Interpretation Bias in Anxious Mothers and Their Children:

Can Interpretation Modification Affect the Intergenerational Transmission of Anxiety?

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Abstract

A currently burgeoning area of research has demonstrated that interpretation biases play a causal role in the onset of anxiety, and by training interpretation biases towards benign interpretations of ambiguity, experimental paradigms can be used to decrease levels of clinical and trait anxiety in both adults and children. Drawing on this well-documented experimental literature, and recently growing treatment literature, training anxious mothers to more benign interpretations of ambiguity in their children's environment may not only lessen their own anxious cognitions, but also reduce the anxious cognitions they transmit to their children. The primary objective of the current study was to determine whether a uniquely *interpersonal* interpretation modification paradigm (IMP) could alter the transmission of an anxious information processing style from clinically anxious mothers to their children. Results suggest that the IMP, compared to a control condition, resulted in fewer child-referent anxious cognitions in mothers and warmer maternal behavior directed to children during preparation for an anxiety-provoking speech task; however, child self-referent anxious cognitions, child behavior, and child physiological arousal during the speech task were not differentially affected. Mother and child general interpretation biases decreased over time in both groups. The current study is discussed as a pivotal step towards assessing the feasibility of modifying anxious mothers' interpretation biases concerning their children in real-life clinical settings.

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Introduction

<u>Overview of Anxiety Disorders in Children and Mothers</u>

Anxiety disorders are among the most common psychological difficulties occurring in childhood. While fear and anxiety is most often a normal response to environmental threat that entails obvious evolutionary benefits, it becomes excessive, maladaptive, and significantly interfering for children with anxiety disorders. A review of the epidemiological literature reveals prevalence rates for children up to and including 11 years of age ranging from 2.6% to 41.2% (Cartwright-Hatton, McNicol, & Doubleday, 2006). Differences are likely due to the presence of very young children, the varying types of prevalence explored, and the different settings investigated. It appears that most studies yield child and adolescent prevalence rates of between 8 and 12% (Bernstein & Borchardt, 1991; Costello & Angold, 1995: Dadds, Spence, Holland, Barrett, & Laurens, 1997). Such rates make anxiety disorders more common than depressive disorders and likely more prevalent than disruptive behavior disorders as well (Cartwright-Hatton et al.) Epidemiological studies with adults show similar results: anxiety disorders have the earliest age of onset distributions, with a median age of onset of 11 years of age (Kessler, Berglund, Demler, Jin, Merikangas, & Walters, 2005).

Child anxiety ('child' will refer to 'child and adolescent' throughout) most commonly falls into one of nine categories; however, there are four main diagnostic categories (American Psychological Association, 2000). Children with separation anxiety disorder (SAD) experience intense fear upon separation from caregivers and often worry that harm will befall themselves and/or their caregivers during periods of separation. Social phobia (SP) is marked by excessive anxiety and subsequent avoidance of interpersonal and/or performance situations. Generalized anxiety disorder (GAD) is identified by persistent and excessive worry about a range of topics.

Lastly, children with specific phobias demonstrate extreme fear and avoidance of specific animals, objects, situations, and environments. All of the anxiety disorders are accompanied by significant interference in daily functioning in areas such as family life, school achievement, and peer relationships.

Child anxiety is often comorbid with other disorders in childhood, and incurs elevated risk for other disorders in adulthood, such as depression (Kovacs, Gatsonis, Paulauskas, & Richards, 1989) and substance use and abuse (Kushner, Sher, & Beitman, 1990). It has also been shown to have detrimental effects on educational attainment (Breslau, Lane, Sampson, & Kessler, 2008). Anxiety disorders tend to remain stable and problematic for many children well into adolescence and sometimes adulthood, particularly if they go untreated (Last, Perrin, Hersen, & Kazdin, 1996). In fact, it is estimated that most individuals suffer with anxiety for between 9 and 23 years before seeking treatment (Wang, Berglund, Olfson, Pincus, Wells, & Kessler, 2005). Further, delay in making treatment contact is associated with earlier onset of the disorder. This may be partly because anxiety tends to go unnoticed in children since externalizing problems such as hyperactivity, impulsivity, defiance, and aggression are more disruptive in home and classroom environments. Accordingly, disproportionately more children with externalizing disorders receive treatment when compared to children with internalizing disorders (Chavira, Stein, Bailey, & Stein, 2004).

Anxiety is also very common in adulthood. Results from the National Comorbidity Survey Replication (NCS-R) indicate that the lifetime prevalence for any anxiety disorder is 28.8% (Kessler et al., 2005). Anxiety disorders in adults most commonly take three forms: SP and GAD as described above, as well as panic disorder (PD) with or without agoraphobia. PD is marked by discrete periods of intense fear known as panic attacks, which are followed by worry

about additional panic attacks and a change in daily life activities in an attempt to avoid such attacks. Agoraphobia sometimes occurs in concert with PD, and its distinguishing characteristic is avoidance of public places for fear that a panic attack might occur and the individual will be unable to escape or get help.

The high prevalence of adult anxiety makes it likely that many children are being raised by anxious parents. It is in fact well-known that anxiety runs in families. Children of parents with an anxiety disorder are 7 times more likely to have an anxiety disorder than children of non-anxious parents (Turner, Biedel, & Costello, 1987). In addition, mothers of anxious children are almost three times more likely to have a current anxiety disorder than mothers of control children (Cooper, Fearn, Willetts, Seabrook, & Parkinson, 2006). This overlap in anxiety is thought to be the result of both genetic (including temperament) and environmental influences, and the interaction between the two (Goldsmith & Lemery, 2000; Rapee, 2001). Environmental influences in particular are thought to explain a significant proportion of variance in child anxiety (Eley, Bolton, O'Connor, Perrin, Smith, & Plomin, 2003).

With the link between anxiety in parents and anxiety in children well established, many researchers have looked at psychological mechanisms through which this transmission of anxiety might occur. Parenting behaviors such as overprotectiveness and a lack of warmth have been associated with parental anxiety (particularly in mothers) and implicated in the etiology of child anxiety (Rapee, 1997; Wood, McLeod, Sigman, Hwang, & Chu, 2003). It is more recently that researchers have begun to delve into this transmission process in order to elucidate the underlying mechanisms through which behavior in parents leads to anxiety in children.

Interpretation Bias in Anxious Mothers and Children

Cognitive models of anxiety stress the importance of processes such as attention, interpretation, and memory in the onset and maintenance of anxiety disorders (Beck, Emery, & Greenberg, 1985; Williams, Watts, McLeod, & Mathews, 1997). It is hypothesized that individuals with anxiety disorders are vigilant for and allocate attentional resources to threat in their environment, interpret ambiguous information in a threatening manner, and have more accurate memory for threat-related material. Kendall (1985) has adapted this theory to be applied to the area of child anxiety, hypothesizing that anxious children have overactive schemas related to threat, danger, and vulnerability. These schemas guide processing resources toward threat-relevant information and result in cognitive distortions.

A large number of studies investigating these information processing biases have focused on the interpretation stage of encoding. In particular, a range of experiments have shown that anxious adults are more likely than normal controls to interpret ambiguous information in a threatening manner (see review by Mathews & MacLeod, 1994). A similar interpretation is often found in anxious children (see review by Muris, 2010). While non-anxious controls interpret ambiguous situations in a relatively benign manner, anxious children and adults tend to perceive such situations as threatening. Ambiguous situations therefore elicit more fear and anxiety in these individuals, and they are more likely to attempt to avoid such situations as a result of these negative emotions.

A common methodology in this line of research is to present children and adults with a series of ambiguous scenarios and ask how they would interpret each of the scenarios if they were actually in that situation, how upsetting it would be, how well they'd be able to cope with it, and/or what they would do in the situation (Barrett, Rapee, Dadds, & Ryan, 1996; Creswell & O'Connor, 2006; Micco & Ehrenreich, 2008). Such studies have found that anxious children

interpret ambiguous scenarios as more threatening than control children and they are more likely to choose an avoidant solution when asked what they would do. Further, following a subsequent discussion with their parents as to what course of action they should take, anxious children choose responses that are even more avoidant in nature. These results indicate the presence of an anxious coping style in anxious children that is reinforced and enhanced by anxiety-maintaining processes within the family. Barrett et al. (1996) accordingly called this the Family Enhancement of Avoidant Response (FEAR) effect.

Given that anxious adults and children both show this interpretation bias, and parents and children have high concordance rates of anxiety, recent research is beginning to assess the relationship between these cognitive distortions within parent-child dyads. When mothers are asked to interpret adult-themed ambiguous situations (e.g., "You are meeting your partner's colleagues at a work party and you are sure they are all looking at you when you walk in") and children are asked to interpret child-themed ambiguous situations (e.g., "You are walking up to a group of peers on the playground and as you approach you notice that they start to laugh,") these self-referent threat interpretations of mothers and children are significantly correlated (Creswell & O'Connor, 2006).

Further, anxious parents tend to perceive threat not only in their own environment, but also in their child's environment (Lester, Field, Oliver, & Cartwright-Hatton, 2009). When anxious mothers are presented with ambiguous situations that their children might face (i.e., child-referent scenarios), they tend to report that these situations will be threatening to their child and suggest that they should choose avoidant responses as a result. It has also been shown that the relationship between mother's anxiety and their child-referent interpretation bias is fully mediated by their own self-referent interpretation bias. In other words, anxious mothers are more

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likely than non-anxious mothers to interpret ambiguous situations in their own lives as threatening, and this interpretation bias, in turn, predicts that they will perceive more threat in ambiguous situations to which their children are exposed.

The expectations of both mothers and children appear to play a key role in the relationship between interpretation biases present in these dyads. For example, the link between mother and child self-referent threat cognitions is partially mediated by mother's expectations of how their child would interpret the ambiguous scenarios (Creswell & O'Connor, 2006). This suggests that mothers who themselves perceive threat in ambiguous situations expect that their children will do the same, and these expectations partially predict the level of threat that their children assign to such situations. The implication is that mothers may be transmitting these expectations to their children, potentially through verbal information or modeling. Similarly, mothers' expectations of their children's ability to cope with potentially anxiety-provoking situations predict children's own threat perceptions and coping expectations for the same situations (Micco & Ehrenreich, 2008). This suggests that again, there may be mechanisms present through which mothers are transmitting their expectations to their children, not only with regard to how threatening situations are, but also in terms of how well children will be able to cope with ambiguous scenarios.

And perhaps most informative, in a longitudinal study, Creswell, O'Connor, and Brewin (2006) found that mothers' expectations of their children's threat perceptions and distress predicted changes in children's anxious cognitions over time. This study was the first to investigate the directionality of this relationship. Again, this points to the idea that mothers transmit their expectations of their children's interpretation biases to their children, and in this particular study, these expectations were shown to have a direct effect on how children actually

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perceive ambiguous situations. This is in line with the developmental literature, which has consistently shown that mothers are powerful socialization agents for their children, particularly in the areas of emotion (Klimes-Dougan & Zeman, 2007), peer relationships (Hastings, McShane, Parker, & Ladha, 2007) and academic achievement (Salazar, Schludermann, Schludermann, & Huynh, 2000).

Theory of Intergenerational Transmission of Anxious Cognitions

This burgeoning area of research suggests that the intergenerational transmission of an anxious information processing style may be a key mechanism underlying the high concordance rates of anxiety among mothers and children. Creswell, Cooper, and Murray (2010) have articulated a comprehensive model by which this transmission occurs. They hypothesize that parent's self-referent interpretation biases have a direct effect on their expectations of their children's cognitions in ambiguous situations. Parents then transmit this anxious information processing style, or these anxious cognitions, to their children. Although not included in the model, children's cognitions would then presumably predict their actual behavior in the situation.

The transmission of anxious cognitions is thought to occur via a number of avenues. First, parental behaviors such as modeling of verbal and non-verbal anxious behaviors, fear responses, and maladaptive coping (i.e., vicarious learning) have all been implicated (Creswell et al., 2010). By watching their parents react to ambiguous situations in a fearful or anxious manner, and/or exhibit maladaptive coping mechanisms, children receive the message that such situations are indeed threatening, difficult to cope with, and to be feared and/or avoided. A second pathway implicated in the transmission of this maladaptive information processing style is the provision of verbal information concerning threat, lack of control, and lack of coping ability (Field & Lester, 2010). By directly telling their children that particular situations are

threatening (e.g., "You're probably going to feel scared when you get up in front of the class to read your report"), difficult to control (e.g., "It's probably going to be scary no matter what you do"), and that they lack the ability to cope with them (e.g., "It might be too scary for you"), anxious parents give a clear message that such situations are to be feared, are beyond their child's control, and are difficult to cope with. Finally, overprotective parenting, lack of autonomy granting, negativity, lack of warmth, reinforcement of anxious behaviors, and promotion of avoidance (e.g., "If you feel too scared to give your oral report, I can let the teacher know and maybe you can just hand in the written version") are other mechanisms through which anxious cognitions can be transmitted from parents to children (Fisak & Grills-Taquechel, 2007).

In line with these theoretical models, experimental research has shown that vicarious learning experiences can produce change in children's fearful responses, fear cognitions, and avoidant behavior. Askew and Field (2007) paired pictures of novel animals with happy, scared, and no facial expressions and presented them to 7-9 year old children. The animals that were paired with scared expressions subsequently elicited increased fear attitudes as measured by self-report and affective priming. Children also took significantly longer to approach a box they were led to believe contained an animal that had previously been paired with scared faces. In a study of 10-14 month old infants and their socially anxious mothers, Murray et al. (2008) found that compared to nonanxious controls, these mothers expressed more anxiety when interacting with a stranger and offered less encouragement to their infant to interact with the stranger. In turn, the children of socially anxious mothers were more likely to show fearful responses and avoidance of the stranger. Similarly, toddlers who saw a rubber snake and spider paired with negative facial expressions of their mother showed more fearful expressions and greater avoidance than those

who saw these toys paired with their mother's positive facial expressions (Gerull & Rapee, 2002).

Other studies have found that verbal threat information affects fear cognitions, avoidance, and physiology. Field and colleagues developed a paradigm whereby children receive positive, negative, or benign information about an unfamiliar animal from a different continent. Children presented with threatening information are more likely to report fearful cognitions about this unknown animal, avoid putting their hand in a box they are led to believe contains the animal, and exhibit heightened physiological arousal (e.g., heart rate) while approaching the box, as compared to children who receive benign or positive information about the animal (Field & Lawson, 2003; Field, Lawson, & Banerjee, 2008; Field & Schorah, 2007).

