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Defining Distinct Negative Beliefs About Uncertainty: Validating the Factor Structure of the Intolerance of Uncertainty Scale

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This study examined the factor structure of the English version of the Intolerance of Uncertainty Scale (IUS; French version: M. H. Freeston, J. Rhéaume, H. Letarte, M. J. Dugas, & R. Ladouceur, 1994; English version: K. Buhr & M. J. Dugas, 2002) using a substantially larger sample than has been used in previous studies. Nonclinical undergraduate students and adults from the community (*M* age = 23.74 years, *SD* = 6.36; 73.0% female and 27.0% male) who participated in 16 studies in the Anxiety Disorders Laboratory at Concordia University in Montreal, Canada were randomly assigned to 2 datasets. Exploratory factor analysis with the 1st sample (*n* = 1,230) identified 2 factors: the beliefs that "uncertainty has negative behavioral and self-referent implications" and that "uncertainty is unfair and spoils everything." This 2-factor structure provided a good fit to the data (Bentler-Bonett normed fit index = .96, comparative fit index = .97, standardized root-mean residual = .05, root-mean-square error of approximation = .07) upon confirmatory factor analysis with the 2nd sample (*n* = 1,221). Both factors showed similarly high correlations with pathological worry, and Factor 1 showed stronger correlations with generalized anxiety disorder analogue status, trait anxiety, somatic anxiety, and depressive symptomatology.

Keywords: generalized anxiety disorder, worry, intolerance of uncertainty, factor analysis, validity

Intolerance of uncertainty has been defined as a "dispositional characteristic that results from a set of negative beliefs about uncertainty and its implications" (Dugas & Robichaud, 2007, p. 24). Given the wealth of evidence on its relevance to worry, intolerance of uncertainty has been proposed as a cognitive vulnerability factor for worry and generalized anxiety disorder (GAD; Koerner & Dugas, 2008).

Although intolerance of uncertainty is present across the anxiety disorders (Ladouceur et al., 1999), it has primarily been investigated in GAD. The specificity of this association has been demonstrated in two ways. First, higher levels of intolerance of uncertainty have been found in GAD populations compared to nonclinical (Dugas, Gagnon, Ladouceur, & Freeston, 1998; Ladouceur et al., 1999) and other anxiety disorder populations (Dugas, Marchand, & Ladouceur, 2005; Ladouceur et al., 1999), with the possible exception of obsessive–compulsive disorder (OCD) samples (Holaway, Heimberg, & Coles, 2006). Similarly, when controlling for neuroticism/negative affect—a global vulnerability for anxiety and mood disorders (see Clark, Watson, & Mineka, 1994; Zinbarg & Barlow, 1996)—intolerance of uncertainty was specifically related to worry but not to symptoms of panic disorder, OCD, or health anxiety (Norton, Sexton, Walker, & Norton, 2005; Sexton, Norton, Walker, & Norton, 2003). Second, intolerance of uncertainty continues to be associated with worry when controlling for anxiety and depression (Buhr & Dugas, 2002), perfectionism and perceived sense of control (Buhr & Dugas, 2006), anxiety sensitivity and perceived responsibility (Dugas, Gosselin, & Ladouceur, 2001), dysfunctional attitudes (Dugas, Schwartz, & Francis, 2004), positive beliefs about worry, negative problem orientation, and cognitive avoidance (Dugas et al., 1998). In addition, intolerance of uncertainty distinguishes mild versus moderate to severe GAD in clinical populations (Dugas et al., 2007).

Based on these findings, intolerance of uncertainty was proposed as a cognitive vulnerability factor for worry and GAD (Koerner & Dugas, 2008). Consistent with proposed criteria for establishing cognitive vulnerability (see Garber & Hollon, 1991; Ingram, 2003; Kraemer, Kazdin, & Offord, 1997; Riskind & Alloy, 2006), intolerance of uncertainty has shown preliminary evidence of manipulability (Ladouceur, Gosselin, & Dugas, 2000), temporal antecedence with respect to worry (Dugas & Ladouceur, 2000), stability (Buhr & Dugas, 2002; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994), and construct validity (see Koerner & Dugas, 2008; see also Koerner & Dugas, 2006, for a review). Nevertheless, the specific negative beliefs about uncertainty and its

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implications that comprise this dispositional characteristic remain to be consistently discerned.

One promising means by which to identify these beliefs would be to more closely examine measures of the intolerance of uncertainty construct to distinguish the composite factors. Intolerance of uncertainty has most commonly been assessed using the Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002; Freeston et al., 1994). Although it is employed as a unifactorial assessment tool, previous studies have pointed to an underlying multifactorial structure for the IUS (e.g., Berenbaum, Bredemeier, & Thompson, 2008; Buhr & Dugas, 2002; Carleton, Norton, & Asmundson, 2007; Freeston et al., 1994; Norton, 2005). As such, closer examination of the factors that comprise the IUS may elucidate the specific negative beliefs about uncertainty that result in intolerance of uncertainty.

Previous factor analyses of the IUS have identified several potential distinct negative beliefs about uncertainty, or factors. Exploratory factor analysis of the original French version of the IUS identified five negative beliefs about uncertainty: (a) uncertainty is unacceptable and should be avoided; (b) being uncertain reflects badly on a person; (c) uncertainty is frustrating; (d) uncertainty causes stress; and (e) uncertainty prevents action (Freeston et al., 1994). Subsequent exploratory factor analysis with the English translation found a four-factor structure instead, comprising these four beliefs: (a) uncertainty leads to the inability to act; (b) uncertainty is stressful and upsetting; (c) unexpected events are negative and should be avoided; and (d) being uncertain about the future is unfair (Buhr & Dugas, 2002). Neither set of factors were proposed as subscales but rather were intended to provide evidence of the content validity of the IUS.

