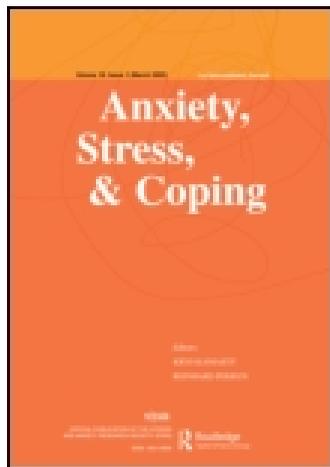


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Differentiating intolerance of uncertainty from three related but distinct constructs

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Differentiating intolerance of uncertainty from three related but distinct constructs

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Individual differences in uncertainty have been associated with heightened anxiety, stress and approach-oriented coping. Intolerance of uncertainty (IU) is a trait characteristic that arises from negative beliefs about uncertainty and its consequences. Researchers have established the central role of IU in the development of problematic worry and maladaptive coping, highlighting the importance of this construct to anxiety disorders. However, there is a need to improve our understanding of the phenomenology of IU. The goal of this paper was to present hypotheses regarding the similarities and differences between IU and three related constructs – intolerance of ambiguity, uncertainty orientation, and need for cognitive closure – and to call for future empirical studies to substantiate these hypotheses. To assist with achieving this goal, we conducted a systematic review of the literature, which also served to identify current gaps in knowledge. This paper differentiates these constructs by outlining each definition and general approaches to assessment, reviewing the existing empirical relations, and proposing theoretical similarities and distinctions. Findings may assist researchers in selecting the appropriate construct to address their research questions. Future research directions for the application of these constructs, particularly within the field of clinical and health psychology, are discussed.

Keywords: intolerance of uncertainty; intolerance of ambiguity; uncertainty orientation; need for cognitive closure

Introduction

The state of uncertainty refers to the doubt that exists about whether or not a particular outcome will occur (Keren & Gerritsen, 1999). There is ample empirical evidence to support the contention that uncertainty is a powerful stressor with both psychological and physiological consequences for the individual. For example, greater perceived uncertainty is associated with higher anxiety and depression (Gentes & Ruscio, 2011) and lower quality of life (Bailey et al., 2009). In contrast to situational uncertainty, intolerance of uncertainty (IU) refers to a trait of the individual rather than a perceived characteristic of the situation. Further, IU refers to a set of cognitive, emotional, and behavioral reactions to situational uncertainty (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). Over the past decade, researchers have firmly established the central role of IU in the development of problematic anxiety, worry, and maladaptive coping, highlighting the importance of

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this construct for certain psychopathologies. For example, IU has been associated with increased stress (Greco & Roger, 2003) and the tendency to interpret ambiguous situations as threatening (Koerner & Dugas, 2008), although it has also been found to predict more approach-oriented coping when faced with an uncertain health threat (Rosen & Knäuper, 2009). The maladaptive cognitive appraisals characteristic of people with high IU appear to exacerbate their physiological arousal (Greco & Roger, 2003), which may contribute to self-perpetuating cycles of fear (Barlow, 2002) and avoidance.

Most notably, current research suggests that IU is a key construct related to worry and anxiety and is a central factor in the development and treatment of several anxiety disorders, but especially Generalized Anxiety Disorder (GAD; Koerner & Dugas, 2008). Researchers are increasingly interested in understanding the mechanisms through which IU is associated with anxiety disorders, health-related anxieties, stress, coping, and other related processes, such as intolerance of emotional arousal and anxiety sensitivity. An improved understanding of IU could also inform the development of more effective, evidence-based treatments for anxiety disorders (e.g., for GAD; Birrell, Meares, Wilkinson, & Freeston, 2011). In a recent review, Birrell and colleagues (2011) specifically called for an improved theoretical understanding of IU and suggested that our current understanding remains broadly defined and lacks specificity. One way to improve construct explication is to differentiate IU from other related but distinct individual differences in uncertainty. The goal of this paper is to present hypotheses regarding the similarities and differences between IU and three related constructs – intolerance of ambiguity (IA), uncertainty orientation (UO), and need for cognitive closure (NCC). The comparison constructs were chosen because they share: (1) similarities in their definitions, (2) highly comparable items on self-report measures, and (3) similar correlates. To assist with achieving this goal, we conducted a systematic review of the literature that helped to generate hypotheses and served to identify current gaps in knowledge.

Prior research examining these constructs has been fragmented with social psychologists studying UO and NCC, whereas IU has remained of primary interest to clinical psychologists focusing largely on its association with anxiety disorders (Freeston et al., 1994; Ladouceur, Gosselin, & Dugas, 2000). Only IA has been applied in both fields. Consequently, there has been limited dialog regarding the relationships among these constructs and their appropriate applications. Furthermore, IU shares some conceptual and measurement properties with the aforementioned traits, and as a result the constructs have previously been confused and used interchangeably with IU (e.g., Clack & Head, 1999; Furnham & Ribchester, 1995; Geller, Tambor, Chase, & Holtzman, 1993; Majid & Pragasam, 1997; McCulloch, Kaul, Wagstaff, & Wheatcroft, 2005; Myers, Henderson-King, & Henderson-King, 1997). Summarizing the commonly used measures for each of the constructs will clarify their operational definitions, and how each construct is typically assessed. In addition to improving our understanding of the phenomenology of IU, the theoretical similarities and distinctions put forth by this paper may indicate that conclusions drawn from past studies need to be re-evaluated because the constructs were confounded in them. It also aims to assist researchers in selecting the appropriate construct to address their research questions related to trait uncertainty and, therefore, make correct predictions. Finally, the results can aid researchers in developing the new trait uncertainty measures with enhanced psychometric properties.