Finally, numerous studies have related parenting behaviors such as overprotection and lack of warmth to child anxiety (Hudson & Rapee, 2001; Moore, Whaley, & Sigman, 2004). While there is some question as to the directionality of the relationship, most researchers agree that the relationship is likely reciprocal in nature. The mediating variable between overprotection and child anxiety is widely believed to be a diminished sense of control (Chorpita & Barlow, 1998). When one's parents continually control their environment, the child begins to believe that the world is a scary place in which they have little control, and they need their parents to help them cope with this constant threat.

A recent paper investigating parenting constructs specific to anxious mothers (Murray et al., 2012) used a coding scheme that examined anxiety, passivity, promotion of avoidance, overprotection, intrusiveness, encouragement, and warmth. Clinical anxious mothers were shown to have higher levels of passivity and expressed anxiety, and lower levels of encouragement and warmth.

Experimental Evidence for the Intergenerational Transmission of Anxious Cognitions

As noted by Creswell et al. (2010), researchers have investigated various sections of their model, but no studies have yet demonstrated the full transmission of anxiety from mother's self-referent interpretation bias to children's actual behavior. For example, Creswell, O'Connor, and Brewin (2008) investigated the relationship between parental expectations and parental behavior. Half of the primary caregivers in the study were given positive expectations about their child's performance on a difficult tangram task that their child was about to do (i.e., "The puzzles we are giving your child are tricky but we expect he/she will find them fun to do and enjoy the challenge,") while the other half were given negative expectations (i.e., "The puzzles we are giving your child are tricky. We expect he/she might struggle with the task, which may become upsetting for him/her at some point during the task.") Parents who were given negative expectations displayed higher levels of overinvolvement compared to parents who were given positive expectations.

In the seminal study by Barrett et al. (1996) described earlier, it was shown that discussions between anxious children and their parents resulted in an increase in the avoidant responses chosen to deal with ambiguous situations. A follow-up study determined that the parents of anxious children were more likely to listen to and agree with avoidant plans (Dadds, Barrett, Rapee, & Ryan, 1996). This study highlights the relationship between parental behavior (accommodation of children's anxiety) and children's subsequent behavior. Unfortunately, this study did not assess children's intermediary cognitions.

Some critics have claimed that such story-based assessment doesn't capture real-world interaction between parents and children. In response, studies have begun to use in vivo stressors to assess parent and child anxious cognitions in an actual anxiety-provoking situation. For

example, Kortlander, Kendall, and Panichelli-Mindel (1997) demonstrated that mothers of anxious children had negative expectations about their child's distress, coping, and performance on a speech task. Unfortunately, this study did not examine any interactions between the parents and children to see if these anxious cognitions were transmitted in any way.

Cobham, Dadds, and Spence (1999) improved on this study by eliciting children's predicted anxiety and skill level on a speech task before and after discussing the task with their parents. Surprisingly, anxious children did not expect to do any worse than control children and this did not change after the family discussion. The authors hypothesize that their task was not sufficiently anxiety-provoking and/or anxious children may have been "faking good." A potential solution to the latter problem would be the collection of physiological data as a more objective indicator of anxiety. Along with subjective distress and behavioral avoidance, physiological arousal is one of the three components of the tripartite model of anxiety first described by Lang (1979). Physiological arousal is more of an automatic process and is under less direct control than subjective distress (which subjects can verbally deny) and behavioral avoidance (because subjects can attempt to be brave, perhaps as a result of demand characteristics).

The most common physiological indices investigated in the context of fear and anxiety are heart rate (HR) and skin conductance level (SCL; Beidel, Turner, & Dancu, 1985; Lang, Levin, Miller, & Kozak, 1983), which result from activation of the fight-or-flight response. Heart rate variability (HRV) is an additional psychophysiological construct that has been assessed in the context of anxiety disorders. HRV in the high frequency spectrum represents an index of respiratory sinus arrhythmia (RSA), which involves regular HR fluctuations that are linked to breathing and moderated by the parasympathetic nervous system (Thayer & Lane, 2000).

Healthy physiological variability involves the ability to respond to environmental demands adaptively and in a way that maintains stability, which is counter to the inflexible ways in which anxiety-disordered individuals respond to their environment. Accordingly, past research has found that individuals with anxiety disorders have lower levels of HRV at baseline and in response to stressors (Friedman & Thayer, 1998; Pittig, Arch, Lam & Craske, 2013).

Another potential drawback in many of the studies reviewed is that they recruit anxious and control children, as opposed to anxious and control mothers. If parental anxious cognitions are conceptualized as the beginning of a chain of events that eventually leads to child anxiety, it makes more intuitive sense to recruit anxious mothers. Studies have shown that maternal anxiety is a key component in child-related cognitions (Gallagher & Cartwright-Hatton, 2009; Wheatcroft & Creswell, 2007) and mother-child interactions (Schneider, Houweling, Gommlich-Schneider, Klein, Nündel, & Wolke, 2009). In addition, many studies have recruited high trait anxious children and mothers rather than those with clinical levels of anxiety. Trait anxiety can be defined as a predisposition to develop anxious states, particularly when there is coherence between the type of stressful situation encountered and the facet of trait anxiety experienced (Endler & Kocovski, 2001). Current research suggests that the distinction between trait and clinical anxiety is a matter of degree rather than quality (Miu & Visu-Petra, 2010). However, there is evidence to suggest that anxious mood states need to be present in order for interpretation biases to be elicited (Eysenck & Mogg, 1992). Given that clinically anxious mothers experience anxious mood states to a higher degree than high trait anxious mothers do, recruiting clinically anxious mothers could increase the possibility of finding evidence for the transmission of an anxious information processing style.

Interpretation Modification

Research into cognitive models of anxiety has focused not only on simply linking anxiety and interpretation biases, but also striving to elucidate the direction of this relationship. Mathews (1990) hypothesized that because ambiguous situations are quite common in everyday life and emotional interpretations may be stored in memory as if they were real events, a chronically negative interpretation bias could be functionally similar to frequent encounters with real danger. This would presumably result in elevated levels of anxiety. In an influential study, Mathews and Mackintosh (2000) demonstrated that it was possible to modify the way people interpret ambiguous situations, and changes in these interpretations resulted in changes in anxiety. Interpretation biases were induced by training individuals to select either threatening or non-threatening interpretations of ambiguous scenarios. Results revealed that subsequent interpretations of new ambiguous scenarios tended to be in accordance with the type of induction the participant received. In addition, state anxiety scores increased only in the negative induction condition.

The ambiguous situations used in this and subsequent studies have generally been designed to reflect social or interpersonal scenarios, as well as potential physical threat (Hoppitt, Mathews, Yiend, & Mackintosh, 2010), presumably since these are two common areas of concern for anxious adults. This type of interpretation training has been shown to affect state anxiety and emotional responses (Hoppitt et al.), as well as stress vulnerability for up to 24 hours (Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006), even in the context of changes in environment and sensory modality. Interestingly, it has been suggested that this interpretation training is similar to what happens between anxious mothers and their children in the real world, where mothers effectively "train" their children towards threatening interpretations of ambiguity (Field & Lester, 2010).

In a study adapted for use with children, Muris, Huijding, Mayer, and Hameetman (2008) employed a "space odyssey" paradigm whereby they induced either a positive or negative interpretation bias in 8-12 year olds using a computer program that simulated a journey to an unknown planet. Children were asked to make interpretations about a number of ambiguous situations on the planet and according to their assigned condition, positive or negative interpretations were reinforced via feedback. Following training, a number of additional ambiguous scenarios were given and children who had received the negative training were more likely than those who had received the positive training to report threatening interpretations. Further, this effect was found to be most pronounced in highly anxious children. Using a series of drawings of ambiguous situations that might occur on the planet, Muris, Huijdong, Mayer, Remmerswaal, and Vreden (2009) had children make a mark to depict where they would put themselves in the scenery (e.g., how close they would get to an alien). The distance between their mark and the salient stimulus was used as a measure of avoidance, and the authors found that children in the negative training group showed higher levels of avoidance.

Additional studies have extended this methodology into the realm of treatment, using interpretation modification procedures to induce positive interpretation biases in individuals who are already anxious. Beard and Amir (2008) used a computer program to provide positive feedback every time participants chose a benign representation of an ambiguous scenario. Negative feedback was given when threatening interpretations were chosen. Twenty-seven socially anxious individuals completed eight training sessions over four weeks. Half were in the active training condition while the other half were in a control condition. Those that received the interpretation modification were observed to make fewer threatening and more benign

interpretations following training, and to evidence reduced symptoms of social anxiety. Further, increases in benign interpretations mediated the reduction in anxiety symptoms.

In a sample of adults with GAD, positive interpretation training was found to affect later interpretation bias in the expected direction and also to decrease the number of negative thought intrusions during a focused breathing task (Hayes, Hirsch, Krebs, & Mathews, 2010). And in the only randomized controlled study to date, Amir and Taylor (2012) administered twelve 20-min interpretation training sessions delivered over a 6-week period to individuals with generalized social anxiety disorder (GSAD). Results showed that the IMP group had significantly decreased threat interpretations and increased benign interpretations from pre- to post-treatment relative to the ICC group. Also, those in the IMP group displayed significantly larger reductions in clinician-rated social anxiety symptoms and self-reported trait anxiety. Sixty-five percent of individuals in the IMP group no longer met DSM–IV criteria for GSAD at post-treatment, compared to 13% in the ICC group.

In the only study conducted with anxious children to date, Vassilopoulos, Banerjee, and Prantzalou (2009) used a similar modification program with 10-11 years olds with high levels of social anxiety. They were trained over 3 sessions to choose benign interpretations of ambiguous scenarios and compared to a control group, subsequently endorsed fewer negative interpretations of new ambiguous situations, had reduced levels of trait social anxiety, and reported less anxiety about an anticipated interpersonal meeting.

Drawing on this well-documented experimental literature, and recently burgeoning treatment literature, Lester et al. (2009) propose that training parents to more benign interpretations of ambiguity may not only lessen their own anxious cognitions, but also reduce the anxious cognitions they transmit to their children. Going back to the model presented by

Creswell et al. (2010), it is mothers' interpretation of ambiguous scenarios in their own life that begins the transmission of anxiety from mother to child. The next step in the transmission process is mothers' interpretation of threat in their children's environment. If researchers are able to mold such interpretations in a more benign fashion, perhaps this will completely preclude or at least somewhat temper the further steps in the model: maternal behavior, children's cognitions, and children's behavior. Considering that cognitive-behavioral (CBT) techniques are only successful at alleviating symptoms for about two thirds of anxious children (Compton et al., 2010), this line of research could prove to be an important adjunct to current treatment options or a stand-alone treatment for CBT non-responders. This paradigm could also be implemented as a preventative measure in youth identified as being at-risk for the development of anxiety (by virtue of having a mother with an anxiety disorder).

Potential Moderators of the Transmission of Anxious Cognitions

The literature has indicated a number of constructs that are likely important moderators of the transmission of an anxious information processing style from parents to children. While maternal anxiety is thought to set the stage for the transmission process, many studies have found that child anxiety plays a key role in the relationships among anxious cognitions and behaviors in children and mothers (Lester et al., 2009). There is likely a complex interplay of these factors, with some studies suggesting that parents of children with an anxious temperament become overinvolved with their child in an attempt to reduce and prevent their apparent distress (Hudson & Rapee, 2004). Parental overinvolvement then serves to increase the child's already anxious temperament, making it more likely that they will eventually develop an anxiety disorder. In terms of Creswell et al.'s model (2010), it could be that the transmission of maternal anxiety is more pronounced if a child is found to already behave in an anxious way. In other words, parents

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may base their child-referent interpretation biases not only on how they perceive threat in their own environments, but also on how they have seen their anxious children behave and cope in ambiguous situations in the past.

Current Study

Current research paradigms that use interpretation bias modification focus on changing *intrapersonal* interpretation biases, either in anxious adults or anxious children. However, given strong evidence for the presence of an *interpersonal* transmission of this anxious cognitive style from mothers to children, this study sought to shift research paradigms to an *interpersonal* interpretation modification training. Instead of giving children and mothers self-referent ambiguous scenarios, as has been done thus far, we adapted this existing methodology to present mothers with ambiguous scenarios that may be interpreted as threatening to their children. Given the *interpersonal* component of the high rates of anxiety among mothers and children, this novel application may hold important advantages over existing methodology.

For example, a common component of child anxiety treatment is to teach children to evaluate the evidence behind their anxious thoughts, but if they are exposed to a mother who continually highlights threat, the likelihood of a non-response to treatment or future relapse may be high. Similarly, current treatments for child anxiety often involve the parents, particularly if they are also anxious. The focus is primarily on changing parents' own anxiety and secondarily on changing parental behaviors that instill anxious cognitions in children. However, if parents leave treatment and still "see" threat within their child's environment, this will make it difficult to implement the behavioral changes their child's therapist is prescribing. Alternatively, if we can successfully train mothers to more benign interpretations of ambiguity in their child's environment, we may be able to not only lessen their own anxious cognitions, but also reduce the

anxious cognitions they transmit to their children (Lester et al., 2009). This would then have an effect on their child's anxious behavior. Considering that CBT is only successful at alleviating symptoms for about two thirds of anxious children (Compton et al., 2010; Ollendick, King, & Chorpita, 2006), achieving the proposed aims of this study could open the door to important adjunctive or stand-alone treatments for CBT non-responders.

The current study improves upon and refines past approaches and methodologies in a number of additional ways. First, as noted by Creswell et al. (2010), researchers have investigated various sections of the proposed model, but no study has yet demonstrated the full transmission of anxiety from mother's child-referent interpretation bias to children's actual behavior. This was the first to attempt such a demonstration. Second, some critics have claimed that the common story-based assessment used in this line of research does not capture real-world interaction between parents and children. In response, studies have begun to use in vivo stressors, such as speech tasks, to assess parent and child anxious cognitions in actual anxiety-provoking situations (Hayes et al., 2010; Kortlander et al., 1997). However, there have been reported difficulties with tasks not being sufficiently anxiety-provoking and anxious children "faking good." Accordingly, the current study introduces a component of being rated by peers when giving a speech about friends, since friendships are an area in which many anxious children struggle (Ollendick, Costa, & Benoit, 2010). We address the latter problem by collecting physiological data as a more objective indicator of anxiety. Along with subjective distress and behavioral avoidance, physiological arousal is one of the three components of the tripartite model of anxiety first described by Lang (1979) and recently demonstrated in children (Ollendick, Allen, Benoit, & Cowart, 2011). Physiological arousal is more of an automatic process and is under less direct control than subjective distress (which subjects can verbally

deny) and behavioral avoidance (because subjects can attempt to be brave as a result of demand characteristics). The proposed study collected the most common physiological indices investigated in the context of fear and anxiety: skin conductance (SC), heart rate (HR), and heart rate variability (HRV; Beidel et al., 1985; Ollendick et al.)

