Is there an all-embracing "intolerance to uncertainty" construct?

French Adaptation and Validation of the Intolerance to Uncertainty Scale-Revised

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The de-identified data, as well as the R code used for analyses, are also available on the Open Science Framework (https://osf.io/7bpcy/).

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Abstract

Intolerance to uncertainty is a trait-like disposition largely studied in psychopathology and known to be involved in many psychological disorders. Yet, the very operationalization of this construct has prompted debate in the literature. Three different models have regularly been discussed: a correlated two-factor solution, a bifactorial solution, and a single-factor structure. A growing body of evidence suggests that the bifactorial model represents the adequate factorial solution; however, its validity has never been tested in a large French-speaking sample. Moreover, uncertainty remains regarding the associations between IUS-R and other psychological constructs, especially stress and depression. This project was designed to overcome these limitations. To do so, we translated the scale into French and tested (n = 728) via confirmatory factor analyses (CFA) whether the French version would better fit with a bifactorial-, correlated, or single-factor structure, as implied by previous works. We also examined the internal reliability of the IUS-R, as well as its associations with concurrent measures of stress, depression, anxiety, and worry. The results pointed to a bifactorial structure as the best-fitting model and provided evidence for a strong general intolerance of uncertainty factor that was more reliable and accounted for significantly more common variance than each subscale factor individually. We discuss how this bifactorial structure impacts the conceptualization of IU.

Keywords: Intolerance to uncertainty, trait-like disposition, psychometrics, French adaptation, assessment, clinical psychology

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Dealing with the unknown is essential to our survival, and intolerance to uncertainty (hereafter, IU) is a trait-like disposition reflecting the tendency to fear unacceptable and harmful future events characterized by uncertainty—in other words, events that may or may occur (Buhr & Dugas, 2002; Carleton et al., 2007). Research on IU initially took place within cognitive approaches to Generalized Anxiety Disorder (e.g., Dugas et al., 1998). For instance, the prominent Intolerance of Uncertainty Model of GAD (IUM) of Dugas et al. (1998) views IU as a cognitive vulnerability factor for worry that drives and maintains GAD. However, IU is now regarded as a critical transdiagnostic process involved in the onset and maintenance of several emotional disorders (for a review, see Rosser, 2019), such as social anxiety disorder (Counsell et al., 2017), panic disorder (Carleton et al., 2014), obsessive-compulsive disorder (Pinciotti et al., 2021), depression (Saulnier et al., 2019), or eating disorders (Brown et al., 2017). According to current transdiagnostic views of IU, this latter affects how people perceive and react to situations wherein the risk of adverse consequences (e.g., the occurrence of a threat) are uncertain (i.e., may or may not occur), which, in turn, can trigger maladaptive emotional responses (e.g., stress, anxiety, depression; Dugas, Schwartz, & Francis, 2004; McEvoy & Mahoney, 2011) and lead to functional impairments in daily life (e.g., Zlomke & Jeter, 2014).

Regarding the assessment of IU, Freeston et al. (1994) developed the first measure of IU, namely the 27-item Intolerance of Uncertainty Scale (IUS). However, this scale has been widely criticized, notably because of a high redundancy between items and the instability of its factor structure (Birrell et al., 2011; Carleton et al., 2007; Helsen et al., 2013). To tackle these issues, Carleton et al. (2007) developed a shorter version (IUS-12), which was meant to best capture the specific hallmark features of IU. More recently, the IU-12 has been slightly

refined to make the phrasing more fluid and adapted for various populations, notably children and adolescents (Birrell et al., 2011; Helsen et al., 2013). The resulting version is the IUS-Revised (IUS-R; Walker et al., 2010), which has become the most commonly used tool for assessing IU. However, its structure has long remained disputed in the literature (McEvoy et al., 2019). Regarding its conceptualization, when Carleton et al. (2007) developed the short version of the IU, they were also the first to identify a two-factor structure underlying it. The first factor (i.e., "Prospective IU") denotes the desire for predictability and active information seeking to reduce uncertainty, and it reflects a disposition to anticipate what the future brings by seeking information and planning. The second factor (i.e., "Inhibitory IU") represents both the feeling of being stuck and unable to respond effectively when facing uncertainty as well as avoidance-oriented responses to uncertainty (Birrell et al., 2011; Bottesi et al., 2019; Hale et al., 2016).

