

Cognitive Vulnerability to Excessive Worry
and Its Relationship to the Processing of Uncertainty

Naomi Koerner-Singh

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ABSTRACT

Cognitive Vulnerability to Excessive Worry and Its Relationship to the Processing of Uncertainty

Naomi Koerner-Singh, Ph.D.
Concordia University, 2007

Numerous studies have shown that clinically-significant anxiety is associated with a tendency to apply threat interpretations to stimuli or situations that can plausibly be interpreted in a neutral or benign fashion. Current thinking suggests that biases in appraisal and interpretation are not merely epiphenomena of disorder; but rather, markers and “transmitters” of underlying cognitive vulnerability. *Intolerance of uncertainty* has been identified as a potential cognitive vulnerability for generalized anxiety disorder (GAD), a condition characterized by excessive and uncontrollable worry. Individuals who endorse high levels of intolerance of uncertainty hold the view that uncertainty is stressful and upsetting; that uncertainty leads to the inability to take action; that uncertain events are negative and to be avoided; and that being uncertain is unfair. This thesis consists of three independent investigations of the relationship of intolerance of uncertainty to the processing of uncertainty. Using three different paradigms, individuals low and high on intolerance of uncertainty were compared on their appraisals of ambiguous scenarios. Collectively, the findings suggest (1) that individuals high on intolerance of uncertainty appraise ambiguous stimuli and events as less pleasant and more disconcerting relative to individuals low on intolerance of uncertainty; (2) that individuals with high levels of intolerance of uncertainty take longer to evaluate affectively-neutral stimuli compared to individuals with low levels of intolerance of uncertainty; (3) that degree of intolerance of uncertainty is a stronger predictor of

appraisals of ambiguous situations than are GAD symptoms and mood variables; (4) that appraisals of ambiguous situations partly mediate the relationship of intolerance of uncertainty to worry; (5) that the appraisals of individuals high on intolerance of uncertainty appear to lack content-specificity; (6) that relative to individuals low on intolerance of uncertainty, those high on intolerance of uncertainty have a greater tendency to use anxious affect as information when appraising potentially threatening situations; and (7) that habitual use of thought suppression is associated with negative appraisals of ambiguous scenarios in individuals high on intolerance of uncertainty only. The findings are discussed within the context of conceptual models of worry and GAD as well as theories of normative decision-making under uncertainty.

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CONTRIBUTIONS OF AUTHORS

This Ph.D. thesis consists of three manuscripts:

Study 1 (see Chapter 2)

Koerner, N., & Dugas, M.J. (in press). An investigation of appraisals in individuals vulnerable to excessive worry: The role of intolerance of uncertainty. *Cognitive Therapy and Research*.

Study 2 (see Chapter 3)

Koerner, N., & Dugas, M.J. (2007). Intolerance of uncertainty, emotional reasoning and their relation to the appraisal of uncertain situations. Manuscript under review for submission.

Study 3 (See Chapter 4)

Koerner, N., & Dugas, M.J. (2007). Intolerance of uncertainty, cognitive avoidance and their relation to interpretative processing. Manuscript under review for re-submission.

Relative Contributions

I proposed the dissertation topic and suggested the focus for each of the studies. The studies were developed on the basis of findings from an initial study conducted in the laboratory (see Dugas, Hedayati et al., 2005). I had a principal role in the definition of research problems, formulation of hypotheses, design and methodology, data collection, statistical analyses and interpretation, and writing of the manuscripts. Dr. Dugas, thesis supervisor, provided direction throughout the entire thesis research and provided feedback on all three of the manuscripts.

For Study 1, I developed a revised version of the vignette task that was used in Dugas, Hedayati et al. (2005). I constructed new items, carried out the pilot-testing, and

was responsible for the selection of the final vignette scenarios. I selected the self-report measures. Research assistants in the laboratory assisted with all of the data collection and were responsible for the data entry. I was responsible for management of the data set, statistical analyses, interpretation of findings, and the writing of the manuscript. Dr. Dugas provided specific suggestions for carrying out the exploratory analyses. In addition, I made revisions to the manuscript on the basis of feedback from Dr. Dugas.

For Study 2, I developed an emotional reasoning task based on one constructed by Engelhard and colleagues (2001; 2002). I constructed all of the scenarios that were used in this task and selected the self-report measures. I carried out all of the testing and research assistants entered the data. I was responsible for management of the data set, statistical analyses, interpretation of findings, and the writing of the manuscript. Dr. Dugas provided specific suggestions for refinement of the manuscript and I made changes to the manuscript based on these suggestions.

For Study 3, I obtained, selected, and pilot-tested the stimuli with the assistance of Mary Hedayati, laboratory coordinator. I constructed the computerized task that was used to assess information processing and selected the self-report measures. Kristin Buhr, doctoral student, assisted with a small part of the participant recruitment. I carried out approximately 75% of the testing and the rest was carried out by Nicole Heinecke, an undergraduate student who was co-supervised by myself and Dr. Dugas as part of the requirements of her thesis course. Research assistants assisted with the data entry and I was responsible for management of the data set, statistical analyses, interpretation of findings, and the writing of the manuscript. I made revisions to the manuscript on the basis of feedback from Dr. Dugas.

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Chapter 1

Introduction

Generalized anxiety disorder (GAD) is a condition characterized by excessive and uncontrollable worry (American Psychiatric Association, 2000). In spite of the fact that GAD is a highly prevalent condition, it has earned the dubious distinction of being the least well-understood and most difficult to treat among the anxiety disorders. Although significant strides have been made in its conceptualization in the last 20 years, documented rates of recovery associated with empirically-supported treatments for GAD remain in the range of 50% to 60% (Fisher, 2006), which is relatively conservative, considering that cognitive-behavioural treatments for panic disorder are associated with considerably higher success rates (Westen & Morrison, 2001). Why has GAD posed such a challenge to theorists and clinicians?

Some researchers have attributed the lag in our understanding of GAD to the fact that the condition was relatively ill-defined in earlier versions of the Diagnostic and Statistical Manual (DSM). GAD first appeared in the third edition of the DSM (DSM-III; American Psychiatric Association, 1980) as a residual diagnosis intended for individuals with a presenting complaint of persistent anxiety of a non-specific nature (literally, generalized anxiety). Accordingly, initial psychosocial treatments for GAD consisted largely of common anxiety-management strategies that were aimed primarily at reducing diffuse physical arousal and tension (e.g., relaxation, distraction; see Butler, Gelder, Hibbert, Cullington, & Klimes, 1987). Strategies were also developed to target the cognitive symptoms of anxiety, which essentially involved helping clients to “control upsetting thoughts” (Butler et al., 1987, p. 536). However, these treatment approaches

were found, for the most part, to be limited in their effectiveness, which suggested that the core of GAD was not being adequately targeted.

During that period, Borkovec and colleagues were conducting research that would eventually contribute to dramatic changes in conceptualizations of GAD. At the time, Borkovec and colleagues had been investigating the cognitive characteristics of individuals with insomnia. They observed that individuals with insomnia would often report tremendous difficulties “turning off” thoughts at bedtime. This observation prompted the influential set of studies conducted by Borkovec, Robinson, Pruzinsky and DePree (1983) that examined the characteristics and process of *worry*. Based on the findings of these studies, Borkovec and colleagues operationalized worry as a form of *cognitive activity* characterized by chains of verbal-linguistic self-statements that are future-oriented in content, repetitive and difficult to control, and that are accompanied primarily by muscle tension and gastrointestinal distress. In addition, they proposed that worry could be distinguished from anxiety and fear, and that worry might be an important factor in a variety of emotional disorders. Borkovec and colleagues developed an intervention to target worry directly, which consisted of identifying and monitoring worry episodes, postponing worry (i.e., stimulus control), and substituting worry with other forms of mentation (Borkovec, 1983). Although this intervention appeared to be effective for reducing self-reported worry (Borkovec, Wilkinson, Folensbee, & Lerman, 1983), the theoretical and clinical significance of worry as a construct was debated. The conceptualization of worry as a specific form of cognitive activity or mentation and not merely a component of anxiety was openly questioned, as was the need for worry treatments (e.g., O’Neill, 1985a; 1985b); thus doubts regarding the utility of addressing

worry empirically and clinically may also have contributed to the slow progression in the beginning stages of GAD research.

Although it was initially hypothesized that worry was implicated in a number of emotional disorders (e.g., obsessive-compulsive disorder, depression), worry eventually came to be viewed as the hallmark symptom of GAD and became the defining feature of GAD in the DSM-III-R (APA, 1987). The change in definition brought about a promotion in status from residual diagnosis to full-fledged anxiety disorder and gave rise to a marked increase in research on the phenomenology of GAD-type worry. The frequency, temporal characteristics, form, and content of worry were examined extensively (e.g., Borkovec, Shadick, & Hopkins, 1991; Freeston, Dugas, & Ladouceur, 1996; Tallis, Davey, & Capuzzo, 1994). Whereas earlier treatments for generalized anxiety were aimed at reducing tension and anxiety, newer treatments were designed to reduce the frequency and intensity of the condition's main symptom—worry, and this was accomplished largely by way of worry monitoring and stimulus control.

Cognitive Processes and Worry

In an effort to improve treatment efficacy, early research in worry and GAD focused on elucidating the *cognitive* factors that contribute to the development and maintenance of excessive worry. Extrapolating from the early work of Butler and Mathews (1983) on anxiety and the perception of risk, MacLeod, Williams, and Bekerian (1991) proposed that GAD-type worrying might, in part, be the product of a cognitive style that is characterized by a tendency to overstate the likelihood of the occurrence of negative outcomes. It was proposed that interventions aimed specifically at having individuals with GAD re-evaluate subjective probabilities could potentially be useful for

reducing worry and anxiety in the face of worrisome situations. Accordingly, interventions were developed to help worriers estimate probabilities of feared events more objectively. However, such strategies were difficult to implement and did little in the way of reducing worry and anxiety, because worriers would report that even negative events with a *low* probability of occurrence have the potential to be a cause for concern. The implication was that even if individuals who are prone to worry have a tendency of overestimating the likelihood of a negative outcome, these faulty or inflated probability estimates may not be the primary mechanism by which worry is perpetuated.

Intolerance of Uncertainty and Worry

The observation that worriers appear to be sensitive to the possibility, however remote, of negative outcomes occurring signaled that individuals with GAD may have fundamental difficulties managing *uncertainty*. Studies employing laboratory tasks demonstrated that high worriers have considerable difficulty making decisions under uncertainty relative to low worriers (Metzger, Miller, Cohen, Sofka, & Borkovec, 1990; Tallis, Eysenck, & Mathews, 1991). Dugas, Buhr, and Ladouceur (2004) reported on clinical observations that supported the notion that individuals who worry excessively seem to be “stalled” by uncertainty. They observed that even small amounts of uncertainty seemed to paralyze individuals with GAD. They also reported observing, interestingly, that individuals with GAD preferred to know with certainty, that a situation will turn out badly than to be uncertain about its outcome, suggesting that a negative outcome might be perceived as easier to cope with than a situation whose outcome is uncertain. Based on these clinical observations and research by Metzger et al. (1990) and Tallis et al. (1991), it was proposed that *intolerance of uncertainty* might be an

explanatory factor in high-level worry and GAD and that a core fear of uncertainty might be the tie that binds the seemingly diffuse worries reported by individuals with GAD (Dugas et al., 2004; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994).

Intolerance of uncertainty was defined initially in broad terms as a constellation of cognitive, emotional, and behavioural reactions to uncertainty in everyday life situations (Freeston et al., 1994). A self-report measure, the *Intolerance of Uncertainty Scale* (IUS; Freeston et al., 1994; Buhr & Dugas, 2002), was developed to assess thoughts and attitudes related to the experience of uncertainty. The IUS assesses the degree to which uncertainty is perceived as stressful and upsetting; unacceptable and to be avoided; and capable of hindering action, as well as the extent to which one believes that it is unfair to be uncertain. Several studies demonstrated that low and high worriers could be distinguished on the basis of their level of intolerance of uncertainty, with high worriers endorsing a greater level of intolerance. Freeston et al. (1994) proposed that a low tolerance for uncertainty might lead worriers to magnify problems or perceive problems that do not objectively exist, thereby providing the fodder for worry. However, in initial writings, intolerance of uncertainty was referred to as a cognitive process involved in worry, reflecting a non-committal position with regards to the causal relationship of intolerance of uncertainty to worry, which was reasonable given the correlational nature of early empirical findings.

There was a progressive shift in theorizing regarding the causal relationship of intolerance of uncertainty to worry as the weight of the evidence began to suggest that intolerance of uncertainty might be a potential cognitive vulnerability for worry. Studies showed (1) that the “activation” of intolerance of uncertainty has a corresponding effect

on worry (Ladouceur, Gosselin, & Dugas, 2000); (2) that changes in intolerance of uncertainty precede changes in worry over the course of cognitive-behavioural treatment (Dugas & Ladouceur, 2000; Dugas, Langlois, Rhéaume, & Ladouceur, 1998); and (3) that the presence of intolerance of uncertainty is not a by-product of state factors such as anxious and depressed mood (Buhr & Dugas, 2002, 2006; Dugas, Freeston, & Ladouceur, 1997; Lachance, Ladouceur, & Dugas, 1999). In light of the evidence, intolerance of uncertainty was redefined as a dispositional characteristic that arises from a set of fundamental beliefs about uncertainty and its implications (Dugas & Koerner, 2005; Dugas & Robichaud, 2007). It was proposed that intolerance of uncertainty might exert its influence on worry by interfering with the adaptive processing of uncertain situations (Dugas & Koerner, 2005; Freeston et al., 1994).

Intolerance of Uncertainty and the Appraisal of Uncertain Events

Using a standardized vignette task, Dugas, Hedayati et al. (2005) examined the relationship of intolerance of uncertainty to the *appraisal* of ambiguous scenarios. Participants were presented with written passages describing events containing the possibility of more than one interpretation (e.g., “my performance in the play was commented on by everyone”; Davey, Hampton, Farrell, & Davidson, 1992). For each scenario, they were asked to imagine that the situation was happening to them personally and to indicate the degree to which they would be concerned. Degree of intolerance of uncertainty was a significant predictor of negative appraisals of ambiguous scenarios, above and beyond non-dispositional factors such as worry and symptoms of anxiety and depression. Furthermore, although individuals high on intolerance of uncertainty expressed greater concern about uncertain, negative and positive events than did their

low-intolerance of uncertainty counterparts, uncertain events appeared to be associated with the greatest between-group difference in appraisals (Hedayati, Dugas, Buhr, & Francis, 2003). Taken together, the findings suggest that one's a priori beliefs about the experience of uncertainty are a more important determinant of reactions to uncertain events than are state factors. In addition, given the empirical evidence supporting a causal relationship between intolerance of uncertainty and worry, the findings suggest, indirectly, that information processing might be a factor that mediates the relationship between intolerance of uncertainty and worry.

The Present Research

This thesis consists of three independent investigations that were conducted to further examine the relationship of intolerance of uncertainty to the processing of uncertainty. The following is an overview of each of the studies:

Study 1 (see Chapter 2) was a replication and extension of the aforementioned investigation conducted by Dugas, Hedayati et al. (2005). Using an expanded vignette methodology, individuals low and high on intolerance of uncertainty were compared on their appraisals of ambiguous, negative, and positive situations. In addition, (1) the *mediating* role of appraisals in the relationship of intolerance of uncertainty to worry and (2) the *content specificity* of appraisals, were examined.

A vignette methodology was also employed in Study 2 (see Chapter 3) to examine how individuals low and high on intolerance of uncertainty use anxious affect in the processing of uncertain events. The main objective was to ascertain whether *emotional reasoning* can serve as an explanatory factor for the negative appraisals observed in individuals who are disposed to worry excessively. In anxious individuals, reasoning

biases are hypothesized to disrupt adaptive information processing by interfering with the ability to consider the objective features of a situation (Aardema, O'Connor, Emmelkamp, Marchand, & Todorov, 2005) and by inhibiting the consideration of plausible alternative outcomes for feared situations (MacLeod et al., 1991). It seems very conceivable that biases in reasoning perpetuate chronic worry by enhancing perceived threat; however, reasoning processes have been examined only minimally in high worriers and individuals with GAD. In addition, the relationship of *cognitive avoidance* to the processing of uncertainty was also considered in this study, since it is a factor that has been shown to interfere with flexible information processing.

In Study 3 (see Chapter 4), individuals with low levels and high levels of intolerance of uncertainty were compared on their evaluations of photographs depicting scenarios that were negative, positive, neutral or ambiguous. The main objective of this investigation was to determine whether the appraisal biases observed by Dugas, Hedayati et al. (2005) could be elicited using pictorial stimuli. The relationship of cognitive avoidance to appraisals was also considered in this investigation.

The thesis concludes with a general discussion of the research findings within the context of current theories of worry and GAD and of normative decision-making under uncertainty.

Chapter 2

An investigation of appraisals in individuals vulnerable to excessive worry:

The role of intolerance of uncertainty¹

Generalized anxiety disorder (GAD) is a condition whose core feature is excessive and uncontrollable worry (DSM-IV-TR; American Psychiatric Association, 2000). Several explanatory models of GAD have been constructed and systematically validated, and at least three of these have resulted in empirically supported cognitive-behavioural treatments (see Borkovec, 2006; Robichaud & Dugas, 2006; Wells, 2006b for descriptions of treatment packages and for data on their efficacy). This progress notwithstanding, GAD remains one of the more difficult disorders to treat. Documented rates of recovery following cognitive-behavioural treatment are in the order of 50 to 60% (Fisher, 2006), which suggests that there is still much to be understood about the factors involved in GAD, particularly the *cognitive vulnerabilities* that contribute to its maintenance and development.

Intolerance of Uncertainty as a Cognitive Vulnerability Factor for GAD

Although the notion of “cognitive vulnerability” is not new, interest in it appears to have intensified in recent years (Ingram, 2003; Riskind & Alloy, 2006). Although it can be readily understood as a constitutional factor that increases one’s susceptibility to pathology; there appears to be no formalized definition of cognitive vulnerability (Ingram, 2003). Given that there are no known comprehensive operational definitions, the following working definition is proposed for the purposes of this report: a cognitive vulnerability refers to a cognitive set (beliefs, attitudes) that (1) when present, heightens the risk that an emotional disorder will develop (Kraemer et al., 1997); (2) has the status

of a causal risk factor in that it contributes to the *etiology* of emotional disorder directly, or indirectly via subsidiary processes (Riskind & Alloy, 2006); and (3) is dispositional or trait-like in its stability, but malleable in that it can be altered with intervention (e.g., psychotherapy) (Ingram, Miranda, & Segal, 2006).

We propose that a potential cognitive vulnerability for GAD might be *intolerance of uncertainty* (Dugas, Gagnon, Ladouceur, & Freeston, 1998; Dugas & Robichaud, 2007; Koerner & Dugas, 2006). It is currently defined as a dispositional characteristic that reflects a set of negative beliefs about uncertainty and its implications (Koerner & Dugas, 2006). These beliefs pertain to the uncertain world (e.g., “a small unforeseen event can spoil everything, even with the best of planning”). In this way, intolerance of uncertainty is thought to be a “filter” through which the worried individual views and responds to the world (Buhr & Dugas, 2002). Beliefs about uncertainty are also self-referent. Individuals who are disposed to worry excessively often report that being in a state of uncertainty has negative implications for their self-concept (e.g., “being uncertain means that I am not first rate”) (Buhr & Dugas, 2002).

References to intolerance of uncertainty as a dispositional characteristic are very recent (Dugas & Robichaud, 2007; Koerner & Dugas, 2006). When it was introduced in the GAD literature, it was described in general terms as a “broad construct representing cognitive, emotional, and behavioural reactions to uncertainty in everyday life situations” (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994, p.792). At that time, it was hypothesized that intolerance of uncertainty might confer vulnerability to worry, but the equally plausible alternative--that it might simply be an epiphenomenon of worry--was also necessarily considered, given the correlational nature of early findings.

Establishing Vulnerability Status

Where methodology is concerned, correlational research has earned the unfortunate reputation of providing data that are perhaps not as compelling or consequential as those obtained in experimental research. However, demonstration of reliable covariation between a putative causal factor and a proposed outcome is a necessary prerequisite to the assessment of causality (Garber & Hollon, 1991; Kraemer et al., 1997). Correlational studies are also appropriate and useful for examining questions related to specificity. One way of demonstrating specificity is by showing that a process is more strongly associated with a particular disorder than with others sharing similar features (“narrow specificity”; see Garber & Hollon, 1991).

The specificity of the relationship between intolerance of uncertainty and worry has been examined in a number of studies. With the exception of one study in which intolerance of uncertainty was found to be as highly related to symptoms of obsessive-compulsive disorder as to symptoms of GAD (Holaway, Heimberg, & Coles, 2006), intolerance of uncertainty has largely been shown to be more highly related to worry, than to symptoms of other anxiety disorders (Dugas, Gosselin, & Ladouceur, 2001; Roberts, Gervais, & Dugas, 2006; Sexton, Norton, Walker, & Norton, 2003). Furthermore, investigations carried out in clinical samples have shown that individuals with GAD report higher levels of intolerance of uncertainty than do individuals with panic disorder (Dugas, Marchand, & Ladouceur, 2005) or no diagnosis of an anxiety disorder (Ladouceur et al., 1999). In addition, a recent study demonstrated that level of intolerance of uncertainty distinguishes individuals with moderate and severe manifestations of GAD from those with mild GAD, even when related factors such

demographic variables and depressive symptoms are accounted for (Dugas et al., 2007). Thus, there appears to be support for the covariation of intolerance of uncertainty and worry/ GAD status.

However, support for specificity does not imply that intolerance of uncertainty is *causally* related to worry and GAD. If intolerance of uncertainty is to be considered a veritable cognitive vulnerability for the development of GAD, a number of conditions must be satisfied. Putative vulnerabilities are evaluated against four criteria: manipulability, temporal antecedence, stability, and construct validity (Garber & Hollon, 1991; Kraemer et al., 1997; Riskind & Alloy, 2006). The data on intolerance of uncertainty are reviewed in relation to each of these in the following paragraphs.

Manipulability

According to Kraemer et al. (1997), a risk factor that is variable in nature might qualify for causal status if it can be shown that its manipulation alters the outcome presumed to be associated with it. Ladouceur, Gosselin, and Dugas (2000) attempted to experimentally manipulate intolerance of uncertainty using a gambling task. Participants were led to believe that if they performed well on the task, their winnings would be donated to a (fictitious) charitable foundation. In one group, level of intolerance for uncertainty was increased by informing participants that their chances of winning (33%) were very low compared to those in previous studies, whereas in the other group, level of intolerance was decreased by having participants believe that the same probability of winning was high compared to previous studies. Participants in both groups were asked to rate the extent to which they were worried about the possible consequences of not succeeding at the task. As predicted, those in the increased intolerance group reported a

greater level of concern than did individuals in the comparison group, suggesting that the experimental manipulation had a direct impact on worry. Specifically, the study suggests that altering the meaning and implications of an uncertain situation can have an impact on worry.

Temporal Antecedence

Temporal antecedence is evidenced either by demonstrating that the *onset* of a proposed vulnerability is a predictor of the onset of symptoms that are linked to it, or less stringently, by showing that *changes* in the vulnerability precede changes in associated symptoms (Kraemer et al., 1997). In a multiple baseline, small N experiment, Dugas and Ladouceur (2000) examined the temporal relationship between intolerance of uncertainty and worry in individuals receiving cognitive-behavioural treatment for GAD. Using time series analysis on daily self-evaluations of time spent worrying and of level of intolerance for uncertainty, the authors showed that for most participants, changes in intolerance of uncertainty preceded changes in worry over the course of treatment and that the relationship was unidirectional. Similar findings were obtained in a study with a larger sample (Dugas, Langlois, Rhéaume, & Ladouceur, 1998). Although longitudinal research over a protracted period is still needed to address the hypothesis that intolerance of uncertainty actually precedes the *onset* of excessive worry, the results of this study validate the hypothesis that variation in the degree to which one tolerates uncertainty generally leads to changes in the excessiveness of worry.

Stability

Riskind and Alloy (2006) suggest that a putative vulnerability should demonstrate some degree of stability in that its presence and effects should not be highly dependent on

fluctuations in mood state. The independence of intolerance of uncertainty from state factors has been demonstrated. Several investigations have shown that intolerance of uncertainty remains a significant and robust predictor of worry when the effects of mood state (e.g., symptoms of anxiety and depression) are held constant (Buhr & Dugas, 2002, 2006; Dugas, Freeston, & Ladouceur, 1997; Lachance, Ladouceur, & Dugas, 1999). In addition, psychometric research has provided evidence for the stability of the construct of intolerance of uncertainty as measured by the *Intolerance of Uncertainty Scale* (IUS; Freeston et al., 1994) in that responses to the IUS remain relatively stable over a 5-week period ($r = .74$, Buhr & Dugas, 2002; $r = .78$, Dugas, Freeston, & Ladouceur, 1995). It is critical to demonstrate that the presence of intolerance of uncertainty does not depend on state factors, because this strengthens the hypothesis that it might be a disposition, and not simply an outcome of emotional disorder.

