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Mother and Child Interpretations of Threat in Ambiguous Situations: Relations With Child Anxiety and Autonomic Responding

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This study examined maternal and child interpretive bias to threat (IBT) during dyadic conversation, child physiological reactivity and regulation during dyadic conversation, and maternal report of child anxiety in a community sample of 35 mothers and their 8- to 10-year-old children. Mothers and children discussed one neutral and six ambiguous scenarios, which were subsequently coded for frequency of maternal and child initiation, minimization, and expansion of threat-related themes. Child electrocardiogram data were collected during these conversations and maternal reports of child anxiety and internalizing problems were obtained. Across the sample, children initiated threat-related discussion more often than mothers. Maternal threat expansions were significantly positively correlated with child anxiety and internalizing behaviors. Maternal minimizations of threat were significantly associated with augmented child vagal tone throughout the IBT paradigm. Implications for prevention of child anxiety and directions for extending IBT research within the context of the mother-child dyad are discussed.

Keywords: interpretive bias, mother-child interaction, vagal tone, anxiety, internalizing

Previous research has demonstrated a link between parenting style and the development of anxious behavior in childhood. For instance, maternal overprotectiveness (Bayer, Hastings, Sanson, Ukoumunne, & Rubin, 2010) and solicitousness (Degnan, Henderson, Fox, & Rubin, 2008; Rubin, Burgess, & Hastings, 2002) in early childhood; and maternal affectively negative, controlling behavior in middle childhood (Hane, Cheah, Rubin, & Fox, 2008) are associated with increased anxiety-related problems in children. Critically, the mechanisms of influence involved in the associations between measures of maternal behavior and child anxiety remain underspecified (Bogels & Breechman-Toussaint, 2006). Emergent evidence points to the transmission of anxious beliefs as one mechanism involved in the development of childhood anxiety (Muris, van Zwol, Huijding, & Mayer, 2010), yet little is known about how parent's or children's anxious beliefs influence children at a physiological level. The present research applied a novel

approach to investigating maternal contributions to the development of child anxiety by examining children's physiological (autonomic) response during a novel paradigm in which mothers and children were invited to work together to discuss hypothetical, potentially threatening situations commonly encountered by children.

Interpretive Bias to Threat

Interpretive bias to threat (IBT) refers to an individual's propensity to interpret ambiguous situations as negative or threatening (Barrett, Rapee, Dadds, & Ryan, 1996). When confronted with ambiguity, anxious adults (Byrne & Eysenck, 1993; Derakshan & Eysenck, 1997) and children (Barrett et al., 1996; Muris, Merckelbach, & Damsma, 2000) have been found to interpret threat more readily and with more frequency than less anxious peers. There is evidence that such biases are influenced by environmental input. IBT has been experimentally induced in adults (Grey & Mathews, 2000) and children (Muris, Huijding, Mayer, & Hameetman, 2008; Muris, Huijding, Mayer, Remmerswaal, & Vreden, 2009). Wilson, Macleod, Mathews, and Rutherford (2006) found that induced biases were associated with increased anxiety in college students.

Parents may be an important source of influence in the development of interpretive biases. Creswell and O'Connor (2006) found a positive association between children's and mothers' threat cognitions in response to ambiguous situations. Lester, Field, Oliver, and Cartwright-Hatton (2009) showed that parents demonstrate similar interpretive biases across ambiguous situations potentially occurring in their own and their child's environments. Additional evidence has demonstrated that maternal interpretations and teaching

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have direct and proximal effects on child fear-related beliefs. Muris et al. (2010) demonstrated via experimental manipulation that children of parents who receive negative information about a novel stimulus reported more fear beliefs about the stimulus than children whose mothers were provided with positive or ambiguous input regarding the stimulus.

