Exploring the Relationship between Self-Regulation and Boredom

by

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Author's Declaration

This thesis consists of material all of which I authored or co-authored: see Statement of Contributions included in the 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.

Statement of Contributions

This work has been conducted in collobaration with my supervisor Dr. James Danckert and my co-supervisor Dr. Abigail Scholer.

Abstract

The following two studies examined the relationship between various aspects of self-regulation, boredom proneness and the experience of boredom. Prior research on trait boredom has demonstrated that it is often related to variables indicative of poor self-regulatory control. Likewise, prior research has shown a relationship between state boredom and conditions in which individuals are prevented from self-regulating effectively. The goal of this research was to directly test the relationship between boredom proneness and various aspects of self-regulation, as well as exploring how conditions that *prevent* effective self-regulation influence the experience of boredom. Study 1 explored the relationship between self-regulation and boredom proneness using a variety of measures of self-regulation. Results identified a unique set of factors related to boredom proneness, suggesting that effective goal pursuit is associated with reduced likelihood of experiencing boredom. Study 2 examined the influence of low perceived control on the experience of boredom. To do this, high or low perceived control was induced using a computerized version of the children's game 'rock-paper-scissors' in which individuals arbitrarily either won or lost, respectively, regardless of their own play strategy. Individuals in the low control condition (0% win rate) reported being less bored than individuals in the high perceived control condition where wins came easily. This suggests that the potential to gain control may play a role in facilitating engagement with the environment and may be an important factor in mitigating the experience of boredom. This research highlights the importance of effective self-regulation in the experience of boredom.

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CHAPTER 1: Introduction

Despite the growing attention that boredom has gained as a construct of scientific inquiry, it is still poorly understood (Danckert, 2013). To date, boredom has been characterized as a state of high arousal marked by negative affect, coupled with a state of attentional disengagement from one's environment (Eastwood, Frischen, Fenske, & Smilek, 2012; Goetz, et al., 2013; Merrifield, & Danckert, 2014). Furthermore, recent research emphasizes the role of boredom in self-regulation, suggesting that the state of boredom leads individuals to change activities or modify behavior to maintain optimal levels of interest, meaning and challenge (Sansone, Weir, Harpster, & Morgan, 1992; Smith, Wagaman, & Handley, 2009; Van Tilburg & Igou, 2011). Individuals who are prone to boredom appear to have a tendency to feel unchallenged and lack a sense of meaning (Van Tilburg & Igou, 2011). Further, it has been recently proposed that the function of boredom may be to regulate behavior, perhaps by signaling to individuals the need to seek out alternative goals that are more meaningful and satisfying (Bench and Lench, 2013; Elpidorou, 2014).

Given these associations we first wanted to investigate the possibility that trait boredom reflects poor self-regulatory ability (i.e., chronic inability to redress the state of boredom). Indeed, researchers have suggested that the tendency to experience boredom may depend on an individual's capacity to regulate attention (Eastwood, et al., 2012; Fisher, 1993; Gerritsen, Toplak, Sciaraffa, & Eastwood, 2014; Hamilton, 1981; Harris, 2000). Any decrement in the ability to regulate attention would presumably prevent individuals from effectively satisfying their needs. Consistent with this hypothesis, prior research has found trait boredom to be associated with a range of characteristics thought to be indicative of poor self-regulation. For example, boredom proneness has been associated with impulsive behaviors such as problem gambling (Blaszczynski, McConaghy, & Frankova, 1990; Mercer & Eastwood, 2010), substance abuse (Amos, Wiltshire, Haw, & McNeill, 2006; German & Latkin, 2012; LePera, 2011; Wiesner, Windle, & Freeman, 2005) and binge eating (Stickney & Miltenberger, 1999).

Furthermore, regarding boredom as a motivational state gives us an opportunity to explore potential antecedents of the experience. If boredom acts as a signal to motivate individuals to explore more stimulating alternatives, it is thus likely that conditions that *prevent* effective exploration may play a key role in an individual's tendency to experience boredom. Indeed, prior research has demonstrated that individuals who lack autonomy or lack control over their environment are more likely to be bored (Dicintio, & Gee 1999; Watt & Vodanovich, 1999), consistent with the idea that boredom arises when individuals are not able to effectively explore their environment. However, it could further be argued that both a low level of control (barriers to exploration) and high level of control (complete mastery of a task) would lead to boredom. Indeed, research suggests that individuals who are not sufficiently challenged (and presumably have a high level of control) are more likely to be bored (Csikszentmihalyi, 1975; Tilburg, & Igou, 2011). This notion is further stated in control-value theory of achievement emotions, which outlines how the two dimensions (value and control) interact to result in distinct affective experiences (Pekrun, 2006). For example, individuals are particularly frustrated when they cannot exert control over activities high in intrinsic value. In the case of boredom, it is predicted that in addition to conditions in which individuals have a high or a low sense of control, activities that lack incentive value can also be experienced as boring. Furthermore, it is postulated that the effect of a perceived sense of control on boredom is mediated through reduction of incentive value. However, Higgins (2014) suggested that wanting to exert control can be a sufficient motivator on its own, so regardless of the intrinsic value of an activity participants will try to establish a degree of control. Indeed, when our sense of control is threatened individuals experience psychological reactance – a state of motivational arousal aimed to re-establish one's sense of control (Wortman & Brehm, 1975). This implies, contrary to the prior findings, that conditions of low perceived control may, despite being perceived of as frustrating, lead to an engaging state, and thus be less boring than conditions of high perceived control.

Finally, it is also important to distinguish boredom from other affective experiences. Boredom has been previously described as a state of wanting but not being able to engage in meaningful activities (Eastwood et al., 2012). Such a description suggests that boredom may reflect a type of frustration. Indeed, Perkins and Hill (1985) found that boring situations are often perceived to be frustrating. However, unlike boredom, frustration was found to be a less persistent state in learning environments and showed a weaker association with poor learning outcomes (Baker, D'Mello, Rodrigo, & Graesser, 2010). While in a different study, boredom was successfully induced without significantly inducing frustration (Tilburg, & Igou, 2011). These findings suggests that frustration and boredom are distinct states. Despite this evidence, the connection between frustration and boredom has yet to be fully explored. Interestingly, boredom is known to arise in situations which also contribute to a diminished sense of control (e.g., a high school classroom; Dicintio, & Gee 1999) – situations which are also likely to contribute to a state of frustration. This suggests that although frustration and boredom may be distinct, they may both be elicited by similar circumstances. It is known for instance that under conditions of low perceived control, individuals exert effort to establish control, which can be frustrating if they are not effective (Wortman & Brehm, 1975). We thus wanted to further demonstrate whether conditions of low perceived control can help delineate the experience of frustration and boredom.

The aim of this thesis was to investigate whether boredom proneness is associated with poor self-regulation ability. Additionally, we wanted to investigate the influence of conditions that prevent individuals from effective self-regulation on the experience of boredom. We predicted that although boredom proneness may be characterized by self-regulatory failure, threats to effective self-regulation (which in turn are associated with potential to *gain* control) may actually be more engaging and less boring than conditions where individuals are effective (or do not have any potential to gain control). Finally, we wanted to dissociate frustration and boredom by creating conditions that influence these variables differentially.

CHAPTER 2: Study 1[1]

Recent research has identified at least one self-regulatory profile associated with the vulnerability to experience boredom. Specifically, boredom proneness was associated with increased behavioral inhibition system (BIS) sensitivity (Mercer-Lynn, Hunter, & Eastwood, 2013; Mercer-Lynn, Bar, & Eastwood, 2014) – reflecting elevated sensitivity to punishment (Gray, 1970). Blunt and Pychyl (1998) demonstrated a positive association between boredom proneness and a state orientation – an aspect of action control thought to reflect a specific focus on either present, past or future states of an organism, as opposed to a fully developed action plan that would lead to a desired state (Kuhl, 1981, 1994). While this research provides some insights into the relationship between self-regulation and boredom proneness, there is much yet to explore; the goal of Study 1 was to utilize a self-regulatory approach to understanding boredom proneness.

Boredom is not a Unitary Construct

Much of the previous research assumes boredom is a unitary construct. However, the Boredom Proneness Scale (BPS; Farmer & Sundberg, 1986), the most commonly used measure of trait boredom proneness, has been shown to be multifactorial (Vodanovich & Kass, 1990; Ahmed, 1990). Although there is some disagreement as to the number of factors needed to fully capture the variance in the BPS, a review by Vodanovich and colleagues (2005) suggested that the BPS can be consistently divided into at least two factors – boredom proneness originating

[1] The study described in this chapter has been accepted for publication:
Struk, A.A, Scholer, A.A., Danckert, J. (In Press). A Self-Regulatory Approach to Understanding Boredom. *Cognition and Emotion*.

from a perceived lack of external stimulation (external factor) and boredom proneness originating from a perceived lack of internal stimulation (internal factor).

Although this distinction is somewhat controversial, the external factor is thought to measure one's inability to satisfy a high need for excitement, challenge, and change (Vodanovich & Kass, 1990). That is, although individuals are motivated to engage in meaningful activities, every attempt to do so is met with a failure to satisfy or expunge feelings of boredom. This kind of boredom proneness, characterized by a heightened need for, but failure to attain, external stimulation, has been implicated in sensation seeking (Vodanovich & Kass, 1990), the tendency to ruminate about oneself (Seib & Vodanovich, 1998), insensitivity to errors of sustained attention, and both inattentive and hyperactive symptoms of Attention Deficit Hyperactivity Disorder (ADHD; Malkovsky, Merrifield, Goldberg, & Danckert, 2012).