Construct Validity

Support for construct validity is attained by demonstrating that individuals designated as either low or high on a putative vulnerability differ from one another on other theoretically-relevant processes that have a more *proximal* influence on the disorder of interest (Riskind & Alloy, 2006). Proximal factors have been defined as those processes that “transmit” the effects of vulnerability. A key proximal process that is thought to mediate the relation between cognitive vulnerability and the expression of emotional disorder is *cognitive bias* (Beck & Clark, 1997; Riskind & Alloy, 2006). A central tenet of cognitive theories of anxiety is that the content of maladaptive beliefs and assumptions are directly reflected in the manner in which individuals attend to, appraise, store, and recall information and events. Biases in cognitive processing are considered

crucial in the etiology and maintenance of anxiety disorders (Beck & Clark, 1997) and provide a “window” by which cognitive vulnerability can be studied.

A large body of documented evidence suggests that persons with GAD have a proclivity to focus their attention on stimuli that are denotative of physical or psychological threat and a tendency to make threat-consistent appraisals and interpretations of ambiguous information (see MacLeod & Rutherford, 2004 for a thorough review). Dugas, Hedayati, et al. (2005) examined the relationship between intolerance of uncertainty---a putative vulnerability for GAD--and interpretations of ambiguous information and observed a strong correlation between the two. Furthermore, although intolerance of uncertainty has also been shown to be associated with a tendency to appraise negative and positive information as disconcerting, its relationship to the appraisal of ambiguous information as threatening is more robust (Hedayati, Dugas, Buhr, & Francis, 2003). In their discussion of their findings (Dugas, Hedayati, et al., 2005) and in a theoretical paper published the same year (Dugas & Koerner, 2005), Dugas and colleagues suggested that intolerance of uncertainty might influence worry *via* information processing. Such a conceptualization is entirely consistent with cognitive models of anxiety, which propose that cognitive biases mediate the relationship between vulnerability and the expression of symptoms of disorder (Beck & Clark, 1997); however, the hypothesis proposed by Dugas and colleagues that cognitive bias mediates the relationship of intolerance of uncertainty to worry has not yet been tested empirically.

Goals and Hypotheses

The research described herein is a replication and extension of the study on appraisal bias conducted by Dugas, Hedayati, et al. (2005). The main goals were (1) to examine the unique relation of intolerance of uncertainty to appraisals of ambiguous situations and (2) to examine the mediating role of appraisals in the relationship between intolerance of uncertainty and worry.

Based on findings by Dugas, Hedayati et al. (2005) and Hedayati et al. (2003), it was hypothesized (1) that relative to individuals low on intolerance of uncertainty, those high on intolerance of uncertainty would appraise ambiguous, negative, and positive scenarios as more disconcerting, and that the most robust between-group differences would be observed for the ambiguous scenarios and (2) that in individuals high on intolerance of uncertainty, level of intolerance of uncertainty would be a stronger predictor of appraisals of ambiguous scenarios than would non-dispositional factors such as demographic, clinical, and mood variables. Lastly, based on principles of general cognitive theory, it was hypothesized that negative appraisals of ambiguous situations would mediate the relationship of intolerance of uncertainty to worry.

A subsidiary objective was to explore the *content specificity* of appraisals. Eysenck, Mogg, May, Richards and Mathews (1991) attempted to examine the content specificity of interpretation biases in individuals with GAD and did not find evidence of a relationship between reported worries and interpretations of ambiguous situations reflecting worry content. The authors concluded that the interpretive bias observed in individuals with GAD might indeed be non-specific, which is consistent with the view of GAD as a condition characterized by diffuse concerns. However, their examination was

limited to only social and physical concerns; therefore, methodological limitations may have contributed to the null findings. In the current study, a larger range of worries was assessed and stimuli mapping onto these were developed to better assess content specificity.

Method

Participants

Participants were 199 Concordia University students (140 women and 59 men; mean age = 23.63 years, $SD= 4.97$) recruited from various departments (5% of the sample consisted of students majoring in psychology).

Materials and Procedure

Participants carried out the study tasks in groups of 15 to 40 individuals. After providing written informed consent (see Appendix), they completed the vignette task, followed by a package of self-report measures. Upon completion of the study tasks, participants received information regarding the objectives, hypotheses, and implications of the research and were given the opportunity to ask questions. Participation was voluntary; financial compensation was not offered.

Vignette task. A vignette methodology was used to assess appraisals. Participants were presented with 55 written scenarios. They were asked to read the scenarios and to imagine that the events described therein were happening to them personally. All scenarios were worded in the first person. For each scenario, respondents rated their level of concern on a scale of 1 (not at all concerned) to 5 (extremely concerned). The 55 vignettes covered 11 content areas: friendships, romantic relationships, relationships with parents, academic performance, work competence, finances, one's own health, health of

loved ones, threat of physical harm or danger, the future, and self-concept. Each content area was represented in one positive scenario, one negative scenario, and three ambiguous scenarios (for an example, see Table 2.1 for scenarios relating to the topic of work competence). The content areas were selected on the basis of research on worry themes (Davey, Hampton, Farrell, & Davidson, 1992; Dugas, Freeston, Doucet, Lachance, & Ladouceur, 1995; Dugas, Freeston, et al., 1998).

The 55 vignettes used in this study were selected from an initial pool of 79 vignettes. Of the 79 vignettes, 28 originated from the *Ambiguous/Unambiguous Situations Diary* (AUSD; Davey et al., 1992); the rest were constructed for this investigation. The AUSD is a measure that was developed to assess appraisal biases and is composed of seven positive, seven negative, and 14 ambiguous scenarios. The AUSD scenarios have been used in at least three studies examining the relation of worry and worry-related processes to the interpretation of ambiguous situations (Davey et al., 1992; Dugas, Hedayati, et al., 2005; Rassin & Muris, 2005). Given the diversity of worries reported by individuals with GAD (and individuals who do not worry excessively, for that matter), an additional 51 vignettes were constructed to expand the thematic content.

The 79 vignettes were pilot-tested with nine raters who were unaware of the objectives and hypotheses of the present study. The raters evaluated the valence of each of the scenarios on a scale from 1 (not at all pleasant) to 9 (very pleasant) and evaluated the degree to which the scenarios were ambiguous, also on a scale from 1 (not at all ambiguous) to 9 (very ambiguous). In addition, raters were asked to classify each scenario into one of the 11 content area categories described earlier. Of the 79 vignettes,

Table 2.1

Examples of Work Competence Vignettes

Ambiguous: Our boss at work discussed the company's poor performance and agreed that I was the most responsible.*

Today, my supervisor called me to their office to discuss the change in the quality of my work over the last few weeks.

On my first night as a chef in the restaurant, I was called to the diners' tables twice.*

Negative: My boss pulled me aside today to discuss my poor work ethic.*

Positive: My summer job applications are going very well, so far I have been offered second interviews by all three of the companies I'd most like to work for.*

Note. * = Scenarios retained from the *Ambiguous/Unambiguous Situations Diary* (Davey, Hampton, Farrell, & Davidson, 1992).

55 were retained for inclusion in the task. Of the vignettes that were retained, 17 were from the AUSD (11 ambiguous; three negative; three positive).

A one-way within-subjects analysis of variance (ANOVA) was performed to test for differences in valence among the three categories of scenarios. The analysis yielded a significant main effect, $F(2, 16) = 1620.38, p < .01$ and follow-up tests with Bonferroni adjustment revealed that the positive scenarios ($M = 8.25, SD = .23$) were rated as most pleasant relative to the other two categories while the negative scenarios ($M = 1.85, SD = .12$) were rated as least pleasant. Ambiguous scenarios ($M = 4.53, SD = .32$) were rated as more pleasant than the negative scenarios and more unpleasant than the positive scenarios (all p values $< .01$).

A one-way within-subjects ANOVA was also performed to test for differences in ambiguity between the three categories. The analysis yielded a significant main effect, $F(2, 16) = 312.59, p < .01$. Bonferroni-adjusted follow-up tests revealed that the ambiguous scenarios ($M = 7.12, SD = .31$) were rated more highly on ambiguity than were the positive ($M = 1.51, SD = .18$) and negative scenarios ($M = 1.32, SD = .12$) (all p values $< .01$) with no differences between the latter two categories.

Self-report measures. Participants completed the following questionnaires:

The *Intolerance of Uncertainty Scale* (IUS; Freeston et al., 1994; English translation, Buhr & Dugas, 2002) contains 27 items that assess the extent to which one experiences uncertainty as intolerable. Specifically, respondents report the degree to which they hold the view (1) that uncertainty is stressful and upsetting; (2) that uncertainty leads to the inability to take action; (3) that uncertain events are negative and to be avoided; and (4) that being uncertain is unfair. Although the IUS appears to assess

various, distinguishable aspects related to the experience of uncertainty, Buhr and Dugas (2002) recommend using the IUS as a unitary measure. The English version of the IUS has excellent internal consistency, good test-retest reliability, and demonstrated convergent and divergent validity (Buhr & Dugas, 2002).

The *Penn State Worry Questionnaire* (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item, content-free measure of the tendency to worry excessively. The PSWQ has high internal consistency and good test-retest reliability and this measure has been shown to assess a construct that can be distinguished from anxiety and depression (Metzger et al., 1990; Molina & Borkovec, 1994).

The *Worry and Anxiety Questionnaire* (WAQ; Dugas et al., 2001) is a brief measure that was developed to assess the symptoms of DSM-IV-defined GAD. Three items assess the extent to which worry is experienced as excessive and difficult to control, the core symptom of GAD. The somatic subscale contains six items that assess the degree to which respondents have been bothered by restlessness or feelings of being keyed up or on edge, fatigue, difficulties with concentration, irritability, muscle tension, and sleep disturbances. In addition, respondents indicate the extent to which they have experienced functional interference as a result of their worry and anxiety. The somatic subscale of the WAQ can also be used in conjunction with the PSWQ to assess the severity of GAD symptoms. The WAQ has adequate test-retest reliability and in a nonclinical sample has been shown to effectively discriminate between individuals with low, moderate and high levels of worry (Dugas et al., 2001).

The *Worry Domains Questionnaire-Short Form* (WDQ-SF; Stöber & Joormann, 2001) is a 10-item content-specific measure of non-pathological worry. The WDQ-SF is

an abridged version of the original 25-item Worry Domains Questionnaire (Tallis, Eysenck, & Mathews, 1992). Like the full-length version, the WDQ-SF assesses the extent to which one worries about relationships, lack of confidence, the notion of a goalless future, work performance, and finances. Each worry domain is represented in 2 items. All items are rated on a Likert-type scale ranging from 0 (not at all) to 4 (extremely) and are summed to yield a total score. Scores for each worry domain are obtained by summing the two items representing each one. The internal consistency of the WDQ-SF is very good (Cronbach's $\alpha = .89$). Moreover, the WDQ-SF has a correlation of $r = .97$ with the original WDQ and has a factor structure that is nearly identical to that of the original version (Stöber & Joormann, 2001), which suggests that the shortened version is an appropriate alternate.

The *Beck Anxiety Inventory* (BAI; Beck, Epstein, Brown, & Steer 1988) is a 21-item measure that assesses the extent to which one was bothered by symptoms associated with anxiety in the past week. In undergraduate samples, the BAI has demonstrated a high level of internal consistency and discriminant validity (Creamer, Foran, & Bell, 1995).

The *Center for Epidemiological Studies- Depression Scale* (CES-D; Radloff, 1977) is a 20-item measure of depressive symptoms experienced in the previous seven days. The CES-D is non-diagnostic and is intended for use in nonclinical populations. High internal consistency, good test-retest reliability, and concurrent and construct validity have been demonstrated with the CES-D (Radloff, 1977).

Results

Group Classification

Participants were classified as either low ($n= 110$) or high ($n= 89$) on intolerance of uncertainty (IU) on the basis of their total score on the IUS. Participants with a score of 58 or above on the IUS were classified as being high on intolerance of uncertainty and participants with scores below this cut point were considered low on intolerance of uncertainty. Sex distribution did not differ significantly between groups. Descriptive data for the Low-IU and High-IU groups are presented in Table 2.2. As expected, mean scores on symptom and mood measures were all significantly more elevated in the High-IU group than in the Low-IU group.

Although it is common practice in quasi-experimental psychological research to divide individuals into groups along a specific cut-point on a scale for the purposes of comparison on the dependent variable(s), methodologists and statisticians have cautioned about the limitations of this practice (see MacCallum, Zhang, Preacher, & Rucker, 2002; Preacher, Rucker, MacCallum, & Nicewander, 2005). Therefore, the decision to dichotomize in this investigation certainly warrants explanation.

Our position is that intolerance of uncertainty is a dimensional construct with discrete boundaries. Its dimensional nature is reflected in the fact that some degree of discomfort with uncertainty is present in all people; in this way, intolerance of uncertainty is very much an “individual difference” variable. We hypothesize however, that it might be possible to identify a taxon variant of intolerance of uncertainty that is distinguishable from a normative variant on the basis of divergent cognitive, emotional,

Table 2.2

Summary Statistics for Study Variables in Participants Low on Intolerance of Uncertainty (Low-IU; n=110) and Participants High on Intolerance of Uncertainty (High-IU; n=89)

	Low-IU		High-IU		$X^2(1)$
	<i>N</i>	<i>%</i>	<i>N</i>	<i>%</i>	
Demographics					
Sex					2.83
Male	38	34.5	21	23.6	
Female	72	65.5	68	76.4	
Measures	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i> (1, 197)
IUS	43.18	8.38	77.67	15.24	410.59*
PSWQ	40.27	11.07	57.88	12.10	114.45*
WAQ-Somatic	15.65	4.98	19.80	5.14	33.26*
WDQ-SF	11.30	7.68	22.15	8.04	94.11*
Relationships	1.76	1.93	3.67	2.37	39.24*
Confidence	1.89	1.83	4.26	2.29	65.63*
Future	2.35	2.10	4.85	2.18	67.25*
Work	2.65	1.89	4.58	1.87	51.67*
Finances	2.64	2.14	4.78	2.45	43.26*
BAI	10.54	8.78	20.57	11.40	49.14*
CES-D	12.07	8.55	22.86	10.40	64.54*

Note. IUS=Intolerance of Uncertainty Scale; PSWQ=Penn State Worry Questionnaire;
WAQ-Somatic= Somatic subscale of the Worry and Anxiety Questionnaire; WDQ-
SF=Worry Domains Questionnaire-Short Form Total Score; BAI=Beck Anxiety
Inventory; CES-D= Center for Epidemiological Studies-Depression Scale

* $p < .01$

and behavioural reactions to uncertainty. A categorical approach permits the examination of features that may (or may not) distinguish the two variants.

Given that at present there are no known data on the taxonicity of intolerance of uncertainty, in the current study, a cut-score that is thought to carry clinical significance was used to classify participants as low versus high on intolerance of uncertainty. A score of 58 on the IUS is consistent with a score one standard deviation below the group mean of individuals who have met diagnostic criteria for GAD by self-report or clinical interview in previous studies (e.g., Buhr & Dugas, 2002; Dugas, Marchand, & Ladouceur, 2005). In the sample described in the present study, a significant proportion of individuals within the High-IU group (51%) had cognitive and somatic symptoms that would be consistent with a diagnosis of GAD (as assessed by self-report with the WAQ), while a significant proportion of individuals in the Low-IU group (41%) met neither the cognitive nor the somatic criteria for GAD, which provides additional support for our categorization. That the groups are not completely homogeneous is not seen as problematic, because this suggests that dividing the sample in this manner did not seriously compromise variability.

Preliminary Analyses

In order to identify potential confounding variables, Pearson product moment correlations were conducted in the total, undifferentiated sample to examine the relationships of demographic variables (age and sex), IU (IUS), worry (PSWQ), GAD somatic symptoms (Somatic subscale of the WAQ), anxious symptoms (BAI), and depressive symptoms (CES-D) to appraisals of scenarios in the vignette task (Table 2.3).

Table 2.3

Zero-Order Correlations between Study Variables and Appraisals^a of Ambiguous, Negative and Positive Scenarios

Variable	Scenario Type		
	Ambiguous	Negative	Positive
Age	-.03	-.12	-.03
Sex ^b	-.27**	-.38**	-.05
IUS	.54**	.44**	.22**
PSWQ	.50**	.43**	.20**
WAQ-Somatic	.37**	.33**	.16 *
BAI	.39**	.33**	.16 *
CES-D	.37**	.31**	.15 *

Note. IUS= Intolerance of Uncertainty Scale; PSWQ= Penn State Worry Questionnaire; WAQ-Somatic= Somatic subscale of the Worry and Anxiety Questionnaire; BAI= Beck Anxiety Inventory; CES-D= Center for Epidemiological Studies-Depression Scale

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

^a Higher values indicate appraisals that are more negative

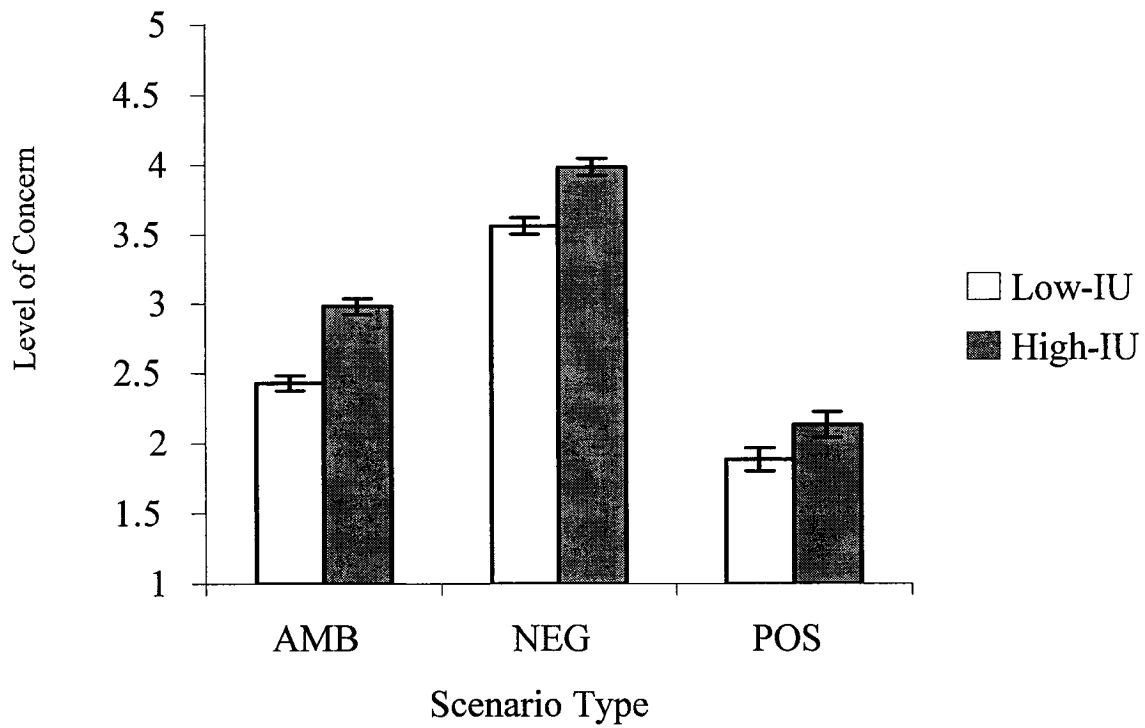
^b Coding: 0= Female; 1= Male

Higher scores on clinical and mood measures were associated with appraisals of ambiguous, negative and positive scenarios as more disconcerting. In addition, women rated ambiguous and negative scenarios as more disconcerting relative to men; however, women and men did not differ in their evaluation of positive scenarios.

Hypothesis 1

Means and standard errors in the Low-IU and High-IU groups for appraisals as assessed with the vignette task are presented in Figure 2.1. The first hypothesis stated that individuals high on IU would appraise ambiguous, negative, and positive scenarios as more disconcerting relative to individuals low on IU, and that the most robust between-group differences would be observed for the ambiguous scenarios. A 2 (IU Group) X 3 (Scenario Type) mixed ANOVA with Bonferroni-adjusted tests of simple effects was performed to test this hypothesis. The analysis yielded significant main effects of IU Group ($F(1, 197) = 26.23, p < .01, \text{partial } \eta^2 = .12$) and Scenario Type ($F(2, 394) = 603.20, p < .01, \text{partial } \eta^2 = .75$), and a significant IU Group X Scenario Type interaction effect ($F(2, 394) = 4.39, p < .01, \text{partial } \eta^2 = .02$).

Follow-up tests of simple effects revealed that individuals high on IU rated ambiguous scenarios ($F(1, 197) = 48.44, p < .01, \text{partial } \eta^2 = .20$), negative scenarios ($F(1, 197) = 23.16, p < .01, \text{partial } \eta^2 = .11$), and positive scenarios ($F(1, 197) = 3.99, p = .05, \text{partial } \eta^2 = .02$) as more disconcerting relative to the comparison group. To further examine the interaction effect, effect sizes were compared using tests of differences between non-independent correlation coefficients (Meng, Rosenthal, & Rubin, 1992). Pearson product moment correlations were computed between IU group membership and



Note. AMB= Ambiguous; NEG= Negative; POS= Positive

Figure 2.1. Mean Level of Concern (+SE) as a function of Scenario Type for the Low Intolerance of Uncertainty group (Low-IU; $n= 110$) and the High Intolerance of Uncertainty group (High-IU; $n= 89$).

mean appraisals of ambiguous ($r_{pb} = .44$), negative ($r_{pb} = .33$), and positive ($r_{pb} = .14$) scenarios. Comparisons of the correlations revealed that the correlation between IU level (High versus Low) and mean appraisal of ambiguous scenarios was significantly larger than the correlation of IU level to mean appraisal of negative scenarios ($z = 2.56, p < .01$) and positive scenarios ($z = 5.17, p < .01$).

To control for the effects of potential confounds, the first hypothesis was re-examined using an analysis of covariance with Bonferroni adjustment. Sex, and scores on the PSWQ, Somatic subscale of the WAQ, BAI, and CES-D were introduced into the analysis as covariates. The IU Group X Scenario Type interaction effect did not reach significance when covariates were held constant ($F(2, 384) = 1.89, p = .15, \text{partial } \eta^2 = .01$). Follow-up tests of simple effects revealed, however, that in this more controlled analysis, the Low- and High- IU groups differed only in their responses to the ambiguous scenarios ($F(1, 192) = 9.62, p < .01, \text{partial } \eta^2 = .05$). In keeping with the original uncontrolled analysis, effect sizes were once again compared. Partial correlations controlling for sex, and scores on the PSWQ, WAQ Somatic subscale, BAI, and CES-D were computed between IU group membership and mean appraisals of ambiguous ($pr = .22$), negative ($pr = .12$), and positive ($pr = .02$) scenarios. Comparisons of the correlations revealed that the correlation between IU level (High versus Low) and mean appraisal of ambiguous scenarios was significantly larger than the correlation of IU level to mean appraisal of negative scenarios ($z = 1.75, p = .04$) and positive scenarios ($z = 3.22, p < .01$).

Hypothesis 2

An additional analysis within the High-IU group was conducted to test the second hypothesis that IU would be a stronger predictor of appraisal bias for ambiguous scenarios than would demographics, GAD symptoms and mood variables. A multiple regression was conducted with responses to the ambiguous scenarios as the dependent variable, and sex and scores on the IUS, PSWQ, Somatic subscale of the WAQ, BAI, and CES-D entered simultaneously as predictors. Of all the variables, only IU ($\beta = .25, p = .03$) and sex ($\beta = -.25, p = .02$) emerged as significant predictors of appraisals of ambiguous scenarios. The analysis was repeated in the Low-IU group as well and IU emerged as the only significant predictor of appraisals ($\beta = .25, p = .02$).

Hypothesis 3

The study's third prediction was that negative appraisals of ambiguous situations would have a mediating role in the relationship of intolerance of uncertainty to worry. Mediation was tested using the procedure outlined by Baron and Kenny (1986).

