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Attention to Threat as a Predictor of Shyness in the Context of Internalizing and Externalizing Problems

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Abstract

The duration of children's attention to putative threat has been documented as a consistent predictor of later anxiety in inhibited children across childhood (Fox, 2010; Perez-Edgar & Fox, 2005). However, attention to threat has not been broadly examined within existing behavioral contexts, and has seldom been studied in very early childhood. Whereas toddlers with high levels of internalizing behavior may view fear-inducing stimuli as a threat, toddlers with high levels of externalizing behavior may demonstrate attention out of interest or sensation seeking. Thus, attention to threat was expected to predict increased toddler shyness in the context of either high internalizing problems or low externalizing behavior. We examined 117 24-month-old toddlers to determine whether attention to threat interacted with internalizing and externalizing behavior at 24 months of age to predict toddler shyness one year later. Results indicated that attention to threat predicted toddlers' lower shyness at 36 months when toddlers' externalizing behavior at age 24 months were high, but there was no significant interaction between toddlers' internalizing behavior and their attention to threat in predicting later shyness. These results expand our understanding of the contexts in which attention to threat in early childhood is a viable predictor of later shyness.

Keywords

shyness; attention to threat; internalizing problems; externalizing problems

The examination of individual differences in how infants and toddlers respond to and cope with novel situations has yielded important predictions about the development of childhood anxiety. In particular, attention to threat, or children's sustained attention to putative threat in fear-inducing situations, has been consistently linked with outcomes such as shyness (also termed social inhibition; Kiel & Buss, 2011; Pérez-Edgar et al., 2010, 2011). Several behavioral contexts, namely behavioral and social inhibition in early childhood, are documented risk factors for anxiety disorders in childhood and adolescence (Fox, 2010; Perez-Edgar & Fox, 2005; White et al., 2011), making it important to understand factors that may help predict such outcomes, particularly in the infancy and toddlerhood periods which may be well-suited for prevention. However, several barriers to understanding attention to threat in early development exist. First, toddlers cannot reliably be tested with computerized tasks typically used for assessing attention to threat, such as the dot-probe task, that are its typical dependent measures (i.e., RTs and error rates), although gaze measures can be used at this age. Second, it remains unclear precisely under which conditions sustained attention to threat results in anxiety-spectrum outcomes such as shyness. For example, infants and

toddlers may attend to a threatening stimulus because of fearful vigilance falling in the domain of internalizing behavior, or because they are attentionally fixated on the stimulus, which may indicate sensation-seeking characteristic of some externalizing behavior. Thus, we assessed toddlers' naturalistic looking behavior when in the presence of putative threat and examined the behavioral contexts (i.e., as a function of different levels of internalizing and externalizing behavior) in which attention to threat in toddlerhood predicts shyness one year later.

Attention to Threat

Attention to threat is characterized by the duration of the child's attention to putative threat. Attention to threat can also be quantified by measuring "attention shifting," or the low frequency in which children shift their attention from this stimulus (White et al., 2011). Variation in children's attention to threat in the face of novel, fear-inducing stimuli is linked to neurological fear circuits in the prefrontal cortex and medial temporal lobe (e.g., amygdala), and is shaped both by genetics and early-life experiences (Gross & Hen, 2004; Monk et al., 2008; Pine, 2007). Attention to threat develops throughout the first year of life in conjunction with the ability to divert gaze from stimuli and anticipate visual events (Peltola, Hietane, Forssman, & Leppänen, 2013; Posner & Petersen, 1990). Although sustained attention to fear-inducing stimuli appears before one year of age, attempts to examine these effects in very young children have been difficult; school-age children are often assessed using computer tasks such as the dot-probe (MacLeod, Mathews, & Tata, 1986). Instead, we relied on observation to determine how toddlers attend to threat in their environment, as toddlerhood is a valuable developmental period in which we can establish patterns of risk and inform early interventions for social problems.