In contrast, the internal stimulation factor is thought to measure an inability to self-generate interest and engagement (Vodanovich & Kass, 1990). This factor has also been associated with lapses of everyday attention and attention-related cognitive failures (e.g., pouring orange juice on your cereal; Malkovsky et al., 2012). Furthermore, the internal factor has been associated with a reduced ability to identify and process feelings (Harris, 2000; Swinkels & Giuliano, 1995). This factor also seems to be coupled with a lack of awareness of one's internal milieu (Seib & Vodanovich, 1998) – in other words, poor awareness of and insensitivity to one's own thoughts and emotions.

We suggest that if trait boredom proneness is associated with inadequate self-regulation, these distinct boredom proneness cognitive profiles—individuals who experience a perceived lack of external stimulation versus those who experience a perceived lack of internal stimulation—may reflect *distinct* self-regulatory profiles by which each type of boredom propensity originates. To explore this, we examined the relationship between the two boredom proneness factors and various facets of self-regulation. We contrasted the strength of those relationships across each boredom proneness factor, and explored whether each factor was predicted by a unique set of self-regulatory variables. Such an approach should permit identification of key boredom proneness vulnerabilities, and thus may lead to the development of interventions specific to each boredom proneness component.

Self-Regulation, Goal Pursuit and Boredom Proneness

Self-regulation is regarded as the process by which people bring their behaviors in line with standards and goals (Baumeister & Vohs, 2003; Rawn & Vohs, 2006). Pursuing goals effectively often involves the exertion of effort, overriding automatic affective reactions to bring our actions in line with important goals. Self-regulation involves not only the regulation of behavior, but also the regulation of thoughts, emotions, and impulses (Baumeister, Heatherton, & Tice, 1994). Failures of self-regulation have been shown to play a significant role in a number of social and personal problems, while self-regulation success is related to better well-being across many dimensions (Duckworth & Kern, 2011; Moffitt et al., 2011; Tangney et al., 2004). One prominent measure of general self-regulatory effectiveness is the trait self-control scale developed by Tangney and colleagues (2004). Since boredom proneness, as assessed by either subscale of the BPS, seems to be associated with aspects of self-regulatory failure, we hypothesize that this will be reflected in this broad measure of self-control. That is, we expect that individuals who are high in trait self-control will be *less* prone to experiencing boredom, regardless of whether it originates from a perceived lack of external or internal stimulation. In other words, we have no reason to suspect that the *magnitude* of the association between trait self-control and each of the BPS factors would differ.

One critical aspect of effective self-regulation is the ability to flexibly shift behavior and adjust to change (Kashdan & Rottenberg, 2010). Individuals who can flexibly select different means to accomplish a goal (Vallacher & Wegner, 1987) and flexibly shift goals in the face of obstacles and opportunities, can be more effective in life pursuits (Jostmann & Koole, 2009; Wrosch, Scheier, Miller, Schulz, & Carver, 2003). Dennis and Vander Wal (2010) recently developed the cognitive flexibility inventory to capture two key aspects of effective adjustment: first, an individual's sense of control in difficult situations (CFI-control), and second, the tendency to seek multiple solutions to difficult problems and explanations of events (CFI-alternatives). We expect that individuals who can flexibly adapt to changes and new environments should be less prone to boredom since they will be able to find new and engaging activities. Although cognitive flexibility is likely to be associated with both boredom proneness components, we hypothesize that CFI-control will be more strongly *negatively* related to a perceived lack of external stimulation, since the CFI-control measure is an indicator that individuals are capable of satisfying their need for challenge. In other words, we predict that the relationship between the external stimulation factor of boredom proneness and the CFI-control measure will be stronger than that of the internal stimulation factor and CFI-control. Likewise, we hypothesize that the CFI-alternatives measure will be *negatively* associated with both boredom proneness components. However, given that individuals who report a perceived lack of internal stimulation could be described as having difficulty in self-generating interest and engagement, we expect that the relationship with the internal stimulation factor will be larger in magnitude than that of the external stimulation factor.

Individuals may differ not only in the extent to which they tend to be generally effective or ineffective at self-regulation, but also in the types of goals and strategies they tend to value and pursue. Regulatory focus theory distinguishes between self-regulation in the pursuit of nurturance (promotion focus), as compared to self-regulation in the pursuit of security (prevention focus; Higgins, 1997). Promotion-focused individuals represent goals as hopes and aspirations, prefer eager strategies, and are particularly sensitive to opportunities for gains and advancement. In contrast, prevention-focused individuals represent goals as duties and obligations, prefer vigilant strategies, and are particularly sensitive to lurking threats and losses (Scholer & Higgins, 2012). We predict that both promotion- and prevention-focused individuals may be less likely to experience boredom as these measures reflect self-reported *success* in applying distinct goal-pursuit strategies. In other words, regardless of whether you tend towards a promotion or prevention focus, *success in goal pursuit via either system* is likely to be negatively associated with boredom proneness, regardless of whether boredom stems from a perceived lack of external or internal stimulation. As such, we do not expect any difference in the magnitude of these relationships across the boredom proneness subtypes. More specifically, promotion-focused individuals may be less susceptible because of their ability to identify and seize opportunities in the service of maximizing outcomes, whereas prevention-focused individuals may be less susceptible because of their ability to remain vigilant to their surroundings in the service of maintaining security. In the discussion, we explore further the potential ways in which a promotion- or prevention-focus may operate differently to ward off boredom.

In addition to distinctions between the types of goals that individuals pursue, individuals also differ in how they go about pursuing those goals. In particular, people differ in the extent to which they emphasize exhaustive comparison of alternative options (making sure to do the "right" thing) versus implementation of actions ("getting on with it"). Individual differences in these emphases are highlighted in regulatory mode theory that distinguishes between assessment (the comparative aspect of self-regulation) and locomotion (the aspect of self-regulation focused on moving from state to state; Higgins, Kruglanski, & Pierro, 2003; Kruglanski et al., 2000). We hypothesize that those high on the assessment approach to goal pursuit may be more vulnerable to boredom proneness arising from a perceived lack of external stimulation. Given that both the external stimulation factor of boredom proneness and assessment are characterized by self-evaluative concerns (for review see Higgins et al., 2003), we expect the relationship between assessment and the external stimulation factor to be of greater strength than the relationship between assessment and the internal stimulation factor. In contrast, we hypothesize that those high on the locomotion approach to goal pursuit may be less vulnerable to boredom proneness that originates from a perceived lack of internal stimulation, as locomotion is characterized by high motivation to engage in absorbing or intrinsically interesting activities – sometimes referred to as 'flow proneness' (Harris, 2000; for review see Higgins et al., 2003). We therefore expect the relationship between locomotion and the internal stimulation factor to be of greater magnitude than the relationship between locomotion and the external stimulation factor.

2.2 Methods

Participants and Procedure

One hundred and thirty-nine United States participants (67 females; mean age = 28.6 years, SD = 11.34) were recruited using Amazon Mechanical Turk, and completed a questionnaire package online. It was determined, a priori, that we would collect as many participants as permitted by allocated funding. All participants were remunerated 50 cents. Additionally, seventy-four undergraduates (45 females; mean age = 20.3 years, SD = 1.8) from the University of Waterloo, who participated in a separate study exploring the cognitive correlates of boredom not reported here, were included in the analysis, all these participants completed the same questionnaire package in exchange for course credit, prior to completing the experimental tasks not reported here. It was determined, a priori, that we would collect as many participants as possible before the end of the academic term. We did not analyze data until the entire samples had been collected. The order of presentation for questionnaires was counterbalanced in both samples.

Materials

The BPS was used to measure an individual's propensity to experience boredom (Farmer & Sundberg, 1986). It is a self-report questionnaire that consists of 28 items rated on a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." High scores indicate higher proneness to the experience of boredom. Farmer and Sunberg (1986) report that the BPS has an internal consistency of 0.79 and a test-retest reliability of .83. Prior factor analyses divide the BPS into at least two factors (a perceived lack of external stimulation [external factor], or a perceived lack of internal stimulation [internal factor]; Vodanovich & Kass, 1990; Vodanovich, Wallace, & Kass, 2005; Ahmed, 1990; Gana & Akremi, 1998; Melton & Schulenberg, 2009; Gordon, Wilkinson, McGown, & Jovanoska, 1997). The items that appeared most commonly (in at least 3 out of 6 prior factor analyses) within the same factor were used in this study. Thus, the items included for the external factor were items 5, 6, 9, 10, 12, 15, 17, 19, 20, 21, 25, 26, 27, and 28 (e.g., "Many things I have to do are repetitive and monotonous"), while those used for the internal factor were items 1, 7, 8, 13, 18, 22, 23, and 24 (e.g., "I find it easy to entertain myself").

The Self-Control Scale (SCS) was used as a general measure of trait self-control (Tangney, Baumeister, & Boone, 2004). It is a self-report questionnaire that consists of 36 items (e.g., "Pleasure and fun sometimes keep me from getting work done") rated on a 5-point Likert scale ranging from "not at all" to "very much." High scores indicate a good ability to exert self-control. Items tap into the ability to control one's thoughts, feelings, impulses, and performance. Tangney and colleagues (2004) report that the SCS has an internal consistency of 0.83 and a test-retest reliability of 0.89.