Baron and Kenny's test of mediation involves examining the inter-relationships between three variables: the "initial variable" (i.e., the putative cause), the outcome variable, and the mediator. In Step 1, the correlation between the initial variable and the outcome variable is assessed. In Step 2, the correlation between the initial variable and the proposed mediator is assessed. In Step 3, the correlation between the mediator and the outcome variable is assessed, with covariation associated with the initial variable held constant. Finally, in Step 4, the indirect effect of the mediator is evaluated. *Total* mediation is indicated if the relation of the initial variable to the outcome variable is nullified once the mediator enters the equation. *Partial* mediation (the more likely

scenario) is indicated if there is a significant attenuation in the effect of the initial variable on the outcome variable once the mediator enters the equation. The Sobel test (see Baron and Kenny, 1986) is used to determine whether the degree of attenuation is significant or not. Mediation is *not* supported under the following conditions: (1) if non-significant findings are obtained in Steps 1, 2, or 3, or (2) if the Sobel test is non-significant.

Three multiple regressions were performed with sex, and scores on the WAQ Somatic subscale, BAI, and CES-D as covariates. In the first regression (Step 1), the unique relation of IU group (the initial variable) to worry (the outcome variable) was assessed. IU group was a significant predictor of worry ($B = 9.02, SE = 1.43, p < .01$). In the second regression (Step 2), the unique relation of IU group to mean appraisal of ambiguous scenarios (the mediator) was assessed. IU group was shown to be a significant predictor of appraisals ($B = 0.39, SE = 0.09, p < .01$). In the third regression (Step 3), when IU group and mean appraisal of ambiguous scenarios were entered together in the equation with worry as the outcome variable, both emerged as significant predictors (IU group: $B = 7.98, SE = 1.48, p < .01$; mean appraisal: $B = 2.65, SE = 1.15, p = .02$) and the regression coefficient for IU group was smaller than in Step 1. In Step 4, the indirect path was tested. The Sobel test indicated a significant attenuation in the prediction of worry from IU group once mean appraisal of ambiguous scenarios was accounted for, $z = 2.03, p = .02$. Given that IU group continued to be a significant predictor of worry in Step 3, appraisals could only be considered a *partial* mediator.

Baron and Kenny (1986) recommend repeating mediation analyses with the mediator and outcome reversed to check for reciprocal pathways. Accordingly, the

analyses were carried out a second time, with mean appraisal of ambiguous scenarios as the outcome variable and worry as the mediating variable. The covariates used in this set of regressions were the same as the ones used in the previous set. Steps 1 and 2 in this analysis were identical to those in the previous analysis, but were carried out in reverse order. In Step 3, IU group (the initial variable) and worry (the mediator) were entered as predictors in the regression equation with mean appraisal of ambiguous scenarios as the outcome variable. IU group ($B = 0.30, SE = 0.10, p < .01$) and worry ($B = 0.01, SE = 0.004, p = .02$) were both significant predictors of appraisals. The regression coefficient for IU group was smaller than in Step 1, but was still significant. In the final step, the Sobel test indicated a significant reduction in the relationship of IU group to appraisals once worry was accounted for, $z = 2.32, p = .01$, indicating that worry partly mediated the relationship between level of intolerance of uncertainty and threatening appraisals of ambiguous scenarios.

Exploratory Analyses

The content specificity of appraisals was examined in two ways. First, the Low- and High- IU groups were compared on appraisals of ambiguous scenarios as a function of theme. In the vignette task, 11 themes were each represented in three ambiguous scenarios. For each theme, ratings were summed and averaged. A 2 (IU Group) X 11 (Theme) mixed ANOVA with Bonferroni adjustment was performed and revealed a significant main effect of IU Group ($F(1, 197) = 48.44, p < .01, \text{partial } \eta^2 = .20$). A follow-up test of the main effect revealed that the High-IU group appraised all ambiguous scenarios as significantly more disconcerting irrespective of theme ($M = 8.95, SE = 0.18$) relative to the Low-IU group ($M = 7.29, SE = 0.16$).

In the second analysis, partial correlations controlling for the overall tendency to worry (PSWQ) were computed to examine the unique relation between five specific worries, as assessed by the WDQ-SF and appraisals of the 11 categories of ambiguous situations reflecting specific content. Within the High-IU group, when the overall tendency to worry was held constant, there was no relationship between specific worries and appraisals of ambiguous scenarios reflecting specific themes.

Partial correlations controlling for the overall tendency to worry were also conducted within the Low-IU group and these revealed a markedly different pattern of results. Worry about relationships was significantly correlated with greater concern for situations involving friendships ($pr = .20, p = .04$) and romantic relationships ($pr = .20, p = .03$). Worry about self-confidence was significantly associated with greater concern for situations pertaining to friendships ($pr = .21, p = .03$), romantic relationships ($pr = .28, p < .01$), and self-confidence ($pr = .21, p = .03$). Worry about work was significantly associated with greater concern for situations pertaining to work performance ($pr = .22, p = .02$), academic performance ($pr = .23, p = .01$), friendships ($pr = .21, p = .03$), and self-confidence ($pr = .22, p = .02$). Worries about finances and the future were not associated with appraisals.

Discussion

Intolerance of uncertainty—a dispositional characteristic that arises from a set of negative beliefs about uncertainty and its connotations and consequences—is an important predictor of trait level worry and of the tendency to evaluate ambiguous scenarios in a negative manner, and as such, is considered to be a cognitive disposition that might confer risk for GAD. The current study was an investigation of interpretive

processing in individuals potentially at risk for developing excessive and uncontrollable worry by virtue of having a high level of intolerance of uncertainty.

Appraisals

The study's first hypothesis was supported. Individuals high on intolerance of uncertainty appraised ambiguous, negative, and positive situations as more disconcerting than did individuals low on intolerance of uncertainty, with the largest between-group differences emerging for ambiguous situations. Further, when the potential confounding influences of sex, GAD symptoms, and mood variables were statistically controlled, only the ambiguous situations continued to be appraised as more disconcerting by individuals high on intolerance of uncertainty. This replicates findings reported by Dugas, Hedayati, et al. (2005) who found that intolerance of uncertainty was a more robust predictor of appraisals of ambiguous scenarios than were demographics, symptoms of anxiety and depression, and worry.

The second hypothesis, that intolerance of uncertainty would be the strongest predictor of appraisals of ambiguous scenarios in individuals high on vulnerability, was partly supported. In individuals high on intolerance of uncertainty, female sex also emerged as a significant predictor of negative appraisals of ambiguous scenarios. A noteworthy finding was that intolerance of uncertainty was a salient predictor of appraisals of ambiguous situations, not only in individuals high on intolerance of uncertainty, but in individuals *low* on intolerance of uncertainty (i.e., low on cognitive vulnerability) as well. This underscores the importance of not treating intolerance of uncertainty as a pathology-related process. As mentioned earlier, a dislike for uncertainty and ambiguity is actually normative and universal and most individuals prefer a certain

outcome to one that is uncertain (Laurioloa & Levin, 2001; Lipshitz & Strauss, 1997; Loewenstein, Weber, Hsee, & Welch, 2001; van Dijk & Zeelenberg, 2003). Thus, it makes sense that even in individuals who are more tolerant of uncertainty, higher levels of intolerance would be associated with an tendency to appraise ambiguous scenarios as more disconcerting. However, on average, appraisals were still more positive in individuals low on cognitive vulnerability as compared with individuals high on vulnerability.

Mediation

The hypothesis that appraisal of ambiguous situations would act as a mediator in the relationship between intolerance of uncertainty and worry, was partly supported. The indirect relationship of intolerance of uncertainty to worry via appraisals was found to be significant. This finding—that cognitive bias mediates the relation of vulnerability to symptoms-- is in line with what would be predicted by cognitive models of emotional disorders (Beck & Clark, 1997; Riskind & Alloy, 2006). When tests of mediation were carried out with the mediator (appraisals) and outcome (worry) in reversed roles, worry emerged as a significant partial mediator of the relationship of intolerance of uncertainty to appraisals of ambiguous information. Although a priori hypotheses about the mediating role of worry were not advanced, the findings are entirely comprehensible within the context of current conceptualizations of GAD proposing reciprocal relationships between worry and cognitive processes.

The model of GAD proposed by Dugas, Gagnon, et al. (1998) suggests that while worry is a symptom of the chain of events initiated by the activation of intolerance of uncertainty and subsidiary cognitive processes, worry *also* has an active reciprocating

role in perpetuating the cognitive processes that are thought to stimulate it in the first place. Self-perpetuating mechanisms have been described in at least two other empirically-supported accounts of worry/GAD: Borkovec's avoidance theory (see Sibrava & Borkovec, 2006) and Wells' metacognitive theory (see Wells, 2006a). Although each theory makes unique predictions with regard to the mechanisms underlying worry, both propose that worry essentially contributes to its own maintenance by interfering with flexible information processing. Because worry consists largely of cognitive activity, it is hypothesized to detract from cognitive resources needed for the objective, or unbiased evaluation of ambiguous stimuli or events and for consideration of alternative interpretations.

Content specificity

The content specificity of appraisal biases was explored in this study. Individuals high on intolerance of uncertainty appraised *all* types of ambiguous situations as more disconcerting relative to individuals low on intolerance of uncertainty. Further, in the high vulnerability group, reactions to ambiguous situations did not correspond with self-reported worries. Together, the findings support those from previous research demonstrating that interpretive biases in individuals high on worry are non-specific (Eysenck et al., 1991) and also seem to corroborate clinical descriptions of GAD as a disorder characterized by a generalized tendency to interpret many situations and events in a threatening manner (see MacLeod & Rutherford, 2004). However, our findings should not be considered conclusive evidence for non-specificity of processing; in fact, we propose that if the data are interpreted within the context of the conceptual model of GAD proposed by Dugas and colleagues (Dugas, Gagnon, et al., 1998; Dugas & Koerner,

2005), the results can actually be seen as *supporting* content specificity. The model proposes that a core fear of uncertainty underlies the multitude of worries reported by individuals with GAD. By definition, ambiguous situations are those characterized by uncertainty; therefore, it makes sense that individuals with a high level of intolerance of uncertainty would react more strongly to these, irrespective of whether the situation relates to one's specific worries.

In individuals low on intolerance of uncertainty, on the other hand, there seems to be a closer match between specific worries, and reactions to scenarios related in content. Thus, individuals low on intolerance of uncertainty may have a tendency to respond more selectively to a situation, only if it pertains to their current concern.

Summary and Future Directions

This study's findings support the construct validity of intolerance of uncertainty and contribute to the corpus of evidence supporting its role as a possible cognitive vulnerability for worry. The findings suggest that cognitive vulnerability to GAD might not necessarily be characterized by an excessive tendency to appraise unambiguously *negative* events as threatening, but rather, an indiscriminant tendency to react negatively to situations that are ambiguous (i.e., situations in which the outcome is uncertain). Because uncertainty is the main concern for individuals disposed to worry excessively, many situations might be perceived as threatening, so long as their outcome is uncertain. Intolerance of uncertainty might transmit its influence on worry via biases in processing. In turn, increases in worry may contribute to interferences in information processing. This cycle might contribute to the preservation of negative beliefs about uncertainty.

Further research is needed to understand precisely *why* uncertain situations are perceived as distressing. The vignette task used in the current study could be extended by having respondents evaluate ambiguous scenarios along specific appraisal dimensions. This would be useful for identifying beliefs that might underlie negative appraisals of, and reactions to, uncertainty in individuals who are prone to worry. Perceptions of *controllability* and *effectualness*, for example, may be explanatory factors in why individuals who are prone to worry appraise uncertain events as aversive. This hypothesis is derived from research showing (1) that themes of personal inadequacy are common when high worriers are asked to elaborate on (i.e., catastrophize) their concerns (Davey & Levy, 1998) and (2) that high worriers tend to have negative attitudes toward problems and the problem-solving process (Robichaud & Dugas, 2005). If uncertain situations are perceived as being beyond one's control or if one perceives himself or herself as being incapable of responding adequately and effectually to uncertain or unpredictable situations, this would likely reinforce a low tolerance for uncertainty.

The finding in individuals high on intolerance of uncertainty, that appraisals of hypothetical uncertain events bear no relationship to actual current concerns suggests that individuals who are more prone to worry excessively may be more highly sensitive to uncertain events than individuals who are less prone. Dugas and colleagues (Dugas et al., 1997) have proposed that individuals who are prone to worry have difficulty accepting even small "doses" of uncertainty. This could be tested empirically by comparing the use of probabilistic information in individuals who are low and high on intolerance of uncertainty. Individuals high on intolerance of uncertainty would be expected to appraise

uncertain events with a low probability of a negative outcome as more disconcerting relative to their counterparts.

This investigation requires replication in a sample with a broader demographic profile, given that that the current sample consisted exclusively of university students, and given that a significant majority of the participants were female and of European origin. In addition, the diagnostic specificity of the appraisal biases observed in individuals high on intolerance of uncertainty will need to be examined in a clinical sample to ascertain the extent to which these biases are present in individuals with GAD versus other anxiety disorders (e.g., obsessive-compulsive disorder).

Finally, although the use of a categorical approach was useful in this investigation, it is acknowledged that there are methods of categorization that are more empirically-robust than the one used in this study (cf. Bernstein et al., 2006). The application of cut scores should, ideally, be informed by data supporting the taxonic latent structure of intolerance of uncertainty. There are no known data on the latent structure of intolerance of uncertainty; as such, the findings of the present study must be interpreted with a certain degree of caution. This study will need to be replicated once such data are available.

Implications

Establishing that intolerance of uncertainty is a cognitive vulnerability for GAD opens up the possibility of considering questions and hypotheses related to risk and etiology. Prospective longitudinal investigations would eventually be useful for examining information processing in individuals who are high on intolerance of uncertainty but who *do not* yet have GAD symptoms. Because cognitive bias is a marker

of vulnerability, it may be both a factor implicated in the maintenance of anxiety disorders and a prodromal feature of individuals who are susceptible to the development of pathological anxiety. Current thinking suggests that the manifestation of certain information processing biases may signal that anxiety-related schemata are operative and may *precede* the onset of a diagnosable condition. Convincing evidence for this perspective can be found in the panic disorder literature (Richards, Austin, & Alvarenga, 2001; Teachman, 2005). Identification of the cognitive characteristics of individuals who are potentially at-risk for the development of excessive worry may be worthwhile for prevention efforts.

Finally, establishing that intolerance of uncertainty is a cognitive vulnerability for GAD is also important from a treatment standpoint. Data from four randomized controlled trials (Dugas et al., 2003; Dugas, Savard et al., 2004; Gosselin et al., 2006; Ladouceur et al., 2000) testing the efficacy of a cognitive-behavioural treatment designed to target intolerance of uncertainty suggest that increasing tolerance for uncertainty is helpful for reducing excessive worry. A better understanding of the characteristics of intolerance of uncertainty (e.g., how it manifests) will enable the refinement of existing interventions for GAD.

Chapter 3

Intolerance of uncertainty, emotional reasoning and their relation to the appraisal of uncertain situations²

A central tenet of cognitive models of anxiety is that information processing mediates the influence of cognitive vulnerability on the expression of symptoms of emotional disorder (Beck & Clark, 1997; Riskind & Alloy, 2006). Understanding the manner in which anxious individuals appraise and interpret ambiguous events is particularly critical, in that biases at those levels of processing are thought to be important indicators of underlying cognitive vulnerability (Beck & Clark, 1997). Specifically, a habitual tendency to make threat-consistent appraisals and interpretations in situations that are ambiguous or of events in which the outcome is unclear is one factor (among several) that not only contributes to the maintenance of clinically-significant anxiety, but also possibly confers risk for its development (Riskind & Alloy, 2006; Teachman, 2005).

Biases in appraisal and interpretation have been implicated in virtually all of the anxiety disorders, including generalized anxiety disorder (GAD), a condition characterized by excessive and uncontrollable worry and anxiety (DSM-IV-TR; American Psychiatric Association, 2000).

Many studies have shown that individuals with GAD have a tendency to interpret ambiguous information in a threat consistent fashion relative to non-anxious individuals (see MacLeod & Rutherford, 2004 for a review). Findings from these studies have proven to be informative in so far as they have advanced our understanding of some of the cognitive features of individuals who worry excessively; however, given that these observations are fairly well-replicated and that there is a general consensus that these

biases exist, an increased focus on elucidating the *cognitive dispositions* and *processes* that give rise to these biases is warranted.

A cognitive disposition that has been implicated in the maintenance and possibly the etiology of GAD is *intolerance of uncertainty*. Intolerance of uncertainty is defined as a dispositional characteristic that arises from a set of deep-seated beliefs about uncertainty and its implications (Koerner & Dugas, 2006). Although most individuals report disliking uncertainty and preferring an outcome that is certain to one that is uncertain (Loewenstein, Weber, Hsee, & Welch, 2001), individuals who worry excessively are particularly bothered by uncertainty and experience it as highly aversive. Specifically, high worriers report that uncertainty is stressful and upsetting, should be avoided, interferes with the ability to take action, and that it is unfair to have to be uncertain (Buhr & Dugas, 2002). High worriers also report believing that being uncertain has implications for their adequacy or competence (e.g., “being uncertain means that I am not first rate”). Initially conceptualized as a broad construct representing reactions to uncertainty (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994), intolerance of uncertainty is now hypothesized to be a veritable cognitive vulnerability for excessive worry. Evidence of the specificity, temporal antecedence, manipulability, and stability of this construct has lent support to this notion (see Dugas & Koerner, 2005; Koerner & Dugas, 2006; Study 1 for reviews).

A pathway by which intolerance of uncertainty is thought to influence the expression of worry, is through information processing (see Dugas & Koerner, 2005). Recent research has highlighted a significant association between high levels of intolerance of uncertainty and biased processing of ambiguous information (see Dugas,

Hedayati et al., 2005; Study 1). Individuals who are high on intolerance of uncertainty appraise ambiguous scenarios more negatively and express greater concern about them than do individuals who are low on intolerance of uncertainty (Dugas, Hedayati et al., 2005; Study 1). Moreover, intolerance of uncertainty appears to be a more robust predictor of appraisals of ambiguous scenarios than are demographics, GAD symptoms, and mood variables (Dugas, Hedayati et al., 2005; Study 1). In addition, preliminary research suggests that appraisals of ambiguous scenarios partly mediate the association of intolerance of uncertainty to worry (Study 1). Taken together, at least two studies have demonstrated a consistent association between intolerance of uncertainty, a putative cognitive vulnerability factor for GAD, and negative appraisals of ambiguous events. However, the cognitive processes involved in the *generation* of these appraisals are not well understood.

Emotional Reasoning: Affect as Information

Although the process of disambiguating an uncertain or ambiguous situation is typically thought of as a purely cognitive exercise, general theories of risk and decision-making have emphasized the prominent role of *emotional responses* in judgments made under uncertainty (*risk-as-feelings*, Loewenstein et al., 2001; *affect-as-information*, Schwartz & Clore, 2003; *affect heuristic*, Slovic et al., 2004). More often than not, mundane decisions and even major ones must be made under less than ideal conditions. Nonetheless, people appear quite capable of making adequate decisions within a limited timeframe, without all the information required to engage in complete, systematic analyses of situations, and without the ability to predict with certainty the outcome of decisions. Affect facilitates processing in a number of important ways. Loewenstein et al.

(2001) explain that visceral reactions, particularly the experience of fear and anxiety, are essential to decision-making in that they influence initial appraisals of the overall “goodness” or “badness” of uncertain situations, facilitate the ability to contemplate the potential future consequences of decisions, and motivate approach or avoidance of said situations.

Thus, the use of affect as information when attempting to make sense of an uncertain situation appears to be a *sine qua non* of adaptive information processing; however, it is not a fail-safe strategy. As Slovic et al. (2001) note, affect can be misleading and can lead to misguided reasoning, even in individuals who are typically “systematic” thinkers. Salient visceral reactions have the capacity to override rational, cognitive evaluations; though, people are generally able to arrive at relatively balanced assessments of problematic situations.

Individuals with clinically-significant anxiety, on the other hand, may have a tendency of prioritizing experiential information in lieu of more objective contextual information when processing potentially threatening information, which can engender overestimations of threat (Loewenstein et al., 2001). In the clinical literature, this tendency has been termed *emotional reasoning*. Emotional reasoning (also called *ex-consequencia* reasoning) refers to the tendency to infer “danger” from the experience of an anxious response (Beck & Emery, 1985). Biases in emotional reasoning have been strongly implicated in post traumatic stress disorder (Engelhard & Arntz, 2005; Engelhard, van den Hout, Arntz, & McNally, 2002; Engelhard et al., 2001), social anxiety disorder (Mansell & Clark, 1999) and phobia (Arntz, Rauner, & van den Hout, 1995).

In studies of emotional reasoning, a vignette methodology is typically used to assess the extent to which affect influences appraisals and interpretations of ambiguous situations. In the simplest version of the task, participants are asked to read a series of four brief scenarios and to imagine that the situations described therein are happening to them personally. All four scenarios describe the same event, but vary systematically on two dimensions: possibility of threat (low versus high) and anxiety response information (absence versus presence). For each scenario, respondents use visual analog scales to evaluate the degree to which the described situation is threatening, unsafe, uncontrollable, anxiety-provoking, as well as the likelihood that it will result in a negative outcome. Collectively, studies of emotional reasoning in adults suggest that high- and low- anxious individuals use different pieces of information to assess the threat value of a situation. Low-anxious individuals appear to focus more on the objective aspects of a situation in order to evaluate its “dangerousness” when this information is available. On the other hand, high-anxious individuals may tend to rely on experiential information—specifically, their anxious arousal—to make this assessment (Arntz et al., 1995; Engelhard et al., 2001).

Emotional reasoning is not known to have been studied in relation to worry and GAD. However, research on worry and its relation to negative appraisals of anxious arousal suggests that examining the role of affective cues in appraisals might be relevant for understanding interpretive processing in individuals who are prone to worry excessively (i.e., individuals high on intolerance of uncertainty). Borkovec, Alcaine and Behar (1994) proposed that high worriers and individuals with GAD are highly uncomfortable with emotional arousal and that they engage in avoidant strategies to

down-regulate intense negative affect. The roles of experiential avoidance and emotion regulation difficulties in GAD symptomatology has since been investigated by at least two other groups (Mennin, Heimberg, Turk, & Fresco, 2005; Roemer, Salters, Raffa, & Orsillo, 2005). Our group also conducted a series of studies examining fear of emotional arousal and its relation to worry and worry-related cognitive processes. In a study conducted by Bakerman, Buhr and Dugas (2003), the tendency to worry was shown to be related to concerns about losing control over the experience of anxious arousal, a finding also obtained by Roemer et al. (2005). In a subsequent study (Otis, Buhr, & Dugas, 2003), fear of anxious arousal was shown to predict significant variance in worry, above and beyond cognitive factors already known to be implicated in GAD, such as intolerance of uncertainty, negative problem orientation, positive beliefs about worry, and habitual thought suppression. Furthermore, there is some evidence to suggest that the fostering of negative appraisals of anxious arousal might stimulate worry. In a study involving an experimental manipulation of beliefs about anxiety (Buhr & Dugas, 2007), individuals high on intolerance of uncertainty who were informed that anxiety is dangerous (e.g., anxiety is physically harmful and reflects poorly on a person), worried significantly more about their performance on an impending task, relative to those who received accurate information about anxiety.

Taken together, several studies suggest that worriers are attuned to their anxious arousal. It is plausible that in the absence of disambiguating information, individuals who are high on intolerance of uncertainty may be more apt than individuals low on intolerance of uncertainty to use emotional cues as a source of information in the resolution of uncertainty.

Hypotheses

This study examined emotional reasoning in low threat and high threat situations in individuals low and high on intolerance of uncertainty, by means of a vignette paradigm similar to ones used in studies by Arntz et al. (1995) and Engelhard et al. (2001, 2002). First, in line with general decision-making theories, it was predicted that both individuals low on intolerance of uncertainty and high on intolerance of uncertainty would appraise low threat situations containing anxious cues in a more negative manner than identical situations not containing affective information. Second, based on general cognitive theories of anxiety and research on worry-related processes, it was predicted that the inflating effect of anxious cues on appraisals of low risk situations would be significantly *more* pronounced in individuals high on intolerance of uncertainty than in individuals low on intolerance of uncertainty. Finally, it was predicted that the presence of anxious cues in high threat situations would lead to significant inflations of negative appraisals in individuals high on intolerance of uncertainty, but that appraisals would remain stable in individuals low on intolerance of uncertainty. This hypothesis was derived from findings in emotional reasoning literature that suggest that low-anxious individuals make use of objective information to assess uncertain events when this information is available to a greater extent than do high-anxious individuals.

Method

Participants

The sample consisted of 76 Concordia University undergraduate students (71 women, 5 men; mean age 23.78 years, $SD= 6.33$) enrolled in courses in the Department

of Psychology. Participants were recruited via the department's participant pool and received partial course credit for taking part in this study.

