

Boredom and Motivation: From Anxious Uncertainty and Low Approach Motivation to Low

Self-Control

by

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### Author's Declaration

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

## Abstract

Across two studies, this research investigated trait (Study 1 and 2) and state (Study 2) level variation in anxious uncertainty and approach motivation as motivational substrates of boredom. It further tested a series of mediational models for conceptualizing links between anxious uncertainty and approach motivation, boredom, and self-control. In both an initial study (Study 1) and a direct replication (Study 2), I found that anxious uncertainty sensitivity was positively correlated with boredom proneness and approach motivation sensitivity was negatively correlated with boredom proneness. Together these sensitivities accounted for a substantial amount of the variance in boredom proneness. Anxious uncertainty and approach motivation sensitivities also indirectly predicted self-control through their effects on boredom proneness. In Study 2, these findings were replicated at the state-level using a quasi-behavioural measure of self-control. The results of the state-level mediation analyses showed that participants who reported greater anxious uncertainty and lower approach motivation during a data entry task were less persistent and less likely to follow-through with intentions, and this effect was mediated by higher levels of boredom. I conclude that boredom signals a motivational state characterized by high anxious uncertainty and low approach motivation that is conducive to self-control failure.

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## Introduction

Boredom is commonplace in everyday life (Chin, Markey, Bhargava, Kassam, & Loewenstein, 2017; Larson & Richards, 1991). From waiting in traffic, to performing a tedious task at work, or simply having nothing to do, people frequently find themselves feeling unengaged or unsure of their next move. Boredom has been popularly regarded as an unpleasant, yet fleeting state, while existing research suggests that the phenomenological experience is largely negative (van Tilburg & Igou, 2017a). Moreover, research on the consequences of boredom has consistently shown that boredom proneness is associated with a host of social, psychological and behavioural difficulties. Negative outcomes that have been linked to boredom include depression and anxiety (LePera, 2011; Sommers & Vodanovich, 2000), loneliness (Farmer & Sundberg, 1986), lower quality relationships (Watt & Vodanovich, 1999), antisocial behaviour (Newberry & Duncan, 2001), and various impulsivity-related problems reflecting low self-control (Blaszczynski, McConaghy, & Frankova, 1990; Dahlen, Martin, Ragan, & Kuhlman, 2004; Stickney & Miltenberger, 1999).

Despite its established link to a variety of negative outcomes, other work has suggested that boredom may serve some adaptive functions, such as prompting the search for more satisfying activity (Bench & Lench, 2013) or optimizing the deployment of cognitive resources (Kurzban, Duckworth, Kable, & Myers, 2013). Research focused on elucidating the construct of boredom and its functional properties emphasizes underlying motivational and regulatory processes and the role it may serve in goal pursuit (Bench & Lench, 2013; Elpidorou, 2014; Struk, Scholer, & Danckert, 2016). The present research builds on this literature by proposing high anxious uncertainty and low approach motivation as the motivational substrates of boredom. Furthermore, I suggest that variation in these two motivational systems underlies the

emotional experience of boredom, which serves as a signal of conflicted or uncertain goal-pursuit. Drawing on this motivational perspective, I propose a theoretical model for conceptualizing the relationship between anxious uncertainty and approach motivation, boredom, and self-control failure. This work supports the conclusion that the experience of boredom, and related decrements in self-control, arise from trait and state level variation in anxious uncertainty and approach motivation.

### **Anxious Uncertainty and Boredom**

Goal regulation accounts of motivation and behaviour (Corr, 2009; Gray & McNaughton, 2000) propose that anxious uncertainty arises when a conflict occurs that threatens goal progress, for example, when an individual is simultaneously approach-oriented, (e.g. wanting to succeed in school) and avoidance-oriented (e.g. wanting to avoid a dull lecture; DeYoung & Gray, 2009; Jonas et al., 2014). Anxious uncertainty, when activated, is characterized by symptoms including generalized goal disengagement, aversive arousal, and risk assessment (Corr, 2004; Gray J. A. & McNaughton, 2000). This suite of anxiety-related reactions to conflict can be adaptive insofar as it facilitates either resolution of the motivational conflict in favor of approach/avoidance, or substitution in favour of a more viable alternative (Jonas et al., 2014; Kruglanski et al., 2002). Once the conflict is resolved, anxious uncertainty dissipates allowing focused goal pursuit to resume. However, when anxious uncertainty is dispositionally or situationally high, the heightened sensitivity to possible signs of conflict disrupts focused attention decreasing the likelihood of persistence and success at any one goal (Corr, 2008). Furthermore, the anxiety-related tendencies toward rumination and disengagement can lead people to feel uncertain and uninspired when thinking about what they might like to do (DeYoung, 2015; Hirsh, Mar, & Peterson, 2012).

To understand how anxious uncertainty is related to boredom it is important to recognize how the experience of boredom is related to goal conflict, as in the example of the boring lecture. It has been proposed that the purpose of boredom is to regulate behaviour by signalling the need to pursue more engaging or satisfying goals (Bench & Lench, 2013; Elpidorou, 2014). Thus, the aversive experience of boredom signals a detected discrepancy or possible impedance between one's current and desired states in cases of goal frustration and stagnation (Bench & Lench, 2013). By alerting the need for goal reassessment or switching, boredom helps to restore the sense that one's goals are important and achievable (Elpidorou, 2014). However, people who are overly sensitive to the detection of such discrepancies may accordingly experience boredom more often and more intensely than is functionally adaptive. Indeed, a highly sensitive behavioural inhibition system (BIS; the system that mediates anxiety-related processes; Gray & McNaughton, 2000) is associated with greater boredom proneness (Mercer-Lynn, Bar, & Eastwood, 2014; Mercer-Lynn, Hunter, & Eastwood, 2013). There is good reason to expect, therefore, that the experience of boredom is closely linked to sustained activation of anxious uncertainty and does not just reflect a preference for novelty.

### **Approach Motivation and Boredom**

Approach motivation energizes behaviour that moves an individual towards desired end states when goal pursuit is perceived as clear and un-conflicted (DeYoung & Gray, 2009; Jonas et al., 2014). Approach motivated states are characterized by optimistic, confident, and eager goal pursuit in response to appetitive cues (Corr, 2009; DeYoung, 2013) or anger cues (Harmon-Jones, Harmon-Jones, & Price, 2013). When approach motivation is high, people are more sensitive to approach-evoking cues that elicit goal directed behaviour and are less focused on detecting and responding to discrepancies (Corr, 2004). Furthermore, chronic dispositions

toward approach motivation trigger psychophysiological processes that motivate people to seek out stimuli to approach, even in the absence of any immediate cue (Harmon-Jones et al., 2013). When no immediate goal is salient, high dispositional approach motivation can be perceived as a free-floating state of readiness that prompts the search for new opportunities to approach.

Approach motivation is also associated with greater reductions in breadth of attentional focus following appetitive stimuli (Gable & Harmon-Jones, 2008). This narrowing of attention allows people in approach motivated states to shut out irrelevant stimuli and constrains attention to task-relevant perceptions and cognitions, which facilitates committed goal pursuit (Gable & Harmon-Jones, 2008; Harmon-Jones, Amodio, & Harmon-Jones, 2009). In contrast, when approach motivation is low people tend to be “less engaged, motivated, and energized by the possibilities for reward that surround them” (DeYoung, 2015, p.43). This may also leave them more susceptible to BIS-activating distractions that might conflict with focal goals and heighten anxious arousal. Accordingly, individuals with temperaments characterized by low approach motivation have difficulty sustaining goal pursuit and tend to remain in conflicted states for prolonged periods (Park, 2010). When approach motivation is low, the muted enthusiasm for ongoing goals and greater susceptibility to distractions should therefore lead to more boredom. Indeed, Cloninger (1987) proposed that an important function of the behavioural activation system (BAS; the system that mediates approach motivated processes) is its capacity to overcome “monotony” (p. 575).

### **Boredom and Self-Control**

Self-control is necessary when motivation for proximal temptations conflicts with motivation for a more distal higher order goal (Fujita, 2011). In the face of such dilemmas, dissipating impulses must often be suppressed in order to align behaviour with the more highly

prioritized goal (Hofmann, Baumeister, Förster, & Vohs, 2012). Self-control accordingly requires one to move past conflict (between the temptation and the priority) to stay tenaciously focused on the priority. The ability to effectively exercise self-control is therefore critically important for successful goal pursuit and well-being in general (Tangney, Baumeister, & Boone, 2004). Research consistently indicates that higher levels of boredom proneness are related to poor self-control (Isacescu, Struk, & Danckert, 2016; Struk et al., 2016). People who are prone to boredom have difficulty sustaining attention (Carriere, Cheyne, & Smilek, 2008), have higher levels of mind wandering (which indicates a lack of focus and commitment to the task at hand; Cheyne, Carriere, & Smilek, 2006), and greater affective dysregulation (Isacescu et al., 2016). Boredom proneness also manifests in a variety of impulsive behaviours indicative of low self-control, such as aggression (Dahlen et al., 2004), overeating (Stickney & Miltenberger, 1999), problem gambling (Blaszczynski et al., 1990), and substance abuse (LePera, 2011).

According to the proposed motivational perspective, boredom arises from high anxious uncertainty and low approach motivation. These two orientations that I propose as the motivational substrates of boredom should also predict self-control failure. When anxious uncertainty is activated it disrupts focused goal pursuit and makes people more attuned to conflict, leading to goal-system-wide disengagement (Gray & McNaughton, 2000). In contrast, approach motivation constrains attention to focal goals (Gable & Harmon-Jones, 2008) and promotes eager approach behaviour (Corr, 2009). Furthermore, experimentally manipulating left frontal activity, a neural marker of approach motivation, fortifies commitment to focal goals and diminishes the attractiveness of alternatives (Harmon-Jones et al., 2009). Since self-control dilemmas often entail a conflict between a higher and lower order goal (Hofmann et al., 2012), high anxious uncertainty should draw attention to this conflict, while low approach motivation

should leave people susceptible to distraction and disengagement from the higher order goal. Thus, boredom may be associated with poor self-control because it signals a motivational state characterized by uncertain and conflicted goal pursuit, that increases the likelihood of self-control failure.