Another potential drawback in many studies is the recruitment of anxious and control *children*, as opposed to anxious and control *mothers*. If maternal anxious cognitions are conceptualized as the beginning of the chain that eventually leads to child anxiety, recruiting anxious mothers will be essential. In addition, many studies have recruited high trait anxious individuals rather than those with clinical levels of anxiety. Trait anxiety is a predisposition to develop anxiety states (Lang et al., 1983) and there is evidence to suggest that anxious mood states are required for interpretation biases to be elicited (Gallagher & Cartwright-Hatton, 2009). Given that clinically anxious mothers experience anxious mood states to a higher degree than high trait anxious mothers, recruiting the former could increase the probability of finding evidence for the transmission of an anxious information processing style. Finally, studies have varied in the dimension of parenting behavior that they have assessed, with most focusing on only one or two areas. This study improves on past work by assessing a wide array of parenting behaviors thought to be implicated in the intergenerational transmission of anxiety.

The primary objective of the current study is to investigate whether a uniquely *interpersonal* interpretation modification paradigm using child-referent scenarios can alter the transmission of an anxious information processing style from clinically anxious mothers to their children in the context of a specific anxiety-producing task. A secondary aim was to examine the effect that interpretation modification has on general interpretation biases in anxious mothers and their children. To address these aims, an experimental study randomly assigned clinically

anxious mothers to receive either a training paradigm that taught them to interpret child-referent ambiguous situations in a positive, benign manner or a control condition that was more neutral in its effects. Children were then asked to participate in an anxiety-provoking speech task, discussing how they would approach the task with their mother before beginning. Mothers' behavior during this discussion was coded by trained observers, child and mother interpretation biases with regard to the task were collected, and children's ultimate performance, associated anxiety, and physiological arousal during the task were assessed.

It was hypothesized that the experimental interpretation modification procedure, compared to the control condition, would result in less anxious maternal behavior directed to children during the discussions; fewer self-referent anxious cognitions in children and fewer child-referent anxious cognitions in mothers; and better child performance, less physiological arousal, and less anxious child behavior during the anxiety-provoking task. It was also predicted that this procedure would decrease both mother and child general interpretation biases.

<center>Method</center>

<u>Participants</u>

Mothers were 55 women aged 26-61 years of age, with a mean age of 41.71 years (SD = 6.61). Forty-seven were Caucasian (85.5%), 4 were African-American (7.3%), 2 were Asian (3.6%), and 2 were Hispanic (3.6%). All but one mother returned the Information Form and therefore some of the demographic statistics below do not add up to 100%. Mothers were chosen because they are most often the primary caregiver, most of the related research has been done with mothers, and research shows that fathers may play a unique role in the onset of child anxiety. For example, Bogels and Phares (2008) showed that in contrast to the care and protection that mothers provide to their young children, fathers may play a more critical role in

challenging their children, and encouraging risk-taking behavior and independence. Mothers also reported on their level of educational attainment. Twenty-seven mothers completed graduate school (49.1%), 19 graduated from college (34.5%), 5 attended college or a specialized training program (9.1%), 2 graduated from high school (3.6%), and 1 completed grade 10 or 11 (1.8%). Thirty-seven mothers were employed outside of the home (67.3%), and 17 were not (30.9%). Annual income ranged from $18,720 - $200,000, with a mean of $82,196 ($SD$ = $42,526).

Recruitment initially focused on mothers who met DSM-IV clinical criteria for a primary diagnosis of generalized anxiety disorder (GAD), social phobia (SoPh), or panic disorder with or without agoraphobia (PD). As noted earlier, these are the most common and impairing of the anxiety disorders in adulthood (Kessler, Chiu, Demler, & Walter, 2005). These and other diagnoses were evaluated with a semi-structured interview during an initial assessment, the Anxiety Disorders Interview Schedule for DSM-IV Lifetime (ADIS-IV-L; Di Nardo, Brown, & Barlow, 1994). Assessors used information gathered in this clinical interview to assign diagnoses based on a 0-8 rating scale, with ratings of 4 or above classified as *clinical* diagnoses, while a rating of 3 was classified as a *subclinical* diagnosis (usually indicating that the mother was one criterion shy of meeting full diagnostic criteria). Thirty-eight of the mothers (69.1%) met this initial criterion, but this restriction was later broadened due to recruitment limitations. The final sample also included 10 mothers with a primary *subclinical* diagnosis of one of the indicated disorders (18.2%), 2 with a *secondary* clinical diagnosis of one of the indicated disorders (3.6%), 2 with a *secondary subclinical* diagnosis of one of the indicated disorders (3.6%), 1 with a *clinical* diagnosis of agoraphobia without panic (Ag; 1.8%), 1 with a *clinical* diagnosis of specific phobia (SP; 1.8%), and 1 with a *subclinical* diagnosis of post-traumatic stress disorder (PTSD; 1.8%). See Table 1 for further details (only the first three diagnoses are listed). Overall,

53 mothers had a primary anxiety disorder (96.4%) and 44 had a clinical anxiety disorder (80%; with the other 20% having an anxiety disorder with a clinician severity rating of 3).

Clinically anxious mothers were selected over high trait anxious mother because there is evidence to suggest that anxious mood states need to be present in order for induced interpretation biases to result in emotional vulnerability (Mackintosh et al., 2006), and clinically anxious mothers experience anxious mood states to a higher degree than do high trait anxious mothers. Recruiting this group therefore was used to increase the probability of finding evidence for the transmission of an anxious information processing style.

Regarding comorbidity, adults with anxiety disorders typically present with a variety of comorbid anxiety and depressive disorders (Kessler, Chiu, et al., 2005). Those mothers presenting with such comorbid disorders were not excluded from the study, since their comorbid conditions may shed light onto the applicability of the proposed model to varying clinical presentations. They may also help to determine the robustness of the interpretation modification procedure, as we will be able to determine if it extends to mothers with multiple anxiety disorders and/or other comorbid conditions, such as depressive disorders. In the current sample, 44 of the 55 mothers had a comorbid diagnosis (80%), 41 had a comorbid anxiety disorder (74.5%), 12 had a comorbid depressive disorder (21.8%), 2 had a comorbid substance-use disorder (3.6%), and 1 had comorbid hypochondriasis (1.8%). Obviously, mothers could have more than one comorbid disorder.

Mothers currently receiving psychological treatment and/or taking psychotropic medications were not excluded from the study, granted that they continued to meet criteria for one of the anxiety disorders outlined above. Twelve of the mothers reported being currently in therapy or counseling (21.8%), with 4 specifying that it was for anxiety (7.3%). Thirty-three

mothers noted that they had been in therapy or counseling in the past (60%), with 8 specifying that it was for anxiety (14.5%). In addition, 14 mothers noted that they had been diagnosed with an anxiety disorder in the past (25.5%), with 10 reporting that it has been consistent over time (18.2%). In terms of psychotropic medication, 18 mothers reported taking an anti-anxiety and/or antidepressant medication (32.7%) at the time of the study.

Mothers were excluded from the study if they exhibited current psychotic symptoms, suicidal or homicidal ideation, or substance abuse or dependence. These were assessed during the phone screen and initial clinical interview (see below for more detail). These exclusionary criteria are in accord with the protocols of many experimental studies and ensured that none of the above symptoms or disorders interfered with mothers' ability to complete the experimental protocol. In addition, presence of the above conditions usually interferes with family functioning in a number of domains, which may complicate the process by which anxiety disorders are passed from mothers to children, something that the current model (Creswell et al., 2010) has not yet taken into consideration. One mother with caffeine dependence was included, as was one mother in early full remission of alcohol dependence.

In terms of their relationship to the children in the study, 49 were biological mothers (89.1%), 2 were adoptive mothers (3.6%), 2 were biological grandmothers (3.6%), and 1 was a legal guardian (1.8%). All non-biological mothers had been primary caretakers for the children since they were infants. Mothers classified their family make-up: 38 parents married and living together (69.1%), 4 mother and step-father (7.3), 3 single mother (5.5%), 2 parents divorced (3.6%), 2 parents separated (3.6%), 2 grandparents married and living together (3.6%), 1 parents unmarried and living together (1.8%), 1 legal guardian living with male partner (1.8%), and 1 mother and female partner living together (1.8%).

Children were 28 females (50.9%) and 27 males (49.1%) aged 7-12 years of age, with a mean age of 9.87 (*SD* = 1.44). Forty-six children were Caucasian (83.6%), 4 were African-American (7.3), 2 were Asian (3.6%), 1 was Hispanic (1.8%), 1 was biracial (1.8%), and 1 identified as "other" (1.8%). Children were limited to 7-12 years of age because our diagnostic interview may be more reliable with children this age (Silverman & Eisen, 1992) and we wanted to ensure that children were sufficiently cognitively developed to be able to accurately identify their cognitions about upcoming anxiety-provoking situations. There is evidence that interpretation biases can be accurately assessed in this age range (Barrett et al., 1996; Hadwin, Frost, French, & Richards, 1997) and Muris (2010) notes that other reasoning biases, such as emotional reasoning and covariation bias, might rely more heavily on a certain level of cognitive development.

Anxiety disorders were assessed in children using the Anxiety Disorders Interview Schedule, Child and Parent Version (ADIS-IV-C/P; Silverman & Albano, 1996). Somewhat similar to the most common and impairing anxiety disorders in adults, two of the "big three" in children are GAD and SoPh, while the third is separation anxiety disorder (SAD). Thirty-two children of the 55 children met clinical criteria for at least one of these disorders (58.2%). The final sample also included 5 children with a primary clinical diagnosis of SP (9.1%) and 1 with a primary clinical diagnosis of PTSD (1.8%). Seventeen children (30.9%) did not meet criteria for any anxiety disorders. Table 2 depicts the child anxiety disorders that were present in this sample. Regarding comorbidity, 26 children had at least 1 comorbid anxiety disorder (47.3%), whereas 12 children had no comorbid anxiety disorders (21.8%). In terms of prior treatment, 12 children were reported to have received mental health services in the past (21.8%) and 5 were reported to currently be in treatment (9.1%). Seven mothers specified that their child was seen

for anxiety-related concerns (12.7%). Only 2 children were currently taking an antidepressant (3.6%).

Families were also excluded from the study if the participating child had a diagnosis of a pervasive developmental disorder, an IQ less than 80, current psychotic symptoms, or current suicidal or homicidal ideation. These areas were assessed during the phone screen and initial clinical interview. Regarding suicidal ideation, it is not uncommon for anxious individuals to experience depressive symptomatology; however, they were only excluded from the study if they were experiencing active suicidal ideation and reported having a plan to act on. This process is consistent with routine clinical care.

Recruitment

Anxious mothers were recruited through the Virginia Polytechnic Institute and State University's Child Study Center, Psychological Services Center, and Child and Adult Assessment Clinics, as well as through other services in the New River Valley. Recruitment involved contacting other local mental health professionals, doctor's offices, community services boards, hospitals, schools, day cares, and churches. Additionally, publicity efforts were focused on recruiting this population through print advertisements. Fliers were posted at the above locations and in the community (as well as at restaurants, coffee shops, and grocery stores), a link describing the study was posted on the Child Study Center's website, the VT News outlet wrote a short story about the study, and advertisements were run in local newspapers such as the Roanoke Times.

Research Design

A 2 group design was employed wherein mothers were randomly assigned to one of two computer tasks, either a positive interpretation modification program (IMP) or an interpretation

control condition (ICC). Randomization to the two groups was stratified by child gender and presence of child clinical anxiety.

Materials

Interpretation Modification Program (IMP) and Interpretation Control Condition (ICC). Half of the mothers (randomly assigned) were trained to interpret ambiguous scenarios in a positive, benign manner according to a well-established procedure (Mathews & Mackintosh, 2000). They were presented with child-referent ambiguous scenarios on a computer screen and were asked to imagine their child in each situation. By modifying mother's child-cognitions instead of mother's self-cognitions, we circumvented the initial relationship between the two in Creswell et al.'s model (2010), which should serve to increase the potency of the training. Each child-referent scenario consisted of three lines of text, presented one line at a time (mothers had to press the space bar to advance each line or else they advanced themselves after 15 seconds), concluding with a word fragment that they were to complete. The lines of text were ambiguous until the word fragment was reached. Each fragment had only one possible solution that fit the preceding sentences and they consistently disambiguated the scenarios in a positive way (e.g., "Your family recently returned from a big vacation. Your son's Boy Scout leader suggests he give a talk to the troupe about his travels. On the night, he gets up to talk and his legs feel….st--dy.")

Participants were instructed to use their understanding of the descriptive information to guide their solution of the word fragment. They were told to first press the space bar as soon as they knew what the word fragment was, and then press the key representing the first missing letter. The latency of each of these key presses was recorded. If they chose the correct letter, the completed word was presented on the screen for 2 seconds. If they did not choose the correct

letter, nothing happened and they had up to 10 seconds to choose the correct one. If they were unsuccessful after 10 seconds, a reminder flashed on the screen repeating the instructions and they had an additional 10 seconds to solve the word fragment. If they were still unsuccessful, the completed word automatically appeared for 2 seconds. Before beginning the training, mothers completed 5 neutral practice items and were given the opportunity to ask questions.

The other half of the mothers (randomly assigned) participated in the same procedure but their scenarios were disambiguated positively and negatively an equal number of times (e.g., "Your family recently returned from a big vacation. Your son's Boy Scout leader suggests he give a talk to the troupe about his travels. On the night, he gets up to talk and his legs feel…. w-bb--.") It was randomly determined which ones would end positively and negatively and this was consistent across participants in this condition. This served as a neutral, control condition.