Materials

The *Emotional Reasoning Task* is a paradigm used to assess the role of affective cues in interpretive processing. The version of the emotional reasoning task (ERT) used in this study was modeled after versions constructed by Arntz et al. (1995) and Engelhard et al. (2001; 2002). In the present study, an ERT with 11 types of scenarios was developed. Given that high worriers report a wide variety of concerns, the scenarios were designed to capture a range of potential threats: confrontation of an esteemed individual, dissolution of a romantic relationship, dissolution of a friendship, failure to be admitted to a desired university program, financial insecurity, illness (family member), illness (self), late arrival for an important appointment, loss of employment, negative evaluation of work performance, and physical harm (see Table 3.1 for vignettes related to health). For each scenario type, four versions varying in the possibility of threat [low (T-) versus high (T+)] and anxiety response information [absence (A-) versus presence (A+)] were constructed, making for a total of 44 scenarios in the task. Anxiety responses varied across the 11 sets of scenarios to discourage response bias (Arntz et al., 1995) and consisted for the most part of visceral and somatic sensations (e.g., muscle tension, stomach distress). All scenarios were constructed so that the outcome was uncertain. Using 100 millimeter visual analogue scales, participants evaluate each scenario on the degree to which it was perceived as threatening, unsafe, uncontrollable, anxiety-provoking, as well as the likelihood of it resulting in a negative outcome. Typically, the degree to which situations are experienced as threatening is examined as the main

dependent variable, while the other appraisal dimensions are analyzed as control variables (e.g., Arntz et al., 1995; Engelhard et al., 2001). However, in this study, all appraisals dimensions were examined as dependent variables.

The *Intolerance of Uncertainty Scale* (IUS; Freeston et al., 1994; English translation, Buhr & Dugas, 2002) is a 27-item questionnaire that assesses negative beliefs about the experience of uncertainty. The IUS is composed of items that reflect the beliefs that uncertainty is stressful and upsetting, is negative and to be avoided, and leads to the inability to take action, and that being uncertain is unfair. Although the IUS assesses various dimensions related to the experience of uncertainty, Buhr and Dugas (2002) recommend using it as a unitary measure. The English version of the IUS has excellent internal consistency, good test-retest reliability over a 5-week period, and demonstrated convergent and divergent validity (Buhr & Dugas, 2002).

The *Cognitive Avoidance Questionnaire* (CAQ; Gosselin et al., 2002; English translation, Sexton & Dugas, in press) is a 25-item measure that assesses the extent to which one engages in strategies to avoid distressing thoughts and mental images. These include thought suppression, transformation of disturbing mental images to verbal-linguistic thought, thought replacement, distraction, and avoidance of situations or objects that may trigger distressing cognitions. The internal consistencies of the English CAQ total scale and its five subscales range from good to excellent. Test-retest reliability has been shown to be good for the subscales and high for the total scale. The CAQ shows evidence of convergent and divergent validity (Sexton & Dugas, in press).

Table 3.1

Health Vignettes from the Emotional Reasoning Task

Imagine that you have scheduled an appointment to see your doctor for your annual medical check-up. You undergo the usual physical exam and routine blood testing. Three days later, you receive a message on your answering machine from the clinic nurse. In a neutral tone of voice...

Version 1: Low-Threat/ Absence of Anxiety Response Information (T-A-):

...she asks you to call her back whenever you have time. You call her back.

Version 2: Low-Threat/ Presence of Anxiety Response Information (T-A+):

...she asks you to call her back whenever you have time. You feel your chest tighten. You call her back.

Version 3: High-Threat/ Absence of Anxiety Response Information (T+A-):

...she says that it is extremely important that you call her back as soon as you get the message. You call her back.

Version 4: High-Threat/ Presence of Anxiety Response Information (T+A+):

...she says that it is extremely important that you call her back as soon as you get the message. You feel your chest tighten. You call her back.

The *Anxiety* subscale of the *Affective Control Scale* (ACS; Williams, Chambless, Ahrens, 1997) contains 13 items that assess the extent to which one fears losing control over the experience of anxiety. The ACS also assesses the fear of depressed mood, fear of anger, and fear of positive emotion. The Anxiety subscale has been shown to have very good internal consistency and good test-retest reliability. Convergent and divergent validity of the ACS has been demonstrated in at least two investigations (Berg, Shapiro, Chambless, & Ahrens, 1998; Williams et al., 1997).

The *Penn State Worry Questionnaire* (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item measure of excessive worry. High internal consistency and good test-retest reliability have been demonstrated with the PSWQ and this measure has been shown to assess a construct that is distinct from anxiety and depression (Metzger et al., 1990; Molina & Borkovec, 1994).

The *Worry and Anxiety Questionnaire* (WAQ; Dugas et al., 2001) assesses the symptoms of DSM-IV-defined GAD. Three items assess the extent to which the worry is experienced as excessive and difficult to control. The Somatic subscale assesses the degree to which respondents have been bothered by restlessness or feelings of being keyed up or on edge, fatigue, difficulties with concentration, irritability, muscle tension, and sleep disturbances. In addition, respondents rate the degree of functional interference they are experiencing as a result of their worry and anxiety. The Somatic subscale can be used with the PSWQ to assess the severity of GAD symptoms. The WAQ has adequate test-retest reliability and in a non-clinical sample, has been shown to effectively distinguish individuals with low, moderate and high levels of worry (Dugas et al., 2001).

The *Beck Anxiety Inventory* (BAI; Beck, Epstein, Brown, & Steer, 1988) is a 21-item measure that assesses the extent to which one was bothered by symptoms associated with anxiety in the past week. In undergraduate samples, the BAI has shown a high level of internal consistency and divergent validity (Creamer, Foran, & Bell, 1995).

The *Center for Epidemiological Studies Depression Scale* (CES-D; Radloff, 1977) is a 20-item non-diagnostic measure of depressive symptoms experienced in the previous seven days. The CES-D has high internal consistency, acceptable test-retest reliability, and demonstrated concurrent and construct validity (Radloff, 1977).

Procedure

Participants completed the study tasks in a quiet testing room in the laboratory. After providing written informed consent (see Appendix), they completed the ERT first. The ERT was formatted as a paper-and-pencil task. Each scenario was presented individually on a page, with the five visual analog scales directly below. Scenarios were presented in a pseudorandom order such that scenarios from the same thematic category or ERT condition never appeared consecutively. Participants received instructions to read the scenarios and to imagine that the described situations were happening to them personally. Scenarios were written in the second person and in the present tense to increase personalization. For each scenario, participants made their evaluations by marking a line along each of the five visual analog scales. Participants were asked not to return to scenarios to re-read or re-evaluate them. Upon finishing the ERT, participants completed the self-report measures.

Results

Group Classification

Participants were classified as low on intolerance of uncertainty (Low-IU; $n=37$) or high on intolerance of uncertainty (High-IU; $n=39$) based on their total score on the IUS. A cut-score of 58 was used to divide the sample, which corresponds to a score one standard deviation below the mean of individuals meeting diagnostic criteria for GAD by self-report (see Buhr & Dugas, 2002). This cut-score was used, as there are no known taxometric data for the construct of intolerance of uncertainty (see Study 1). Mean scores ($+SD$) for the Low-IU and High-IU groups on all self-report measures are presented in Table 3.2. Relative to those in the Low-IU group, participants in the High-IU group obtained higher scores on all measures, with the exception of four of the five subscales of the CAQ; although mean scores on all five subscales were higher in the High-IU group than in the Low-IU group, the groups differed significantly only on thought substitution (CAQ-Sub) and the total score (CAQ-Tot).

Preliminary Analyses

Pearson product moment correlations were conducted in the total, undifferentiated sample to assess relations between appraisals of all four types of scenarios in the ERT (T-A-, T-A+, T+A-, T+A+) and demographic variables (age and sex), mood variables (CES-D and BAI), GAD symptoms (PSWQ and WAQ Somatic subscale), habitual cognitive avoidance (CAQ-Tot) and fear of anxious arousal (ACS-Anx). Higher scores on measures of mood, GAD symptoms, and fear of anxious arousal were significantly correlated with appraisals of all ERT scenarios as more threatening, unsafe, uncontrollable, anxiety-provoking, and likely to result in a negative outcome. Habitual

cognitive avoidance showed significant positive associations with all appraisal dimensions only under conditions of low-threat (i.e., T-A- and T-A+ scenarios).

Main Analyses

Means and standard errors for appraisals of the four categories of ERT scenarios as a function of IU Group are presented in Table 3.3. A doubly-multivariate analysis of variance (MANOVA) with follow-up univariate mixed ANOVAs and Bonferroni-adjusted simple effects tests, simple comparisons, and interaction contrasts was performed to examine the effects of IU Group (Low-IU versus High-IU) and Scenario Type (T-A-, T-A+, T+A-, and T+A+) on the five ERT appraisal dimensions: threat, safety, uncontrollability, anxiety-provocativeness, and outcome expectancy. Depressive symptoms (CESD), anxious symptoms (BAI), GAD symptoms (PSWQ and WAQ Somatic subscale), fear of anxious arousal (ACS-Anx) and habitual cognitive avoidance (CAQ-Tot) were introduced as covariates in the analysis, given that these were all significantly correlated with appraisals in the total sample and given that there were significant differences between the Low-IU and High-IU groups on these variables.

Omnibus effects. The analysis yielded a significant omnibus main effect of Scenario Type, multivariate $F(15, 606) = 2.72, p < .01$, which was qualified by a significant omnibus IU Group X Scenario Type interaction effect, multivariate $F(15, 606) = 2.12, p < .01$. This suggests that the overall pattern of appraisals across ERT scenario types varied reliably as a function of IU Group. To situate the source of this omnibus interaction effect, the five appraisal dimensions were examined individually in separate 2 (IU Group) X 4 (Scenario Type) mixed ANOVAs. The univariate F tests yielded significant IU

Table 3.2

Means and Standard Deviations for Self-Report Measures in Participants Low on Intolerance of Uncertainty (Low- IU; n=37) and Participants High on Intolerance of Uncertainty (High-IU; n=39)

Measure	Low IU		High IU		<i>F</i> (1, 74)
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	
IUS	40.16	8.64	71.95	14.30	135.72**
CAQ-Total	51.78	21.50	62.15	18.33	5.14*
CAQ-Supp	12.86	4.77	14.62	4.20	2.89 ^t
CAQ-Trans	10.00	5.05	11.74	4.95	2.31
CAQ-Sub	7.51	3.23	10.79	3.78	16.49**
CAQ-Distract	11.62	5.60	13.03	4.89	1.36
CAQ-Avoid	9.78	5.85	11.97	4.69	3.26 ^t
ACS-Anx	37.73	11.57	51.67	12.78	24.77**
PSWQ	41.35	11.77	58.97	10.51	47.55**
WAQ-	15.38	4.86	20.33	4.11	23.13**
Somatic					
BAI	12.08	10.61	19.98	12.38	8.90**
CES-D	9.78	6.76	19.86	10.50	24.42**

Note. IUS=Intolerance of Uncertainty Scale; CAQ-Total= Total Score of the Cognitive Avoidance Questionnaire; CAQ-Supp= CAQ Thought Suppression subscale; CAQ-Trans=CAQ Transformation of Mental Images into Verbal Thought subscale; CAQ-Sub= CAQ Thought Substitution subscale; CAQ-Distract= CAQ Distraction subscale; CAQ-

Avoid= CAQ Avoidance of Threat Stimuli subscale; ACS-Anx= Anxiety subscale of the Affective Control Scale; PSWQ=Penn State Worry Questionnaire; WAQ-Somatic= Somatic subscale of the Worry and Anxiety Questionnaire; BAI=Beck Anxiety Inventory; CES-D= Center for Epidemiological Studies-Depression Scale

** $p < .01$; * $p < .05$; † $p < .10$

Table 3.3

Means and Standard Errors for Appraisals of Scenarios in the Emotional Reasoning Task in Participants Low on Intolerance of Uncertainty (Low-IU; n=37) and Participants High on Intolerance of Uncertainty (High-IU; n=39)

Appraisal	<i>ERT Condition^a</i>							
	T-A-		T-A+		T+A-		T+A+	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
<i>Threatening</i>								
Low-IU	39.90	2.74	46.26	2.50	60.05	2.68	61.31	2.63
High-IU	38.64	2.64	49.35	2.41	64.53	2.59	67.52	2.54
<i>Unsafe</i>								
Low-IU	34.03	2.83	39.54	2.74	51.14	3.23	52.16	3.18
High-IU	35.28	2.74	44.22	2.65	58.15	3.12	61.02	3.08
<i>Uncontrollable</i>								
Low-IU	46.40	3.20	49.12	3.13	58.35	2.67	62.10	2.60
High-IU	49.17	3.10	56.18	3.03	65.24	2.58	66.84	2.51
<i>Anxiety-Provoking</i>								
Low-IU	53.33	3.09	59.47	2.61	70.21	2.28	71.83	2.30
High-IU	54.04	2.99	64.54	2.53	78.34	2.21	79.68	2.22
<i>Negative Outcome</i>								
Low-IU	32.48	2.80	36.81	2.82	45.44	2.79	46.13	2.96
High-IU	34.76	2.70	41.80	2.73	55.89	2.70	58.79	2.86

Note. Means and standard errors were adjusted for the following covariates: depressive symptoms (Center for Epidemiological Studies-Depression Scale), anxiety symptoms (Beck Anxiety Inventory), worry (Penn State Worry Questionnaire), GAD somatic symptoms (Worry and Anxiety Questionnaire-Somatic subscale), habitual cognitive

avoidance (Cognitive Avoidance Questionnaire-Total Score), and fear of anxious arousal (Anxiety subscale of the Affective Control Scale).

^a ERT conditions: T-A- = Low Threat/ Absence of Anxiety Response Information; T-A+ = Low Threat/ Presence of Anxiety Response Information; T+A- = High Threat/ Absence of Anxiety Response Information; T+A+ = High Threat/ Presence of Anxiety Response Information.

Group X Scenario Type interaction effects for threat [$F(3, 204) = 2.73, p = .05$], safety [$F(3, 204) = 3.07, p = .03$], anxiety-provocativeness [$F(3, 204) = 3.22, p = .02$] and outcome expectancy [$F(3, 204) = 6.30, p < .01$], but not for uncontrollability. Therefore, all appraisal dimensions except for uncontrollability were examined in subsequent analyses.

Tests of the simple effects of Scenario Type within each level of IU Group were performed. Within the Low-IU Group, these tests revealed that there were significant main effects of Scenario Type for threat [$F(3, 66) = 33.47, p < .01$], safety, [$F(3, 66) = 27.40, p < .01$], anxiety-provocativeness [$F(3, 66) = 26.42, p < .01$], as well as outcome expectancy [$F(3, 66) = 14.34, p < .01$]. Similarly, within the High IU Group, there were significant main effects of Scenario Type for threat [$F(3, 66) = 62.93, p < .01$], safety, [$F(3, 66) = 56.86, p < .01$], anxiety-provocativeness [$F(3, 66) = 52.33, p < .01$], and outcome expectancy [$F(3, 66) = 43.63, p < .01$]. Pairwise comparisons performed within the Low-IU and High-IU groups separately revealed that T-A- scenarios were appraised as least threatening, unsafe, and anxiety-provoking, and least likely to result in a negative outcome, followed by T-A+ scenarios, T+A- scenarios, and finally, T+A+ scenarios (all p values $< .01$).

Appraisals of low threat scenarios. Simple comparisons were performed within the Low-IU and High IU groups to compare appraisals of T-A- and T-A+ scenarios. These revealed that relative to the T-A- scenarios, T-A+ scenarios were appraised by *both* the Low-IU and High-IU groups as more threatening [$F(1, 36) = 22.19, p < .01$ and $F(1, 38) = 67.87, p < .01$], unsafe [$F(1, 36) = 20.85, p < .01$ and $F(1, 38) = 58.93, p < .01$], anxiety-provoking [$F(1, 36) = 13.49, p < .01$ and $F(1, 38) = 42.17, p < .01$] and more likely to

result in a negative outcome [$F(1, 36) = 10.96, p < .01$ and $F(1, 38) = 31.03, p < .01$]. In the Low-IU group, effect sizes ranged from $d = 0.25$ to 0.40 and in the High-IU group, effect sizes ranged from $d = 0.42$ to 0.68 .

Given that the presence of anxiety response information appeared to alter appraisals of low-threat scenarios in the Low-IU and High-IU groups, interaction contrasts were performed to test the hypothesis that the inflating effect of anxiety information would be more enhanced in the High-IU group. Contrasts suggested that anxiety response information inflated threat appraisals of T- scenarios to a greater extent in the High-IU group than in the Low-IU group, $F(1, 68) = 4.13, p = .05$, partial $\eta^2 = .06$. In addition, anxiety response information appeared to lead to appraisals of T- scenarios as more unsafe to a greater extent in the High-IU group than in the Low-IU group, $F(1, 68) = 3.23, p = .07$, partial $\eta^2 = .05$.

Appraisals of high threat scenarios. The Low-IU and High-IU groups were also compared on their appraisals of T+A- and T+ A+ scenarios. When anxiety response information was present, the High-IU group appraised T+ scenarios as more threatening [$F(1, 38) = 12.12, p < .01, d = 0.19$], unsafe [$F(1, 38) = 8.54, p = .03, d = 0.15$], and likely to result in a negative outcome [$F(1, 38) = 8.55, p = .03, d = 0.17$] as compared to when anxiety response information was absent. However, High-IU individuals did not evaluate T+A+ scenarios as more anxiety-provoking than T+A- scenarios. A different pattern of results emerged in the Low-IU Group. The presence of anxiety response information did not lead to significant inflations in appraisals of threat, safety, anxiety-provocativeness, and outcome for high-threat scenarios in Low-IU individuals (all p values $> .05$).

Predictors of outcome expectancies. Expectations of how situations will turn out are hypothesized to be influenced by a person's schematic beliefs and appraisal tendencies (Butler & Mathews, 1983). The main analyses revealed that Low-IU and High-IU individuals used affective information when evaluating uncertain situations. Specifically, the presence of anxiety response information appeared to enhance negative appraisals, including expectations of negative outcomes. An a posteriori analysis was performed to examine the factors that may predict changes in perceived outcome expectancy in the presence of anxiety response information. Emotional reasoning scores were computed for appraisals of low threat (T-A+ appraisals minus T-A- appraisals) and high threat (T+A+ appraisals minus T+A- appraisals) scenarios. Two multiple regressions were performed predicting changes in perceived outcome under low threat and high threat conditions, respectively. Scores on mood measures (CES-D and BAI) and symptom measures (PSWQ, WAQ Somatic subscale) were entered in the first step as covariates. In the second step, IU Group, fear of anxious arousal (ACS-Anx), cognitive avoidance (CAQ-Tot), and changes in perceived threat, safety, uncontrollability, and anxiety-provocativeness were entered simultaneously.

Under conditions of low threat, increased perceptions of the anxiety-provocativeness of situations significantly predicted increased negative outcome expectancies ($\beta = .42, p < .01$). On the other hand, under conditions of high threat, increased perceptions of the uncontrollability of situations ($\beta = .42, p < .01$) was a significant predictor of increased negative outcome expectancies. High-IU classification emerged as a marginally significant predictor of increased negative outcome expectancies ($\beta = .27, p = .06$).

Discussion

Numerous studies have shown that relative to nonanxious individuals, people with GAD have a tendency of making threat consistent appraisals and interpretations when confronted with situations that contain the possibility of threat. Recent research has implicated intolerance of uncertainty, a dispositional characteristic that results from a set of negative beliefs about uncertainty and its connotations and consequences, in the appraisal biases that are characteristic of individuals who worry excessively (Dugas, Hedayati et al., 2005; Koerner & Dugas, 2006). Although individuals who are high on intolerance of uncertainty report that uncertain situations are unpleasant and disconcerting, little is known about the underlying cognitive processes that contribute to the promotion of these negative appraisals. The goal of this study was to examine how individuals low and high on intolerance of uncertainty use affective information when evaluating situations in which outcomes are uncertain, in order to assess whether emotional reasoning can be an explanatory factor in appraisals. Individuals low and high on intolerance of uncertainty were compared on their appraisals of low threat and high threat situations.

The first two hypotheses stated that irrespective of level of intolerance of uncertainty, the presence of anxiety cues would enhance threat-related perceptions of low threat situations and that this enhancement would be more pronounced in individuals *high* on intolerance of uncertainty. Individuals low *and* high on intolerance of uncertainty appraised situations without explicit threat cues as more threatening, unsafe, anxiety-provoking, and likely to result in a negative outcome when anxiety cues were present as compared to when they were absent. Therefore, when there was not a sufficient amount

of information about a situation, participants generally appeared to rely on affective response information to make their threat estimations. This is entirely consistent with findings from the decision-making literature that have shown that emotional and visceral reactions play a crucial role in judgment making under uncertainty (e.g., Johnson & Tversky, 1983; Loewenstein et al., 2001; Tiedens & Linton, 2001). Indeed, many studies have demonstrated that when anxiety or worry is induced in individuals with *no* diagnosable anxiety disorder, appraisals of uncertain situations become more negative. Specifically, in situations that convey the potential for threat, the experience of anxiety and worry leads to enhanced estimations of risk and diminished perceptions of personal control (Johnson & Tversky, 1983; Lerner & Keltner, 2001).

Although appraisals of low-threat scenarios were generally dependent upon the presence of affective information, the inflating effect of anxiety cues was more pronounced in individuals high on intolerance of uncertainty than in individuals low on intolerance of uncertainty, but only for evaluations of threat and safety. The inflating effects of anxiety cues on appraisals of anxiety-provocativeness and outcome were similar in both groups. This seems to suggest that the various appraisal dimensions can be dissociated from one another and that there are, in the words of Lerner and Keltner (2001), “boundary conditions” for the effect of emotion on threat assessment in individuals who are high on intolerance of uncertainty. The presence of anxious cues in the absence of tangible, objective information may “prime” individuals who are high on intolerance of uncertainty to the possibility of threat, but may not necessarily alter *all* cognitive appraisals in a corresponding fashion; in other words, there may be some degree of divergence among the various appraisal dimensions. This underscores the

importance of including multiple measures of appraisal in studies of interpretative processing, as it cannot be readily assumed that various attributes are synonymous with one another (i.e., an appraisal of a situation as “threatening” does not necessarily imply that a negative outcome is anticipated).

It was hypothesized that in high threat situations, the presence of anxious cues would influence appraisals in individuals high on intolerance of uncertainty, but that appraisals would remain relatively stable in individuals low on intolerance of uncertainty. The results suggest that individuals low on intolerance of uncertainty appeared to rely more on the objective information presented in the scenarios, as evidenced by the fact that anxiety cues did not significantly alter their appraisals. Individuals high on intolerance of uncertainty, on the other hand, used the affective information in addition to the objective cues, and appraised high-threat situations as more threatening, unsafe, and likely to result in a negative outcome when both types of cues were present as compared to when only the objective information was present. Therefore, the discrepancy in responses to low threat versus high threat scenarios appeared to be due to the more judicious use of affective information by individuals low on intolerance of uncertainty. Thus in the absence of concrete threat cues, individuals low on intolerance of uncertainty used the only available information—emotional cues-- to appraise the threat value of situations; however, when objective cues were available, these appeared to take precedence.

It should be noted that the findings are at variance with those reported by Arntz et al. (1995) and Engelhard et al. (2002), who found no evidence of emotional reasoning in their non-anxious control groups. Paradoxically, their findings suggest that affective cues

do not alter the appraisals of nonclinical adults; but, methodological differences between studies appear to be the most likely explanation for the observed inconsistency. Anxiety cues used in the scenarios in this study appear to differ from those used in the Arntz et al. and Engelhard et al. studies. The anxious cues in this investigation were for the most part visceral or somatic (e.g., “ you feel a burning sensation in your stomach”; “your throat is dry”; “you feel your neck and back stiffening”); whereas they were less descriptive in the other studies (e.g., “you become very anxious”; Arntz et al., 1995 and “you are scared to death”; Engelhard et al., 2002). Interestingly, our findings resemble those of Muris, Merckelbach, and van Spauwen (2003), who observed an emotional reasoning effect in nonclinical children under conditions of low threat only, which they attributed to developmental factors. However, upon examination of the scenarios used in their study, it appears that theirs contained descriptions of specific anxious cues as well (e.g., “you start to sweat”). Thus, equivocal findings among studies may largely be due to the specificity of the affective information employed in emotional reasoning paradigms.

An exploratory analysis was conducted to examine the unique contributions of intolerance of uncertainty and anxiety-associated changes in appraisals of threat, safety, uncontrollability, and anxiety-provocativeness to the prediction of changes in outcome expectancies. Under conditions of low threat, increases in negative outcome expectancies were uniquely predicted by increased perceptions of situations as anxiety provoking. However, under high threat conditions, an increased perception of events as uncontrollable was the most salient predictor of enhanced negative outcome expectancies. Engelhard et al. (2001) also found that in individuals with PTSD, the influence of anxiety response information on perceptions of the dangerousness of

uncertain events was to a large extent mediated by perceived uncontrollability. The findings are also consistent with those emerging from the nonclinical decision making literature showing that appraisals of control mediate the influence of anxious mood on risk estimations (Lerner & Keltner, 2001). It appears that beliefs about uncertainty may also be an important factor in outcome expectancies, as level of intolerance of uncertainty emerged as a predictor of anxiety-induced negative outcome expectancies. This is consistent with studies showing that perceived uncertainty is a salient dimension of the experience of worry, anxiety and fear (Smith & Ellsworth, 1985).