Despite these initial findings, the specific beliefs about uncertainty identified in the Freeston et al. (1994) and Buhr and Dugas (2002) exploratory factor analyses have not been consistently derived or confirmed. For instance, in a series of exploratory analyses in various ethnic groups, Norton (2005) was unable to replicate the item composition of either the four- or five-factor solutions. Similarly, Berenbaum et al. (2008) arrived at a four-factor structure (Desire for Predictability, Uncertainty Paralysis, Uncertainty Distress, and Inflexible Uncertainty Beliefs) for the English version using exploratory factor analysis, but only two factors overlapped substantially with those identified by Buhr and Dugas (2002). Finally, Carleton et al. (2007) found that neither the original four factors nor the five factors provided an adequate fit to the data upon confirmatory factor analysis. Yet despite the poor support for either multifactorial solution, a unitary structure provided a similarly poor fit. Given this finding, and the inconsistencies in previous studies, further analysis of the specific negative beliefs about uncertainty assessed by the IUS is warranted.

An alternative approach was employed by Carleton et al. (2007), who proposed a two-factor structure for a shortened version of the IUS composed of 12 of the original 27 items. To this end, two nonoverlapping factors, one from each of the previously identified five- and four-factor solutions, were selected and refined. The two ensuing subscales were labeled Prospective Anxiety and Inhibitory Anxiety and were composed of seven items from the “Uncertainty Is Unacceptable and Should Be Avoided” Factor (Freeston et al., 1994) and five items from the “Uncertainty Leads to the Inability to Act” Factor (Buhr & Dugas, 2002), respectively. Confirmatory factor analyses found that these two refined factors provided a superior fit to the data than did a single-factor solution or the originally proposed four- and five-factor solutions. Carleton et al., however, did not explore alternative full-scale factor solutions. Furthermore, Carleton et al.’s two factors were not selected on the basis of content but rather were chosen with the aim of establishing nonoverlapping factors, and much of the subsequent refinement of the two factors was based on the apparent face validity of the items rather than on theoretical grounds. Given these considerations, a more content-driven analysis of the underlying factors of the IUS and a re-examination of the full-scale factor structure are warranted in order to identify the set of negative beliefs about uncertainty that comprise the construct.

The present study sought first to explore alternative factor solutions for the IUS full scale using exploratory factor analysis and second to assess the goodness of fit of these newly derived solutions using confirmatory factor analysis. To conduct these analyses, a large nonclinical sample was extracted from archival IUS data. Specifically, data from 16 previous studies conducted in the Anxiety Disorders Laboratory at Concordia University and employing the English translation of the IUS were compiled and subjected to a series of factor analyses. A secondary aim of this investigation was to assess the validity of the derived subscales, or specific beliefs about uncertainty, by examining their relative associations with symptoms of worry, anxiety, and depression and with analogue GAD diagnostic status.

Method

Participants and Procedure

The archival data used in this study were from 2,451 individuals who participated in 16 studies conducted between 1998 and August 2006 in the Anxiety Disorders Laboratory at Concordia University in Montreal, Canada that employed the Intolerance of Uncertainty Scale (English translation). Participants were recruited from undergraduate classes at Concordia University and from the surrounding community. This nonclinical sample was recruited through sign-up sheets circulated in undergraduate university classes as well as through advertisements posted on the university campus and in the surrounding neighborhood. All participants provided written informed consent. As would be expected given that common recruitment methods were employed across studies all within the same geographic area, a survey of the demographic composition (e.g., age, gender ratios, ethnic background) of the 16 samples showed them to be highly similar. Participants were therefore pooled across the 16 samples and then randomly allocated to one of two groups; an exploratory factor analysis was conducted with the first group of participants ($n = 1{,}230$), and the second group was retained for follow-up confirmatory factor analyses ($n = 1{,}221$).

Participants in the exploratory sample ranged in age from 17 to 80 years. Approximately 72.4% of this sample was female ($n = 890$) and 27.6% ($n = 339$) was male (1 participant did not report gender), and there was a significant albeit small gender difference in IUS scores ($M = 57.44$, $SD = 19.09$ for women, $M = 54.16$, $SD = 17.07$ for men), $F(1, 1227) = 7.674$, $p < .01$, $d = 0.18$. Similarly, in the confirmatory dataset, participants were aged 17 to 68 years, and 73.6% ($n = 897$) were female and 26.4% ($n = 321$) were male (3 participants did not report gender). Again, there was a significant gender difference in IUS scores, but the effect size was small (M = 56.17, SD = 18.07 for women; M = 53.69, SD = 17.31 for men), $F(1, 1216) = 4.573$, $p < .05$, $d = 0.14$. For participants who provided information on their ethnic background (self-reported ethnicity was collected in many but not all of the included studies), a comparison of ethnic frequencies across samples is reported in Table 1. No significant differences in age, gender, or ethnicity were found between the two datasets (see Table 1).

Measures

Intolerance of Uncertainty Scale (IUS; French version: Freeston et al., 1994; English translation: Buhr & Dugas, 2002). The IUS is composed of 27 items assessing negative beliefs about uncertainty and its perceived consequences. Higher scores on the IUS indicate greater intolerance of uncertainty. Similar to the original French measure, the English translation has shown excellent internal consistency (α = .94) and temporal stability (r = .74 over 5 weeks) and has demonstrated convergent, criterion, and discriminant validity (Buhr & Dugas, 2002, 2006) cross-culturally (Norton, 2005). In this study, the IUS showed excellent internal consistency (α = .95 in both samples), and the average interitem correlation was r = .40 (95% confidence interval [CI] = .38, .42) in the exploratory dataset and r = .39 (95% CI = .37, .41) in the confirmatory dataset.

Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990). The PSWQ is composed of 16 items assessing the frequency and intensity of worry, with higher scores indicating higher levels of generalized worry. The PSWQ has evidenced excellent internal consistency in this (α = .94 in the exploratory and .93 in the confirmatory samples) and other studies (α = .86 to .95) as well as good stability (r = .92 for test–retest reliability over 8 to 10 weeks, r = .74 to .93 over 4 weeks; Meyer et al., 1990; Molina & Borkovec, 1994). Average interitem correlations in this study were very good (r = .48, 95% CI = .45, .50 in the exploratory dataset; r = .47, 95% CI = .45, .49 in the confirmatory dataset). The convergent, divergent, and discriminant validity of the PSWQ is evident in both clinical and nonclinical populations (Brown, Antony, & Barlow, 1992; Meyer et al., 1990; Molina & Borkovec, 1994).