Work on reactive approach motivation (RAM; McGregor, Nash, Mann, et al., 2010) suggests that when people experience motivational conflict and uncertainty they seek to relieve the aversive state by engaging in eager displacement behaviours. In the context of boredom, for example, someone who is bored might approach an immediately rewarding alternative, such as gambling or eating, to relieve the aversive state. In fact, the motivation to relieve this aversive state is so strong that when bored people are even willing to engage in affectively negative approach behaviours (see Harmon-Jones et al., 2013 for a review of how approach motivation may be experienced both positively and negatively), such as self-administering electric shocks (Nederkoorn, Vancleef, Wilkenhöner, Claes, & Havermans, 2016; Wilson et al., 2014), presumably to mute the eliciting anxiety. The palliative nature of such approach behaviours can lead people to throw themselves into any immediately available alternative, acting impulsively without regard for long-term priorities (McGregor, Nash, Mann, et al., 2010). For people who are highly approach motivated, however, the ability to remain engaged and focused on important goals may insulate them from such conflicted states negating the need to engage in reactive displacement behaviours. Some self-control researchers have referred to a similar phenomenon, whereby people experience less temptation and conflict minimizing the need for effortful inhibition altogether, as “effortless self-control” (Gillebaart & Ridder, 2015; Milyavskaya, Inzlicht, Hope, & Koestner, 2015). Thus, boredom may be associated with poor self-control because it signals a motivational state characterized by goal conflict and disengagement that

increases the chances of self-control failure. This state may lead to self-control failure both by drawing attention to goal conflicts requiring effortful self-control, and by motivating impulsive reactions to alleviate the aversive state.

## **Overview of Research**

In sum, I propose that the motivational processes associated with high anxious uncertainty and low approach motivation make people susceptible to boredom. High anxious uncertainty inhibits ongoing goal pursuit and leaves people in limbo, uncertain and scanning for alternative courses of action. Moreover, low approach motivation makes people vulnerable to disrupted focus on important goals. Gray (1994) suggested that emotional states arise from the activity of these basic systems that are attuned to cues for conflict and approach, and that serve as indicators of possible threats and opportunities (Lazarus & Folkman, 1984). By tracking changing motivational conditions, emotions help individuals adjust their behaviour appropriately to the demands of the present context (Frijda, 1986). I accordingly propose high anxious uncertainty and low approach motivation as the motivational substrates of boredom, which signals the need to reassess and adjust one's current behaviour.

I further propose that these orientations toward anxious uncertainty and low approach motivation should also predict self-control failure, which would account for the association between boredom and poor self-regulation (Struk et al., 2016). From this motivational perspective, chronic anxious uncertainty and low approach motivation should be associated with poor self-control because they would make people more sensitive to and inclined to become stuck in conflict, and less able to stay engaged and focused on the priority. If this is the case, then boredom should mediate the relation between high anxious uncertainty and low approach motivation on the one hand, and self-control on the other.

I tested this theory in two pre-registered studies (see [osf.io/3xzwp](https://osf.io/3xzwp) for pre-registrations), examining trait-level (Studies 1 and 2) and state-level (Study 2) associations among anxious uncertainty, approach motivation, boredom and self-control. In Study 1, I assessed trait-level relationships between these four variables using self-report measures. In Study 2, I directly replicated Study 1 and also included a conceptual replication using state-level measures and a quasi-behavioural assessment of self-control. Across both studies, I predicted main effects of both anxious uncertainty and approach motivation, such that higher anxious uncertainty and lower approach motivation would predict greater boredom and lower self-control. Furthermore, if changes in these two systems serve as the motivational substrates of boredom, then I reasoned that together they should account for a substantial amount of the variance in boredom. I also predicted that anxious uncertainty and approach motivation would influence self-control indirectly through effects on boredom.



## Study 1

In Study 1, I tested whether individual differences in trait-level anxious uncertainty sensitivity and approach motivation sensitivity were related to boredom proneness and trait self-control. I expected that there would be main effects of both anxious uncertainty sensitivity and approach motivation sensitivity, such that high anxious uncertainty sensitivity and low approach motivation sensitivity would predict greater boredom proneness and lower trait self-control. Using multiple regression analysis, I also assessed the unique contribution of these two motivational orientations in predicting boredom proneness. Finally, I tested whether boredom proneness mediated a link between anxious uncertainty and approach motivation sensitivities and trait self-control. I hypothesized that there would be significant indirect effects of these motivational orientations on self-control through boredom proneness.

## Method

### Participants

Data were collected from students in a Personality Psychology course in the fall and winter semesters of the same academic year. The data collection termination rule was therefore pre-set by participant availability, which was determined by enrolment in the course. The two samples from the fall and winter were equivalent on measures of boredom proneness, approach motivation sensitivity, anxious uncertainty sensitivity and self-control, all  $t_s(136) < 1.43$ ,  $p_s > 0.15$ . The final sample consisted of 138 undergraduate psychology students from the University of Waterloo ( $M_{age} = 21.28$ ,  $SD = 1.42$ , range = 19 - 28). Seventy-five percent of the sample self-identified as female, 24% as male and 1% as other. Forty percent of participants self-identified as White/Caucasian, 52% as Asian, 5% as other, 3% as Multi-ethnic, and less than 1% as Latin American. Additionally, following the first round of data collection in the fall the expected

associations between anxious uncertainty and approach motivation sensitivities and boredom proneness were pre-registered (<https://osf.io/rmz6y>). Results from the pre-registered subsample of the data showed the same predictive relationships as the first half of the data, and the separate significant results from the exploratory and preregistered subsamples are presented in Appendix A.

## **Procedure and Measures**

Participants completed self-report measures of trait self-control, anxious uncertainty sensitivity, approach motivation sensitivity, and boredom proneness (presented in that order) as part of a larger online survey assessing various individual difference measures. The survey was completed online using Qualtrics survey software. All measures were rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A complete version of all measures used in the present study are available in Appendices B through E.

**Approach Motivation Sensitivity (AMS).** This was measured using the 15-item Approach Motivation Sensitivity Scale (AMSS; Prentice, 2016) that was recently developed, along with the Anxious Uncertainty Sensitivity Scale (AUSS), to measure approach and anxiety related sensitivities more comprehensively than the popular Behavioural Activation and Behavioural Inhibition Scales (Carver & White, 1994) (for review of BIS/BAS limitations, see Amodio, Master, Yee, & Taylor, 2007; Corr, 2009). The AMSS was designed to more generally measure propensity to move towards incentives and engage in confident, eager goal pursuit. The scale conceptualizes approach motivation sensitivity as an aggregate of behavioral activation, self-esteem, hope, and promotion focus. Specifically, it is comprised of: 2 BAS Drive subscale items and 2 BAS Reward subscale items (from Carver & White, 1994; see Carver's webpage recommendation for using these two subscales, but not the BAS Fun subscale, for assessing

approach motivation); 4 self-esteem items (from Rosenberg, 1965; see Heimpel, Elliot, & Wood, 2006 for justification of these items as approach motivation items); 2 hope items (from Snyder et al., 1991; see McGregor, Prentice, & Nash, 2013 for links between hope and approach motivation), and 5 promotion focus/ approach items (from Lockwood, Jordan, & Kunda, 2002; see Summerville & Roese, 2008 for justification of these items as approach-motivation items).

Together these items provide a comprehensive measure of the traits that facilitate approach-oriented goal pursuit, i.e., wanting to move towards goals (drive), experiencing positive affect when goals are achieved (reward responsiveness), being confident in one's ability to reach them (self-esteem/hope), and being enthusiastically focused on important goals one eagerly wants to accomplish (promotion focus). In addition to the widely-used BAS scale by Carver and White, each of the other contributing scales—self-esteem, hope, and promotion focus—has been associated with and/or used as a measure of approach motivation in previous research (e.g. Heimpel, Elliot, & Wood, 2006; Kashdan, Rose, & Fincham, 2004; McGregor, Gailliot, Vasquez, & Nash, 2007; McGregor, Nash, & Prentice, 2010). An example of a BAS drive item is “When I want something, I usually go all-out to get it.” An example of a BAS reward responsiveness item is “When I get something I want, I feel excited and energized.” An example of a self-esteem item is “I am able to do things as well as most other people.” An example of a hope item is “I can think of many ways to get the things in life that are most important to me.” Finally, an example of a promotion focus item is “I typically focus on the success I hope to achieve in the future.”

In scale development, items from these five scales were submitted to an exploratory factor analysis (using maximum likelihood and promax rotation) to identify the best indicators of a shared approach motivation sensitivity factor. Fifteen items were retained for the final scale,

which all loaded highly ( $> 0.49$ ) on a single “approach” factor (Prentice, 2016). In the current sample, all items loaded highly ( $> 0.42$ ) on the single factor, which explained 41.88% of the variance in scores. A mean score was calculated for each participant, with higher scores indicating greater approach motivation sensitivity. Cronbach’s alpha reliability for the current study was 0.90.

**Anxious Uncertainty Sensitivity (AUS).** This was measured using the 15-item Anxious Uncertainty Sensitivity Scale (AUSS; Prentice, 2016), developed along with the AMSS. The AUSS was designed to measure propensity to perceive goal pursuit as uncertain or conflicted, resulting in vigilant risk assessment, passive avoidance, and anxious arousal. The scale conceptualizes anxious uncertainty sensitivity as an aggregate of prevention focus, BIS activation, and uncertainty aversion. The scale is comprised of 2 prevention focus items (from Lockwood et al., 2002), 1 BIS item (from Carver & White, 1994) and 12 uncertainty aversion items (from the Greco & Roger, 2001, Emotional Uncertainty subscale). Together these items provide a general measure of the combined dispositions that heighten sensitivity to the experience of anxious uncertainty—i.e. being focused on the possibility of negative outcomes (prevention focus), detecting and reacting to cues for goal conflict (BIS), and being wary and averse to conditions of uncertainty in everyday life (uncertainty aversion). Uncertainty is a form of conflict that can be especially pernicious as a chronic activator of anxious uncertainty for humans (Hirsh & Inzlicht, 2008), given the long-term focus and delayed return on investment in many important human goals (Van den Bos, McGregor, & Martin, 2015). Furthermore, in previous research prevention focus, BIS, and uncertainty aversion have been associated with other indicators of anxious uncertainty including anxiety (Corr, 2008; Higgins, 2006), neuroticism (DeYoung, 2015; Greco & Roger, 2001), and low self-esteem (Greco & Roger,

2001). An example of a prevention focus item is “I am anxious that I will fall short of my responsibilities and obligations.” The BIS item is “If I think something unpleasant is going to happen, I usually get pretty worked up.” Finally, an example of an uncertainty aversion item is “I feel anxious when things are changing.”