The Regulatory Focus Questionnaire (RFQ) was used to assess promotion and prevention focus (Higgins et al., 2001). The RFQ is a self-report questionnaire that consists of 11 items, 6 promotion focus items (e.g., "Compared to most people, are you typically unable to get what you want out of life?"), and 5 prevention focus items (e.g., "Not being careful enough has gotten me into trouble at times") rated on a 5-point Likert scale ranging from "never or seldom" to "very often." Subscales assess the *history of success* in self-regulating within either the promotion or prevention systems. Higgins and colleagues (2001) report an internal consistency of 0.73 for the promotion and 0.80 for the prevention scales; and a test-retest reliability of 0.79 for the promotion and 0.81 for the prevention scale.

The Regulatory Mode Questionnaire (RMQ) was used to measure individual differences in regulatory mode – locomotion and assessment – orientations (Kruglanski et al., 2000). This questionnaire consists of 24 items; 12 locomotion items (e.g., "I don't mind doing things even if they involve extra effort"), and 12 assessment items (e.g., "I often critique work done by myself and others") rated on a 6-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." High scores on each subscale reflect greater emphasis on locomotion or assessment, respectively. Kruglanski and colleagues (2000) reported an internal consistency of 0.82 for the locomotion and 0.78 for the assessment scales, and a test-retest reliability of 0.77 for the locomotion and 0.73 for the assessment scales.

The Cognitive Flexibility Inventory (CFI) was used to measure two aspects of cognitive flexibility. The control subscale (CFI-control) measured perceived control in difficult situations, whereas the alternatives subscale (CFI-alternatives) measured the ability to generate alternative solutions to problems, and explanations for events and behavior (Dennis & Vander Wal, 2010). This questionnaire is composed of 20 items; 12 CFI-alternatives items (e.g., "I consider multiple options before making a decision"), and 8 CFI-control items (e.g., "When I encounter difficult situations, I feel like I am losing control.") rated on a 7-point Likert scale ranging from "Strongly Disagree" to "Strongly Agree." High scores reflect a better capacity to flexibly shift behavior and adjust to new situations. Dennis and Vander Wal (2010) reported an internal consistency of 0.91 for the CFI-alternatives and 0.84-0.86 for the CFI-control scales; and a test-retest reliability of 0.75 for the CFI-alternatives and 0.77 for the CFI-control scales.

2.3 Results

Descriptive Statistics and Gender Differences

Sample sizes, means, standard deviations, and reliabilities for all variables are presented in Table 1. As the table indicates, when accounting for multiple comparisons, the two samples only differed in mean age. There were no gender differences evident across any study variables in either sample. Given that there were no gender differences, the remaining analyses were conducted on the combined male and female samples.

Table 1. *Means and Standard Deviations for All Study Variables in Each Sample, and Between Sample Differences.*

	Sample							
	Online (n=139)			UW (n=74)				
	Mean	SD	α	Mean	SD	α	t-score	p
Age	28.62	11.34	-	20.35	1.76	-	6.02	<0.01
BPS	96.12	19.96	0.86	97.81	19.13	0.85	0.60	0.55
External Factor	52.32	12.88	0.82	51.00	11.89	0.81	0.73	0.47
Internal Factor	27.40	7.48	0.77	29.82	7.05	0.69	2.30	0.02
Promotion	3.60	0.66	0.69	3.48	0.62	0.69	1.32	0.19
Prevention	3.14	0.82	0.81	3.25	0.78	0.75	0.90	0.37
Locomotion	4.25	0.73	0.85	4.12	0.63	0.82	1.30	0.20
Assessment	3.89	0.71	0.77	4.02	0.62	0.76	1.36	0.18
Self-control	116.80	18.58	0.91	113.13	17.24	0.91	1.41	0.16
CFI	105.15	16.78	0.90	103.43	11.80	0.82	0.34	0.73
CFI-control	33.65	8.40	0.81	31.89	7.11	0.78	0.89	0.41
CFI-alternatives	71.50	10.93	0.99	71.54	7.48	0.84	0.30	0.98

Note. BPS = Boredom Proneness Scale; CFI = Cognitive Flexibility Inventory; "Online" refers to the Mechanical Turk Sample and "UW" refers to the on campus undergraduates from the University of Waterloo. It is worth noting that the difference between the two samples in Internal Factor is not significant after controlling for multiple comparisons.

Correlations

We first examined zero-order correlations across all measures in each sample separately. Both samples demonstrated largely similar correlations in terms of direction and magnitude (Table 2). Nevertheless, we directly tested whether the correlations differed between the two samples. Correlations between the external and internal factors of the BPS and all other measures were contrasted across the groups using z-scores (DeCoster, 2007). After Bonferroni correction for multiple comparisons no significant differences were found across the two samples. Given that the two samples only differed in mean age, and that all correlations were in the same direction and did not differ in magnitude, we merged the samples and conducted partial correlations, controlling for age (Table 3). All further analyses were conducted using the merged sample.

Table 2. Correlations for All Study Variables in the Online Mechanical Turk Sample (above major diagonal) and UW Undergraduate Sample (below major diagonal).

	1	2	3	4	5	6	7	8	9	10	11
1. BPS		.866**	.585**	-.731**	-.388**	-.651**	.240**	-.655*	-.564**	-.609**	-.398**
2. External Factor	.868**		.156	-.556**	-.404**	-.345**	.303**	-.580**	-.358**	-.512**	-.156
3. Internal Factor	.698**	.307**		-.538**	-.130	-.739**	-.021	-.351**	-.548**	-.359**	-.566**
4. Promotion	-.675**	-.544**	-.524**		.266**	.643**	-.084	.462**	.634**	.601**	.536**
5. Prevention	-.240*	-.311**	0.016	0.166		.222**	-.294**	.477**	.218**	.265**	.151
6. Locomotion	-.638**	-.385**	-.646**	.578**	0.062		.010	.456**	.612**	.512**	.557**
7. Assessment	0.047	0.085	-0.045	-0.039	0.183	-0.018		-.366**	-.083	-.263**	.035
8. Self-Control	-.634**	-.527**	-.363**	.538**	0.156	.530**	-0.078		.420**	.504**	.295**
9. CFI	-.591**	-.485**	-.455**	.463**	0.123	.426**	0.134	.403**		.787**	.936**
10. CFI-control	-.556**	-.486**	-.357**	.461**	0.096	.353**	-0.084	.436**	.765**		.521**
11. CFI-alternatives	-.404**	-.303**	-.379**	.318**	0.104	.349**	.260*	.250*	.867**	.342**	

Note: Online Mechanical Turk Sample (N=139). UW Undergraduate Sample (N=79). * $p < .05$. ** $p < .01$. BPS = Boredom Proneness Scale; CFI = Cognitive Flexibility Inventory.

Table 3. *Partial Correlations and Reliability for All Study Variables in the Combined Sample Controlling for Age*

	1	2	3	4	5	6	7	8	9	10	11
1. BPS	(.852)	.851**	.612**	-.699**	-.336**	-.655**	.135	-.602**	-.542**	-.562**	-.382**
2. External Factor		(.816)	.160*	-.522**	-.382**	-.337**	.202**	-.509**	-.350**	-.462**	-.167*
3. Internal Factor			(.743)	-.522**	-.061	-.716**	-.041	-.337**	-.505**	-.347**	-.496**
4. Promotion				(.691)	.218**	.630**	-.035	.453**	.574**	.552**	.465**
5. Prevention					(.792)	.159*	-.155*	.364**	.191**	.223**	.131
6. Locomotion						(.843)	.004	.482**	.563**	.467**	.500**
7. Assessment							(.768)	-.249**	.002	-.174*	.108
8. Self-Control								(.911)	.384**	.459**	.257**
9. CFI									(.883)	.771**	.924**
10. CFI-control										(.803)	.469**
11. CFI-alternatives											(.905)

Note: Chronbach's α levels are presented on the main diagonal in parentheses. (df = 203) * $p < 0.05$. ** $p < 0.01$. BPS = Boredom Proneness Scale; SCS = Self-Control Scale; CFI = Cognitive Flexibility Inventory. "Online" refers to the Mechanical Turk Sample and "UW" refers to the on campus undergraduates from the University of Waterloo.

Next, in order to determine whether the observed correlations between our study variables and boredom proneness originating from a perceived lack of external stimulation differed in magnitude from the correlations with boredom proneness due to a lack of internal stimulation, we directly contrasted them. After Bonferonni correction for multiple comparisons, z-tests for dependent correlations (DeCoster, 2007) revealed that the prevention, locomotion and CFI-alternatives measures differed significantly across the two boredom proneness subtypes (Figure 1).

