



Research paper

Modifying interpretations among individuals high in anxiety sensitivity

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ABSTRACT

To examine the causal relationship between cognitive biases and anxiety, a bias modification paradigm was used to reduce negative interpretation biases in participants with high anxiety sensitivity (AS). Participants ($N = 75$) were assigned to a Positive training condition or to one of two Control conditions (Neutral or No training). During training, participants imagined themselves in ambiguous scenarios related to AS. Positive training required participants to resolve the scenarios' ambiguity positively and was hypothesized to result in more positive and less negative subsequent interpretations related to AS, fewer self-reported AS symptoms, and less emotional vulnerability on AS stressors (compared to the Control conditions). As expected, Positive training shifted interpretations of novel scenarios and self-reported AS symptoms in the anticipated direction. Evidence was mixed for the effect of Positive training on emotional vulnerability (small effect for less fear, but not for avoidance). Findings support the causal premise underlying cognitive models of anxiety.

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1. Introduction

General cognitive models of anxiety posit that a series of cognitive biases maintain, and possibly cause, anxiety disorders (e.g., Beck & Clark, 1997; Beck & Emery, 1985; Williams, Watts, MacLeod, & Mathews, 1997). If these biases are causally related to anxiety disorders, it is theoretically expected that reducing the biases will lead to a decrease in anxiety symptoms. The current study tests this causal premise by examining whether it is possible to modify interpretation biases among individuals high in anxiety sensitivity, and then examining the effects on subsequent interpretations, self-reported anxiety sensitivity symptoms, and fear and avoidance during interoceptive exposures (tasks that elicit unusual bodily sensations).

Anxiety sensitivity (AS) refers to a fear of symptoms related to anxiety (e.g., bodily sensations, such as sweating or heart racing), stemming from beliefs that these sensations have negative physical, psychological, or social consequences (Reiss, 1991; Reiss & McNally, 1985). Critically, elevated AS is a vulnerability marker for anxiety pathology (Rapee, Brown, Antony, & Barlow, 1992; Taylor, Koch, & McNally, 1992), and it appears to be especially important to the development of panic disorder (Ehlers, 1995; Hayward, Killen, Kraemer, & Taylor, 2000; Reiss, 1991). For instance, Maller and Reiss (1992) found that high (versus low) levels of AS were associated with a five times greater risk of developing a future anxiety disorder. Moreover, AS appears to be

associated with reductions in pathological anxiety. In fact, Smits, Powers, Cho, & Telch (2004) found that changes in AS fully mediated changes in global impairment related to panic following cognitive-behavioral therapy (CBT) for panic disorder. Further, numerous studies have demonstrated that successful CBT for panic disorder results in lower levels of AS (see review by Otto & Reilly-Harrington, 1999). AS is thus connected to both vulnerability for future anxiety pathology and treatment outcomes.

Given the apparent link between change in AS and anxiety disorder onset and reduction, the value of being able to quickly modify AS seems high. Theoretically, this would help demonstrate that AS has a functional (versus merely correlational) relationship with anxiety, and clinically, this may point to additional approaches to prevent and treat anxiety difficulties.

1.1. Cognitive bias modification: shifting interpretations

Modifying interpretation biases may be a useful target to reduce high AS, because AS is characterized by a bias to favor threatening interpretations of ambiguous information (e.g., Richards, Austin, & Alvarenga, 2001; Teachman, 2005). For instance, people with high AS are likely to interpret a racing heart as a precursor to a heart attack, rather than the normal effect of a brisk walk. The current study extends these correlational investigations by attempting to directly modify interpretation biases in a sample with elevated AS.

Most research on cognitive bias modification (CBM) has focused on attentional bias training using a dot probe paradigm, in which participants see a neutral or a threat-relevant cue and subsequently detect the presence of a probe (e.g., MacLeod, Rutherford, Campbell,

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Ebsworthy, & Holker, 2002; Vasey et al., 2002). Results have demonstrated that it is possible to modify attentional biases, which in turn may reduce emotional vulnerability (MacLeod et al., 2002) and even pathological anxiety symptoms (Amir, Beard, Burns, & Bomyea, 2009; Amir, Weber, Beard, Bomyea, & Taylor, 2008).

Modifying interpretation biases in non-anxious samples also appears effective (e.g., Grey & Mathews, 2000; Hertel, Mathews, Peterson, & Kinter, 2003). In a series of experiments, Mathews and Mackintosh (2000) showed that it is possible to induce both negative and positive interpretation biases in an unselected community sample. In their training paradigm, participants read and imagined themselves in a series of emotionally ambiguous scenarios. To induce a positive bias, participants read scenarios that ended in a non-threatening way. To induce a negative bias, participants read the identical scenarios but with a threatening ending. The authors found that training resulted in training-congruent interpretations when participants were presented with novel ambiguous scenarios. Several studies have replicated the Mathews and Mackintosh study with non-anxious populations and found similar results (Mackintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Salemink, van den Hout, & Kindt, 2007a,b; Yiend, Mackintosh, & Mathews, 2005). Moreover, the effect of training on interpreting novel scenarios has been shown to endure for at least 24 h (Yiend et al., 2005), and to persist despite changes in environmental context (Mackintosh et al., 2006).