The Worry and Anxiety Questionnaire (WAQ; Dugas, Freeston, et al., 2001). The WAQ is an 11-item screening questionnaire for GAD as defined in the 4th edition of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM–IV–TR*; American Psychiatric Association, 2000). Individuals are asked to rate the frequency, controllability, and excessiveness of their worries and to report on the frequency of GAD somatic symptoms. The WAQ has shown both sensitivity and specificity as a screening tool for GAD in nonclinical samples (Dugas, Freeston, et al., 2001). In the current study, the WAQ was used as a dichotomous measure (i.e., presence vs. absence) of analogue GAD diagnostic status, with analogue GAD coded as 1 and absence of full diagnostic criteria coded as 0.

State–Trait Anxiety Inventory—Trait version (Form Y; STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1977). The STAI-T is a 20-item measure of the "relatively stable individual differences in anxiety proneness" (Spielberger et al., 1977, p. 5), or trait anxiety. Reviews of this construct suggest that there is considerable theoretical overlap between this construct and the constructs of neuroticism or negative affect (Barlow, 2002; Watson & Clark, 1984; Zinbarg & Barlow, 1996). Higher scores on the STAI-T indicate higher levels of trait anxiety, or neuroticism. The STAI-T has demonstrated stability (r = .71 to .75 over 30 days, r = .65 to .68 over 60 days in a student sample; Spielberger et al., 1977) and good internal consistency in student (e.g., α = .81; Bernstein & Eveland, 1982) and anxiety disorder patient samples (α = .89; Beiling, Antony, & Swinson, 1998). High correlations between the STAI-T and other measures of anxiety attest to its construct validity (Beiling et al., 1998; Creamer, Foran, & Bell, 1995). In this study, the STAI-T showed excellent internal consistency (α = .93 in the exploratory sample and α = .92 in the confirmatory sample) and good average interitem correlations (r = .38, 95% CI = .34, .43 in the exploratory sample; r = .36, 95% CI = .32, .41 in the confirmatory sample).

Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988). The BAI is a 21-item measure of anxiety symptomatology that is designed to have minimal overlap with depressive symp-

Table 1
Means, Standard Deviations, and Frequencies on Demographic Variables in the Exploratory and Confirmatory Samples

Measure	Exploratory sample	Confirmatory sample	df	F	χ^2	d	φ	p
Age, M (SD)	23.83 (6.44)	23.65 (6.28)	1, 2430	0.508		0.03		.48
Gender, %			1, 2445		0.469		.01	.49
Women	72.4	73.6						
Men	27.6	26.4						
Ethnic origin,[a] %			7, 1856		4.726		.05	.69
White/European	67.2	67.9						
Black	9.9	9.1						
Asian	7.6	7.4						
Hispanic	2.7	2.3						
Middle Eastern	5.0	3.8						
Native American	0.7	1.3						
Multiracial	4.1	5.1						
Other	2.8	3.1						

Note. n = 1,230 in the exploratory sample and n = 1,221 in the confirmatory sample.
[a] Frequencies are expressed as a percentage of participants who reported on their ethnic origin (n = 954 participants in the exploratory sample and n = 910 participants in the confirmatory sample).

Table 2
Promax-Rotated Principal Factor Standardized Regression Coefficients and Final Communality Estimates (h^2) of the IUS (n = 1,230)

No.	Item	Factor 1	Factor 2	h^2
12	When it's time to act, uncertainty paralyses me.	**.84**	−.03	.65
14	When I am uncertain, I can't go forward.	**.83**	−.04	.64
22	Being uncertain means that I lack confidence.	**.83**	−.13	.54
15	When I am uncertain, I can't function very well.	**.80**	.04	.69
13	Being uncertain means that I am not first rate.	**.74**	.07	.63
1	Uncertainty stops me from having a strong opinion.	**.72**	−.22	.32
16	Unlike me, others seem to know where they are going with their lives.	**.70**	−.05	.44
17	Uncertainty makes me vulnerable, unhappy, or sad.	**.65**	.24	.72
2	Being uncertain means that a person is disorganized.	**.63**	−.11	.31
20	The smallest doubt can stop me from acting.	**.63**	.11	.51
25	I must get away from all uncertain situations.	**.51**	.32	.61
9	Uncertainty keeps me from living a full life.	**.48**	.40	.68
24	Uncertainty keeps me from sleeping soundly.	**.47**	.20	.41
23	I think it's unfair that other people seem to be sure about their future.	**.46**	.25	.46
3	Uncertainty makes life intolerable.	**.44**	.26	.44
10	One should always look ahead so as to avoid surprises.	−.25	**.84**	.45
18	I always want to know what the future has in store for me.	−.18	**.84**	.50
5	My mind can't be relaxed if I don't know what will happen tomorrow.	<−.01	**.78**	.60
19	I can't stand being taken by surprise.	<.01	**.74**	.55
21	I should be able to organize everything in advance.	−.09	**.73**	.43
8	It frustrates me not having all the information I need.	<.01	**.71**	.51
7	Unforeseen events upset me greatly.	.12	**.69**	.61
11	A small unforeseen event can spoil everything even with the best planning.	.17	**.53**	.45
4	It's unfair having no guarantees in life.	.20	**.51**	.45
6	Uncertainty makes me uneasy, anxious, or stressed.	.33	**.51**	.63
26	The ambiguities in life stress me.	.37	**.44**	.59
27	I can't stand being undecided about my future.	.31	**.42**	.47
	Eigenvalues following rotation	**11.94**	**11.40**	