Only two studies to-date have examined family processes and IBT (Barrett et al., 1996; Dadds, Barrett, Rapee, & Ryan, 1996). In a study of family interactions with 7- to 14-year-old children, Barrett and her colleagues asked parents to independently respond to the same hypothetical scenarios of ambiguous situations that had previously been presented to their children. Parents of anxious children made threat interpretations at similarly high rates as their children without knowledge of their children's responses. They also independently matched their children's responses to the situations and chose avoidant responses. Following the individual responses, parents and children were given time to discuss the scenarios together, and children were asked again to respond to the ambiguous scenarios. After family discussion, anxious children's avoidant responses significantly increased.

A follow-up study by Dadds et al. (1996) video-taped and coded family discussion of ambiguous situations to look for patterns in the interactions. Two ambiguous scenarios were discussed for 5 minutes each, and coding focused on each interactant's IBT-related behavior. Clinically anxious children were more likely than aggressive or control children to make avoidant responses following discussion with their parents. However, mothers of clinically anxious children were not significantly more likely to interpret threat during the course of the conversations than were mothers of aggressive or control children. There was evidence, however, that parental reward and reciprocation of child avoidant talk was associated with avoidant child responses postfamily discussion. Hence, the increase in avoidant responses seen in anxious children following the discussion of ambiguous situations with parents may have been a function of *parental reinforcement* of children's anxious interpretations. The present report builds upon the work of Dadds et al. (1996) by examining maternal and child initiations, expansions, or de-bunking (minimizing) of threat-related themes in a community sample of school-age children. We examined if the nature of the dyadic discourse was associated with children's physiological arousal and regulation by acquiring electrocardiogram (ECG) data from children throughout the dyadic IBT paradigm.

Cardiac Reactivity and Regulation

The autonomic nervous system serves to maintain homeostasis, with two separate branches of the autonomic nervous system (ANS; sympathetic and parasympathetic) serving in reciprocal harmony (Cannon, 1928). The sympathetic branch of the ANS prepares the body for the release of energy and is activated during fear-eliciting situations. This branch increases heart rate (HR) and metabolism, and allows the body to prepare for fight-or-flight in response to

a stressor. Response to stress is accompanied by an increase in sympathetic responding, including accelerated HR. Previous research has shown increased resting HR (Rogeness, Cepeda, Macedo, Fischer, & Harris, 1990) and change in HR in response to a stressor in anxious children (van Lang et al., 2007).

The parasympathetic branch of the ANS acts through the vagus nerve to slow the heart, calm the body, and direct resources to the visceral system, thus returning to a homeostatic equilibrium. The vagus acts as a sort of brake, slowing HR, thereby allowing a calm visceral state and the conservation of metabolic resources. The ability to activate and withdraw the vagal brake has been linked to self regulation (Stifter & Corey, 2001). In a well-regulated individual, vagal tone (VT) should be high in unexceptional, nonthreatening situations. Under conditions of stress, however, a suppressed VT allows the sympathetic nervous system to engage in a fight-or-flight response (Porges, 2007). A profile of high basal VT is associated with adaptive emotional regulation and optimal temperamental reactivity in children (Calkins, 1997). Basal VT may be an important biomarker of social regulation in school-age children, as higher basal VT is associated with more social competence and fewer internalizing problems in preschoolers (Blair & Peters, 2003; Fox & Field, 1989; Hastings et al., 2008).

Summary and Hypotheses

The present report examines maternal and child interpretations of threat while simultaneously measuring child physiological response during dyadic discussion of ambiguity in a community sample of school-age children. Like Dadds et al., we presented mothers and children with potentially threatening, ambiguous situations and allowed them to engage in free discussion. We developed a novel, highly focused approach to coding these conversations, considering specifically only IBT-related behaviors, and in particular the degree to which either interactant initiated (introduced), expanded (elaborated), or minimized (debunked) threat-related themes. In order to elucidate the more proximal, direct correlates of dyadic IBT-related behavior on the child's experience, we acquired ECG from the child throughout the paradigm, including basal measures of HR and VT during a neutral conversation and throughout the discussion of six ambiguous, potentially threatening situations. Child anxiety and internalizing problems were assessed via maternal report.

