An Examination of Interpretive Bias Induction on Cognitive and Symptom Variables Associated with Generalized Anxiety Disorder

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A Thesis

in

The Department

of

Psychology

Presented in Partial Fulfillment of the Requirements
for the Degree of Master of Arts (Psychology) at
Concordia University
Montreal, Quebec, Canada

September 2009

Your file Votre référence
ISBN: 978-0-494-63146-1
Our file Notre référence
ISBN: 978-0-494-63146-1

Abstract

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The purpose of the present study was to examine the potential causal role of interpretive bias in cognitive vulnerability to generalized anxiety disorder and its primary symptom, worry. An interpretive bias induction paradigm developed by Mathews and Macintosh (2000) was used to modify participants' interpretations of ambiguous scenarios. Sixty-nine (69) individuals were randomly assigned to either the negative induction group (n = 35) or the positive induction group (n =34). Following training, participants completed two measures of intolerance of uncertainty (IU), a cognitive vulnerability factor implicated in worry, and an interview related to processes involved in worry. Among the two measures of IU, one was a self-report questionnaire measuring explicit beliefs about uncertainty, while the other was a computerized task designed to assess automatic threat associations related to uncertainty. It was hypothesized that compared to the positive induction group, the negative induction group would evidence: (1) more explicit negative beliefs about uncertainty, (2) stronger automatic associations related to uncertainty, and (3) higher levels of worry. Results revealed that interpretive bias was successfully induced, but did not lead to group differences on IU or worry. In contrast to previous studies (Mathews & Macintosh, 2000), no effect of the training on state anxiety was found. Potential explanations for the discrepant findings are discussed as well as treatment implications for interpretive bias modification during therapy.

Acknowledgments

First and foremost, I would like to thank my supervisor, Dr. Michel Dugas, for his guidance, expertise, and dedication. I'd also like to thank my thesis committee members, Dr. Adam Radomsky and Dr. Natalie Phillips for their thoughtful feedback on this project. I'd also like to thank Dr. Naomi Koerner not only for her assistance with the project, but also her considerable support. Thank you to my labmates for their assistance with adapting the training paradigm. I would especially like to thank Kristin Anderson for her immense help with recruiting, coordinating, and interviewing potential participants. Without her, this project would not have been conducted so smoothly. I would also like to thank Constantina Stamoulos and Stephanie Bender for their assistance with data entry, and Tara Gralnick for her immense help with scoring the Catastrophizing Interview. I am truly lucky to have had the help and support provided to me during the various stages of this project.

I would also like to thank Dr. Andrew Mathews for kindly allowing me to use his interpretive bias paradigm.

This research was supported by fellowships from the Canadian Institutes of Health Research (CIHR) and le Fonds de la recherche en santé du Québec (FRSQ), and by a research grant from CIHR.

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Generalized anxiety disorder (GAD) is a prevalent, chronic, and disabling condition characterized by excessive and uncontrollable worry (American Psychiatric Association, 2000). This disorder is costly both to the individual and society, as it has been shown to lead to decreased work productivity and higher use of health care services (Whittchen & Hoyer, 2001). A number of effective psychological treatments have been developed for GAD, most of which are based on Beck's cognitive model of anxiety disorders (Beck & Clark, 1997). According to this model, individuals with anxiety disorders possess cognitive structures (or schemas) containing negative beliefs related to threat or danger. In addition, the cognitive structures are believed to reflect automatic associations (Segal 1988; Teachman, Marker, & Smith-Janik, 2008). Once activated, the cognitive structures are thought to automatically facilitate the biased processing of information, leading the individual to misperceive the existence of threat or danger in the environment. These information-processing biases, which include both automatic and strategic modes of processing, are believed to be involved in both the development and maintenance of all anxiety disorders (Beck & Clark, 1997).

One particular bias that has received considerable empirical support for its role in GAD is the tendency to interpret ambiguity in a threatening manner (see Macleod & Rutherford, 2004, for a review). This interpretive bias is believed to contribute to the development and maintenance of excessive and uncontrollable worry, the core feature of GAD. Before discussing the role of interpretive bias in GAD, evidence in support of the role of cognitive structures as a vulnerability factor for GAD will be reviewed.

Cognitive Vulnerability

Beliefs about uncertainty. In the literature on GAD, vulnerability has been assessed primarily from a cognitive perspective. One cognitive vulnerability factor linked to GAD is intolerance of uncertainty (IU), which is defined as a dispositional characteristic arising from a set of negative beliefs about uncertainty and its implications (Dugas & Robichaud, 2007). Such negative beliefs include that uncertainty is unacceptable, reflects badly on a person, and leads to feelings of frustration, stress, and the inability to act (Buhr & Dugas, 2002, 2006). The available data suggest a robust relationship between IU and worry. Not only is IU highly and specifically related to worry (Dugas, Schwartz, & Francis, 2004; Ladouceur et al., 1999), it also shares a stronger association with level of worry than with symptoms of depression and other anxiety disorders (Dugas, Gosselin, & Ladouceur, 2001; Roberts, Gervais, & Dugas, 2006; Sexton, Norton, Walker, & Norton, 2003). Level of IU also appears to be higher in individuals diagnosed with GAD than those diagnosed with panic disorder (Dugas, Marchand, & Ladouceur, 2005), and has been shown to be higher in individuals with moderate to severe GAD than in those with mild GAD (Dugas et al., 2007). The relationship between IU and worry remains relatively strong even after accounting for level of anxiety and depression (Buhr & Dugas, 2002, 2006). Level of IU also appears to be relatively independent of fluctuations in mood and anxiety. When using the Intolerance of Uncertainty Scale (IUS; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994) to assess level of IU, responses have been shown to remain relatively stable over a 5-week interval. Despite this stability, IU appears to be malleable and changes in IU have been shown to precede changes in worry level during cognitive-behavioural treatment for GAD (Dugas, Langlois, Rhéaume, & Ladouceur, 1998). Using time-series analysis to

assess the temporal relationship between daily ratings of IU and percent time spent worrying throughout therapy, Dugas and colleagues observed that change in IU preceded change in worry for the majority of participants. Thus, not only does IU appear to share a robust relationship with worry, change in IU appears to precede change in worry.

In addition to the correlational research presented above, there is also increasing experimental evidence for the role of IU in worry. For example, Ladouceur, Gosselin, and Dugas (2000) used an experimental approach to assess the impact of modifying IU on worry. Using a gambling procedure where the appraisal of the probability of winning was manipulated, the authors observed that changes in IU associated with the task resulted in changes in level of worry in the expected direction. The results from this study suggest that IU levels can be successfully manipulated, and that manipulation of IU results in differences in worry levels. A subsequent study conducted by Grenier and Ladouceur (2004) found additional support for the role of IU in worry. The authors used a different modification procedure, whereby participants were first asked to imagine ingesting medication, then to repeat aloud statements reflecting either increased or decreased IU. Results indicate that level of IU was modified in the expected direction and that participants who's IU was increased demonstrated significantly more worry than those who's IU was decreased. More recently, Rosen and Knäuper (2009) examined the impact of manipulating both IU and situational uncertainty, on information seeking behaviour and worry level. The authors differentiated IU from situational uncertainty (SU) by stating that the former refers to a trait whereas the latter refers to a characteristic of a given situation. Participants were randomly assigned to one of four conditions; High IU and SU, High IU and Low SU, Low IU and High SU, and Low IU and Low SU. IU

was manipulated linguistically using a paradigm used in a previous study (Rosen, Knäuper, & Sammut, 2007), whereby the experimenters changed qualifiers for all items to either increase the probability of endorsement in the case of the High IU groups or decrease in the case of the Low IU groups. Further, false feedback was provided to further increase or decrease IU depending on group membership. In addition, SU was manipulated by having participants read information about a fictitious virus to which they were introduced. The information was provided to either increase or decrease uncertainty about whether or not they had contracted the virus. Following these manipulations, the High IU and SU group sought more information and reported significantly more worry relative to the Low IU and SU group. Taken together, these three studies demonstrate that modifying IU leads to changes in worry.

Thus, the available data support the notion that IU is a cognitive vulnerability factor for GAD. Although cognitive theory of anxiety disorders (Beck & Clark, 1997) predicts that symptoms develop via the influence of cognitive vulnerability factors on information processing biases, it is important to test this prediction empirically. Thus, in addition to establishing IU as a putative cognitive vulnerability factor for GAD, it is also critical to determine its influence on proximal risk factors such as biases in information processing. It is also necessary to establish the precise role of such proximal risk factors in IU and worry.

Automatic associations related to uncertainty. Attempts to measure cognitive structures (or cognitive vulnerability) in anxiety disorders have typically involved self-report methods. These methods, which typically assess explicit beliefs, tap into slower, more voluntary cognitive processes. However, cognitive vulnerability may also be

characterized by associations represented in memory (Segal, 1988) that are activated automatically and difficult to control (Teachman et al., 2008). Automatic associations have been conceptualized as evaluations of stimuli that influence one's responses without awareness that an evaluation has been made (Wilson, Lindsey, & Schooler, 2000). These associations are thought to influence subsequent processing and behaviour (De Houwer & Hermans, 2001). Individuals with anxiety disorders have been conceptualized as possessing stronger automatic threat associations relative to non-anxious controls. In other words, representations of associations involving an evaluation of stimuli are believed to be stored in memory and when the stimuli are perceived as threatening, these associations are thought to be stronger in individuals with anxiety disorders relative to non-anxious individuals. These associations are believed to act at an automatic level of processing, outside of awareness.

Evidence for the role of automatic associations in anxiety disorders has accumulated. For example, Teachman, Smith-Janik, and Saporito (2007) were able to successfully differentiate individuals with panic disorder from non-anxious controls based on their automatic associations for panic stimuli. Using a response time (RT) task, participants were presented with a series of word stimuli on a computer screen and were asked to categorize them as either descriptive of themselves or others. The word stimuli denoted either panic symptoms (e.g., scared) or opposing concepts, such as calm (e.g., relaxed). RTs categorizing word-stimuli as threat-consistent (e.g., panic-descriptive of self; calm-descriptive of others) were compared to RTs categorizing word-stimuli as threat-inconsistent (e.g., panic-descriptive of others; calm-descriptive of self), and a difference score was calculated for each participant. Participants with panic disorder had

significantly larger difference scores than non-anxious participants, with shorter RTs to threat-consistent trials than threat-inconsistent trials. This suggests that automatic panic associations are stronger in those with panic disorder than in non-anxious controls. Using the same task, De Jong, Pasman, Kindt and van den Hout (2001) were able to distinguish socially anxious from non-socially anxious participants on socially relevant automatic associations. The authors reported that socially anxious participants evidenced stronger automatic associations to socially-relevant word stimuli compared to non-socially anxious participants. In addition to distinguishing clinically anxious from non-anxious individuals, automatic threat-related associations have been shown to change during treatment for patients with panic disorder (Teachman et al., 2008) and spider phobia (Teachman & Woody, 2003). In addition, Teachman and colleagues (2008) observed that attenuations in the strength of automatic associations related to threat were correlated with symptom reduction. To date, no research has assessed the presence of automatic threat associations in GAD. Given that negative beliefs about uncertainty are known to be involved in this condition, perhaps there are automatic threat associations involved in GAD concerning stimuli denoting uncertainty. Stated differently, perhaps individuals who hold negative beliefs about uncertainty also possess stronger threat associations for stimuli denoting uncertainty than individuals who do not hold such beliefs.