Artz et al. (1995) hypothesized that a fear of anxious sensations might account for the emotional reasoning effects observed in high-anxious individuals; however, in this investigation, relevant processes such as fear of anxious arousal and habitual cognitive avoidance were not correlated with outcome expectancies once the effects of intolerance of uncertainty status and appraisals of threat, safety, uncontrollability, and anxiety provocativeness were accounted for. In addition, perceptions of the anxiety-provocativeness of low-threat scenarios were not significantly more enhanced in individuals high on intolerance of uncertainty, and anxiety response information did not seem to enhance their perceptions of the anxiety-provocativeness of high-threat situations either. Although these null findings are somewhat peculiar, others (Engelhard et al., 2001; Engelhard & Arntz, 2005) have also reported an absence of a relationship between fear of anxiety and the use of emotional reasoning. This suggests that sensitivity to anxiety cues might not be promoted by a fear of anxiety per se and might not foster inflated perceptions of the anxiety-provocativeness of potentially threatening situations.

The results, suggest rather, that affect might influence appraisals primarily by fostering reduced perceptions of control and an internal sense of uncertainty.

The nonclinical decision-making literature suggests that three dimensions appear to be specific to the appraisal of uncertain situations: unpleasantness and uncontrollability (which were assessed to some extent in this study), as well as uncertainty (Lerner & Keltner, 2001; Smith & Ellsworth, 1985). Lerner and Keltner (2001) showed that in dispositionally anxious individuals, perceived uncontrollability and perceived uncertainty were the two appraisal dimensions that best predicted negative perceptions of the outcome of ambiguous situations. Perceived uncertainty was not included as an appraisal dimension in the paradigm used in this study, but the fact that level of intolerance of uncertainty emerged as a salient predictor of changes in negative outcome expectancies in the exploratory regression analysis indicates that anxious affect might exert its influence on appraisals by increasing subjective uncertainty. Feelings of uncertainty might act as a “barometer” by which worry-prone individuals gauge the threat value of uncertain situations.

Implications and Limitations

Research on appraisal tendencies might have relevance for understanding how worried individuals set about the task of addressing their problems, since problem solving is essentially an exercise in threat resolution. Although individuals who are prone to excessive worry possess adequate problem-solving skills, their attempts at managing problems can seem disorganized and inconsistent. What is more, high worriers and individuals with GAD report believing that difficulties with problem solving arise particularly when problems are self-relevant. Robichaud, Dugas, and Radomsky (2007)

conducted a study comparing quality of problem solving in individuals high and low on intolerance of uncertainty and assessed the roles of dispositional and state factors that could potentially contribute to problem-solving difficulties. Participants were asked to engage in the task of solving two problems: a current, self-relevant problem and a non-personally relevant problem selected by the experimenter. In individuals high on intolerance of uncertainty, higher levels of anxiety were shown to be associated with difficulties related to problem definition and goal formulation--the first stages of constructive problem-solving—only when the problem was self-relevant, which suggests that the non-personally relevant problem may not have been perceived as threatening.

Given that problems are essentially uncertain situations that contain the possibility of threat, information processing perspectives can be particularly useful for understanding the cognitive mechanisms that underlie the poor problem solving exhibited by individuals who worry. Emotional reasoning, for example, might be an explanatory factor in the relationship between the experience of somatic anxiety and difficulties with problem solving. Individuals who worry excessively, in addition to possessing an inflexible orientation toward uncertainty, also tend to have a negative orientation toward problems and the problem-solving process (Belzer, D’Zurilla, & Maydeu-Olivares, 2002; Dugas, Gagnon et al., 1998; Robichaud & Dugas, 2005, 2007). When an individual who is high on intolerance of uncertainty is confronted with a potentially threatening situation, the experience of anxious arousal might activate negative perceptions of uncertainty and negative beliefs about one’s capacity to deal with problems effectively, which may promote negative appraisals surrounding one’s ability to control the situation and possibly an internal state of uncertainty. The initiation of this chain of cognitive events

might lead to interferences with aspects of information processing that are necessary for addressing problematic situations in an efficient and effective manner. For example, attention toward anxious cues, in addition to reducing perceptions of control and certainty, may also interfere with the ability to distinguish relevant from irrelevant information, to consider the objective aspects of a situation, and to recall the details of how one handled a similar situation in the past (Engelhard & Artanz, 2005). Such interferences may conceivably hinder one's ability to conceptualize problems in a concrete and specific fashion, which may lead to maladaptive coping and the perpetuation of anxiety and worry.

This study had a number of limitations, the main one being that the paradigm utilized to examine emotional reasoning permitted only a very cursory assessment of appraisal tendencies. In an investigation of cognitive appraisal dimensions, Reizenzein and Hofmann (1990) asked participants to read a series of scenarios and to assign attributes to each one. The authors were able to identify *ten* different categories of appraisal and furthermore, each appeared to be decomposable into more precise concepts. For example, control appraisals consisted of statements referring to situations as changeable versus unchangeable or under one's influence versus not under one's influence, and also included statements referring to feelings of self-assuredness versus helplessness (Reizenzein & Hofmann, 1990). Similarly, Smith and Ellsworth (1985) suggested that control appraisals could be understood in a number of ways. An uncontrollable event could mean that an event is beyond anyone's control (e.g., a natural disaster); within one's control but currently in someone else's; or not within one's personal control. Thus, even though five appraisal dimensions were examined in this

study, these likely do not encapsulate the full range and complexity of appraisals involved in the processing of uncertainty.

An additional limitation is that emotional reasoning was assessed entirely by self-report. Although the paradigm used in this study is a common one, the effects of anxious response information on the appraisals of individuals high on intolerance of uncertainty were relatively small in the high threat condition (effect sizes ranged from $d= 0.17$ to $d= 0.19$), which suggests that the manipulation may not have been sufficiently salient. Future investigations may consider examining the effects of anxiety on information processing using experimental manipulations of mood state, as the induction of anxiety might produce a more robust emotional reasoning effect than can be accomplished with a vignette task. However, it can also be argued that the induction of anxiety might interfere with the capacity to disentangle the mood effects from the cognitive effects.

A final limitation of this study pertains to the sample composition. The sample consisted mainly of women; as such it was not possible to examine sex differences in appraisals. The findings of this study cannot be generalized with confidence to men. Furthermore, the sample consisted entirely of undergraduate students recruited via a psychology department participant pool, which further limits the generalizability of the findings.

Conclusion

Taken together, there appears to be some evidence for emotional reasoning in individuals who are high *and* low on intolerance of uncertainty. Individuals who are prone to worry excessively by virtue of having a low tolerance for uncertainty may, however, have an enhanced tendency of using affective cues when processing uncertain

situations. Under low threat conditions, when there are no objective features to process, affective cues may serve to “prime” individuals to the possibility of danger. This appears to be the case for individuals low on intolerance of uncertainty and to a greater extent in individuals high on intolerance of uncertainty. However, in ambiguous situations containing more concrete cues, anxious cues may inflate threat-related appraisals in individuals high on intolerance of uncertainty, but not in individuals low on intolerance of uncertainty. As noted earlier, although the use of affect as information is adaptive, the prioritization of this information might lead to disturbances in adaptive information processing, and in turn, maladaptive coping, and perpetuation of worry and anxiety in individuals who are at risk for developing excessive worry by virtue of having a high level of intolerance of uncertainty.

Chapter 4

Intolerance of uncertainty, cognitive avoidance and their relation to interpretative processing³

Early work in the domain of worry-related information processing was based on the presumption that individuals with GAD are excessively concerned with *any* threat to their physical or psychological integrity. Experimental research yielding findings of an association between GAD and enhanced attention toward stimuli (e.g., words) related to these themes appeared to confirm this notion (see MacLeod & Rutherford, 2004 for a review). The implication was that people with GAD have an overactive alarm system that leads them to focus their attention on any cues that indicate the presence of potential threat. Clinically, however it was difficult to address such a diffuse bias using standard cognitive interventions. Application of common cognitive strategies (e.g., probability estimation; see Dugas & Koerner, 2005) did not appear to be effective for GAD, which signaled that a radically different understanding of this condition was needed.

Empirical and anecdotal evidence began to suggest that what individuals with GAD might be afraid of is not threatening events per se, but the *uncertainty* associated with them. This was hypothesized based on the findings that (1) the notion of an uncertain future emerged as a prominent theme in the concerns of individuals with GAD (Borkovec, Robinson, Pruzinsky, & DePree, 1983); (2) individuals with GAD had “elevated evidence requirements” (Tallis & Eysenck, 1994); and (3) GAD clients would often report preferring to know with 100 percent certainty that a situation would turn out badly, than to be in a state of uncertainty about its outcome (Dugas & Koerner, 2005). Taken together, it became apparent that the presence of an inflexible uncertainty orientation was an important feature of GAD.

Intolerance of Uncertainty: A Specific Worry-Related Cognitive Vulnerability

A cognitive vulnerability that has been identified in individuals at-risk for developing clinically-significant levels of worry, is the presence of strong negative beliefs about uncertainty. *Intolerance of uncertainty* (IU) is defined as a dispositional characteristic that arises from a set of beliefs about uncertainty and its implications (Koerner & Dugas, 2006) and has been identified as a key process involved in the maintenance and possibly the development of the type of worry that individuals with GAD engage in.

Dugas and colleagues propose that chronic worry is the expression of a set of negative beliefs about the uncertain world and the uncertain self. These include the beliefs that uncertainty is aversive and should be avoided; that it is unfair to have to tolerate being uncertain about the future; and that uncertainty is an obstacle to one's functional well-being (Buhr & Dugas, 2002; Buhr & Dugas, 2006; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994; Koerner & Dugas, 2006). Although it is actually the *norm* for people to dislike uncertainty and to prefer outcomes that are certain to those that are not (Kahneman & Tversky, 1982), individuals who are high on intolerance of uncertainty are presumed to be especially sensitive to and easily disrupted by uncertainty.

Negative beliefs about uncertainty are presumed to be easily activated in situations that are unclear, arise unpredictably, and involve outcomes over which one has little or no control. It is hypothesized that the activation of uncertainty-related beliefs fuels selective search for and attention toward threat cues, threat-consistent interpretations of ambiguous events, and *approach* behaviours that include information-seeking, overplanning, reassurance-seeking, as well as frenetic and disorganized attempts at problem resolution.

These approach behaviours are largely aimed at reducing, and thereby controlling, external and internal uncertainty.

Intolerance of Uncertainty and Interpretative Processing

Past research has shown that individuals with GAD are more likely to appraise ambiguous events (i.e., situations that are unclear due to the uncertain nature of their outcome) as threatening compared with non-anxious individuals. However, given that similar biases have been observed in individuals with other forms of anxiety (see MacLeod & Rutherford, 2004), it is unclear whether this interpretative bias is necessarily a specific feature of GAD. Teachman (2005) emphasized that the discerning of disorder-specific cognitive biases requires the adoption of an approach that is *schematically-based* rather than purely phenomenological. In other words, the approach to take is to examine the relationship between known disorder-specific *cognitive vulnerabilities* and information processing. In the case of GAD, this would entail examining the relation of intolerance of uncertainty to information processing.

Recent research suggests that a high level of intolerance of uncertainty may in fact be an explanatory factor for negative interpretations of ambiguous situations. In a study by Dugas, Hedayati et al. (2005), undergraduate students completed a task in which they rated the threat value of ambiguously-worded scenarios that could potentially be interpreted as threatening or benign (e.g., “I got a term paper back from my professor today and was surprised at the mark it received”). Respondents were asked to make judgments about these scenarios as though they were experiencing them personally. As predicted, individuals who were high on intolerance of uncertainty tended to rate the scenarios as more threatening compared to individuals low on intolerance of uncertainty.

Further, the relationship between intolerance of uncertainty and the tendency to interpret ambiguous scenarios as threatening remained significant after accounting for variance shared with worry, anxiety, and depression. This finding represented a first step toward linking this interpretive bias with a *specific* cognitive process known to be highly related to worry and GAD.

GAD, Approach and Avoidance

In individuals predisposed to worry excessively, a low tolerance for uncertainty is hypothesized to promote biases in information processing (at least at the interpretation level, and perhaps even at the attentional level) that stimulate *approach*-oriented behaviour. However, individuals who worry excessively are also motivated to avoid. Behavioural avoidance is a feature of GAD, but it tends to be less explicit or absolute than the avoidance observed in individuals with other forms of anxiety. Cognitive avoidance is more prominent in the clinical profile of individuals with GAD. Cognitive avoidance is thought to consist of a mixed repertoire of controlled and automatic strategies (Sexton & Dugas, in press; Sexton & Dugas, 2006) aimed at managing distressing thoughts and regulating negative affect. Because of the highly covert nature of avoidance in GAD, there has been a considerable amount of focus on elucidating the internal events that are the target of the avoidance.

One hypothesis is that individuals who worry may be avoiding emotional arousal. Individuals with GAD report being highly uncomfortable with their emotional experiences (Bakerman, Buhr, & Dugas, 2002; Bergevin, Koerner, & Dugas, 2003; Mennin, Heimberg, Turk, & Fresco, 2005), as such it has been proposed that they attempt to avoid cues that may bring about the experience of uncomfortable affective and somatic

arousal (Sibrava & Borkovec, 2006). Borkovec's avoidance theory (see Sibrava & Borkovec, 2006), for example, proposes that individuals with GAD find vivid mental images of feared events particularly aversive, because these can arouse strong negative emotions. As such, it has been suggested that cognitive avoidance down-regulates negative emotion by reducing the intensity of emotion-laden mental images (East & Watts, 1994; Wenzlaff & Wegner, 2000).

Theories suggest that some individuals with GAD use *thought suppression* as a cognitive avoidance strategy (Becker, Rinck, Roth, & Margraf, 1998; Koerner & Dugas, 2006). Several studies have shown that individuals who worry excessively obtain high scores on self-report measures of habitual thought suppression (Dugas, Gagnon et al., 1998; Robichaud, Dugas, & Conway, 2003; Sexton & Dugas, 2006). Thought suppression is an effortful, cognitively demanding mental control strategy. Its "effectiveness" depends on the individual's ability to keep unwanted thoughts at bay, while simultaneously monitoring for the renewed presence of these very thoughts (Wenzlaff, Meier, & Salas, 2002). Suppressors who are good at managing this delicate balance may actually succeed at warding off distressing thoughts, at least in the short-term. However, when cognitive resources are weakened (e.g., with the introduction of a competing cognitive demand), suppression efforts may break down and give way to a surge in the thoughts originally targeted for inhibition. The long-term consequence associated with the chronic use of thought suppression (and other forms of avoidance) is reduced emotional processing, which is purported to maintain worry, anxiety, and other emotions that may be considered highly unpleasant (Sibrava & Borkovec, 2006).

Beside the presence of distressing mental images and emotional arousal, it is quite plausible that other internal events also prompt efforts to avoid. Given that uncertainty is a core concern for individuals with GAD, it is proposed that being in a *state of uncertainty* might in and of itself serve as a cue for the potential onset of disturbing thoughts and mental images and by association, uncomfortable emotional arousal. Indeed, people who worry excessively do report that while uncertainty should be prevented, it must also be avoided (Buhr & Dugas, 2002). Thus, intolerance of uncertainty may stimulate both the need to approach and a strong desire to avoid that which is uncertain. One way of conceptualizing excessive worry is as a manifestation of the conflict between these two motivations (Dugas & Koerner, 2005).

Uncertainty, Thought Suppression and Interpretative Processing

The focus thus far has been on discussing processes that may promote maladaptive responses to uncertainty in individuals with GAD. However, given the ubiquity of uncertainty, it is also useful (and necessary) to consider *commonplace* responses to it. Because of their emphasis on non-pathological processes, explanatory models in the human decision-making, economics and business literatures provide important information on normative reactions to uncertainty. Interestingly, models in these literatures suggest that *most* people dislike uncertainty to such an extent, that even a remote possibility that an uncertain situation will result in a negative outcome is enough to trigger worry and anxiety (Loewenstein, Weber, Hsee, & Welch, 2001). These models also suggest that the desire to avoid uncertainty is not inherently maladaptive; if it is feasible, most people will try to avoid it. The first course of action is typically to reduce uncertainty (e.g., by seeking information) (Lauriola & Levin, 2001; Lipshitz & Strauss,

1997; van Dijk & Zeelenberg, 2003). If reducing uncertainty is ineffective or impossible, people move to a stage of acknowledging and accepting it and will factor it into the decision-making process. When people can neither reduce nor accept uncertainty, they turn to *suppression* as a last resort to “avoid paralysis” (Lipshitz & Strauss, 1997). Essentially, people move into a suppressive mode of coping upon the realization that escaping uncertainty is not a viable option.

In conclusion, it appears that the need to avoid uncertainty is normative. However, when attempts to reduce it fail, some individuals are more apt to turn to suppressive coping in their continued efforts to avoid, whereas others are able to abandon these efforts and turn to acceptance instead. Models of decision-making suggest that *dispositional characteristics* are important determinants of how people react and choose to cope under uncertainty (Loewenstein et al., 2001) and we propose that one’s orientation toward uncertainty is one such factor. Specifically, individuals with a very low tolerance for uncertainty are less likely to take an accepting approach to uncertainty and are more likely to turn to suppression and other forms of cognitive avoidance to reduce an internal state of uncertainty. The non-clinical literature, however, is relatively silent on the possible consequences of engaging in cognitive avoidance.

It is proposed that the chronic use of thought suppression might strengthen interpretative biases for ambiguous situations or information in individuals who already have a low tolerance for uncertainty. In the absence of competing cognitive demands, thought suppression may possibly be helpful for maintaining a low level of internal uncertainty and correspondingly, a mood that is relatively non-anxious, thus facilitating the inhibition of interpretative biases. But with the introduction of a competing cognitive

demand (e.g., a stressor), suppression attempts may become disarmed, making it easier for these biases to come to the fore. The interfering effects of thought suppression on information processing have been observed in individuals at-risk for depression (Wenzlaff & Eisenberg, 2001; Wenzlaff, Meier, & Salas, 2002; Wenzlaff, Rude, & West, 2002); however, the relationship of habitual thought suppression to GAD-related interpretative processing has not to our knowledge been explored.

The Current Study

The primary goal of this study was to further examine the relation of intolerance of uncertainty to interpretative processing of ambiguous information, using a different experimental task. In nearly all known investigations of interpretative bias, the primary method for accessing this bias has been with the use of tasks involving verbal stimuli that convey a double meaning (e.g., homophones, ambiguously written scenarios). For this study, pictorial stimuli (digitized photographs) were used instead on the basis of specific methodological and theoretical considerations. First, because pictures can be quite emotionally-evocative, they are ideal for activating threat-related schemata. For this reason, photographs or video clips of individuals with ambiguous facial expressions are often used as stimuli in studies of information processing in socially anxious individuals (Amir, Beard, & Bower, 2005). Similarly, we sought to determine whether an intolerance of uncertainty-related interpretative bias could be activated with the use of photographs depicting ambiguous scenarios. Relatedly, given that individuals with GAD are presumed to be sensitive to mental imagery (Sibrava & Borkovec, 2006), we thought the use of photographic imagery might be particularly suitable for eliciting an intolerance of uncertainty-related bias. In addition, latency to respond to each photograph was also

measured. Given that ambiguous information is more cognitively-taxing to process than neutral or unambiguously emotional information, this should reflect in longer latencies to respond to photographs depicting ambiguous scenarios (Hock & Krohne, 2004).

A subsidiary goal was to examine the relationship of thought suppression and other forms of cognitive avoidance to interpretative processing. Given that research in individuals with remitted depression points to an important relationship between thought suppression and processing of ambiguous information (Wenzlaff & Eisenberg, 2001; Wenzlaff, Meier, et al., 2002; Wenzlaff, Rude, et al., 2002) and given that thought suppression is one of several strategies used by individuals who worry excessively, it seemed logical to examine whether a relationship exists between the use of cognitive avoidance strategies and interpretative processing of ambiguous scenarios in individuals who are intolerant of uncertainty. Although past literature links thought suppression to information processing biases, other cognitive avoidance strategies were also considered in this investigation, given that individuals with GAD are known to engage in many forms of avoidance.

It was hypothesized (1) that individuals high on intolerance of uncertainty would rate photographs depicting ambiguous and negative scenarios as more unpleasant relative to individuals low on intolerance of uncertainty; (2) that individuals high on intolerance of uncertainty would take longer to rate the pleasantness of the photographs depicting ambiguous scenarios relative to individuals low on intolerance of uncertainty; and (3) that in high-intolerance of uncertainty individuals, a greater tendency to use cognitive avoidance strategies would be associated with ratings of photographs depicting ambiguous and negative scenes that are more unpleasant and that these strategies would

be stronger predictors of appraisals than demographics variables, worry, and negative affect.

Method

Participants

One hundred and eighteen adults (60 men and 58 women, mean age=27.35 years, $SD= 9.31$) took part in this experiment. The sample consisted of Concordia University students ($n=74$) as well as non-students from the local community ($n=44$). Participants were recruited via announcements posted on the university campus.

Materials

The *Affective Picture Rating Task* (APRT) is a computerized task developed by our group to assess appraisal biases. The organization of the task and the rationale underlying the various aspects of its design are described in the following paragraphs:

In the introduction to the APRT, respondents read detailed instructions displayed on a computer monitor. These inform respondents that they will be viewing photographs of different events and situations one at a time and that after each one, they will be asked to rate the pleasantness of the scene depicted in the photograph by entering a number from 1 (= very unpleasant) to 9 (= very pleasant), using the keyboard. Respondents are informed that each picture will be displayed for only a brief time and that they should not spend too much time rating them. After reading the instructions, respondents complete three practice trials in which they are provided with exemplars of the range of pictures they will be viewing in the experimental trials. After they complete the practice trials, they then proceed with the 60 experimental trials, which are presented in a new pseudorandom order for each participant.

All the trials are structured as follows: Each trial begins with a “preparatory” slide that is displayed for 5000 milliseconds that informs the respondent to prepare to rate the upcoming picture (see Lang, Bradley, & Cuthbert, 2001). This slide serves as a “buffer”, helping to mitigate any strong emotions that might have been evoked while viewing the photograph presented prior, thereby minimizing the potential for carryover effects. At the offset of the preparatory slide, a photograph is then displayed for 3000 milliseconds. As most of the photographs contain scenes that are fairly detailed, it was important to ensure that respondents would have sufficient time to view and process them before providing a rating; however, it was also important to ensure that the ability to capture individuals’ automatic reactions to the scenes would not be compromised. In the attentional processing literature, there is a general consensus that verbal and visual stimuli (faces, scenes) should be displayed for 100 to 500 milliseconds to ensure capture of the orienting response (Bradley, Mogg, Falla, & Hamilton, 1998; Mogg, Bradley, de Bono, & Painter, 1997; Mogg, Bradley, Miles, & Dixon, 2004). However, there are no known set guidelines for selecting stimulus durations to assess *appraisal* biases using detailed pictorial stimuli. Therefore, a duration time of 3000 milliseconds was selected for this study based on the following considerations stemming from a survey of the relevant literature: Given that all the photographs were taken from the International Affective Picture System (IAPS; see *Stimuli* section), the methodologies used in its validation provided an initial reference point for selecting a display time. In the standardization studies, respondents were shown IAPS photographs for 6000 milliseconds at a time before being asked to make judgments regarding their valence (Lang, Bradley, & Cuthbert, 2001).

However, given that the goal of this experiment was to assess potential information processing biases, it was important to maximize the ability to evoke them. One way of facilitating “hot” processing is to impose some degree of time pressure on decision-making. A study by Hock and Krohne (2004) examining interpretations of ambiguously written passages effectively showed that biases were not apparent when high-trait anxious individuals were given 8000 milliseconds to read and make judgments about the scenarios presented in each passage, but *were* exposed when respondents in a subsequent study were only given 2000 milliseconds to complete the same task. Along these lines, research in the field of behavioural decision-making has shown that under time pressure, people’s appraisals are driven predominantly by “intuitive feeling” (i.e., gut reactions) (Finucane et al., 2000). However, when people are given unlimited time to make decisions about uncertain situations, people are capable of engaging in higher-order, controlled processing of events, such that situations which are tagged initially as “risky”, may be re-appraised as benign upon more thorough analysis (Slovic, Finucane, Peters, & MacGregor, 2004). Taking into consideration all of these issues, a stimulus duration of 3000 milliseconds was decided on for this study.

