTI identified two factors with eigenvalues > 1 (Table 1), which explained 67.55% of the variance. The first factor appeared to represent *surgency*, including primary loadings for activity level, high-intensity pleasure, impulsivity,

TABLE 1
Loadings in Principal Component Analysis of Surgency and Attention Focusing Data

	<i>Surgency</i>	<i>Attention focusing</i>
Impulsivity from CBQ	.89	
Shyness from CCTI	-.80	
Activity from CCTI	.78	
Shyness from CBQ	-.73	
Activity level from CBQ	.73	
Sociability from CCTI	.62	
High-intensity pleasure from CBQ	.60	
Attention focus from CBQ		.84
Attention from CCTI		.82

CBQ, Children's Behavior Questionnaire; CCTI; Colorado Childhood Temperament Inventory.

and shyness from the CBQ, and activity, shyness, and sociability from the CCTI. The second factor was labeled as *attention focusing*, with primary loadings for attention focusing from the CBQ and attention from the CCTI. In line with the PCA, the data were reduced, using the average of standardized scores of the relative subscales, to create an overall *surgency composite* and an *attention focusing composite*. Furthermore, the two final composites were unrelated ($p = .12$), supporting their independence as outcome variables.

RESULTS

Preliminary analyses

An examination of all continuous variables indicated that they had normal distributions (skewness values ranged from $-.47$ to 1.21 , and no data points were 2 or more *SDs* above or below the mean). The descriptive statistics of positive reactivity to novelty, anger to restraint and subscale scores in CBQ and CCTI are shown in Table 2. There were no associations between socio-demographic variables (i.e., parents' education and children's ethnicity), and any key variables ($ps > .10$). Moreover, gender was unrelated to any of the key variables ($ps > .16$).

Relation between anger and positive reactivity

An independent *t*-test was conducted to examine the relation between positive reactivity to novelty at 4 months and anger to restraint groups at

TABLE 2
Descriptive Statistics of the Key Variables

<i>Variables</i>	<i>Min</i>	<i>Max</i>	<i>M</i>	<i>SD</i>
Positive reactivity to novelty				
Positive affect	0	142.06	1.73	20.34
Motor movement	0	85.00	3.21	19.89
Anger to restraint	0	1	.54	.34
Children's Behavior Questionnaire (CBQ)				
Activity level	3.23	6.69	4.98	.73
High-intensity pleasure	3.31	6.77	5.09	.73
Impulsivity	3.25	6.38	4.75	.69
Shyness	1.08	6.00	3.42	1.24
Attention focus	2.22	6.22	4.73	.77
Colorado Childhood Temperament Inventory (CCTI)				
Activity	2.20	5.00	3.95	.62
Shyness	1.00	4.40	2.22	.82
Sociability	2.20	5.00	3.62	.58
Attention	1.80	4.40	3.35	.61

9 months. However, there was no difference in positive reactivity to novelty between the infants who scored high and low in anger, $t(112) = -.50$, $p = .63$.

Anger and positive reactivity in relation to surgency and attention focusing

Two hierarchical multiple regression analyses were computed to examine whether positive reactivity to novelty at 4 months, anger to restraint at 9 months, and their interaction predicted surgency and attention focusing. The positive reactivity and anger scores were entered first and followed by the two-way interaction term for positive reactivity (standardized score) \times anger (low 0, high 1).

Surgency

In the regression analyses using the surgency composite at age 4 as the dependent measure, there was a significant main effect of anger to restraint, $\beta = .19$, $t = 2.03$, $p < .05$, $f^2 = .06$, but not a significant main effect of positive reactivity to novelty or an interaction between anger and positive reactivity ($ps > .49$, see Table 3). Specifically, infants who were more likely to express anger were rated higher on surgency at 4 years than infants who were less likely to express anger.

TABLE 3
Summary of Regression Examining Positive Reactivity to Novelty and Anger to Restraint on Surgency and Attention Focusing

Variable	Surgency			Attention focusing		
	R^2	ΔR^2	F^Δ	R^2	ΔR^2	F^Δ
Positive reactivity	.02	.02	2.02	.00	.00	.10
Anger	.06	.04	4.19*	.00	.00	.00
Positive reactivity \times anger	.06	.00	.15	.04	.04	3.92*

Note. * $p < .05$.

Attention focusing

In the regression analysis using the attention focusing composite as the dependent measure, there was a significant interaction between 4-month positive reactivity and 9-month anger, $\beta = .24$, $t = 1.96$, $p = .05$, $f^2 = .04$ (see Table 3). To interpret this interaction, the relation between positive reactivity and attention focusing was examined separately for infants high in anger and low in anger. In the high anger group, the relation between positive reactivity and attention focusing was positive, though not significant, $r(57) = .20$, $p = .14$; while in the low anger group, the relation between positive reactivity and attention focusing was negative, though not significant, $r(57) = -.18$, $p = .18$. Using a Fisher's r -to- z transformation (Fisher, 1921), the difference between two r values was significant, $z = 1.99$, $p < .05$. The regression lines for the anger groups are plotted in Figure 1.