Interpretive Bias

Research demonstrates that GAD is associated with the tendency to misinterpret ambiguous information as threatening; further, this tendency is thought to contribute to an increase in worry and anxiety levels (Macleod & Rutherford, 2004). Support for this association comes from a range of studies, including those using homophones to compare

patients with GAD to nonclinical control participants. Overall, patients display a greater tendency to interpret audio taped homophones negatively than do control participants (Mathews, Richards, & Eysenck, 1989). Other studies comparing high and low trait anxious participants found a similar pattern of results (see Macleod & Rutherford, 2004, for a review). Some have argued that the observed findings are the result of response biases, whereby anxious individuals are more likely to choose the more negative or threatening interpretation (Mathews & Macleod, 1994). Subsequent studies examining the relationship between interpretive bias and anxiety using different methodologies have found converging evidence for an interpretive bias associated with GAD, while controlling for the effects of possible response biases. For example, Eysenck, Mogg, May, Richards, and Mathews (1991) compared individuals with GAD to non-anxious controls in terms of their ability to remember previously-presented sentences that were either clear in meaning, or ambiguous, to allow for both threatening and non-threatening interpretations. Following a delay, participants were presented with new sentences, some of which contained disambiguated versions of the ambiguous sentences seen previously. The authors also included emotionally-valenced sentences unrelated to the previously presented sentences. Participants were asked to indicate which sentences they remembered seeing in the first part of the study. Significant differences were reported between the anxious and control group for negatively disambiguated sentences corresponding to sentences seen previously, but not to the negatively-valenced foil sentences, thus disconfirming the possibility that the between-group differences are due to a generalized response bias in the anxious group. An anxiety-related memory bias can also not be excluded as a possible alternate explanation. However, other procedures have

been designed to assess current or "online" interpretations to help determine whether such a bias is involved. For instance, Marcel (1980) reported a difference between high and low trait-anxious participants in the processing of "target" words when the meaning of the target word was related to the threatening interpretation of a homograph "prime" word that preceded it. High trait-anxious participants responded quicker to these targets than did low trait-anxious participants, suggesting that high levels of trait anxiety are linked to an increased tendency to interpret ambiguity in a threatening manner (Marcel, 1980). Thus, the extant data support the existence of a relationship between the presence of GAD and the tendency to interpret ambiguity in a threatening manner. Although it does not appear likely that the results reported above are due to either a response or memory bias, it is difficult to determine whether observed differences between patients with GAD and non-anxious controls reflect differences in trait anxiety rather than differences in GAD status. More research is necessary to help clarify this matter.

Relationship between Cognitive Vulnerability and Interpretive Bias

Whereas one study found no support for a relationship between IU and interpretive bias (Rassin & Muris, 2005), the majority of studies have found either some support (Cantor, Gervais, & Dugas, 2008; Dellerba, Gervais, & Dugas, 2007) or strong support (Dugas & Gervais, 2007; Dugas, Hedayati et al., 2005; Koerner & Dugas, 2008). Rassin and Muris (2005) assessed interpretive bias using the ambiguous subscale of the Ambiguous/Unambiguous Situations Diary (AUSD; Davey, Hampton, Farrell, & Davidson, 1992), which is a vignette task that includes 14 ambiguously worded scenarios. Respondents were asked to read each scenario while imagining being in the situation, then to indicate whether they were concerned or not. The authors were

interested in predicting concern from level of IU, indecisiveness, depression, trait anxiety, and worry. Results indicate that indecisiveness was the only significant predictor of threat interpretations, suggesting that the more indecisive an individual is, the more likely they are to interpret ambiguity in a threatening manner. A follow-up study (Cantor et al., 2008) was carried out using an extended version of the ambiguous subscale of the AUSD (Koerner & Dugas, 2008) that included a wider array of scenarios. Although none of the relationships were significantly different, IU did correlate significantly and positively with threatening interpretations of ambiguous scenarios whereas indecisiveness did not.

In addition to assessing the strength of the association between IU and interpretive bias, other studies have examined the ability of IU to predict interpretive bias beyond related variables. For example, after accounting for demographic variables, level of anxiety, depression, and worry, Dugas, Hedayati and colleagues (2005) found that IU predicted 11% of the variance in threat ratings of ambiguous scenarios. Participants more intolerant of uncertainty were also found to have significantly higher threat ratings of ambiguous scenarios than those more tolerant of uncertainty. In a follow-up study, Koerner and Dugas (2008) compared participants who were more intolerant of uncertainty (i.e., High IU group) to those who were less intolerant (i.e., Low IU group) in terms of their respective tendency to worry excessively and interpret ambiguous scenarios as threatening. Results indicated that after accounting for the variance explained by sex, worry, GAD somatic symptoms, trait anxiety, and depression, the High IU group made significantly more threat interpretations of ambiguous scenarios relative

to the Low IU group. No group differences were observed in threat ratings made for both positive and negative non-ambiguous scenarios.

Despite the discrepant findings, the weight of the evidence suggests that IU and interpretive bias are related. Koerner and Dugas (2008) were interested in further understanding the role of IU in GAD. Specifically, they assessed the prediction made by cognitive theory (Beck & Clark, 1997) that cognitive vulnerability leads to the expression of symptoms via its effect on information processing. They were particularly interested in determining whether the presence of IU makes one vulnerable to developing excessive worry and whether this influence occurs as a function of IU's predicted effect on threat interpretations of ambiguity. In other words, does interpretive bias mediate the relationship between IU and worry? Given that the study conducted by Koerner and Dugas was correlational, this question was assessed using Baron and Kenny's (1986) test of mediation. The results partially support the role of interpretive bias as a mediator in the relationship between IU and worry: threat interpretations of ambiguous scenarios were found to partially mediate the relationship between IU and worry. However, in the reverse mediation analysis, worry was found to be a partial mediator of the relationship between IU and interpretive bias. These results suggest that interpretive bias and worry may have a reciprocal relationship. In order to clarify the role of interpretive bias in the relationship between IU and worry, experimental research manipulating interpretations of ambiguity is necessary.

Causal Role of Interpretive Bias in Anxiety Disorders

Research over the last ten years has begun assessing the causal role of interpretive bias in anxiety. Mathews and Macintosh (2000) developed an interpretive induction

paradigm in which nonclinical participants were trained to interpret personally relevant, emotionally ambiguous social situations in either a negative, benign or positive fashion. The paradigm was presented on a computer screen and involved 104 trials, 64 of which served to induce the congruent interpretive bias. The remaining trials included probe trials that served as an initial measure of interpretation, and emotionally neutral (or filler) trials. The trials consisted of social situations three lines in length, which remained ambiguous until the final word. The final word was presented as a word fragment and when solved correctly, clarified the emotional meaning (or valence) of the scenario. The series of experiments described by Mathews and Macintosh demonstrated not only that an interpretive bias can be successfully induced, but that it could also result in congruent changes in state anxiety when participants actively generated the interpretations. Subsequent studies have reported consistent findings (Salemink, van den Hout, & Kindt, 2007a,b; Yiend, Macintosh, & Mathews, 2005).

When assessing the validity of the training paradigm by Mathews and Macintosh (2000), it was found that the effect of training did not generalize to other tasks evaluating interpretations (Salemink et al., 2007b, Salemink et al., in press). However, when using the same task, the paradigm has been shown to generalize to another domain (Salemink et al., in press). Despite consisting of scenarios related solely to social anxiety, the interpretive bias training paradigm has been used successfully to modify interpretations of scenarios related to academic performance. Further, the impact of training appears to persist for at least 24 hours (Macintosh, Mathews, Yiend, Ridgeway, & Cook, 2006; Yiend et al., 2005) and to withstand changes in context (i.e., testing in different room than training) and presentation modality (i.e., either acoustically or visually; Macintosh et

al., 2006). Taken together, these data suggest the training paradigm presented by Mathews and Macintosh is viable, but may not generalize across other tasks of interpretation.

To further assess the causal role of interpretive bias in anxiety, researchers have assessed the impact of interpretive bias training on anxiety vulnerability, or subsequent reactivity to a stressor. Studies using the training paradigm presented above have produced mixed findings. Specifically, Macintosh and colleagues (2006) assessed the impact of inducing interpretive bias on subsequent reactivity to a stressful video. Results indicate that relative to the positive training condition, the negative training condition was associated with an increase in anxiety in response to viewing a stressful video on the following day. A more recent study by Salemink and colleagues (2007a) reported divergent findings. Anxiety reactivity was induced following interpretive bias training using an anagram task. Although increases in level of anxiety and depression were reported following the stressor, this increase did not differ across groups.

Despite the results described by Salemink and colleagues, the majority of the research examining the causal role of interpretive bias on subsequent anxiety reactivity is consistent with Macintosh and colleagues' findings (e.g., Wilson, Macleod, Mathews, & Rutherford, 2006). Nevertheless, more research is needed to determine the precise role of interpretive bias in vulnerability to anxiety in general and to specific disorders. For instance, it remains to be seen whether inducing interpretive bias results in congruent changes in worry (the primary symptom of GAD), in IU, or in both. Given that Koerner and Dugas (2008) reported that threatening interpretations of ambiguity mediated the relationship between IU and worry, and that worry mediated the relationship between IU

and threatening interpretations, it is important to consider the potential effects of inducing an interpretive bias on both cognitive vulnerability and the expression of symptoms.

Worry as a Process

As mentioned previously, research has demonstrated a significant association between worry and interpretive bias (Cantor et al., 2008; Davey et al., 1992; Dellerba et al., 2007; Dugas, Hedayati et al., 2005; Koerner & Dugas, 2008; Zalta & Chambless, 2008). Although the above-mentioned studies assessed the general tendency to worry, other characteristics of the worry process may also be important. For instance, using the Catastrophizing Interview technique (c.f. Vasey & Borkovec, 1992), Provencher, Freeston, Dugas, and Ladouceur (2000) found that high worriers rated the occurrence of each self-generated feared outcome as more likely relative to low worriers. Further, the final feared outcome generated for each worry topic was rated as more severe in the High Worry group relative to the Low Worry group. Vasey and Borkovec (1992) reported similar findings using the catastrophizing technique. They found that high worriers generated more feared outcomes for each worry topic, rated them as more probable, and demonstrated an increase in discomfort during the catastrophizing sequence relative to low worriers.

It can be argued that the Catastrophizing Interview is superior to standard self-report worry measures (such as the Penn State Worry Questionnaire; Meyer, Miller, Metzger, & Borkovec, 1990) as it assesses aspects of the worry process that are more closely linked to the cognitive fear structure (Provencher et al., 2000). Aspects assessed via the catastrophizing technique include the ultimate feared consequence of one's worry (worst case scenario) generated in later stages of the catastrophizing sequence and

measured via interviewer ratings of the severity of the final feared outcome. Thus, the Catastrophizing Interview may be quite sensitive to changes in the cognitive fear structure that are expected to occur following brief modifications to processes influencing the fear structure, including modifying interpretations of ambiguity.

The findings generated using the Catastrophizing Interview (Provencher et al., 2000; Vasey & Borkovec, 1992) are consistent with those reported by Butler and Mathews (1983), who used standard self-report measures. Butler and Mathews found that high-anxious participants rated negative outcomes as more probable and more costly relative to low-anxious participants. Interestingly, it has been found that worry severity is positively correlated with perceived probability and perceived personal cost associated with feared outcomes (Berenbaum, Thompson, & Bredemeier, 2007; Berenbaum, Thompson, & Pomerantz, 2007; Dellerba et al., 2007). In addition, perceived probability, perceived personal cost, and the interaction between the two have been found to predict worry severity (Berenbaum, Thompson, & Pomerantz, 2007). Dellerba and colleagues reported that perceived personal cost mediated the relationship between IU and threatening interpretations of ambiguity. Given this evidence, it seems plausible that modifying interpretations of ambiguity would lead to subsequent changes in perceived cost or severity of the final feared consequence when using the catastrophizing technique. Although Dellerba and colleagues found no evidence that perceived probability mediates the relationship between IU and interpretive bias, the findings reported by Berenbaum, Thompson, and Pomerantz (2007) suggest that interpretive bias induction would lead to changes in perceived probability of consequences associated with worries. Less is known about the importance of the length of catastrophic sequences associated with a worry.

However, given the findings reported by Vasey and Borkovec (1992), it is possible that inducing a negative interpretive bias would also lead to longer catastrophic sequences associated with a worry, whereas induction of a positive interpretive bias would have the reverse effect.