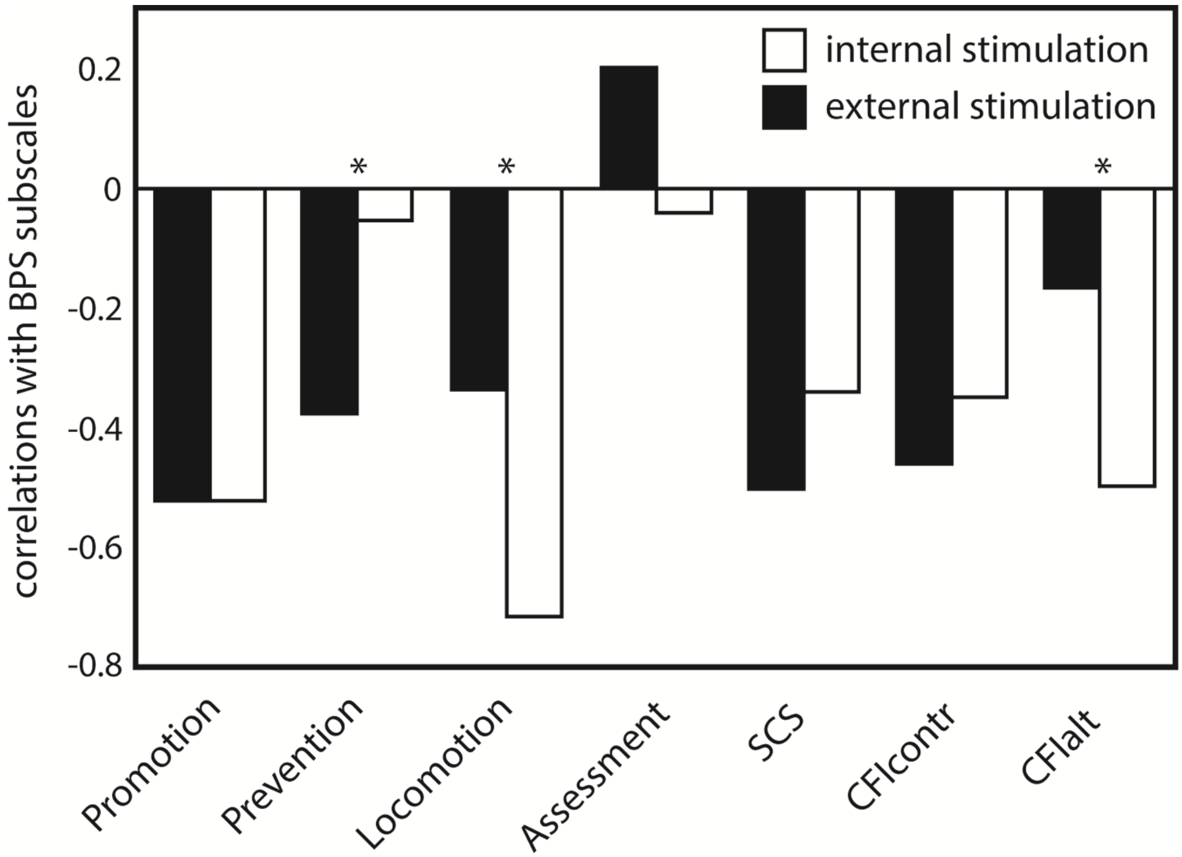

Figure 1. Correlations between external factor, internal factor and the study variables. Partial correlations based on a combined UW and Online Sample (df = 203), controlling for age. SCS = Self-Control Scale, CFI = Cognitive Flexibility Inventory.

Regression

The fact that we observed differences in the magnitude of the observed relationships between our study variables and the external and internal stimulation factors of the BPS, suggested that the two boredom proneness factors may be associated with *distinct* self-regulatory profiles. However, given the broad inter-relationship between our self-regulatory variables, we felt it was warranted to conduct a regression analysis in an attempt to identify unique significant predictors of each boredom proneness factor. Multivariate linear regression analysis was performed using the enter method for the external and internal factors subscales separately. As recommended by Mundfrom and colleagues (2006), for the purpose of identifying unique significant predictors, a Bonferroni corrected alpha level of ($p<0.0065$; i.e., 0.05/8) was used. When the external factor was the dependent variable (Table 4), results showed that promotion focus ($\beta = -0.391$, $p < 0.001$), prevention focus ($\beta = -0.195$, $p < 0.001$), and trait self-control ($\beta = -0.242$, $p < 0.001$) were significant *negative* predictors of the external factor score. Neither locomotion ($\beta = 0.046$, $p = 0.537$), assessment ($\beta = 0.065$, $p = 0.266$), CFI-control ($\beta = -0.114$, $p = 0.111$), CFI-alternatives ($\beta = 0.128$, $p = 0.062$), nor age ($\beta = -0.034$, $p = 0.552$), significantly predicted the external factor score and failed to improve the fit of the model. The overall model fit was significant $F(7,205) = 20.051$, $p < 0.001$, adjusted $R^2 = 0.448$.

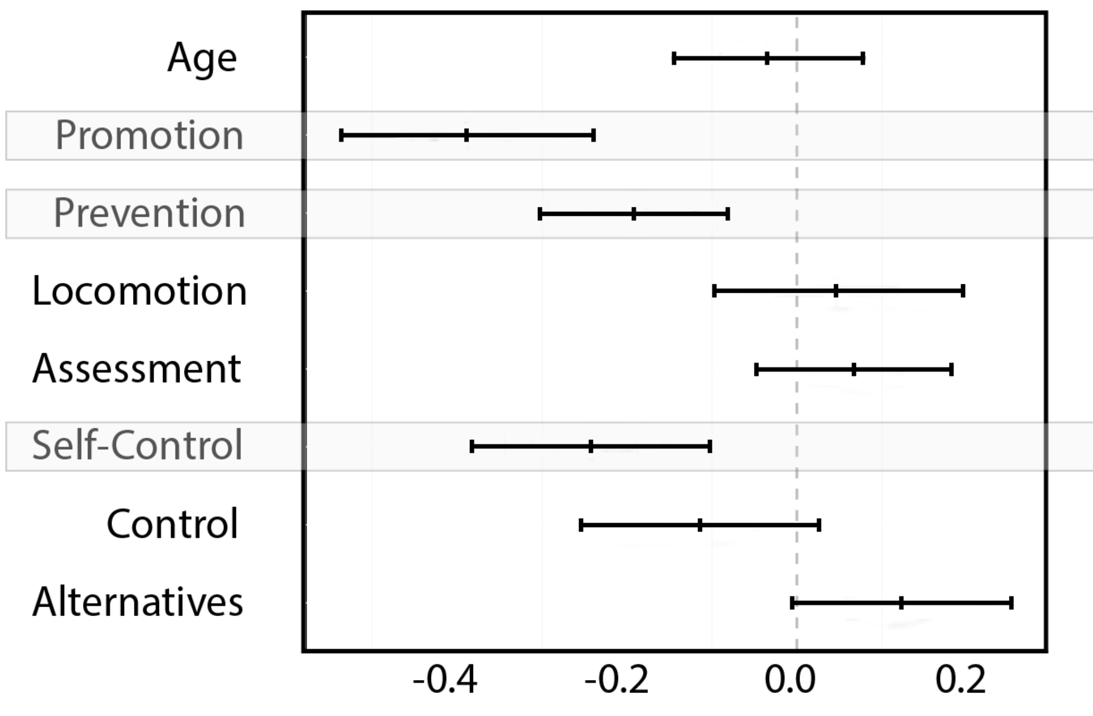

Figure 2. Beta coefficients and 95% confidence intervals with External Factor as DV. Significant negative predictors of boredom are highlighted in grey bars.

Table 4. *Regression Analysis Statistics for Boredom Proneness: External Factor as Dependent Variable*

						95% Confidence Interval for B		Correlations		
Predictor	B	SE	β	t	p	Lower Bound	Upper Bound	Zero-order	Partial	VIF
Age	-.042	.071	-.034	-.596	.552	-.182	.098	-.201	-.041	1.149
Promotion	-7.521	1.457	-.391	-5.161	.000	-10.395	-4.647	-.537	-.345	2.053
Prevention	-2.992	.881	-.195	-3.396	.001	-4.730	-1.255	-.387	-.235	1.177
Locomotion	.823	1.330	.046	.619	.537	-1.801	3.447	-.341	.044	2.006
Assessment	1.206	1.082	.065	1.115	.266	-.928	3.340	.243	.080	1.233
Self-control	-.168	.049	-.242	-3.398	.001	-.265	-.070	-.528	-.235	1.822
CFI-control	-.235	.147	-.114	-1.600	.111	-.524	.055	-.434	-.114	1.803
CFI-alternatives	.156	.083	.124	1.878	.062	-.008	.320	-.177	.132	1.566

Note: Results are based on a merged sample (df = 206). B = unstandardized beta coefficient; SE = standard error of unstandardized beta coefficient; ß = standardized beta coefficient; t = t-score; p = significance value; VIF = variance inflation factor.

When we performed the same regression analysis with the internal factor subscale as the dependent variable (Table 5), results showed that locomotion (β = -0.601, $p < 0.001$), and CFI-alternatives (β = -0.195, $p < 0.001$), were significant *negative* predictors of the internal factor score. Neither promotion focus (β = -0.139, $p = 0.041$), prevention focus (β = 0.061, $p = 0.232$), assessment (β = 0.007, $p = 0.894$), trait self-control (β = 0.013, $p = 0.841$), CFI-control (β = 0.121, $p = 0.58$), nor age (β = -0.057, $p = 0.263$) were significant predictors of the internal factor score and failed to improve the fit of the model to the data. The overall model fit was significant $F(7,205) = 31.546$, $p < 0.001$, adjusted $R^2 = 0.560$.