The same word fragment was not used more than twice in the whole training. The two conditions had roughly the same number of letters and missing letters in their word fragments. The positive and negative probes were also equal on total number of letters and missing letters. In addition, the IMP and ICC groups were comparable on word frequency, as were the negative and positive probes. The majority of words fell in the top 5000 most frequently used in the English language. The Flesch Reading Ease test rates text on a 100-point scale, with higher scores indicating that it is easier to understand. The Flesch-Kincaid Grade Level test rates text on a U.S. school grade level (e.g., a score of 8.0 means that an eighth grader can understand the document). The current training had a Flesch Reading Ease score of 89.3 and a Flesch-Kincaid Grade Level score of 3.1.

Once the fragment was correctly solved, a comprehension question followed, which could only be answered correctly by using the intended positive or negative interpretation of the

scenario (e.g., "Is your son nervous about the talk?"). The comprehension questions sometimes extended to future emotional implications beyond those actually stated. A "Yes/No" prompt appeared below each question (1 and 0 keys, respectively) and answers were followed by feedback ("Correct!" or "Wrong!") depending on the assigned condition. If mothers did not respond in 10 seconds, they heard a 'ping' sound and a reminder message appeared. If they did not respond in an additional 10 seconds, the correct answer was automatically highlighted. In the example given above, after presentation of the fragment corresponding to *steady,* the correct answer was "No," whereas after the fragment corresponding to *wobbly,* it was "Yes." Therefore, the training enabled mothers to be reinforced for making correctly valenced interpretations, both when solving the word fragment itself and when correctly answering the comprehension question.

All scenarios in both conditions were child-relevant and social in nature, in order to match the anxiety-provoking speech task (see below). Adult-relevant scenarios from Mathews and Mackintosh (2000) and Murphy, Hirsch, Mathews, Smith, and Clark (2007) were modified to fit into a youth context. Scenarios were also pulled from adolescent cognitive bias modification work (Lothmann, Holmes, Chan, & Lau, 2011). The resulting scenarios covered an array of social situations including school, friends, family, performance, sports, extracurricular activities, public speaking, meeting new people, appearance, assertiveness, and interacting with the opposite sex.

Mixed in with the induction scenarios described above were 8 neutral fillers (without emotional content or ambiguity), and 16 probe scenarios (8 positive and 8 negative). The probes took the same form as the induction scenarios but had an identical outcome for all participants, irrespective of condition. The probe trials were included both to make the induction less obvious

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and to assess reaction time for items that were congruent or incongruent with the assigned condition. Scenarios were presented in 8 blocks, with each block consisting of 10 active training items, 1 negative probe, 1 positive probe, and 1 neutral filler. Each of the above social categories was roughly equally distributed among each of the 8 blocks and among the positive and negative probes. Blocks were presented in a randomized order for each participant, and scenarios within each block were also randomized. There were a total of 104 scenarios (80 active training items, 8 negative and 8 positive items, and 8 neutral filler items). Mothers were able to self-pace the presentation of scenarios by pressing the space bar and breaks were built in at the end of every two blocks.

Recognition Test. Following the training all mothers were administered a recognition test in order to confirm the effects of the training (Mathews & Mackintosh, 2000). They were presented with 10 additional 3-line scenarios in a random order that were similar in theme to the IMP/ICC (social situations), but with distinct content. These scenarios were further distinguished from the training scenarios by changing the color of the background screen. In contrast to the training, however, the completed word fragments in this part of the task preserved the ambiguity of the scenario (e.g., "Your daughter has a homework assignment due in her class. When her teacher gives her back the homework, she is surprised because she did not get the grade she….exp--t--.") They also had a brief identifying title (e.g., "Homework Grade.") The comprehension question that followed did not require the mother to make a positive or negative interpretation about the scenario (e.g., "Does your son's teacher hand back his homework?") A practice scenario preceded the 10 descriptions in order to ensure that participants understood the task. After the mother had read all 10 situations, the experimenter administered a short, 2-minute filler task (reverse digit span from the WAIS-IV).

Mothers then came back to the computer for the recognition test, which was used to assess the interpretations that they made on these 10 ambiguous scenarios. In an individually randomized order, mothers saw the identifying title of each scenario, followed by four versions of the final sentence, also in random order. The final sentences reflected a positive target (e.g., "When your daughter's teacher gives her back her homework, she is surprised because she received a much better grade than she expected"), negative target ("When your daughter's teacher gives her back her homework, she is surprised because she received a much lower grade than she expected"), positive foil ("When your daughter's teacher gives her back her homework, she is surprised because he has given her bonus points"), and negative foil ("When your daughter's teacher gives her back her homework, she is surprised because he has left red corrections all over it"). Mothers were told that none of the sentences were worded identically to the associated scenario they read earlier, but that any number of them could be similar in meaning. They were then asked to rate on a 4-point scale how similar in meaning each of the sentences was to the same-titled scenario they read earlier (1 = very different in meaning, 4 = very similar in meaning). They were asked to rate sentences independently of all others. The 10 scenarios were preceded by a practice set of 4 recognition items, which referred to the initial practice description given in the encoding phase.

Booster Training. There is some concern that the process of completing the recognition test, which essentially serves as a manipulation check to see if the training "worked," might unintentionally weaken the effect of the training. In order to address this possibility, all mothers were administered a booster training following the recognition test, which consisted of one additional block of scenarios, identical in format to the 8 blocks administered during the training, but with novel scenarios.

<u>Procedure</u>

Prior to the initial assessment, a brief telephone screen was conducted to assess current anxiety symptoms in mothers and children. The screen also determined if mothers or children met any of the exclusionary criteria. If the mother and child seemed appropriate for the study, an initial assessment session was scheduled. A packet was also sent to them in the mail which included more information on the study, a copy of the informed consent and assent forms to review, and a demographic information form and a measure of general interpretation bias to complete in anticipation of the first session.

At the beginning of the first session the experimenters reviewed the information in the consent and assent forms: the nature and rationale of the study was explained, potential risks and benefits were reviewed, and participants were informed of the limits of confidentiality and told that they could withdraw from the study at any point in time without penalty. The experimenters then answered any questions that participants had before meeting separately with the mother and child. Mothers were asked to sign a consent form for themselves and a permission form for their child in which the risks and benefits of participation in the study were detailed. Children signed a corresponding assent form. Next, mothers were administered a full semi-structured interview concerning their own psychological difficulties. They were also administered a semi-structured interview with regard to their child's anxiety symptoms. Children were simultaneously administered the child-version of this latter interview. Children also completed self-report measures of general interpretation bias, anxiety, anxiety sensitivity, and fear. This initial session lasted an average of 2.5 hours. If deemed eligible, mothers and children were invited back for a second session and randomized to one of the two conditions. The second session occurred on average about 2 weeks following the first.

In the second session, mothers began by completing self-report measures of trait anxiety and anxiety sensitivity, as well as a parent-report measure of their child's anxiety. Experimenters then provided a neutral description of the speech task and subsequently had mothers and children individually complete a measure designed to assess their specific interpretation biases (SIBs; predictions of child's distress, coping, and performance during the task). Experimenters then separated mothers and children, and mothers completed a measure of state anxiety. Next, mothers received either the IMP or ICC training, followed by the recognition test, a second measure of state anxiety (so that change in mood from pre- to post-training could be assessed), and the booster training, as described above. Concurrently, children were hooked up to the physiological equipment and a 10 minute period was observed in order to allow the child to adjust to the apparatus and the equipment to get a stable reading. Next, a series of 5-minute baselines were observed, presented in a fixed order: with the child sitting quietly in a room by themselves, with the child sitting by themselves and reading a standard set of five stories at a 2nd grade reading level (which served as the baseline for the discussion task during which children were also sitting and talking), and with the child standing by themselves and reading a different standard set of five stories at a 2nd grade reading level (which served as the baseline for the speech task during which children were also standing and talking).

Mothers and children were then reunited and reminded of the speech task to be completed, and SIBs were again collected (allowing us to directly test if the training was successful in changing mothers' cognitions). Participants were then told that children vary in how well they do on the task depending on how they approach it. Children were given paper on which to take notes but were told that they would not be able to use their notes during the speech. Mothers and children were subsequently left alone for 5 minutes to discuss and plan for how the

child would go about completing the task. The subsequent interaction was videotaped in order to enable later behavioral coding, as described below. Immediately following this discussion the experimenters re-entered the room and had parents and children complete the same measures of SIBs (allowing us to test if predicted distress coping, and performance changed in children whose mothers had received the IMP).

Children were then escorted to a separate room to take part in the actual speech task, which was also videotaped in order to enable later behavioral coding (as described below). Mothers were separately escorted to an observation room where they observed their child participating in the task on a television screen. Following completion of the speech, mothers and children rated their perception of the child's actual distress, coping, and performance. Children then completed a 5-minute recovery period during which they sat quietly in a room by themselves. General interpretation biases were then re-assessed in mother and children in the same manner as the first session. Finally, mothers and children were fully debriefed. Mothers were also given feedback on the assessment and provided with referral options for themselves and their child if they so desired. The second session also lasted an average of 2.5 hours.

Experimental Task

The speech task was designed to elicit social-evaluative threat in mothers and children. Modifying a methodology used by Heilbron, Prinstein, and Hilt (2008), children were asked to give a 5-minute speech about what makes a good friend while looking straight ahead into a two-way mirror. An experimenter was present in the room and they were told that their mother was watching from behind the mirror. Children were led to believe that as part of the study we were having the kids who come in rate each other's speeches. They were told that we were videotaping their speech so that the next few children who came into the study could rate how

good they thought the speech was. We also told them that when they completed their speech, they would get to watch some speeches given by other children who had already been in the study and rate them in the same way.

If the child ran out of things to talk about during the speech, the experimenter provided a general prompt after 10 seconds of silence ("Please continue, do the best you can"). If there were additional 10 second periods of silence, the experimenter asked more specific questions about the child's speech to help the child keep talking (e.g., "Tell me more about a good friend being loyal.") If the experimenter ran out of things to prompt on, they encouraged the child to get to at least the 3 minute mark ("Please stand here until 3 minutes are up, I'll let you know when. If you think of anything else to say during this time, go ahead and talk about it.") Only 1 child was unable to talk for 5 minutes but made it to the 3-minute mark. In addition, the experimenter monitored the child for strong signs of anxiety (e.g., crying, becoming visibly upset) and gave the child the option to stop if these were present ("You may stop at any point in time if you no longer wish to continue.") Two children did not make it to the 3-minute mark due to strong signs of distress and subsequently opting to stop the speech.

The rationale behind the use of this task was threefold. First, social-evaluative threat is one of the most common areas of anxiety for both adults and children. Second, the speech task is the most commonly used paradigm in the child anxiety literature. And third, we believe that in planning for this task with their child, there was ample opportunity for mothers to exhibit anxious behavior, and therefore for the transmission of anxiety to occur. The topic of friendship was chosen because anxious children have significant peer difficulties (Ollendick et al., 2010). Because past researchers have postulated that their speech task wasn't anxiety-provoking enough

(Cobham et al., 1999), the idea that the child is being evaluated by peers was included in order to increase the strength of the manipulation.

Measures

Measures included a variety of assessments across multiple informants, including clinician-rated interviews, child self-reports, parent reports, and blind observer ratings. Measures included those designed to assess clinical status of mothers and children, maternal anxiety, child anxiety, general and specific interpretation biases, maternal behavior during the discussion, and child behavior and physiology during the tasks. The assessment instruments are organized into categories based on these constructs. All of the measures were determined based on their sound psychometric properties and they were deemed to be the most theoretically appropriate.

Measures of Clinical Status

Anxiety Disorders Interview Schedule for DSM-IV Lifetime (ADIS-IV-L; Di Nardo et al., 1994). The ADIS-IV-L in a semi-structured interview that assesses all of the major disorders of adulthood in the DSM-IV, including anxiety disorders, depression, somatoform disorders, substance abuse and dependence, and psychotic disorders. Clinicians elicit ratings of distress and impairment for each diagnosis from the interviewee, which enables an overall impairment rating from 0 to 8 to be assigned (e.g., 0 = absent; 8 = very severely disturbing/disabling). A severity rating of 4 or above is generally accepted as being indicative of a clinical diagnosis. For the purposes of this study, a severity rating of 3 indicated a subclinical diagnosis. This instrument was administered by trained graduate-level clinicians and diagnoses were reviewed by a licensed clinical psychologist. The ADIS-IV-L has shown excellent psychometric properties, with high levels of inter-rater and test-retest reliability (Brown, Di Nardo, Lehman, & Campbell, 2001). This structured diagnostic interview was videotaped and a randomly selected group of 33% of

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the interviews was reviewed by trained graduate clinicians in order to assess reliability. The resulting kappa coefficients were as follows: primary diagnosis = 0.88, secondary diagnosis = 0.79, and tertiary diagnosis = 0.91. Intraclass correlation coefficients were also computed on the clinician severity ratings: primary diagnosis = 0.65, secondary diagnosis = 0.66, and tertiary diagnosis = 0.94.

Anxiety Disorders Interview Schedule, Child and Parent Version (ADIS-IV-C/P; Silverman & Albano, 1996). The ADIS-IV-C/P is a semi-structured interview that assesses the major DSM-IV disorders of childhood, including anxiety, mood, and externalizing behavior disorders. For the purposes of the current study, only the anxiety disorder sections were administered**.** The interview was administered by two trained graduate-level clinicians who interviewed the parent and child separately. Each diagnosis was assigned a clinical severity rating (CSR), which reflects the level of impairment the disorder reflects in the child. CSRs of four or above on an eight-point scale (e.g., 0 = none; 2 = a little bit; 4 = some; 6 = a lot; and 8 = very, very much) are considered to be clinical diagnoses, while CSRs of 3 were considered subclinical diagnoses for the purposes of this study. Assigned diagnoses from both parent and child clinicians were reviewed by a licensed clinical psychologist and then combined into composite diagnoses according to the ADIS-IV-C/P manual. The ADIS-C/P has shown excellent psychometric properties, with high levels of inter-rater and test-retest reliability (Silverman, Saavedra, & Pina, 2001). These structured diagnostic interviews were videotaped and a randomly selected group of 33% of parent interviews and 33% of child interviews were reviewed by trained graduate clinicians in order to assess reliability. The resulting kappa coefficients were as follows for child interviews: primary diagnosis = 0.78, secondary diagnosis = 0.79, and tertiary diagnosis = 0.87 and parent interviews: primary diagnosis = 0.78, secondary diagnosis =

0.72, and tertiary diagnosis = 0.71. Intraclass correlation coefficients were also computed on the clinician severity ratings for child diagnoses: primary diagnosis = 0.81, secondary diagnosis = 0.76, and tertiary diagnosis = 0.91 and parent diagnoses, primary diagnosis = 0.67, secondary diagnosis = 0.63, and tertiary diagnosis = 0.58.