In terms of measurements models, Carleton et al. (2007) reported that a correlated two-factor solution—that is, a correlation between these two latent variables that indicates a shared variation between them while not incorporating any general or underlying factor (for an overview, see Dunn & McCray, 2020; Reise et al., 2010)—outperforms a single-factor structure. Researchers have replicated this correlated two-factor solution several times (Fergus & Wu, 2013; Helsen et al., 2013; Jacoby et al., 2013). However, since the correlation between the two factors remained especially high (r =.73), Carleton et al. (2007) recommended using a global scale score encompassing all the items, a suggestion that has rendered comparisons between studies difficult, as different researchers used different scoring systems.

To tackle this issue, Hale et al. (2016) suggested testing the viability of a bi-factor solution, which hypothesizes a general factor onto which all items load, as well as a series of orthogonal (here, two uncorrelated) factors (for an overview of bi-factor models, see Dunn &

McCray, 2020; Reise et al., 2010). And Hale and colleagues compared this bi-factor solution to two alternative models: 1) a single-factor model (encompassing all items) and 2) a correlated two-factor model (as proposed by Carleton et al., 2007). They found that the bi-factor model outperformed the two other ones, highlighting the existence of a strong general factor underlying the IU construct, while also acknowledging the existence of two grouping factors. These observations have since been replicated across different samples with various cultural and linguistic backgrounds (Bottesi et al., 2019; Lauriola et al., 2016; Shihata et al., 2018).

However, despite the extensive use of this scale in research and practice, this scale has never been translated into French. That is unfortunate given that French is the official language in 32 countries and territories worldwide (Marcoux & Wolff, 2019). The main goals of the present study were to tackle these issues by translating, validating, and testing the psychometric properties of the IUS-R. Inspired by Hale et al. (2016), our principal interest was to test whether the bi-factor structure outperforms both a correlated two-factor model and a single-factor model in an unselected French-speaking sample. We also examined the internal reliability of the IUS-R and examined its associations with concurrent measures of anxiety, depression, stress, and worry.

Translation of the scale into French

In line with prior French adaptation of clinical measurements (e.g., Adam et al., 2015, Heeren et al., 2013; Lannoy et al., 2014), we followed the guidelines for test adaptation detailed by Hambleton and colleagues (2004). First, we translated the items into French and then back-translated them into English. Three fully bilingual experts translated the original English scale into French using a committee approach. The French version was then translated back into English and reevaluated by another bilingual expert. The first author supervised the entire translation/ backtranslation process. We asked another expert to verify

the conformity of the retranslated English version with the original version and the precision of the French items. Items with problematic back-translation were thoroughly discussed and appropriately amended. Most discrepancies were minor, involving the choice between two synonyms. The French version of the scale is available via the Open Science Framework (OSF) at https://osf.io/7bpcy/.

Method

Participants

We recruited 729 adult French-speaking participants. They were recruited from the general community via online social media and listserv advertisements. There were no recruitment criteria other than being a French-speaking adult. Regarding gender, our sample was composed of 50.55% women, 48.08% men, and 1.37% others. Participants were between the age of 18 and 81 (M = 38.71, SD = 13.93). Regarding nationality, 58.10% (n =423) were from France, 38.46% (n = 280) from Belgium, 0.82% (n =6) from Switzerland, 0.14% (n =1) from Gabon, and 2.47% (n = 18) from native French-speakers living abroad. Their years of education completed since primary school ranged from 0 to 27 (M=16.59, SD = 3.25).

The study was approved by the Institutional Review Board (Reference: 2021-12; UCLouvain Psychological Sciences Research Institute) and conducted according to the Declaration of Helsinki. Each participant provided written informed consent before completing the survey.

Measures and Procedure

Participants completed our French adaptation of The Intolerance of Uncertainty Scale-Revised (IUS-R; see above)). As in prior research on the IUS-R (e.g., Botessi et al., 2019; Carleton, 2007), we assessed depression, anxiety, stress, and worry using, respectively, the French version of the Depression Anxiety and Stress Scale (DASS-21; Ramasawmy, 2015) and the French version of the Penn State Worry Questionnaire (PSWQ; Gosselin et al., 2001).