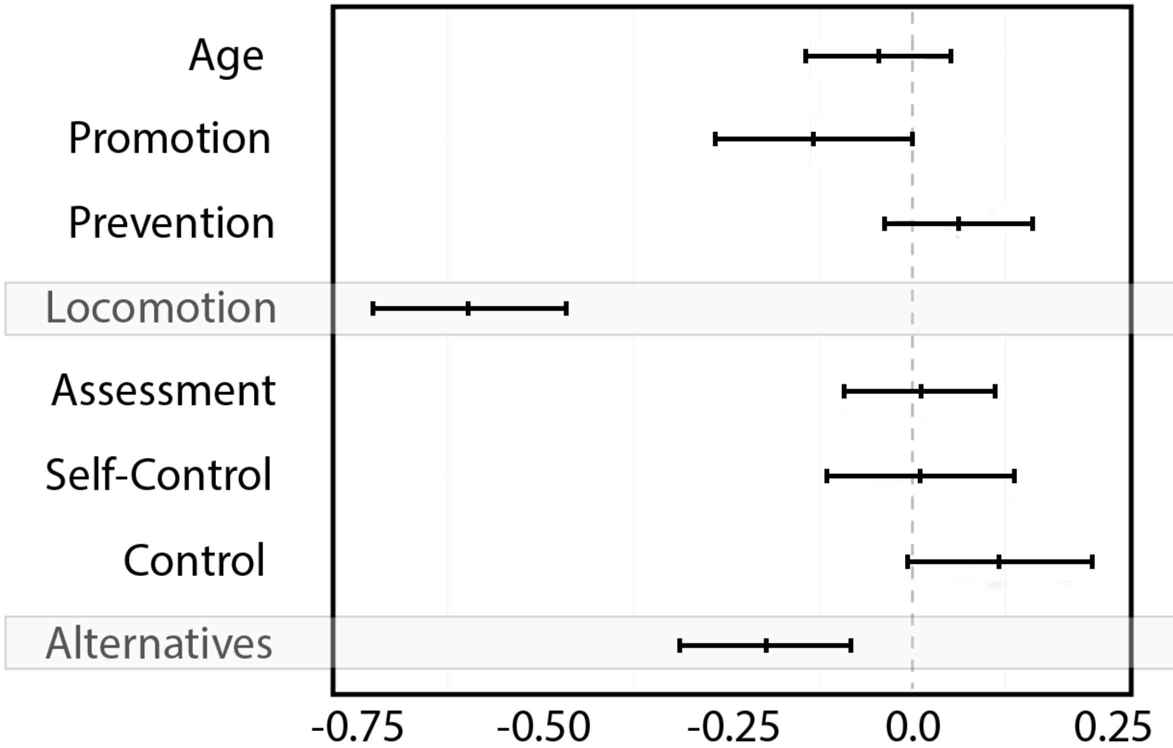

Figure 3. Beta coefficients and 95% confidence intervals with Internal Factor as DV. Significant negative predictors of boredom are highlighted in grey bars.

Table 5. *Regression Analysis Statistics for Boredom Proneness: Internal Factor as Dependent Variable*

						95% Confidence Interval for B		Correlations		
Predictor	B	SE	β	t	p	Lower Bound	Upper Bound	Zero-order	Partial	VIF
Age	-.042	.038	-.057	-1.123	.263	-.116	.032	-.090	-.063	1.149
Promotion	-1.59	.773	-.139	-2.060	.041	-3.118	-.068	-.528	-.139	2.053
Prevention	.560	.467	.061	1.198	.232	-.362	1.482	-.066	.085	1.177
Locomotion	-6.36	.706	-.601	-9.003	.000	-7.747	-4.963	-.717	-.537	2.006
Assessment	.076	.574	.007	.133	.894	-1.056	1.208	-.017	.014	1.233
Self-control	.005	.026	.013	.201	.841	-.046	.057	-.329	.012	1.822
CFI-control	.148	.078	.121	1.903	.058	-.005	.301	-.325	.129	1.803
CFI-alternatives	-.146	.044	-.195	-3.305	.001	-.233	-.059	-.499	-.233	1.566

Note: Results are based on a merged sample (df = 206). B = unstandardized beta coefficient; SE = standard error of unstandardized beta coefficient; ß = standardized beta coefficient; t = t-score; p = significance value; VIF = variance inflation factor.

To more directly test the assertion that each boredom proneness factor significantly differed in terms of the associated pattern of self-regulatory predictors, we examined the difference between partial correlations of each significant predictor variable (e.g., those found to be unique predictors for either boredom proneness factor; Tables 4 and 5; Figures 2 and 3), across each boredom proneness factor. For example, the partial correlation observed between the prevention focus and the internal stimulation factor was directly compared to the partial correlation observed between the prevention focus and the external stimulation factor. Our logic here was that the observed relationship found to be significant for one factor may not differ statistically from the non-significant relationship observed for the other factor. Thus, this additional test provides a stronger test of our hypotheses. The William's T_2 statistic (Steiger, 1980) was used to determine whether there was a significant difference between the two correlations. To correct for multiple comparisons, a Bonferroni corrected family wise alpha level of 0.01 was used. As expected results showed that prevention focus and self-control were both more strongly *negatively* related to the external stimulation factor of boredom proneness than to the internal stimulation factor ($t(200) = 3.66$, $p < 0.005$ and $t(200) = 2.81$, $p < 0.01$ respectively). In contrast, locomotion was more strongly *negatively* related to the internal, as opposed to the external stimulation factor ($t(200) = 7.64$, $p < 0.001$). Furthermore, the CFI-alternatives was also differentially related to each boredom proneness factor such that it was positively related to the external stimulation factor and negatively related to the internal stimulation factor ($t(200) = 4.22$, $p < 0.001$). Finally, contrary to our prediction, promotion focus was equally predictive of each boredom proneness factor ($t(200) = 2.41$, $p = 0.017$). Thus, the relationships highlighted by our regression analyses (Figures 2 and 3) are supported by the direct contrast of partial correlations arising from the regressions – each boredom proneness subtype has a distinct self-regulatory profile.

2.4 Discussion

Given the broad relationships between boredom proneness and traits indicative of poor self-regulation, the present study aimed to assess the relationship between specific aspects of self-regulatory function and two distinct types of boredom proneness. In particular, we wanted to investigate whether each boredom proneness factor was differentially associated with different self-regulatory profiles. Consistent with our predictions, results indicated that each boredom proneness factor was associated with distinct measures of self-regulation, and the magnitude of these relationships differed significantly between the two factors.

External and Internal Boredom Proneness are Negatively Associated with Self-Control

As predicted, both boredom proneness factors were negatively related with a general measure of trait self-control (Figure 2). In other words, individuals who are high in trait self-control are less likely to experience boredom regardless of the means by which it originates. In general, this suggests that individuals who are effective at regulating engagement in meaningful activities are less likely to be prone to boredom.

External and Internal Boredom Proneness are Negatively Associated with Promotion Focus

As predicted, promotion focus – an index of success in pursuing goals within the promotion system – was negatively associated with both boredom proneness factors. This suggests that goal pursuit in service of nurturance promotes effective regulation of both internal and external stimulation, perhaps by allowing individuals to remain engaged through eager pursuit of goals. In other words, a tendency to initiate positive behavioral changes – a characteristic of promotion focus – may be an effective way to remain satisfied. This speculation is consistent with the notion that the experience of boredom is related to higher levels of mind wandering (Cheyne et al., 2006), an indicator that an individual is not fully committed to the stimulus or task at hand. Additionally, these findings are consistent with prior work that demonstrates the importance of the promotion focus in interest enhancement strategies (Smith, Wagaman, Handley, 2009), suggesting that elevated boredom proneness may reflect inadequate self-regulation of interest.

Boredom Proneness Factors are Differentially Associated with Prevention Focus Failure

Although we expected prevention focus – an index of success in pursuing goals within the prevention system – to be negatively associated with both boredom proneness factors, it was only strongly negatively associated with boredom related to the perceived lack of external stimulation (Figure 2). This relationship suggests that individuals with a strong tendency to avoid losses and approach non-losses (i.e., high prevention focused individuals) are more effective at regulating external stimulation, perhaps by fulfillment of their duties and obligations through the use of vigilant strategies. Indeed, prior research has shown that those scoring high on the external stimulation factor of the BPS also demonstrate higher rates of ADHD symptomatology and are insensitive to having made errors of sustained attention, reflective of poor sustained attention (Malkovsky et al, 2012). This result could be recast as inefficient use of vigilant strategies, particularly in monotonous tasks or circumstances. Interestingly, ineffectiveness in utilizing a prevention self-regulatory system has also been associated with increased anxiety (Higgins, Shah, & Friedman, 1997). Such a finding may account for the high arousal states associated with boredom (Merrifield & Danckert, 2014) and the reports of a concurrence of dejection and agitation related emotions during episodes of boredom (Harasymchuk & Fehr, 2010). This feature of boredom, which stems from a perceived lack of external stimulation, is consistent with an early description of boredom, characterizing it as an *agitated* state (Greenson, 1953). Given that boredom proneness has been associated with behavioral inhibition system sensitivity (Mercer-Lynn, Hunter, & Eastwood, 2013; Mercer-Lynn, Bar, & Eastwood, 2014), it is important to distinguish this relationship from the current findings. Specifically, prevention motivation should not be confused with avoidance behavior and is not synonymous with BIS (Haws, Dholakia, & Bearden, 2010; Mooradian, Herbst, & Matzler, 2008; Scholer & Higgins, 2008). The BIS underlies sensitivity to cues of punishment (both lack of reward and withdrawal of safety) and can be seen as an underlying avoidance motivation. In contrast, prevention focus reflects a preference for addressing security needs (approaching safety, avoiding danger) through the use of vigilant strategies, which can be accomplished by either avoiding losses or approaching non-losses. Prior work has established that regulatory focus is orthogonal to approach/avoidance goals (Haws et al., 2010; Scholer & Higgins, 2008). In other words, the current results are silent on the relationship between avoidance goal motivation and boredom, but do suggest that vigilance in the pursuit of security goals (i.e., a prevention focus) correlates negatively with a perceived lack of external stimulation.