The nature of the IBT paradigm allowed for assessment of variations in maternal and child interpretations of ambiguity. This task was not devised to serve as a stress-inducing task. We therefore did not expect to see a consistent pattern of physiological change during the conversations across the sample. Instead, we expected that cardiac reactivity and regulation might vary as a function of the manner in which the child and/or mother interpreted the ambiguity, such that variation in interpretive style would be associated with variation in autonomic responding. We hypothesized that higher frequency of maternal and child initiation or expansion of threat-related themes would be associated with in-

creased HR and vagal suppression from the beginning to the end of the IBT conversation paradigm. We also expected that higher frequency of maternal and child initiations and expansions of threat would be associated with maternal report of higher levels of child internalizing behaviors and anxiety. We conjectured that nonanxious, well-regulated children would be more likely to debunk, or minimize threat-related themes during dyadic conversation. Accordingly, we also expected that such high child minimizing would be associated with higher child basal vagal tone and maternal report of low child internalizing behaviors and anxiety.

We expected a different pattern to emerge for maternal minimizations, as we surmised that maternal minimization of threat-related themes may reduce stress and support child physiological regulation. Accordingly, we expected that higher levels of mother's minimization of threat-related themes would be associated with decreased HR and augmented VT from the beginning to the end of the conversation paradigm. We also hypothesized that higher frequencies of maternal minimizations would be associated with maternal report of low internalizing problems and anxiety.

Methods

Participants

Thirty-five typically developing children (21 male) and their mothers participated in the current study. Mothers and children were recruited from the third and fourth grades of an elementary school in a small, rural New England town. The parents of third and fourth graders were contacted by phone and invited to participate. Of the 57 families contacted by phone, 35 children participated in this study. The children ranged from ages 8 to 10 years and averaged 8.81 years ($SD = .75$). Of their mothers, 91.4% were married to the child's father, all were Caucasian, and from middle to upper-middle class households (household income ranged from \$50,000 to \$250,000.00 [$M = 123.44k$, $SD = 57$]). All mothers reported to have completed at least some college. The three mothers who reported a divorced marital status also reported a joint custody arrangement with the child's father. Mothers provided a health history of their child, including chronic illness, major injuries, and use of medications (Health Behavior Questionnaire, Armstrong et al., 2003). None of the children in this community sample were reported by their mothers to be diagnosed with, or undergoing treatment for, an anxiety-related disorder.

Procedure

Thirty-five children and their mothers came to the laboratory for a 1.5-hour session as part of a larger study of mother-child interaction and child biobehavioral responding. One to two weeks prior to the scheduled laboratory visit, mothers received, via mail, an informed consent form and a packet of questionnaires focused on their child's behavior. Upon arrival to the laboratory, maternal report measures were collected. For the IBT portion of this study,

mothers and children were escorted into a living room environment and children were fitted with portable ECG monitors, with electrodes attached to the base of the left rib and to the left and right clavicles. Child and mother were then instructed that they were going to discuss hypothetical situations. For each scenario, the researcher entered the room; read the scenario, which were adapted from Barrett et al., 1996 and Dadds et al., 1996; offered standard directives of "What do you think is happening? And what would you do?" and then left for 2 min. During the two minutes, mother and child engaged in free discussion, after which the experimenter reentered the room and presented another scenario. This session was video recorded via wall-mounted cameras.

The first situation presented was an ambiguous, non-threatening scenario designed to collect baseline ECG and involved the discussion of a benign topic. Presentation of six ambiguous but potentially threatening situations followed in fixed order, as presented in Table 1.