The scale was created by submitting all the items from these three scales to an exploratory factor analysis (using maximum likelihood and promax rotation) to identify the best indicators of a shared anxious uncertainty sensitivity factor (Prentice, 2016). Fifteen items were retained in the final scale, which all loaded highly ( $> 0.60$ ) on a single “anxious uncertainty” factor. In the current sample, all 15 items loaded highly ( $> 0.58$ ) on the single factor and it explained 53.03% of the variance in scores. A mean score was calculated for each participant, with higher scores indicating greater anxious uncertainty sensitivity. Cronbach’s alpha reliability for the current study was 0.94.

**Boredom Proneness.** This was measured using the 10-item Multidimensional Trait Boredom Scale-Disengage (MTBS-D; Gerritsen, Toplak, Sciaraffa, & Eastwood, 2014). The MTBS-D is a trait version of the Disengagement factor of the Multidimensional State Boredom Scale (Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013), designed to measure propensity to experience boredom in the general population. The MTBS-D is a broad measure intended to capture all facets of the experience of boredom. In contrast with some other measures of boredom proneness, including the popular Boredom Proneness Scale (Farmer & Sundberg, 1986), it was developed by surveying individual experiences of boredom as opposed to being based on any one specific theory (Gerritsen et al., 2014). Furthermore, its face-valid operationalization of boredom is un-confounded with other subscales that include items which seem to capture antecedents or consequences of boredom, rather than the phenomena itself. This

is especially important for the current research because it positions boredom between its motivational antecedents (high anxious uncertainty and low approach motivation) and consequences (low self-control). Example items are, “I often feel like I’m sitting around waiting for something to happen” and “In general, I feel bored.” A mean score was calculated for each participant, with higher scores reflecting greater boredom proneness. Cronbach’s alpha reliability for the current study was 0.89.

**Trait Self-Control.** This was measured using the 13-item Brief Self-Control Scale (BSCS; Tangney, Baumeister, & Boone, 2004). The BSCS is a general measure of trait self-control that taps the ability to control one’s thoughts, impulses and behaviours. Example items are, “People would say that I have iron self-discipline,” and “I have a hard time breaking bad habits” (reverse-scored). A mean score was calculated for each participant, with higher scores reflecting greater ability to exert self-control. Cronbach’s alpha for the current study was 0.88.

## Results

### Associations with Boredom Proneness and Self-Control

Bivariate correlations and descriptive statistics are presented in Table 1. AUS was significantly positively correlated with boredom proneness,  $r(136) = .59, p < .001$ , and negatively correlated with self-control,  $r(136) = -.27, p = .001$ . Conversely, AMS was significantly negatively correlated with boredom proneness,  $r(136) = -.43, p < .001$ , and positively correlated with self-control,  $r(136) = .40, p < .001$ . Boredom proneness was also significantly negatively correlated with trait self-control,  $r(136) = -.44, p = .001$ . A multiple regression analysis was conducted where boredom proneness was regressed on AUS and AMS to assess their unique contribution in predicting boredom proneness (see Figure 1 for a summary of the results). The model explained a significant proportion of the variance in boredom proneness,

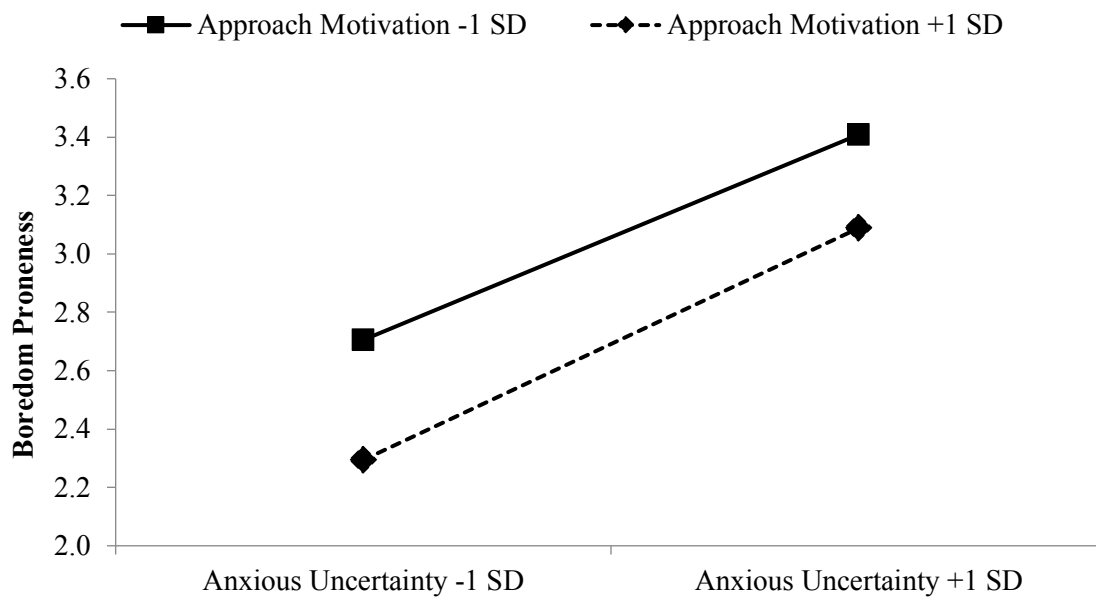
$R^2 = 0.40$ ;  $F(2, 135) = 45.56$ ,  $p < .001$ . AUS was a unique, significant positive predictor,  $B = 0.48$ , 95% CI [0.35, 0.62],  $\beta = 0.50$ ,  $p < .001$ , and AMS was a unique, significant negative predictor,  $B = -0.34$ , 95% CI [-0.54, -0.14]),  $\beta = -0.24$ ,  $p = .001$ , of boredom proneness, when both were entered simultaneously.

Table 1

*Descriptive Statistics and Bivariate Correlations Among Variables*

Variables	Mean	SD	1	2	3
1. Boredom Proneness	2.87	0.74	1		
2. AMS	3.84	0.53	-.43***	1	
3. AUS	3.21	0.77	.59***	-.37***	1
4. Self-control	2.84	0.72	-.44***	.40***	-.27**

\*\*  $p < .01$ , \*\*\*  $p < .001$



*Figure 1.* Participants self-reported boredom proneness as a function of anxious uncertainty sensitivity and approach motivation sensitivity. Participants with higher AUS and lower AMS reported higher boredom proneness.

## Mediation Analyses

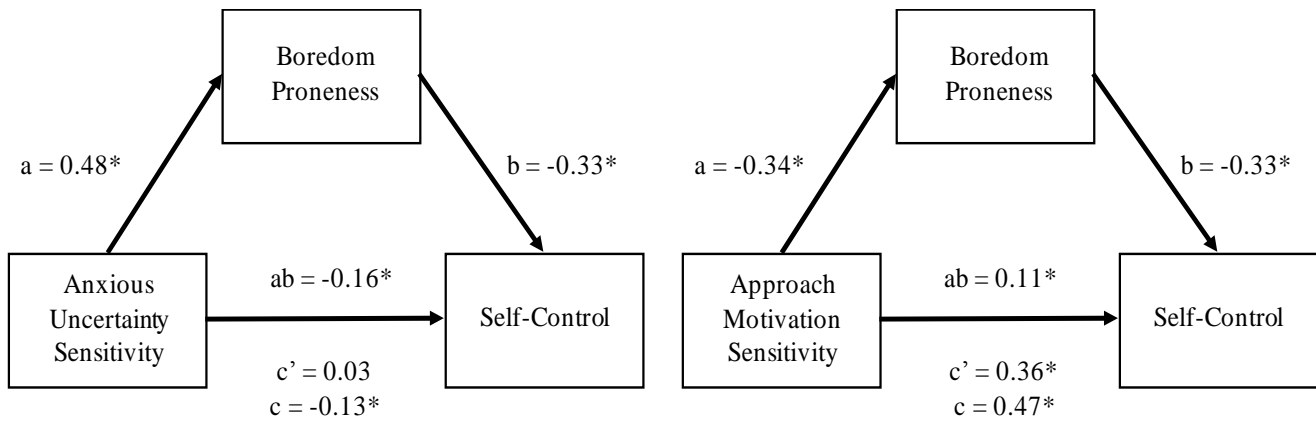
Simple mediation analyses were conducted with the PROCESS macro for SPSS, which uses ordinary least squares path analysis (Hayes, 2013). Two mediational pathways were tested examining the influence of anxious uncertainty and approach motivation sensitivity respectively, on self-control through boredom proneness. To assess the unique contribution of AUS and AMS, I included the other predictor as a covariate in both models.<sup>1</sup>

The results of the first analysis indicated that AUS indirectly influenced self-control through its effect on boredom proneness. As can be seen in Figure 2, participants with greater AUS were more prone to boredom ( $a = 0.48, p < .001$ ), and participants who were more prone to boredom had lower levels of self-control ( $b = -0.33, p < .001$ ). A bias-corrected bootstrap confidence interval for the indirect effect ( $ab = -0.16$ ) based on 5,000 bootstrap samples was entirely below zero [-0.29, -0.05]. Anxious uncertainty sensitivity did not influence self-control independent of its effect on boredom proneness ( $c' = 0.03, p = .734$ ). The results of the second analysis indicated that AMS also indirectly influenced self-control through its effect on boredom proneness. As shown in Figure 2, participants with lower AMS were more prone to boredom ( $a = -0.34, p < .001$ ), and participants who were more prone to boredom had lower levels of self-control ( $b = -0.33, p < .001$ ). A bias-corrected bootstrap confidence interval for the indirect effect ( $ab = 0.11$ ) was entirely above zero [0.03, 0.23]. AMS still had a significant direct effect on self-control independent of its effect on boredom proneness ( $c' = 0.36, p = .002$ ).