Measures of Maternal Anxiety

State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The STAI is a 40-item self-report measure that indicates the intensity of feelings of anxiety. It distinguishes between state anxiety (i.e., a temporary condition experienced in specific situations) and trait anxiety (i.e., a general tendency to feel anxious), with each being assessed via 20 items (STAI-S and STAI-T). All items are rated on a 4-point scale (1 = "Almost Never," 4 = "Almost Always"), with higher scores indicating greater anxiety. It has been shown to have excellent test-retest reliability and discriminant validity (Oei, Evans, & Crook; 1990; Rule & Traver, 1983). In the current study Cronbach's alpha was found to be very high at 0.93 for the STAI-T, and also for the STAI-S (0.94 at time 1 and 0.93 at time 2).

Anxiety Sensitivity Index (ASI; Peterson & Reiss, 1993). The ASI is a 16-item measure used to assess beliefs about the social and somatic consequences of anxiety symptoms. Items are rated on a 4-point scale ("Very Little," "A Little," "Some," "Much," and "Very Much,") with higher scores being indicative of great sensitivity to anxiety symptoms. The ASI has been found to have good reliability and validity (Peterson & Heilbronner, 1987; Vujanovic, Arrindell, Bernstein, Norton, & Zvolensky, 2007). Cronbach's alpha in the current study was 0.89.

Measures of Child Anxiety

Spence Children's Anxiety Scale - Child and Parent Report Versions (SCAS-C and SCAS-P; Spence, 1998; Nauta, Scholing, Rapee, Abbott, Spence & Waters, 2004). The SCAS-C assesses the severity of anxiety symptoms broadly in line with the anxiety disorders of DSM-IV. The measure consists of 44 items, of which 38 reflect anxiety symptoms and 6 are positive, filler items to reduce negative response bias. Children are asked to rate the degree to which they experience each symptom on a 4-point frequency scale (0 = "Never," 1 = "Sometimes," 2 = "Often," and 3 = "Always.") The scale assesses six domains of anxiety including generalized anxiety, panic/agoraphobia, social phobia, separation anxiety, obsessive compulsive disorder, and physical injury fears. All scales are summed to compute a total score, which is what was used in the current study. This measure has been found to have good reliability and validity (Essau, Muris, & Ederer, 2002) in the past and in the current study Cronbach's alpha was very high at 0. 91. The SCAS-P consists of 38 items reflecting anxiety and is used to assess parent's understanding of their child's anxiety symptoms. Items are rated on the same 4-point scale and the same six domains of anxiety are derived, as well as a total score. Internal consistency in this study was 0. 87.

Fear Survey Schedule for Children - Revised (FSSC-R; Ollendick, 1983.) This is an 80-item questionnaire that is used to obtain a measure of fear in children. On this survey schedule, children are asked to indicate their level of fear of various stimuli and situations on a three-point scale (1= "None," 2 = "Some," and 3 = "A lot.") There are five subscales of this measure: fear of failure and criticism, fear of the unknown, fear of animals/minor injuries, fear of danger and death, and medical fears. Total scores are determined by summing responses to the 80 items, and this is the score used in the present study. High internal consistency ratings have been reported for American children (a = .95; Ollendick, King, & Frary, 1989). Cronbach's alphas for the

subscales range from .65 - .91. Similarly, test-retest reliability estimates for this measure have been shown to be acceptable (King & Ollendick, 1993; Ollendick, 1983). In this study Cronbach's alpha for the total score was 0.97.

Childhood Anxiety Sensitivity Index (CASI; Silverman, Fleisig, Rabian, & Peterson, 1991). The CASI, adapted from the adult version of the ASI, is an 18-item measure assessing anxiety sensitivity, the fear of anxiety-related symptoms and sensations. Children were asked to rate each item using a 3-point Likert scale of none, some, or a lot, with total scores ranging from 18-54. The CASI has been found to have adequate internal consistency and reliability in both clinical and nonclinical populations (Silverman et al., 1991). Internal consistency in the current study was 0.91.

Measures of General Interpretation Bias

Ambiguous Scenarios Questionnaire - Child (ASQ-C; Barrett et al., 1996). Children were presented with 12 ambiguous scenarios that could be interpreted as either threatening or non-threatening. Six have a social theme while the other six reflect physical concerns. Children rated how distressed they would be and how much control they would feel in each situation on a 10-point Likert scale. These scores were summed to get a total score for distress and control. Cronbach's alpha for the distress scale was 0.85 in session 1 and 0.91 in session 2; for the control scale it was 0.84 in session 1 and 0.85 in session 2.

For each situation, children are also asked "What do you think is most likely to have happened?" and their response is later coded as threatening or non-threatening. Following this free response, children are presented with a threat and non-threat interpretation and asked to indicate which of the two is most likely. The correlations between open and forced-choice responses were high ($r = .79$ in session 1 and $r = .84$ in session 2), and the number of threat

choices were therefore summed across the two response types for a total score out of 24. In addition, total threat and total distress was found to be highly correlated ($r = 0.57$ in session 1 and $r = 0.59$ in session 2), and so these scales were also summed to create a variable for combined threat interpretation/distress. Children are also asked what they would do if they were in each of the situations and their responses were later coded as avoidant or non-avoidant. The number of avoidant responses was summed to get a total score out of 12.

A randomly selected group of 33% of the ASQ-C's were coded a second time for threat and avoidance by trained graduate clinicians in order to assess reliability. The 12 open threat and 12 avoidant responses were summed and intraclass correlation coefficients were calculated: free threat was 0.91 in session 1 and 0.83 in session 2, avoidance was 0.96 in session 1 and 0.97 in session 2. This measure has previously demonstrated good reliability as well (Creswell et al., 2006; Creswell & O'Connor, 2006).

Ambiguous Scenarios Questionnaire - Parent Child (ASQ-PC; Creswell & O'Connor, 2006). Mothers were presented with the same 12 ambiguous scenarios from the ASQ-C and asked to predict their child's distress, control, interpretations, and responses. Responses were summed in exactly the same way as reported above for the ASQ-C. Cronbach's alpha for the distress scale was 0.77 in session 1 and 0.85 in session 2; for the control scale it was 0.85 in session 1 and 0.90 in session 2. The correlations between open and forced-choice threat responses were high ($r = .79$ in session 1 and $r = .73$ in session 2), and the number of threat choices were therefore summed across the two response types for a total score out of 24. In addition, total threat and total distress was found to be highly correlated ($r = 0.71$ in session 1 and $r = 0.65$ in session 2), and so these scales were also summed to create a variable for combined threat interpretation/distress.

Mothers also rated their own predicted control over their child's feelings and their child's behaviors on 10-point Likert scales ("When you are with your child later on, how much can you change how they feel about this?" and ("How much could you change what your child does if this happened again") and these scores were summed to get total scores for predicted control over feelings and predicted control over behaviors. Cronbach's alphas for predicted control over feelings was 0.87 in session 1 and 0.94 in session 2; for predicted control over behaviors it was 0.89 in session 1 and 0.95 in session 2. These scales were found to be highly correlated with each other ($r = .92$ in session 1 and $r = .93$ in session 2) and also with parent's ratings of control child has over the situation ($r = .65$ and $r = 0.81$ in session 1 and $r = .60$ and $r = 0.65$ in session 2), and all 3 scales were therefore summed to get a total score for mother's perceived control.

A randomly selected group of 33% of the ASQ-P's were coded a second time for threat and avoidance by trained graduate clinicians in order to assess reliability. The 12 open threat and 12 avoidant responses were summed and intraclass correlation coefficients were calculated: free threat was 0.94 in session 1 and 0.96 in session 2; avoidance was 0.91 in session 1 and 0.90 in session 2. This modified version of the ASQ-C has previously shown good reliability as well (Creswell et al., 2006; Creswell & O'Connor, 2006).

Measures of Specific Interpretation Bias

Predicted Distress, Coping, and Performance Scale - Child (PDCP-C; Chorpita & Barlow, 1998; Cobham et al., 1999). Slightly modifying questions used in previous measures, the PDCP-C presented children with three questions regarding the speech task. Using 7-point Likert scales, children were asked "How upset do you think you'll be during this task?" "How well do you think you'll be able to help yourself feel less upset during this task?" and "How good do you think you'll be at performing this task?" This measure was administered both before

and after the mothers completed their training and again after the discussion task. These questions were only highly correlated at time 3 and therefore were looked at as individual items. The scales that this measure was adapted from have demonstrated acceptable reliability (Cobham et al.; Kendall, 1994).

     Predicted Distress, Coping, and Performance Scale - Parent Child (PDCP-PC; Chorpita & Barlow, 1998; Cobham et al., 1999). The three questions above were slightly reworded in order to assess mothers' predictions of their child's distress, coping, and performance on the speech task. This measure was administered at the same time points as the PDCP-C. Scores on the three scales of the PDCP-PC (distress, coping, and performance) were found to be significantly correlated at each of the three time points (pre-training from $r = 0.43$-0.65; post-training from $r = 0.40$-0.69; post-discussion from $r = 0.43$-0.59). Therefore distress was reverse-scored and the three scales were summed in order to form a total score for mother's specific interpretation bias, with higher scores indicating more positive expectations of their child. Internal consistency was found to be acceptable in the current study at time 1 ($\alpha = 0.76$), time 2 ($\alpha = 0.75$), and time 3 ($\alpha = 0.76$).

Measures of Maternal Behavior

     Independent coders followed a recently established protocol to assess maternal behavior during the discussion task with children (Murray et al., 2012). Content scales were divided into those of negative valence (anxiety, passivity, promotion of avoidance, overprotection, and intrusiveness), positive valence (warmth, facilitation, engagement, and encouragement), and those that entailed looking at the mother-child relationship (sensitive responsiveness and quality of relationship). Narrative codes were also assessed, including those that were negative (criticism, threat augmentation, and vulnerability promotion) and positive in valence (praise,

threat minimization, and vulnerability minimization). All maternal behaviors were rated on a 5-point scale (1 = none, 5 = pervasive/strong), with the exception of promotion of avoidance (which was rated on a 3-point scale), and criticism and praise (which were count variables). All scales were rated for each of the 5 minutes and then an average (or total count) was calculated. Coders were undergraduate and graduate research assistants who were trained to within 80% reliability before beginning work on the project. Discussion tasks from the first 4 participants were used for training purposes, so a total of 51 were included in the analyses. Coders were blind to mother's training condition.

A random sample of an additional 33% of the mother-child discussions were coded for parent behavior by trained graduate research assistants in order to ensure reliability. Two-way mixed consistency models were run on all scales and the resulting single measures intraclass correlation coefficients (ICCs) were used. Three of the 17 scales were found to have no variance and were thus not used: overprotection, promotion of avoidance, and criticism. Two additional scales had unacceptable reliability and were also not used: anxiety and threat augmentation. The remaining scales were found to have reliability in the moderate to very good range: warmth = 0.75, intrusiveness = 0.65, passivity = 0.72, facilitation = 0.57, engagement = 0.60, encouragement = 0.70, sensitive responsiveness = 0.79, quality of relationship = 0.72, praise = 0.84, threat minimization = 0.53, vulnerability promotion = 0.75, and vulnerability minimization = 0.87.

In an attempt to decrease the number of dependent variables, and following the protocol of the developer of this coding scheme (Murray et al., 2012), we combined some highly correlated scales together. Sensitive responsiveness and quality of relationship were correlated at 0.70 and were combined to form a general positive relationship scale. Warmth, facilitation,

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encouragement, and engagement were all highly correlated with one another (0.543-0.722) and were combined to form a general maternal positivity scale.

Measures of Child Behavior

Actual Distress, Coping, and Performance Scale - Child (ADCP-C). Following completion of the speech task, children were administered a second rating form consisting of three questions slightly reworded from those above to assess their actual perceived distress, coping, and performance during the speech. Using a 7-point Likert scale, children were asked "How upset were you during that task?" (1 = not at all upset, 7 = extremely upset), "How well were you able to help yourself feel less upset during that task?" (1 = not at all able to help myself feel less upset, 7 = completely able to help myself feel less upset), and "How good were you at performing this task?" (1 = not at all good, 7 = extremely good). Scores on the three scales of the ADCP-C (distress, coping, and performance) were found to be significantly correlated ($r = 0.44$-0.77). Therefore distress was reverse-scored and the three scales were summed in order to form a total score for child-report on their behavior during the speech, with higher scores indicating more positive expectations of their child. Internal consistency was found to be good ($\alpha = 0.83$).

Actual Distress, Coping, and Performance Scale - Parent Child (ADCP-PC). Mothers also rated how they perceived their child's actual distress, coping, and performance during the speech task. Questions were slightly reworded from those above. Scores on the three scales of the ADCP-PC (distress, coping, and performance) were found to be significantly correlated ($r = 0.48$-0.74). Therefore distress was reverse-scored and the three scales were summed in order to form a total score for mother-report on child's behavior during the speech, with higher scores indicating more positive expectations of their child. Internal consistency was found to be good ($\alpha = 0.83$).

Behavioral Observation of Children. Independent coders followed a recently established protocol to assess child behavior during the discussion task with mother and during the speech (Murray et al., 2012). Children were rated on the following scales: anxiety, avoidance, non-compliance, and engagement. All behaviors were rated on a 5-point scale: 1 = none, 5 = pervasive/strong. Additionally, two new 5-point Likert scales were developed to rate children's performance on the speech task (both content and presentation style). Specific examples were provided for each anchor to aid in the reliability of coding. Coders also counted the total number of general and specific prompts given by the experimenter. All scales were rated for each of the 5 minutes and then an average (or total count) was calculated. Discussion tasks from the first 4 participants were used for training purposes, so a total of 51 discussions were included in the analyses. This was also the case for speeches and, as noted, 2 children were too anxious to complete the speech (as noted above), and 3 speeches were lost due to video recording malfunction, resulting in 46 speeches included in the current analyses. Coders were blind to mother's training condition.

A random sample of an additional 33% of the mother-child discussions and child speeches were coded for child behavior by trained undergraduate and graduate research assistants in order to ensure reliability. Two-way mixed consistency models were run on all scales and the resulting single measures intraclass correlation coefficients (ICCs) were used. All 4 scales during the discussion were found to have reliability in the strong to almost perfect range: anxiety = 0.876, noncompliance = 0.732, avoidance = 0.952, and engagement = 0.803. Scales during the speech were found to have reliability in the fair to very good: anxiety = 0.828, noncompliance = 0.403, avoidance = 0.891, engagement = 0.827, content = .814, and style = .711. Due to low reliability of non-compliance during the speech, this scale was not used in the

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analyses.