Attention to threat is considered to be one of several attention-based emotion regulation strategies in early childhood. Children who are especially prone to fear often use sustained attention to threat (hypervigilance) as a means of regulating their arousal (Kagan, Reznick, & Snidman, 1988), but this strategy is ineffective in reducing distress as children develop. Indeed, in infancy, sustained attention to threat has been found to increase distress, whereas consistent visual avoidance of distressing stimuli is associated with decreased negative affect and fear (Buss & Goldsmith, 1998; Crockenberg & Leerkes, 2004; Johnson, Posner, & Rothbart, 1991; Whitehead & Frick, 2004). Though some research has found that attention away from threat, or threat avoidance, is also linked to anxiety risk in some individuals in middle childhood (e.g., Morales, Perez-Edgar, & Buss, 2015), as well as anxiety outcomes (e.g., Salum, Mogg, Bradley, Gadelha, Pan, et al., 2013; Waters, Bradley, & Mogg, 2014), it is likely that vigilance towards threat is linked to outcomes such as shyness in early childhood.

Indeed, increased attention to threat, in combination with child characteristics such as behavioral inhibition, is linked to maladaptive child outcomes such as shyness (Kiel & Buss, 2011; Pérez-Edgar et al., 2010, 2011), which is characterized by withdrawal and reticent behavior in social situations with unfamiliar peers (Coplan, Prakash, O'Neil, & Armer, 2004). Prolonged attention to threat in toddlerhood is thought to be maladaptive because it prevents children from utilizing more developmentally advanced coping skills (Crockenberg

& Leerkes, 2006). Further, by sustaining their attention to threat, young children are less likely to actively approach and explore novel social situations commonly encountered in early childhood, which may alleviate anxious arousal associated with uncertainty. Attention to threat also significantly increases children's risk for anxiety disorders directly and indirectly through shyness. For example, Pérez-Edgar and colleagues (2010) not only found that adolescents who demonstrated behavioral inhibition as toddlers and young children showed heightened attention bias to threat, but also found that attention bias to threat moderated the relation between childhood inhibition and adolescent social withdrawal, such that inhibited children high in attention to threat were more socially withdrawn in adolescence. A follow-up study found that attention to threat also moderated the relation between behavioral inhibition measured in toddlerhood and social withdrawal in 5-year-old children (Pérez-Edgar et al., 2011). By contrast, White and colleagues (2011) found that the behaviorally inhibited toddlers who demonstrated increased ability to shift their attention away from threat at age 24 months exhibited a reduced risk for anxiety disorders at 48 months of age. Taken together, previous research appears to suggest that attention to threat is a risk factor for shyness and later anxiety outcomes.

The extent to which attention to threat acts as a predictor of socioemotional difficulties in early childhood is likely to depend on the behavioral context in which this behavior occurs. In the studies above, it is possible that attention to threat may be linked to a broader profile of risk. The link between attention to threat and later anxiety may only be specific to children demonstrating other indices of problems in the internalizing domain, such as social withdrawal. Much research, as cited above, demonstrates that attention to threat is maladaptive only for children with a behaviorally or socially inhibited temperament, which is later linked to a broader range of internalizing problems. Importantly, shyness and behavioral inhibition may be manifestations of the same underlying construct and likely fall under the bigger umbrella of social withdrawal (although behaviorally inhibited children may also be reactive to novel objects in addition to people), often considered as both an indicator of motivational orientation and as a symptom of internalizing disorders linked to child maladjustment (Rubin, Coplan & Bowker, 2009). Thus, attention to threat should be examined in a wider social and behavioral context. For instance, in a study examining 24-month old toddlers' attention to threat in predicting shyness upon entrance to kindergarten, attention to threat predicted shyness only when toddlers demonstrated low proximity to the threatening stimulus (Kiel & Buss, 2011). This latter study suggests that some children may show a high level of attention to a threatening stimulus without being at risk for anxiety because they then approach and explore the stimulus. Thus, the nature of attention to threat may depend on the type of behavioral responses toddlers regularly demonstrate. The current study will examine how toddlers' internalizing and externalizing behavior interact with attention to threat to predict later shyness.