In summary, this paper provides an analysis of broader scope than previous attempts (Birrell et al., 2011; Grenier, Barette, & Ladouceur, 2005). The specific goals of this paper are to present: (1) the definitions of IU, IA, UO, and NCC, followed by the most common means of assessing each construct; (2) theoretical hypotheses regarding the similarities and differences between IU and the three related constructs and to present a narrative analysis of the current literature (see Table 1 for a summary); and lastly (3) recommendations for future research to substantiate these distinctions. To support the aforementioned goals, we conducted a systematic review of the literature, and the results of the review together with our own hypotheses formed the basis for the theoretical propositions and recommendations. We first outline the systematic review methodology and then present the definitions, assessment methods, and narrative analysis. We begin with IU as it is our central construct and then proceed in historical order with respect to the remaining constructs.

Search strategy for systematic review

A systematic review of the literature (from 1986 to November 2012) was conducted to identify studies that have differentiated IU and the three related constructs of uncertainty. Any studies that included IU and at least one of the other three trait variables were eligible for inclusion. All stages of the review process (e.g., establishing the search terms, screening titles and abstracts, etc.) included at least two independent researchers. The literature searches were conducted in 20 electronic bibliographical databases (Appendix A, online supplemental material, lists the included electronic databases and key search terms). The search strategy used key words, subject headings, and adjacency features combining IU (or “Uncertainty Tolerance”) with one other trait construct: IA (“tolerance for ambiguity” and “ambiguity tolerance”); NCC (“cognitive closure”); and UO (with and without the hyphen). Only peer-reviewed articles were included. There were no restrictions according to study design, methodology, or language. The review resulted in 270 articles, following the removal of duplicates. After screening the titles and abstracts of the articles, 26 papers were extracted for a full review. The full review resulted in only three studies that assessed trait IU and at least one of the other constructs and were, therefore, included in this analysis: two quantitative (Berenbaum, Bredemeier, & Thompson, 2008; Buhr & Dugas, 2006); and one theoretical (Grenier et al., 2005) (Figure 1, online supplemental material). The narrative synthesis explored the findings within the three studies based on several predetermined coding categories (e.g., sample characteristics, study design, and associations with IU). Given that only three papers were identified by this review reveals a critical lack of empirical findings with regards to the similarities and differences between IU and the three related constructs. Still, the results from this review served to highlight gaps in the literature, which together with the theoretical conceptualizations outlined in this paper should form the basis for future research.

Intolerance of uncertainty

Krohne’s (1993) theory of coping proposed that for some individuals, ambiguous situations – defined as unpredictable, complex and/or insoluble – are perceived as

Table 1. Summary of hypothesized similarities and differences with IU.

Construct	Definition	Hypothesized similarities with IU	Hypothesized differences to IU	Suggested utilization in clinical/health psychology
Intolerance of uncertainty (IU)	A dispositional characteristic that arises from a set of negative beliefs about uncertainty and its connotations and consequences			<ul style="list-style-type: none"> • Psychopathology, particularly anxiety disorders • Impact of unknown future health consequences
Intolerance of ambiguity (IA)	An individual's tendency to interpret ambiguous situations as a source of threat or discomfort	<ul style="list-style-type: none"> • Cognitive interpretation of uncertain or ambiguous environment as source of threat • Tendency to respond with pattern of negative cognitive, affective, and behavioral reactions to threat • Measures are modestly and positively correlated • Measures assess general tendency to prefer predictability 	<ul style="list-style-type: none"> • People with higher IU feel threatened by future situation; higher IA feel threatened by current situation • IU more highly correlated with worry (which typically center on anticipation of future consequences) than IA 	<ul style="list-style-type: none"> • Impact of ambiguous health symptoms or receiving ambiguous health information
Uncertainty orientation (UO)	Categorization of people into those who are (a) uncertainty-oriented (find uncertainty desirable and are motivated to resolve it) and (b) certainty-oriented (avoid uncertainty and prefer to maintain clarity)	<ul style="list-style-type: none"> • Reflects individual preferences regarding uncertainty • Reactions to uncertainty depend on the situational context (degree of uncertainty) 	<ul style="list-style-type: none"> • IU is dimensional; UO is categorical • IU focuses on psychological effects of uncertainty; UO focuses on desire to resolve or avoid uncertainty 	<ul style="list-style-type: none"> • Decisions to adopt new evidence-based practices • Effects of perceived stress between certainty and uncertainty oriented individuals.