Goals and Hypotheses

Despite strong evidence suggesting that worry is associated with the tendency to interpret ambiguity in a threatening manner (Cantor et al., 2008; Davey et al., 1992; Dellerba et al., 2007; Dugas et al., 2005; Koerner & Dugas, 2008; Zalta & Chambless, 2008), little is known about the precise role of interpretive bias in the worry process. Although it has been shown that successful treatment of GAD involves decreases in both negative beliefs about uncertainty and worry (Dugas et al., 2007), it is not known whether decreases in interpretive bias also occur during successful treatment. It also remains to be seen whether reducing a negative interpretive bias will result in decreases in both negative beliefs about uncertainty and worry. Given the correlational evidence presented by Koerner and Dugas (2008), it is possible that modifying interpretive bias would have multiple effects; influencing both the cognitive fear structure, or cognitive vulnerability, and worry. Although cognitive vulnerability is believed to include explicit negative beliefs about uncertainty; strong automatic associations involving uncertainty and threat may also be a characteristic. Thus, it is possible that inducing interpretive bias would result in congruent changes in both explicit beliefs about uncertainty and in the strength of the automatic associations related to uncertainty. In addition, interpretive bias induction is also expected to result in congruent changes in the worry processes that are closely associated with cognitive vulnerability (i.e., IU). Thus, the goal of the current

study was to investigate the causal role of interpretive bias in worry by determining whether it exerts effects on the expression of this symptom as well as on IU. It was predicted that compared to individuals trained to interpret ambiguity in a positive (or non-threatening) manner (positive interpretive bias), individuals trained to interpret ambiguity in a threatening manner (negative interpretive bias) would: (1) report significantly more negative beliefs about uncertainty; (2) have stronger automatic associations between uncertainty and threat; (3) report higher levels of worry, as evidenced by longer catastrophic sequences, higher average probability ratings, and more severe final consequences for each worry generated.

Method

Participants

The final sample consisted of 69 participants (66.7% female) between the ages of 18 and 53 ($M = 28.45$, $SD = 9.57$) recruited from the local community. Most of the participants spoke English as a first language (66.7%), whereas the remaining participants reported a first language other than English (27.5%), or reported English and an additional language as their first language (5.8%). Most participants described themselves as being of European descent (66.67%). Of the remaining 33.33%, six (8.6%) reported being of African descent, four (5.8%) of Asian descent, three (4.35%) as Latino/Hispanic, two (2.9%) as Middle-Eastern, two (2.9%) as bi-racial, and the remaining six (8.6%) did not classify themselves in any of the ethnic categories that were provided. Seventy percent (70%) of participants were full-time students, 11 (23%) of which were also currently working full-time, 20 (41.67%) working part-time, and 16 (33.33%) not working at the time the data were collected. Three (4%) of participants

reported being part-time students, one of which was working full-time, another working part-time, and the third was not working at the time the data were collected. Of the 26% of participants who were not students, 10 (55.56%) were working full-time, two (11.11%) part-time, and six (33.33%) were not working at the time the data were collected.

Procedure

Two hundred and twenty-one (221) individuals contacted the Anxiety Disorders Laboratory of Concordia University between March and August 2008 regarding participation in response to advertisements placed both in the local community and on one of the university's campuses. The lab's research coordinator described the study's purpose as involving an examination of the association between perception and anxiety. She also provided information pertaining to the study's inclusion criteria and procedures. The general inclusion criteria included the following: a) age between 18-55, b) fluent in English, c) no evidence of current substance abuse or suicidal intent, d) no history of schizophrenia or bipolar disorder, e) a score no greater than a "2" on the Clinician's Severity Rating (CSR) of the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown, Di Nardo, & Barlow, 1994) and Mini International Neuropsychiatric Interview, version 5.0 (MINI 5.0, Sheehan et al., 1998) for unipolar depression, f) no change in type or dose of anxiolytic or hypnotic medication in the last four weeks, no change in the last 12 weeks for antidepressant medication, g) no use of any benzodiazepine on an "as needed" (i.e., p.r.n.) basis, and h) no evidence of anxiety symptoms due to a general medical condition. Of the initial 221 callers, 67 were no longer interested in participating, and 15 did not meet inclusion criteria and therefore were not contacted again. During a second telephone conversation, the research

coordinator conducted a preliminary screening (see Appendix A for a copy of the screening questions) and the MINI 5.0 over the telephone with 139 individuals after obtaining verbal consent. The total duration of this telephone interview (including screening) varied from 15-45 minutes. Following the telephone interview, 81 individuals were invited to the laboratory. However, 5 of the 81 were no longer interested in participating. Thus, 76 participants signed an informed consent form, and completed the ADIS-IV, administered by the primary investigator (Nicole Gervais). The duration of administration varied from 30-180 minutes, and participants were compensated $20 for their time. Four participants did not meet inclusion criteria according to the ADIS-IV, and two no longer wished to participant. Thus, 70 participants returned to the laboratory, where they were first asked to complete a battery of quasi-counterbalanced questionnaires, including a demographics form, State-Trait Anxiety Inventory (Form Y) – Trait (Spielberger 1983), Beck Depression Inventory, second edition (Beck, Steer, & Brown, 1996), Social Desirability Scale-Short Form (Reynolds, 1982), and Visual Analogue Scales (VAS; McCormack, Horne, & Sheather, 1988). Following completion of all baseline measures, participants were seated in front of an IBM computer, used to run the induction training, manipulation check, and Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998), which were programmed using E-Prime version 1.2 (Schneider, Eschman, & Zuccolotto, 2002). Participants were first asked to complete ten practice trials, prior to commencing the induction training. The practice trials enabled participants to familiarize themselves with the order in which to make responses (i.e., to press the "spacebar" prior to solving the word fragment). Following the practice trials, participants were randomly assigned to one of the two induction groups (*n*

= 35 for the negative group, n = 34 for the positive group) and began the training session. Participants completed the manipulation check as well as the VAS for a second time before the post-manipulation measures, which included the Intolerance of Uncertainty Scale (Freeston et al., 1994), IAT, and Catastrophizing Interview (Provencher et al., 2000; Vasey & Borkovec, 1992), presented in a counterbalanced order. During administration of the IAT, all participants were seated at a distance of 50cm from the screen. For those who received the negative induction training, a brief positive-induction training was given prior to debriefing to counteract any potential negative effects attributed to the training. Debriefing was provided both orally and in writing and compensation of $30 was provided at the final visit. The entire session was conducted in a sound attenuated room and varied from 90-150 minutes.

Materials

Diagnostic interviews. The *Anxiety Disorders Interview Schedule for DSM-IV, Current version* (ADIS-IV; Brown et al., 1994) is a semi-structured clinical interview assessing the presence of anxiety disorders, as defined by DSM-IV diagnostic criteria. In addition to anxiety disorders, this interview also can be used to screen for mood disorders, somatoform disorders, substance use disorders, psychotic disorders, and medical conditions. The ADIS-IV contains a 9-point (0-8) Clinician's Severity Rating (CSR) scale that is used to rate the severity of each disorder assessed. A rating of 4 or above indicates the presence of a clinically significant disorder, whereas ratings from 1-3 indicate the presence of subclinical levels of symptomatology. A reliability study conducted by Brown, Di Nardo, Lehman, and Campbell (2001) reported good to excellent inter-rater agreement for all principal diagnoses (κ = .67 to .86), with the

exception of dysthymia (κ = .22). This indicates improvement over previous versions of the ADIS (Brown et al., 2001).

Mini International Neuropsychiatric Interview, Version 5.0 (MINI 5.0; Sheehan et al., 1998) is a brief structured interview designed to assess DSM-IV and ICD-10 diagnostic criteria for Axis I disorders, including mood and anxiety disorders, substance abuse and dependence, psychotic disorders, eating disorders, and suicidal risk. Interviewers are asked to indicate either the presence or absence of symptoms. Although this interview does not typically provide severity ratings for disorders assessed, the CSR scale of the ADIS-IV was included in the MINI for the current study. Unfortunately, no psychometric properties are currently available for the more recent version of the MINI. However, previous versions have demonstrated generally good to very good agreement with the Composite International Diagnostic Interview, (CIDI; Lecrubier et al., 1997), good to very good agreement with the Structured Clinical Interview for DSM, patient edition (SCID-P), excellent inter-rater reliability, and very good test-retest reliability (Sheehan et al., 1997).

Baseline measures. The *State-Trait Anxiety Inventory (Form Y) - Trait* (STAI-T; Spielberger 1983) is a 20-item self-report measure assessing the propensity to experience anxiety. Respondents are asked to rate each item by indicating how they generally feel using a 4-point Likert scale from 1 (Almost Never) to 4 (Almost Always). The maximum possible score on the STAI-T is 80. There are nine items on this measure that are inverted and summed along with the remaining items to obtain a total score, with higher scores indicating greater experience of anxiety. Example items include: "I am happy", which is an inverted item, and "I feel nervous and restless". The demonstrated psychometric

properties of the STAI-T include excellent internal consistency (α = .89 - .96), acceptable to high test-retest reliability from 20-104 days (r = .65 - .86), and concurrent, convergent, and discriminant validity (Spielberger 1983). The STAI-T is presented in Appendix B.

Beck Depression Inventory, second edition (BDI-II; Beck et al., 1996) is a 21-item measure assessing the presence and severity of DSM-IV depressive symptoms. Nineteen items include four options, differing in severity. The remaining 2 items consist of seven options, which assess depressive symptoms that involve change (i.e. increase/decrease in appetite/sleep). As such, change is assessed at each level of severity, excluding the lowest severity as it indicates the absence of the symptom. Respondents are asked to indicate which option best describes them in the past two weeks. The maximum possible score on this questionnaire is 63. The BDI-II demonstrates excellent internal consistency (α = .92 - .93), high test-retest reliability after one-week (r = .93), and adequate content, convergent, and discriminant validity (Beck et al., 1996). The BDI-II is presented in Appendix C.

Social Desirability Scale-Short Form (SDS-SF; Reynolds, 1982) is a 13-item measure assessing one's tendency to endorse socially desirable characteristics. Respondents are asked to indicate whether each item is true or false. True responses are given a value of "1", whereas false responses are given a value of "0". Eight items on this measure are inverted and summed along with the remaining items to obtain a total score. Lower scores indicate a greater response style tendency towards social desirability. Example items include "I sometimes feel resentful when I don't get my way", which is an inverted item, and "I am always courteous even to people who are disagreeable". The

SDS-SF demonstrates adequate internal consistency ($r_{K\text{-}R\,20} = .76$), and evidence of convergent validity (Reynolds, 1982). The SDS-SF is presented in Appendix D.

The *Visual Analogue Scales* (VAS; McCormack, Horne, & Sheather, 1988) were used to measure current level of anxiety, sadness, worry, irritability, and fatigue prior to the induction training and immediately following assessment of interpretive style. Participants were asked to indicate their current level of each state by making marks on each of five 100mm lines. Qualifiers for each line were provided and included: 0 (Not at all), and 100 (Extremely). The location of each response from the left end of the line was measured with a ruler. The VAS is believed to be useful for assessing idiosyncratic changes (Crichton, 2001). The five visual analogue scales are presented in Appendix E.

Induction training. The training consisted of scenarios adapted from those developed by Mathews and Mackintosh (2000) to induce an interpretive bias. Ten blocks of thirteen scenarios, or trials, depicting social events were presented on a computer screen. Following each block, participants were given the option to rest. Each block included eight induction trials, which were valenced according to the direction of the training. For the negative induction group, these trials were disambiguated negatively, whereas for the positive induction group, they were disambiguated positively. The remaining five trials per block were fixed, as the outcomes of these trials were identical for both induction groups. These trials included two probes, one that was disambiguated negatively and the other positively. The remaining three were filler trials in that their outcomes were neutral in valence. Participant RTs to solve the word fragments for both negative and positive probes were recorded and served as an initial test for the induction of an interpretive bias.

Trials within each block were presented in a random order for each participant, whereas the blocks were presented in a predetermined order. All scenarios were approximately the same length (i.e., 3 lines), and only one line was presented at a time per scenario, with the exception of the final line, which was presented without the final word. Once all three lines were read, the participant was provided with the missing word, presented as a word fragment. Participants were instructed to press the spacebar on the computer's keyboard once a solution to the word fragment was known. They were then asked to enter in the first missing letter. All scenarios remained ambiguous in valence until the final word was solved. Immediately following the scenario, participants were asked to answer a comprehension question by responding either "Y" for yes, or "N" for no. Feedback for the response was provided such that those congruent with the induction training were given positive feedback (i.e. correct answer), whereas incongruent responses were given negative feedback (i.e. wrong answer). An example of a complete induction trial is as follows:

> You organize a party for your friends every year. Last year, it did not go well and so you have changed the plans slightly. You anticipate that the problems of the last party will be rep—t-d (repeated)/ fo-got—n (forgotten).