Note. Significant promax-rotated principal factor standardized regression coefficients from the pattern matrix are those >.40 and appear in boldface. The two-factor rotated solution accounted for 52.9% of the variance. The two factors were correlated at $r = .77$. IUS = Intolerance of Uncertainty Scale; Factor 1 = Uncertainty Has Negative Behavioral and Self-Referent Implications; Factor 2 = Uncertainty Is Unfair and Spoils Everything.

toms (Beck et al., 1988). Higher scores are indicative of greater, mainly somatic anxiety (Cox, Cohen, Direnfeld, & Swinson, 1996). The BAI has shown excellent internal consistency in anxiety disorder patient (α = .85 to .92; Beck & Steer, 1993) and undergraduate student samples (α = .90 to .91; Creamer et al., 1995) as well as good test–retest reliability (r = .83 in a panic disorder patient sample over 5 weeks; de Beurs, Wilson, Chambless, Goldstein, & Feske, 1997). The BAI showed excellent internal consistency in this study (α = .90 in the exploratory and α = .91 in the confirmatory samples), and average interitem correlations were adequate (r = .31, 95% CI = .27, .34 in the exploratory sample; r = .33, 95% CI = .30, .36 in the confirmatory sample). The BAI has shown convergent validity with anxiety measures (Beck et al., 1988) and, compared to the STAI-T, has evidenced superior discriminant validity with measures of depressive symptomatology (Creamer et al., 1995; Fydrich, Dowdall, & Chambless, 1992).

Center for Epidemiologic Studies—Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item measure of depressive symptomatology intended for use in the general population. Higher scores indicate a higher frequency of depressive symptoms over the past week. The CES-D has shown very good to excellent internal consistency (α = .85 in community samples and α = .90 in outpatient and inpatient samples) and test–retest reliability (r = .51 to .67 over 2 to 8 weeks, r = .32 to .54 over 3 to 12 months; Radloff, 1977). In this study, the CES-D showed excellent internal consistency (α = .91 in both samples) and good average interitem correlations (r = .34, 95% CI = .30, .37 in the exploratory sample; r = .33, 95% CI = .29, .36 in the confirmatory sample). The CES-D has shown convergent validity with other measures of depressive symptoms (Radloff, 1977; Weissman, Prusoff, & Newberry, 1975, as cited in Radloff, 1977) and has evidenced a highly stable (Shafer, 2006) four-factor structure, which attests to its construct validity.

Results

Preliminary Analyses

Data screening and outlier analysis. Analysis of all study measures for multivariate outliers, univariate outliers, and distribution normality was performed in the exploratory factor analysis dataset and in the confirmatory factor analysis dataset separately. First, to identify multivariate outliers, Mahalanobis distance was computed and a conservative chi-square cutoff of $p < .001$ was employed, given the narrow 5-point range of individual IUS items. Second, univariate outliers for the total scale scores were defined as data points ±3.29 *SD*s from the mean ($p < .001$, two-tailed; Tabachnick & Fidell, 2001). For the exploratory factor analysis, 89 multivariate IUS item outliers and 5 univariate outliers on the IUS total score were identified and excluded. For the confirmatory factor analysis dataset, 91 IUS item multivariate outliers and an

Table 3
Univariate Summary Statistics, Interitem and Item-Total Correlations of the IUS: Confirmatory Dataset (n = 1,221)

Item	*M*	*SD*	r_{corr}	1	2	3	4	5	6	7	8	9	10	11
1	2.7	1.1	.45	—										
2	1.7	0.9	.43	.32	—									
3	1.8	1.0	.57	.29	.40	—								
4	2.0	1.1	.57	.24	.25	.51	—							
5	2.0	1.1	.66	.26	.25	.42	.46	—						
6	2.5	1.1	.73	.35	.28	.46	.46	.65	—					
7	2.1	1.0	.66	.28	.25	.41	.40	.53	.59	—				
8	2.8	1.1	.57	.25	.22	.37	.37	.47	.53	.48	—			
9	1.8	2.0	.71	.35	.37	.50	.41	.53	.57	.50	.45	—		
10	2.5	1.2	.47	.16	.18	.27	.21	.37	.38	.39	.41	.40	—	
11	2.1	1.1	.52	.27	.23	.26	.30	.33	.35	.46	.33	.39	.42	—
12	1.8	0.9	.67	.41	.34	.38	.36	.38	.47	.46	.33	.54	.28	.40
13	1.6	0.9	.63	.33	.43	.40	.36	.38	.44	.38	.32	.52	.24	.31
14	1.8	0.9	.68	.38	.35	.41	.34	.41	.50	.44	.37	.54	.28	.34
15	1.9	0.9	.71	.36	.33	.43	.39	.48	.56	.48	.39	.58	.28	.33
16	2.1	1.2	.57	.33	.26	.30	.35	.31	.40	.32	.26	.38	.17	.29
17	2.0	1.0	.78	.38	.35	.48	.44	.50	.61	.54	.43	.61	.34	.42
18	2.5	1.2	.61	.24	.20	.33	.42	.50	.47	.41	.40	.37	.45	.35
19	1.8	0.9	.62	.20	.27	.35	.36	.48	.44	.57	.40	.44	.44	.40
20	2.0	1.0	.47	.41	.24	.31	.32	.38	.47	.42	.35	.44	.28	.36
21	2.5	1.1	.36	.16	.15	.23	.25	.38	.33	.37	.41	.29	.44	.33
22	2.0	1.1	.46	.39	.40	.37	.33	.33	.46	.36	.31	.49	.21	.27
23	1.7	1.0	.49	.25	.26	.32	.47	.36	.38	.34	.24	.37	.20	.30
24	1.9	1.1	.42	.24	.24	.35	.33	.48	.51	.44	.37	.45	.26	.30
25	1.6	0.9	.53	.29	.32	.41	.44	.44	.47	.44	.33	.52	.33	.39
26	2.1	1.0	.59	.31	.27	.45	.45	.52	.63	.50	.44	.55	.33	.38
27	2.4	1.2	.47	.26	.23	.35	.43	.43	.48	.40	.41	.41	.30	.35

Note. Intolerance of Uncertainty Scale (IUS) item intercorrelations are polychoric correlations computed using EQS Version 6.1 software (Bentler, 1995; Bentler & Wu, 1995). r_{corr} = corrected item-total correlations. All correlations are significant at $p < .001$.

additional 5 univariate outliers were identified and removed from the dataset.