Table 1 (Continued)

Construct	Definition	Hypothesized similarities with IU	Hypothesized differences to IU	Suggested utilization in clinical/health psychology
Need for cognitive closure (NCC)	An individual's desire for a firm answer to a question and an aversion toward ambiguity	<ul style="list-style-type: none"> • Reflects individual preferences for uncertainty • Measures show similar correlates (e.g., with IA) • Measures both have subscales of "desire for predictability" • Measures' subscales have several significant correlations with each other 	<ul style="list-style-type: none"> • In IU, affect is a product of the uncertainty; In UO, affect is a product of one's motivation to resolve or avoid uncertainty • People with higher IU perceive greater threat due to uncertainty; neither uncertainty-oriented nor certainty-oriented individuals feel threatened by uncertainty • IU reflects psychological effects of uncertainty; NCC reflects motivation to approach or avoid closure (i.e., certainty) • IU is unilateral in that people report more or less IU; NCC can reverse according to benefits/costs of the situation 	<ul style="list-style-type: none"> • Motives for engaging in health coping behaviors

threatening and lead to an emotional state of uncertainty. Such individuals whom he called “vigilant” have an inability to tolerate uncertainty, which leads to an extensive and continual search for threat signals (Krohne, 1993). Following Krohne’s work, some researchers suggested that it was the uncertainty itself that led to greater threat perception in ambiguous situations. In combination with their clinical observations, these researchers conceptualized IU as “cognitive, emotional, and behavioral reactions to uncertainty in everyday life situations” (Freston et al., 1994, p. 792) and began investigating its association with anxiety and worry. In a series of studies with both nonclinical and clinical populations, the research group established that IU was strongly linked to worry and to GAD (see Birrell et al., 2011 for review). Experimental and treatment studies in which reductions in IU were found to precede decreased worry led to a revised definition as “a predisposition to react negatively to an uncertain event or situation, independent of its probability of occurrence and its associated consequences” (Dugas, Gosselin, & Ladouceur, 2001; Ladouceur et al., 2000, p. 934). The definition was recently further revised to refer to “a dispositional characteristic that arises from a set of negative beliefs about uncertainty and its connotations and consequences” (Koerner & Dugas, 2008, p. 631). This definition included findings that suggested individuals with high IU interpret ambiguous situations as threatening or negative, and that IU may be an important cognitive risk factor for anxiety disorders (Koerner & Dugas, 2008). Thus, IU is considered to be a *cognitive filter* through which the environment is viewed and uncertainty is regarded as unacceptable (Buhr & Dugas, 2002). Grenier and colleagues (2005) further specified that IU represents an apprehension toward unpredictable events in the future rather than the present, although empirical evidence is lacking.

Among nonclinical samples, confirmatory factor analysis of the most commonly used measures provides strong evidence for two factors that best operationalize IU: (1) *Desire for predictability* (e.g., “I always want to know what the future has in store for me”) and (2) *Uncertainty paralysis* (e.g., “when it’s time to act, uncertainty paralyzes me”; Birrell et al., 2011). Individuals with high IU, therefore, view uncertain situations as stressful and upsetting and may feel incapacitated when they experience uncertainty. In contrast, individuals low in IU are not bothered by these same situations. McEvoy and Mahoney (2011) established further support for a two factor structure among clinical samples and operationalized the factors along similar lines: (1) *Prospective anxiety* (i.e., fear of uncertainty based on future events) and (2) *Inhibitory anxiety* (i.e., uncertainty inhibiting action). Psychometric based studies should establish the extent to which these factors overlap between nonclinical and clinical samples.

Assessment

The self-report measure most often used to assess IU is the Intolerance of Uncertainty Scale (IUS, 27 items). This measure was first developed in French (Freston et al., 1994) and subsequently validated in English (Buhr & Dugas, 2002). Although the original French IUS was proposed to have a five-factor structure, the English version was composed of four: (1) uncertainty leads to the inability to act (e.g., “uncertainty stops me from having a strong opinion”); (2) uncertainty is stressful and upsetting (e.g., “uncertainty makes life intolerable”); (3) unexpected events are negative and should be avoided (e.g., “I can’t stand being taken by

surprise”); and (4) being uncertain is unfair (e.g., “I can’t stand being undecided about my future”). However, the scale has mainly been applied as a unifactorial measure due to the considerable overlap of some items on more than one factor and because the factors correlate highly with the total score, $r = .82$ to $.94$, $p < .001$ (Buhr & Dugas, 2002). The total score of the IUS has excellent internal consistency, $\alpha = .91$ (Freeston et al., 1994) and acceptable test–retest reliability over a five-week period, $r = .78$; $p < .001$ (Dugas, Freeston, & Ladouceur, 1997). An alternative short-version of the IUS has been created – Intolerance of Uncertainty Scale-Short Form (IUS-12; Carleton, Norton, & Asmundson, 2007). The IUS-12 has two factors: *prospective anxiety* and *inhibitory anxiety*. The scale has demonstrated good internal consistency ($\alpha = .85$) and it correlates with the IUS-27 ($r = .96$; Carleton et al., 2007).

Khawaja and Heidi Yu (2010) compared the psychometric properties of the IUS-27 and the IUS-12 in a community sample of individuals diagnosed with one, or more, anxiety disorder/s. Among clinical populations, the total scores of both measures had adequate predictive validity for clinically elevated levels of worry and trait anxiety. Conversely, in a community sample, the subscales (and not the total score) of the IUS-12 were better predictors of worry and trait anxiety. However, the *Prospective anxiety* subscale of the IUS-12 did not distinguish clinical from nonclinical samples, suggesting that uncertainty related to future events may impact individuals diagnosed with an anxiety disorder and nonclinical individuals in a similar manner (Khawaja & Heidi Yu, 2010). In sum, total scores may be more appropriate to use when distinguishing clinical from nonclinical samples. To widen the applicability of IU, future studies should clarify the factor structure of the IUS and address whether IU should have different operational definitions for clinical and nonclinical populations.