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<sup>1</sup> I also ran both mediation models only testing one predictor at a time without the other included as a covariate. The indirect effects of AUS on self-control through boredom proneness ( $ab = -0.24$ ) and of AMS on self-control through boredom proneness ( $ab = 0.19$ ) were significant and slightly larger in magnitude, as were both total effects. This indicates that although there is some shared variance, both AUS and AMS uniquely predict trait self-control through effects on boredom proneness.





\*95% confidence interval does not include zero

*Figure 2.* Simple mediation models for the indirect effects of AUS (controlling for AMS) and AMS (controlling for AUS) on trait self-control through boredom proneness.

## Discussion

Examination of the relationships between AUS, AMS, boredom proneness, and trait self-control yielded the predicted associations. People who reported higher levels of AUS were more prone to boredom, and people who reported higher levels of AMS were less prone to boredom. Together the two motivational orientations could account for 40% of the variance in boredom proneness, and each predicted variation that was unique from the other. These findings provide initial support for the notion that high anxious uncertainty and low approach motivation are the motivational substrates of boredom.

Additionally, people who reported higher AUS also reported lower levels of trait self-control and people who reported higher AMS reported higher levels of trait self-control. Both relationships were mediated by boredom proneness, suggesting that AUS and AMS exert their influence on self-control indirectly through effects on boredom proneness. These findings also support the proposed theoretical model, suggesting that boredom signals the motivational states of high anxious uncertainty and low approach motivation, that predict self-control failure.

One limitation of the present study was that all the measures used were self-reported. Although the use of self-report measures can make data collection more efficient, there is also a risk that people's responses are influenced by motivated cognitions and personal biases. For example, social desirability concerns may motivate people to report higher levels of trait self-control as it is popularly associated with a variety of beneficial outcomes. Therefore, in Study 2 I assessed self-control by measuring actual behaviour during a task requiring focused persistence and adherence to reported intentions. Since a behavioural measure is necessarily assessed at the state-level, I also opted to use state-level measures of anxious uncertainty, approach motivation, and boredom to see if these results would mirror the trait-level findings.

## Study 2

Study 2 included both a direct and conceptual replication of Study 1. The purpose of the direct replication was to assess the reliability of the findings observed in the first study. I accordingly pre-registered the predicted trait-level results based on the findings of the previous study before beginning Study 2 (pre-registration available at <https://osf.io/h6cqj/>). More specifically, I predicted that AUS would be associated with more boredom proneness and less trait self-control, while AMS would be associated with less boredom proneness and more trait self-control. I also predicted that together AUS and AMS would account for a significant proportion of the variance in boredom proneness. Additionally, I predicted that boredom proneness would mediate links between AUS and AMS with trait self-control.

In this study, I also wanted to address a limitation of Study 1, namely the exclusive reliance on self-report measures, by including a behavioural measure of self-control. Therefore, in the second part of Study 2 participants completed a data entry task, requiring focused persistence, and I measured state-level variation in approach motivation, anxious uncertainty, and boredom during the task. I also assessed whether participants' behaviour during the task deviated from their reported intentions before beginning. I predicted that participants who reported greater anxious uncertainty and lower approach motivation during the task would also feel more bored, and that they would consequently be less persistent on the task, and less likely to follow through with their stated intentions. I again tested the proposed mediational pathways by examining the indirect effects of state-level anxious uncertainty and approach motivation on self-control through boredom.

## Method

### Participants

To determine an appropriate sample size, I conducted a power analysis with G\*Power using a fixed model, single coefficient. I based the power analysis on the effect sizes observed in Study 1, specifically I used the coefficient of the smaller predictor (i.e. AMS) from the multiple regression analysis. The suggested sample size was 199 to achieve 90% power. I therefore aimed to collect a sample of approximately 200 participants (see pre-registration). Two hundred and thirteen undergraduate psychology students from the University of Waterloo ( $M_{age} = 21.38$ ,  $SD = 5.21$ , range = 18 - 60) participated in exchange for course credit. Participants were recruited through the University's online subject pool. Three participants did not consent to have their data used after the post-study debriefing and were therefore removed, leaving a final sample of 210. Fifty-nine percent of the sample self-identified as female and 41% as male. Fifty percent of the sample self-identified as Asian, 25% as White, 9% as Indian, 3% as Black, 2% as Latin American, 1% as Multi-ethnic, and 10% as other or undisclosed.

### Procedure

Participants began by completing the same four measures of anxious uncertainty sensitivity, approach motivation sensitivity, boredom proneness, and trait self-control (presented in random order) as in Study 1. Following completion of these trait measures, participants were told that they would be completing a data entry task. They were instructed to type as many consecutive numbers as possible (each separated by a space and a comma) in the text box provided, starting with the number one. They were told that after an unspecified period of time the screen would automatically advance. In fact, the screen automatically advanced after five minutes had elapsed. They were also told that at any point they could choose to stop the task and

simply wait for the screen to advance, or if needed take a break and resume. To ensure that participants who chose not to persist did not do something else in the interim, they were told that if they stopped or took a break it was recommended that they not engage in any other activities like getting up from their computer or checking their phone, as doing so tended to be distracting and disrupt focus for the remainder of the study.

As part of the instructions, participants were told ostensibly that data entry tasks have been found to be a quick and reliable method for gauging general academic performance among undergraduate students, as they tend to be associated with outcomes like greater reading comprehension and working memory. Furthermore, they were also told that at the end of the study they would receive feedback indicating how their performance compared to normative scores on the task. Participants, however, did not receive any information about their performance after completing the task. I included these statements to try and make participants feel motivated to perform well and not simply like they were doing what they were told. I suspected that the hypothesized effects would not emerge in a context where participants did not care about their performance, as there would be limited variation across participants in motivation and boredom. Previous research has shown that people tend to prioritize goals that they want to do, rather than have to do, as they perceive more utility in deploying regulatory resources towards goals that feel personally important and meaningful (Milyavskaya et al., 2015). Therefore, I hoped that by telling students that the task was reflective of academic success and that their performance would be compared to their peers, that this would activate participants' personally relevant academic goals.

Before beginning the task, participants also completed pre-measures of intention to remain focused and not check their phone. After completing the data entry task, participants were

asked to report their state approach motivation, anxious uncertainty, and boredom while completing the task. They were also asked to report (yes or no) whether they had chosen to stop or take a break during the task, whether they had become distracted during the task, and whether they had checked their phone. At the end of the study, participants responded to an open-ended question eliciting their thoughts about the purpose/hypotheses of the study to ensure that they were not suspicious of the cover story about the data entry task. State data were removed for two individuals who expressed suspicion that the data entry task was not in fact related to any academic outcomes. Finally, participants were debriefed and they provided post-study consent with full knowledge of the deception involved.

## Measures

The same trait-level measures of boredom proneness (Cronbach's  $\alpha = 0.89$ ), approach motivation sensitivity (Cronbach's  $\alpha = 0.93$ )<sup>2</sup>, anxious uncertainty sensitivity (Cronbach's  $\alpha = 0.93$ ), and trait self-control (Cronbach's  $\alpha = 0.85$ ), were used as in Study 1. State approach motivation, state anxious uncertainty, and state boredom were all rated on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

**State Approach Motivation.** This was measured with six items adapted from the Approach Motivation Sensitivity Scale used in Study 1. Participants were asked to check in with how they felt during the data entry task, and rate the statements based on how they had felt while completing it. All items began with the stem "I felt...", followed by a modified state version of the item. The measure consisted of: 1 BAS Drive subscale item (from Carver & White, 1994), "I felt like I would go all-out to get something I wanted", 2 self-esteem items (from Rosenberg,

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<sup>2</sup> It was decided apriori that outliers would be defined as scores that fell 3 standard deviations above or below the mean on any given measure (see pre-registration). Three extreme scores more than 3 SDs above the mean on AMS were therefore removed.

1965), e.g., “I felt like I had a positive attitude toward myself,” 2 hope items (from Snyder et al., 1991), e.g., “I felt like energetically pursuing my goals,” and 1 promotion focus /approach item (from Lockwood et al., 2002), “I felt focused on achieving positive outcomes”. These items were chosen because they were face valid, had high factor loadings ( $> .68$ ) and item-total correlations ( $> .61$ ) on the trait version of the scale, and could be easily adapted to a state context. A mean score was calculated for each participant, with higher scores reflecting greater state approach motivation during the task. Cronbach’s alpha reliability for the current study was 0.93.

**State Anxious Uncertainty.** This was measured with six items adapted from the Anxious Uncertainty Sensitivity Scale used in Study 1 and eight items from McGregor et al.'s (2001) Felt Uncertainty Scale. I used the six state-modified AUSS items to be consistent with the trait-level measure, however, since McGregor and colleagues had already created a measure that has been used in previous research to assess state anxious uncertainty (e.g., Alquist et al., 2018; Hayes, Ward, & McGregor, 2016), a shortened version of this scale was also included. Independent scores from the two scales were highly correlated,  $r(186) = .65, p < .001$ , which suggested that they were measuring the same underlying construct and supported the creation of a single composite measure using the items from both scales. A principal components analysis revealed that all fourteen items loaded highly on a single factor ( $> .42$ ), which explained 49% of the variance in scores. Furthermore, results were consistent and significant whether the 14-item scale or the 6-item version with only the AUSS items was used.

Participants reflected on how they felt during the data entry task, and rated the statements based on their experience while completing it. All items began with the stem “I felt...”, followed by a modified state version of the item (for the 8 state anxious uncertainty items no modification was necessary). The final measure consisted of: 1 prevention focus item (from Lockwood et al.,

2002), “I felt anxious that I would fall short of my responsibilities and obligations,” 5 uncertainty aversion items (from Greco & Roger, 2001), e.g., “I felt lost and uncertain about what to do next,” and 8 felt uncertainty items (from McGregor et al., 2001), e.g., I felt... “conflicted,” “pre-occupied,” “distractible,” “restless,” “indecisive,” “uncertain,” and “jumbled.” Items from the AUSS were again chosen because they were face valid, had high factor loadings ( $> .65$ ) and item-total correlations ( $> .60$ ) on the trait version of the scale, and because they could be easily adapted to measure state responses. A mean score was calculated for each participant, with higher scores reflecting greater anxious uncertainty during the task. Cronbach’s alpha reliability for the measure was 0.91.