Internalizing and Externalizing Behavior

To expand upon the value of attention to threat as a predictor of social problems related to childhood anxiety, it is important to understand this behavior in the context of a larger domain of problematic behaviors. Thus, it may be beneficial to examine how existing child problem behaviors relate to attention to threat. Specifically, we examine children's

internalizing behavior (e.g., social withdrawal, anxiety, depression, and psychosomatic reactions; Achenbach, 1991) and externalizing behavior (e.g., aggressive and impulsive behavior; Achenbach, 1991). We posit that children's internalizing and externalizing behaviors in toddlerhood serve as an indicator of when children's increased attention to threat is maladaptive.

Children demonstrating higher levels of internalizing behavior consistently display a broad range of social, emotional, and behavioral symptoms, including fearfulness, anxiety, depression, withdrawal, and behavioral inhibition to novelty (Zahn-Waxler, Klimes-Dougan, & Slattery, 1999). There is an abundance of evidence documenting the attentional biases in individuals demonstrating these behaviors across the lifespan, including increased attention to threatening stimuli measured with dot probe and reaction time methods, as well as mood-congruent interpretations and recall of negatively-valenced emotional stimuli in individuals with depressive symptoms (Macleod & Mathews, 1988; Mogg, Bradley, & Williams, 1995; Puliafico, & Kendall, 2006). Research on attention to threat in children and adolescents has consistently found that participants diagnosed with a variety of anxiety disorders, as well as those high in subclinical levels of anxiety, demonstrate greater attention biases to threat relative to non-anxious individuals across a variety of experimental conditions (Bar-Haim et al., 2007; Roy et al., 2008; Shechner et al., 2013). Additional research in young children has found that attention to threat in behaviorally inhibited children is a significant predictor of later anxiety. Fox (2010) found that inhibited children who demonstrated prolonged orienting towards threat were more stable in their behavioral inhibition over time, and more prone to develop anxiety disorders in adolescence. Thus, attention to threat appears not only to co-occur with anxiety symptoms, but also to be a meaningful predictor of both social problems (e.g., Perez-Edgar et al., 2010, 2011) and anxiety symptoms later in life. In addition to main effects of attention to threat and internalizing problems in relation to anxiety-related outcomes, attention to threat may also interact with existing levels of internalizing problems to increase risk for anxiety. Consistent with the evidence presented above indicating a consistent relation between increased attention to threat and anxiety symptoms, and future anxiety outcomes for behaviorally inhibited children (Pérez-Edgar et al., 2010, 2011; White et al., 2011), we expected that for children with higher levels of internalizing behavior, high levels of attention to threat indicates vigilance and would thus predict later shyness.

On the other hand, children with externalizing behavior are characterized by their tendency to seek sensation, excessive reward-focused orientation, and a low distress tolerance that often results in frustration and anger under conditions of non-reward or withdrawal of reward (Rothbart & Ahadi, 1994). Children with externalizing behavior also often demonstrate reactive aggression, defiance, impulsivity, and hyperactivity (Campbell, Shaw, & Gilliom, 2000), and tend to exhibit stronger approach tendencies (e.g., Putnam & Stifter, 2005). Further, evidence has consistently found that cognitive deficits, namely those in the executive functioning systems, underlie externalizing behavior (Endres, Rickert, Bogg, Lucas, & Finn, 2011; Ogilvie, Stewart, Chan, & Shum, 2011). Children with externalizing behavior may view a novel stimulus not as threatening, but as interesting or otherwise stimulating. Because of their reduced ability to effectively manage cognitive control systems and a limited working memory capacity, children high in externalizing symptoms are often