Recently, Gosselin and colleagues (2008) developed an alternative French self-report scale of IU (Intolerance of Uncertainty Inventory [IUI]). Development of the IUI was based on the assertion that both versions of the IUS (i.e., the IUS-27 and the IUS-12) generally evaluate the consequences of IU and neglects the tendency of an individual to consider uncertainties as intolerable or unacceptable (Gosselin et al., 2008). The IUI consists of 45 items and has two parts: Part A – *Tolerance of Acceptance of Uncertainties*; and Part B – *Negative Manifestations/Consequences of Uncertainties*. Both subscales have excellent internal consistency ($\alpha = .96$ and $.97$, respectively), and acceptable test–retest reliability of $.76$ (Part A) and $.75$ (Part B) over a five-week period. The IUI subscales moderately correlate (Part A: $r = .68$; Part B: $r = .72$) with the French version of the IUS. The IUI was recently validated in English (Carleton, Gosselin, & Asmundson, 2010).

Intolerance of ambiguity

Ambiguity exists when there is more than one possible interpretation of an event and each possibility carries a varying degree of uncertainty (Cioffi, 1991). The construct of Intolerance of Ambiguity (IA) was first introduced by Frenkel-Brunswick in 1949. Since then, researchers have mainly focused on its applications to nonclinical fields such as management, particularly in cross-cultural settings, with additional studies investigating variables such as personality style, religious beliefs, attitudes, and career choices (Furnham, 1994; Furnham & Ribchester, 1995; Budner, 1962). For example, researchers have shown that lower IA was associated with higher trait mindfulness

(Ie, Haller, Langer, & Courvoisier, 2012), lower anxiety (Buhr & Dugas, 2006), and fewer symptoms of depression (Andersen & Schwartz, 1992). Researchers concur that IA refers to an individual's tendency to interpret ambiguous situations as a source of threat or discomfort (Grenier et al., 2005; Budner, 1962). This interpretation leads to three specific reactions that are characteristic of people with high IA. First, their cognitive reactions include the tendency to view ambiguous situations rigidly in black or white. Second, their emotional reactions involve uneasiness, discomfort, dislike, anger, and anxiety. And third, they exhibit predictable behavioral reactions, such as the rejection or avoidance of ambiguous situations (Grenier et al., 2005). In contrast, people with low IA view ambiguous stimuli as challenging, desirable, and interesting (Furnham & Ribchester, 1995).

Assessment

The Scale of Tolerance-Intolerance of Ambiguity (TIA; Budner, 1962) is a commonly used measure for assessing IA. The TIA, however, has poor psychometric properties. Although the test-retest reliability is adequate ($r = .85$, $p < .001$, two-month period) to moderate ($r = .64$; six-week period), the internal consistency is unacceptable ($\alpha = .49$ to $.59$; Furnham, 1994). The TIA was recently refined to 12 items (Tolerance for Ambiguity Scale: TAS; Herman, Stevens, Bird, Mendenhall, & Oddou, 2010) consisting of four factors: (1) valuing diverse others (e.g., "I avoid settings where people don't share my values"); (2) change (e.g., "The sooner we all acquire similar values and ideals the better"); (3) challenging perspectives (e.g., "I would like to live in a foreign country for a while"); and (4) unfamiliarity (e.g., "I like to surround myself with things that are familiar to me"). The internal consistency of the TAS is improved ($\alpha = .73$; Herman et al., 2010), but test-retest reliability and validity data are not yet available.

Similarities and differences with IU

The systematic review revealed only two studies that point to theoretical (Grenier et al., 2005) and empirical (Buhr & Dugas, 2006) similarities and differences between IU and IA. Both can be understood as cognitive filters through which individuals perceive their environment as a source of discomfort (Buhr & Dugas, 2002; Grenier et al., 2005). In addition, both constructs involve the tendency to react negatively as reflected by emotions, cognitions, and behaviors to uncertain or ambiguous situations. IU (as assessed by IUS-27) and IA (as measured by the TIA) have a moderate positive correlation of $r = .42$, $p < .01$ (Buhr & Dugas, 2006). However, the authors did not provide information regarding the correlations between the subscales of the IUS and the TIA, making it difficult to interpret the degree of overlap. Furthermore, the sample of university students was predominantly female (77%), Caucasian students (70%), and it remains unclear whether this correlation generalizes to clinical populations. The total-score positive correlations suggest that both scales assess the general tendency to prefer certainty and predictability (Buhr & Dugas, 2006), yet the moderate correlation indicates that the scales assess distinct constructs.

Grenier et al.'s (2005) theoretical paper suggested that those with high IA cannot tolerate the ambiguous features of a situation in the "here and now," which translates

into feeling threatened by the current situation. In contrast, those with high IU find that uncertainty over a potential negative event is unacceptable and, therefore, feel threatened by a future situation. In both cases, a person with a high IA or a high IU will experience distress, however, the impetus for IA is in the *present* and for IU it is in the *future*. In support of this contention, IU has consistently been found to play a central role in the acquisition and maintenance of worries, which are typically focused on the anticipation of a future negative consequence (Birrell et al., 2011). Although, both IU and IA show significant correlations with worry, IU is more highly related to worry than IA (Buhr & Dugas, 2006). When examining the underlying dimensions of the IUS and the TIA, it is clear that some unique aspects of these constructs, as reflected by items in the measures, may account for their differential relation to worry. Specifically, the TIA has items assessing variety, originality, clarity, and regularity, which may not be related to worry. In contrast, the factors of the IUS, namely, negative emotional responses to uncertainty, avoidance of uncertainty, and the belief that uncertainty is unfair, may make a greater contribution to worry (Buhr & Dugas, 2006). These findings are cross-sectional, and experimental and longitudinal studies are necessary to establish the unique role of IU in relation to worry and anxiety disorders.