**State Boredom.** This was measured with two items adapted from the Boredom Proneness scale used in Study 1 (Gerritsen et al., 2014), to assess participant’s experience during the data entry task. The two items were, “How boring did you find the task?” and “How much did you wish you could be doing something else?”. These items were chosen as they were easily adapted to a state context and because they were highly face valid. A mean score was calculated for each participant, with higher scores reflecting greater boredom experienced during the task. Cronbach’s alpha reliability for the current study was 0.85.

**State Self-Control.** This was measured with a composite of four indices of self-control, namely, total numbers entered, stopping or taking a break, and deviation from intentions to give the task one’s undivided attention and refrain from checking one’s phone. Before completing the task, participants reported whether they planned to give the task their undivided attention and whether they planned to check their phone (reverse-scored). Both questions were rated on a 5-point scale ranging from 1 (definitely not) to 5 (definitely yes). Mean scores on both items were near the end-point of the scale, 4.50 and 4.31 respectively, indicating that in line with the cover



story describing the task as a marker of academic success, participants reported high motivation to stay focused and engaged. To isolate the remaining variance left over after accounting for pre-task intentions logistic regression analyses were conducted where: 1) post-task self-reported distraction (i.e. whether participants reported becoming distracted during the task; yes or no) was regressed on pre-task self-reported intention to remain focused (i.e. whether participants intended to give the task their undivided attention), and 2) post-task self-reported phone checking (i.e. whether participants reported checking their phone during the task; yes or no) was regressed on pre-task self-reported intention to not check one's phone (i.e. whether participants intended to refrain from checking their phone during the task). Standardized residuals were saved from both analyses, which assessed participants' deviation from their intentions to stay focused and engaged (i.e. deviation from the priority). Next, the total numbers entered and breaks taken variables were standardized. Finally, a mean score was calculated for each participant by averaging these four standardized values, with higher scores reflecting greater state self-control. Cronbach's alpha reliability for the measure was 0.67.

## **Results**

### **Trait-Level Associations with Boredom Proneness and Self-Control**

Trait measure correlations and descriptive statistics are presented in Table 2. In line with the results of Study 1, AUS was positively correlated with boredom proneness,  $r(208) = .54, p < .001$ , and negatively correlated with self-control,  $r(210) = -.22, p = .001$ , while AMS was negatively correlated with boredom proneness,  $r(207) = -.27, p < .001$ , and positively correlated with self-control,  $r(207) = .29, p < .001$ . When boredom proneness was regressed on AUS and AMS, AUS was a unique significant positive predictor,  $B = 0.47, 95\% \text{ CI } [0.36 -0.59], \beta = 0.47, p < .001$ , and AMS was a unique significant negative predictor,  $B = -0.20, 95\% \text{ CI } [-0.35, -$

0.06]),  $\beta = -0.16, p = .007$ . See Figure 3 for a summary of the results. Although it was not hypothesized, the interaction of AUS and AMS was also a significant predictor of boredom proneness,  $B = 0.19, 95\% \text{ CI } [0.05, 0.34]$ ,  $\beta = 0.15, p = .010$ . Probing the interaction revealed that at low levels of AUS (- 1 SD), AMS was a significant predictor of boredom proneness ( $B = -0.35, p < .001$ ), however, at high levels of AUS (+ 1 SD), AMS was not a significant predictor of boredom proneness ( $B = -0.04, p = .648$ ). Together the model accounted for a significant proportion of the variance in boredom proneness,  $R^2 = 0.32, F(3, 203) = 32.22, p < .001$ .

Table 2

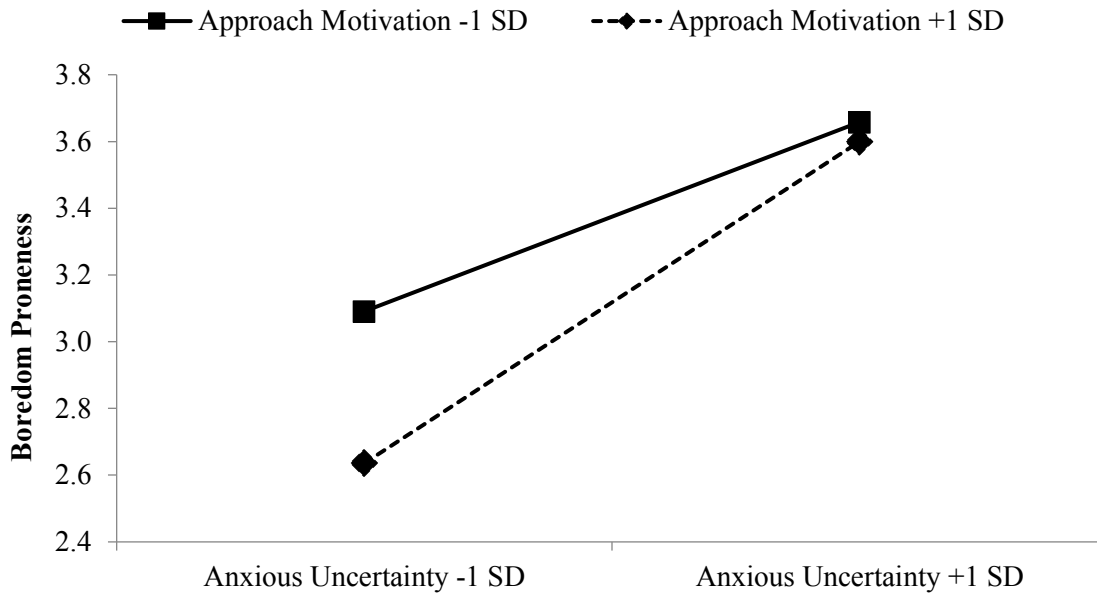
*Trait-Level Descriptive Statistics and Bivariate Correlations Among Variables*

Variables	Mean	SD	1	2	3
1. Trait AMS	3.86	0.64	1		
2. Trait AUS	3.41	0.81	-.22**	1	
3. Boredom Proneness	3.22	0.81	-.27***	.54***	1
4. Trait Self-Control	2.81	0.69	.29***	-.22**	-.42***

\*\*  $p < .01$ , \*\*\*  $p < .001$

**Trait-Level Mediation Analyses**

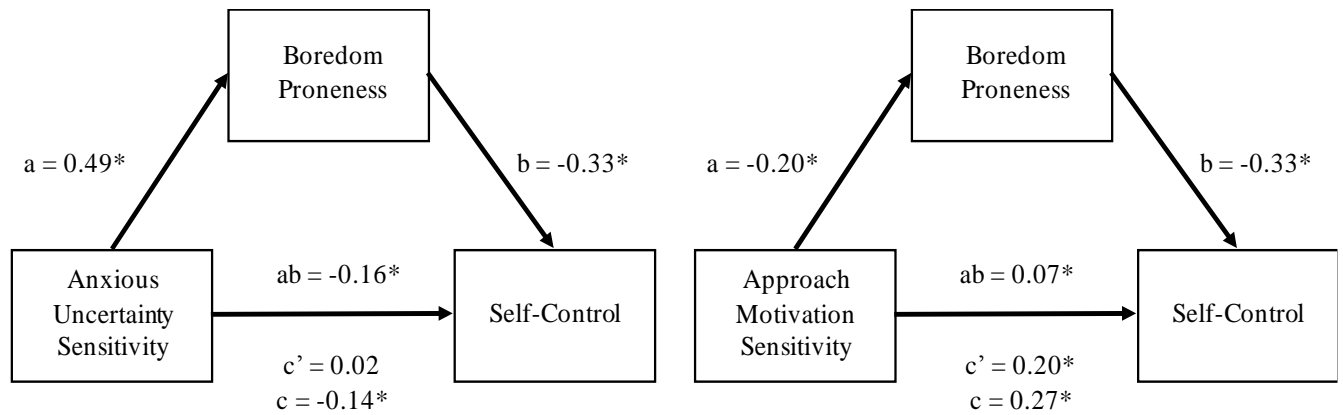
The same meditational pathways were tested as in Study 1 examining the influence of anxious uncertainty and approach motivation sensitivity respectively, on self-control through boredom proneness. To assess the unique contribution of AUS and AMS, I included the other predictor as a covariate in both models. Both AUS and AMS indirectly influenced self-control through their effects on boredom proneness. As can be seen in Figure 4, participants with greater AUS were more prone to boredom ( $a = 0.49, p < .001$ ), and participants who were more prone to boredom had lower levels of self-control ( $b = -0.33, p < .001$ ). A bias-corrected bootstrap



*Figure 3.* Participants self-reported boredom proneness as a function of anxious uncertainty sensitivity and approach motivation sensitivity. Participants with higher AUS and lower AMS reported higher boredom proneness. AMS was not a significant predictor of boredom proneness at high levels of AUS.

confidence interval for the indirect effect ( $ab = -0.16$ ) based on 5,000 bootstrap samples was entirely below zero  $[-0.25, -0.09]$ . Anxious uncertainty sensitivity did not influence self-control independent of its effect on boredom proneness ( $c' = 0.02, p = .689$ ). Participants with lower AMS were also more prone to boredom ( $a = -0.20, p = .008$ ), and a bias-corrected bootstrap confidence interval for the indirect effect ( $ab = 0.07$ ) on self-control through boredom proneness was entirely above zero  $[0.02, 0.13]$ . AMS still had a significant direct effect on self-control independent of its effect on boredom proneness ( $c' = 0.20, p = .004$ ).<sup>3</sup>

<sup>3</sup> As in Study 1, I also ran both mediation models only testing one predictor at a time without the other included as a covariate. The indirect effects of AUS on self-control through boredom proneness ( $ab = -0.20$ ) and of AMS on self-control through boredom proneness ( $ab = 0.11$ ) were significant and slightly larger in magnitude, as were both total effects. Again, this indicates that although there is some shared variance, both AUS and AMS uniquely predict trait self-control through effects on boredom proneness.



\*95% confidence interval does not include zero

Figure 4. Simple mediation models for the indirect effects of AUS (controlling for AMS) and AMS (controlling for AUS) on trait self-control through boredom proneness.

### State-Level Associations with Boredom and Self-Control

All state measure correlations and descriptive statistics are presented in Table 3.