DASS-21. The DASS-21 is a 21-item self-report instrument assessing depression, anxiety, and stress over the previous week (Ramasawmy et al., 2015). The scale is composed of three subscales with 7 items each, assessing respectively: Depression (e.g., « I couldn't seem to experience any positive feeling at all »), Anxiety (e.g., « I felt scared without any good reason»), and Stress (e.g., « I was intolerant of anything that kept me from getting on with what I was doing »). Participants rate each item on a 4-point Likert-type scale from 0 (*Did not apply to me at all*) to 6 (*Totally true for me*). Internal reliability for the three subscales was high in our sample, with Cronbach alphas of 0.89 for depression, 0.83 for anxiety, and 0.85 for stress.

PSWQ. The PSWQ is a 16-item self-report measure that assesses the frequency and intensity of worry, using a Likert rating from 1 (*Not at all typical of me*) to 5 (*Very typical of me*). The scale was originally created by Meter et al. (1990) and the French translation was developed by Gosselin et al. (2001). The scale measures worry through items such as "Many situations make me worry," "My worries overwhelm me," "Once I start worrying, I can't stop." The internal consistency of the PSWQ was high in the present sample, with a Cronbach alpha of 0.93.

Data Analysis Strategy

We performed all our analyses using R, mainly via the R packages *laavan* Rosseel, 2012) and *psych* (Revelle, 2021), as well as built-in functions. Our de-identified data and R script are publicly available via the Open Science Framework at (https://osf.io/7bpcy/).

Normality check. None of the IUS-R items violated normality, according to benchmarks of skewness from –2 to + 2 and kurtosis from –7 to +7 (Curran et al., 1996). The skewness and kurtosis of each item are available in *Table* S1 in the Supplementary Materials, available at https://osf.io/7bpcy/.

Confirmatory factor analyses. We ran confirmatory factor analyses using the maximum likelihood method (as the data were normally distributed). We did so to examine whether a bi-factor structure, a correlated two-factor, or a single-factor model would better fit the IUS-R data. Following Kline's recommendations (Kline, 2005), model fit was determined using the Chi-square test, the Standardized Root Mean Square Residual (SRMR), the Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), and the Tucker Lewis index (TLI). Regarding RMSEA, values close to 0 represent an optimal fit, while RMSEA values equal to or below .05 represent a good fit, values between .05 and .08 an adequate fit, values between .08 and .10 a poor fit, and values higher than .10 a non-acceptable fit (Browne & Cudeck, 1992). SRMR values are expected to stay below .05 (Kline, 2005). For the CFI, values between .95 and 1.0 indicate a good model fit, whereas values ranging between .90 and .95 denote acceptable fit (Hu & Bentler, 1999). Finally, for the TLI, values range between 0 and 1, with a value of .90 or greater indicating good model fit (Hu & Bentler, 1999).

Internal reliability. We computed the Cronbach's alpha and McDonald's omega coefficients for the global scale and each possible subscale. For both indices, a value higher than .75 reflects acceptable internal reliability (Nunnally, 1978).

Convergent and divergent validity. We computed Pearson product-moment correlations between each pair of measures of interest. We applied a Benjamini–Hochberg correction (Benjamini & Hochberg, 1995) to hold the false discovery rate (i.e., the expected proportion of falsely rejected null hypotheses) at 5% for the twelve correlations estimated.

Results

The mean, standard deviation, range, skewness, and kurtosis of each item are available in *Table* S1 in the Supplementary Materials (https://osf.io/7bpcy/). Participants' total IUS-R scores ranged from 12 to 60 (M= 31.82; SD = 9.28). All in all, these results suggest that the overall score distribution was relatively symmetrical and bell-shaped.

Comparison of the three factor-structures

We examined the correlated two-factor solution, the bifactorial factor solution, and the single-factor structure. *Table 1* displays the fit indices of the three models and indicates that a bi-factor model outperformed the correlated two-factor and the single-factor solution. And although the correlated two-factor solution was acceptable, the single-factor structure was clearly not.