DISCUSSION

This study examined individual differences in positive reactivity to novel sensory stimuli at 4 months, anger in response to arm restraint at 9 months, and their joint effects on maternal report of surgency and attention focusing at 4 years. Consistent with a motivational approach/avoidance systems model of temperament, positive reactivity is associated with exuberance, a behavioral style in which children display high joy and approach (Fox et al., 2001; Hane et al., 2008). Anger is also considered part of the approach system, as it is suggested to support approach behavior toward goals (Derryberry & Rothbart, 2001; He, Xu, & Degnan, in press) and is linked to approach-related patterns of left frontal EEG asymmetry (Carver & Harmon-Jones, 2009). However, in contrast to the current hypothesis, observed positive reactivity and anger were unrelated in the current study. This is consistent with the findings of Calkins, Fox, and Marshall (1996), who reported

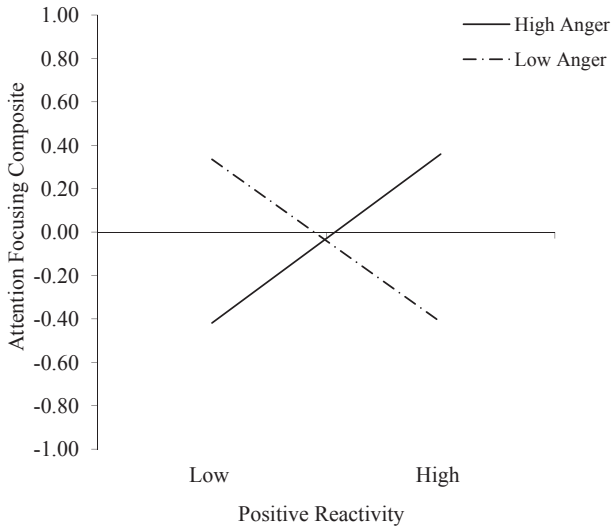


Figure 1 The interaction of positive reactivity to novelty at 4 months and anger to restraint at 9 months on attention focusing at age 4.

no correlation between 4-month positive reactivity and 9-month parental report of distress to limitations (not anger expression to arm restraint), and with the findings of Hane et al. (2008) that positively reactive infants did not show greater frustration (intensity of facial anger, struggle, and vocal distress) during the toy behind the barrier paradigm than others. In addition, these null findings are supported by Derryberry and Rothbart (2001) who reported that infant approach tendencies do not contribute to negative affect expressions such as anger until later in childhood (7 years of age). It is conceivable that anger and positive reactivity might not be inter-related at this young age but rather become inter-related over time.

More importantly, the current study explored the contributions of infant anger to restraint and positive reactivity to novelty to social and attentional outcomes in early childhood, including maternal report of surgency and attention focusing. Consistent with previous findings (Derryberry & Rothbart, 2001), there were strong relations between anger and surgency, such that infants with high anger were rated by their mothers at 4-years of age as happier, more sociable, more active, and less shy, relative to children who expressed low levels of anger in infancy. These results support the notion that anger is an approach-related emotion (Carver & Harmon-Jones, 2009; He et al., 2010) and does not necessarily have a maladaptive effect on later socio-emotional development. Indeed, infants who express anger when met

with obstacles (i.e., toy removal) have displayed greater persistence toward goals (He et al., in press), perhaps due to the perceived control from the cumulative experience of successfully dealing with challenging situations (Sullivan & Lewis, 2003). Positive states including perceived control and surgency may therefore be positively reinforcing and overtime increase approach behaviors to cope with environmental demands.

In contrast to the direct role of anger in predicting later surgency and contrary to our hypothesis, positive reactivity to novelty at 4 months was not significantly related to 4-year surgency and did not interact with anger in relation to surgency. This lack of association between infant positive reactivity (positive affect coupled with activity) and surgency during childhood is similar to the lack of longitudinal stability in positive affect or activity level from laboratory infant assessment to parent report at 7 years (Rothbart et al., 2000). This may be due to the onset of control systems over impulsive activity and approach behavior beginning late in the second half of the first year and during the preschool years (Rothbart & Bates, 2006). Moreover, in a recent study, stable exuberance (positivity and approach) during infancy and toddlerhood was related to later maternal report of surgency, but only when children showed a physiological pattern of left frontal EEG asymmetry (Degan et al., 2011). Thus, exuberance and its associated positive reactivity may result in multiple pathways, which are impacted by various factors (e.g., parenting) throughout development. Additionally, surgency is sometimes disruptive, since it includes activity (Rothbart et al., 2001). Previous researchers revealed that surgency related to externalizing behaviors (Berdan, Keane, & Calkins, 2008) and aggression (Rothbart, 1994). Therefore, surgency was more predicted by anger, rather than positive reactivity in the current study.