Comprehension question:

> Do you believe you will have problems with your party again this year? (Correct answers: "Yes" for negative induction, "No" for positive induction).

Manipulation check. An assessment of interpretation style, or the manipulation check, immediately followed the training session. This consisted of two sections; the first involved ten scenarios presented in a similar manner to the training scenarios. However, these scenarios remained ambiguous after solving the word fragments. Further, although comprehension questions were provided, no response feedback was given. Finally, each of these new scenarios was presented with a title, which remained visible until the end of the trial. An example is as follows:

The Wedding Reception

> Your friend asks you to give a speech at her wedding reception. You prepare some remarks and when the time comes, get to your feet. As you speak, you notice some people in the audience start to l—gh (laugh).

Comprehension question:

> Did you stand up to speak?

Immediately following presentation of all ten scenarios, participants were provided with four interpretations for each and asked to rate the degree to which they were similar in meaning to the scenario they referred to. The title of the corresponding scenario was presented at the top-right corner of the screen for each series of interpretations. Participants rated the interpretations one at a time, independent of the others, using a 4-point scale ranging from 1 (very different in meaning) to 4 (very similar in meaning) before progressing the to next series of interpretations. Both the interpretations within a series and the series themselves were presented in a random order for each participant. Among the four interpretations, two were feasible, including one negatively-valence and one positively-valence interpretation, and two foil interpretations,

which also included one negatively-valence and one positively-valence interpretation. The four interpretations for the ambiguous scenario presented above are the following:

a) As you speak, some people in the audience find your efforts laughable

b) As you speak, people in the audience start to laugh appreciatively

c) As you speak, you notice somebody in the audience start to yawn

d) As you speak, everyone in the audience bursts into applause

Post-induction measures. The *Intolerance of Uncertainty Scale* (IUS; original French version: Freeston et al., 1994; English translation: Buhr & Dugas, 2002) is a 27-item self-report measure assessing the degree to which one possesses negative beliefs about uncertainty. Items are rated in terms of how characteristic they are of the respondent using a 5-point Likert type scale ranging from 1 (Not at all characteristic of me) to 5 (Entirely characteristic of me). The maximum possible score on the IUS is 135. An example item includes "Uncertainty makes me vulnerable, unhappy, or sad". Although the IUS has two factors including beliefs that "uncertainty has negative behavioral and self-referent implications", and "uncertainty is unfair and spoils everything" (Sexton & Dugas, 2009), given that the current study was interested in general negative beliefs about uncertainty, only the total score was utilized. This measure has demonstrated excellent internal consistency ($\alpha = .94$), adequate test-retest reliability at five weeks ($r = .74$), and good convergent and divergent validity (Buhr & Dugas, 2002, 2006). The IUS is presented in Appendix F.

Implicit Association Test (IAT; Greenwald et al., 1998) measures the relative strength of automatic associations between concepts and attributes. Given that automatic threat associations are believed to be one aspect of the cognitive fear structure (Teachman

et al., 2008), the IAT is thought to assess the relative strength of associations representing these structures. Two opposing word-categorizations, such as certain and uncertain, serve as concepts and are paired with two opposing word-groupings, such as positive and negative, which serve as attributes (such as threatening and non-threatening). Stimulus words are presented one at a time and participants are asked to classify them into concepts or attributes, a combination of a concept and attribute. For example, the word *ambiguous* is presented at the centre of the screen and participants are asked to classify the stimulus as either a "certain" word or an "uncertain" word, as "positive" or "negative", as "uncertain/negative" or "certain/positive", or as "uncertain/positive" or "certain/negative". The assumption underlying this task is that when an individual possesses a strong association between a concept and an attribute, this will be reflected by a quicker response to a word stimulus denoting either concept or attribute as compared to a word denoting a concept and attribute that are weakly associated.

The IAT was presented on a computer screen and included 5 blocks of trials. Each block involved presenting a list of words in random order, with two categories continuously displayed, one at the top left, and the other on the top right of the screen. Participants were required to press "Q" with their left hand to classify the stimulus word into the category displayed on the top-left corner, and "P" with their right hand to classify the word into the category on the top right of the screen. The word remained on the screen until either key was pressed. If a mistake occurred, an error sign (e.g. "Wrong answer") was presented for 1000ms. Otherwise, an inter-trial interval involving a black screen ensued for 400ms prior to the presentation of subsequent stimulus words. Three of the five blocks served to pair either concepts or attributes with two response keys and

these consisted of blocks one, two, and four. Blocks three and five consisted of pairing concepts with attributes, which was either threat consistent (*uncertain/negative* versus *certain/positive*), or threat inconsistent (*uncertain/positive* versus *certain/negative*). Blocks one and two served to train participants to press a key in response to words categorized as a concept and attribute that would later be combined in block three. Block four involved reversing the key associated with the concepts in block one in order to train participants to correctly combine concepts and attributes in block five. This block was necessary, given that the combinations were reversed to those in block three.

In the first block, participants were asked to correctly classify 20 words as either *certain*, or *uncertain*. Half of the words denoted certainty and the remaining half denoted uncertainty. The *certain* category was presented on the top left of the screen, and *uncertain* on the top-right. The subsequent block involved correctly classifying 20 new words as either positive or negative. For half of the participants, *positive* was displayed at the top-left corner and *negative* at the top-right, whereas the reverse occurred for the remaining participants. There were 10 negatively-valence words and 10 positively-valence words. The third block involved combining concept-attribute into new categories. For half the participants, this first combined categorization was threat-consistent, as it involved pairing of *uncertain* with *negative,* and correspondingly, *certain* with *positive*. For the remaining participants, the threat-inconsistent categorization was assessed (i.e. *uncertain* paired with *positive*, and *certain* paired with *negative*). All 40 words were utilized in this block of trials. The fourth block involved the same stimuli and categorizations as the first block (i.e. *certain* and *uncertain*), however the display locations for the two categories were reversed. The final block was similar to the third

block, in that the concepts and attributes were again combined and the same stimuli were utilized. However, the combined categories differed in that participants receiving threat-consistent categorization in third block received the threat-inconsistent categorization in the final block and those receiving threat-inconsistent categorization in block three received threat-consistent categorization in the final block. Appendix G includes a list of the 40 stimulus words utilized in this task. The average and standard deviations of RTs, and number of correct trials for blocks three and five were used to calculate a difference score for each participant, as described by Greenwald, Nosek, and Banaji (2003).

Catastrophizing Interview (Provencher et al., 2000; Vasey & Borkovec, 1992) is a validated worry task designed to assess different aspects of the worry process. Although originally developed to assess worry within the last six months, the Catastrophizing Interview was used in the current study to assess for state worry. There are three phases to the interview. In the first phase (i.e., topic generation), participants were asked to recall **all** current worry themes present during the past month, then to indicate using a comprehensive list of worry themes, any other current worries. During the catastrophizing phase, participants engaged in a forced worry chain, whereby the interviewer asked: "What is it about (*worry theme*) that worries you?". Once a response was provided (i.e. feared consequence), the interviewer asked the next question: "If this actually happened, what are you afraid would happen next?". This question was repeated until the participant was no longer able to generate feared consequences. Participants were then asked to rate the likelihood of each feared consequence, using a scale ranging from 0 (Not at all likely) to 100 (Definite). This process was repeated for all worry themes generated in the initial phase of the Catastrophizing Interview. In the final phase,

the interviewer rated the severity of the final feared consequence of each worry theme, using the Consequence Severity Grid (CSG), which provides severity ratings that range from 1 to 8. The average number of feared consequences per worry theme, average likelihood ratings per feared consequence per worry theme, and average severity of final feared consequences were collected and used for data analysis. See Appendix H for a copy of the CSG.

Results

Preparation of IAT Score

As described above, a difference score for the IAT was calculated. Response times (RTs) for both threat consistent and threat inconsistent trials of the IAT below 300ms or above 10000ms were deleted. The mean for threat consistent trials was computed and used to replace RTs for trials in which an error was made, along with a 600ms error penalty. The same procedure was applied to threat inconsistent trials. For the negative induction group, the average number of errors made for threat-consistent trials was 1.66 (*SD* = 1.47), and 5.34 (*SD* = 7.05) for threat-inconsistent trials. The positive induction group made 1.26 (SD = 1.52) errors on average for threat-consistent trials, and 4.00 (SD = 3.09) for threat-inconsistent trials. Finally, adjusted means and standard deviations for both threat consistent and threat inconsistent trials were calculated and used to compute the difference score.

Inter-rater Agreement

Given that the severity of the final feared consequence of each worry theme on the Catastrophizing Interview was assessed by the interviewer, an additional rating was provided by a second individual (an undergraduate student trained by Nicole Gervais) to

calculate inter-rater agreement using the CSG. The criterion for agreement on the severity of the final consequence of each worry theme was defined by a difference of no more than 1 point on the CSG. Using this criterion, the obtained kappa score was $\kappa = .60$.

Data Screening

Data from 70 participants were screened for normality of the distribution, and for univariate and multivariate outliers for all baseline measures. One univariate outlier was identified on the BDI-II and was deleted from subsequent analyses. Although eight multivariate outliers were found, Cook's distance revealed that none influenced the analyses. Thus the multivariate outliers were retained for subsequent analyses.

Power analyses conducted on a portion of the final sample revealed that a sample size of 69 is sufficient to detect an effect (see Appendix I for details of the Power analyses). As such, the final sample size for the current study was deemed adequate.

Preliminary Analyses

Independent samples t-tests and chi-square tests revealed no significant group differences on age ($t(67) = 1.44, p = .16$), sex ratio ($\chi^2 = 1.86, p = .17$), STAI-T ($t(67) = 0.08, p = .94$), BDI-II ($t(67) = 0.10, p = .92$), SDS-SF ($t(66) = 1.33, p = .19$), and the five baseline VAS ($t(67) = 0.04$ to $1.16, p = .25$ to $.97$). In addition, the groups did not differ in the amount of change on any of the VAS scales from pre- to post-test ($t(67) = 0.43$ to $1.81, p = .08$ to $.67$). Finally, there was an equal number of participants within each group receiving either the threat-consistent or the treat-inconsistent trials first ($\chi^2 = 1.76, p = .18$). Descriptive information for the induction groups and total sample is presented in Table 1 for age, STAI-T, BDI-II and SDS-SF, and in Table 2 for pre- and post-training

VAS scores.

Induction Training

Response times to probe trials. To assess the immediate efficacy of the induction training on interpretation, RTs to complete word fragments on both negative and positive probe trials were analyzed. After omitting RTs of incorrect trials, the RTs of the remaining trials were averaged for each participant across the ten negative and ten positive trials. A two-way mixed factorial analysis of variance was conducted with induction group (negative vs. positive training) as the between-subjects factor and probe valence (negative vs. positive trials) as the within-subjects factor. The average number of errors made for the negative induction group was 0.37 (SD = 0.58) for negative probes and 0.37 (SD = 0.50) for positive probes. For the positive group, the average number of errors made was 0.33 (SD = 0.48) for negative probes, and 0.37 (SD = 0.57) for positive probes. Results indicate a significant main effect of probe ($F(1, 67) = 9.85$, $p < .01$, partial $\eta^2 = .13$), with quicker RTs for positive (M = 2045.41ms, SD = 861.17ms) than negative trials (M = 2249.91ms, SD = 871.62ms). However, there was no significant main effect of training ($F(1, 67) = 0.90$, $p = .35$, partial $\eta^2 = .01$) on RT. Further, there was a significant Group X Probe interaction ($F(1, 67) = 28.01$, $p < .001$, partial $\eta^2 = .30$). Bonferroni-corrected pairwise comparisons revealed no significant difference in RTs to the different probes for the negative training group (M positive = 2129.09ms, SD = 811.55ms vs. M negative = 1985.24ms, SD = 606.97, $p = .13$). However, the positive training resulted in quicker RTs to the positive probes than the negative probes (M positive = 1959.26ms, SD = 913.54ms vs. M negative = 2522.36ms, SD = 1017.42ms, $p < .001$). This interaction is represented graphically in *Figure* 1.