All measures in both samples were then assessed for skewness and kurtosis in the distribution of total scale scores. The IUS was significantly positively skewed in both the exploratory and confirmatory factor analysis datasets (skew = .827 and .843, respectively). Significant kurtosis in the IUS was not observed in either dataset (kurtosis = .235 and .389, respectively). All remaining total scale scores were also within skew tolerances (i.e., skew/$SE < |5|$, given $N > 100$) and within kurtosis tolerances (i.e., kurtosis/$SE < |5|$, given $N > 100$). We opted not to correct for the observed skewness in the IUS due to the nature of the population sampled. Specifically, as this study employed primarily clinical assessment tools in a nonclinical sample, some degree of positive skew was expected and was presumed to reflect the characteristics of the sample rather than a bias in the observed scores.

For the IUS, normality of the distribution was also assessed at the item level. Significant positive skewness was observed for most individual IUS items. In particular, all but three IUS items (Items 1, 8, and 10) were significantly positively skewed in the exploratory sample, and all items except Items 1, 6, and 8 showed significant positive skew in the confirmatory sample. Significant kurtosis was also observed in several IUS item distributions (Items 2, 8, 9, 13, 23, and 25 in the exploratory sample; Items 1, 2, 9, 13, 19, 23, 25, and 27 in the confirmatory sample). Rather than transforming items, which could reduce the ecological validity of our factor analytic findings, we opted to use polychoric correlations for the exploratory factor analysis and employed an alternate method of extraction in the confirmatory factor analysis to adjust for the observed skewness and kurtosis in the IUS and guard against potential bias in the goodness-of-fit indices.

Psychometric Properties of the IUS

Exploratory factor analysis. Exploratory factor analysis was conducted using SPSS Version 15 software. Principal axis factoring (PAF) was selected as the method of extraction. Polychoric correlations were computed using EQS Version 6.1 software (Bentler, 1995; Bentler & Wu, 1995) and then imported into SPSS. Kaiser's (1970) measure of sampling adequacy (the Kaiser–Meyer–Olkin MSA) indicated that this intercorrelation matrix was appropriate for factor analysis (MSA = 0.97). The Kaiser rule (minimum eigenvalue = 1; Kaiser, 1970) suggested a three-factor solution (the first 10 eigenvalues were 13.47, 1.76, 1.20, 0.98, 0.90, 0.73, 0.70, 0.58, 0.55, and 0.54). In contrast, the scree test (Cattell, 1966) suggested that a two-factor solution may be more appropriate. Velicer's minimum average partial (MAP) test (Velicer, 1976) and Horn's parallel analysis (Horn, 1965) were also conducted to determine the number of factors to be extracted. Zwick and Velicer (1986) have suggested that these two tests are the most reliable in determining the appropriate number of components to retain. These tests were conducted in SPSS using the command syntax proposed by O'Connor (2000). The MAP test suggested a two-factor solution (as the minimum average partial correlation corresponded to two principal components). In addition, in a parallel analysis, only the first two eigenvalues (13.47

Table 3 (*continued*)

12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
—															
.60	—														
.62	.58	—													
.59	.57	.75	—												
.43	.42	.44	.46	—											
.57	.53	.60	.63	.56	—										
.35	.30	.36	.39	.36	.48	—									
.41	.39	.37	.41	.28	.46	.49	—								
.54	.42	.52	.50	.39	.53	.40	.45	—							
.28	.29	.27	.29	.20	.31	.42	.42	.35	—						
.48	.52	.50	.48	.43	.55	.30	.33	.43	.29	—					
.40	.41	.39	.40	.60	.48	.38	.31	.34	.24	.41	—				
.41	.37	.42	.45	.36	.53	.33	.39	.38	.27	.33	.38	—			
.52	.49	.49	.52	.40	.56	.43	.50	.48	.35	.46	.47	.48	—		
.48	.48	.52	.53	.43	.63	.47	.44	.46	.35	.48	.47	.54	.58	—	
.38	.35	.40	.44	.50	.51	.51	.43	.43	.35	.39	.47	.38	.45	.51	—

and 1.76, as reported above) were found to be larger than the eigenvalues in the 95th percentile (the first five randomly generated eigenvalues derived from 1,000 randomly generated datasets with 27 variables and 1,230 cases were 1.31, 1.27, 1.24, 1.21, and 1.18). Given the convergence of the scree plot, MAP test, and parallel analysis, the two-factor solution was selected as the most appropriate.

Because the factors assess facets of the same underlying intolerance of uncertainty construct, they were expected to correlate to some degree. Promax (oblique) rotation was therefore employed. The resulting two-factor solution explained 52.9% of the variance (the two eigenvalues calculated after the rescaling of factor coefficients following rotation were 11.94 and 11.40), and the factors showed a correlation of $r = .77$.

In examining the individual items, a cutoff of $>.40$ was employed to identify significant factor coefficients. Factor 1 was found to be composed of 15 items denoting the beliefs that uncertainty impairs performance and reflects poorly on an individual's character; this factor was labeled "Uncertainty Has Negative Behavioral and Self-Referent Implications." Factor 2 was composed of 12 items that assessed the belief that future events ought to be predictable and that uncertainty about the future is unfair and therefore frustrating or upsetting; this factor was labeled "Uncertainty Is Unfair and Spoils Everything." There were no hyperplane and no complex items. Promax-rotated principal factor standardized regression coefficients from the pattern matrix are presented in Table 2.