One attempt has been made to establish empirical support for the time-oriented distinction proposed by Grenier et al. (2005) in a cross-sectional study (Miller, Rosen, & Knäuper, 2007). The examined associations were between the IUS and the TIA with measures of future and present time perspective, as assessed by the Zimbardo Time Perspective Inventory-Short Form (Keough, Zimbardo, & Boyd, 1999). Although some trends were found in the hypothesized direction for the relationship between IU and future-orientation, the authors did not find support for the Grenier et al. hypothesis. This result may be a consequence of the poor internal consistency of some of the scales, including the measure of IA ($\alpha = .55$) and of present-orientation ($\alpha = .42$). In addition, participants completed self-report measures on a single occasion in this study and it is possible that features of IU and IA may only manifest themselves under conditions of high situational uncertainty and/or ambiguity.

Uncertainty orientation

The next construct to be distinguished from IU is uncertainty orientation (UO; Sorrentino & Short, 1986). Kagan (1972) suggested that uncertainty reduction is a primary motivation that occurs when people are presented with uncertainty about the self or the environment. Rokeach (1960) distinguished between people who do not feel threatened by uncertainty and are able to resolve it, and those people who do feel threatened by uncertainty. Sorrentino and Short (1986) combined aspects of both researchers' work to classify individuals as either "uncertainty oriented" (those who deal directly with uncertainty, are motivated to reduce it, are capable of resolving it, and find uncertainty desirable) or "certainty oriented" (those who avoid uncertain information and instead prefer to maintain clarity). According to this theory, individuals' develop cognitive schemas based on their orientation that interact with situational cues (uncertainty versus certainty) to subsequently activate motivation. Thus, uncertainty oriented individuals are motivated when there is uncertainty to be resolved about the self or the environment, leading them to orient

toward new or unfamiliar environments. In contrast, certainty oriented individuals are not propelled to resolve uncertainty, and in fact, they orient toward environments that are familiar and consistent. In addition, when an individual's orientation is incongruent with the situation, it decreases their systematic information processing (e.g., examining the strength of the argument), increases nonsystematic means of obtaining information (e.g., relying on others opinion), and the individual is more likely to disengage from the situation (Sorrentino, Smithson, Hodson, Roney, & Walker, 2003). Thus, one's information processing style changes according to individual differences in UO as well as the situational context. Individual differences in UO have been studied primarily in the field of social psychology, establishing associations with various psychological outcomes including decision-making, information-processing, and achievement-related motives (Sorrentino et al., 2003; Sorrentino, Ye, & Szeto, 2009).

Assessment

The assessment of uncertainty orientation (UO) consists of two theoretically and empirically independent measures: (1) a projective test to assess the tendency to approach uncertainty (Sorrentino, Roney, & Hanna, 1992) and (2) a 22-item self-report questionnaire of acquiescence-free authoritarianism (Cherry & Byrne, 1977) to assess the tendency to approach or maintain certainty. The projective test uses four sentence leads, and the stories written by participants based on the leads are coded and scored for uncertainty-resolving imagery. Standardized scores on the authoritarianism measure are subtracted from standardized scores on the uncertainty measure (i.e., the projective test) to calculate one's UO. Previous research has found excellent inter-rater reliability for the uncertainty measure (e.g., $r = .90$; Frederick & Sorrentino, 1977) and excellent test-retest reliability ($r = .90$; Sorrentino, 1977) for the measure of authoritarianism. It should be noted that extensive training and scoring of the projective measure (approximately 40 hours of training, A.C.H. Szeto, personal communication, September 21, 2006) may have discouraged outside researchers from studying this construct and precluded attempts to compare it with other measures (e.g., Webster & Kruglanski, 1994). In particular, it is difficult to compare the degree of overlap in the assessment measures for UO and related constructs such as IU given these limitations.

Similarities and differences with IU

The systematic review did not yield articles that differentiated IU from UO. Theoretically, both reflect individual differences in preferences for uncertainty. One key similarity in both constructs is that psychological outcomes and behavioral reactions varied according to the degree of situational uncertainty (SU; Rosen & Knäuper, 2009; Sorrentino et al., 2009). For example, an experimental study showed an interaction effect of IU and SU on information-seeking and worry about a health threat: Individuals in the high IU and high SU condition sought the most information and worried most due to uncertainty compared to people in the low IU and low SU condition, who sought the least information and worried least (Rosen & Knäuper, 2009). With regard to UO, as noted, a persons' information processing style changes according to an interaction between individual differences in UO and

the degree of uncertainty in the situation (Sorrentino et al., 2009). For instance, Brouwers and Sorrentino (1993) found that uncertainty-oriented people were more likely to seek out health-related information when they perceived a greater threat to their health and when they perceived that obtaining information would be efficacious in reducing the threat. In contrast, certainty-oriented individuals sought information only when threat or efficacy increased, but not both. Thus, the behavioral reactions changed according to an interaction between individual differences in UO and the degree of uncertainty in the situation, as defined by a threat and efficacy manipulation (Sorrentino et al., 2009).