Measures

Interpretive bias to threat. Using Noldus behavioral coding software, the videotaped discussions were coded using a time-sampled approach that time stamped and classified the content of the interpretations posited by the mother and child (separately) throughout each of the six, 2-min ambiguously threatening conversations. *Threat initiate* was coded when mother or child initiated the interpretation of the situation in a negative way that would somehow result in harm to the child, which we defined as physical harm, punishment, or social rejection, for example, "I'm not going to be invited to that birthday party." A child or mother's response to a threat initiation that further developed the threat in a negative direction was coded as *threat expand*. This included the addition of details to the

Table 1
Interpretive Bias to Threat Scenarios

Basal (Neutral)	You are walking down the street and you notice some trash on the ground.
Ambiguous	<ol style="list-style-type: none"> 1. On the way to school you feel funny in the tummy. 2. You see a group of students from another class playing a great game. As you walk over and want to join in, you notice that they are laughing. 3. At lunch, you hear your friends talking about an upcoming birthday party that you didn't know about. 4. You are showing your school project in front of the class and two students in the back are giggling. 5. It is your turn at bat during baseball in gym class. You hear a classmate yelling, but underneath your helmet, you couldn't tell what was said. 6. You gave your dad a graded spelling test that you got some words wrong on. He spends a long time looking at it.

Note. Scenarios were presented in fixed order, as listed. Each scenario was followed by the standard probes: "What do you think is happening? And what will you do?" Scenarios were adapted from Barrett et al., 1996 and Dadds et al., 1996.

situation that augmented the negative effects of the threat or enhanced the negative emotional experience that would result from the present threat, for example, “*I think everyone in my class was invited to the party except me.*” *Threat minimize* was coded when a child or mother responded to a threat initiation by interpreting it as not likely, not plausible, or not present, or by attenuating its negative emotional impact, for example, “*If it wasn’t one of your close friends, you wouldn’t mind not being invited.*” For each behavior rated and for each of the six IBT conversations, Noldus generated an average rate-per-minute (rpm) score by dividing total frequencies for each behavior by the number of minutes in each conversation. The rpm for each behavior for each interactant in each of the six potentially threatening scenarios were summed, to obtain the overall rpm for *initiations*, *expansions*, and *minimizations* of threat across the six IBT conversations. IBT coding was completed by two independent raters who achieved interrater reliability across 20% of the sample. Kappas for agreement on the maternal IBT codes ranged from .61 to .95 and averaged .75 for maternal codes and ranged from .69 to 1.0 and averaged .82 for child codes.

Cardiac reactivity and regulation. Children were outfitted with portable ECG acquisition equipment, including three electrodes, placed on the right and left clavicles, and at the base of the lower left rib. These electrodes connected to a portable ECG unit, which consisted of a personal data assistant locked inside an analog-to-digital converter box, by Mindware Technologies. The wireless ECG signal was transmitted to an acquisition computer in an adjacent control room. Following the participants’ laboratory visit, ECG data were cleaned and analyzed using Mindware software (HRV 3.01), which summarizes data into time sampled windows prespecified by the researcher. Portions of the ECG signal thought to be contaminated by artifact were identified using Mindware’s artifact detection algorithm and then these flagged portions were cleaned by-hand, using the average interbeat interval as the guide to detect R-waves. The cleaned ECG data were submitted to Fast Fourier Transformation and respiratory sinus arrhythmia (RSA) was calculated as the natural log of high frequency power (.15–.40 Hz) (Berntson et al., 1997). The HRV software also calculated HR in terms of beats per minute. The average HR and RSA scores were calculated separately for each of the two min conversations. HR and RSA from the first 2-min neutral conversation were used as markers of *basal HR* and *basal VT*, respectively. In order to approximate level of physiological arousal during the course of the IBT conversations, the change in HR from the baseline, neutral conversation to the average HR recorded in the last IBT conversation was computed by regressing the HR scores averaged during the last 2-min IBT conversation onto baseline HR and saving standardized residuals. A higher score on *HR change* indicates more increase in HR from the first (neutral) to the last IBT conversation. A similar *VT change* score was computed using this regression approach, with a higher score representing an increase in VT from the first neutral to the last IBT conversation.

Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001). The CBCL/6–18 is a widely used, reliable and valid parent-report measure of child behavior problems. It includes 113 behavioral descriptors (e.g., cries a lot), which are rated on a 3-point scale as follows: 0 = not true; 1 = sometimes true; 2 = very often true. In its entirety, the CBCL yields broadband, narrow-band, and *DSM-IV* oriented scales and addresses behavior problems of an internalizing and an externalizing nature (Achenbach, Dumenci, & Rescorla, 2003). The *DSM-IV* oriented *Anxiety Scale* addresses behaviors associated with anxiety disorders in children, including items such as “fears school” and “nervous.” The broad-band *Internalizing scale* is a composite score of the Anxious/Depressed, Withdrawn/Depressed, and Somatic Complaints subscales and is an index of mood- and anxiety-related behavior problems. The raw values for each scale were used in the present report, with a higher score indicative of more frequent problem behavior.

Results

Preliminary Analyses

Descriptive statistics were computed on all variables and are reported in Table 2. Maternal minimizations of threat showed a significant positive skew. This variable was transformed via a square root function, which yielded a normal distribution. The transformed variable was used in all analyses. No other variables showed significant skewness. All variables were devoid of outliers.

Four children were missing ECG data due to a loss of the wireless signal during data acquisition. These four children did not significantly differ from the remaining 31 on the IBT or CBCL variables.

Gender differences on all variables were examined with independent sample *t* tests. Boys and girls did not significantly differ on the IBT, physiological, or maternal-report variables.

Differences between mother and child behavior during the IBT paradigm were examined with paired sample *t* tests. Results showed that children engaged in more initiations of

Table 2
Descriptive Statistics

	<i>N</i>	<i>M</i>	<i>SD</i>
Maternal threat initiate	35	.09	.08
Child threat initiate	35	.22	.09
Maternal expand	35	.12	.11
Child expand	35	.15	.11
Maternal minimize	35	.10	.12
Child minimize	35	.15	.13
CBCL Child Anxiety	35	1.63	1.96
CBCL Child Internalizing (Raw)	35	5.94	5.83
CBCL Internalizing (<i>t</i> -score)	35	50.23	10.85
Child basal heart rate	31	89.94	11.81
Child basal vagal tone	31	7.07	1.13
Child change in heart rate	31	-.02	1.01
Child change in vagal tone	31	-.02	1.00

Note. CBCL = Child Behavior Checklist (Achenbach & Rescorla, 2001).

threat than mothers, $t(33) = -5.42, p < .01$. There was also a trend for children to expand threat-related themes more often than mothers, though this was not statistically significant, $t(33) = -1.80, p = .08$.

Interrelations among maternal and child IBT variables were examined with a series of correlations and are reported in Table 3. Maternal threat initiations were significantly positively associated with maternal threat expansions and significantly negatively associated with child threat expansions. Child initiations of threat were significantly positively associated with child expansions of threat and maternal minimization of threat. Maternal expansions of threat were significantly positively associated with child minimizations.

Maternal report of child internalizing problems and anxiety were not significantly associated with child basal HR/VT or change in child HR/VT across the IBT paradigm.

Maternal and Child Autonomic Reactivity and Regulation Across the IBT Paradigm

Change in child HR and VT across each individual conversation in the IBT paradigm was examined in two separate repeated measures analyses of variance. Across the sample of children, HR and VT remained stable, with no significant fluctuations across the basal and 6, 2 min IBT conversations, $F(6, 180) < 1$, for HR and VT alike.

Threat Initiation and Expanding, Child Anxiety, and Child Autonomic Responding

To test the first hypothesis involving associations between maternal/child threat initiations and expansions; child anxiety; and child autonomic responding, a series of correlations were computed. Neither child initiations nor child expansions of threat were significantly associated with basal values or change in HR or VT or maternal report of internalizing problems or anxiety.