Consistent with the trait-level results, state anxious uncertainty was associated with greater boredom during the data entry task,  $r(193) = .27, p < .001$ , and less state self-control,  $r(193) = -.31, p < .001$ . Conversely, state approach motivation was associated with less boredom during the task,  $r(194) = -.23, p = .001$ , and greater state self-control,  $r(194) = .18, p = .010$ . Participants who were more bored during the task, entered fewer numbers on the data entry task,  $r(191) = -.18, p = .012$ , and were more likely to stop or take a break,  $r(192) = -.35, p < .001$ , get distracted,  $r(192) = -.38, p < .001$  and check their phone,  $r(192) = -.31, p < .001$ . To examine the unique predictive power of anxious uncertainty and approach motivation, boredom was regressed on the two predictors simultaneously (see Figure 5 for a summary of the results). The model accounted for a significant proportion of the variance in boredom experienced during the task,  $R^2 = 0.19$ ,  $F(2, 186) = 22.28, p < .001$ . Anxious uncertainty was a unique positive predictor of boredom,  $B$

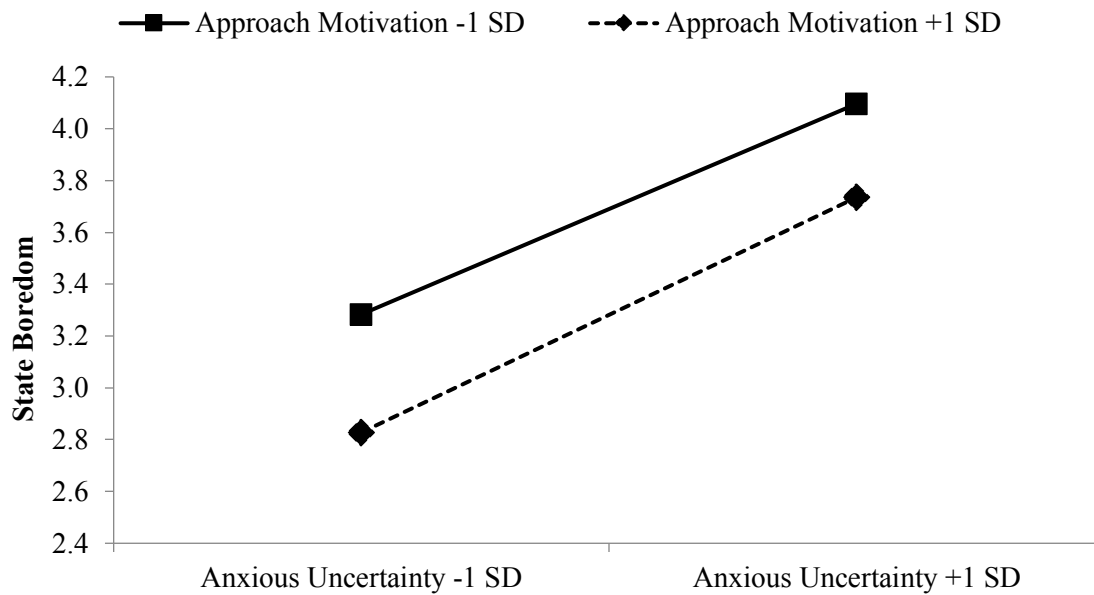
Table 3

*State-Level Descriptive Statistics and Bivariate Correlations Among Variables*

Variables	Mean	SD	1	2	3	4	5	6	7	8	9	10
1. Pre-Attention	4.50	0.73	1									
2. Pre-Phone Check	4.31	1.03	.38***	1								
3. State Approach Motivation	3.34	0.96	.17*	.10	1							
4. State Anxious Uncertainty	2.53	0.90	-.24**	-.23**	-.15*	1						
5. State Boredom	3.48	1.16	-.17*	-.27***	-.24**	.40***	1					
6. State Self-Control	0.003	0.71	.18*	.24**	.19**	-.35***	-.40***	1				
7. Numbers Entered	184.58	67.71	.19**	.24**	.09	-.17*	-.18*	.70***	1			
8. Stop/Break	-	-	.20**	.24**	.16*	-.31***	-.35***	.78***	.46***	1		
9. Distracted	-	-	.33***	.34***	.22**	-.33***	-.38***	.72***	.31***	.45***	1	
10. Post-Phone Check	-	-	.32***	.34***	.12	-.32***	-.31***	.71***	.34***	.45***	.43***	1

\*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$  Notes: State self-control is a standardized variable. Stop/break, distracted, and post-phone checking are dichotomous variables with a yes/no response.

= 0.48, 95% CI [0.31 - 0.65]),  $\beta = 0.38$ ,  $p < .001$ , and approach motivation was a unique negative predictor of boredom,  $B = -0.22$ , 95% CI [-0.38 - -0.06]),  $\beta = -0.18$ ,  $p = .008$ .<sup>4</sup>



*Figure 5.* Participants self-reported state boredom as a function of state anxious uncertainty and state approach motivation. Participants who reported higher anxious uncertainty and lower approach motivation tended to report higher levels of boredom during the task.

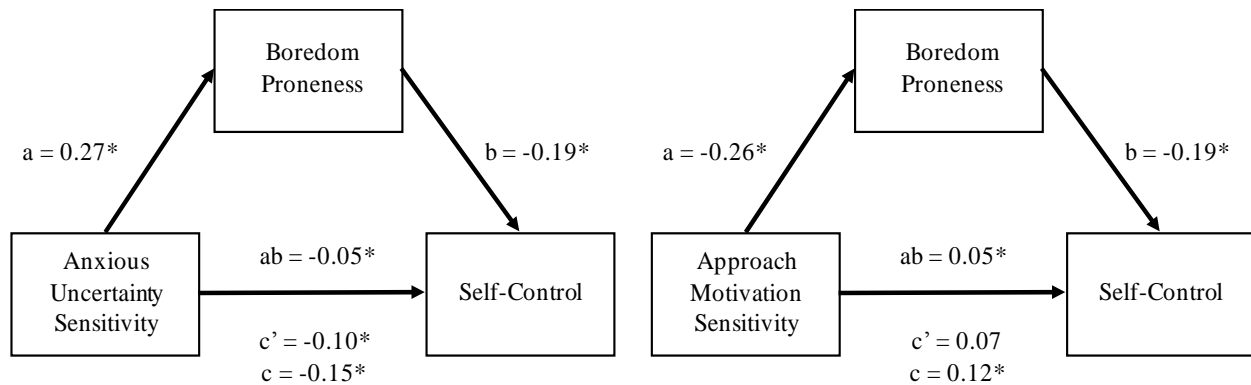
### State-Level Mediation Analyses

Two meditational pathways were tested examining the indirect pathways of state anxious uncertainty and state approach motivation respectively, on self-control through boredom. To assess the unique contribution of anxious uncertainty and approach motivation, I included the other predictor as a covariate in both models. In line with the trait-level findings, both anxious uncertainty and approach motivation indirectly influenced self-control through their effects on

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<sup>4</sup> These results were consistent when using the 6-item state AUSS as the measure of state anxious uncertainty, rather than the 14-item measure composed of the 6 AUSS items and the 8 felt uncertainty items. Using the 6 item scale, state anxious uncertainty was associated with greater boredom  $r(191) = .28$ ,  $p < .001$ , and lower self-control  $r(191) = -.31$ ,  $p < .001$ . Furthermore, the results of a simultaneous multiple regression analysis with state anxious uncertainty, and approach motivation indicated that anxious uncertainty remained a unique significant positive predictor of boredom,  $B = 0.28$ , 95% CI [0.14 - 0.43]),  $\beta = 0.27$ ,  $p < .001$ , and approach motivation remained a unique significant negative predictor of boredom,  $B = -0.26$ , 95% CI [-0.42 - -0.10]),  $\beta = -0.22$ ,  $p = .002$ . The model accounted for 13% of the variance in boredom.

boredom. As can be seen in Figure 6, participants who reported greater anxious uncertainty during the data entry task tended to find it more boring ( $a = 0.27, p < .001$ ), and participants who experienced greater boredom had lower levels of self-control on the task ( $b = -0.19, p < .001$ ). A bias-corrected bootstrap confidence interval for the indirect effect ( $ab = -0.05$ ) based on 5,000 bootstrap samples was entirely below zero  $[-0.09, -0.02]$ . Anxious uncertainty sensitivity still had a direct effect on self-control independent of its effect on boredom ( $c' = -0.10, p = .001$ ). The results of the second analysis indicated that approach motivation also indirectly influenced self-control through boredom. Participants with lower approach motivation tended to find the task more boring ( $a = -0.26, p = .002$ ), and a bias-corrected bootstrap confidence interval for the indirect effect ( $ab = 0.05$ ) on self-control through boredom was entirely above zero  $[0.01, 0.10]$ . Approach motivation did not influence self-control independent of its effect on boredom ( $c' = 0.07, p = .133$ ).<sup>5</sup>



\*95% confidence interval does not include zero

*Figure 6.* Simple mediation models for the indirect effects of state anxious uncertainty (controlling for state approach) and state approach motivation (controlling for state anxious uncertainty) on state self-control through boredom.

<sup>5</sup> I also ran both models with trait AMS and AUS included as additional covariates. The results remained largely unchanged with the addition of the trait variables, suggesting that these state-level effects exist independent of trait-level differences. Both the indirect effect of anxious uncertainty ( $ab = -0.07$ ) and the indirect effect of approach motivation ( $ab = 0.05$ ) on self-control through boredom remained significant and of similar magnitude.

In addition to predicting self-control on the data entry task, boredom also predicted whether participants completed the task correctly by following all the instructions,  $\chi^2(209) = 4.42, p = .036$ . Participants were explicitly asked to type a series of numbers each separated by a comma and a space, however, 43% of the sample deviated from the instructions in some way (e.g., didn't use commas or didn't put spaces between numbers). For every one-unit increase in reported boredom during the task, there was a 31% decrease in the odds of following the instructions while completing it. Although this effect was not predicted, it is consistent with the state self-control findings as it suggests that the more bored people were, the more likely they were to be lazy or careless while completing the task.