Manipulation check. To assess whether the induction training resulted in changes in interpretative style, mean ratings for each participant were calculated separately across the four different interpretations and used in two 2-way mixed factorial ANOVAs, one for the foil interpretations, and a second for feasible interpretations. Induction group (negative vs. positive training) served as the between-subjects factor and interpretive valence (negative vs. positive interpretation) as the within-subjects factor. After applying a Bonferroni correction to control for family-wise error, no significant main effect of valence was found for foil ($F(1, 67) = 5.18, p = .03$, partial $\eta^2 = .07$), nor for feasible ($F(1, 67) = 0.03, p = .87$, partial $\eta^2 = .00$) interpretations. In addition, there was no main effect of group for either analysis ($F(1, 67) = 0.00, p = .97$, partial $\eta^2 = .00$ for foil, $F(1, 67) = 0.60, p = .44$, partial $\eta^2 = .01$ for feasible). However, both analyses revealed a significant Group X Valence interaction ($F(1, 67) = 15.46, p < .001$, partial $\eta^2 = .19$ for foil, $F(1, 67) = 28.64, p < .001$, partial $\eta^2 = .30$, for feasible interpretations). Bonferroni-corrected pairwise comparisons of the induction groups for the foil interpretation ratings revealed no significant group differences for either the negatively (*M* negative group = 1.71, *SD* = 0.52 vs. *M* positive group = 1.46, *SD* = 0.51, $p = .052$) or positively-valenced (*M* negative group = 1.60, *SD* = 0.57 vs. *M* positive group= 1.86, *SD* = 0.68, $p = .09$) interpretations. However, significant differences were found between induction groups for both the negatively (*M* negative group = 2.89, *SD* = 0.42 vs. *M* positive group = 2.52, *SD* = 0.53, $p < .01$) and positively-valenced (*M* negative group = 2.52, *SD* = 0.45 vs. *M* positive = 2.97, *SD* = 0.49, $p < .001$) feasible interpretation ratings. These two interactions are presented in *Figure* 2.

Main Analyses

Intolerance of Uncertainty Scale. To test the first hypothesis that interpretive bias induction training would lead to difference in explicit beliefs about uncertainty, an ANOVA was conducted. Results revealed no significant difference between groups ($F(1, 67) = 1.07$, $p = .31$, partial $\eta^2 = .02$) on the IUS. Thus, although training resulted in interpretive biases in the expected direction, this training did not influence scores on the IUS. Means and standard deviations on the IUS for each induction group and the total sample are presented in Table 3.

Implicit Association Test. The IAT was used to assess the relative strength of threat consistent word pairings and threat inconsistent word pairings, whereby quicker RTs to correctly classify a word into one category versus another would suggest a stronger association. It was expected that regardless of training, participants would demonstrate quicker RTs to threat-consistent than threat-inconsistent trials. As such, a paired-samples t-test was conducted and revealed a significant difference between the two types of word pairings ($t(67) = 11.00$, $p < .001$) in the predicted direction. Specifically, participants were quicker to correctly classify words in treat-consistent than threat-inconsistent word pairings.

To assess the second hypothesis that interpretive bias induction training would lead to a discrepancy between the two groups on the IAT difference score, a univariate ANOVA was conducted. Results revealed no significant difference between groups ($F(1, 67) = 0.69$, $p = .41$, partial $\eta^2 = .01$). Means and standard deviations for both RTs of threat-consistent and threat-inconsistent word pairings on the IAT for each induction group and the total sample are presented in Table 3.

Catastrophizing Interview. Given that three ratings were collected from this measure, including the average number of feared consequences per worry theme, average likelihood ratings of each feared consequence per worry theme, and average severity of final feared consequences, the ratings were combined in order to assess the final hypothesis that inducing an interpretive bias would lead to differences in the worry process. A multivariate analysis of variance was conducted to examine group differences on the composite of the worry ratings. Results indicate no significant difference between the two induction groups ($F(3, 56) = 2.56, p = .06, \eta^2 = .12$). Means and standard deviations for all three worry measures on the Catastrophizing Interview for each induction group and the total sample are presented in Table 3.

Discussion

The purpose of the present study was to examine the role of interpretive bias in worry by manipulating interpretations of ambiguous social events. Results from the induction training and manipulation check suggest that interpretive bias was successfully induced. While RTs to the two probe types during training were not significantly different in the negative induction group, the positive induction group was quicker to respond to positive probes than negative probes. On the subsequent manipulation check, however, significant group differences were observed with respect to feasible interpretations of ambiguous social situations. Specifically, relative to the negative induction group, the positive induction group rated the positive interpretations as more similar and the negative interpretations as less similar to the original scenarios. However, given the limited research assessing generalizability of the induction paradigm to other interpretive bias measures (Salemink et al., 2007b; Salemink et al., in press), it is difficult

to ascertain whether the induction can extend beyond the paradigm used. Including multiple measures of interpretive bias (e.g., AUSD; Davey et al., 1992) may have clarified the generalizability of the findings.

It was predicted that following successful induction of interpretive bias, the negative group would report significantly more negative beliefs about uncertainty, demonstrate stronger automatic threat associations related to uncertainty, and display more worry relative to the positive group. There were no statistically significant differences between the two induction groups on any of the dependent variables. Although none of the hypotheses were confirmed, there are many potential explanations for the null findings. For example, it is possible that negative beliefs about uncertainty, automatic associations related to uncertainty, and worry are not amenable to change from this type of induction procedure. Stated differently, an interpretive bias may have been successfully induced, but the bias may not have activated the cognitive fear structure. Both explicit beliefs about uncertainty and automatic associations related to uncertainty are believed to be different aspects of the cognitive fear structure (Koerner & Dugas, 2008; Teachman et al., 2008). Also, the worry variables assessed in the present study are believed to be influenced by activation of the cognitive fear structure (Provencher et al., 2000). As such, had the cognitive fear structure been activated, this activation should have been reflected in the dependent measures.

Further, and in contrast to previous research (Mathews & Macintosh, 2000; Salemink et al., 2007a,b; Yiend et al., 2005), the interpretive bias had no observable effect on state anxiety.

Previous studies included the *State-Trait Anxiety Inventory (Form Y) - State* (STAI-S; Spielberger, 1983) as a measure of state anxiety, whereas the present study used a Visual Analogue Scale (VAS). Although the VAS is recommended for examining idiosyncratic changes (Crichton 2001), perhaps the STAI-S is a more sensitive measure for the assessment of between-group differences. Given that the VAS contains two anchors with a large range (100-point scale) from no anxiety to extreme anxiety, perhaps this promotes larger within group variability than is obtained with the Likert scale of the STAI-S. Had the current study used the same measure of state anxiety as that used in previous studies, an effect of interpretive bias on state anxiety may have been observed.

Another possibility is that change in cognitive vulnerability and worry requires multiple sessions of interpretive bias training. Beard and Amir (2008) conducted a study involving the modification of interpretive bias in a sample of socially anxious individuals. Interpretive bias modification involved a computerized interpretation modification program (IMP) designed to train individuals to make benign interpretations of ambiguous social situations and reject threatening ones. Following eight sessions of IMP, increases in benign interpretations and decreases in threatening interpretations of ambiguous social situations, as well as decreases in social anxiety symptoms, were reported relative to a control condition. In addition, change in benign interpretations was found to mediate the effect of the IMP on social anxiety symptoms, and was a significant predictor of change in social anxiety. These findings suggest that interpretive bias modification can lead to change in symptoms. In a similar study, Salemink, van den Hout, Kindt, and Rienties (2008) found that eight sessions of a modified version of the interpretive bias training paradigm developed by Mathews and Macintosh (2000) lead to

decreases in trait anxiety, depressive symptoms, and general psychopathological symptoms in a clinically anxious sample. In addition, Salemink et al. found that improvements were maintained at three-month follow-up. Taken together, these two studies suggest that interpretive bias training can lead to changes in symptoms, but that multiple days of training may be required. However, given that the participants in both studies were only assessed twice (pre-treatment and following the final training session), it is not possible to know if multiple sessions were actually required to produce the observed findings. Accordingly, future research should assess participants following each training session.

No study to date has examined the effect of multi-session interpretive bias modification on cognitive vulnerability to anxiety. Had the current study involved multiple sessions of interpretive bias induction training, effects on cognitive vulnerability and worry may have been observed. Another possibility is that a minimum time delay between training and testing is required to allow for the consolidation of the training. Mathews, Ridgeway, Cook, and Yiend, (2007) assessed the influence of a four-session interpretive bias modification paradigm on trait anxiety. Using a high trait-anxious sample, the authors randomly assigned participants to either an interpretive bias modification group, or a test-retest control group. The training resulted in increases in positive interpretations and decreases in threatening interpretations in the active group relative to the control group. In addition, although no group difference was found on state anxiety at post-training, the active group reported lower trait anxiety levels relative to the control group one week following treatment termination. Thus, perhaps changes in trait anxiety and other variables such as cognitive vulnerability and worry are delayed

following interpretive bias training and can only be observed if the assessment is conducted accordingly.

Requiring either multiple sessions or a delay to promote consolidation (or a combination of the two) is consistent with assumptions underlying cognitive-behavioural therapy (CBT) for GAD. IU, an important treatment target in the CBT approach developed by Dugas and Ladouceur (2000), is addressed both directly and indirectly over multiple sessions of therapy. Research demonstrates that this treatment leads to decreases in IU and worry severity and that progress in level of IU continues over the course of two-year follow-up (Dugas et al., in press). There also exists evidence that shows IU can be modified in one test session, but only when using an experimental paradigm designed to target IU directly (Grenier &Ladouceur, 2004; Ladouceur, Gosselin et al., 2000). Although this research examined IU via explicit beliefs about uncertainty, other constructs related to cognitive fear structures have been shown to change across treatment. For example, Teachman and colleagues (Teachman et al., 2008; Teachman & Woody, 2003) demonstrated that automatic threat associations decrease across the course of CBT. There is also evidence that automatic associations can be manipulated directly in one test session (Rudman & Lee, 2002). Future research is needed to elucidate whether incorporating multiple sessions of interpretive bias training, introducing a time delay between the training and test, or a combination of the two, are required in order to observe congruent changes in cognitive vulnerability and worry.

Given that previous research has demonstrated that changes in worry occur following successful manipulation of IU (i.e., Grenier & Ladouceur; Ladouceur, Gosselin et al., 2000; Rosen & Knäuper, 2009), it is surprising that no group differences were

detected on any of the worry measures taken from the Catastrophizing Interview (Vasey & Borkovec, 1992; Provencher et al., 2000). Previous research has found differences between high and low worriers in terms of length of catastrophic sequences, likelihood ratings of consequences, and severity ratings of the final feared consequence when using the Catastrophizing Interview (Provencher et al., 2000; Vasey & Borkovec, 1992). With the exception of the present study, no research to date has been conducted to assess the relationship between interpretive bias and these three variables simultaneously. One study did assess the relationship between interpretive bias and perceived probability and perceived cost (Dellerba et al., 2007). Although perceived probability of the occurrence of a negative event was positively correlated with threatening interpretations of ambiguous scenarios, it did not mediate the relationship between these interpretations and IU. Perceived personal cost of negative outcomes was found to both correlate with threat interpretations of ambiguous scenarios and mediate the relationship between these interpretations and IU. A further study examining the role of perceived cost and perceived probability in worry found perceived cost to moderate the relationship between perceived probability and worry severity (Berenbaum, Thompson, & Pomerantz, 2007). These two studies suggest that perceived cost may be more important in the worry process than perceived probability. Despite this evidence, the interpretive bias induction training used in the present study did not alter cost ratings. Rather than assessing perceived cost, as was done previously, interviewer ratings of cost for the final consequence of each worry topic were used. Given that perceived cost is a subjective assessment of the severity of the final consequences of worries, perhaps it is sensitive to cognitive fear structure activation, whereas interviewer-rated severity is not. Stated

differently, it is possible that the change produced by the induction training on severity of final consequences of worries was subjective in nature. Had a more subjective self-report measure been used, perhaps differences on participant-rated perceptions of costs would have been observed (even if objective interviewer ratings remained similar in both conditions).