At the end of the 3000 millisecond display period, the photograph is replaced with a slide with the following question: “How unpleasant or pleasant was your experience of the scene depicted in this picture?” This question is similar in format to one posed in a study by Hock, Krohne, and Kaiser (1996). A rating scale ranging from 1 (= very unpleasant) to 9 (=very pleasant) is presented underneath the question and the computer prompts respondents to enter a rating from 1 to 9 using the number pad of the keyboard. The degree to which one finds a situation pleasant or unpleasant is taken to represent

one's interpretation of it, since appraisals are essentially evaluations of the "goodness" or "badness" of a situation (Finucane, Alhakami, Slovic, & Johnson, 2000). The maximal allowable time to enter a response is 9000 milliseconds, which participants are not explicitly told about at the outset. This upper limit was set to minimize the impact of two potential threats to the experimental manipulation. First, as was mentioned earlier, it was important to reduce the degree to which respondents could engage in controlled processing (i.e., conscious modification of one's appraisal of a stimulus). It is for this reason that respondents were not given an unrestricted amount of time to provide their responses. At the same time, however, it was important that the task not be experienced as performance-oriented. The stressfulness of the task was kept at a minimum by giving participants just enough time to enter their responses. Latency to enter a rating was recorded in milliseconds for each trial.

The APRT was programmed and presented on an IBM © personal desktop computer with a 17-inch colour monitor. Ratings and response latency data for each trial were collected by the experiment generator software used to design and present the task [E-Prime Version 2.2 for Windows XP (Psychological Software Tools)]. All digital photographs were resized to dimensions of 7.11 x 5.33 inches and were displayed at a resolution of 72 x 72 dots per inch.

Stimuli. All stimuli used in the APRT were selected from the International Affective Picture System (IAPS; Lang et al., 2001). The IAPS is a set of approximately 800 digitized color photographs compiled and standardized by researchers at the NIMH Center for Emotion and Attention (CSEA) at the University of Florida. The photographs range in affective valence from pleasant to unpleasant. The photographs were rated on

valence (among other dimensions) in a number of standardization studies carried out by the CSEA over a 10 - year period. The data were collapsed across the standardization studies and mean valences were obtained for each of the IAPS photographs (see IAPS instruction manual; Lang et al., 2001).

The stimulus set used in this task consisted of 60 photographs⁴ classified into one of four categories: (1) negative (e.g., car accidents, illness, violence); (2) positive (e.g., smiling couples, families, children playing); (3) neutral (e.g., household items); or (4) ambiguous. The ambiguous set was composed of photographs depicting scenarios that were less clear in their affective valence mainly due to their lack of critical contextual details or to the presence of conflicting information (the photographs were not inherently vague or visually distorted).

The final stimulus set was constructed based on the results of pilot testing of an initial pool of 131 IAPS photographs selected by the first author and a research assistant. The negative, positive, and neutral photographs in this larger pool were selected based on normative ratings on affective valence derived from the IAPS manual. Photographs were flagged as candidates for inclusion in the ambiguous set if they induced uncertainty or mixed emotions, if their valence was disagreed on, or if the possibility for threat and non-threat interpretations was evident. In the IAPS normative studies, these photographs were typically rated in the middle of the scale, as neither pleasant nor unpleasant.

In the pilot study, ten judges who were unaware of the study hypotheses rated the initial pool of 131 IAPS photographs on pleasantness (1 = very unpleasant to 9= very pleasant) and classified the scenarios depicted in each one as negative, positive, neutral or ambiguous. For the final stimulus set, 15 pictures from each category were retained based

on high inter-rater agreement on their categorical classification. There were significant differences (all p values $< .01$) on mean pleasantness between all four categories.

Consistent with the IAPS normative data, photographs depicting negative scenarios were rated lowest on pleasantness ($M= 1.77, SD=.53$) while those depicting positive scenarios were rated highest on this dimension ($M=7.00, SD=.59$). On average, photographs with neutral content were rated as neither pleasant nor unpleasant ($M= 4.77, SD=.79$). Finally, the photographs depicting ambiguous scenarios were rated as more unpleasant ($M=4.13, SD=.72$) than the ones with neutral content, which suggests that people were in fact distinguishing between the two types of scenes when appraising them.

Self-Report Measures

The *Intolerance of Uncertainty Scale* (IUS; Freeston et al., 1994; English translation, Buhr & Dugas, 2002) is a 27-item measure of the degree to which uncertainty is experienced as intolerable. The IUS consists of items reflecting the notions that uncertainty is stressful and upsetting and leads to the inability to take action, that uncertain events are negative and should be avoided, and that being uncertain is unfair. Buhr and Dugas (2002) recommend using the IUS as a unitary measure. The English version of the IUS has excellent internal consistency, good test-retest reliability, and demonstrated convergent and divergent validity (Buhr & Dugas, 2002).

The *Cognitive Avoidance Questionnaire* (CAQ; Gosselin et al., 2002; English translation, Sexton & Dugas, in press) is a 25-item measure that assesses the extent to which one engages in five strategies aimed at avoiding distressing thoughts and mental images: thought suppression, transformation of disturbing mental images to verbal-linguistic thought; thought replacement, distraction, and behavioural avoidance of

situations or objects that may trigger distressing cognitions. The internal consistencies of the CAQ total scale and its five subscales range from good to excellent. Test-retest reliability has been shown to be good for the subscales and high for the total scale (Sexton & Dugas, in press). The CAQ shows evidence of convergent and divergent validity and assesses avoidant strategies that can be distinguished from ostensibly similar forms of coping (e.g., blunting).

The *Penn State Worry Questionnaire* (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990) is a 16-item measure of excessive worry. High internal consistency and good test-retest reliability have been demonstrated with the PSWQ and this measure has been shown to assess a construct that is distinct from anxiety and depression (Metzger et al., 1990; Molina & Borkovec, 1994).

The *State-Trait Anxiety Inventory- Form Y-1 and Form Y-2* (STAI; Spielberger et al., 1977) is a widely used measure that consists of two 20-item scales assessing state anxiety (Form Y-1) and trait anxiety (Form Y-2). In undergraduate student samples, both scales have shown excellent internal consistency (Ramanaiah, Franzen, & Schill, 1983). Convergent and divergent validity have been demonstrated with these scales as well (Ray, 1984).

The *Center for Epidemiological Studies Depression Scale* (CES-D; Radloff, 1977) is a 20-item non-diagnostic measure of depressive symptoms experienced in the previous seven days. The CES-D has high internal consistency, acceptable test-retest reliability, and demonstrated concurrent and construct validity (Radloff, 1977).

Procedure

Participants completed the study on an individual basis in a sound-attenuated room. After reading and signing a consent form (see Appendix), they completed the APRT, followed by the self-report measures. Upon completion of the study tasks, participants were debriefed and thanked for their time.

Results

Manipulation Check

Pleasantness ratings and response latencies were averaged across trials within each of the four scenario types. To verify that participants were distinguishing among the four categories of photographs, a one-way within-subjects analysis of variance (ANOVA) with a Bonferroni correction for inflated familywise error was conducted, examining differences in mean valence as a function of scenario type in the total, undifferentiated sample. The analysis yielded a significant effect of Scenario Type, $F(3, 351) = 794.72, p < .01$, partial $\eta^2 = .87$. Follow-up pairwise comparisons produced findings that were similar to those of the initial pilot testing. Specifically, photographs depicting negative scenarios were rated as least pleasant, $M = 2.19, SD = 0.89$ while photographs depicting positive scenarios were rated as most pleasant, $M = 7.23, SD = 1.00$. Photographs with neutral content were rated as neither unpleasant nor pleasant, $M = 5.09, SD = 0.51$, while photographs depicting ambiguous situations were rated slightly lower, $M = 4.64, SD = 0.63$ (all differences were significant at $p < .01$).

A one-way within subjects ANOVA with Bonferroni correction was conducted to examine differences in mean response latencies as a function of Scenario Type. The analysis produced a significant effect of Scenario Type, $F(3, 351) = 60.84, p < .01$, partial

$\eta^2 = .34$. Follow-up pairwise comparisons revealed significant differences among all picture types. Participants took longest to rate the ambiguous photographs, $M = 3010.52$ ms, $SD = 908.29$, followed by negative photographs, $M = 2789.55$ ms, $SD = 960.61$, positive photographs, $M = 2452.77$ ms, $SD = 808.50$, and neutral photographs, $M = 2228.92$ ms, $SD = 821.60$ (all p values $< .01$).

Group Classification

Participants were classified as low on intolerance of uncertainty (Low-IU; $n = 67$) or high on intolerance of uncertainty (High-IU; $n = 51$) based on their total score on the IUS. A cut-score of 58 (see Study 1 and Study 2) was used to divide the sample, which corresponds to a score one standard deviation below the mean of individuals meeting diagnostic criteria for GAD by self-report (see Buhr & Dugas, 2002). This cut-score was used, as there are no known taxometric data for the construct of intolerance of uncertainty. Descriptive data for the Low-IU and High-IU groups are presented in Table 4.1.

Ratings

The first hypothesis stated that High-IU individuals would rate the photographs depicting ambiguous or negative scenarios as less pleasant relative to Low-IU individuals (and that the groups would be comparable in their appraisals of photographs showing positive or neutral scenes). Means and standard errors for the High- and Low- IU groups on pleasantness ratings are presented in Figure 4.1.

A 2 (IU Group) X 4 (Scenario Type) mixed ANOVA with Bonferroni-corrected tests of simple effects was conducted to address this hypothesis. As expected, the analysis yielded a main effect of Scenario Type, $F(3, 348) = 836.48$, $p < .01$, partial $\eta^2 = .88$.

Follow-up tests revealed a pattern of means that was similar to the one found as part of the manipulation check and pilot testing described earlier.

A significant IU Group X Scenario Type interaction was also produced, $F(3, 348) = 6.60, p < .01$, partial $\eta^2 = .05$. Follow-up tests of simple effects showed that the High-IU group gave significantly lower pleasantness ratings to the ambiguous and negative scenarios than did the Low-IU group ($F(1, 116) = 4.81, p = .03$, partial $\eta^2 = .04$ and $F(1, 116) = 6.96, p = .01$, partial $\eta^2 = .06$, respectively). In addition, the High-IU group gave significantly *higher* pleasantness ratings to the positive scenarios than did the Low-IU group, $F(1, 116) = 5.49, p = .02$, partial $\eta^2 = .04$. There were no significant between group differences on ratings of neutral scenes.

Response Latency

The second prediction was that the High-IU group would take longer than their Low-IU counterparts to rate the ambiguous scenes. The response latency data are presented in Figure 4.2. A 2 (IU Group) X 4 (Scenario Type) mixed ANOVA with Bonferroni-corrected tests of simple effects was conducted to examine this hypothesis and consistent with findings of the manipulation check, a main effect of Scenario Type was yielded, $F(3, 348) = 59.66, p < .01$, partial $\eta^2 = .34$. In addition, a significant IU group X Scenario Type interaction was found, $F(3, 348) = 3.65, p = .01$, partial $\eta^2 = .03$. Follow-up tests of simple effects revealed that relative to the Low-IU group, the High-IU group took longer to rate the neutral scenarios, $F(1, 116) = 3.26, p = .07$, partial $\eta^2 = .03$. The groups did not differ in latencies to rate the ambiguous, negative, and positive scenarios.

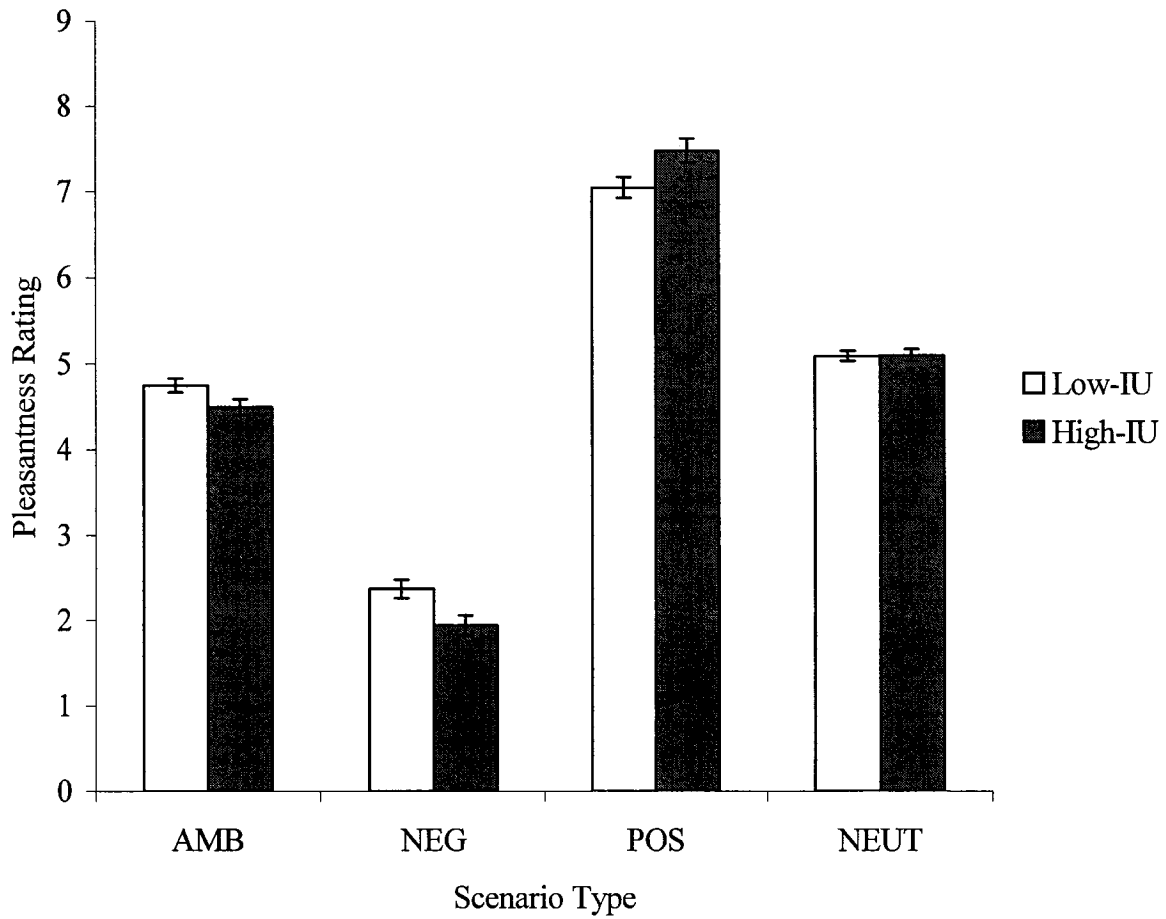
Table 4.1

Means and Standard Deviations for Self-Report Measures in Participants Low on Intolerance of Uncertainty (Low IU; n=67) and Participants High on Intolerance of Uncertainty (High-IU; n=51)

Variable	Low IU		High IU		F(1, 116)
	M	SD	M	SD	
IUS	42.21	7.50	78.43	16.70	249.66*
CAQ-Total	50.17	16.84	66.22	17.98	24.63*
CAQ-Supp	12.34	4.50	15.20	4.78	11.03*
CAQ-Trans	9.47	4.71	11.82	4.91	6.99*
CAQ-Sub	8.43	2.95	10.51	3.92	10.86*
CAQ-Distract	10.50	4.49	14.42	5.12	19.30*
CAQ-Avoid	9.62	4.13	14.27	5.38	28.32*
PSWQ	37.34	11.20	56.36	11.13	83.45*
STAI-S	30.53	8.15	40.05	12.47	24.99*
STAI-T	35.18	8.17	48.57	9.71	66.00*
CES-D	9.22	7.72	19.91	10.33	41.40*

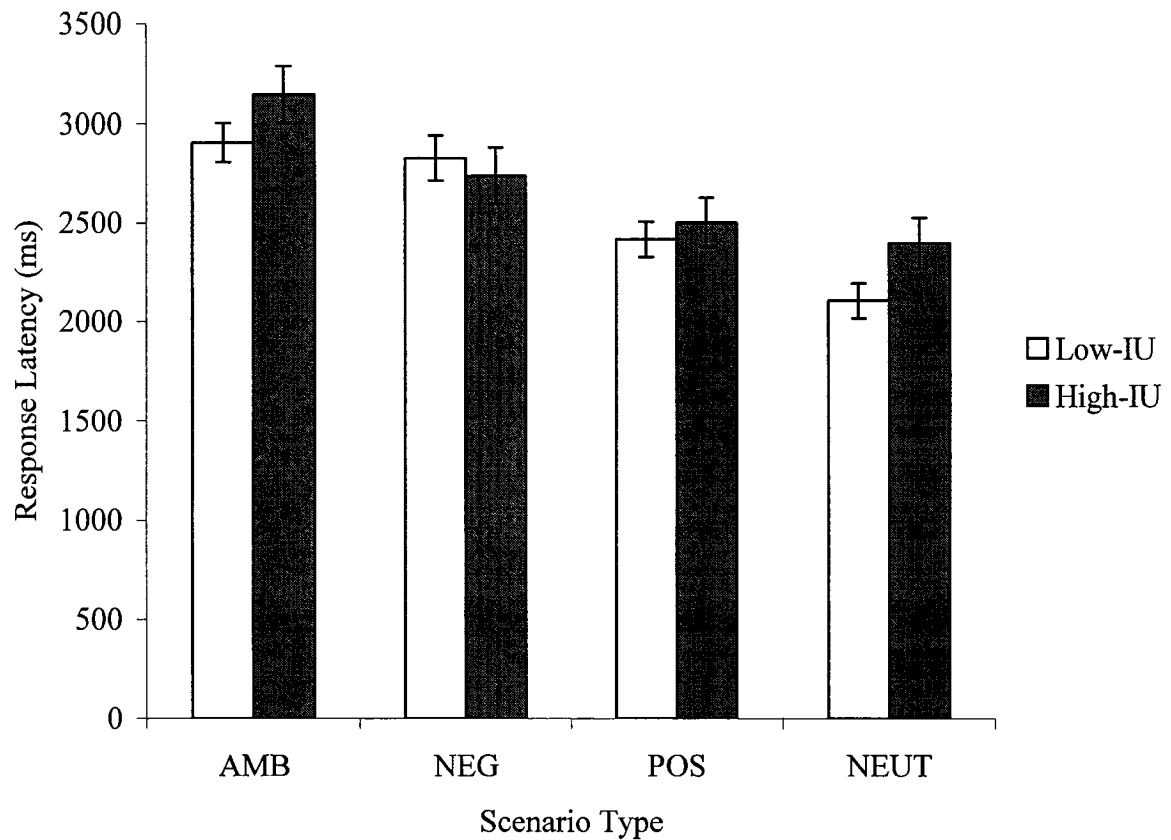
Note. IUS=Intolerance of Uncertainty Scale; CAQ-Total= Total Score of the Cognitive Avoidance Questionnaire; CAQ-Supp= Thought Suppression; CAQ-Trans=Transformation of Mental Images into Verbal Thought; CAQ-Sub= Thought Substitution; CAQ-Distract= Distraction; CAQ-Avoid= Avoidance of Threat Stimuli; PSWQ=Penn State Worry Questionnaire; STAI-S= State Anxiety scale of the Spielberger State-Trait Anxiety Inventory; STAI-T=Trait Anxiety scale of the Spielberger State-Trait Anxiety Inventory; CES-D= Center for Epidemiological Studies-Depression Scale

* $p < .01$



Note. AMB = Ambiguous; NEG = Negative; POS = Positive; NEUT = Neutral

Figure 4.1. Mean pleasantness ratings (+SE) as a function of Scenario Type for the Low Intolerance of Uncertainty group (Low-IU; n =67) and the High Intolerance of Uncertainty group (High-IU; n =51).



Note. AMB = Ambiguous; NEG = Negative; POS = Positive; NEUT = Neutral

Figure 4.2. Mean response latencies (+SE) as a function of Scenario Type for the Low Intolerance of Uncertainty group (Low-IU; n=67) and the High Intolerance of Uncertainty group (High-IU; n=51).

Further analyses were conducted within the Low-IU and High-IU groups to examine the relationships between ratings of the four Scenario Types and response latencies. Within the Low-IU group, lower pleasantness ratings of negative scenarios were associated with shorter latencies to respond to these scenarios ($r(67) = .45, p < .01$), while *higher* pleasantness ratings of positive scenarios were associated with shorter latencies to respond to these scenarios ($r(67) = -.28, p = .02$).

Within the High-IU group, similar findings emerged. Lower pleasantness ratings for negative scenarios were correlated with shorter response latencies ($r(51) = .40, p < .01$) and higher pleasantness ratings for positive scenarios were correlated with shorter response latencies ($r(51) = -.27, p = .05$). In addition, however, lower pleasantness ratings for ambiguous scenarios were associated with shorter latencies to respond to these scenarios ($r(51) = .27, p = .05$). In Low-IU individuals, ratings of ambiguous scenarios were not correlated with the time it took to respond to these scenarios.

Predictors of Appraisals

The last hypothesis stated that in the High-IU group, greater use of cognitive avoidance strategies would be associated with increasingly unpleasant evaluations of ambiguous and negative scenarios, and that these strategies would be stronger predictors of appraisals than demographic and symptom variables (i.e., worry and negative affect).

Pearson correlations were conducted between the 5 subscales of the CAQ and ratings of ambiguous and negative scenes within High-IU individuals. Only one cognitive avoidance strategy was associated with lower pleasantness ratings in response to ambiguous scenarios: thought suppression ($r(51) = -.33, p < .01$). Similarly, only thought suppression was associated with lower ratings of negative scenarios ($r(51) = -.40, p <$

.01). Given that thought suppression was the only cognitive avoidance strategy to show a significant association with evaluations of ambiguous and negative scenarios, further analyses were conducted to assess the unique relation of thought suppression to evaluations of these scenarios.

Preliminary analyses were conducted first to determine whether demographic (sex and age) and symptom variables [depressive symptoms (CES-D), worry (PSWQ), state anxiety (STAI-S) and trait anxiety (STAI-T)] were also significantly associated with ratings of ambiguous and negative scenarios. Pearson correlations revealed that demographic and symptom variables were *not* associated with ratings of ambiguous scenarios. As for negative scenarios, women rated these in a more negative way ($r(51) = .31, p = .03$). Among the symptom variables, only worry was associated with ratings of negative scenarios ($r(51) = -.30, p = .04$). Therefore sex and worry were retained as predictors in the regression on ratings of negative scenarios. After controlling for the effects of demographic and symptom variables, a high level of habitual thought suppression was no longer a significant predictor of unpleasant appraisals of negative scenes in individuals high on IU.

Habitual thought suppression turned out to be associated with lower ratings of pleasantness for ambiguous ($r(67) = -.29, p = .02$) and negative ($r(67) = -.30, p = .01$) scenarios in Low-IU individuals as well. The same analytic strategy was used to examine the specific relation of thought suppression to appraisals in this group. Pearson correlations showed that female sex and worry were significantly associated with lower ratings of pleasantness in response to photographs depicting negative scenarios and that only worry was associated with lowered ratings in response to the ambiguous scenarios.

When sex and worry were controlled for in the hierarchical regressions on pleasantness ratings, thought suppression was no longer a predictor of ratings of negative and ambiguous scenarios.

Discussion

This study sought to investigate interpretative processing in individuals who are at-risk for developing chronic and excessive worry by virtue of their low tolerance for uncertainty. The first hypothesis, that individuals high on intolerance of uncertainty would appraise negative and ambiguous information as more unpleasant relative to individuals low on intolerance of uncertainty, was supported. Given that intolerance of uncertainty is a cognitive vulnerability factor for the development of excessive worry and anxiety, that individuals high on this dispositional characteristic would appraise photographs depicting threatening scenarios as unpleasant, is fitting. Perhaps of greater theoretical import, was the finding that participants high on intolerance appraised photographs of ambiguous scenarios as more unpleasant relative to participants low on intolerance of uncertainty. This is consistent with the findings of Dugas, Hedayati et al. (2005), who observed a significant association between high levels of intolerance of uncertainty and negative appraisals of ambiguous information presented in written scenarios. It has been suggested that appraisal biases extend from underlying threat-related schemata and that such biases may be important to the etiology and maintenance of other forms of cognitive bias (e.g., attention and memory) (Craske & Pontillo, 2001). We proposed that intolerance of uncertainty, a set of deep-seated beliefs about uncertainty and its implications promotes cognitive biases in individuals who worry excessively. Specifically, it appears to affect perceptions or evaluations of ambiguous

information; however, further research is needed to determine how intolerance of uncertainty affects encoding and storage of information. Our group conducted a study on the relationship between intolerance of uncertainty and recall of uncertainty-relevant information and we found that when participants were shown uncertainty-denoting words (e.g., chance) and neutral words, the proportion of uncertainty-relevant words to the total number of words recalled was greater for individuals high on intolerance of uncertainty than for individuals low on intolerance of uncertainty (Dugas, Hedayati et al., 2005), which suggests that having a low tolerance for uncertainty may promote biases in recall.

