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Self-reported intolerance of uncertainty and behavioural decisions

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ABSTRACT

Intolerance of Uncertainty (IU) appears to be a robust transdiagnostic risk factor related to anxiety and depression. Most transdiagnostic IU research has used the self-report Intolerance of Uncertainty Scale-Short Form; however, there is comparatively little research exploring presumed behavioral correlates of IU. The current study was designed to assess relationships between self-reported IU and decisions in uncertainty-based behavioral tasks (specifically, the Wisconsin Card Sorting Task, the Risky Gains Task, and the Modified Iowa Gambling Task). Participants comprised compensated community members ($n = 108$; 69% women) and undergraduates ($n = 98$; 78% women). Community member compensation was not contingent on performance, but undergraduate compensation was partially contingent on performance. Results replicated prior research, with both samples producing small ($r = .19$) to moderate ($r = -.29$) correlations ($ps < .05$) between self-reported IU and outcome variables from each of the behavioral tasks. The relationships were larger in the undergraduate sample, likely due to the compensation incentive. In general, the results suggest that increasing IU is associated with increasingly risk adverse behaviors; however, the relationship appears complex and in need of substantial additional research to understand how clinically-significant IU would impact pathology-related behaviours.

1. Introduction

Almost every choice or decision made by an organism involves some consideration of uncertainty, where uncertainty describes imperfect or unknown information relevant to a decision. Decision-making under uncertainty has been (and continues to be) a key topic of inquiry in the behavioral sciences, especially biology, economics, and psychology, and has inspired a vast literature of thousands of studies (reviewed in Plous, 1993; see for recent examples, Pleskac, Diederich, & Wallsten, 2015; Starcke & Brand, 2012). Despite the interest, surprisingly little of this vast literature has addressed whether or not there are stable individual differences in how organisms make decisions under uncertainty until recently.

Intolerance of Uncertainty (IU) is a dispositional characteristic resulting from negative beliefs about uncertainty and its implications (Dugas & Robichaud, 2007), the core of which is appears to be fear of the unknown (Carleton, 2012), wherein the possibility of a negative event occurring is considered threatening irrespective of the probability of its occurrence (Carleton, Sharpe, & Asmundson, 2007). IU is an uncertainty-specific lower-order construct that is the most prominent factor underlying the broader higher-order construct that is distress tolerance (Bardeen, Fergus, & Orcutt, 2013; Zvolensky, Vujanovic, Bernstein, & Leyro, 2010). Because of the central importance of sensitivity to uncertainty in decision-making, the development of IU as an index of behaviors and responses to uncertainty is a key step forward, and has broad implications for understanding decision-making in multiple domains.

IU is particularly relevant to understanding psychopathology. Fearing the unknown and difficulties associated with tolerating uncertainty have been posited as transdiagnostic vulnerability factors for the development and maintenance of anxiety and depression symptoms e.g., (Carleton, Mulvogue, et al., 2012; Gentes & Ruscio, 2011; Hong & Cheung, 2015). There is now substantial evidence that IU accounts for variance in several anxiety- and

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mood-related disorders (see for review Carleton, 2012; Hong & Cheung, 2015) and appears consistently higher for clinical samples relative to undergraduate and community samples (Carleton, Mulvogue, et al., 2012). The evidence implicates IU as a potentially critical transdiagnostic vulnerability factor (Carleton, 2012). There is also evidence that uncertainty automatically activates the fight or flight response (Thayer, Ahs, Fredrikson, Sollers, & Wager, 2012) and the behavioural inhibition system (Gray & McNaughton, 2003), implicating IU in the development of psychopathology and decision-making processes. Most research e.g., (Hong & Lee, 2015) has supported two robust dimensions of IU measurement, a more immediate behaviorally focused dimension (i.e., Inhibitory IU) and a more future-oriented cognitively focused dimension (i.e., Prospective IU).

Current theories (Carleton, 2012) and models e.g., (Dugas, Buhr, & Ladouceur, 2004; Einstein, 2014; Grupe & Nitschke, 2013) of IU implicate a potentially significant transdiagnostic role for uncertainty in decision making for clinical and non-clinical populations. Most of the research supporting such models has used self-report measures, such as the Intolerance of Uncertainty Scale (IUS; Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994), the 12-item short form (IUS-12; Carleton, Norton, & Asmundson, 2007), and the Intolerance of Uncertainty Index (IUI; Carleton, Gosselin, & Asmundson, 2010) to assess IU; however, there is relatively limited research explicitly assessing behavioural correlates of IU. Understanding the relationship between IU as a cognitive construct and behaviour appears to be an important aspect of demonstrating broad utility (Carleton, 2012). In the following, we summarize some studies that have examined IU as a behavioral outcome.

Ladouceur and colleagues (Ladouceur, Talbot, & Dugas, 1997) demonstrated that behavior associated with reducing uncertainty (as measured by the Beads Task) was positively associated with self-reported trait IU. The Beads Task has participants draw a series of beads (with replacement) from a container and then choose the ratio of black and white beads from a set of presented options. The results indicated a positive relationship between IU and number of draws before choosing, *r*s = .32 to .43, with the relationship falling as the ambiguity increased (i.e., as participants were given more potential ratios), *r*s = .26 to .32. Ladouceur et al. (1997) suggested that too much uncertainty produced a ceiling effect (i.e., a range restriction) that removed the relationship between IU and task performance.