Maternal expansions of threat were significantly associated with child anxiety, $r(29) = .48, p < .01$; and internalizing behavior problems, $r(29) = .56, p < .01$. Given the significant association between maternal threat expanding and initiating, and for clarity in specificity of effects, these significant associations were recomputed using hierarchical multiple regression, with maternal threat initiations entering the equation first, as a covariate. The semipartial associations between maternal threat expanding and maternal re-

port of anxiety and internalizing remained statistically significant with maternal threat initiations statistically controlled, ($p < .01$), incremental r 's (r^2) = .434 and .458, respectively. Maternal expanding was not significantly related to child basal HR and VT or change in HR and VT.

Initiations of threat on the part of the mother or child were unrelated to CBCL internalizing; CBCL anxiety; child basal HR and VT; and change in HR and VT.

Threat Minimization, Child Anxiety, and Child Autonomic Responding

The second set of hypotheses involved associations between maternal/child minimization of threat, child anxiety, and child autonomic responding. Contrary to our predictions, child minimization of threat was positively associated with maternal perceptions of child anxiety, $r(31) = .42, p < .05$. Given the significant association between child minimizing and maternal expanding, this significant association was reexamined while controlling for maternal threat expanding. The semipartial association between child minimizing and CBCL anxiety was no longer statistically significant when maternal expanding was applied as a covariate, $r^2 = .16, p > .05$. Child minimizations were not significantly associated with CBCL internalizing, child basal HR and VT; or child change in HR or VT across the IBT paradigm.

Maternal minimization of threat was not significantly associated with her report of child internalizing problems and anxiety; child basal HR and VT; or change in HR across the IBT paradigm. A significant association between maternal minimizations of threat and child vagal augmentation during the IBT paradigm was yielded, $r(29) = .50, p < .01$. Given the significant association between child initiation of threat and maternal minimizing, the association between maternal minimizations and change in child VT was examined while controlling for child initiations. This association remained statistically significant, $r^2 = .50, p < .01$.

Discussion

The current study examined the relations between maternal-child IBT, child autonomic responding, and maternal report of child anxiety and internalizing problems. Here, we presented mother-child dyads with six potentially threatening but ambiguous scenarios, and examined rates of threat initiations, expansions, and minimizations on the part

Table 3
Interrelations Among Maternal and Child Interpretive Bias to Threat Behaviors

	Maternal initiations	Maternal expansions	Maternal minimizations	Child initiations	Child expansions
Maternal expansions	.42*	—			
Maternal minimizations	-.02	-.16	—		
Child initiations	-.23	.21	.46**		
Child expansions	-.33*	.08	.28	.39	
Child minimizations	.32	.58**	.02	.22	-.02

* $p < .05$. ** $p < .01$.

of each interactant. We acquired child ECG data in vivo at baseline during a neutral conversation, and throughout the IBT paradigm. Data on child anxiety and internalizing problems were collected via maternal report.

Maternal IBT, Child Anxiety, and Child Autonomic Responding

Barrett et al. (1996) found that anxious children and their parents each chose avoidant responses to ambiguous situations. Following parent-child discussion, anxious children's avoidant responses increased, suggesting that parents reinforced their child's anxious responding.

In the present study, and contrary to our expectations, maternal initiations of threat-related themes were not associated with her report of an anxious profile in children or child physiological responding during the IBT paradigm. Maternal initiations of threat occurred less frequently than children's initiations, and were significantly, positively associated with maternal expansions.

Maternal report of child anxiety and internalizing problems in the present report was significantly related to maternal expanding of threat-related themes. Mothers who developed threat-related themes more frequently rated their children as having more anxiety and internalizing problems. These associations between maternal expanding and child anxiety and internalizing problems were independent of the contribution of maternal initiations. The examination of the expansion variable itself marks an extension of the previous research in this area, which has focused on coding the initial interpretation and type of solution-based response (e.g., avoidance or aggression) that mothers and children forward in the context of IBT conversations. Frequent maternal threat expansions signify that mothers were consistently enhancing the possibility of threat by "turning up the volume" once a threat was introduced—that is, making the scenario itself potentially more hurtful than had previously been mentioned, or by elaborating on the level of harm the child might experience as a result of the threat. The findings of the current report reveal that this highly specific maternal response style may be more relevant to child anxiety than the initial threat interpretation itself. However, it is important to note that contrary to our hypotheses, no significant relations were observed between maternal initiations or expansions of threat-related themes and child autonomic responding during the IBT paradigm.