It was also predicted that individuals high on intolerance of uncertainty would take longer than those low on intolerance of uncertainty to appraise ambiguous scenarios. Irrespective of uncertainty orientation, it took participants more time to evaluate the photographs depicting ambiguous scenarios than the ones depicting scenarios with neutral or unambiguous emotional content, which is consistent with theories of decision-making under uncertainty. According to these theories, when individuals are confronted with ambiguous information, this is typically experienced as disorienting, as this activates a sense of being uncertain (Kahneman & Tversky, 1982). In order to reduce this uncertainty, people engage in controlled processing to disambiguate the information, which may manifest itself in delayed decision-making (Finucane et al., 2000). However, contrary to our expectations, the High-IU group took longer than the Low-IU group to evaluate photographs with *neutral* content (e.g., a chair, a mug). We propose that the neutral photographs may have induced a form of uncertainty that becomes activated when one has the perception of not having enough information, when a well-thought out plan is derailed, or when one is unsure about how to approach a task. The neutral photographs

were practically devoid of affective content, therefore, participants high on intolerance of uncertainty may very well have felt uncertain as to how to respond to these, resulting in delayed reaction times, but not differences in perceived valence.

It is interesting to note that in individuals high on intolerance of uncertainty, *faster* responses to ambiguous scenarios were associated with appraisals that were more negative, whereas this relationship was absent for the comparison group. In individuals high on intolerance of uncertainty, automatic, or experiential processing may have been reflected in faster and more negative responses to the ambiguous scenarios, whereas controlled processing may have been responsible for slower, more positive appraisals. This suggests that not all individuals who are intolerant of uncertainty react the same way to ambiguity; some appear able to arrive at relatively neutral appraisals of ambiguous information. This issue was addressed in our exploration of the relation of cognitive avoidance to interpretative processing.

It was predicted that the habitual use of thought suppression and other forms of cognitive avoidance would be associated with unpleasant appraisals of photographs depicting negative or ambiguous scenarios in individuals high on intolerance of uncertainty. Among the cognitive avoidance strategies assessed, habitual thought suppression was most strongly associated with lowered evaluations of the pleasantness of these scenarios. This finding is in line with several studies that have shown that the chronic use of thought suppression inadvertently promotes attention to negative stimuli (Wenzlaff, Rude, Taylor, Stultz, & Sweatt, 2001) and interferes with the processing of ambiguous information, particularly in the presence of a cognitive load (Wenzlaff & Eisenberg, 2001; Wenzlaff, Meier, et al., 2002; Wenzlaff, Rude et al., 2002). In the

current study, there was no introduction of a cognitive load; however, there was an imposition of a time constraint. Participants were given a restricted amount of time to make their appraisals and were explicitly told not to spend too much time making their judgments. Research has shown that time pressure can alter information processing and decision-making under uncertainty. Wenzlaff and Eisenberg (2001) found for example that under time pressure, individuals at-risk for depression were more apt to impose negative interpretations on homophones but that this bias was absent when time constraints were lifted. Similarly, Finucane et al. (2000) reported that participants who were asked to evaluate an uncertain (but potentially risky) situation under time pressure, appraised it as more dangerous than did participants who were told to “take as much time as they wanted” to make decisions about the identical situation.

In the presence of cognitive load, avoidant individuals may not be able to simultaneously attend to an ambiguous situation and engage in suppressive coping because both tasks are cognitively-demanding. In other words, it may be difficult to reduce uncertainty and engage in emotion regulation at the same time. In remitted dysphoric individuals who report high levels of habitual thought suppression, the imposition of a cognitive load has been shown to be sufficient to interrupt suppression efforts and reveal interpretative biases for ambiguous information that are otherwise undetectable (Wenzlaff, Meier, et al., 2002). Perhaps this is very close to the experience of individuals who worry excessively. We have proposed that one way of understanding worry is as a symptom of being in a firm state of approach-avoidance (Dugas & Koerner, 2005; Dugas & Ladouceur, 1998; Koerner & Dugas, 2006). Intolerance of uncertainty may promote the need to approach uncertainty while habitual thought suppression and

other forms of cognitive avoidance may function to down-regulate negative internal events. Under stress or pressure, uncertainty-related schemata may become activated and information processing may move from a mode that is controlled to one that is more highly schematic. Threat processing may be most enhanced for people who habitually engage in thought suppression.

Suggestions for Future Research

As was mentioned earlier, processing of ambiguity has been investigated in a number of ways: with the use of homophones, sentences, written scenarios, faces, and in this study, pictorial scenarios. Individuals high on intolerance of uncertainty responded differently to photographs depicting ambiguous scenes than did individuals low on intolerance of uncertainty, which suggests that our categorization was successful. We propose, however, that the use of written scenarios may actually be more effective for accessing interpretive bias. In the aforementioned study by Dugas, Hedayati et al. (2005) for example, individuals classified as either high or low on intolerance of uncertainty were compared on their appraisals of written descriptions of ambiguous situations. The effect sizes in the Dugas et al. study (Cohen's $d=0.68$) and in Study 1 (Cohen's $d=0.99$) were greater than in the current study (Cohen's $d=0.40$), which suggests that the use of written scenarios may be more effective for assessing uncertainty-related appraisals. The superiority of imagery to semantic stimuli is often touted for its ability to evoke strong emotions (Mogg, Bradley, Miles, & Dixon, 2004). Use of imagery (pictures, photographs) may indeed be most effective for assessing information processing in individuals whose fears are based in external events. For example, given that socially-anxious individuals tend to focus attention on changes in people's facial expressions,

pictures of faces are suitable stimuli for assessing cognitive biases in this population (Mogg, Philippot, & Bradley, 2004). In contrast, internal events (e.g., vivid mental images of feared scenarios) are the *primary* sources of anxiety for individuals with GAD. Lang and Cuthbert (1984) emphasized that mental images are not simply pictures that are constructed in the “mind’s eye”. When a person is asked to read a scenario and imagine that it is happening to him or her, a mental representation of himself or herself in the scenario is formed, which includes perceptions, sensations, and behavioural responses, making the experience highly idiographic. In this way, written scenarios differ significantly from photographs and may actually be *more* emotionally-evocative for individuals who worry excessively.

The stimuli used in this investigation were selected based on valence and ambiguity; however, the amount of *arousal* associated with each of the stimulus types was not factored into the stimulus selection, and not controlled for as a result⁵. Nevertheless, it may not have been feasible or even advantageous to equate the categories on this dimension. First, neutral photos (e.g., mugs, tables, chairs) are inherently low-arousal stimuli. It would have been impossible to match these photos to the others types on the arousal dimension. Second, the ambiguous photos were selected for their potential to evoke multiple appraisals. Given that appraisal is essentially a subjective cognitive-affective exercise, a certain amount of individual variability in “activation” would be expected. That said, in subsequent applications of this task, participants could be asked for ratings of arousal, in addition to ratings of pleasantness/unpleasantness to examine the extent to which activation accounts for between-group differences on appraisals of the stimulus types.

It is also worth noting that in this study, appraisals were not directly assessed; rather, they were inferred on the basis of ratings of pleasantness. This is common practice in information processing research (e.g., Hock & Krohne, 2004; Hock, Krohne, & Kaiser, 1996), the rationale being that appraisals basically amount to evaluations of “goodness” or “badness.” The results of this study and the Dugas, Hedayati et al. (2005) study support the notion that individuals who worry excessively find uncertainty aversive, however, they do not tell us *why* this is so. Given that uncertainty is a core fear for individuals with GAD, a better understanding of the *self-schemata* underlying the aversion of uncertainty is needed.

Finally, in this study, thought suppression and other forms of cognitive avoidance were assessed by self-report, the limitations of which have been noted by others (e.g., Wenzlaff & Wegner, 2000). Studies involving experimental manipulations of thought suppression under varying conditions of cognitive load such as the ones used in investigations by Wenzlaff et al. are needed in order to better assess the specific effect of thought suppression on information processing in individuals high on intolerance of uncertainty.

Theoretical Implications

This study contributes to current conceptualizations of excessive worry by providing hypotheses regarding the roles of intolerance of uncertainty and cognitive avoidance in the processing of ambiguous information. Intolerance of uncertainty has been discussed as a risk factor for the development and maintenance of excessive and uncontrollable worry in that it promotes cognitive biases (Dugas, Hedayati et al., 2005). However, the results of this study, though preliminary, suggest that being intolerant of

uncertainty may be necessary, but not sufficient for the expression of these biases. Having a dislike for uncertainty may not be in and of itself maladaptive. A vast amount of research in the non-clinical literature suggests in fact that *most* individuals are averse to uncertainty and would choose to avoid or reduce it if possible. Having strong negative beliefs about the significance of being uncertain and having an avoidant style of coping, on the other hand, appear to be important determinants of the development of the type of worry that characterizes GAD. A suppressive style of coping with distressing internal events (e.g., mental images) might catalyze the expression of cognitive biases in individuals who are highly intolerant of uncertainty.

Studies have demonstrated that cognitive avoidance enhances an attentional bias toward threat (Lavy & van den Hout, 1994) and promotes superficial cognitive processing (Beevers & Scott, 2001). In the GAD literature, suppression has been discussed extensively as a maladaptive avoidant strategy that has short-term benefits (down-regulation of emotional arousal), but long-term side-effects (e.g., Koerner & Dugas, 2006; Sibrava & Borkovec, 2006; Wells, 2006). Models of GAD propose that suppression and other forms of cognitive avoidance may indeed precipitate worrying by absorbing cognitive resources needed for adaptive emotional processing and facilitating disruptions in cognitive processing (see Sibrava & Borkovec, 2006; Wells, 2006a). However, suppression and other forms of avoidance are not known to have been conceptualized as strategies that may modulate an *internal state of uncertainty*. Further, the specific impact of cognitive avoidance strategies on the appraisal, encoding and storage of *ambiguous* information and how these interact with other cognitive and emotional states and dispositional characteristics to influence information processing has

not, to our knowledge, been systematically investigated in individuals with GAD. This represents a fruitful avenue of research that could enhance our understanding of the factors that contribute to the etiology and maintenance of this condition.

Chapter 5

Discussion

A small number of investigations have been conducted to examine appraisal tendencies in individuals who are considered disposed to excessive levels of worry by virtue of having a low tolerance for uncertainty. Collectively, the current research, and work by Metzger et al. (1990), Tallis et al. (1991), and Dugas, Hedayati et al. (2005) suggests that gaining a better understanding of why some individuals develop excessive and uncontrollable worry, necessitates enhancing our understanding of how individuals process uncertain events, and elucidating the factors that distinguish *non-normative* from *normative* reactions to uncertainty. Dugas and colleagues have conceptualized GAD as a condition that is characterized by a strong dislike and low tolerance for uncertainty. Accordingly, they have proposed, and demonstrated in four randomized controlled treatment trials (Dugas et al., 2003; Dugas, Savard et al., 2004; Gosselin et al., 2006; Ladouceur et al., 2000), that increasing tolerance for uncertainty can lead to important reductions in worry and anxiety. It has been proposed (Dugas & Koerner, 2005; Study 1) that individuals who are prone to high-level worry, in addition to having an overall lower tolerance for uncertainty, may also have non-normative cognitive, emotional, and behavioural reactions to uncertainty that distinguish them from individuals who are not prone to worrying excessively. The clinical literature, however, has been relatively silent on the factors that characterize “adaptive” versus “non-adaptive” reactions to uncertain events.

Conversely, discussions of factors that guide cognitive, emotional, and behavioural responses to uncertain events are pervasive in the literatures on learning and motivation (animal and human), behavioural decision-making, risk analysis, and economics, as

“uncertainty constitutes a major obstacle to effective decision making” (Lipshitz & Strauss, 1997, p.149). The research on decision-making has a great deal to offer in terms of enhancing our understanding of how worriers appraise, interpret and respond to uncertain events; what reactions represent a departure from expected or typical responses to uncertainty; why worriers appear to have considerable difficulty negotiating and coming to terms with uncertainty; and why certain cognitive interventions do not seem to be effective in the treatment of worry. The following discussion is not intended to be an exhaustive review of the literature on uncertainty, but is meant to highlight specific findings in the nonclinical literature that may be particularly informative in guiding the refinement of research on cognitive processing in worry and GAD, and by extension, psychological interventions for worry.

Uncertainty Is Aversive

The nonclinical decision-making literature suggests that although there are individual differences in the degree to which people are willing to cope with uncertainty, most individuals, given the choice, would prefer to minimize it. Put simply, the prevailing opinion is that uncertainty is aversive. Individuals, by and large, dislike uncertainty to some extent, and would prefer an outcome that is certain to one that is uncertain. Indeed, circumstances exist in which *bad* news is preferred to no news (Farber, 1944, as cited in Berlyne, 1957; Lieberman, Cathro, Nichol, & Watson, 1997; Loewenstein et al., 2001). Studies have shown that animals are also highly motivated to reduce uncertainty. In a study by Dashiell (1925), rats were observed to cross an electrified grid to explore stimuli that were unfamiliar. Imada and Nageishi (1982)

reviewed a number of studies demonstrating that rats show a preference for events that are certain to those that are uncertain, even when the events are highly aversive.

When faced with uncertain circumstances, most individuals are motivated to reduce uncertainty and do so by seeking as much information as possible about the uncertain event, soliciting advice from others, and attempting to increase control over external events (Lipshitz & Strauss, 1997). These reactions to uncertainty have been observed in various kinds of decision-makers, including university students, expert risk analysts, military officers, and managers of organizations. Clinical worriers report engaging in comparable coping behaviours (e.g., planning, reassurance-seeking, information-seeking, checking/verifying) and these behaviours have similarly been conceptualized as attempts at reducing a felt sense of uncertainty (Dugas & Koerner, 2005). Therefore, the reactions to uncertainty reported by and observed in individuals who are prone to excessive worry are, in actuality, not unusual. Berlyne (1957) noted, “human beings find *relief* from doubt about vital matters rewarding, even when the truth is unpleasant” (p. 337). This suggests that individuals may be intrinsically motivated to engage in behaviours that are aimed at reducing uncertainty, perhaps in an effort to release themselves from the state of anxiety and tension that tends to accompany feelings of uncertainty.

However, critical differences between worriers and the decision-makers who are studied in the normative literature may lie in how they cope with uncertainty when attempts to increase certainty become impractical, or fail altogether. Although the uncertainty reduction strategies that high worriers engage in are not inherently maladaptive, worriers may persist with these strategies past the point at which they cease to be useful. Research in the behavioural decision-making literature suggests that

typically, individuals will abandon efforts to control uncertainty when it becomes apparent that these attempts are futile and when productive goal-directed behaviour has stagnated. Lipshitz and Strauss (1997) suggest that under these circumstances, decision makers will *acknowledge* the uncertainty and will begin to take steps toward confronting the “potential threat”, using whatever information is available. Actions designed to minimize or control uncertainty are replaced with actions aimed at solving the problem at hand. This typically involves generating a variety of viable solutions and weighing the pros and cons associated with the implementation of each one, as well as generating a number of strategies for coping with a potentially negative outcome (Lipshitz & Strauss, 1997).

Lipshitz and Strauss (1997) describe a third level of uncertainty-coping that consists of engaging in actions aimed at “suppressing” uncertainty. Suppressive actions consist for the most part of avoidant or disorganized coping strategies and are generally regarded as ineffective methods for dealing with uncertainty. If suppression is considered a “last resort” strategy for dealing with uncertainty, why would expert decision-makers resort to it at all? According to Lipshitz and Strauss “suppressing uncertainty helps decision-makers *avoid paralysis*”(p. 154).

Whereas individuals typically give up on attempts to control uncertainty when these lose their utility and when the costs begin to outweigh the benefits, individuals who are prone to high-level worry may persevere in their attempts to control uncertainty. When the pursuit of certainty becomes too distressing, worriers may turn to suppressive coping strategies as a secondary course of action, rather than acknowledging and “working with” the uncertainty. Worriers often describe feeling “stuck” or “paralyzed” when confronted

with problems, and suppressive coping strategies may provide some relief from states of anxiety and tension.

Thus, according to the normative decision-making literature, when people are confronted with uncertain events, the first course of action is to attempt to reduce the uncertainty; however, when these attempts fail, people will tend to accept the uncertainty and will factor it into a more proactive problem-solving process. High worriers similarly attempt to reduce uncertainty as a first step in managing an uncertain situation, but may *persist* in their efforts to control uncertainty for a longer period and may be less inclined than low worriers to instigate strategies that are more instrumental. In an earlier paper (Dugas & Koerner, 2005), we offered the hypothesis that individuals who are prone to worry, might find themselves caught in an approach-avoidance dilemma when faced with uncertain events and that this manifests itself in delayed decision-making. Approach behaviours may be initiated in an effort to reduce an internal sense of uncertainty; however, as these attempts fail, anxious arousal is likely to increase, which must also be reduced. Thus, high worriers find themselves caught between competing needs to increase certainty and reduce anxious arousal and the negotiation of these needs may supplant problem-solving attempts. This may account for the stalled decision-making reported by persons with GAD and for the slowed responses in high worriers in laboratory decision-based tasks (Study 3; Tallis, 1991).

Uncertainty Is A Complex, Multi-Dimensional Construct

The finding that people generally prefer a certain outcome to one that is uncertain, is well established. However, research in normative decision-making indicates that

uncertainty is in fact not a unidimensional construct and that different forms of uncertainty can engender different reactions.

External and Internal Uncertainty

One distinction that has been made in the literature pertains to the “locus” of the uncertainty (Howell & Burnett, 1978, as cited in Kahneman & Tversky, 1982b). *External* uncertainty refers to the objective reality or status of a situation, regardless of how someone might feel about that situation (e.g., “the forecast calls for a 30% chance of snow”; “the future is uncertain”). This is contrasted with *internal* uncertainty, which refers to the uncomfortable state (e.g., a negative mood or mindset, or both) that is evoked within the individual when his or her state of knowledge about the outcome of an uncertain situation is unclear or has become destabilized (e.g., “I’m feeling uncertain”; “I’m feeling indecisive about this situation”; “I’m unsure of the answer to this question”). Kahneman and Tversky (1982b) proposed that individuals become disoriented when they are confronted with an unclear situation, as this activates a felt sense of being uncertain.

It might be possible to further divide Kahneman and Tversky’s concept of *internal* uncertainty into two sub-variants and individuals who are prone to worry might struggle with both. In Study 3, individuals high and low on intolerance of uncertainty were compared on their appraisals of pictorial scenarios varying in valence and ambiguity. Individuals high on intolerance of uncertainty appraised photographs depicting ambiguous scenarios more negatively than did individuals low on intolerance of uncertainty. Contrary to expectation, individuals high on intolerance of uncertainty also took longer than their counterparts to evaluate photographs with *neutral* content (e.g., a chair, a mug). It is hypothesized that the task utilized in that study may have induced two

kinds of internal uncertainty, which for the purposes of this discussion will be termed *cognitive uncertainty* and *cognitive-motivational uncertainty*.

Cognitive uncertainty can be thought of as the experience of having one's state of knowledge about a situation become de-stabilized. This kind of uncertainty might become activated when one has the perception of not having enough information, or when one is unsure about how to approach a task. For example, if one meticulously plans a trip several months in advance and on the day of departure, he or she learns that the flight has been delayed for an undetermined period of time, this might stimulate cognitive uncertainty. Being in this state might lead to frustration or irritation, but is less likely to arouse strong negative emotions because one's self-schema is not necessarily activated by such situations. Under these circumstances, uncertainty may not elicit threat-related processing.

Cognitive-motivational uncertainty on the other hand, can be conceptualized as a cognitive-affective state of internal uncertainty. This variant of uncertainty might become activated in situations similar to those described above; however, the distinction is that when one is in this state, the experience of uncertainty arouses inner conflict. On the one hand, there is a need to approach or investigate the ambiguous situation in order to appease cognitive uncertainty. However, this can lead to the activation of conflicting interpretations, thereby fuelling internal uncertainty. This rise in internal uncertainty may then evoke negative emotional arousal, which prompts avoidance efforts. Similar to cognitive uncertainty, cognitive-motivational uncertainty might lead to delayed action, as the individual vacillates between the need to disambiguate a situation and the need to avoid this process altogether. Situations that evoke cognitive-motivational uncertainty are

likely ones in which one's self-schema is activated. Thus, being in this state is more likely to elicit threat-related appraisals than being in a state of cognitive uncertainty.

The neutral photographs were practically devoid of emotional content, therefore, participants high on intolerance of uncertainty may very well have felt uncertain as to how to respond to these. However, this uncertainty may not have been arousing, judging from the fact that the appraisals of neutral scenarios were so similar for individuals high and low on intolerance of uncertainty. Conversely, the photographs depicting ambiguous scenarios may have induced cognitive-motivational uncertainty. These photographs were chosen for the task precisely for their potential to activate threat interpretations. The fact that individuals high on intolerance of uncertainty appraised these scenes more negatively than did individuals low on intolerance of uncertainty and that response latencies were generally longest for these scenarios relative to the neutral, positive, and negative scenarios, seems to support this notion.

Known, Unknown, and Unknowable Uncertainties

Distinctions have also been drawn between uncertainties that are more (or less) tolerable than others. Chow and Sarin (2002) described three distinct forms of uncertainty: known, unknown, and unknowable uncertainties. A *known* uncertainty refers to a situation in which the individual knows the specific probability of the occurrence of an outcome. To use a simple example, if an individual was asked to place a bet on whether a red chip or a black chip will be drawn from a bag and knew in advance that that there were exactly five red chips and five black chips in the bag, that individual would have the information necessary to calculate the probability of drawing a red chip versus a black chip and could use this information to direct the bet. On the other hand, an

unknown uncertainty refers to a situation in which the probability of an event occurring is not known to the individual, but *is* known to others. For example, suppose an individual is applying to a graduate program in clinical psychology. The only information that individual might have from the outset is that there are 10 spots available. However, the admissions committee might not inform the individual of the total number of applications received, or the number of applicants that will be short-listed for an interview, which are both pieces of information that would provide the individual with some idea of the likelihood that they will be granted admission to the program. The third variant of uncertainty described by Chow and Sarin (2002) is the *unknowable* uncertainty, which reflects a situation in which the probability of an event occurring is not known to the individual, but is believed not to be known to anyone else. For example, the probability of a third World War and the probabilities associated with the occurrence of most natural disasters would be considered unknowable uncertainties.

Chow and Sarin (2002) demonstrated in a series of laboratory-based tasks that decision-making varies as a function of whether uncertainties are known, unknown, or unknowable. Their findings suggest that people are generally most tolerant of known uncertainties, and are least tolerant of unknown uncertainties, with unknowable uncertainties falling in between. Chow and Sarin (2002) suggested that differences between known, unknown, and unknowable uncertainties amount to perceptions of the *availability of information*; in other words, when people are making decisions under uncertainty, they prefer to have more information and if this information is missing, it is more tolerable if everyone is on equal ground in that regard. Anxiety researchers would likely characterize the differences among the various forms of uncertainty in terms of

variations in perceptions of control. Known uncertainties likely pose the least threat to people's perceptions (or, illusions) of control, while unknown uncertainties may pose the greatest threat to people's perceived sense of control. The role of perceived control is not known to have been investigated in relation to the responses of worriers to uncertain events.

Unexpected and Expected Uncertainties

Closely related to the concepts described by Chow and Sarin (2002), Rosen and Donley (2006) highlighted a distinction between situations in which a change in contingency is foreseen (expected uncertainty) versus situations in which a change in contingency is unforeseen (unexpected uncertainty), with the latter being characterized by a greater degree of unpredictability as compared with the former. Studies conducted in rats have shown that the two types of uncertainty are associated with differential amygdala responding, which lends validity to this distinction. Rosen and Donley (2006) showed that the amygdala is engaged when rats encounter situations characterized by unexpected uncertainty, but not in situations characterized by expected uncertainty, which provides further justification for treating uncertainty as a discontinuous construct.

Individuals with GAD commonly present with numerous worries, but are their responses to uncertainty characterized by a lack of discrimination? Study 1 examined the content specificity of appraisals of uncertain scenarios and found that in individuals low on intolerance of uncertainty (and by extension, at a lower risk for developing clinically-significant worry), scenarios were appraised more negatively when their content was congruent with self-reported worry domains. However, individuals high on intolerance of uncertainty tended to appraise uncertain scenarios in a more negative direction,

irrespective of their content, which suggests that their appraisals are characterized by a certain degree of indiscrimination. However, this need not mean that worriers display a global bias for uncertainty. As discussed above, the nonclinical literature suggests that uncertainty can be decomposed and it might be that worriers are sensitive only to certain kinds of uncertainty. This is a question that merits further empirical investigation.