Jacoby and colleagues (Jacoby, Abramowitz, Buck, & Fabricant, 2014) replicated and extended Ladouceur et al. (1997) results with the Beads Task using an undergraduate sample and a clinical sample with anxiety disorders. They used two self-report measures to assess IU; specifically, the IUS-12 and the Perfectionism/Certainty subscale of the Obsessive Beliefs Questionnaire (Obsessive Compulsive Cognitions Working Group, 2001, 2003). Correlations were used to assess relationships between self-reported IU and the time participants took to decide the ratio of beads in a container. The results indicated a statistically significant positive relationship between the Perfectionism/Certainty subscale and the number of bead draws before a participant decided, $r = .36$; in contrast, the relationship with the IUS-12 total and subscale scores (i.e., Prospective IU and Inhibitory IU) was not significant. There was no statistically significant relationship identified between IU and the time taken to reach a decision.

Rosen and colleagues (Rosen et al., 2010) found a positive association between self-reported trait IU (measured as a total score) and behaviors associated with the reduction of uncertainty. In an experimental design, they manipulated health-related uncertainty in a sample of undergraduates and then assessed subsequent health seeking behaviours, which may be more ecologically valid than the beads task. The results indicated a positive relationship between IU and behaviours designed to reduce uncertainty, $r = .26$ (i.e., taking health brochures and requesting information packages).

Luhmann and colleagues (Luhmann, Ishida, & Hajcak, 2011) found that self-reported trait IU (measured as a total score) was associated with greater delay discounting behavior—that is, preference for smaller immediate rewards over larger distal rewards. Specifically, the results indicated an inverse relationship ($R = -.30$) between IU and delay discounting. There was also an inverse relationship ($\beta = -.49$) between IU and willingness to wait. In other words, the desire to end the uncertainty appeared to outweigh the desire for specific gains; moreover, trait anxiety was not related to the behavioural measures, even though IU and trait anxiety were correlated ($r = .66$).

Thibodeau and colleagues (Thibodeau, Carleton, Gomez-Perez, & Asmundson, 2013) found an inverse relationship between both of the IU subscale scores (i.e., Prospective IU and Inhibitory IU) and typing speed ($r = -.54$), which was higher after controlling for other psychological and physiological variables (*part* $r = -.68$); however, neither IU nor the reduced speed were related to fewer typographic errors. Higher IU may have produced intentional or unintentional visual or haptic checking before key strikes in an attempt to maximize certainty and minimize errors. Such slight hesitancies over hundreds of keystrokes would have aggregated to an overall slower typing speed. van Horen and Mussweiler (van Horen & Mussweiler, 2014) may have investigated the most subtle relationship between IU and behaviour by assessing the desirability of soft (i.e., comforting) haptic sensations under uncertainty. Participants primed to consider the world as uncertain demonstrated greater desire for softer rewards, Cramer's $V = .28$ to .45; however, van Horen and Mussweiler did not assess for a relationship with self-reported IU.

The current research was designed to further explore the relationship between self-reported IU and behaviours related to decision-making under uncertainty. The current research extends previous work in several important ways. First, we use multiple well-established behavioral measures involving decision-making under uncertainty, which have not been examined in concert with a transdiagnostically robust measure of trait IU in undergraduate, community, or clinical samples. The behavioral measures include the Wisconsin Card Sorting Task (WCST; Grant & Berg, 1948), the Risky Gains Task (RGT; Paulus, Rogalsky, Simmons, Feinstein, & Stein, 2003), and the Modified Iowa Gambling Task (MIGT; Cauffman et al., 2010).

The WCST, RGT, and MIGT behavioural tasks were selected because each has been used broadly in the decision-making literature to measure decision-making under uncertainty. Second, each of these tasks taps into different cognitive elements of decision-making e.g., the WCST has been associated with executive functioning; the MIGT is associated with implicit cognitive processes; e.g., (Bechara, Damasio, Tranel, & Damasio, 2005; Miyake, Friedman, Emerson, Witzki, & Howerter, 2000), although each involves decision-making under uncertainty (our key behavioral outcome of interest). Third, the ecological validity of behavioral measures of uncertainty avoidance have been highly variable. As a consequence, it is unclear whether associations between self-reported trait IU and behavioral decision-making under uncertainty are confounded by the ecological validity of the tasks used. The ecological validity of the behavioral tasks we use in this study range from relatively low (e.g., the WCST) to relatively high (e.g., the MIGT). Finally, we use both undergraduate and community participants. This approach allows for the initial examination of the trait-behavioral IU relationship in a much more variable sample than has been used in previous studies (e.g., solely undergraduate or clinical samples); moreover, clinical samples typically exhibit ceiling effects for self-reported trait IU (Carleton, Mulvogue, et al.,