The standardized factor loadings of the correlated two-factor solution and the single-factor solution were all statistically significant ($p < .001$) for each item. Concerning the bifactorial factor solution, three items were problematic in the prospective subscale (items 1, 2, and 6), with negative and not statistically significant factors loadings. The factor loadings for the three models are available in *Table* S2, *Table* S3, and *Table* S4 in the Supplementary Materials sections (https://osf.io/7bpcy/). We also reran these analyses without the problematic items and obtained almost identical findings (see *Table S6* in the Supplementary Materials sections).

Internal Reliability

With a Cronbach's alpha of .89 and a McDonald's omega coefficient of .91, internal reliability was high for the global scale score. For the Prospective IU factor, the Cronbach's alpha was.82 and the McDonald's omega coefficient.89. For the Inhibitory IU factor, the Cronbach's alpha was.87 and the McDonald's omega coefficient.85.

Correlations Between the IUS-R and Other Constructs

Table 2 shows the correlations between the IUS-R total score, its two factors, the DASS-21 subscales, and the PSWQ. Both the global IUS-R scale and each of its two factors exhibited significant and positive medium-sized correlations with worry, depression, stress, and anxiety.

Complementary analyses

We also checked for potential univariate outliers. To do so, we first identified participants with values below or above 2.5 standard deviations from the mean. We identified 13 participants with outlier values. We then re-ran the analyses without those participants, and their exclusion did not lead to any substantial differences in the pattern of findings observed. The fit indices of the models estimated without these potential outliers are available in the supplementary materials (see *Table S5*).

Discussion

In this study, we aimed to present a French adaptation of the IUS-R. All recent studies have pointed toward a bifactorial factor solution as the best-fitting model (Bottesi et al., 2019; Lauriola et al., 2016; Shihata et al., 2018), but none have tested this approach in a French-speaking sample. In line with prior research, we found that a bifactorial solution, reflecting a general factor and two grouping factors (specifically prospective IU as Factor 1 and inhibitory IU as Factor 2), best fit our data.

The IUS-R has become the gold standard measure for assessing IU. However, uncertainty remains regarding its factorial structure, since prior research has suggested that a bifactorial solution best fit the IUS-R data. In the present study, we replicated these prior findings in a large sample of French-speaking participants. We found that the general or latent IU factor accounted for 80% of the variance, which is also consistent with previous findings (Hale et al., 2016; Shihata et al., 2018). In conclusion, our results provide evidence for a strong, reliable, and latent factor underlying the IUS-R items. In addition, our results clearly support the bifactorial nature of the IUS_R, with, on the one hand, one single all-embracing latent entity tapping onto IU and onto which all items load, and on the other hand, two orthogonal subscales reflecting prospective and inhibitory IU. Our findings thus suggest these two factors are not fully independent and result from the same global entity.

However, although the bifactorial factor solution fit the data better than alternative models, the prospective factor appeared to be unreliable in our sample, notably because of the presence of three items exhibiting negative factor loadings (i.e., item #1, item #2, and item #6). And that should not come as a surprise. This observation has been reported several times in prior research (Bottesi et al., 2019; Hale et al., 2016). As suggested by Bottesi et al. (2019), these items all reflect emotional reactions to uncertainty (e.g., “When things happen suddenly, I am very upset”; “It bothers me when there are things I do not know”), whereas the other items of this factor reflect proactive behaviors to reduce uncertainty (e.g., “I should always be prepared before things happen”; “I must get away from all things I am unsure of”). A critical next step in future research will thus be to investigate whether it might be pertinent to dissociate proactive intolerance to uncertainty into further subcomponents: namely, emotional reactions and proactive behaviors. Although the bifactorial structure represents the adequate factorial structure, we thus recommend to avoid scoring the subscales independently. Indeed, given the high common variance between the two sub-factors (80%) and the low reliability of the prospective subscale, clinicians can be assured that the use of a global score truly reflects the general factor. Moreover, the strong evidence for unidimensionality is fully consistent with the transdiagnostic nature of IU, given that unidimensional constructs are more likely than multidimensional constructs to exhibit invariance across individuals with different types of psychopathology (Hale et al., 2016).