easily focused on motivational targets that “hijack” attention and focus. When these children encounter highly stimulating environmental stimuli, they over-allocate their attentional resources to these stimuli (Baskin-Sommers et al., 2012). As a result, these children may demonstrate problems inhibiting impulsive behavioral responses, and in controlling and shifting their attention from affectively stimulating information in their environment (in this case, a novel stimulus). Consistent with this interpretation, a study by Morales and colleagues (2015) found that attention bias towards reward was positively related to externalizing problems, suggesting that attentional behavior of those high in externalizing behavior may be driven by motivational processes related to reward sensitivity. By contrast, children low in externalizing problems may exhibit attentional biases because of different motivational processes. For example, a study by Koster and colleagues (2004) found that attentional biases to threat stimuli were present in both anxious and normal individuals, suggesting that typically developing individuals (e.g., low externalizing) may also demonstrate attentional biases more similar to individuals high in internalizing problems. Additionally, Coplan and colleagues (2006) found that children who were high in avoidance motivation and low in approach motivation were particularly at risk for maladaptive socioemotional outcomes such as social anxiety, suggesting that low levels of externalizing behavior may also be a risk factor for social problems like shyness. Thus, for all children, with the exception of those high in externalizing behavior (e.g., anxious children, typically developing children such as children low in externalizing behavior), attention biases may be indicative of vigilance or similar fear responses, and thus associated with social problems, such as shyness. For children high in externalizing behavior, inability to disengage from novel stimuli may at least indicate interest in the stimuli, and at most increase risk for impulsive behavioral responses related to approaching and exploring novel stimuli. For example, Laucht and colleagues (2006) found that higher visual attention during repeated stimulation in infancy related to higher novelty seeking in adolescence. The degree to which attention to threat effects depend on increased threat detection or problematic disengagement, rather than mere interest in the stimuli, may then depend on preexisting child characteristics and behaviors, such as externalizing behavior.

Though children with high levels of internalizing or externalizing behavior both demonstrate increased negative affect and reactivity (Lengua, 2003), and may appear similar in their attentional responses and attempts to regulate their emotions in the face of threatening stimuli, fundamentally different motivational processes may underlie the attentional biases of children high in externalizing behavior relative to typically developing children (low externalizing), and children high in internalizing behavior (Colder & O'Connor, 2004; Putnam & Stifter, 2005). Thus, when toddlers are highly attuned to novel stimuli, but also demonstrate signs of externalizing problems, attention to threat may be more indicative of engagement, sensation seeking, or even disinhibition rather than shyness or withdrawal. By contrast, when toddlers high in internalizing behavior or low in externalizing behavior are highly attuned to novel stimuli, attention to threat may be more indicative of anxiety. Understanding how internalizing and externalizing behaviors may relate to different attentional motivations and behavior is important in better predicting how attentional behavior may relate to social problems like shyness.

Current Study

Research described thus far has established a positive relation between attention to threat and social problems and anxiety in childhood and adolescence, either directly or indirectly through child characteristics such as behavioral inhibition. However, attention to threat and the contexts under which it occurs, including internalizing and externalizing problems, have seldom been examined in toddlerhood due to age limitations in current methodologies. The current study aims to broaden our understanding of attention to threat as a predictor of toddler shyness. First, it is hypothesized that attention to threat at 24 months in toddlers demonstrating high levels, but not low or average levels of internalizing behavior, will demonstrate higher levels of shyness at age 36 months. Second, it is hypothesized that increased attention to threat at 24 months in toddlers with low, but not average or high levels of externalizing behavior, will demonstrate higher levels of shyness at 36 months.

Method

Participants

Participants included 117 24-month-old toddlers ($M_{\text{age}} = 24.78$ months, $SD_{\text{age}} = 0.74$ months; 54 female) and their mothers. Eligibility criteria for mothers to participate in the study included having a child between 24 and 26 months of age who was considered “typically developing,” being 18 years of age or older, and having sufficient English language ability to complete study measures and understand task directions. Mothers were recruited through the mail based on birth announcements published in local newspapers and in person at meetings of the Women, Infants, and Children (WIC) program. Children were 84.9% European American, 4.7% African American, 8.5% Asian American, 1% biracial, and 1% “other.” Mothers in this sample tended to be college educated (years of education: $M = 16.40$, $SD = 2.45$; range: 11–20 years). Mothers indicated categories of gross annual income in which their family fell, ranging from below \$16,000 to higher than \$61,000; 40.7% of mothers indicated their households made \$60,000/year or less. Mothers ($n = 76$) then completed a second questionnaire battery when toddlers were approximately 36 months old. Most families lost to attrition either moved and did not provide forwarding information, or agreed to participate but never returned the questionnaire packet despite multiple attempts from the laboratory staff.