Confirmatory factor analysis. Confirmatory factor analysis of the proposed two-factor structure of the IUS was performed with the EQS structural equation program, Version 6.1 (Bentler, 1995; Bentler & Wu, 1995). Given the high degree of skewness and kurtosis among the IUS items (Mardia's coefficient of multivariate kurtosis = 136.93, normalized estimate $Z = 60.45$), the elliptical (ERLS) method of estimation was employed. This method of extraction was chosen in preference to alternative approaches for nonnormally distributed data, as it has been suggested that elliptical estimation is less prone to error when employing small sample sizes or, as is more pertinent in this context, when testing complex models (Kline, 1998). As was done in the exploratory factor analysis, the two factors were allowed to covary, given that the proposed subscales compose the same construct and were therefore expected to be highly correlated. Correlations between the observed variables, or IUS items, are presented in Table 3 along with IUS item means, standard deviations, and corrected item-total correlations.

All items loaded significantly on their respective factor, with the strength of association ranging from $r^2 = .22$ to .66 (see Table 4 for factor loadings of the IUS for the confirmatory factor analysis), and the factors were correlated at $r = .87$. As the chi-square measure of the goodness of fit can be unreliable, particularly in large samples (Brown, 2006; Tabachnick & Fidell, 2001), additional indices of model fit were assessed. The two-factor model generally met conventional standards for good model fit, though the model $\chi^2(323) = 2479.477$ was significant ($p < .001$). This model produced a Bentler–Bonett normed fit index (NFI) of .96 (NFIs $> .90$ are indicative of good model fit; Tabachnick & Fidell, 2001), a comparative fit index (CFI) of .97 (CFIs $> .95$ indicate good fit; Hu & Bentler, 1999; Tabachnick & Fidell, 2001), and a

Table 4
Factor Loadings for the Confirmatory Factor Analysis of the IUS (n = 1,221)

No.	Item	Factor 1	Factor 2	E
17	Uncertainty makes me vulnerable, unhappy, or sad.	.81		.81
15	When I am uncertain, I can't function very well.	.78		.62
14	When I am uncertain, I can't go forward.	.77		.64
9	Uncertainty keeps me from living a full life.	.74		.68
12	When it's time to act, uncertainty paralyses me.	.74		.68
13	Being uncertain means that I am not first rate.	.70		.71
25	I must get away from all uncertain situations.	.70		.71
22	Being uncertain means that I lack confidence.	.66		.75
20	The smallest doubt can stop me from acting.	.65		.76
16	Unlike me, others seem to know where they are going with their lives.	.61		.79
24	Uncertainty keeps me from sleeping soundly.	.60		.80
3	Uncertainty makes life intolerable.	.58		.81
23	I think it's unfair that other people seem to be sure about their future.	.58		.81
1	Uncertainty stops me from having a strong opinion.	.49		.87
2	Being uncertain means that a person is disorganized.	.47		.88
6	Uncertainty makes me uneasy, anxious or stressed.		.78	.62
26	The ambiguities in life stress me.		.75	.66
5	My mind can't be relaxed if I don't know what will happen tomorrow.		.73	.69
7	Unforeseen events upset me greatly.		.72	.70
18	I always want to know what the future has in store for me.		.66	.75
19	I can't stand being taken by surprise.		.66	.75
27	I can't stand being undecided about my future.		.65	.76
8	It frustrates me not having all the information I need.		.63	.77
4	It's unfair having no guarantees in life.		.59	.81
10	One should always look ahead so as to avoid surprises.		.53	.85
11	A small unforeseen event can spoil everything even with the best planning.		.54	.84
21	I should be able to organize everything in advance.		.52	.85

Note. All factor loadings are significant at $p < .05$. IUS = Intolerance of Uncertainty Scale; Factor 1 = Uncertainty Has Negative Behavioral and Self-Referent Implications; Factor 2 = Uncertainty Is Unfair and Spoils Everything; E = standardized error variance. Comparative fit index = .97; Bentler–Bonett normed fit index = .96; standardized root-mean-square residual = .05; root-mean-square error of approximation = .07.

standardized root-mean-square residual (SRMR) of .05 (SRMRs < .08 are recommended; Hu & Bentler, 1999), although the root-mean-square error of approximation (RMSEA) was .07 (whereas RMSEAs < .06 are recommended; Hu & Bentler, 1999). Thus, overall, the two-factor model provided a good fit to the data.

For comparative purposes, given the high observed correlation between the factors, which can indicate poor factor differentiation, a unitary factor solution was assessed. This one-factor solution provided an adequate fit to the data, $\chi^2(324) = 5390.164$, $p < .001$; Bentler–Bonett NFI = .93; CFI = .93; SRMR = .06; RMSEA = .11, though not all measures of goodness of fit (e.g., chi-square, CFI, RMSEA) were above conventional criteria as specified by Hu and Bentler (1999). In contrast, the two-factor solution provided a superior fit to the data, $\Delta\chi^2(1) = 2910.687$, $p < .001$.

Internal consistency. The IUS subscales showed excellent internal consistency in the exploratory ($\alpha = .92$ for Factor 1, $\alpha = .91$ for Factor 2) and confirmatory ($\alpha = .92$ for Factor 1, $\alpha = .90$ for Factor 2) datasets.

Construct Validity of the IUS Items

Assessing the overlap between IUS items and a measure of worry. Given the high correlations between the IUS and PSWQ observed in previous research (e.g., correlations ranging from r = .57 to r = .69 have been observed; e.g., Dugas et al., 2004; Robichaud, Dugas, & Conway, 2003), we sought to ensure that all IUS items were assessing the construct of intolerance of uncertainty rather than the phenomenon of worry. To this end, correlations between individual IUS items and the PSWQ and IUS total scores were computed and compared using Fisher's Z test of nonindependent correlations (Meng, Rosenthal, & Rubin, 1992). All IUS items showed significantly stronger correlations with the IUS total score (jackknife correlations ranged from r = .42 to r = .78 in the exploratory dataset) than with the PSWQ (correlations ranged from r = .20 to r = .60; Fisher's Z ranged from Z = 2.52 to Z = 14.93, n = 1,102, $p < .05$; similar correlations were observed in the confirmatory dataset). The effect size of this difference between correlations was moderate ($r^2_{\text{difference}}$ ranged from .06 to .33 in the exploratory sample).