There are also some potentially important theoretical differences. First, UO is a categorical construct, whereas IU occurs along a continuum. Second, although Sorrentino and Short (1986) conceptualize UO as a cognitive variable, this construct has implications for the *motivation* to avoid or approach uncertainty (e.g., Brouwers & Sorrentino, 1993). IU focuses on the psychological effects of given uncertainties (like social or health threats) on the individual (e.g., the development of worries or the activation of coping efforts such as information seeking), whereas UO focuses on individual differences in the desire to resolve or avoid uncertainty (Rosen, Knäuper, & Sammut, 2007). Third, in UO, positive or negative affect is considered to be a product of one's motivation rather than a product of the uncertainty. Thus, uncertainty is a moderator of affect: It either enhances or attenuates emotional responses to uncertain situations but does not itself produce the affective reaction (Sorrentino et al., 2009). This conceptualization clarifies why the direct effects of UO on affective responses has not been a central focus of prior studies. In contrast, higher IU directly produces greater anxiety and worry (Ladouceur et al., 2000). Fourth, uncertainty-oriented individuals find uncertain situations to be desirable and challenging and, therefore, approach these situations. In contrast, individuals with low IU, although not particularly bothered by uncertainty, do not feel invigorated by it or motivated to seek it out. Similarly, certainty-oriented individuals are not necessarily threatened by uncertainty because their rigid cognitive style is likely to dismiss information that is not in line with their worldview. For example, when certainty-oriented individuals are confronted with incongruent messages, they are more likely to avoid this information but will *not* feel threatened or anxious by it (Sorrentino & Short, 1986). In contrast, individuals high in IU, perceive uncertainty to be especially threatening and react accordingly.

In sum, UO specifies not only which individuals find uncertainty desirable but also whether they will avoid or seek situations that contain uncertainty. In contrast, IU identifies those who find uncertainty threatening and, therefore, avoid it.

Need for cognitive closure

The final construct to be distinguished from IU is Need for Cognitive Closure (NCC). Kruglanski and Webster (1996, p. 264) defined NCC along a motivational continuum as “an individual's desire for a firm answer to a question and an aversion toward ambiguity.” NCC was first described in relation to individual differences in one's motivation for information processing and decision-making (Webster & Kruglanski, 1994). The “need” denotes a desire for *any* answer on a given topic. NCC is proportional to the perceived benefits of closure and the perceived costs of lack of closure, or both (Webster & Kruglanski, 1994). Greater need for closure may

arise, for example, when predictability or action is important, when a person is under time constraints, or when further information processing seems effortful, dull, or unattractive. Individuals with higher NCC tend to be impulsive in decision-making due to their impatience to find an answer, whereas individuals lower in NCC tend to avoid closure and are reluctant to give a definite opinion (Kruglanski & Webster, 1996). Like UO, NCC addresses individuals' motivations to approach or avoid uncertainty. However, both uncertainty- and certainty-oriented individuals are motivated toward cognitive closure. Those who are certainty-oriented strive for closure by avoiding new information and thus obtaining closure as quickly as possible; whereas uncertainty-oriented individuals enjoy a slower process of obtaining closure by engaging with new information (Webster & Kruglanski, 1994). Thus, one might expect a low positive correlation between NCC and certainty orientation, and a low negative correlation between NCC and UO. These low associations may be attributed to the fact that NCC is a broader construct encompassing individual differences beyond motivated responses to uncertainty, such as preference for order and close-mindedness. Researchers, predominantly social psychologists, have established relationships between NCC and various psychological phenomena including impression formation, stereotyping, and persuasion (e.g., Heaton & Kruglanski, 1991). Further, one recent study showed that scoring higher in NCC is associated with a greater vulnerability to psychological problems, including symptoms of anxiety and depression (Roets & Soetens, 2010).

Assessment

The self-report measure used to assess NCC is the Need for Closure Scale (NFCS) (Webster & Kruglanski, 1994). The 47 items, including a 5-item lie scale, consist of five subscales: (1) desire for predictability (e.g., "I dislike unpredictable situations"); (2) discomfort with ambiguity (e.g., "I don't like situations that are uncertain"); (3) preference for order and structure (e.g., "I like to have a plan for everything and a place for everything"); (4) decisiveness (e.g., "I usually make important decisions quickly and confidently"); and (5) close-mindedness (e.g., "I always see many possible solutions to problems I face"). Past research has shown that the NFCS has excellent convergent and discriminant validity, good test-retest reliability over 12–13 weeks ($\alpha = .86$) and good internal consistency ($\alpha = .84$; Webster & Kruglanski, 1994).

Similarities and differences with IU

The systematic review yielded one paper that empirically examined IU and NCC (Berenbaum et al., 2008). There are several noteworthy similarities between IU and NCC. The definitions of IU and NCC both reflect individual preferences regarding uncertainty. Some items on the IUS and the NFCS are highly comparable (e.g., IUS: "I must get away from all uncertain situations," NFCS: "I don't like situations that are uncertain"). Indeed, both measures have subscales titled "desire for predictability." Further, studies have shown that IU and NCC are both correlated with intolerance of ambiguity (Buhr & Dugas, 2006; Webster & Kruglanski, 1994).

There are two theoretical differences between IU and NCC. First, NCC occurs along a *motivational* continuum where one end of the continuum reflects a strong need for closure and the other end reflects a strong need to avoid closure. In contrast,

IU focuses on the psychological effects of uncertainty (e.g., anxiety, worry) on the individual rather than the motivation to approach or avoid uncertainty. Second, NCC theory posits that the motivation to approach or avoid closure can reverse according to the perceived benefits and costs of the situation. A person with high NCC may actually approach or prefer uncertainty if he or she perceives the benefits of uncertainty to outweigh the costs of uncertainty (Kruglanski & Webster, 1996). Conversely, although the psychosocial impact of IU may change (increase or decrease) under conditions of high and low uncertainty (Rosen & Knäuper, 2009), the conceptualization of IU is unilateral in that individuals demonstrate more or less of the tendency to react negatively to uncertainty.