Procedure

Upon expressing interest in joining the study (by returning a postcard through the mail or signing up at a WIC meeting), a laboratory staff member called the mother to schedule a laboratory visit and sent her a packet containing a consent form and questionnaires. At the laboratory, an experimenter explained that the child would engage in a series of episodes, including a Risk Room episode designed to elicit individual differences in fear/withdrawal behaviors. Tasks were modified from the Laboratory Temperament Assessment Battery (Lab-TAB; Buss & Goldsmith, 2000) and other previous studies assessing children’s responses to novelty (e.g., Buss, 2011; Nachmias, Gunnar, Mangelsdorf, Parritz, & Buss, 1996). Only the Risk Room was used in the current study. One year later, when toddlers

were 36 months of age, upon indicating interest in participating, families were sent a follow-up questionnaire packet.

Risk room—In the Risk Room task, mothers and toddlers entered a room with four relatively neutral activities (i.e., tunnel, trampoline, balance beam, black box) and one putatively threatening stimulus (i.e., angry-looking gorilla mask on a pedestal). The experimenter instructed the mother to sit in a chair and limit her interactions with her toddler. The experimenter told the toddler to play in the room “however you like” and left the room for the child to play. After three minutes elapsed, the experimenter returned and asked the child to engage with each activity, ending with the gorilla mask. The episode was video recorded through a one-way mirror, such that the toddlers’ looks to the mask were easily visible.

Measures

Toddler attention to threat—Trained coders recorded the target of toddlers’ attention second-by-second during the Risk Room episode. Coders scored attention to threat when the child directly looked at the gorilla mask from beyond two feet away or when they spoke to the parent about it. Coders established minimum reliability with a master coder and maintained reliability throughout coding (92% agreement, $\kappa = .79$). The proportion of time attending to the mask across the Risk Room episode (except when the experimenter asked the child to engage with the gorilla mask) yielded the measure of attention to threat.

Toddler internalizing and externalizing behavior—When toddlers were 24 months of age, mothers completed the Infant-Toddler Social and Emotional Assessment (ITSEA; Carter, Briggs-Gowan, Jones, & Little, 2003) a 168-item questionnaire measure designed to assess social-emotional and behavioral problems in toddlers 12 to 36 months of age. Mothers complete items using a 3-point scale ranging from 0 (*not true/rarely*) to 2 (*very true/often*). Previous research has evaluated test-retest reliability of this measure, with coefficients ranging from .82 to .90 for the different subscales, and validity has been supported by associations with similar measures of child behavior problems (Carter et al., 2003). Of relevance to the current study was the Internalizing domain (32 items; $\alpha = .79$), which included depression/withdrawal items (e.g., “looks unhappy or sad without any reason”) and anxiety items (e.g., “seems nervous, tense, or fearful”), and the Externalizing domain (24 items, $\alpha = .82$), which included activity/impulsivity items (e.g., “is restless and can’t sit still”) and aggression/defiance items (e.g., “is disobedient or defiant”). A mean of these items was used to create overall internalizing and externalizing behavior scores.

Toddler shyness—Mothers completed the Child Social Preferences Scale (CSPS; Coplan, Prakash, O’Neil, & Armer, 2004) at the 24-month and 36-month assessments. The CSPS is a parent-report measure of children’s shyness and social disinterest. Mothers indicated on a 1 (*not at all*) to 5 (*a lot*) scale how typical particular behaviors were for their children. The current study uses the shyness scale (7 items, α s = .80, .89 for ages 2 and 3, respectively; e.g., ‘My child “hovers” near where other children are playing, without joining in’). A mean of these items was used to create an overall shyness score. Previous research has shown the

CSPS to be reliable and relate to maternal report of temperament and observed peer interactions (Coplan et al., 2004).