Maternal expanding of child-centric interpretive threat may be related to her own interactional history with her child. Previous research has demonstrated associations between earlier temperamental inhibition and child anxiety (Fox, Henderson, Marshall, Nichols, & Ghera, 2005) and early inhibited tendencies predict subsequent overprotective parenting (Rubin, Nelson, Hastings, & Asendorpf, 1999). Maternal overprotective behavior, in turn, interacts with earlier inhibited tendencies in the maintenance of shy/inhibited behavior (Rubin, Cheah, & Fox, 2001). Research involving clinically anxious children also provides evidence for complex, reciprocal interactions between mothers and anxious children (Hudson, Doyle, & Gar, 2009). Hudson

and her colleagues showed that women manifest increased levels of overinvolvement during interactions with anxious (vs. nonanxious) children who were not their own, regardless of whether or not their own child was anxious. Future research should specifically examine if temperamentally inhibited and clinically anxious children elicit expansion of threat-related themes from parents.

It also seems plausible that the relation between maternal threat-expanding and child anxiety is mediated by maternal anxiety. Mothers who engaged their children with high levels of threat expanding may have been more anxious themselves, though this awaits empirical support. It is well-established that maternal anxiety biases reporting of her child's anxiety (e.g., see De Los Reyes & Kazdin, 2005; Moreno, Silverman, Saavedra, & Phares, 2008). Hence, the significant association between maternal threat expanding and child anxiety reported herein may be a function of maternal anxiety, which itself is associated with higher levels of her own child-centric threat expanding and her reporting of her child's anxiety. Future research that incorporates assessment of maternal anxiety and objective measures of child anxiety are necessary to rule this out. Given evidence for the intergenerational transmission of anxiety (Cooper, Fearn, Willetts, Seabrook, & Parkinson, 2006), a critical next step in dyadic IBT research is to examine if parental development of child-relevant, threat-related themes is one mechanism through which anxious parents transmit or reinforce anxious beliefs in their children.

Contrary to our hypotheses, maternal minimizations of threat-related themes were not associated with maternal report of low anxiety or child internalizing. However, as expected, maternal minimizations of threat appeared to support physiological regulation in children. Children's vagal tone was augmented when they engaged in conversation with mothers who showed a tendency to minimize threat. Hastings and his colleagues showed that parent-child interaction influences preschoolers' ability to regulate physiologically (Hastings & De, 2008; Hastings et al., 2008). The findings reported here indicate that parental support of child physiology extends into middle childhood. The present report joins other research demonstrating that positive maternal behavior buffers risk for anxious responding in school-age children (Hane et al., 2008). Future research that investigates if maternal minimizing induces reduction in children's anxious beliefs is necessary. The findings reported here suggest that direct teaching of threat-minimization strategies to mothers of vulnerable children may assist in supporting anxiety-prone children, at the level of physiological regulation, when they encounter ambiguity in social settings.

Child IBT, Child Anxiety, and Child Autonomic Responding

Direct associations for the child IBT variables were less fruitful. It was more common for children to initiate and expand threat than mothers, but these behaviors alone did not correlate with markers of anxiety-related risk or physi-

ological responses within the IBT paradigm in this community sample. It is important to note that our design probe invited mothers and children to disambiguate scenarios that were based on the experiences of children. Children were expected to be the one experiencing the situation, and children were the “you” in the standard probes of “*What do you think is happening? And what would you do?*” Hence, our methodology may explain the increased frequency with which children initiated threat relative to mothers. Previous research with clinically anxious children has found significant associations between child initiation of threat-related themes (Barrett et al., 1996; Muris et al., 2000) and attention to threat-related stimuli (Roy et al., 2008). Future research should examine if children with clinically significant anxiety engage in more threat expanding during IBT tasks than nonanxious children.