The present study also revealed an interesting temperament-by-temperament interaction (i.e., anger to restraint by positive reactivity to novelty) on maternal report of attention focusing. Follow-up tests indicated that positive reactivity was positively linked to attention focusing for infants high in anger, while it was negatively associated with attention focusing for infants low in anger. First, the characteristics of an approach tendency, typified by high anger and positive reactivity, are linked with higher attention focusing. This is consistent with results that approach-oriented preschoolers, who are characterized by preference for challenging tasks and demonstrating higher optimism, exhibit higher attention skills in orienting, vigilance, and executive tasks, than avoidance-oriented children, who are characterized by avoiding challenges and exhibiting negativity (Chang & Burns, 2005). In addition, evidence that anger, an adaptive reaction elicited by arm restraint, is the by-product of both interest in and focus on desired goals (Lewis & Ramsay, 2005) or rewarding information (Ford et al., 2010), and persistence in mastery situations (He et al., in press; Kearney, 2004), supports the

current relations between anger and attention focusing. Moreover, other work has found that positive affect is associated with longer attention focusing in a learning task (Rose, Futterwelt, & Jankowski, 1999). The current study links these two disparate areas of study by suggesting that high levels of both anger and positive reactivity in infancy were related to greater attention focusing at age 4.

In addition, lower levels of anger and positive reactivity were also associated with greater attention focusing. It is possible that being low in both positive reactivity and anger not only reflects low approach, but also possibly suggests temperamental wariness or inhibition to unfamiliar or novel stimuli. Inhibition to novelty is often associated with being more controlled (Rothbart et al., 1994) and displaying heightened vigilance to the environment (Nigg, 2001; Pérez-Edgar et al., 2011). Similarly, Rothbart et al. (2000) found that infants with longer looking times to an attractive toy in the laboratory were described by mothers as displaying less high-intensity pleasure (risk-taking) at the age of 7. Therefore, both combinations of low anger and low positive reactivity, as well as high anger and high positive reactivity, lead to greater attention focusing, while infants displaying only one high approach factor were rated as lower on attention focusing. It is conceivable that for low positive infants, anger is less useful as an approach strategy and actually hinders the ability to develop regulatory behaviors such as attention focusing due to too much frustration. Similarly, for high positive infants who display low anger, their reactive tendencies may be more difficult to harness and result in being distracted and less able to focus their behavior and attention. Given that attention focusing was only measured at 4 years, it is difficult to disentangle the direction of effects between these three factors (positive reactivity, anger, and attention). However, future research should examine the roles of anger and attention in the developmental pathways of positive reactivity to novelty (i.e., exuberance) across time.

LIMITATIONS AND CONCLUSIONS

The current findings are limited to positive reactivity during one novelty task at one age of 4 months, and anger expression in one arm restraint task at one age of 9 months. It cannot be determined whether infant responses to these particular situations reflect stable individual characteristics. Further research on infants' emotional and reactive responses across several contexts (e.g., laboratory versus familiar surroundings, anger to restraint versus anger to other goal blocked situations) and different ages is needed. As well, all outcome measures were assessed by maternal report and may be somewhat biased by maternal perceptions. It is unclear whether the patterns of

findings reported here would replicate if observed behavior was used to measure surgency or attention focusing. Finally, the results may be effected by the large amount of missing data, which may decrease the effect sizes, especially when examining interaction effects (Jaccard, Wan, & Turrissi, 1990). An investigation of anger, positive reactivity, and attention at multiple points across development, including additional factors (e.g., maternal behaviors or regulatory processes), would help differentiate the direction of effects between these factors as they relate to behavior across time.

Taken together, the results of this study confirmed that infant anger to restraint and positive reactivity to novelty are associated with surgency and attention focusing in early childhood. It appears that anger, an approach-related emotion, supports continued active approach, exuberance, and sociability (i.e., surgency) as rated by mothers. Moreover, anger to restraint and positive reactivity to novelty, both representing approach tendencies, seem to jointly contribute to an intense focus on desired goals (i.e., attention focusing), while low anger and low positive reactivity may contribute to greater attention focusing due to their links with vigilant attention (Nigg, 2001; Pérez-Edgar et al., 2011). Thus, the development of attention processes likely involves multiple mechanisms for different temperament profiles. Future research should explore the developmental trajectories of different profiles of emotion and reactivity in relation to child behavioral outcomes in order to elucidate the function of the approach system in behavioral development.

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