Results

Missing Data

Forty-three mothers did not complete the CSPS for the 36-month assessment. Independent-samples *t*-tests revealed that these mothers differed from mothers who did complete the CSPS at 36 months on socioeconomic status (M/SD s = 45.60 [14.50] and 52.10 [9.48], respectively, $p < .05$). A significant Little's MCAR test ($\chi^2 = 15.05$, $p = .02$) suggested that missing data were systematically related to patterns of variables in the data set, likely because of the difference in socioeconomic status. Because of this, we used multiple imputation (MI) to impute missing data, which is the most recommended approach when data do not appear to be missing completely at random (Graham, 2009). SES was included in the imputation algorithm and as a covariate in all subsequent analyses, as has been recommended for imputing data that is not missing completely at random (Graham, 2009; Widaman, 2006).

Missing values of 36-month shyness scores were imputed across 20 imputations. The algorithm included 24-month internalizing and externalizing scores, socioeconomic status, attention to threat, interaction terms (i.e., internalizing behavior x attention to threat and externalizing behavior x attention to threat), 24-month shyness scores, and existing values of 36-month shyness scores. Remaining analyses use this imputed data ($n = 117$).

Preliminary Analyses

Descriptive statistics and bivariate relations are presented in Table 1. Primary variables showed reasonable adherence to normality (skew and kurtosis < 2.0). Overall, toddlers' attention to threat related to toddlers' externalizing ($r = .22$, $p < .05$), but not internalizing ($r = .10$, $p = .30$) behavior at 24 months. Toddlers' internalizing behavior at 24 months was also related to their shyness at 36 months ($r = .37$, $p < .01$). SES was not related to internalizing behavior ($r = -0.21$, *ns*) but was marginally related to externalizing behavior ($r = -0.18$, $p < .10$). Scatter plots of significant bivariate relations are provided in Figure 1. Additionally, a range of both internalizing (0.00–1.04) and externalizing behavior (0.11–1.22) were present in the sample, and some toddlers in the sample met clinical cutoff scores for these behaviors ($ns = 5, 4$ for internalizing and externalizing behavior, respectively), indicating that more extreme levels of internalizing/externalizing behavior were represented.

Moderation Analysis

Regression analyses were conducted by examining the two-way interactions between attention to threat and internalizing behavior and attention to threat and externalizing behavior in relation to children's shyness at age 36 months, controlling for SES and 24-month shyness scores (Table 2). Primary variables were centered at their means prior to analyses, and interaction terms were created by calculating the cross-product of the centered variables. Significant interactions were probed for simple effects by re-centering the relevant

moderator at standard values (i.e., ± 1 SD in addition to their means). Results used pooled estimates of the 20 imputations.

Regression analyses revealed a significant interaction between attention to threat and externalizing behavior (Figure 2; $b = -4.14$, $t = -2.0$, $p = .03$). Probing the significant interaction revealed that attention to threat predicted lower shyness at 36 months when externalizing behavior were high ($b = -1.22$, $t = -2.41$, $p = .02$) but not when externalizing behavior were at mean ($b = -0.22$, $t = -0.42$, $p = .67$) or low levels ($b = 0.82$, $t = 0.95$, $p = .34$).

There was no significant interaction between attention to threat and internalizing behavior (Figure 3; $b = -1.39$, $t = -0.81$, $p = .42$), nor was there a significant main effect of children's internalizing behavior ($b = 0.46$, $t = 0.86$, $p = .40$).

Discussion

The goal of the current study was to better understand the role of attention to threat in predicting toddlers' shyness, which may have important implications for toddlers' anxiety development. We examined both internalizing and externalizing behaviors as larger behavioral contexts that may determine whether attention to threat predicted shyness.