Although the training involved learning to make either negative or positive interpretations of social situations, there is reason to believe that this training extends to other life domains or situations. For example, Salemink and colleagues (in press) showed that the induction paradigm generalizes to situations concerning academic performance. In addition, following an interpretive bias modification for ambiguous social situations, Salemink and colleagues (2008) demonstrated symptom reduction in a clinically anxious sample that included patients with GAD. As such, it does not appear likely that the choice of life domain for the interpretive bias training explains the lack of effect on GAD-related variables.

There are a number of limitations to the current study that should be noted. As reported by Salemink and colleagues (2007a,b), the interpretive bias induction training may not generalize across tasks. Thus, omission of an additional measure of interpretive bias poses one major limitation to the present study. Another important limitation was that the experimenter was not blind to participant group membership; therefore, the experimenter may have unwittingly treated individuals from each group differently. This may have influenced the administration of the Catastrophizing Interview in particular, given that the interview was administered by the experimenter.

Another limitation of the study involves the assessment of anxiety. Previous research assessing the role of interpretive bias in anxiety has measured state anxiety using the *State-Trait Anxiety Inventory (Form Y) - State* (STAI-S; Spielberger, 1983). Since the present study used a different measure (VAS), it is difficult to interpret the discrepant findings. However, both measures have demonstrated sound psychometric properties (Grant et al., 1999; Spielberger, 1983) and are therefore appropriate options for assessing state anxiety.

Finally, although the word stimuli used to assess automatic threat associations related to uncertainty have been used in previous research (i.e., Anderson, Gervais, & Dugas, 2007; Heinecke, Koerner, Mogg, & Dugas, 2006), the IAT as a measure of such associations has yet to be validated. This task has been used in previous research using word stimuli to distinguish individuals with panic disorder from non-anxious controls (Teachman et al., 2007) and socially anxious individuals from non-anxious controls (de Jong et al., 2001). It remains to be seen whether individuals with GAD are distinguishable from non-anxious controls on automatic threat associations related to uncertainty using this task. Further, it remains to be seen whether automatic threat associations related to uncertainty are associated with worry severity, IU, interpretive bias, and other GAD-related variables. Given the findings from research on automatic threat associations related to other anxiety disorders, and given the abundant research linking IU to GAD, it would not be surprising to find evidence of such relationships.

Despite these limitations, the present study has several notable strengths. For one, this is the first study, to our knowledge, to assess the impact of inducing interpretive bias on GAD-related variables. It is also the first study that attempted to test the potential

effects of interpretive bias on these variables using an experimental design. The present study also incorporated a semi-structured interview assessing different aspects of the worry process. Whereas previous research typically assessed worry severity, the current study included an assessment of likelihood and cost ratings, which are believed to be important aspects of the worry process and have been shown to be related to interpretive bias (Berenbaum, Thompson, & Bredemeier, 2007; Berenbaum, Thompson, & Pomerantz, 2007; Dellerba et al., 2007). Finally, this was the first attempt at examining automatic threat associations related to uncertainty and at determining whether they are malleable following interpretive bias training. Cognitive theory claims that cognitive fear structures contain both automatic and controlled (or strategic) processes (Beck & Clark, 1997; Segal 1988). Thus, developing an understanding of the role of automatic associations in the etiology and maintenance of worry and GAD, as well as in cognitive change during treatment is just as crucial to understanding the role of explicit beliefs. As such, there are a number of directions for future research.

Although the present study builds on previous research examining the role of interpretive bias in GAD, more research is necessary to understand its precise role. The goal of the current study was to determine whether inducing an interpretive bias would have an effect on both cognitive vulnerability and worry processes. Although the findings suggest that interpretive bias training does not influence these variables, future research should continue examining its precise role, given what has been learned thus far about interpretive bias in GAD. Research should continue examining its potential causal role, with some modifications to the procedure used in the current study (e.g., incorporating multiple training sessions and additional measures of interpretive bias). Further, studies

should examine the efficacy of the training paradigm developed by Mathews and Macintosh (2000) in a GAD sample. Future research should also focus on whether automatic threat associations related to uncertainty are involved in worry and GAD. This can be done by determining whether performance on this task can distinguish individuals with GAD from non-anxious controls, and whether this performance is associated with GAD-related variables. It is also important to determine whether such associations are amenable to change during treatment for GAD.

Even though there were no observable effects on GAD-related variables, interpretive bias training may still prove to be clinically useful. The present study illustrates the difficulty in achieving cognitive and symptom change following a brief intervention. Given that other studies (i.e., Beard & Amir, 2008; Salemink et al., 2008) have shown that such changes can occur following multiple therapy sessions, it may be unrealistic to expect such changes to occur following one interpretive bias training session. However, the clinical utility of multiple interpretive bias training sessions can be called into question as it is extremely unlikely that such a technique would be as effective as current empirically-supported therapy options for anxiety disorders. Rather, it is possible that interpretive bias modification techniques may serve to facilitate gains achieved in therapy, or perhaps to increase the efficacy of current approaches. For example, such paradigms as those used by Beard and Amir (2008) and Salemink and colleagues (2008) could be incorporated into CBT approaches as exercises to be completed multiple times during therapy.

In summary, the present study shows that interpretive bias can be induced using the paradigm developed by Mathews and Macintosh (2000). Conversely, no support was

found for the causal role of interpretive bias in cognitive vulnerability for worry. Contrary to previous research, there was no evidence suggesting that interpretive bias training influences state anxiety. However, there are a number of potential explanations for the observed findings. More research is necessary before concluding whether or not interpretive bias plays a causal role in GAD-related cognitive vulnerability and worry. In addition to developing a greater understanding of the role of interpretive bias, research aimed at modifying interpretive bias has important treatment implications. It remains to be seen whether decreases in interpretive bias occur during treatment of GAD and if so, whether they lead to decreases in symptoms and cognitive vulnerability. Research aimed at answering such questions may lead to adjustments to current treatment approaches.

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Table 1

Mean and Standard Deviation for Baseline Measures for Induction Groups and Total Sample (N = 69)

	Negative		Positive		Total	
Baseline Measures	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	26.83	9.02	30.12	9.96	28.45	9.57
STAI-T	40.09	11.24	40.31	11.85	40.20	11.46
BDI-II	9.51	8.40	9.32	7.93	9.42	8.12
SDS-SF	6.44	2.80	7.27	2.29	6.85	2.57

Note. STAI-T = State-Trait Anxiety Inventory- Trait; BDI-II = Beck Depression Inventory, second edition; SDS-SF = Social Desirability Scale- Short Form.

Table 2

Mean and Standard Deviation for VAS scores for Induction Groups and Total Sample (N = 69)

	Negative (n = 35)				Positive (n = 34)				Total			
	Pre-training		Post-training		Pre-training		Post-training		Pre-training		Post-training	
Variables	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
VAS-Anxiety	20.59	20.35	24.62	24.92	19.38	19.99	20.01	19.91	19.99	20.03	22.35	22.55
VAS-Sadness	16.11	22.34	12.52	17.67	15.92	19.23	9.49	12.90	16.02	20.71	11.03	15.46
VAS-Worry	22.15	23.76	21.15	25.94	29.11	25.93	21.41	23.87	25.58	24.92	21.28	24.76
VAS-Fatigue	27.97	23.74	36.51	26.73	24.03	19.89	30.35	23.39	26.03	21.86	33.48	25.15
VAS-Irritability	12.86	19.02	15.31	20.32	16.68	20.49	16.74	21.95	14.74	19.70	16.02	21.00

Note. VAS = Visual Analogue Scale.

Table 3

Mean and Standard Deviation for the IUS, IAT, CI for Induction Groups and Total Sample (N = 69)

Variables	Negative (n = 35)		Positive (n = 34)		Total	
	M	*SD*	*M*	*SD*	*M*	*SD*
IUS	56.31	19.13	61.32	21.17	58.78	20.17
IAT						
Threat-consistent	945.68	227.75	1009.49	321.93	977.12	277.96
Threat-inconsistent	1715.92	629.56	1968.36	946.19	1840.31	805.48
CI						
Number	4.20	1.31	4.97	1.97	4.56	1.68
Likelihood	31.82	15.81	24.29	11.18	28.30	14.24
Severity	3.53	1.50	3.44	1.49	3.49	1.49

Note. IUS = Intolerance of Uncertainty Scale; IAT = Implicit Association Test; CI = Catastrophizing Interview; Number = average number of feared consequences per worry theme; Likelihood = average likelihood ratings of feared consequences per worry theme; Severity = average severity of final feared consequences.

Figure Captions

1. *Figure 1. Average response time (RT) to solve word fragments of negative and positive probes for the negative (n = 35) and positive (n = 34) induction groups.*

2. *Figure 2. Ratings of negatively and positively-valenced foil and feasible interpretations for the negative (n = 35) and positive (n = 34) induction groups.*

Figure 1. Average response time (RT) to solve word fragments of negative and positive probes for the negative (n = 35) and positive (n = 34) induction groups.