Boredom Proneness Factors are Differentially Associated with Locomotion and Assessment

As predicted, although locomotion was negatively related to both boredom proneness factors, this relationship was strongest for those reporting higher levels of a perceived lack of internal stimulation. These findings suggest that individuals who value movement from state to state – either physical or mental – may be less susceptible to experiencing boredom. In other words, keeping oneself continuously engaged, regardless of the goal value, may have the potential to stave off boredom. This finding is consistent with prior work suggesting that boredom prone individuals are fixated on only a single aspect of an intended action instead of appreciating a more complex, variegated, or fully developed action plan (Blunt & Pychyl, 1998). These results provide further evidence that each boredom proneness factor is associated with a distinct self-regulatory profile. In this instance, a distinction in the manner in which individuals pursue their goals. Unlike individuals who experience a perceived lack of external stimulation, individuals experiencing a perceived lack of internal stimulation are less likely to initiate and maintain goal directed action – evident in their low locomotion scores. Assessment, on the other hand, was only weakly positively related to the external stimulation factor. However, contrary to our prediction, the strength of this relationship did not differ significantly when compared to the relationship between assessment and the internal stimulation factor of the BPS.

Boredom Proneness is Negatively Associated with Perceived Sense of Control

We predicted that the CFI-control measure would have a stronger negative relationship with the external than the internal stimulation factor of boredom proneness. In contrast, the results indicated that both factors demonstrated negative relationships with CFI-control that did not differ in magnitude (Figure 1). Our finding suggests that having a sense of self-efficacy in problem solving may be associated with the ability to flexibly regulate challenges related to both external and internal stimulation. Indeed, this is consistent with the observation that boredom prone individuals tend to adopt an external locus of control (Hunter & Csikszentmihalyi, 2003;

Workman & Studak, 2007) – characterized by a belief that events and actions are a result of chance or are under the control of others (Rotter, 1966).

Boredom Proneness Factors are Differentially Associated with the Ability to Generate Alternatives Solutions

The CFI-alternatives measure was negatively related to both BPS factors. However, as predicted, the association with the internal stimulation factor was stronger when compared directly to the relationship with the external stimulation factor. This suggests that being able to self-generate multiple alternatives is related to a reduced likelihood of experiencing boredom, perhaps by enabling discovery of adequate sources of stimulation. It is perhaps not surprising that this relationship was stronger in individuals whose boredom proneness originates from a perceived lack of internal stimulation as they are unable to effectively self-generate interest and engagement. Such a difference provides further evidence that the two boredom proneness factors represent distinct self-regulatory profiles. Unlike individuals reporting a perceived lack of external stimulation, individuals who perceive a lack of internal stimulation are unable to generate alternative solutions that may be instrumental in sustaining effective engagement with their environment.

Conclusion

Our findings suggest that those prone to experiencing boredom characterized by a perceived lack of external stimulation may also be less effective at pursuing goals within both the promotion and prevention motivational systems. However, although both internal and external stimulation factors were negatively associated with promotion focus, we found that when controlling for all variables, the external stimulation factor was uniquely negatively associated with trait self-control and a prevention focus. We therefore speculate that trait self-control and effective regulation within the prevention system in particular, play an important role in an individual's ability to regulate external stimulation. This suggests that chronic inabilities to exert self-control or effectively harness a prevention motivation will increase the likelihood of experiencing boredom. Future research should further explore this hypothesis, perhaps by assessing an individual's tendency to experience boredom when goal pursuit effectiveness is hindered in some way. In contrast, the internal stimulation factor of boredom proneness was uniquely negatively associated with a locomotion orientation and the CFI-alternatives measure. Thus, in contrast to the external stimulation factor, boredom stemming from a perceived lack of internal stimulation may be better characterized as an inability to generate and initiate goal-directed behavior. In this case we speculate that poor accessibility of internal states characteristic of a perceived lack of internal stimulation may prevent individuals from finding and engaging in satisfactory outlets in order to ward off boredom.

CHAPTER 3: Study 2

In Study 1, we demonstrated the tendency to experience boredom is strongly related to self-regulation ability, such that individuals who score poorly on various measures of self-regulation are more likely to experience boredom. In the next study, we wanted to directly investigate the influence of an individual's sense of control on the experience of boredom. Specifically, given that low perceived control is thought to lead to greater exertion of effort (in order to re-establish control) we expect that individuals will be more engaged in low as opposed to high perceived control conditions. We also took the opportunity to attempt to disentangle frustration from boredom, since conditions of low perceived control would be predicted to increase feelings of frustration while reducing boredom. In order to manipulate control we took advantage of an individual's tendency to attribute agency to occurrences, particularly when participants are given a choice in a skill-based situation. That is, even in circumstances where the outcome of each choice is pre-determined, individuals tend to behave as if they have control over the uncontrollable event (Higgins, 2015; Langer, 1975). We accomplished this by designing a computerized version of the children's game of 'rock-paper-scissors' in which individuals played against a computer opponent with differing win rates. The assumption here is that when individuals win frequently they will tend to attribute agency to this outcome (i.e., they have 'figured out' the computer's strategy and are exploiting it). Such a circumstance ought to create an illusion of control. In contrast, when individuals arbitrarily lose at high rates they should experience this circumstance as a lack of control.

Given that it is difficult to manipulate perceived sense of control without manipulating challenge, we also assessed self-reported levels of perceived challenge, and we further tested whether perceived challenge or control serves as a better predictor of boredom. Given that the win frequency could influence other variables such as perceived reward, we wanted to ensure that our manipulation did not influence the perceived intrinsic value of the activity. To address this we assessed self-reported level of task value. This further allowed us to test two claims postulated by value-control theory: 1) perceived incentive value of an activity is associated negatively with boredom, 2) high perceived control exerts its influence on boredom by reducing perceived incentive value (Pekrun, 2006).

3.1 Methods

Participants

One hundred and eighty nine undergraduates (135 females, mean age = 20.5 years; 35.4% were East Asian, 31.2% identified themselves as Caucasian, 21.16 % as other Asian groups, and 12.2% were other groups) from the University of Waterloo, participated in this study in exchange for course credit. Data was collected during spring and fall terms of 2014. It was determined, a priori, that we would collect as many participants as possible before the end of the two academic terms. We did not analyze data until the entire sample had been collected. This study was approved by the University Of Waterloo, Office of Research Ethics.

Apparatus

Computerized version of the rock-paper-scissors game was programmed using python 2.7 with the aid of a pygame library. The game was displayed on 16” CRT monitor with a screen resolution of 1024x768. Participants sat approximately 50 cm away from the monitor and used a mouse to make all responses. Computer choices and participants response options appeared in 210x210 pixel square boxes.

Procedure

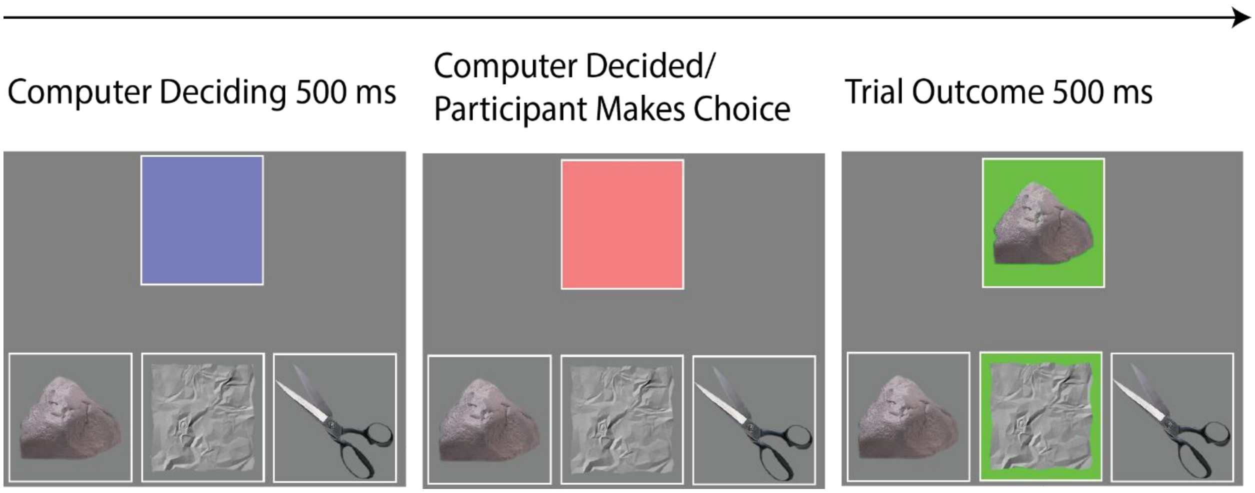

Figure 4. A sample trial of the rock-paper-scissors game. The left panel displays a blue square on the top portion of the screen, indicating that the computer is deciding which option to play. The middle panel displays a red square on the top portion of the screen indicating that computer has made a decision and the participant may now make a choice by clicking on any of the three options displayed at the bottom of the screen. The right panel displays the computer's choice in the top portion of the screen. Both the computer`s and participant`s choices are highlighted in green in this example, indicating that the participant won this round (choices would be highlighted in red if the participant lost the round).