In the present study we aggregated IBT behaviors obtained across six brief conversations that varied in terms of the nature of potential threat in order to obtain robust measures of IBT responding. The scenarios were designed to present ambiguous situations encountered by children related to their health, academic performance, athletic performance, peer rejection/ostracization, and parental disapproval. Four of these six scenarios involved peers and the potential for peer ostracization or rejection. It may be the case that peer-related ambiguity poses a more salient threat to school-age children than concerns related to physical illness or parental disapproval. Accordingly, it is plausible that maternal minimization or development of children’s anxious interpretations about peer behavior is of particular importance for 8- to 10-year-old children. Limited data in each 2-min conversation prevented meaningful interpretation of differences in child response based on the nature of the ambiguous threat (peer, somatic, academic/athletic performance, parental disapproval). Future research is necessary to examine if IBT, as defined in this report, represents an interactional style on the part of mothers and children that is domain-general or if IBT responding is domain-specific, with certain contexts posing more (or less) threat based on child temperament or varying forms of child anxiety.

Contrary to our predictions, child minimizations of threat were associated with higher levels of maternal report of child anxiety. Correlations among the IBT variables indicate that child minimizations tended to occur more frequently in the context of maternal expansions—that is, across the sample there was a tendency for children to minimize maternal expanding. Hence, the association between the child minimize variable and child anxiety may be a direct function of the fact that such children were presented with threat-related content that required minimization. Indeed, the association between child minimizing and maternal report of child anxiety was considerably attenuated in magnitude, and no longer statistically significant when maternal expansions were accounted for in the equation.

Limitations

Several methodological limitations warrant mention. The limited power from this small sample may have prevented the emergence of all potentially significant associations. The findings here are drawn from a European American sample and may not generalize to other populations. As well, the examination of mother–child interaction used herein focuses exclusively on IBT-related behavior. Hence, it is uncertain if these IBT-related behaviors are independent from other dimensions of mother–child interaction known to correlate with child internalizing behaviors, such as maternal negative control (Hane et al., 2008); overprotectiveness (Bayer et al., 2010); or solicitousness (Degnan et al., 2008). As well, the overrepresentation of peer-involved scenarios limits the ability to generalize these findings to interpretive biases for ambiguous situations that do not involve peers. Also, maternal participation in the IBT paradigm and maternal report of child anxiety and internalizing behaviors increases the chance that the findings reported here were influenced by shared method variance. Mothers who expanded threat may have also viewed their child as more anxious when completing the CBCL. Maternal report of child anxiety and internalizing behaviors in this community sample were slightly (though not significantly) skewed, with fewer children rated as high (vs. low or moderate) on these dimensions. The lack of clinically significant child anxiety in this small community sample may have attenuated associations between maternal report of anxiety/internalizing; child autonomic responding; and maternal and child IBT. Future research involving community samples should examine child behavioral functioning using objective methodologies, such as observed peer play behavior and/or multiple informants.

Summary

The present report examined associations between maternal and child behavior during discussion of ambiguous situations, changes in child autonomic reactivity and regulation during these discussions, and maternal report of child anxiety and internalizing problems. The findings extend the IBT literature by drawing an important distinction between initiation of threat-related interpretations and expansions of existing threat interpretations, demonstrating that the latter is associated with maternal report of child anxiety. As well, our findings highlight the potential for protective maternal behavior, as maternal minimizations of threat were associated with children’s augmented vagal tone across the IBT paradigm. Future research that applies this dyadic IBT methodology to the longitudinal study of the development of anxious behavior in at-risk samples may help to elucidate the mechanisms underlying associations between parenting style and anxious behavior in children. Examination of IBT-related behavior during parent–child conversation in clinical samples may reveal important insight for the development of family-based intervention programs that seek to reduce the development of anxiety in vulnerable children.

This may involve teaching parents techniques to minimize child interpretations of threat, thereby diminishing the tendency of all family members to focus on threat in the face of uncertainty.

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