<u>Apparatus</u>

IMP/ICC. The training was programmed using E-Prime (Psychology Software Tools, 2008) version 2.0 software. It was presented visually on a PC-compatible computer and responses were collected on a standard keyboard.

Physiological Equipment. Physiological data was collected with the LifeShirt®, a continuous ambulatory monitoring system. The LifeShirt® is a lightweight vest into which physiologic sensors are sewn that collect continuous HR and HRV data. Power estimates ($msec^2$) in the high frequency bandwidth (0.15-0.4 Hz) were used as an estimate of vagal influence on cardiac chronotropy (i.e., HRV; Allen, Chambers, & Towers, 2007). A galvanic skin response sensor was plugged into the serial port of the LifeShirt so that skin conductance level (SCL) was also a part of the digital data stream. HR and SCL are measures of sympathetic activation, whereas HRV is a measure of parasympathetic activation. VivoSense analysis software was used to analyze the physiological data. These data were collected during the discussion task, speech task, and their corresponding baseline periods. The difference scores from baselines to tasks served as indices of negative emotional arousal during the speech.

<div align="center">Results</div>

<u>Data Analytic Plan</u>

Power analyses were conducted to ensure that there was a large enough sample size for the proposed analyses (Faul & Franz, 1992). Past studies have shown effect sizes on recognition ratings mostly in the large range of at least $d = 0.8$ (Cohen, 1988; Mathews, Ridgeway, Cook, & Yiend, 2007; Murphy et al., 2007), although some have evidenced small-medium effect sizes in the range of 0.39 to 0.77 (Salemink, van den Hout, & Kindt, 2009). When looking at subsequent

emotional vulnerability, Murphy et al. showed effect sizes of 0.39 and 0.62. Accordingly, we assumed a small-medium effect size of $d = 0.4$, two-tailed analyses, power of 0.8, and alpha of 0.05. This resulted in required total sample sizes for the various ANOVAs and MANOVAs ranging from 52 to 68. Thus, our original sample size of 70 was determined to be sufficient to detect small-medium effect sizes. As noted, 55 participants were available for the present analyses; however, we may not currently have sufficient power to find true effect sizes with the 55 participants. As a result, we decided to set a more conservative p-value of 0.1, as has been suggested when low power is a significant concern (McClelland, 2000). All missing data was determined to be missing completely at random and maximum likelihood via the expectation-maximization (EM) algorithm was used.

Demographic, Diagnostic, and Questionnaire Data

The experimental and control groups were compared on all demographic variables and no significant differences were found, indicating that our groups were comparable at baseline (see Table 3). The two groups were also compared on diagnostic information and questionnaire measures; again there were no significant differences between groups (See Table 4). Lastly, group scores on the ASQ-C and ASQ-PC in session 1 were assessed to ensure that groups were not significantly different on general interpretation bias before undergoing the training. This entailed two MANOVAs, one comparing the IMP and ICC groups on ASQ-C scales and the other on ASQ-PC scales. The results indicated that the two groups were comparable at baseline, $F(3, 51) = 1.13$, $p = 0.35$, $\eta\rho^2 = .06$ and $F(3, 51) = 0.82$, $p = 0.49$, $\eta\rho^2 = .05$, respectively.

Effectiveness of IMP

In order to test the effectiveness of IMP in changing interpretive style, reaction times to the positive and negative probes were analyzed with a mixed model ANOVA with group (IMP

vs. ICC) as the between subjects factor and probe valence (positive vs. negative) and time (first vs. second half of the training) as the within-subject factors. Time was included to enable examination of the development of training effects on interpretations. Trials where an incorrect response was given were omitted from the analysis (5.7% of all trials), as were trials where the mother did not provide a response within the first 10 seconds (3.9%). There were a handful of trials (0.8%) in which mothers pressed the space bar (to indicate that they knew what the word fragment was) in less than 500ms. For all of these cases, mothers then took an extended amount of time to press the key identifying the first missing letter. It was assumed that they pressed the space bar prematurely and 500ms was therefore added to half of the amount of time it took them to press the correct key, in order to get a more accurate estimate of reaction time. Means and standard deviations for reaction time data are illustrated in Table 5.

Results showed that there was a main effect of time, $F(1, 52) = 5.24$, $p < .05$, $\eta \rho^2 = .09$, indicating that faster responses were given in the second half of the training. There was also a main effect of probe, $F(1, 52) = 8.98$, $p < .01$, $\eta \rho^2 = .15$, indicating that participants responded faster to positive probes, and a main effect of group, $F(1, 52) = 3.54$, $p < 0.1$, $\eta \rho^2 = .06$, indicating that ICC participants responded faster overall than IMP participants. More importantly, the predicted Group X Probe interaction effect was significant, $F(1, 52) = 20.05$, $p < .001$, $\eta \rho^2 = .28$, confirming the effectiveness of the training. While the control group did not react differently to negative and positive probes (2266ms, $SD = 909$ and 2372ms, $SD = 846$, $t(25) = 1.04$, $p = .31$), participants who were exposed to the IMP displayed a marked slowing in reacting to negative (3066ms, $SD = 1005$) as compared to positive probes (2231ms, $SD = 836$, $t(28) = 4.50$, $p < .001$, see Fig. 1).

The second test of induced interpretations was the recognition test, which was completed immediately following the training. A mixed model ANOVA with group as the between-subjects factor and valence (positive vs. negative) and sentence type (target vs. foil) as the within-subject factors was performed. Means and standard deviations are displayed in Table 6. The results revealed a main effect of valence, $F(1, 53) = 114.39$, $p < .001$, $\eta\rho^2 = .68$, with positive sentences being endorsed more than negative sentences, and a main effect of sentence type, $F(1, 53) = 67.09$, $p < .001$, $\eta\rho^2 = .56$, indicating greater endorsement of probable interpretations than of foils. In addition, there was a significant Group x Valence interaction, $F(1, 53) = 4.69$, $p < .05$, $\eta\rho^2 = .08$. While the two groups did not differ on their ratings of positive interpretations (ICC 2.70, $SD = .43$ and IMP 2.80, $SD = .39$, $F(1, 53) = .82$, $p = .37$), the ICC group endorsed negative interpretations more highly (1.98, $SD = .43$) than the IMP group (1.72, $SD = .53$, $F(1, 53) = 4.05$, $p < .05$, see Fig. 2).

We also tested for the effects of the training on mother's state anxiety. A 2 x 2 ANOVA on total scores on the STAI-S revealed a main effect for time, $F(1, 53) = 5.17$, $p < .05$, $\eta\rho^2 = .09$, meaning that state anxiety increased similarly for both the IMP (before 33.07, $SD = 9.85$ and after 37.62, $SD = 12.11$) and ICC groups (before 36.92, $SD = 11.47$ and after 38.04, $SD = 13.75$).

Effect of Training on Mothers Specific Interpretation Bias

We hypothesized that the interpretation modification procedure would result in decreased child-referent anxious cognitions among mothers. More specifically, for mothers who received the IMP, scores on the PDCP-PC would increase significantly from pre- to post-training (more positive predictions), whereas they would remain the same for mothers in the ICC. Total scores were entered into a mixed-model ANOVA with group (IMP vs. ICC) as the between-subjects factor and time (pre-training vs. post-training) as the within-subjects factor. The means and SD's

are shown in Table 7. Results revealed a significant effect of time, $F(1, 53) = 3.94$, $p < 0.1$, $\eta\rho^2 =$ .09, indicating that across participants there was an increase in positive predictions from pre- to post-training. There was also a significant group X time effect, $F(1, 53) = 3.38$, $p < 0.1$, $\eta\rho^2 =$ .06, which is depicted in Figure 3. Post-hoc tests showed that while the ICC group did not differ on specific interpretation bias over time, $t(1, 25) = .11$, $p = .91$, the IMP group developed more positive expectations of how their child would do on the speech following the training, $t(1, 28) =$ 2.60, $p < .05$.

Effects of Training on Maternal Behavior during the Discussion Task

We hypothesized that the IMP would result in less anxious maternal behavior during the discussion, as compared to the ICC group. A MANOVA was conducted with group (IMP vs. ICC) as the between-subjects factor and the various scales from our maternal behavior coding scheme as dependent variables: general maternal positivity, general positive relationship, intrusiveness, passivity, praise, threat minimization, vulnerability promotion, and vulnerability minimization. The MANOVA was significant, $F(8, 42) = 2.07$, $p < 0.1$, $\eta\rho^2 = .28$. Examination of the resulting ANOVAs revealed significant group differences on general maternal positivity, $F(1, 49) = 4.48$, $p < .05$, $\eta\rho^2 = .08$, and threat minimization, $F(1, 49) = 3.21$, $p < 0.1$, $\eta\rho^2 = .06$. Examination of the means (see Table 8) revealed that mothers who received the IMP training were rated as more positive (a summed variable comprising warmth, facilitation, encouragement, and engagement) during the discussion with their child, whereas mothers who received the ICC training were rated as more threat minimizing.

Effects of Training on Child Behavior during the Discussion Task

Given the high level of anxiety in children in this study, and the knowledge that the relationship between parenting behavior and child anxiety is indeed reciprocal (Hudson, Doyle,

& Gar, 2009), it is reasonable to assume that how mother's interact with their child may be colored by how anxious their child is. Therefore, we decided to use the same coding scheme as during the speech task to also quantify child behavior during the discussion task with mothers. Noncompliance, avoidance, and engagement were found to be highly correlated ($r = 0.74$-0.87) and were thus summed to create one variable reflected general avoidance of the discussion task. A MANOVA was conducted with group (IMP vs. ICC) as the between-subjects factor and the scales from our child discussion behavior coding scheme as dependent variables: anxiety and general avoidance as described above. The MANOVA was not significant, $F(1, 48) = 1.35$, $p = .27$, $\eta\rho^2 = .05$, indicating that child behavior during the discussion task was similar across both training groups.

Effects of Discussion Task on Child Specific Interpretation Bias

We hypothesized that children of mothers in the IMP group would have decreased specific interpretation biases following the discussion with their mother, as compared to children of mothers in the ICC group. The three scales of distress, coping, and performance were entered into a mixed model MANOVA with group (IMP vs. ICC) as the between-subjects factor and time (pre-discussion vs. post-discussion) as the within-subject factor. There were no significant main effects for group, $F(3, 51) = 1.63$, $p = .19$, $\eta\rho^2 = .09$, or time, $F(3, 51) = 2.13$, $p = .11$, $\eta\rho^2 = .11$. In addition, the group X time interaction was also non-significant, $F(3, 51) = 0.68$, $p = .57$, $\eta\rho^2 = .04$, indicating that the expectations for the speech task of children in both groups remained consistent from pre- to post-discussion.

Effects of Training on Child Behavior during the Speech Task

We predicted that children in the IMP group would be less anxious and perform better on the speech task as compared to those in the ICC group. This was assessed via observational

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coding, parent-report, and child-report. First, a MANOVA was conducted with group (IMP vs. ICC) as the between-subjects factor and the various scales from our child speech coding scheme as dependent variables: anxiety, avoidance, engagement, content, and style. The MANOVA was non-significant, $F(5, 40) = 0.70$, $p = .63$, $\eta\rho^2 = .08$, indicating that child behavior during the speech task was similar across both training groups. Second, two ANOVAs were conducted with group (IMP vs. ICC) as the between-subjects factor and total scores on the ADCP-C and ADCP-PC as dependent variables. Similar to the behavioral coding, no group differences were found on either child report, $F(1, 53) = 0.62$, $p = 0.44$, or parent-report, $F(1, 53) = 0.96$, $p = 0.33$.

Effects of Training on Child Physiology during the Speech Task

We predicted that children whose mothers were in the IMP group would evince less physiological arousal during the speech on the measures of HR and SCL, as well as higher rates of HRV. Change rates were calculated from speech to the standing baseline in order to account for individual differences in baseline physiology. A MANOVA as conducted with group (IMP vs. ICC) as the between-subjects factor and change in physiological indices as the dependent variables. The MANOVA was nonsignificant, $F(3, 47) = 1.18$, $p = .34$, $\eta\rho^2 = .11$, indicating that the training groups reacted similarly to the speech task in terms of their physiology.

Effect of Training on General Interpretation Bias in Mothers and Children

Lastly, we predicted that the IMP training would result in decreased parent and child general interpretation biases from session 1 to session 2, whereas they would stay the same for the ICC group. Scores on the ASQ-C and ASQ-PC were entered into two separate mixed model MANOVAs with group (IMP vs. ICC) as the between-subjects factor and time (session 1 vs. session 2) as the within-subjects factor. The MANOVA with the ASQ-C subscales as dependent variables revealed a significant effect of time, $F(3, 51) = 4.70$, $p < .01$, $\eta\rho^2 = .22$. Subsequent

univariate tests revealed that time was significant on the combined interpretation threat/distress, $F(1, 53) = 4.84$, $p < .05$, $\eta\rho^2 = .08$ and control scales, $F(1, 53) = 9.29$, $p < .01$, $\eta\rho^2 = .15$. Review of means and *SD*'s (see Table 9) revealed that across groups, ratings of threat/distress decreased from session 1 to session 2, while ratings of control increased during that time period. The MANOVA with the ASQ-PC subscales as dependent variables also revealed a significant effect of time, $F(3, 51) = 9.25$, $p < .001$, $\eta\rho^2 = .35$. Univariate tests revealed that time was significant on the combined threat/distress scale, $F(1, 53) = 25.82$, $p < .001$, $\eta\rho^2 = .33$, and the avoidance scale, $F(1, 53) = 2.85$, $p < 0.1$, $\eta\rho^2 = .05$. Review of means (see Table 9) revealed that across groups, ratings of threat/distress and avoidance decreased from session 1 to session 2.

Exploratory Analyses

We wanted to investigate whether there was a relationship between strength of the training effects and mothers' subsequent cognitions and behavior. Two bias scores were created: one by subtracting the reaction time for positive probes from the reaction time for negative probes, with higher scores indicating faster reaction to positive probes; and one by subtracting negative recognition ratings from positive recognition ratings, with higher scores indicating higher endorsement of positive interpretations in the recognition test. For mothers' cognitions, we created a change score by subtracting PDCP-P pre-training scores from PDCP-P post-training scores, with positive scores indicating that positive predictions had increased as anticipated. Lastly, we looked at general maternal positivity during the discussion task. Correlations were examined among all variables and results are depicted in Table 10. Maternal positivity during the discussion task was found to be significantly correlated with both faster reaction times during training and more positive interpretations on the recognition test following training. Stronger training effects were not related to changes in SIB.