Participants played a computerized version of the rock-paper-scissors game, where rock beats scissors, scissors beats paper and paper beats rock. On each trial participants first viewed a blue square in the upper half of the screen for 500 ms. Participants were told the blue square represents the computer's choice and while it remains blue the computer is "deciding" which option to play. After this interval the square turned red, indicating that the computer had made a choice and the participant may now choose their response option. The three response options (e.g., rock, paper, scissors) were always visible and displayed on the lower half of the screen (Figure 4). Participants responded by clicking on the pictorial depiction of the option using a mouse, at which point the computer’s choice was revealed, and both the participant`s and computer`s choices were highlighted in red or green, depending on whether the participant lost or won, respectively, for a duration of 500 ms. Participants were explicitly told that the computer would be playing an exploitable strategy and were instructed to attempt to exploit that strategy in order to win as often as possible. There was in fact, no exploitable strategy played by the computer. Instead, participants were randomly assigned to one of two conditions: the win condition, in which participants arbitrarily beat the computer opponent 100 percent of the time (i.e., 100% wins), or the lose condition, in which participants arbitrarily lost against the computer opponent on 100% of trials. That is, in both conditions, unbeknown to the participant, the outcome of a given trial was entirely independent of their own play choice. Each participant played 20 hands of rock-paper-scissors, after which they were asked a number of questions probing how bored, in control, or frustrated they felt, as well as their perceived value and challenge of the task (Table 6). Participants made the probe responses by moving a slider on a 100 point scale ranging from “not at all” to “extremely”.

Table 6: *Study variables and probe questions.*

Variable	Question
Control	"To what extent do you feel in control in the task?"
Frustration	"How frustrated are you?"
Boredom	"How bored are you?"
Value	"How much do you care about winning?"
Challenge	"How challenging is this task?"

Data Preprocessing

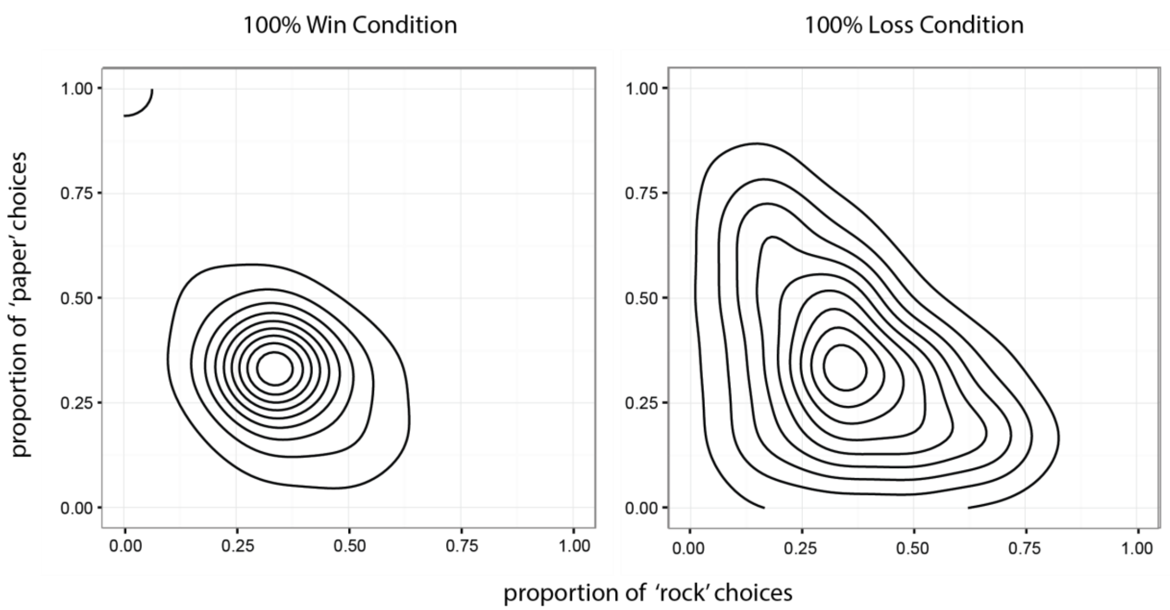

Figure 5. Distribution of explored state space in the 100% win (left) and 100% lose (right) conditions. The proportion of rock choices is presented on the x-axis and the proportion of paper choices is presented on the y-axis averaged over 6 trial windows. The density plot was generated by collapsing across all blocks for each participants and all participants for each condition separately. Regions with many concentric lines indicate a high density or frequency of that particular state. In the left panel, (100% Win Condition) regions of high density occur around 33:33 region, indicating that many participants adopt a strategy where all options (rock, paper and scissors) are played equally. In the right panel, (100% Lose Condition) participants adopt more diverse strategy types, and consequently explore more of state space.

All data manipulations and analyses were conducted in R statistical software package. As an index of task engagement we wanted to obtain a measure of response variability (or the degree to which participants explored the solution space). To first visualize how extensively participants explored state space in each condition we calculated moving averages of each response proportion (i.e., proportion of rock, paper, and scissor) over a moving average of 6 trials (the choice of the window size had little influence on the results). The solution state space can be represented as a 2D vector, since although there are 3 response types, there are only 2 degrees of freedom. In other words, the proportion of “scissors” responses can be inferred from only knowing the proportions of both “paper” and “rock” responses. Using a moving average of 6 we can construct a state space that contains 28 distinct states (number of unique possible combinations of “paper” and “rock” proportions within this window size). We then visualized the explored state space by plotting proportions acquired from a small moving window across all trials on a 2D plot, in which the proportion of “rock” choices are plotted on the x-axis and proportion of “paper” responses are plotted on the y-axis. Finally, given that many of these states are visited multiple times between and within subjects, we can apply a density function to reveal the distribution of visited regions within the state space (Figure 5). As is evident from this plot, exploration of state space within the 100% win condition is characterized by a highly dense region clustered around 0.33:0.33 on the 2D plot. This indicates that in the 100% win condition participants adopted strategies that included roughly equal amounts of all three options. In contrast, in the 100% lose condition, satrategy choice indicated a more diffuse clustering pattern, which indicates that individuals in this condition explored more of the solution space (Figure 5). Given this observation, as a metric of response variability, we calculated on an individual participant basis the total number of unique states that they explored, a value that ranges from 1 (minimal number of states) to 14 (potential number of states that can be explored in 20 trial period given our 6 trial window adopted for the moving average). To be consistent with the rest of our measures we standardized this response variability measure to range between 1 and 100.

3.2 Results

Prior to conducting contrasts between our groups we tested whether the assumption of normality is met for each variable in each sample. Significant skew was found for the perceived control, frustration, and challenge variables in the 100% win condition, and perceived control in the 100% lose condition (Table 7). Given the violation of normality, non-parametric comparisons were conducted. To remain consistent, non-parametric comparisons were conducted using Wilcoxon's rank-sum test (Wilcoxon, 1945), for all comparisons (Table 7). Perceived control levels in the 100% win condition (*Mdn* = 93.50) were significantly greater than those in the 100% lose condition (*Mdn* = 7.00), $W = 7983$, $p < 0.0001$, $r = -0.68$. Boredom levels in the 100% win condition (*Mdn* = 52.00) were significantly higher than those in 100% lose condition (*Mdn* = 39.00), $W = 5787$, $p < 0.001$, $r = -0.26$. Frustration levels in the 100% win condition (*Mdn* = 3.00) were significantly lower than those in the 100% lose condition (*Mdn* = 49.00), $W = 1498$, $p < 0.0001$, $r = -0.58$. Challenge levels in the 100% win condition (*Mdn* = 1.00), were significantly lower than those in 100% lose condition (*Mdn* = 59.00), $W = 1229$, $p < 0.0001$, $r = -0.63$. Value levels in the 100% win condition (*Mdn* = 50), did not differ significantly from those in the 100% lose condition (*Mdn* = 51.00), $W = 4553$, $p = 0.814$, $r = -0.02$. Response variability in the 100% win condition (*Mdn* = 28.57) was significantly lower than in the 100% lose condition (*Mdn* = 46.43), $W = 2113$, $p < 0.0001$, $r = -0.44$. Note that despite the normality assumption violation, t-tests (not reported here) lead to similar significance levels across all variables.