Construct Validity of the IUS Subscales

Factor score correlations with worry, anxiety, and depression measures. As a preliminary examination of the construct validity of the two factors, correlations were computed between these factors and measures of excessive worry, analogue GAD status, trait anxiety (or neuroticism), somatic anxiety, and depressive symptomatology. For the analysis with GAD diagnostic status, biserial rather than point-biserial correlations were calculated (given that the symptoms of this disorder exist on a continuum, raising the potential that point-biserial correlations with this dichotomous variable may be attenuated; Fields, 2005). In the exploratory sample, factor scores were computed in SPSS as regression-based coefficients derived from PAF, so as to obtain a more "pure" measure of each factor. Factor score correlations were then compared using Fisher's *Z* test of nonindependent correlation coefficients (Meng et al., 1992). Analogue GAD diagnostic status as assessed by the WAQ, trait anxiety/neuroticism as assessed by the STAI-T, and depressed mood as assessed by the CES-D were more strongly correlated with the belief that uncertainty has negative behavioral and self-referent implications (Factor 1). There were no significant differences between the two factors in their correlation with the PSWQ or BAI (see Table 5 for factor score correlations with all study measures).

Subscale correlations with worry, anxiety, and depression measures. The IUS factors derived in this study are intended to be employed as subscales in future uses of this measure. A preliminary evaluation of the utility of these subscales, computed from the raw scores rather than weighted factor scores, was therefore conducted using the confirmatory factor analysis sample. Subscale scores were computed as the sum of the raw scores of all items comprising a subscale. Pearson correlations between the two subscales and the PSWQ, STAI-T, BAI, and CES-D, as well as biserial correlations with the WAQ, were subsequently computed (see Table 5) and compared using Fisher's *Z* test of nonindependent correlation coefficients (Meng et al., 1992). Similar to the results with the factor scores, the WAQ, STAI-T, and the CES-D were more highly related to the belief that uncertainty has negative behavioral and self-referent implications (Subscale 1). In addition, the BAI was found to be more highly correlated with Subscale 1 than with Subscale 2. In contrast, the PSWQ showed a similarly high correlation with both subscales.

Table 5
Factor Score and Subscale Correlations With the Study Measures and Descriptive Statistics for the Subscales of the IUS

Measure	Factor 1	Factor 2	*n*	Fisher's *Z*	$r^2_{difference}$
Exploratory dataset (n = 1,230): Factor score correlations[a]					
PSWQ	.62	.65	469[b]	−1.30	.04
WAQ[c]	.65	.55	559	4.90**	.12
STAI-T	.68	.58	264	3.69**	.13
BAI	.50	.47	426	1.00	.03
CES-D	.63	.56	431	2.84**	.08
M	28.89	27.62			
SD	10.45	9.31			
Confirmatory dataset (n = 1,221): Subscale correlations[d]					
PSWQ	.59	.62	431[e]	−1.31	.04
WAQ[c]	.65	.58	535	3.24**	.09
STAI-T	.66	.59	242	2.11*	.09
BAI	.58	.51	413	2.69**	.08
CES-D	.58	.48	426	3.95**	.11
M	28.23	27.27			
SD	10.06	8.94			

Note. IUS = Intolerance of Uncertainty Scale; Factor 1 = Uncertainty Has Negative Behavioral and Self-Referent Implications; Factor 2 = Uncertainty Is Unfair and Spoils Everything; PSWQ = Penn State Worry Questionnaire; WAQ = Worry and Anxiety Questionnaire; STAI-T = State–Trait Anxiety Inventory—Trait version; BAI = Beck Anxiety Inventory; CES-D = Center for Epidemiological Studies Depression Scale.
[a] Factor scores were computed in SPSS from regression coefficients derived from principal axis factoring. [b] Participants were randomly selected from a sample of n = 1,102 who completed the PSWQ. [c] Biserial correlation; analogue generalized anxiety disorder diagnostic status coded as 1, absence of full generalized anxiety disorder diagnostic criteria coded as 0. [d] Subscale scores were computed as the raw sum of the items loading on their respective factors. [e] Participants were randomly selected from a sample of n = 1,107 who completed the PSWQ.
* $p < .05$, two-tailed. ** $p < .01$, two-tailed.

Discussion

The purpose of this study was to identify and validate the set of negative beliefs about uncertainty that comprise the construct of intolerance of uncertainty, as assessed by the IUS. Two subscales were derived using exploratory factor analysis. Subsequent confirmatory factor analysis found that these two factors provide an adequate fit to the observed item intercorrelations on the IUS. A survey of the items that loaded on Factor 1 suggested that this factor encompasses the beliefs that being uncertain impairs behavior and reflects badly on an individual's character; accordingly, this factor was labeled "Uncertainty Has Negative Behavioral and Self-Referent Implications." The second set of items reflected the belief that the future should be predictable and that unpredictability is unfair and therefore distressing; accordingly, Factor 2 was labeled "Uncertainty Is Unfair and Spoils Everything." Both factor labels therefore showed face validity for the items they comprise. Nonetheless, Tracy (1990) has recommended that additional methods be employed to assess the validity of factor labels.

As an initial step toward validating the two distinct IUS factors, this study found differential patterns of correlations for the subscales with measures of worry, analogue GAD diagnostic status, somatic anxiety, depression, and neuroticism. Factor 1 was more highly associated with measures of depression, trait anxiety/neuroticism, and analogue GAD diagnostic status in both samples and with somatic anxiety in the confirmatory sample. Despite the high correlations of both subscales with all symptom measures, the effect sizes of the difference in these correlations were nonetheless moderate. Overall, these findings suggest that there is a meaningful distinction between the two subscales in their association with symptoms of emotional disorders. Worry, in contrast, showed a similar strength of association with both factors, providing support for the criterion-related validity of these subscales.