### **Discussion**

The results of Study 2 directly replicated those observed in Study 1. Associations among the trait-level variables were consistent across the two studies, with higher AUS and lower AMS related to higher boredom proneness and lower trait self-control. In the present study, AUS and AMS together accounted for 32% of the variance in boredom proneness, and each predictor contributed significantly to the multiple regression model. Interestingly, in the present study the main effects of AUS and AMS on boredom proneness were qualified by a significant interaction. Probing the interaction revealed that AMS significantly predicted lower boredom proneness only when AUS was low but not high. It may be the case that the ability to stay tenaciously engaged in important goals, which is characteristic of high approach motivation, buffers people against boredom only when goal focus is not simultaneously disrupted by the aversive experience of anxious uncertainty. However, this interaction did not significantly predict boredom proneness in Study 1, suggesting that further research is necessary to make any strong claims about the conditions of this relationship. Additionally, the results of the mediation analyses mirrored the



effects observed in Study 1 very closely. These findings provide further support for the proposition that boredom signals the states of high anxious uncertainty and low approach motivation that predict lapses in self-control.

The results of Study 2 also conceptually replicated these findings at the state level using a quasi-behavioural measure of self-control. Higher state anxious uncertainty and lower state approach motivation were associated with greater boredom and lower self-control while completing the task. Participants who were more bored on the task were more likely to deviate from their reported intentions, and be less focused and persistent. That is, they were more likely to become distracted by other tempting alternatives (e.g. daydreaming, using one's phone) compromising performance on the prioritized goal (i.e. to do well on the data entry task). Also in line with the trait-level results, the relationships between state anxious uncertainty and state approach motivation and self-control were mediated by boredom. These findings point to boredom as the affective mechanism by which changing activity in these motivational systems signals a possible goal conflict, thereby disrupting focus on the goal at hand and leaving people vulnerable to self-control failure.

## **General Discussion**

The present research supports a motivational account of boredom. First, it provides evidence that state and trait level variation in anxious uncertainty and approach motivation can account for a significant amount of the variance in boredom and boredom proneness, respectively. Second, it provides evidence that these motivational orientations are also related to self-control and that boredom mediates these relationships. This research contributes to the growing literature on the regulatory function of boredom by suggesting that motivational orientations produce conditions that give rise to the emotional experience of boredom, which is a state conducive to self-control failure.

### **Theoretical Implications**

Across two studies, the results of the present work provide evidence of the association between anxious uncertainty and boredom. In Studies 1 and 2, people who reported higher levels of AUS were more prone to experiencing boredom, and in Study 2 people who reported higher state anxious uncertainty felt more bored during the data entry task. Individuals who are dispositionally or situationally high in anxious uncertainty may be more likely to experience boredom because they are more sensitive to potential threats in their environment that indicate a goal conflict. This sensitivity would result in a BIS-mediated state of disengaged vigilance, characterized by goal re-assessment and scanning for potential alternatives (Corr, 2009; Gray & McNaughton, 2000). Boredom functions as an emotional signal that one should seek out more engaging and less conflicted or uncertain goal pursuits (Bench & Lench, 2013). Boredom's regulatory signal can be functionally adaptive when it prompts people to abandon goals that have become fraught with conflict and disruption or that no longer align with one's values and interests (Elpidorou, 2014). However, a heightened sensitivity to discrepancy and uncertainty

cues may lead people to experience boredom more often or more intensely than is warranted given the immediate circumstances.

The current studies also provide evidence of the association between approach motivation and boredom, with people low in approach motivation reporting greater trait and state level boredom. Approach motivation may be negatively associated with boredom because people who are highly approach motivated are able to remain engaged and focused on important goals insulating them from the distraction of possible goal conflicts (DeYoung, 2015). Situations are perceived as boring when an individual is unable to engage with the environment or perceives their current goal to be less attractive than other alternatives, resulting in the desire to do something else (van Tilburg & Igou, 2017b). People who are low in approach motivation may be more likely to find situations boring because they cannot maintain engagement and attention on focal goals without other goals seeming equally appealing, resulting in conflict and distraction (Gable & Harmon-Jones, 2008). They may accordingly remain in conflicted states longer because they cannot mobilize approach behaviour to alleviate the anxious state (Park, 2010). Corr's (2009) notion of sub-goal scaffolding suggests that complex approach behaviour consists of a series of nested goals. Successfully pursuing higher order goals, therefore, often requires restraint and long-term planning at lower levels to keep behaviour aligned with priorities (e.g. when a high-order goal requires enduring a boring task). People low in approach motivation may also have difficulty engaging in the types of interest-enhancing behaviours that help keep individuals engaged in boring tasks that serve higher order goals (Sansone, Weir, Harpster, & Morgan, 1992).

In sum, the results of the present studies indicate that motivational orientations toward high anxious uncertainty and low approach motivation account for a significant amount of the

variance in boredom. Furthermore, despite being reciprocal in nature (Corr, 2004), the multiple regression analyses revealed that both anxious uncertainty and approach motivation were unique predictors of boredom when entered simultaneously. One important implication of the present findings is that boredom does not always depend on what is occurring in the immediate environment, but rather, depends at least in part on what people bring to the situation in terms of their ambient motivations. Variation in the activity of these underlying motivational systems may alter the way that people experience any given situation, including emotional appraisals and behavioural consequences. Thus, the solution to boredom may not necessarily lie in the specific features of the situation, but may also be related to people's free-floating motivational states that either facilitate or impede engagement.

This work also provides evidence of a relationship between approach motivation and anxious uncertainty with self-control that is mediated by boredom. Exercising self-control is necessary when there is a conflict between a transient temptation and a more important goal (Hofmann et al., 2012). In such situations, for example when one wants to go to a party instead of staying home to study, self-control is required to actively resist the desire that conflicts with devotion to the higher order goal. Anxious uncertainty draws attention to conflict and promotes disengagement from goals that are uncertain, until the conflict can be resolved (Corr, 2004). High anxious uncertainty should therefore make people more attuned to the inherent conflict in self-control, which through the motivational dampening effect of BIS activation should decrease the appeal of the focal goal. On the other hand, approach motivation promotes attention to important goals and energizes confident and eager approach behaviour (DeYoung, 2013). To successfully resolve self-control conflicts it would be optimal to focus on progress towards goals and shut out tempting distractions (Harmon-Jones et al., 2009). People with low approach

motivation may struggle to engage the approach-oriented states that automatically mute salience of distractions and conflicts. Moreover, the frequent activation of anxious uncertainty may promote impulsive behaviours intended to relieve the aversive state (McGregor, Nash, Mann, et al., 2010).

Notably, some previous work has conflated the experience of boredom with its behavioural consequences, likening boredom proneness to sensation seeking susceptibility or impulsivity (e.g. Zuckerman, 1979). Based on the proposed motivational process account, these impulsive behaviours are better understood as consequences of boredom rather than features of boredom itself. From this perspective, although boredom is often associated with increased risky or impulsive behaviour, it is not necessarily inextricably linked with such impulsivity-related traits. Instead, the frequent experience of boredom may prompt reactive displacement behaviours, leading to impulsive actions when there are no other immediate functional alternatives to approach (McGregor, Nash, Mann, et al., 2010).

The findings of this work also highlight the indirect effect of anxious uncertainty and approach motivation on self-control through boredom. Boredom may mediate the relationship between these motivational systems and self-control because it is an emotional signal that arises from high anxiety and low approach that predicts self-control failure. It is worth noting that in the present studies boredom fully mediated some relationships, but only partially mediated others. More specifically, across both Study 1 and Study 2 boredom proneness only partially mediated the link between AMS and trait self-control, and conversely, in Study 2 state boredom only partially mediated the link between anxious uncertainty and state self-control. This suggests that there may be other emotional or cognitive factors not specified in the present models that can account for some of the relationship between these motivational systems and self-control.

Future research should continue to explore other possible mediating variables to further clarify the mechanisms by which these motivational orientations exert their influence on self-control.

It is also interesting that the pattern of partial and complete mediation differed across the trait and state levels. One possibility for this difference is the qualitatively different nature of the trait and state measures of self-control. For example, it may be the case that the link between approach motivation and self-control was only partially mediated at the trait level, but completely mediated at the state level, because the measure of trait self-control assessed commitment to more complex, long-term goals. Perhaps in this context, other factors such as future orientation or flexibility would also be important in explaining this relationship.

Furthermore, when comparing the relative size of the indirect effects of approach motivation and anxious uncertainty through boredom to each other, across all three sets of mediation models (2 trait and 1 state) the two indirect effects were of similar magnitude to one another. This suggests that the different patterns of partial and complete mediation across the trait and state levels was a function of the varying size of the total effects, rather than the indirect effects themselves. The larger total effect of approach motivation on self-control at the trait-level and the larger total effect of anxious uncertainty on self-control at the state-level, meant that holding the size of the indirect effect constant there was a smaller proportion of the total effect that was mediated leaving a larger direct pathway.

### **Methodological Implications**

The present findings also speak to existing confusion in the literature surrounding the conceptualization and measurement of trait boredom. Previous research suggests that popular measures of trait boredom, including the widely used Boredom Proneness Scale (BPS; Farmer & Sundberg, 1986) and Boredom Susceptibility Scale (ZBS; Zuckerman, 1979), may not measure

the same underlying constructs (Gerritsen et al., 2014; Mercer-Lynn et al., 2014; Mercer-Lynn, Flora, Fahlman, & Eastwood, 2013). Notably, this work has found that while the BPS is associated with greater BIS activity and experiential avoidance, the ZBS is associated with greater BAS activity and sensitivity to reward (Mercer-Lynn et al., 2014; Mercer-Lynn, Flora, et al., 2013). It is possible that these measures capture different aspects or forms of trait boredom that are differentially associated with tendencies towards anxious uncertainty and approach motivation. It is also possible, however, that the items of the BPS (e.g., “I often find myself at ‘loose ends,’ not knowing what to do”) more closely captures trait boredom, while the items of the ZBS (e.g., “I prefer friends who are excitingly unpredictable”) are more closely related to sensation seeking or reactive approach motivation as a response to the anxious arousal associated with boredom (Jonas et al., 2014). The results of the present studies indicate that boredom proneness is associated with greater anxious uncertainty sensitivity and lower approach motivation sensitivity, which aligns with previous work using the BPS. Furthermore, the findings of the current studies would likely be different if it were replicated using the ZBS as our measure of trait boredom. This suggests that some existing measures of trait boredom may assess the causes or consequences of boredom proneness, and not the construct itself.