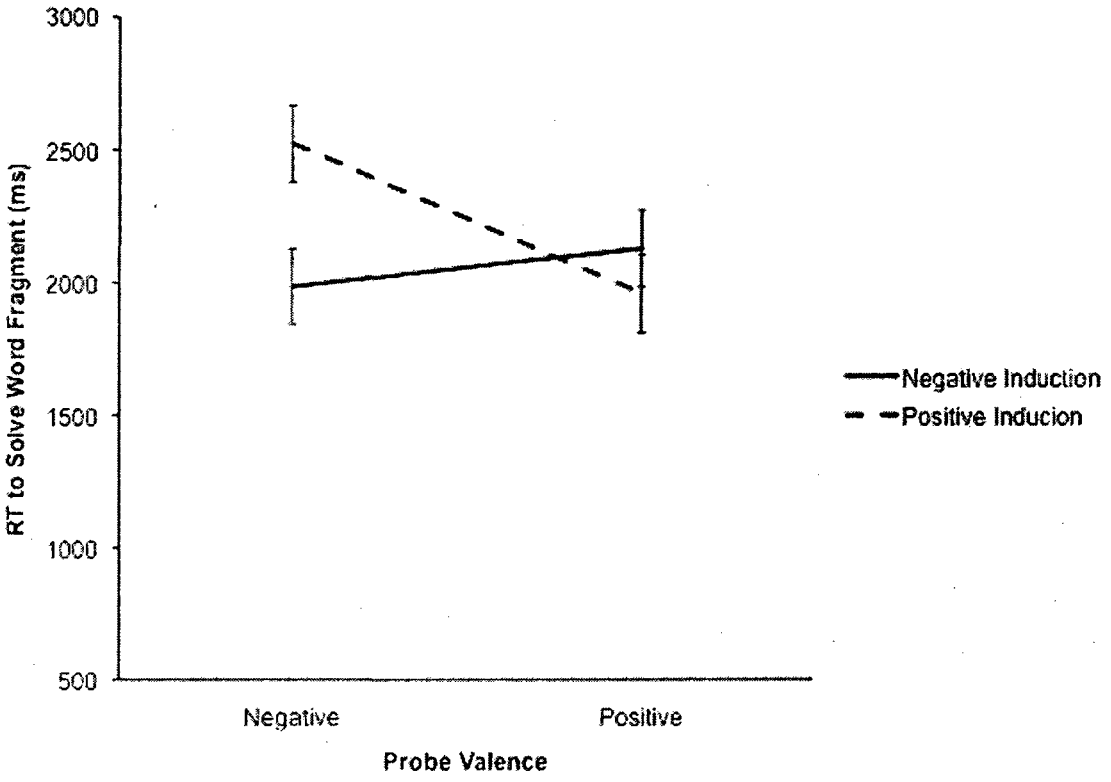
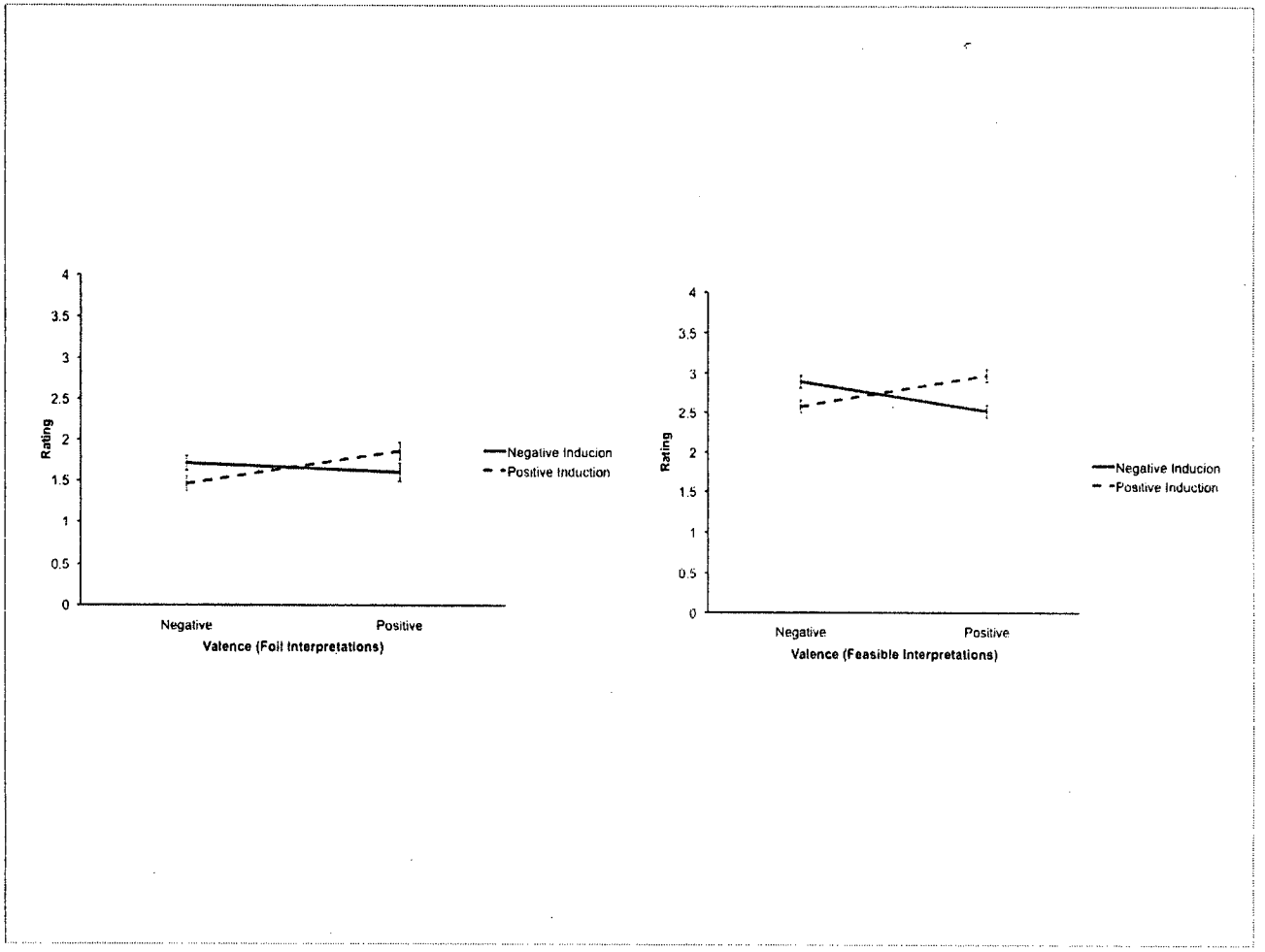


Figure 2. Ratings of negatively and positively-valenced foil and feasible interpretations for the negative (n = 35) and positive (n = 34) induction groups.



Appendix A

Preliminary Screening

Preliminary Screening
ID#:_____

1. Age: _____
*(Between 18 and 55 – if not then **EXCLUDE**)*

2a). First language: _____

2c). If English not first language, fluent?: YES:____ NO: _____

3. Wear glasses/contact lenses? (Maybe we can ask this question so that they can be flagged in the excel sheet so I will know to remind them to bring their glasses for the two visits to the lab).

YES:____ NO: _____

4. Are you currently taking any medication? YES:____ NO: _____

IF YES: What is the name of your medication(s)?:

_____

_____

How long have you been taking this medication?: *(4 weeks stable for Benzodiazepines, & 12 weeks for other medications. If they take benzos p.r.n., they need to be flagged in excel document so that experimenter can remind them to not take 4 hrs prior to testing session)*

_____

_____

_____

STABLE: YES:___ NO:____ (if no, what is nature of unstable...benzo p.r.n.? recent increase/decrease? Change in meds?)

5. Have you ever been diagnosed as having a reading disability? YES:____ NO:_____
*(IF YES for reading disability – **EXCLUDE**)*

6. Have you ever been diagnosed with schizophrenia, bipolar disorder, or any other mental illness? YES: _____ NO: _____

YES: *specify which*

_____

_____

*(IF YES for schizophrenia, bipolar, or other organic mental disorder – **EXCLUDE**)*

7. Do you have any other medical conditions? (*hyperthyroidism, hypoglycemia, anemia etc...*):
YES: ____ NO:_____

IF YES: *specify which*

_____

_____

8. Have you ever been diagnosed with an anxiety disorder?

YES: ____ NO:_____

YES: *specify which disorder and when were they diagnosed?*

_____

_____

9. Currently experiencing any thoughts of suicide?
YES: ____ NO:_____

If YES...

4. What kind of thoughts of death or suicide have you had? *Assess: Concreteness of ideas; presence of specific plan; access to method for carrying out plan; specific timeline for plan; ability to state reasons for living. Note the difference between actual suicidal ideation and self-harm obsessions. In* ***Self-harm obsessions****, thoughts about death or harming oneself are intrusive in that the person does not want to have them (egodystonic). The person may fear that because they are having these re-occurring thoughts, they might commit suicide without actually wanting to.*

_____

_____

_____

_____

_____

_____

_____

SUICIDALITY *Based on the person's description above, check one of the 4 LEVELS below:*

____ *LEVEL 0: No current suicidal ideation*

____ *LEVEL 1: Vague thoughts about suicide, but no plan*

____ *LEVEL 2: Fuzzy plan (i.e. would take pills, but don't know specifically what pills, or how many are needed, or where to get these pills etc...)*

____ *LEVEL 3: Clear plan, but no intention or timeline of when it will take place*

____ *LEVEL 4: Clear plan and clear intention of when it will take place*

5. Have you ever acted on thoughts about suicide, or attempted suicide?
If YES, How long ago?

____ *ATTEMPT 0: Never attempted suicide*

____ *ATTEMPT 1: Suicide attempted more than 2 years ago*

____ *ATTEMPT 2: Suicide attempt made within the past 2 years*

Based on the responses above, check ***one*** *of the categories below:*

ATTEMPT 0
+ LEVEL 0 _____ *OK*
+ LEVEL 1 _____ *OK*
+ LEVEL 2 _____ *EXCLUDE*
+ LEVEL 3 _____ *EXCLUDE*
+ LEVEL 4 _____ *EXCLUDE*

ATTEMPT 1
+ LEVEL 0 _____ *OK*
+ LEVEL 1 _____ *EXCLUDE*
+ LEVEL 2 _____ *EXCLUDE*
+ LEVEL 3 _____ *EXCLUDE*
+ LEVEL 4 _____ *EXCLUDE*

ATTEMPT 2
+ ***ANY*** *LEVEL* ____ *EXCLUDE*

IF EXCLUDED AT
LEVEL 3 or LEVEL 4: Contact Michel. *Con U: ext 2215; Clinic (514)338-4201; Home (450)971-2913.*
LEVEL 3: *Confirm absence of immediate intention; give referral/number for helpline, information about nearest hospital emergency, and any other information participant requests.*
Any other level of exclusion, offer participant referral/number for helpline.

Appendix B

State-Trait Anxiety Inventory (Form Y) - Trait

STAI

STAI Form Y-2

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	Almost Never	Sometimes	Often	Almost Always
1. I feel pleasant.	1	2	3	4
2. I feel nervous and restless.	1	2	3	4
3. I feel satisfied with myself.	1	2	3	4
4. I wish I could be as happy as others seem to be.	1	2	3	4
5. I feel like a failure.	1	2	3	4
6. I feel rested.	1	2	3	4
7. I am "calm, cool, and collected".	1	2	3	4
8. I feel that difficulties are piling up so that I cannot overcome them.	1	2	3	4
9. I worry too much over something that really doesn't matter.	1	2	3	4
10. I am happy.	1	2	3	4

	Almost Never	Sometimes	Often	Almost Always
11. I have disturbing thoughts.	1	2	3	4
12. I lack self-confidence.	1	2	3	4
13. I feel secure.	1	2	3	4
14. I make decisions easily.	1	2	3	4
15. I feel inadequate.	1	2	3	4
16. I am content.	1	2	3	4
17. Some unimportant thought runs through my mind and bothers me.	1	2	3	4
18. I take disappointments so keenly that I can't put them out of my mind.	1	2	3	4
19. I am a steady person.	1	2	3	4
20. I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

 STAIP-AD Test Form Y

Appendix C

Beck Depression Inventory, second edition

BDI-II

This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for each group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1) Sadness
- 0 I do not feel sad.
- 1 I feel sad much of the time.
- 2 I am sad all the time.
- 3 I am so sad or unhappy that I can't stand it.

2) Pessimism
- 0 I am not discouraged about my future.
- 1 I feel more discouraged about my future than I used to be.
- 2 I do not expect things to work out for me.
- 3 I feel my future is hopeless and will only get worse.

3) Past Failure
- 0 I do not feel like a failure.
- 1 I have failed more than I should have.
- 2 As I look back, I see a lot of failures.
- 3 I feel I am a total failure as a person.

4) Loss of Pleasure
- 0 I get as much pleasure as I ever did from the things I enjoy.
- 1 I don't enjoy things as much as I used to.
- 2 I get very little pleasure from the things I used to enjoy.
- 3 I can't get any pleasure from the things I used to enjoy.

5) Guilty Feelings
- 0 I don't feel particularly guilty.
- 1 I feel guilty over many things I have done or should have done.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all of the time.

6) Punishment Feelings
- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

7) Self-Dislike
- 0 I feel the same about myself as ever.
- 1 I have lost confidence in myself.
- 2 I am disappointed in myself.
- 3 I dislike myself.

8) Self-Criticalness
- 0 I don't criticize or blame myself more than usual.
- 1 I am more critical of myself than I used to be.
- 2 I criticize myself for all my faults.
- 3 I blame myself for everything bad that happens.

9) Suicidal Thoughts or Wishes
- 0 I don't have any thoughts of killing myself.
- 1 I have thoughts of killing myself, but I would not carry them out.
- 2 I would like to kill myself.
- 3 I would kill myself if I had the chance.

10) Crying
- 0 I don't cry any more than I used to.
- 1 I cry more now than I used to.
- 2 I cry over every little thing.
- 3 I feel like crying but I can't.

11) Agitation
- 0 I am no more restless or wound up than usual.
- 1 I feel more restless or wound up than usual.
- 2 I am so restless or agitated that it's hard to stay still.
- 3 I am so restless or agitated that I have to keep moving or doing something.

12) Loss of Interest
- 0 I have not lost interest in people or activities.
- 1 I am less interested in other people or things than before.
- 2 I have lost most of my interest in other people or things.
- 3 It's hard to get interested in anything.

13) Indecisiveness
- 0 I make decisions about as well as ever.
- 1 I find it more difficult to make decisions than usual.
- 2 I have much greater difficulty in making decisions than I used to.
- 3 I have trouble making any decision.

14) Worthlessness
- 0 I do not feel I am worthless.
- 1 I don't consider myself as worthwhile and useful as I used to.
- 2 I feel more worthless as compared to other people.
- 3 I feel utterly worthless.

15) Loss of Energy
- 0 I have as much energy as ever.
- 1 I have less energy than I used to have.
- 2 I don't have enough energy to do very much.
- 3 I don't have enough energy to do anything.