The current study found that attention to threat in the context of high externalizing behavior at age 24 months related to lower shyness one year later, controlling for shyness at 24 months of age. This finding extends our previous understanding of attention to threat in important ways. First, previous research has focused on how attention to threat predicts anxiety outcomes in children with inhibited temperaments or withdrawal-based behavioral tendencies, while ignoring the potential role of externalizing problems (e.g., Bar-Haim et al., 2007; Roy et al., 2008; Shechner et al., 2013). Whereas previous research suggests attention to threat may be indicative of vigilance or similar fear responses, and thus associated with social problems like shyness, results of our study are consistent with the idea that children high in externalizing problems may allocate their attention to novel stimuli because they find them interesting or otherwise stimulating rather than threatening. This is consistent with research suggesting that children high in externalizing problems encounter highly stimulating environmental stimuli, they over-allocate their attentional resources to these stimuli (Baskin-Sommers et al., 2012). Results of the current study thereby extend previous literature and suggest that, in addition to behaviors in the internalizing domain (e.g., behavioral inhibition), externalizing behaviors may help specify when attention to threat predicts anxiety-spectrum outcomes like shyness. Thus, it is important that researchers investigating attention to threat as a predictor of anxiety outcomes consider the potential role of externalizing behavior in addition to internalizing behavior.

Inconsistent with hypotheses, we did not find a significant interaction between toddlers' internalizing behavior and their attention to threat in relation to their later shyness. Although previous studies have found that attention to threat predicts social inhibition in behaviorally inhibited children (e.g., Perez-Edgar et al., 2010), results of the current study did not replicate this finding, nor did we find a relation between internalizing problems and attention

to threat at a bivariate level. It is possible that attention to threat does not interact with pre-existing internalizing behavior to predict later shyness at this age, or that shared variance between 24-month shyness and internalizing problems made it difficult to detect a unique effect of internalizing problems. It is also possible that while internalizing behavior were normally distributed within the sample, the severity of internalizing problems was not high enough to yield an effect. For example, work by Mogg and colleagues (1995) suggests that the intensity of internalizing behavior may play a role in the strength of attention bias to threat; given that the current study utilized a community sample, it is possible that the severity of internalizing behavior was not high enough to yield an effect. Indeed, only 5 children out of the sample met clinical cutoff scores for internalizing behavior. Further, though behavioral inhibition has been found to be a moderator in previous studies (e.g., Fox, 2010), it is possible that internalizing behavior are broader than behavioral inhibition, making it more difficult to find an interaction effect. Alternatively, although some research have found a positive relation between attention to threat and anxiety risk (e.g., Morales, Perez-Edgar, & Buss, 2015), other research suggests that attention *away* from threat (i.e., threat avoidance), rather than attention toward threat is a predictor of later anxiety-related outcomes for some individuals (e.g., Salum et al., 2013). Indeed, although not significant, in the current study high internalizing behavior was related to higher shyness at lower levels of attention to threat (Figure 3), perhaps suggesting that these children were averting their gaze from their mask rather than vigilantly attending to it.

Limitations and Future Directions

Results of the current study should be understood in the context of its limitations. First, the current study utilized a relatively homogenous sample comprised of primarily European American, middle class families. Future work should aim to examine these effects in more diverse families in order to better understand the impact cultural and socioeconomic backgrounds may have on attentional biases to threat. The current study also utilized a community rather than a clinical sample, which may have made it difficult to detect an interaction between toddlers' internalizing behavior and attention bias. Given previous work suggesting that intensity of internalizing behavior may play a role in the strength of attention bias to threat (Mogg et al., 1995), future research could examine samples of toddlers with clinical levels of internalizing and externalizing symptoms in order to understand how more severe symptomatology interacts with attention bias to threat.

Future research could examine more narrow constructs within internalizing behavior more broadly (e.g., anxiety symptoms) to see if interaction effects are yielded. Given that previous research has found interactions with constructs such as behavioral inhibition (e.g., Fox, 2010), examining narrower aspects of internalizing behavior may clarify when attention to threat predicts later shyness. Future research could also extend the current study by examining potential externalizing-spectrum outcomes (e.g., sensation seeking) related to attention to threat or novelty, particularly for toddlers high in externalizing problems who exhibit higher attention to threat.