### **Limitations and Future Directions**

One possible limitation of the present research is the type of self-control task that was used in Study 2. Although we tried to make the data entry task feel personally important by relating it to academic achievement goals, the state-level associations observed may have been stronger had we measured self-control by assessing persistence and commitment to a goal that felt more consequential and meaningful. Our conceptualization of self-control failure implies that there is deviation from a prioritized goal. To assess loss of self-control it is therefore critical that

participants feel at least somewhat invested in attaining this higher order goal. Thus, it may be most effective to measure self-control as it relates to a goal that participants choose for themselves to ensure that it is valued and important. Furthermore, in Study 2 43% of participants did not complete the data entry task correctly, suggesting that a more consequential higher order goal might lead to more careful and thoughtful responses from participants.

The present studies are also limited by the correlational nature of our analyses; therefore, our suggested causal processes are speculative. Previous correlational research has suggested that it may in fact be poor self-regulation that gives rise to boredom proneness (Struk et al., 2016) and not the other way around as I propose here. Other research that has experimentally manipulated anxious uncertainty supports the proposed model insofar as it found induced anxious uncertainty to significantly reduce self-control (Alquist et al., 2018). In that study, the effect of the anxious uncertainty manipulation on reducing anagram solving persistence was mediated by the felt uncertainty reported by participants. It is also possible that chronic boredom is the result of bidirectional relationships, with anxious uncertainty and approach motivation exerting effects on self-control, and self-control influencing levels of approach and anxiety in a positive feedback loop. Future research should explore the causal nature of these relationships by experimentally manipulating anxious uncertainty and approach motivation and observing effects on self-control, and by assessing whether the experience of boredom mediates any causal effects of anxious uncertainty or approach motivation on self-control.



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## Appendix A

### **Analysis of Exploratory and Pre-Registered Subsamples (Study 1)**

#### **Exploratory Sample**

The exploratory sample was collected in the Fall semester of the 2016-2017 academic year. The sample consisted of 71 undergraduate psychology students ( $M_{age} = 21.19$ ,  $SD = 1.62$ , range = 19 – 28). Seventy-five percent of the sample was female, 24% male, and 1% other.

Thirty-nine percent of participants self-identified as White/Caucasian, 37% as East Asian, 16% as South Asian, and 9% as Other.

#### **Results from Exploratory Sample**

Correlations and descriptive statistics are presented in Table 4. AUS was significantly positively correlated with boredom proneness. AMS was significantly negatively correlated with boredom proneness and positively correlated with self-control.

In a multiple regression analysis AMS and AUS explained a significant proportion of the variance in boredom proneness,  $R^2 = 0.48$ ;  $F(2, 68) = 31.93$ ,  $p < .001$ . AUS was a unique, significant positive predictor ( $\beta = 0.49$ ,  $p < .001$ ; 95% CI [0.26, 0.60]) and AMS was a unique, significant negative predictor ( $\beta = -0.31$ ,  $p = .002$ ; 95% CI [-0.60, -0.14]) of boredom proneness, when both were entered in the regression analysis simultaneously.

Table 4

*Exploratory Sample Descriptive Statistics and Bivariate Correlations*

Variables	Mean	SD	1	2	3	4
1. Boredom Proneness	2.95	0.67	1			
2. AMS	3.82	0.57	-0.54***	1		
3. AUS	3.18	0.76	0.64***	-0.45***	1	
4. Self-control	2.76	0.58	-0.40***	0.58***	-0.22	1

\*\*  $p < .01$ , \*\*\*  $p < .001$

**Pre-registered Sample**

The pre-registered sample was collected in the Winter semester of the 2016-2017 academic year. The sample consisted of 67 undergraduate psychology students ( $M_{age} = 21.37$ ,  $SD = 1.18$ , range = 19 – 27). Seventy-six percent of the sample was female, and 24% male. Forty percent of participants self-identified as White/Caucasian, 39% as East Asian, 12% as South Asian, 6% as Multi-ethnic, 2% as Latin American and 2% as Other.

**Results from Pre-Registered Sample**

Correlations and descriptive statistics are presented in Table 5. AUS was significantly positively correlated with boredom proneness and significantly negatively correlated with self-control. AMS was significantly negatively correlated with boredom proneness and significantly positively correlated with self-control.

In a multiple regression analysis AMS and AUS explained a significant proportion of the variance in boredom proneness,  $R^2 = 0.36$ ;  $F(2, 64) = 18.21$ ,  $p < .001$ . AUS was a unique, significant positive predictor ( $\beta = 0.53$ ,  $p < .001$ ; 95% CI [0.33, 0.76]) and AMS was a marginally significant negative predictor ( $\beta = -0.18$ ,  $p = .089$ ; 95% CI [-0.63, 0.05]) of boredom proneness.

Table 5

## Pre-registered Sample Correlations and Descriptive Statistics

Variables	Mean	SD	1	2	3	4
1. Boredom Proneness	2.77	0.81	1			
2. AMS	3.86	0.49	-0.33***	1		
3. AUS	3.24	0.78	0.58***	-0.28**	1	
4. Self-control	2.86	0.76	-0.44***	0.24**	-0.29**	1

\*\*  $p < .01$ , \*\*\*  $p < .001$

## Appendix B

Multidimensional Trait Boredom Scale-Disengage (MTBS-D; (MTBS-D; Gerritsen, Toplak, Sciaraffa, & Eastwood, 2014)

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1. I am often stuck in situations that I find irrelevant.
  2. In general, everything seems repetitive and routine to me.
  3. I seem to be forced to do things that have no value to me.
  4. In general, I feel bored.
  5. I am typically indecisive or unsure of what to do.
  6. I want to do something fun, but nothing usually appeals to me.
  7. I often wish I were doing something more exciting.
  8. I often feel like I am wasting time that would be better spent on something else.
  9. I often feel like I want something to happen but I'm not sure what.
  10. I often feel like I'm sitting around waiting for something to happen.
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Note: Items are scored on a 5-point scale (1 – strongly disagree to 5 – strongly agree)

## Appendix C

### Approach Motivation Sensitivity Scale (AMSS; Prentice, 2016)

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1. In general, I am focused on achieving positive outcomes in my life.
  2. I feel that I'm a person of worth, at least on an equal basis with others.
  3. I feel that I have a number of good qualities.
  4. I take a positive attitude toward myself.
  5. I see myself as someone who is primarily striving to reach my "ideal self"—to fulfill my hopes, wishes, and aspirations.
  6. Overall, I am more oriented toward achieving success than preventing failure.
  7. I can think of many ways to get the things in life that are most important to me.
  8. I typically focus on the success I hope to achieve in the future.
  9. I am able to do things as well as most other people.
  10. When I'm doing well at something, I love to keep at it.
  11. When I get something I want, I feel excited and energized.
  12. I energetically pursue my goals.
  13. If I see a chance to get something I want, I move on it right away.
  14. When I want something, I usually go all-out to get it.
  15. I often imagine myself experiencing good things that I hope will happen to me.
- 

Note: Items are scored on a 5-point scale (1 – strongly disagree to 5 – strongly agree)

## Appendix D

### Anxious Uncertainty Sensitivity Scale (AUSS; Prentice, 2016)

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1. Uncertainty frightens me.
  2. Facing uncertainty is a nerve-wracking experience.
  3. When uncertain about what to do next, I tend to feel lost.
  4. I get worried when a situation is uncertain.
  5. I feel anxious when things are changing.
  6. Thinking about uncertainty makes me feel depressed.
  7. When I can't clearly discern situations, I get apprehensive.
  8. When making a decision, I am deterred by the fear of making a mistake.
  9. When the future is uncertain, I generally expect the worst to happen.
  10. I am anxious that I will fall short of my responsibilities and obligations.
  11. If I think something unpleasant is going to happen, I usually get pretty worked up.
  12. Sudden changes make me feel upset.
  13. I often imagine myself experiencing bad things that I fear might happen to me.
  14. I am hesitant when it comes to making changes.
  15. When a situation is unclear, it makes me feel angry.
- 

Note: Items are scored on a 5-point scale (1 – strongly disagree to 5 – strongly agree)

## Appendix E

### Brief Self-Control Scale (BSCS; Tangney, Baumeister, & Boone, 2004)

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1. I have a hard time breaking bad habits. \*
  2. I am lazy. \*
  3. I say inappropriate things. \*
  4. I do certain things that are bad for me, if they are fun. \*
  5. I refuse things that are bad for me.
  6. I wish I had more self-discipline. \*
  7. I am good at resisting temptation.
  8. People would say that I have iron self-discipline.
  9. I have trouble concentrating. \*
  10. I am able to work effectively toward long-term goals.
  11. Sometimes I can't stop myself from doing something, even if I know it's wrong. \*
  12. I often act without thinking through all the alternatives. \*
  13. Pleasure and fun sometimes keep me from getting work done. \*
- 

Note: Items are scored on a 5-point scale (1 – strongly disagree to 5 – strongly agree); \* Items are reverse-scored.



## Appendix F

### State Approach Motivation Scale (adapted from Prentice, 2016)

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1. I felt... focused on achieving positive outcomes.
  2. I felt...like I have a number of good qualities.
  3. I felt...like I had a positive attitude toward myself.
  4. I felt...like there are many ways to get the things in life that are most important to me.
  5. I felt...like energetically pursuing my goals.
  6. I felt...like if I wanted something, I would go all-out to get it.
- 

Note: Items are scored on a 5-point scale (1 – strongly disagree to 5 – strongly agree)

## Appendix G

State Anxious Uncertainty Scale (McGregor et al., 2001; adapted from Prentice, 2016)

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1. I felt... lost and uncertain about what to do next.
  2. I felt...worried.
  3. I felt...apprehensive.
  4. I felt...deterred by the fear of making a mistake.
  5. I felt...anxious that I would fall short of my responsibilities and obligations.
  6. I felt...hesitant to make changes.
  7. I felt...uneasy.
  8. I felt...pre-occupied.
  9. I felt...distractible.
  10. I felt...restless.
  11. I felt...conflicted.
  12. I felt...indecisive.
  13. I felt...uncertain.
  14. I felt...jumbled.
- 

Note: Items are scored on a 5-point scale (1 – strongly disagree to 5 – strongly agree)