In addition, we also wanted to assess if our results would be similar if we examined only

the mothers who met our original inclusion criteria of a clinical diagnosis of GAD, SoPh, and/or

PD. All main analyses were therefore re-run with this subsample of 40 mothers (21 IMP, 19

ICC). For most analyses the results were very similar, with the exception of the following. In the

examination of reaction time data during the training, the main effect of time was not significant.

In looking at change in mother's specific interpretation bias from pre- to post-training, the effect

size of the group x time interaction was found to be larger: $F(1, 53) = 3.38$, $p < 0.1$, $\eta\rho^2 = .06$

compared to $F(1, 38) = 5.74$, $p < .05$, $\eta\rho^2 = .13$. In looking at mother's behavior during the

discussion, the effect size of the overall MANOVA was found to be larger: $F(8, 42) = 2.07$, $p <$

0.1, $\eta\rho^2 = .28$ compared to $F(8, 28) = 2.23$, $p < 0.1$, $\eta\rho^2 = .39$; however the effect size on general

maternal positivity was found to be the same. Additionally, no group difference was found on

threat minimization.

More striking differences were found on the ASQ-PC. There was a bigger overall effect

of time: $F(3, 51) = 9.25$, $p < .001$, $\eta\rho^2 = .35$ compared to $F(3, 36) = 8.98$, $p < .001$, $\eta\rho^2 = .43$.

Unlike the full sample, there was also a significant main effect of group, $F(3, 36) = 2.37$, $p < 0.1$,

$\eta\rho^2 = .17$, and a significant group x time interaction, $F(3, 36) = 2.38$, $p < .001$, $\eta\rho^2 = .17$. None of

these differences were seen on the avoidance scale (as was the case for time in the full sample),

but they were all observed on the combined threat/distress scale. There was a bigger effect of

time on this scale than previously: $F(1, 53) = 25.82$, $p < .001$, $\eta\rho^2 = .33$ compared to $F(1, 38) =$

24.90, $p < .001$, $\eta\rho^2 = .40$. There was also a significant main effect of group, $F(1, 38) = 7.49$, $p <$

$.01$, $\eta\rho^2 = .17$, indicating that scores were overall lower for the IMP group, and a significant

group x time interaction, $F(1, 38) = 6.54$, $p < .05$, $\eta\rho^2 = .15$. This interaction is depicted in Figure

4. One-way ANOVAs revealed that while the groups did not differ on general threat/distress

interpretations at session 1, $F(1,38) = 2.68$, $p = .11$, the IMP group was significantly lower on this scale at session 2, $F(1,38) = 11.81$, $p < .01$.

Discussion

The current study aimed to assess the feasibility of an interpersonal cognitive bias modification paradigm within mother-child dyads. Clinically anxious mothers were exposed to ambiguous scenarios relevant to their child, rather than relevant to themselves as has been done in prior research in this area. Those in the positive condition were trained to interpret these situations in a benign manner and were subsequently positively reinforced for using these benign interpretations to solve related comprehension questions. Mothers in the neutral condition were trained to interpret the situations in a benign and threatening manner an equal number of times.

The first aim of the study was to assess whether the training could successfully modify mother's interpretations about ambiguous situations for their child, which was assessed in two ways. In looking at reaction time data for positive and negative probes, it was found that while the control group did not differ in how quickly they responded to each type of valence, those in the positive group were significantly slower to react to negative as compared to positive probes. So rather than the training helping anxious mothers to choose benign interpretations more quickly, it appears that it made it more difficult for them to see a threatening outcome when it was actually indicated by the word fragment. This is consistent with past research using the same paradigm but in an intrapersonal manner (Salemink et al., 2009; Salemink & Wiers, 2012). However, we failed to replicate past research which showed that those who received an IMP training were significantly faster to complete positive probes compared to individuals who were in an ICC group (Salemink & Wiers, 2011), as there were no group differences on reaction times to positive probes in the current study.

The second test of induced interpretations was the recognition test, which presented mothers with new ambiguous scenarios following the training to see how they would interpret them. It was found that both groups endorsed positive interpretations more highly than negative interpretations. In addition, the two groups similarly endorsed positive interpretations, but the ICC group endorsed negative interpretations more highly than the IMP group. This is in contrast to past research using this paradigm which has shown that positive training increases ratings for positive interpretations (Mathews & Mackintosh, 2000; Salemink et al., 2009). Taken together, these results suggest that our interpersonal training paradigm made anxious mothers less likely to interpret ambiguity in a threatening manner, but no less likely to interpret ambiguity in a positive manner. This may have affected our various outcomes variables, which we turn to now.

In terms of their specific expectations for the speech task at hand, mothers in the IMP condition increased in their level of positive expectations from pre- to post-training (predicted that their children would be less distressed, better able to cope, and more skilled), while the ICC group remained consistent in this regard. This is similar to Vassilopoulos et al. (2009), who found that children who had received positive training later anticipated that they would be significantly less anxious in an upcoming social situation than those in a control group. This study is the first to show such effects in an interpersonal dyad. It is interesting that even though the training did not result in increased positive interpretations in the recognition task (but rather decreased negative interpretations), it worked to increase positive expectations to an in vivo stressor.

These positive expectations in the IMP group appeared to at least partly follow through to the discussion task with children as mothers in this group were rated as being more positive (a summed variable comprising warmth, facilitation, encouragement, and engagement) as compared

to mothers who had received the ICC training. The implication is that because these mothers

expected their children to do better on the task, they were able to engage with their child in a

more positive, less anxious manner. Future research should strive to use mediation analyses to

directly investigate any causal effects that may be present. Inconsistent with predictions, mothers

who had received the ICC training were rated as more threat minimizing during the discussion

than IMP mothers. Because this difference had a very small effect size and was not present in the

smaller subsample of mothers who met the original inclusion criteria, it is probable that it is due

to noise introduced into the data by including mothers with subclinical anxiety disorder

diagnoses.

On the other hand, these group differences did not appear to carry over to how children

were observed to behave during the discussion task with mothers. Although not one of our initial

hypothesis, it would be reasonable to assume that if mothers in the IMP group were more

positive towards children during the discussion, this might translate into less anxiety and

avoidance on the part of children; however, this was not the case as children were observed to

behave similarly during the discussion across groups. Interestingly, we were able to code the

interaction on a minute-by-minute basis, so as long as these codes are reliable, it would be

possible to see if there was an effect of time across the 5 minutes whereby children in the IMP

group became less anxious the longer they interacted with their more positive mothers. However,

since it was found that children's expectations for the speech task did not change over the course

of the discussion regardless of the training their mom received, this would suggest that the

increased warmth shown by IMP mothers during the discussion did not carry over to affect

children's specific interpretation bias. Consistent with this, children in each group did not differ

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on observed behavior or physiological reactivity during the speech, nor did they differ on their self-report or mom's report of how they did on the speech (distress, coping, and performance).

We were also interested in how our training would affect interpretation biases in mothers and children more generally and for this we used a general measure of interpretation bias completed both at time 1 (when only diagnostic interviews were administered) and time 2 (after the training was complete). We did not find the group x time interaction that we hypothesized in the full sample; rather it was found that regardless of group, the act of participating in the study resulted in lower scores on threat/distress for all mothers and children, lower scores on avoidance for all mothers (although this effect was not present in the sub-sample), and higher scores on control for all children. Perhaps by virtue of completing the anxiety-provoking stress task, children learned to interpret future ambiguous scenarios in a more benign manner and feel that they would be less distressed and have more control over them. This is akin to what happens when anxious individuals are exposed to situations that they fear and learn that they're not actually as bad as they initially thought. Similarly, it may be that in seeing their child complete an anxiety-provoking task, mothers learned that in the future their child would approach ambiguous scenarios with fewer threat interpretations and less distress. Interestingly, in looking at the subsample of mothers meeting initial diagnostic criteria, it was found that only mothers in the IMP group decreased on their interpretations of threat and distress in their child, suggesting that the training was responsible for this effect, not simply seeing their child complete the speech task.

Taken together, the results of this study suggest that we were partially successful in demonstrating the feasibility of an interpersonal cognitive bias modification paradigm with mothers and children. More specifically, mothers who received the positive training endorsed

fewer negative interpretations of ambiguous scenarios on a recognition test, were slower to respond to negative probes, had more positive expectations for their child during a speech task, and interacted with their child in a warmer manner while helping them to prepare for the speech. Confirming the efficacy of the training, significant correlations were found between strength of the training effects (on reaction time and the recognition test) and general maternal positivity during the discussion. This suggests that the training may actually be more effective for mothers who have a pre-existing interpretation bias and thus more "room" to have a stronger training effect. However, these positive effects on mothers did not appear to transmit over to their children. Children behaved similarly during the discussion and speech tasks, reacted in a similar way physiologically to the speech, and had similar expectations of how they would do on the speech task, regardless of which training their mother had received.

Interestingly, when looking at our subsample of mothers meeting initial inclusion criteria, it appears that despite the fact that their children responded the same to the stressful speech task as children of ICC mothers, mothers who received the IMP training still endorsed that their child would see less threat and be less distressed in future ambiguous scenarios. This suggests that for clinically anxious mothers, the effects of the training may have been powerful enough to withstand evidence suggesting that their child will actually respond in an anxious way to an anxiety-provoking situation.

There are many possible reasons for the partial success of our training. The most obvious is the high level of anxiety that was present in children in this sample, the majority of whom met criteria for a clinical anxiety disorder. It may be that the effects of our training were not strong enough to overcome the anxiety already present in most children. Our results may have been

different had we worked with a sample of children who were less anxious, which highlights the importance of future work in this area for the prevention of child anxiety in high-risk samples.

Our partial success could also be due to the heterogeneous nature of anxiety in our sample and we might have had more success had we only worked with individuals with social phobia, since that is the anxiety disorder most closely linked to a speech task stressor. Including only mothers with clinical diagnoses of GAD, SoPh, and PD may also have strengthened our results, which is partially supported by the differing results obtained when examining this subsample of mothers. In addition, it may be that we need to employ more training sessions before we are able to see a more robust effect. Many other studies using this paradigm have participants engage in multiple training sessions before testing for effects (Amir & Taylor, 2012; Salemink & Wiers, 2011). Mothers in our study were observed to become particularly bored and sometimes frustrated with how long the training was, so breaking it up into multiple sessions may be beneficial in numerous ways

In addition, our results may have been more robust had we been successful in training IMP mothers to more positive interpretations on the recognition test (and not just fewer negative interpretations). This could be due to the fact that we had a fairly high percentage of missed word fragments and reaction times that were somewhat longer than those in past studies, which indicates that our fragments may have been too difficult for participants to solve. We made the choice to include word fragments with slightly more missing letters since there is some indication in the literature that this induces more cognitive work to solve the fragment, which in turn results in a more strongly trained interpretation bias. Future work directly assessing difficulty of word fragments and the effect they have on this type of training will be beneficial.

A brief comment should be made on the topic of statistical vs. clinical significance. Many clinical researchers suggest that estimating the probability of results to be obtained by chance is very different from results that are clinically meaningful (Pintea, 2010). Indeed, many of the results of our study have small effect sizes, bringing into question the actual clinical changes that our interpretation bias modification paradigm was able to induce in anxious mothers. For the reasons stated above, however, we believe there is much more to be done in the future to optimize the effects of such paradigms and work towards producing clinically significant change.

The current study was a pivotal step towards assessing the feasibility of modifying anxious mothers' interpretation biases concerning their children in real-life clinical settings. Results contribute to an emerging body of research exploring the ameliorating effects of experimental paradigms that target information-processing biases in anxious youth. Given the high concordance of anxiety between mothers and children and emerging evidence for the transmission of an anxious information processing style, findings from this study have implications for improving the current prevention and treatment options available for anxious youth.

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Table 1: DSM-IV Anxiety Disorder Diagnoses in Mothers

	Primary	Secondary	Tertiary
GAD	30	12	1
SoPh	12	18	1
PD	3	3	2
Ag	1	0	0
PTSD	3	2	2
OCD	0	1	2
SP	4	4	11

Note: GAD = generalized anxiety disorder, SoPh = social phobia, PD = panic disorder, Ag = agoraphobia, PTSD = post-traumatic stress disorder, OCD = obsessive compulsive disorder, and SP = specific phobia.

Table 2: DSM-IV Anxiety Disorder Diagnoses in Children

	Primary	**Secondary**	**Tertiary**
GAD	10	6	2
SoPh	8	6	3
SAD	3	0	2
PTSD	2	0	0
OCD	1	1	2
SP	14	13	8

Note: GAD = generalized anxiety disorder, SoPh = social phobia, SAD = separation anxiety disorder, PTSD = post-traumatic stress disorder, OCD = obsessive compulsive disorder, and SP = specific phobia.

Table 3: Socio-demographic Information for the Control and Experimental Groups

	ICC (*N* = 26)	IMP (*N* = 29)
Mother Age	41.58 (7.52)	41.83 (5.82)
Mother Race (% Caucasian)	81%	90%
Mother Educational Level	7.04 (1.24)	7.38 (.94)
Child Age	9.88 (1.58)	9.86 (1.33)
Child Gender (% Female)	50%	52%
Child Race (% Caucasian)	81%	86%
Number of Siblings	1.36 (.95)	1.69 (1.20)
Family Make-up (% Parents married, together)	65%	76%
Family Income	$77,605 (44,894)	$86,979 (40,302)

Note. Values shown are means (unless otherwise indicated), with *SD*s in parentheses. Educational attainment was defined as a categorical variable with 8 groups of increasing education (e.g., 7 = "graduated from college"), and it was analyzed as a continuous variable. Group differences were examined with one-way ANOVAs and chi-square tests. The groups were not significantly different on any of the demographic variables.