In the paper that empirically examined IU and NCC (Berenbaum et al., 2008), the authors examined the associations between the subscales of the IUS (desire for predictability, uncertainty paralysis, uncertainty distress, and inflexible uncertainty beliefs; as labeled by Berenbaum et al., 2008) and the NFCS. The “desire for predictability” subscale of the IUS was most strongly correlated with the “desire for predictability” ($r = .47$), “discomfort with ambiguity” ($r = .55$), and “preference for order and structure” ($r = .32$) subscales of the NFCS (all $p < .01$; Berenbaum et al., 2008). The “preference for order and structure” subscale of the NFCS did not correlate, or had lower magnitude correlations, with the other subscales of the IUS. The fourth subscale of the NFCS – “decisiveness” – was negatively correlated with all of the IUS subscales, (i.e. the more decisive [reflects higher NCC], the less intolerant of uncertainty [reflects lower IU]). Given that those higher in IU are characterized by an inability to act under conditions of uncertainty, it follows that such individuals would have difficulty making decisions, particularly in uncertain situations. The correlations between the fifth subscale of the NFCS, “close-mindedness”, and the IUS subscales were all positive but low (less than .31), suggesting some relationship but not a significant overlap. In sum, these correlational results suggest that the “desire for predictability,” “discomfort with ambiguity,” and “preference for order and structure” subscales of the NFCS are most closely aligned with IU and particularly with the “desire for predictability” subscale of the IUS (Berenbaum et al., 2008). Researchers may consider using the desire for predictability subscale, or the uncertainty paralysis subscale of the NCC, rather than the total score of the IUS when testing specific aspects of IU. The moderate correlations, however, as well as the other dimensions of the NCC that are unrelated to the IUS subscales demonstrate that IU and NCC each capture additional variance not accounted for by the other. It should be noted that the sample in this study was undergraduate students who were generally women (59%) of European American decent (75%), limiting the generalizability of the findings (Berenbaum et al., 2008).

Discussion and recommendations

The primary aim of this paper was to tease apart the construct of intolerance of uncertainty (IU) from intolerance of ambiguity (IA), uncertainty orientation (UO), and need for cognitive closure (NCC) by outlining their definitions, primary tools of assessment, and presenting hypotheses and preliminary empirical evidence regarding their similarities and differences (see Table 1 for summary). To support this aim, we conducted a systematic review to identify the literature to date and potential gaps to be pursued by future research. To summarize,

- Both IU and IA are similar in that they lead to cognitive, emotional and behavior consequences due to uncertainty, whereas NCC and UO are similar in that they appear to have implications for motivation.
- IU may be distinguished from IA in that the latter construct focuses on the “here and now,” while the former centers on an apprehension of events occurring some time in the future (Grenier et al., 2005), however, strong empirical support for this assertion is lacking.
- IU may be distinguished from UO and NCC because the latter constructs focus on individuals’ desire to approach or avoid uncertainty, whereas IU focuses on the psychological effects of uncertainty.

IU is a dispositional characteristic, and evidence suggests that it should be conceptualized as two-dimensional (Birrell et al., 2011; McEvoy & Mahoney, 2011). However, this empirical distinction has only been established with nonclinical populations and future studies should determine if IU remains a strong correlate with worry in clinical samples. IU alone has been primarily researched within the context of anxiety disorders, and evidence suggests that it is central to generalized anxiety disorder (e.g., Koerner & Dugas, 2008). Future empirical research, should examine the true specificity of IU in relation to anxiety disorders (Gentes & Ruscio, 2011). That is, IU may be relevant to other psychopathologies, such as major depression, and may exert its effects through similar processes such as a negative problem orientation (Gentes & Ruscio, 2011). Recent studies have linked IU to other psychopathologies, including psychosis (Broome et al., 2007) and eating disorders (Sternheim, Startup, & Schmidt, 2011), suggesting that IU may be an important target in clinical interventions for these disorders. However, the efficacy of targeting IU in treatments aimed at improving symptoms associated with these disorders remains to be seen. A deficit in cognitive control – that is, conscious cognitive processing – might be the mechanism that links IU to various psychological disorders (Mushtaq, Bland, & Schaefer, 2011). For example, patients with higher symptoms of anxiety have been found to exhibit greater deficits in response inhibition and to be more hypervigilant to threatening distractors in experimental tasks of attention (Mathews, May, Mogg, & Eysenck, 1990). More experimental studies to precisely characterize the causal associations are needed.

Selecting the appropriate assessment tool to measure IU depends on the population of interest, and whether the sample is clinical or drawn from the community. Based on the limited empirical data, we suggest the use of the IUS-27 (Buhr & Dugas, 2002) or the IUS-12 (Carleton et al., 2007) when researchers aim to distinguish clinical from nonclinical samples. Studies predicting levels of worry and trait anxiety among clinical and nonclinical samples may want to use the total scale score for the IUS-27 and the subscale scores of the IUS-12, respectively. Clinicians may consider administering the IUS as a screening tool or as a means of examining change over time in anxiety-related treatments. The TAS may be the superior measure for assessing IA, though more studies documenting its psychometric properties are required. To our knowledge, there is only one measure of NCC (the NFCS) and one method of assessing UO (as outlined) and their continued use appears to be warranted.