Another limitation of the current study is that it lacked a measure of gaze aversion. Some research has suggested that avoidance of or attention away from threat may also be

indicative of risk for anxiety-related outcomes (e.g., Morales, Perez-Edgar, & Buss, 2014) for some individuals. Although not significant, in the current study high internalizing behavior was related to higher shyness at lower levels of attention to threat (Figure 3), perhaps suggesting that these children were averting their gaze from their mask rather than vigilantly attending to it. However, in order to test this, a measure of gaze aversion would need to be included, but this was beyond the scope of the current study. It is important for future research to examine the potential role of threat avoidance, in addition to attention to threat, in the context of children's internalizing and externalizing problems when examining anxiety-related outcomes.

Lastly, the current study utilized maternal report rather than observational measures of toddlers' internalizing/externalizing problems and shyness. Although maternal report is often the preferred measure of toddler behavior and temperament, the accuracy of these ratings are debated, with previous research finding small to moderate correlations between maternal report and behavioral observations (e.g., Seifer, Sameroff, Barrett, & Krafchuk, 1994). Thus, incorporating observational measures of toddlers' internalizing/externalizing behavior and shyness could be important in further clarifying how attention to threat may act within a toddlers' existing behavioral context to predict later outcomes. Further, the current study only utilized a single threatening stimulus (i.e., gorilla mask) to assess attention. Future research could examine attention biases across multiple stimuli across the threat spectrum.

Conclusion

The current study examined how attention to threat interacted with internalizing and externalizing behavior at 24 months of age to predict toddler shyness one year later, controlling for shyness at age 24 months. Results indicated that attention to threat predicted toddlers' lower shyness at 36 months when toddlers' externalizing behavior at age 24 months were high, but no significant interaction between toddlers' internalizing behavior and their attention to threat was found. These results expand our understanding of the contexts in which attention to threat in early childhood relates to later shyness.

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Figure 1.
Scatter plots for significant bivariate relations.

Figure 2.

Significant interaction between toddler attention to threat and externalizing behavior at age 2 in relation to shyness at age 3. The simple effect of attention to threat (centered at its mean) was significant at low, but not mean or high, levels of externalizing behaviors.

* $p < .05$

Figure 3.

Non-significant interaction between attention to threat and internalizing behavior at age 2 in relation to shyness at age 3. The simple effect of attention to threat was not significant at any level of internalizing behaviors.

Table 1

Descriptive Statistics and Bivariate Relations

<i>Variable</i>	1	2	3	4	5	6
1. Attention to Threat	--	0.10	0.22 [*]	-0.01	0.04	-0.23 [*]
2. 24-month Internalizing Symptoms		--	0.09	0.43 ^{**}	0.37 ^{**}	-0.21
3. 24-month Externalizing Symptoms			--	-0.20 [*]	-0.11	-0.18 [†]
4. 24-month Shyness				--	0.55 ^{**}	0.15
5. 36-month Shyness					--	0.09
6. Hollingshead Index (SES)						--
<i>Skew (Kurtosis)</i>	1.33(1.99)	-0.05(-0.55)	0.67(0.35)	0.77(0.42)	0.41(0.68)	-0.77(-0.09)
<i>Mean (SD)</i>	0.16(0.16)	0.54(0.23)	0.46(0.22)	2.11(0.74)	2.05(0.74)	49.74 (11.93)
<i>Range</i>	0-0.77	0-1.04	0.11-1.22	1-4.86	1-4.14	17-66

Note.

[†] $p < .10$,^{*} $p < .05$,^{**} $p < .01$

Table 2

Summary of Regression Model Predicting 36-Month Shyness with Internalizing and Externalizing Behavior as Moderators

Variable	<i>b</i>	<i>t</i> -test
SES	0.03	0.31
24-month shyness	0.49	3.87 **
24-month attention to threat (AT)	-0.22	-0.42
24-month internalizing behavior (INT)	0.46	0.87
24-month externalizing behavior (EXT)	0.14	0.35
AT X INT	-1.39	-0.84
AT X EXT	-4.64	-2.14 *

Note. SES = socioeconomic status, AT = attention to threat, INT = internalizing behavior, EXT = externalizing behavior.

*
 $p < .05$,

**
 $p < .01$