Table 4: Diagnostic and Questionnaire Information for Control and Experimental Groups

	ICC (*N* = 26)	IMP (*N* = 29
CSR of Mother's Primary Anxiety Disorder	4.96 (1.46)	5.10 (1.35)
Mother Number of Anxiety Disorders	2.46 (1.27)	2.72 (1.73)
STAI-T	43.12 (11.54)	42.52 (9.21)
ASI	19.05 (9.12)	20.32 (10.37)
Child Clinical Anxiety (% with an Anxiety Disorder)	69%	69%
Child Number of Anxiety Disorders	2.00 (2.04)	1.83 (1.95)
SCAS-C	17.85 (10.87)	20.13 (14.38)
SCAS-P	18.24 (8.44)	17.63 (9.62)
FSSC-R	117.65 (22.86)	121.05 (28.36)
CASI	25.38 (7.75)	24.61 (5.49)

Note. Values shown are means (unless otherwise indicated), with SDs in parentheses. Group differences were examined with one-way ANOVAs and a chi-square test. The groups were not significantly different on any of the variables.

Table 5: Reaction Time Data for Control and Experimental Groups

	ICC (N = 26)		IMP (N = 29)	
	First Half	*Second Half*	*First Half*	*Second Half*
Positive Probes	2349.42 (989.95)	2284.21 (1049.91)	2344.52 (942.35)	2107.72 (891.27)
Negative Probes	2394.27 (948.60)	1915.66 (819.84)	3134.35 (968.48)	2950.49 (1281.45)

Note: Reaction time means and *SD*'s (in parenthesis) are listed in milliseconds.

Table 6: Interpretation Ratings for Control and Experimental Groups

	ICC (N = 26)		IMP (N = 29)	
	Targets	*Foils*	*Targets*	*Foils*
Positive Interpretations	2.81 (0.39)	2.58 (0.53)	2.96 (0.43)	2.63 (0.48)
Negative Interpretations	2.14 (0.44)	1.825 (0.45)	1.89 (0.55)	1.55 (0.55)

Note: Participants endorsed interpretations on a scale of 1-4 with higher numbers indicating greater endorsement. Means ratings are shown with *SD*'s in parenthesis.

Table 7: Change in Mothers Specific Interpretation Biases from Pre- to Post-Training for Control and Experimental Groups

	ICC (N = 26)		IMP (N = 29)	
	Pre	*Post*	*Pre*	*Post*
PDCP-PC Total Score	15.54 (3.68)	15.58 (3.60)	15.97 (2.82)[a]	16.97 (2.90)[a]

Note: The PDCP-PC is composed of three questions that assess mother's predictions of their child's distress, coping, and performance on the speech task. [a] indicates that scores were different at the $p < 0.05$ level.

Table 8: Maternal Behavior during the Discussion Task for Control and Experimental Groups

	ICC (N = 26)	IMP (N = 29)
General Positivity	2.72 (0.64)[a]	3.05 (0.47)[a]
General Positive Relationship	2.99 (0.70)	3.27 (0.62)
Intrusiveness	1.49 (0.85)	1.36 (0.50)
Passivity	1.41 (0.79)	1.28 (0.62)
Praise	0.84 (1.14)	0.62 (1.02)
Threat Minimization	1.07 (0.15)[b]	1.01 (0.05)[b]
Vulnerability Promotion	1.09 (0.18)	1.08 (0.17)
Vulnerability Minimization	1.04 (0.08)	1.09 (0.16)

Note: All scales were rated from 1-5 for each of the 5 minutes of the discussion and then an overall average was taken. [a] indicates that the groups were significantly different at $p < 0.05$. [b] indicates that the groups were significantly different at $p < 0.1$.

Table 9: General Interpretation Biases in Mothers and Children for Control and Experimental Groups

	ICC (N = 26)		IMP (N = 29)	
	Session 1	*Session 2*	*Session 1*	*Session 2*
Child Threat/Distress	48.56 (22.53)	44.89 (26.44)	53.82 (26.82)	49.88 (28.73)
Child Control	44.85 (19.69)	57.81 (19.62)	55.79 (25.29)	58.48 (26.36)
Child Avoidance	1.92 (2.48)	2.12 (1.48)	1.52 (1.53)	1.59 (1.50)
Mother Threat/Distress	78.74 (21.05)	71.82 (24.02)	70.19 (19.55)	57.05 (17.41)
Mother Control	198.34 (55.03)	207.85 (63.68)	194.81 (64.00)	199.32 (69.63)
Mother Avoidance	3.74 (1.76)	3.35 (2.04)	3.50 (2.77)	2.89 (1.88)

Note: Results are taken from the ASQ-C and ASQ-PC.

Table 10: Correlations between Strength of Training and Maternal Cognition and Behavior

Measure	1	2	3	4
RT Bias Score	1			
Interpretation Bias Score	.116	1		
Change in SIB	-.036	-.012	1	
General Positivity	.352**	.237*	-.023	1

*Correlation is significant at the 0.1 level (2-tailed).

**Correlation is significant at the .05 level (2-tailed).

Figure 1. Mean Reaction Time to Positive and Negative Probes for the Control and Experimental
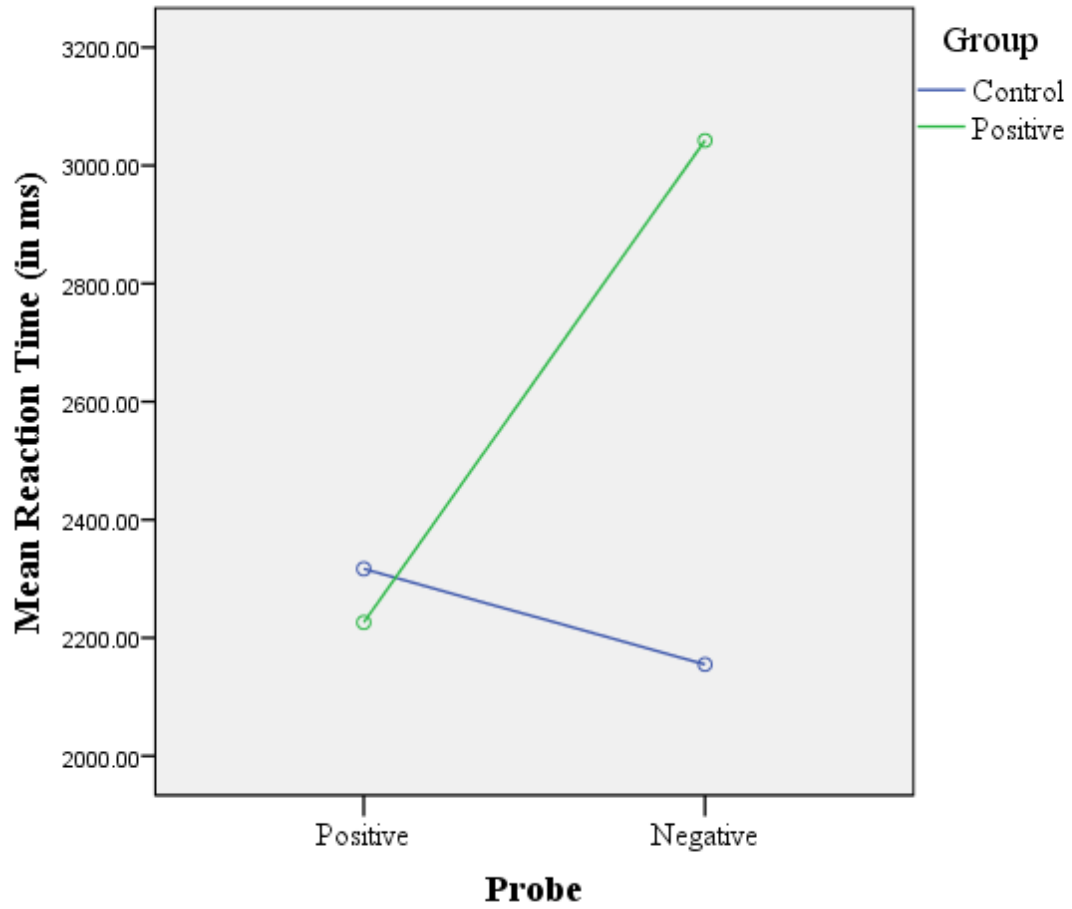
Groups

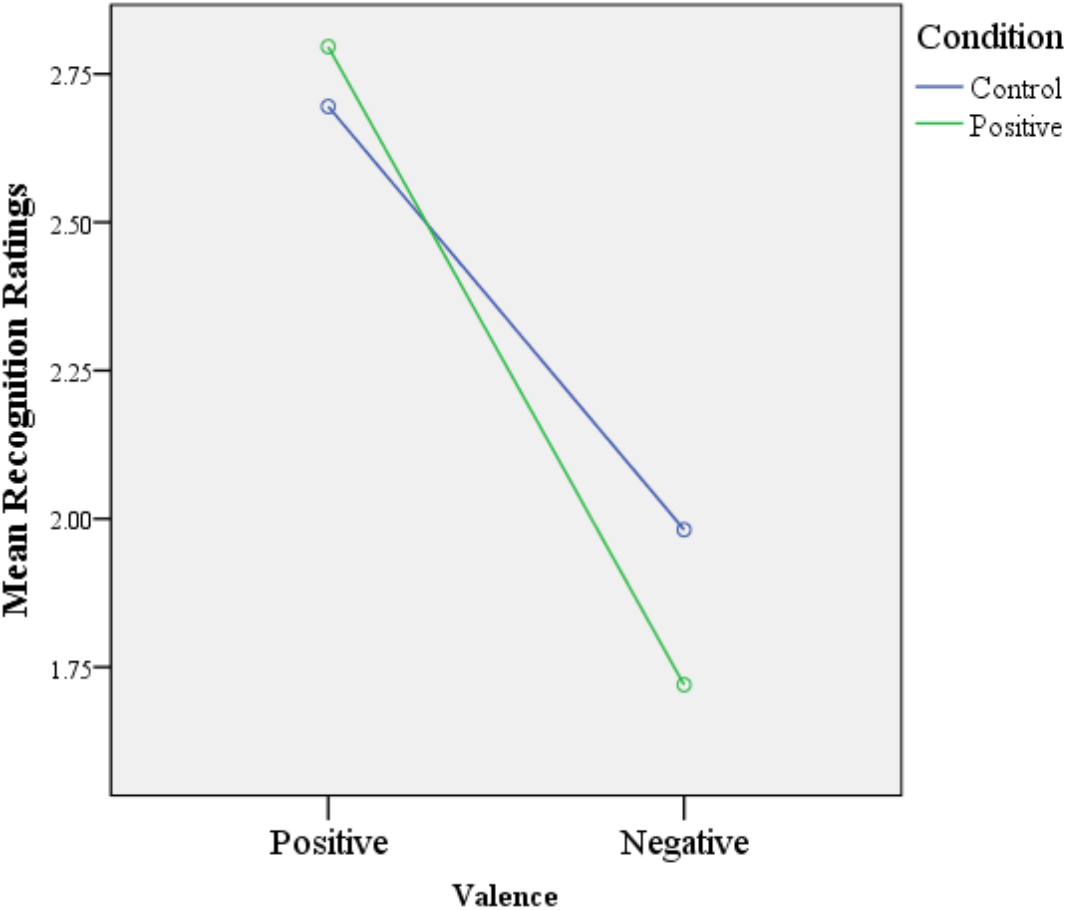Fig. 2. Mean Recognition Ratings for the Control and Experimental Groups

Figure 3: Change in Mothers Specific Interpretation Bias from Pre- to Post-Training for Control and Experimental Groups
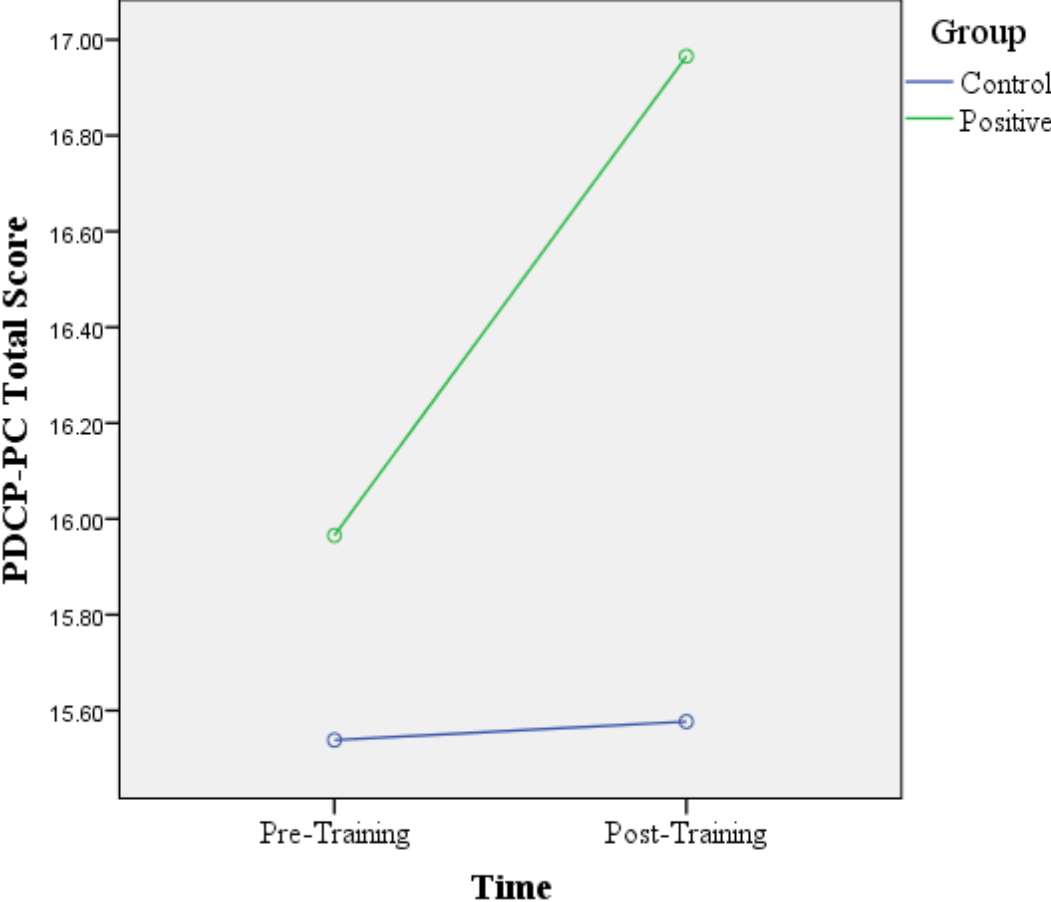
Figure 4: Change in Mothers General Interpretation Bias from Session 1 to Session 2 for Control
and Experimental Groups