16) Changes in Sleeping Pattern
- 0 I have not experienced any changes in my sleeping pattern.
- 1a I sleep somewhat more than usual.
- 1b I sleep somewhat less than usual.
- 2a I sleep a lot more than usual.
- 2b I sleep a lot less than usual.
- 3a I sleep most of the day.
- 3b I wake up 1-2 hours early and can't get back to sleep.

17) Irritability
- 0 I am no more irritable than usual.
- 1 I am more irritable than usual.
- 2 I am much more irritable than usual.
- 3 I am irritable all the time.

18) Changes in Appetite
- 0 I have not experienced any changes in my appetite.
- 1a My appetite is somewhat less than usual.
- 1b My appetite is somewhat greater than usual.
- 2a My appetite is much less than before.
- 2b My appetite is much greater than usual.
- 3a I have no appetite at all.
- 3b I crave food all the time.

19) Concentration Difficulty
- 0 I can concentrate as well as usual.
- 1 I can't concentrate as well as usual.
- 2 It's hard to keep my mind on anything for very long.
- 3 I find I can't concentrate on anything.

20) Tiredness or Fatigue
- 0 I am no more tired or fatigued than usual.
- 1 I get more tired or fatigued more easily than usual.
- 2 I am too tired or fatigued to do a lot of the things I used to do.
- 3 I am too tired or fatigued to do most of the things I used to do.

21) Loss of Interest in Sex
- 0 I have not noticed any recent change in my interest in sex.
- 1 I am less interested in sex than I used to be.
- 2 I am much less interested in sex now.
- 3 I have lost interest in sex completely.

Appendix D

Social Desirability Scale-Short Form

SDS

SDS-SF

Listed below are a number of statements concerning personal attitudes and traits. Please read each item and circle T (true) or F (false) as it pertains to you.

T	F	1.	It is sometimes hard for me to go on with my work if I am not encouraged.
T	F	2.	I sometimes feel resentful when I don't get my way.
T	F	3.	On a few occasions, I have given up doing something because I thought too little of my ability.
T	F	4.	There have been times when I felt like rebelling against people in authority even though I knew they were right.
T	F	5.	No matter who I'm talking to, I'm always a good listener.
T	F	6.	There have been occasions when I took advantage of someone.
T	F	7.	I'm always willing to admit it when I make a mistake.
T	F	8.	I sometimes try to get even rather than forgive and forget.
T	F	9.	I am always courteous, even to people who are disagreeable.
T	F	10.	I have never been irked when people expressed ideas very different from my own.
T	F	11.	There have been times when I was quite jealous of the good fortune of others.
T	F	12.	I am sometimes irritated by people who ask favors of me.
T	F	13.	I have never deliberately said something that hurt someone's feelings.

Reynolds, W.M. (1982).

Appendix E

Visual Analogue Scales

Before

Please rate your ***current*** level of anxiety on the scale below by marking a line between 0 (Not at all anxious) and 100 (Extremely anxious)

0 ——————————————— **100**

Not at all anxious Extremely anxious

Please rate your ***current*** level of sadness on the scale below by marking a line between 0 (Not at all sad) and 100 (Extremely sad)

0 ——————————————— **100**

Not at all sad Extremely sad

Please rate your ***current*** level of worry on the scale below by marking a line between 0 (Not at all worried) and 100 (Extremely worried)

0 ——————————————— **100**

Not at all worried Extremely worried

Before

Please rate your ***current*** level of fatigue on the scale below by marking a line between 0 (No fatigue) and 100 (Extreme fatigue)

0 ——————————————— **100**

No fatigue Extreme fatigue

Please rate your ***current*** level of irritability on the scale below by marking a line between 0 (Not at all irritable) and 100 (Extremely irritable)

0 ——————————————— **100**

Not at all irritable Extremely irritable

After

Please rate your ***current*** level of anxiety on the scale below by marking a line between 0 (Not at all anxious) and 100 (Extremely anxious)

0 ——————————————— **100**

Not at all anxious Extremely anxious

Please rate your ***current*** level of sadness on the scale below by marking a line between 0 (Not at all sad) and 100 (Extremely sad)

0 ——————————————— **100**

Not at all sad Extremely sad

Please rate your ***current*** level of worry on the scale below by marking a line between 0 (Not at all worried) and 100 (Extremely worried)

0 ——————————————— **100**

Not at all worried Extremely worried

After

Please rate your ***current*** level of fatigue on the scale below by marking a line between 0 (No fatigue) and 100 (Extreme fatigue)

0 ——————————————————— **100**

No fatigue Extreme fatigue

Please rate your ***current*** level of irritability on the scale below by marking a line between 0 (Not at all irritable) and 100 (Extremely irritable)

0 ——————————————————— **100**

Not at all irritable Extremely irritable

Appendix F

Intolerance of Uncertainty Scale

IUS

You will find below a series of statements which describe how people may react to the uncertainties of life. Please use the scale below to describe to what extent each item is characteristic of you. Please circle a number (1 to 5) that describes you best.

	Not at all characteristic of me			Somewhat characteristic of me	Entirely characteristic of me
1. Uncertainty stops me from having a firm opinion.	1	2	3	4	5
2. Being uncertain means that a person is disorganized.	1	2	3	4	5
3. Uncertainty makes life intolerable.	1	2	3	4	5
4. It's unfair not having any guarantees in life.	1	2	3	4	5
5. My mind can't be relaxed if I don't know what will happen tomorrow.	1	2	3	4	5
6. Uncertainty makes me uneasy, anxious, or stressed.	1	2	3	4	5
7. Unforeseen events upset me greatly.	1	2	3	4	5
8. It frustrates me not having all the information I need.	1	2	3	4	5
9. Uncertainty keeps me from living a full life.	1	2	3	4	5
10. One should always look ahead so as to avoid surprises.	1	2	3	4	5

	Not at all characteristic of me				Somewhat characteristic of me				Entirely characteristic of me
11. A small unforeseen event can spoil everything, even with the best of planning.	1		2		3		4		5
12. When it's time to act, uncertainty paralyses me.	1		2		3		4		5
13. Being uncertain means that I am not first rate.	1		2		3		4		5
14. When I am uncertain, I can't go forward.	1		2		3		4		5
15. When I am uncertain I can't function very well.	1		2		3		4		5
16. Unlike me, others always seem to know where they are going with their lives.	1		2		3		4		5
17. Uncertainty makes me vulnerable, unhappy, or sad.	1		2		3		4		5
18. I always want to know what the future has in store for me.	1		2		3		4		5
19. I can't stand being taken by surprise.	1		2		3		4		5
20. The smallest doubt can stop me from acting.	1		2		3		4		5
21. I should be able to organize everything in advance.	1		2		3		4		5
22. Being uncertain means that I lack confidence.	1		2		3		4		5

	Not at all characteristic of me			Somewhat characteristic of me		Entirely characteristic of me
23. I think it's unfair that other people seem sure about their future.	1	2		3	4	5
24. Uncertainty keeps me from sleeping soundly.	1	2		3	4	5
25. I must get away from all uncertain situations.	1	2		3	4	5
26. The ambiguities in life stress me.	1	2		3	4	5
27. I can't stand being undecided about my future.	1	2		3	4	5

Origianl French Version: Freeston, M.H., Rhéaume, J., Letarte, H., Dugas, M.J., & Ladouceur, R. (1994): Why do people worry? *Personality and Individual Differences, 17*(6), 791-802.

English Version: Buhr, K., Dugas, M. J. (2002). The intolerance of uncertainty scale: psychometric properties of the English version. *Behavior Research and Therapy, 40*, 931-945.

Appendix G

Stimulus Words for Implicit Association Test

UNCERTAIN WORD LIST	CERTAIN WORD LIST	POSITIVE WORD LIST	NEGATIVE WORD LIST
AMBIGUOUS	DEFINITE	GREAT	TOXIC
DEBATABLE	PREDICTABLE	WORTHY	HATED
CHANCE	SURE	GENEROUS	FOOLISH
HESITATION	CONVINCED	INTEGRITY	PATHETIC
VAGUE	KNOWN	ADORED	LETHAL
RANDOM	CLEAR	ADMIRED	INFERIOR
DOUBTFUL	UNDENIABLE	GOOD	POISONOUS
VARYING	GUARANTEED	ENTHUSIASTIC	IMMATURE
MAYBE	CONCLUSIVE	WONDERFUL	UNHEALTHY
QUESTIONNABLE	ABSOLUTE	CONFIDENT	FEVERISH

Appendix H

Consequence Severity Grid

Consequence Severity Grid

1) Symptoms or difficulties do not affect individual's functioning

a) *Emotional*: absence of positive emotion (inattention, bored, uneasiness, etc.)

b) *Interpersonal*: disagreement with someone

c) *Behavioural/Occupational*: take a little more time

d) *Others*:

e) *Society*:

2) Mild symptoms or difficulties affect some of the individual's functioning

a) *Emotional*: negative emotion (stressed, depressed, ashamed, guilty, discouraged, lonely, etc.), difficulty concentrating, anxious symptoms (palpitations, shaking, insomnia, etc.)

b) *Interpersonal*: arguments with family

c) *Behavioural/Occupational:* finish work late, unsatisfied at work, etc.

d) *Others*: my parents are unhappy

e) *Society*:

3) Moderate symptoms or difficulties affect individual's functioning with increasing intensity or frequency, but non-chronic

a) *Emotional*: panic attacks, feeling like you're nothing, wanting to be alone

b) *Interpersonal*: arguments with significant other, problems with boss or colleagues, few friends, not speaking to family, loss of friends, etc.

c) *Behavioural/Occupational:* fails a class, becomes sick

d) *Others*: hurt others, loved one falls ill

e) *Society*:

4) Serious symptoms or difficulties cause observable and persistent interference in the individual

a) *Emotional*: Mood disorder (depression, anxiety, etc.)

b) *Interpersonal*: separation from wife/husband, no friends

c) *Behavioural/Occupational:* incapable of holding a job, financial difficulties, academic failure

d) *Others*: serious illness of loved one

e) *Society*

5) Chronic symptoms or difficulties cause marked interference in multiple aspects of individual's life

a) *Emotional*: Suicidal ideation, non-fatal accident with severe consequences (handicap, paralysis, disfiguration)

b) *Interpersonal*: divorce

c) *Behavioural/Occupational:* incapable of working, no work, on welfare, serious financial problems (in debt for rest of life)

d) *Others*: death of husband/wife

e) *Society*

6) Extreme symptoms or difficulties cause marked interference in nearly all aspects of individual's life

a) *Emotional*: Psychosis (become insane, etc), being a failure

b) *Interpersonal*: no significant relationship

c) *Behavioural/Occupational:* live in poverty, no home, become a beggar or homeless

d) *Others*: death of child, suicide of husband/wife

e) *Society:* concentration camps

7) Catastrophic symptoms or difficulties cause harm to the individual's life without causing death

a) *Emotional*: suicidal attempt, fatal disease (AIDS, cancer, etc)

b) *Interpersonal*: none

c) *Behavioural/Occupational:* none

d) *Others*: none

e) *Society:* natural disaster, epidemic, war, etc

8) Fatal symptoms or difficulties cause immediate death of the individual or result in post-mortem consequences

a) *Emotional*: suicide, burn in hell, does not rest in peace

b) *Interpersonal*: none

c) *Behavioural/Occupational:* none

d) *Others*: none

e) *Society:* destruction of planet, nuclear war

Appendix I

Power Analyses

Power and sample size calculations were determined from a subset of the final sample. These calculations involved calculating Cohen's d using the following formula:

$$d = (mean_{neg} - mean_{pos}) / SQRT(((n_{neg} - 1)s_{neg}^2 + [(n_{pos} - 1)s_{pos}^2)/(n_{neg} + n_{pos}))$$

In order to determine an appropriate sample size, analyses for each of the five dependent variables were calculated using the following formula, assuming a Power of 0.8 and alpha of 0.5:

$n' = [(z_{\alpha/2} + z_{\beta}) / d]$, where $z_{\alpha/2} = 1.96$, and $z_{\beta} = 0.84$

DV	**Cohen's d**	**Required sample size**
Intolerance of Uncertainty Scale	0.18	242
Implicit Association Test-Difference score	0.34	68
Average length of catastrophic sequences	0.62	20
Average probability ratings	0.68	17
Severity of final consequences	0.09	969