The small number of studies that has used interpretive CBM programs with anxious populations has been promising, though there is limited evidence for reduction of clinically significant symptoms. For instance, Murphy, Hirsch, Mathews, Smith, & Clark (2007) used a modification of the Mathews and Mackintosh (2000) paradigm in which the training scenarios were presented aurally to a sample high in social anxiety symptoms. The authors found that Positive training led to more positive interpretations, relative to the Control condition (which included scenarios that had a neutral, valence-irrelevant ending), and that participants in the Positive training condition *predicted* that they would be significantly less anxious in future social situations, but there was no assessment of an actual social interaction in the study. Teachman and Addison (2008) modified the Mathews and Mackintosh training scenarios to use with a high spider fear sample. Positive training led to faster resolution of positive (versus negative) word fragments and more positive interpretations of novel spider scenarios. Although the training did not have a strong effect on subsequent fear and avoidance related to a live spider, in the Positive training condition (but not the full sample), faster resolution of positive word fragments was correlated with less avoidance and fear of the live spider. Hirsch, Hayes, & Mathews (2009) used both an aural modification of the Mathews and Mackintosh paradigm and a homograph-based interpretation training task with a sample with high levels of worry. In the homograph-based interpretation training task, participants repeatedly practiced retrieving benign meanings of threat-related homographs (such as sack; which could be interpreted in a benign manner as a bag for potatoes or in a threatening manner as being dismissed from a job). The authors found that the combined interpretation training approaches led to less negative thought intrusions and less fear during a breathing task when compared to a Control condition. In addition, Mathews, Ridgeway, Cook, & Yiend (2007) found that the Mathews and Mackintosh training paradigm, repeated over the course of four sessions, not only reduced subsequent negative interpretation biases, but also successfully reduced trait anxiety in a sample of high trait-anxious volunteers.

Notably, previous studies using the Mathews and Mackintosh (2000) paradigm have produced conflicting results regarding whether the training affects state anxiety immediately (e.g., Salemink et al., 2007b) or only when participants are presented with a subsequent emotional stressor (i.e., training did not have an

immediate effect on state anxiety: e.g., Mathews et al., 2007; Salemink et al., 2007a; Teachman & Addison, 2008). Importantly, results have been more reliable for effects on subsequent stressors, which is the critical outcome to indicate changes in emotional vulnerability. For example, Wilson, MacLeod, Mathews, & Rutherford (2006) found that Positive interpretation training resulted in less anxiety following a video stressor. Interpretation training is thus expected to affect subsequent levels of emotional vulnerability, but may not immediately alter mood (suggesting the training is more likely specific to interpretation biases, as opposed to an affect manipulation).

The current study expands on this promising early research by looking at a population that is at high risk for future anxiety problems – participants high in AS – to evaluate whether it is possible to reduce this risk factor through modifying interpretation biases. In addition, this study examines the effects of interpretation bias modification on actual fear and avoidance during tasks designed to elicit AS (as opposed to predicted future anxiety, as in Murphy et al., 2007). A modified version of the CBM paradigm used by Mathews and Mackintosh (2000) was used in which participants learned to ascribe positive or negative interpretations to ambiguous scenarios related to AS. We included a Positive training condition, as well as two Control conditions: a Neutral training condition (to control for the effects of making interpretations in general), and a No training condition (to control for the effects of being exposed to stimuli related to AS). It was hypothesized that Positive training would lead to more positive and less negative interpretations for novel ambiguous scenarios and faster completion of positively valenced word fragments, relative to the two Control conditions (which were expected to have similar results to one another). It was also hypothesized that Positive training would lead to lower levels of self-reported AS symptoms, as well as less subsequent emotional vulnerability, as indicated by fear and avoidance during interoceptive exposures.

2. Methods

2.1. Participants

Participants were recruited from the university's psychology department participant pool based on their responses to the Anxiety Sensitivity Index (ASI; Reiss, Peterson, Gursky, & McNally, 1986). Only students who scored 27.5 or greater on the ASI were invited to participate, matching a one standard deviation cutoff above prior ASI college student norms (Peterson & Reiss, 1992). Seventy-five students (69.3% female, mean age = 18.93, SD = 1.00, range = 18–24) participated in the study. Sixty percent reported their ethnicity as Caucasian, 26.7% as Asian, 4% as African American, 1.3% as Native Hawaiian/Pacific Islander, 5.3% as multiple ethnicities, and 2.7% as "other".

2.2. Materials

2.2.1. Anxiety and mood symptoms

The Anxiety Sensitivity Index (ASI; Reiss et al., 1986) is a 16-item Likert-type questionnaire that measures a person's concern about or fear of anxiety-related symptoms (e.g., "It scares me when I become short of breath"). The ASI was used to recruit high AS participants and to examine whether training had an immediate impact on ASI scores. Scores in the current sample were similar to ASI scores found in clinical samples with panic disorder (Rapee et al., 1992), supporting the classification of this sample as a clinical analogue. Cronbach's alpha in the current sample for the ASI completed during the testing session was .84.

The Positive and Negative Affect Schedule-Fear Subscale (PANAS-FS; Watson & Clark, 1994) is a self-report measure of

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