This study also found support for the validity of the proposed factor labels. The stronger association of Factor 1 with depressive symptoms is consistent with the self-referent nature of the perceived implications of uncertainty reflected in the Factor 1 items (e.g., "Being uncertain means that I am not first rate" or "that I lack confidence"). These negative self-appraisals are similar to the negative thinking patterns described in the literature on cognitive vulnerabilities to depression (e.g., Ingram, 2003). In addition, the perceived behavioral implications of Factor 1 (e.g., "When it's time to act, uncertainty paralyses me"; "When I am uncertain, I can't function very well") may lead to reduced confidence in one's ability to cope with threat. This reduced confidence may contribute to more somatic anxiety in threatening situations, as suggested by the stronger correlation between the BAI and Factor 1 in the confirmatory sample. This finding was not, however, observed with the factor scores in the exploratory sample. To the extent that factor scores may be a more "pure" measure of a construct, there remains the possibility that this is a spurious finding. Alternatively, the greater strength of association between somatic anxiety and Factor 1 may not be as consistent or robust as the relationship between Factor 1 and trait anxiety/neuroticism or depression, or it may depend on other worry-related processes at play.

Finally, the stronger correlations of depression and anxiety with Factor 1 suggest this factor may be the more affectively laden component of intolerance of uncertainty. This affectivity would account for the stronger correlation between the STAI-T and Factor 1 compared to Factor 2. It may also be this same experience of distress or interference as a result of worrying, an integral part of *DSM–IV–TR* criteria (American Psychiatric Association, 2000), that accounts for the higher correlation between Factor 1 and the WAQ. However, as this study's subscale correlation analyses were exploratory in nature, further research examining correlates of these proposed subscales over time and in clinical contexts is needed to replicate and clarify these relationships. In addition, future studies should examine the incremental validity of the two IUS subscales to explore their relative utility in the prediction of these criterion variables.

The factor solution arrived at in this study offers several advantages over previous factor analytic findings for the IUS. First, it is likely that the factors inherent in the IUS have been oversampled in previous factor analyses (e.g., Buhr & Dugas, 2002; Freeston et al., 1994), given the high number of cross-loading items observed in these factor solutions and the use of a more liberal >.30 cutoff for factor coefficients. This study's use of a substantially larger sample than in previous studies may increase the reliability of the results obtained and reduce the possibility of oversampling factors. Second, the use of a more stringent cutoff to establish the significance of factor loadings (i.e., >.40) ensured that only meaningfully related items were retained in the factor solution; that all items were nonetheless significantly and highly related to their respective factors argues against the exclusion of individual items to shorten the IUS, which was the approach employed by Carleton et al. (2007). Third, the use of both exploratory and confirmatory factor analytic techniques employed on separate samples allowed for a more complete and nuanced re-examination of the factor structure of the IUS. Finally, the use of principal axis factoring (PAF), which many have argued may more accurately derive the true latent factors (Brown, 2006; Conway & Huffcutt, 2003; Ford, MacCallum, & Tait, 1986), coupled with a more conceptually driven approach to factor interpretation, afforded a more meaningful analysis of the component factors that underlie intolerance of uncertainty.

Despite these advantages, a substantial amount of variance was not accounted for by the two common factors derived in this study. Although the 52.9% of variance explained by the two-factor PAF solution is comparable to previous factor analyses of the English version of the IUS (e.g., Berenbaum et al., 2008; Buhr & Dugas, 2002), a considerable proportion of variance remains unexplained. The use of PAF, which analyzes common variance, as opposed to principal components analysis (PCA), which analyzes both common and specific variance, may have contributed to the moderate proportion of variance explained by our two-factor solution. Further research is needed to assess to what extent the residual variance represents measurement error as opposed to unique but reliable variability captured by individual IUS items; the existence of substantial item-specific variance may have important implications for our conceptualization of the IUS subscales and for any future revisions to this measure.

The results of this study are primarily limited by the use of a nonclinical sample of convenience. Although this nonclinical sample was necessary to obtain the required number of participants for the analyses conducted, it may limit the generalizability of the findings to the clinical populations in which the IUS is commonly employed. Previous research on the IUS employing the original French version has found comparable psychometric properties in clinical and nonclinical populations (Dugas & Robichaud, 2007). Nonetheless, the proposed subscales should be validated in a clinical sample of GAD participants. Of further interest is the question of whether, and to what extent, these IUS factors may be relevant in other, often comorbid, anxiety and mood disorders. For instance, it has been theorized that high levels of worry may lead to symptoms of depression and demoralization in GAD (e.g., Dugas et al., 1998). It is conceivable that beliefs about the negative behavioral and self-referent implications of uncertainty captured in Factor 1 of the IUS may be particularly relevant in GAD patients who present with comorbid mood disorders. The use of a nonclinical sample, however, did not enable us to examine these questions. Finally, the clinical utility of the proposed subscales in both the diagnosis and treatment of worry and anxiety remains to be established. Future research is therefore needed to validate the proposed two-subscale structure of the IUS in alternate populations, including clinical GAD and other anxiety disorder patient samples.

Despite this limitation, a few tentative clinical implications may be drawn from this study. Given that Factor 1 was consistently more highly associated with neuroticism and depressive symptoms, individuals scoring high on this subscale may warrant assessment not only for GAD but for depression and other symptoms of negative affect. That Factor 2 was as highly predictive of worry, yet not more highly associated with any other criterion variable employed in this study, suggests that the role of this factor is not yet fully understood. Other clinical correlates of this belief about uncertainty, such as perhaps frustration, may not be captured by the symptom measures typically administered to GAD patients. The clinical presentation of these individuals therefore merits further research attention. Finally, an examination of the developmental trajectories of these beliefs may have important implications for prevention and treatment.

Tracy (1990) noted that factor labels should be regarded as hypotheses to be subjected to further testing and scrutiny. Although the current study provided preliminary evidence of the construct validity of these factors, first by confirming the two-factor structure of the IUS in an independent sample and second by assessing the factors' correlations with symptom measures, the construct validity of the proposed subscales remains to be firmly established using additional experimental methods. Closer examination of the two proposed IUS subscales and their factor labels will be needed to justify their use in clinical research and practice.

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