This study also aimed to clarify the relations of IUS-R factors with stress, depression, anxiety, and worry. As expected, we found medium-sized positive relations between the IUS_R and these clinical measurements. Moreover, patterns were similar when distinguishing prospective and inhibitory subscales: both were moderately correlated with these clinical measurements. These results are not surprising and echo the transdiagnostic nature of IU (Behar et al., 2009; Hale et al., 2016; McEvoy & Mahoney, 2011; van der Heiden et al.,

2010). Moreover, its transdiagnostic nature yields implications for research and clinical practice (P. McEvoy & Erceg-Hurn, 2016; Rosser, 2019). Indeed, since IU has been theorized as a maintenance factor for a wide range of emotional disorders, changes in IU during treatment should be associated with symptom reduction for multiple disorders. This hypothesis has been supported by McEvoy & Erceg-Hurn (2016), who have shown that changes in IU were linked with symptom relief in social anxiety and general anxiety disorders. By providing a French validation of the IUS-R, practitioners from French countries worldwide will thus now be able to follow and monitor IU in their patients. In addition, consistent with previous studies (Bottesi et al., 2019; Hale et al., 2016; Lauriola et al., 2016), the global IU construct appears to be not only highly valid (i.e., regarding the relation with concurrent measures) but also highly reliable (i.e., as depicted by its internal consistency).

This study has limitations. First, this study was based on an unselected sample recruited online. A critical next step would be to examine whether the present findings generalize to clinical samples. Second, we only assessed IU through self-reported items, and did not include concurrent behavioral measurements of IU (for a discussion, see Morriss et al., 2016). Third, this study was conducted during the COVID-19 pandemic, characterized by great levels of uncertainty and a related increased of anxiety disorders (e.g., Santomauro et al., 2021; Suen et al., 2022). Beyond the pandemic, several stressful events, characterized by uncertainty vis-à-vis their potential detrimental consequences, occurred during the collection of the present data, such as geopolitical conflicts, an economic crisis, a global energy crisis, and a growing awareness of the impending threats of climate change (e.g., Heeren & Asmundson, 2023; Heeren et al., 2023). Therefore, we cannot exclude a potential bias in the assessment of IU given the global worldwide context.

These limitations notwithstanding, we provided the first adaptation and validation of the IUS-R in a French-speaking community sample and found that the bifactorial factor solution structure best fit our data.

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Table 1. **Comparison of three CFA Models**

Model	χ^2	df	SRMR	RMSEA	RMSEA 90% CI	CFI	TLI
Correlated Model	349.591**	53	.05	.08	.079–.097	.92	.90
Bi-factor Model	**173.447 ****	**42**	**.03**	**.06**	**.056–.076**	**.96**	**.94**
Single factor Model	586.042 **	54	.06	.11	.078–.111	.86	.83

Note. df = degree of freedom; CI= confidence interval; SRMR = Standardized Root Mean Square Residual; RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index; TLI = Tucker Lewis Index; The best fitting model is shown in bold. **p< .01.

Table 2: Correlations between the Intolerance to uncertainty (sub)scale and other constructs

	Pro-IU	Ini-IU	PSWQ	DEP	STR	ANX
IUS-R	.92**[.91–.93]	.89**[.87–.90]	.39**[.33–.45]	.36**[.29–.42]	.36**[.29–.42]	.36**[.30–.42]
Pro-IU	-	.66**[.62–.70]	.33**[.26–.39]	.29**[.22–.36]	.33**[.26–.39]	.31**[.25–.38]
Ini-IU	.66**[.62–.70]	-	.40**[.33–.46]	.37**[.30–.43]	.32**[.26–.39]	.35**[.29–.41]

Note. IUSR= Intolerance to uncertainty Scale Revised; Pro-IU = Prospective Intolerance to uncertainty; IniIU = Inhibitory Intolerance to uncertainty; PSWQ = Penn State Worry Questionnaire; DEP= Depression; STR= Stress; ANX = Anxiety.

**$p < .05$; (corrected for multiple comparison using the Benjamini-Hochberg procedure).