The Possibility, Not the Probability of Threat, Guides Reactions to Uncertainty

Two studies (Dugas, Hedayati et al., 2005; Study 1) have shown that individuals who are high on intolerance of uncertainty report greater concern for hypothetical uncertain events than do individuals who are low on intolerance of uncertainty. However, those studies did not investigate the cognitive operations that might promote concern for these situations. One possibility is that individuals high on intolerance of uncertainty might be more apt to judge negative outcomes as being more likely compared to their counterparts. As noted earlier, an enhanced tendency to overestimate the probability of undesirable outcomes has been linked with worry (see Butler et al., 1987; Butler & Mathews, 1983; MacLeod, 1991); yet, contrary to expectation, cognitive interventions aimed at adjusting subjective probability estimations have turned out to be only minimally effective for reducing worry. Researchers in the domain of risk analysis would suggest that this is entirely to be expected. Unlike actuaries or expert decision-makers, the average individual does not conceptualize risk in terms of probability; degree of risk is determined based on a constellation of factors, many of which are highly idiosyncratic (Kahneman & Tversky, 1982b; Rottenstreich & Kivetz, 2006). Thus, the assessment of the uncertainty associated with an event is not only a personal process, but is a complex one at that.

Baron, Hershey and Kunreuther (2000) highlighted the subjectivity of risk estimation and opined that attempts to inform people about the relative probability of risks are likely to be ineffective, as people generally “worry too much about risks they know to be minor and too little about risks they know to be serious (p. 426).” Loewenstein et al. (2001) also noted that negative reactions to uncertainty reflect a sensitivity to the *possibility*, not the probability of a negative outcome occurring and that “feelings about risk are largely insensitive to changes in probability” (p. 271). In short, people use “subjective weights” and non-quantitative methods (Lipshitz & Strauss, 1997), rather than objective probabilities when making decisions under uncertainty. Idiosyncratic, self-constructed mental models are necessarily used to make inferences about cause and effect and to make predictions about the outcomes of events, because of the impracticability of using formal probability models (Tversky & Kahneman, 1982b). Thus, given that worry reflects sensitivity to the possibility of threat, irrespective of how remote that possibility is, high worriers are expected to be especially sensitive to uncertain events. Given the findings in the normative literature, it also makes sense that worry is resistant to adjustments in probability estimations. If feelings about uncertainty are insensitive to changes in probability, then what are the cognitive processes that promote negative appraisals of uncertainty? The nonclinical literature suggests that (1) the perception of the valence and controllability of the outcome; and (2) the mental construction of the event, are two factors that moderate the influence of perceived probability on negative reactions to uncertain events.

Perceived Valence and Control of the Outcome

Research in the normative decision-making literature suggests that the *affective valence* attached to a particular outcome is an important determinant of how individuals make decisions under uncertainty. In other words, the “cost” or “badness” associated with an undesirable outcome can moderate the impact of subjective and objective probabilities on emotional and behavioural reactions to uncertainty (Finucane et al., 2000).

Surprisingly, few studies have examined the cognitive mechanisms that underlie the process of threat estimation specifically in high worriers and individuals with GAD. Extrapolating from the seminal work of Butler and Mathews (1983), Berenbaum, Thompson, and Pomerantz (2007) conducted a study examining the roles of perceived probability and perceived valence of outcome in the appraisals of hypothetical scenarios of high and low worriers. Perceptions of the “badness” of outcomes moderated the impact of subjective probability estimations on worry.

To date, research on appraisal biases in GAD has demonstrated that high worriers interpret ambiguous events as threatening and our own work suggests that negative beliefs about the experience of uncertainty are a salient contributor to this bias. However, little is known about the ways in which *perceptions of control* motivate responses to uncertain events. Indeed, research has shown that a generalized perception of a lack of control over aversive internal and external events exacerbates threat-consistent interpretations of ambiguous scenarios in individuals *without* a history of psychopathology (Zvolensky et al., 2001). This suggests that negative beliefs about one’s own abilities to anticipate or exert an influence on events that contain the possibility of threat (i.e., ambiguous, or uncertain events) may in itself be a cognitive risk factor for the development of clinically-significant anxiety. Perceived control has been attended to

more closely in the panic disorder literature, which makes sense given that a fear of losing control over interoceptive experiences is so integral to the disorder (Zvolensky et al., 2001). However, no known research has directly examined the unique influence of perceived control on cognitive biases in worry and GAD. Study 2 examined the role of perceived control as a factor in the appraisal of uncertain events. Individuals low and high on intolerance of uncertainty were compared on their appraisals of low-threat and high-threat scenarios; the scenarios were all characterized by uncertain outcomes. For each scenario, respondents were asked to use visual analog scales to evaluate the degree to which the described situations were threatening, unsafe, uncontrollable, anxiety-provoking, as well as the likelihood that they would result in a negative outcome. One of the findings was that under conditions of high threat, a high level of intolerance of uncertainty and an increased perception of the uncontrollability of situations were both significant predictors of increased negative outcome expectancies.

Mental Representations

Research in normative decision-making has also suggested that threat perceptions and decision-making are highly influenced by *mental representations* of feared outcomes. Kahneman and Tversky (1982a) proposed that the ease with which one is able to construct a mental scenario is an important determinant of how one will react on a cognitive, emotional, and behavioural level to uncertain events. Mental simulations are hypothesized to be involved in various aspects of decision-making under uncertainty, including probability estimation and outcome prediction. Understanding the relationship between mental representations and cognitive reactions to uncertainty necessitates a consideration of the *temporal-spatial* characteristics of mental representations of

uncertain events. Kahneman and Tversky (1982a) and Wakslak et al. (2006) proposed that uncertain events are appraised, in part, based on their perceived *psychological distance*. Psychologically distant events exist in the past (“it could have happened”) or in the future (“it may happen”); because they do not exist in the here-and-now, they are not a part of one’s direct experience (Wakslak et al., 2006). Trope and Liberman (2003) have proposed and demonstrated in a number of studies that psychologically distal events are associated with a mode of processing that is abstract, whereas psychologically proximal events are associated with a mode of processing that is more concrete. In a series of studies, Wakslak et al. (2006) examined the relationship between processing mode and likelihood judgments associated with uncertain events. Abstract mental representations of uncertain events were associated with probability judgments that were more conservative; whereas concrete mental representations were associated with probability judgments that were more highly elevated. Wakslak et al. (2006) proposed that the more information we have about a hypothetical event, the closer the event comes to being viewed as a reality rather than an eventuality. Thus, it appears that mental imagery plays a role in the construal of events.

Borkovec’s cognitive avoidance theory of worry and GAD explicitly postulates a relationship between worry and mental imagery. Borkovec and colleagues (Borkovec, Alcaine, & Behar, 2004; Sibrava & Borkovec, 2006) propose that worry functions to dampen the intensity of mental images of feared hypothetical scenarios and the attendant anxious arousal. This suggests, albeit indirectly, that individuals with GAD may have particularly enhanced mental images that they must dampen in order to mitigate the anxious arousal that accompanies the mental images. Based on research in the decision-

making literature, the dampening of the images may render the scenarios depicted in them more abstract, and perhaps by extension, more psychologically distant and less threatening as a result. With reference to the function of worry, Borkovec and colleagues have in fact proposed that the mental act of worrying interferes with concrete processing of threatening hypothetical scenarios, by discouraging the invocation of salient mental representations, which has the effect of reducing the perceived threat associated with the scenario.

The role of mental imagery in the anxiety disorders has been emphasized (Holmes & Mathews, 2005). However, the covert nature of mental imaging processes makes them notoriously challenging to study, which means that a high level of methodological rigour is needed to address questions related to imagery. Verbal stimuli (words, sentences) are commonly employed in paradigms that are designed to assess deficits and biases in attention, appraisal, interpretation, and memory processes. Probe detection tasks and vignette tasks, for example, require respondents to react to, evaluate, recognize, or recall verbal stimuli varying in valence and evocativeness. Responses are considered to be the “output” of underlying cognitive processes. Although numerous studies have shown in effect, that anxious and non-anxious individuals respond differently on a cognitive level to verbal stimuli denoting threat (see MacLeod & Rutherford, 2004), the limitations of the approaches used to assess various cognitive processes have received increased attention. One perspective is that verbal/conceptual stimuli may not be sensitive enough to evoke mental representations of fear objects and to detect differences in affective and physiological responses between fear and non-fear groups. However, a moderating element that must be considered is the *focality* of the fear. The more concrete and

circumscribed the fear object is, the easier it is to activate an accurate mental representation of it using linguistic stimuli. For example, the words “hairy” and “crawling” are sufficient to arouse anxiety and elicit cognitive biases in persons with a spider phobia. However, the more abstract or “fuzzy” fears are, the more challenging it becomes to activate accurate mental representations using simple stimuli. Lang and Cuthbert (1984) described GAD as the condition with the highest degree of abstractness and complexity and the least coherent fear associations among all the anxiety disorders. Although worry is hypothesized to be characterized by substantial mental “scenario-building”, individuals with GAD actually have considerable difficulty articulating the content of their fears. Indeed, Stöber and colleagues (Stöber & Borkovec, 2002; Stöber, Tepperwein, & Staak, 2000) have demonstrated that the problem elaborations of high worriers are characterized by reduced concreteness compared to those of low worriers. Thus, although the concerns of worriers *appear* to be more inflated and extensive relative to those of individuals with fears that are circumscribed, it is not uncommon for the content of the concerns to be somewhat vague (e.g., “If X happens, my future will be ruined”).

The standard laboratory tasks that are employed in studies of cognitive processing in GAD may not be sufficiently engaging to call into play the complex processes involved in worry. Specifically, vignette methodologies that require participants to report how they would respond to a “static” scenario are useful only to a certain extent for inducing stereotyped appraisals, but may not be stimulating enough to activate the full range of ‘on-line’ reactions to uncertainty. Self-report and experimental methodologies that capture the dynamic processes involved in worry do exist, but tend to be

underutilized in experimental psychopathology research (Brown et al., 2002). Two paradigms appear to be promising for enhancing our understanding of the dynamic aspects of uncertainty processing in that both engage participants in active scenario construction. One paradigm is derived from research on the *simulation heuristic* (Kahneman & Tversky, 1982a). It has been suggested that the ease with which one engages in mental simulations of ‘worst case scenarios’ is a determinant of cognitive and affective reactions to uncertainty. Mental scenarios are also constructed to estimate the probability that an action plan will succeed and to generate and evaluate factors that might interfere with implementation of specific courses of actions (Kahneman & Tversky, 1982a). The paradigm that has been used in examinations of the simulation heuristic involves having participants actively engage in a problem-solving process. For example, Brown et al. (2002) asked first-time pregnant women to provide a step-by-step account of how they would get themselves to the hospital if they were to go into labour at home in the middle of the day. The quality of the simulations were coded and the findings revealed that participants who provided simulations that were lower on cohesiveness, reported higher levels of worry and lower estimates of a successful outcome.

Riskind (2005) developed a vignette methodology that attempts to draw on the *temporal-spatial* aspects of mental scenario construction. It has been proposed that dynamic mental representations are a key component of the cognitive style of chronically anxious individuals. Specifically, the threat representations of anxious individuals are thought to be characterized by “dynamically intensifying danger and rapidly rising risk” (Riskind, 2005, p. 9) that are not adequately captured with the use of “static”

methodologies that elicit single-point threat estimations. The Looming Maladative Style Questionnaire (LMSQ) is a task in which respondents are asked to read vignettes describing potentially threatening events and to imagine that the scenarios are happening to them personally. Respondents are asked to respond to questions that assess the extent to which they perceive that risk and danger are intensifying. Findings in GAD analogue samples indicate that perceptions of “looming” danger and risk are more pronounced in individuals with GAD as compared to nonclinical comparison groups. Perhaps of greater significance, however, is the finding that dynamic threat appraisals (as assessed by the LMSQ) lead to increments in the prediction of GAD group membership above and beyond conventional “static” threat appraisals (e.g., probability/likelihood estimates threat) (Riskind, 2005; Riskind & Williams, 2005). This suggests that dynamic mental representations of threat may be an important feature of GAD.

*Implications of Research on Uncertainty Processing for the Treatment of
Generalized Anxiety Disorder*

The implications of research on uncertainty processing for the treatment of GAD are varied. It has been proposed that *increasing tolerance for uncertainty* is one pathway by which to reduce chronic worry and the anxiety that tends to accompany it (Dugas, Gagnon et al., 1998; Dugas & Koerner, 2005; Dugas & Robichaud, 2007). In this section, a few of the ways in which research on decision-making under uncertainty can be used to inform the cognitive-behavioural treatment of GAD will be discussed.

A factor that is known to contribute to the experience of chronic, clinically-significant levels of anxiety is the tendency to overestimate the risk of bad outcomes. This cognitive bias has been observed in obsessive-compulsive disorder, panic disorder,

social anxiety disorder, as well as GAD (MacLeod et al., 1991; McManus, Clark, & Hackmann, 2000; Overton & Menzies, 2002; Rachman, 1991). Research has shown that helping anxious clients re-evaluate and arrive at more accurate probability estimates is useful for reducing threat perceptions. Such an intervention is a part of most cognitive treatments for anxiety. However, as noted earlier, evaluating the veracity of probability estimates seems to be only minimally effective for individuals with GAD. Although individuals with GAD do overestimate the likelihood of the occurrence of bad outcomes, based on clinical observations and research on uncertainty processing, this might *not* be a direct mechanism by which worry is perpetuated. Extant research indicates that there are a number of mediating and moderating factors in the relationship between worry and probability overestimation. Furthermore, the nonclinical literature indicates that worry is stimulated by the *possibility* of threat, and not by its probability. Therefore interventions aimed at examining the accuracy of predictions about future outcomes may have limited utility, since even low-probability negative events have the capacity to incite worry. In fact, one can argue that probability estimation interventions may even be counterproductive, particularly if the worry pertains to situations that can be classified as unknown or unknowable uncertainties. In the former scenario, the information required to make the probability judgment is accessible, but is unavailable to the worrier, whereas in the latter scenario, this information is completely inaccessible. The ability to predict is contiguous with a perception of control (Mineka & Hendersen, 1985) and having clients engage in probability estimation exercises to reduce worry may instill a false perception of control over uncertainty when in reality, uncertainty cannot be eliminated. A more

constructive approach is to help clients *reduce their negative appraisals of uncertainty* with the aim of fostering greater acceptance of it.

Psychoeducation

Psychoeducation is a key component of virtually all cognitive-behavioural treatments and is an intervention that can have an important impact on clients' appraisals of their psychological experiences. Many individuals with panic disorder, for example, have a categorically negative view of their anxiety and report wanting to *eliminate* it. Clients receiving treatment for panic disorder are provided with information at the outset conveying that anxiety is a part of the normal range of emotional experience and is a state that is typically experienced as unpleasant at very high levels. In addition, clients learn about the *adaptive* aspects of anxiety. They learn about the necessity of anxiety for survival and learn to construe their panic attacks as a displaced fear response. The overarching aim is to validate and normalize the experience of anxiety and to have clients arrive at a decatastrophized view of it. Thus, one way to promote adjustments in appraisals is via psychoeducation.

In our current GAD treatment package, the conceptualization of worry as the expression of a high level of intolerance of uncertainty is shared with clients right from the first session. However, there is no formalized psychoeducation on uncertainty that would be analogous to the psychoeducation on anxiety in current cognitive-behavioural treatments for panic disorder, for example. The notion that one cannot control uncertainty, but can change one's own response to uncertainty is conveyed (Dugas & Robichaud, 2007). In addition, clients learn that one way they can reduce their worry is to

decrease their intolerance for uncertainty, which involves changing unhelpful attitudes and patterns of thinking and unproductive coping strategies.

However, clients may further profit from explicit psychoeducation on the *benefits* of uncertainty. The normative decision-making literature indicates that as much as people tend to dislike uncertainty, constant *certainty* can also engender uncomfortable states such as boredom (Inglis, 2000). Furthermore, research on exploratory behaviour in animals suggests that variability is essential to adaptive learning. Research has shown that learning is enhanced when contingencies are *not* constant, as this forces organisms to attend and adapt to changes in their environment (Inglis, 2000). However, a *high* degree of novelty, particular if it is unpredictable, can produce low levels of liking and induce anxious responses (Inglis, 2000; Lee, 2001).

Clients may also benefit from education on the appropriate and adaptive aspects of their responses to uncertainty. For example, research has shown that novel or unfamiliar stimuli automatically evoke competing appetitive and defensive motivations that stimulate approach and avoid behaviours (Duckworth, Bargh, Garcia, & Chaiken, 2002; Russell, 1973). Approach behaviour typically manifests as an orienting response, which is an index of enhanced vigilance to potential threat. Avoidance behaviour is then prompted when the novel or unfamiliar stimulus is appraised as harmful or dangerous. Muscle tension, one of the six GAD somatic symptoms (DSM-IV-TR, American Psychiatric Association, 2001) is a counterpart to the freezing response observed in animals evaluating an unfamiliar situation in which the degree of threat is unclear. Interestingly, muscle tension appears to be uniquely associated with GAD (Hoehn-Saric, MacLeod, & Zimmerli, 1989; Joorman & Stöber, 1999). Accordingly, the chronic worry

and muscle tension reported by individuals with GAD may be a symptom of protracted approach-avoidance tendencies that may reflect continual activation of evaluative processes.

Direct Modification of Interpretive Biases: A Future Direction?

A central assumption of cognitive models of anxiety disorders is that distortions in appraisals are the product of internal representations in memory of threat and of biases in information processing. Cognitive treatments consist of interventions that are aimed at helping clients identify and challenge distortions in their appraisals of their experiences and this work relies almost entirely on clients' self-report of thoughts that are presumed to be "automatic". Changes in self-reported thoughts are inferred to reflect changes in "higher-order" cognitive processes that are inaccessible to self-report. However, research in the depression literature indicates that changes in self-reported cognition can occur in the absence of changes in underlying cognitive operations or structures and that such a discrepancy may be a marker for relapse (Dozois, 2007; Wenzlaff et al., 2001).

New findings in the experimental cognitive psychology literature suggest that the *direct* modification of interpretive biases may alter vulnerability to emotional disorder (Mathews, 2006; Wilson, Macleod, & Mathews, 2006). In a series of elegant laboratory investigations, Mathews and MacLeod (2002) were able to produce interpretive biases in non-clinical individuals using vignette-type methodologies that traditionally have been used to assess naturally-occurring biases. In a typical experiment, participants are trained to consistently apply either a threatening or neutral interpretation to written scenarios or statements describing uncertain situations. Participants who are trained to consistently make threatening interpretations report a significant increase in their state anxiety after

engaging in a stressful task (e.g., attempting to solve unsolvable anagrams; viewing video clips of catastrophes or emergency situations); whereas, participants who are trained to make neutral interpretations display little reactivity to the same tasks (Mathews & MacLeod, 2002). What is more, the effects of interpretation training have been shown to endure for at least 24 hours and to survive contextual changes (Mackintosh, Mathews, & Yiend, 2006), which suggests that the paradigm might have clinical utility if in fact, the effects of interpretation training persist beyond the experimental context.

Given that research on intolerance of uncertainty and information processing is still at an early stage, no definitive conclusions can be made regarding the applicability of the aforementioned research to current treatments for GAD. However, the methodologies employed in this research can be used to get a better understanding of the *causal* role of appraisal biases in excessive worry and GAD. For example, it might be fruitful to examine whether the induction of either a negative or a neutral/positive interpretive bias produces changes in state worry in individuals who are high on intolerance of uncertainty.

Conclusion

Generalized anxiety disorder is a condition that is considerably challenging to treat in an effective manner. Research on the cognitive vulnerabilities and processes involved in worry has contributed significantly to our understanding of this condition and has led to considerable improvements in psychological treatments for GAD. Research by Dugas and colleagues (see Dugas & Koerner, 2005; Dugas & Robichaud, 2007; Koerner & Dugas, 2006 for reviews) suggests that a priori beliefs about uncertainty (i.e., intolerance of uncertainty) play a key role in the promotion of excessive worry. One

pathway by which intolerance of uncertainty might influence worry is by interfering with flexible processing of uncertainty. In this thesis, three independent investigations were conducted to examine the relationship of intolerance of uncertainty--a putative cognitive vulnerability for worry and GAD—to the processing of information characterized by ambiguity or uncertainty. Collectively, the findings revealed key differences in the way in which individuals low and high on intolerance of uncertainty appraise such information and suggested that the cognitive mechanisms that promote negative appraisals are likely complex. Suggestions for future research were advanced and it was proposed that research on normative decision-making under uncertainty can provide perspective on the discernment of adaptive from maladaptive responses to uncertainty. It is believed that continued research on uncertainty processing has the potential to enhance existing conceptual models and cognitive-behavioural treatments for GAD.

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Footnotes

1. A portion of this research was presented at the congress of the European Association for Behavioural and Cognitive Therapies (EABCT), Thessaloniki, Greece (September 2005). A version of this chapter has been accepted for publication:

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2. This research was presented at the World Congress of Behavioural and Cognitive Therapies (WCBCT), Barcelona, Spain (July 2007). A version of this chapter will be submitted for publication (co-author: M.J. Dugas). We would like to thank Nicole Gervais, Beatrice Garfinkiel, Ellenie Kibaris and Danit Nitka for their assistance with data entry, and Kathryn Sexton for helpful discussions regarding statistical analysis. We would also like to express gratitude to Dr. Iris M. Engelhard, Department of Clinical Psychology, Utrecht University, for her input regarding the Emotional Reasoning Task and to Dr. Andy Field, Department of Psychology, University of Sussex for his advice regarding certain statistical procedures.

3. Portions of this research were presented at the European Association for Behavioural and Cognitive Therapies (EABCT) convention, Manchester, United Kingdom (September 2004) and at the Canadian Psychological Association (CPA) convention, Montreal, Canada (June 2005). A version of this chapter was submitted for publication to *Cognition*

and Emotion (co-author: M.J. Dugas). We wish to acknowledge Mary Hedayati, Nicole Heinecke, Nicole Gervais, and Kristin Buhr for their help with pilot testing, participant recruitment, data collection and data entry. We also wish to thank Peter J. Lang, Ph.D. of the NIMH Center for the Study of Emotion and Attention for permitting the use of the International Affective Picture System in this investigation.

4. IAPS photographs used in this study:

Negative: 2710, 2900, 3181, 3230, 6312, 6560, 6838, 9040, 9050, 9421, 9430, 9435, 9600, 9920, 9921

Positive: 2000, 2030, 2209, 2216, 2222, 2224, 2299, 2304, 2340, 2655, 4623, 4626, 5201, 5831, 7325

Neutral: 6150, 7004, 7006, 7009, 7025, 7035, 7036, 7041, 7080, 7100, 7130, 7150, 7211, 7235, 7705

Ambiguous: 2221, 2272, 2312, 2372, 2441, 2480, 2520, 2595, 2752, 2810, 2880, 6000, 8010, 9110, 9432

5. We wish to thank the anonymous reviewer who raised this point.

Appendix
Consent Forms

CONSENT FORM TO PARTICIPATE IN RESEARCH (STUDY 1)

This is to state that I, _____ agree to participate in a program of research conducted by Naomi Koerner, under the supervision of Dr. Michel J. Dugas of the Psychology Department at Concordia University, (848-2424 ext. 2229, nmkoerner@yahoo.com).

A. PURPOSE

I have been informed that the purpose of the research is to examine different factors related to worry.

B. PROCEDURES

I have been informed that I will be asked to complete 8 questionnaires assessing different aspects of mood and other psychological variables. The completion of the study is expected to take approximately 20 minutes. I have been made aware that the questionnaires I will be completing are ones that have previously been used in published research. I will not be required to do any tasks other than that described above. Any identifying information that I will provide will not be associated with my data in the experiment. My consent form will not be kept with my questionnaire package and all information will be kept under lock and key. I understand that my participation in the experiment and the information and data I will provide will be kept strictly confidential. Moreover, I understand that I am free to discontinue my participation in the study at any time without negative consequences.

C. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at anytime without negative consequences.
- I understand that my participation in this study is confidential (i.e., the researcher will know, but will not disclose my identity).
- I understand that the data from this study may be published.
- I have been informed of the purpose of the study and know that there is no hidden motive of which I have not been fully informed.

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOLUNTARILY AGREE TO PARTICIPATE IN THIS STUDY.

NAME (please print) _____

SIGNATURE _____

WITNESS SIGNATURE _____

DATE _____

If at any time you have questions about your rights as a research participant, please contact Adela Reid, Research Ethics and Compliance Officer, Concordia University, at 514.848.2424, x.7481 or by email at Adela.Reid@Concordia.ca.