Table 7. *Descriptive statistics for all variables and conditions, and non-parametric independent samples comparisons, associated significance levels and effect sizes.*

	100% Win n = 96				100% loss n = 93						
Variable	Mdn	M	SD	skew.2SE	Mdn	M	SD	skew.2SE	W	p	R
Control	93.50	76.79	30.39	-2.59*	7.00	19.12	25.25	3.26*	7983	<0.0001	-0.68
Boredom	52.00	53.68	27.16	-0.05	39.00	40.61	24.69	0.97	5787	<0.001	-0.26
Frustration	3.00	8.79	13.71	4.59*	49.00	45.68	32.24	-0.05	1498	<0.0001	-0.58
Challenge	1.00	4.65	9.94	7.53*	59.00	54.58	36.78	-0.54	1229	<0.0001	-0.63
Value	50.00	48.99	29.70	-0.91	51.00	47.26	29.34	-0.08	4553	0.814	-0.02
Variability	28.57	28.72	20.60	0.371	46.43	47.778	14.51	0.54	2113	<0.0001	-0.44

Note: skew.2SE is observed skew divided by 2 standard errors, values of greater than 1 indicate significant skew at $p < 0.05$. W = Wilcoxon rank-sum statistic, r = effect size

Next, we wanted to explore zero-order correlations between all study variables in both of our groups collapsed. We found a number of significant correlations (Table 8). Notably, we found that boredom was positively associated with perceived control ($r = 0.24$, $p < 0.01$), and negatively with challenge ($r = -0.20$, $p < 0.01$), perceived value ($r = - 0.20$, $p < 0.01$) and frustration ($r = - 0.15$, $p < 0.01$). Perceived control was negatively associated with frustration ($r = -0.55$, $p<0.001$) and response variability ($r = - 0.42$, $p < 0.001$), and there was no association between perceived control and value ($r = 0.12$, $p = 0.11$). To examine these relationships in more detail we conducted a series of regression analyses.

Table 8: *First-order correlations of all study variables and their significance levels.*

	Boredom	Control	Challenge	Value	Frustration
Control	0.24**				
Challenge	-0.20**	-0.55***			
Value	-0.20**	0.12	0.09		
Frustration	-0.15*	-0.50***	0.56***	0.31***	
Variability	-0.04	-0.42***	0.37***	-0.19**	0.30***

Note: * p < 0.05, ** p < 0.01, *** p < 0.001

To determine whether the observed effects of boredom could be best accounted for by differences in perceived control or reported challenge, we tested whether challenge accounted for additional variance in reported boredom levels beyond perceived control using incremental regression analyses. Perceived control was found to be a significant predictor of boredom $F(1,185) = 12.25$, $p < 0.001$, adjusted $R^2 = 0.055$. Adding reported levels of challenge as a predictor yielded a significant model fit $F(2,181) = 6.863$, $p < 0.005$, adjusted $R^2 = 0.057$, with perceived control operating as a significant positive predictor ($\beta = 0.1252$, $p < 0.05$), and challenge as a non-significant negative predictor ($\beta = -0.073$, $p = 0.23$). Furthermore, the addition of challenge as a predictor of boredom did not significantly improve the model fit $F(1,181) = 1.44$, $SS = 958.04$, $p = 0.237$.

To test whether perceived value accounted for additional variance in reported boredom levels beyond control, we ran an incremental regression analyses. Adding perceived value as a predictor yielded a significant model fit $F(2,191) = 11.28$, $p < 0.001$, adjusted $R^2 = 0.057$, with perceived control operating as a significant positive predictor ($\beta = 0.179$, $p < 0.005$), and value as a significant negative predictor ($\beta = -0.212$, $p < 0.005$). The addition of perceived value as a predictor of boredom significantly improved the model fit $F(1,181) = 10.82$, $SS = 7114$, $p < 0.005$.

To test whether the effect of perceived control on boredom is mediated by change in the perceived value, we conducted a mediation analysis in which perceived control predicted boredom, and perceived value served as the third variable. This analysis was conducted using the *mediate* package in R, with 500 Monte Carlo draws used to form a quasi-Bayesian approximation of direct and indirect effects. This analysis provides estimates and significance of direct and indirect effects, as well as proportion mediated. The average direct effect (ADE), represents the extent to which the dependent variable (boredom) changes per unit of the independent variable (control), after accounting for indirect effects. Average causal mediation effect (ACME), represents the effect of an independent variable on a dependent variable that is due to the mediator (value). The proportion mediated indicates the portion of the total effect of the independent variable that can be accounted for by the mediator. We found a significant ADE between perceived control and boredom, with an estimated magnitude of 0.17 (for every unit change in control, there was 0.17 change in boredom, after accounting for the effect of value), $p < 0.01$, however ACME had an estimated magnitude of -0.01, $p = 0.18$. The proportion of the total effect of control on boredom that could be accounted for by perceived value was not significant (proportion mediated=0.09, $p = 0.12$), suggesting no mediation.

Finally, we wanted to test whether the observed relationship between frustration and boredom could be accounted for by perceived control. To do this we conducted a mediation analysis, in which frustration predicted boredom, and perceived control served as the third variable. We found a significant ACME, the effect of frustration on boredom due to perceived control of -0.10, $p < 0.05$, and non-significant average direct effect of frustration on boredom of -

0.03, $p = 0.67$. The proportion of total effect of frustration on boredom that could be accounted by perceived control was significant (proportion mediated = 0.74, $p < 0.05$), suggesting mediation. These results can be recast to indicate that the relationship between boredom and frustration is due to the influence of perceived control on both variables.

3.3 Discussion

In order to investigate the influence of perceived control on boredom and frustration we induced either a high or low sense of perceived control using a computerized version of rock-paper-scissors where participants either won or lost 100 percent of the time, regardless of what they played. Self-reports suggested that our manipulation was effective, as participants reported elevated levels of control in win condition relative to the lose condition. As predicted, low levels of control led to psychological reactance; attempts to establish control are evidenced by elevated levels of behavioral variability and frustration. Consistent with our predictions, results indicated that conditions of high perceived control led to a stronger sense of boredom than did the low perceived control condition. Our findings also suggest that frustration and boredom have a negative association (the more frustrated the less bored individuals are), however this relationship is entirely accounted by perceived control. In other words, individuals who experienced a low sense of control were more likely to be frustrated and less likely to be bored. These findings suggest that not only is frustration distinct from boredom, but that frustration is likely to represent a state of engagement or attempts to engage, while boredom represents a lack of engagement (Eastwood et al., 2012).

We also tested whether perceived challenge or control is a better predictor of boredom, and found that perceived control accounted for more variance in boredom than did perceived level of challenge. Similar findings have been found in students' self-reports in learning contexts, in which only perceived control operates as a significant predictor of boredom when controlling for challenge. However, unlike our results, a stronger sense of control was *negatively* associated with boredom in this study (Dicintio & Gee, 1999). Such a discrepancy in findings may be accounted by the difference in duration for which individuals experienced a low sense of control. Presumably, when individual's attempt to establish control and are frustrated in their attempts to do so for long enough periods of time (such as the duration of a typical school class) they will eventually de-value the task and ultimately become bored. We found no association between perceived control and perceived value in the current study, however, this does not preclude this relationship from being observed in a different design. Future research, should assess the hypothesis that conditions of low perceived control may lead to both frustration and boredom depending on the duration individuals are exposed to such conditions.

CHAPTER 4: General Discussion

The purpose of this research was to provide insight into the relationship between self-regulation, trait and state boredom. Study 1 demonstrated that poor self-regulation ability is strongly associated with the trait tendency to experience boredom. While, Study 2 demonstrated that when it comes to the state experience of boredom, opportunities to *gain control* are more important than a high sense of control. Study 2, further allowed us to differentiate between frustration and boredom, suggesting that they are distinct states that can operate differentially under conditions of low perceived control.

Our results suggest that boredom proneness is strongly related to an individual's effectiveness in goal pursuit. Within this framework, we speculate that boredom proneness may arise from an inability to effectively regulate oneself in a goal-directed manner. Therefore, addressing self-regulatory failure may provide novel avenues for boredom proneness intervention. Furthermore, our findings do suggest that distinct aspects of boredom proneness (here characterized as a perceived lack of external stimulation or a perceived lack of internal stimulation) are in turn related to distinct profiles of self-regulatory failure, and thus may reflect different means by which boredom originates and manifests itself.

Furthermore, our findings suggests that boredom can be thwarted by providing opportunities to satisfy our need for control, even though our ability to establish control may fail. This perspective is slightly distinct from existing models, which suggest that as long as we are prevented from exerting control we are bored. Our results suggest that more complex dynamics are involved in task disengagement than the degree to which we can exert control over our environment. Future studies should consider how individuals estimate their prospects of gaining control as predictors of boredom. Presumably, disengagement and thus boredom, occurs not only when we lack perceived control, but also when we confirm that control cannot be established through a series of attempts to do so.

Finally, our findings suggest the potential for developing novel interventions to reduce boredom based on the observed relationships. Although there are a number of known boredom coping strategies, it appears that strategies rooted in either approach or avoidance behaviors show some level of efficacy (Nett, Goetz, & Daniels, 2010). Given that regulatory foci and regulatory modes are thought to influence both approach and avoidance motivation, manipulation of these regulatory orientations may increase the use of effective boredom coping strategies. For instance, both a promotion focus and a high locomotion motivation can be experimentally induced (Avnet & Higgins, 2003; Higgins, et al., 2001). Given that both of these self-regulatory orientations are associated with reduced boredom, experimental induction of either may reduce the likelihood that individuals will experience boredom. In addition, the current study suggests the possibility of developing self-regulation training – directed in specific ways depending on the subtype of boredom proneness most commonly experienced – to reduce boredom proneness. By recognizing that different types of boredom are associated with distinct self-regulatory profiles, it may be possible to help individuals more effectively maintain desired levels of both internal and external stimulation.

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