Promising avenues for future experimental and longitudinal research could focus on understanding psychosocial reactions and coping strategies under conditions of uncertainty, for instance, in preventing health-related anxiety. Health psychologists

may benefit from using IU to better understand the implications of experiencing uncertainties in one's health and to improve individuals' coping strategies in uncertain situations. Few studies to date have examined trait differences in uncertainty in a health context, despite the fact that there is extensive research suggesting that health uncertainty is rampant and can severely impact one's coping and psychological adjustment (Mishel, 1997). One notable exception is a series of studies conducted by Rosen and colleagues, which investigated the impact of IU on health behaviors (e.g., Rosen et al., 2007; Rosen & Knäuper, 2009). This research showed that a higher IU causes people to seek out more health-related information, but that more information also induces greater anxiety and worries. Clinically, the authors suggested that health providers must simultaneously help their patients' cope by, for example, encouraging patients with higher IU to bring a supportive person with them to appointments. Empirically supported interventions for managing uncertainty are necessary to help individuals with high IU, who are at greater risk for distress, cope with uncertainty-inducing information about their health.

In the Rosen et al. studies (2007; 2009), IU was the appropriate construct for examining the informational needs of people faced with an uncertain health threat because the threat was with respect to future negative health consequences and one of the outcomes of interest was distress. In contrast, IA may be appropriate for studies examining the impact of ambiguous health symptoms or receiving ambiguous health information, whereas UO and NCC would be appropriate for studies investigating what motivates people to engage in particular health-coping behaviors. Selecting the best construct for prediction must be guided by the specific research question. For example, IU may be a better predictor of whether a person will attend a future doctor's appointment, or worry about whether one will develop cancer. IA may be a better predictor of whether or not a person will ask questions when given health information that they find difficult to interpret. UO may be a better predictor of decisions to adopt new evidence-based therapies by clinicians. Specifically, those who are UO may be motivated to apply new evidence-based practices, whereas those who are certainty-oriented may be motivated to maintain familiarity in their practices (see Nelson, 2011). Finally, NCC may be a better predictor of being tested for sexually transmitted infections (STIs), as someone low in NCC may be more reluctant to receive a firm answer to their STI status.

Future research efforts could use any of the aforementioned research questions to examine which construct is a better predictor of a specific health or distress outcome. Support for such hypotheses would suggest a differentiated model. However, if multiple uncertainty constructs were equally predictive, this result would support the contention that the constructs are more similar. The latter finding may lead researchers to consider whether these constructs can or should be conceptualized as dimensions of a larger trait uncertainty construct.

There is a need for studies to empirically validate the proposed theoretical comparisons and explore additional pairwise distinctions among the constructs. For example, future research should correct limitations of prior studies to establish empirically whether the time-oriented distinction between IU and IA proposed by Grenier et al. (2005) can be supported. This study could experimentally manipulate the situational context by inducing either present-oriented ambiguity or future-oriented uncertainty to test differential associations with IU and IA. Furthermore, Krohne (1993) suggested that IA might precede IU because ambiguity is the impetus

for subsequent uncertainty. IA might reflect fears of the unknown that are temporally immediate and based on a narrow realm of current possibilities. However, over time, the possible outcomes may widen into concerns related to the future, and thus fears of the unknown become more temporally distant and IU emerges (Carleton, 2012). The temporal order of the association between IA and IU has never been empirically examined and should be the focus of future experimental research in order to clarify the associations. This clarification will have clinical implications for the design of treatment studies aimed at reducing symptoms of anxiety disorders (e.g., for GAD). It would also be of interest to test the theoretically proposed differences between IU and UO. One might expect a low negative correlation between IU and UO based on theoretical similarities and differences.

The current findings in conjunction with future empirical support may assist researchers in selecting the appropriate construct and measurement tools to address their research questions and make accurate predictions. Enhanced differentiation among constructs will also improve the psychometric properties of novel measures designed to test individual differences in uncertainty. Finally, it is possible that conclusions drawn from prior studies may be called into question if the uncertainty constructs were confounded in them. For example, several prior studies have stated that their purpose was to examine effects of IU on psychological and behavioral outcomes, yet proceeded to assess IU with a measure of IA (e.g., Andersen & Schwartz, 1992; McCulloch et al., 2005), or to simply group the two concepts into one (i.e., “tolerance of ambiguity and uncertainty”; Clack & Head, 1999). Given the potential differences outlined in this review, such approaches limit the conclusions that can be drawn about the true effects of IU on outcomes.

The primary aim of this paper was to examine the relation of IU to three related constructs: IA, UO, and NCC. This task was challenging given that the definitions of several constructs include references to the common terms of “uncertainty” and “ambiguity.” Further, caution is warranted when interpreting the limited empirical evidence that does exist. The identified studies were correlational and do not directly indicate that each measure is assessing unique variance; variability due to measurement differences and error could also account for these associations. An improved understanding of these constructs may increase their utility and has the potential to foster new lines of research in clinical and health psychology. Researchers should examine other contexts in which targeting IU may be beneficial, such as health diagnoses and treatments, or mood management. They should also investigate tailoring interventions to individual differences in uncertainty. Indeed, a growing literature on tailoring interventions to individual characteristics suggests that this technique can induce positive behavioral changes (e.g., mammography uptake) and reduce negative psychological outcomes (Williams-Piehota, Pizarro, Schneider, Mowad, & Salovey, 2005). Thus, the current findings may inform the development of more effective clinical and health interventions that are appropriately tailored to individual differences in uncertainty.

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