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Three Essays on Boredom

A dissertation submitted to the
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by

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Abstract

Boredom has consistently been recognized as a powerful emotion that pervades modern society. Yet despite academic, literary, and media commentaries on boredom's importance, it has historically received sporadic and sparse attention from scientific researchers. This trend of neglect has begun to change course, and researchers have recently made progress in measuring boredom in a given situation, generating a theory of boredom to account for its various causes, and documenting the correlates of boredom proneness. Nevertheless, some significant gaps remain. This dissertation contributes to the rising tide of boredom research by addressing three gaps in the literature. First, the majority of past researchers have confined their examination of boredom to one-shot surveys and laboratory studies, which has narrowed the shape of research questions and can limit the external validity of findings. The first empirical paper (Chapter 2) leverages a rich experience sampling dataset to document boredom's prevalence, examine its situational and demographic correlates, and explore whether situational differences can account for group differences (e.g., whether men are more bored than women because of differences in how they spend their time). In addition to the gap in empirical work outside the laboratory, the work on boredom inside the laboratory is characterized by a significant methodological limitation, the lack of a validated boredom elicitation task. The second empirical paper (Chapter 3) addresses this methodological gap by testing and comparing the effectiveness of boredom inductions. This necessary methodological development contributes to the internal validity of laboratory experiments, which are indispensable in addressing boredom's causal factors. Recently, a comprehensive theory outlining boredom's function and causal determinants was proposed (Kurzban, Duckworth, Kable, & Myers, 2013). However, this theory has not been empirically tested, the main goal of the third essay (Chapter 4). These three essays contribute to empirical knowledge about the experience of boredom in everyday life, provide a validated methodological tool necessary to manipulate boredom in controlled laboratory settings, and advance the development of a comprehensive theory of state boredom that can be used to predict boredom's occurrence and inform interventions. Taken together, these essays characterize the nature of boredom in society and help explain when, and why, this interesting emotion occurs.

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Chapter 1

Introduction

> Boredom as a factor in human behaviour has received, in my opinion, far less attention than it deserves. It has been I believe, one of the great motive powers throughout the historical epoch, and it is so at the present day more than ever.
>
> –Bertrand Russell, *The Conquest of Happiness*

Russell's observation of boredom's power and prevalence in society has been echoed across generations of philosophers, writers, and scientists. Boredom has been labeled one of the most "insistent and universal" forces shaping human behavior (Nisbet, 1982, p. 22). Its destructive influence is epitomized by its memorable moniker, "the root of all evil" (Kirkegaard, 1843/1987, p. 286), and it has since earned additional distinctions, including "the main obstacle to efficiency" (Wyatt, 1950, p. 70), an "enemy of human happiness" (Schopenhauer, 1850/2004, p. 97), and most recently, "the human doom" (Spacks, 1995, p. 253). Although boredom's pernicious effects have received disproportionate attention, there has been some recognition of boredom's positive influence as well. For instance, Nietzsche (1887/2010, p. 108) speculated that artists "require a lot of boredom if their work is to succeed," Linton (1936, p. 90) suggested that boredom "lies at the root of man's cultural advance," and Russell himself (1930, p. 52) speculated that learning to endure boredom is "essential to a happy life."

Besides its power, boredom's prevalence has also been widely recognized (e.g., Anderson, 2004; Klapp, 1986; Orcutt 1984), especially in modern society, which has been termed "the age of boredom" (Farnworth, 1998, p. 145; see also, Darden & Marks, 1999; Klapp, 1986; Svendsen, 2005). Scholars have proposed various societal factors contributing to the supposed rise of boredom, which include the rise of industrialization and repetitive work (Thompson, 1929), an increase in leisure time (Spacks, 1995), and the rise of media reporting on extraordinary events juxtaposed with ordinary lives (Darden & Marks, 1999). Of course, empirical documentation of boredom's prevalence in modern society, let alone many generations ago, is limited, as is the evidence on boredom's socio-cultural determinants. Nevertheless, the commentary on boredom's influence, prevalence and causes is thought-provoking, and is a tribute to the fact that boredom is anything but boring.

1.1 Boredom Research in the Twentieth Century

Despite persistent speculation on its influence, empirical research over the past century has been surprisingly inconsistent regarding boredom, which is defined broadly as an aversive affective state associated with a lack of interesting, meaning, and attentional engagement (e.g., Eastwood, Frischen, Fenske, & Smilek, 2012; Nett, Goetz, Daniels, 2010; Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013; Vodanovich et al., 2011). Beginning in the 1920's, there was a surge of research by industrial psychologists examining the role of boredom in assembly line work (e.g., Wyatt, 1929; Wyatt & Langdon, 1937). However, interest (and funding) by the English government was short-lived, and industrial psychologists quickly abandoned boredom in favor of more valuable academic pursuits.

Short bursts of research punctuated the next half-century. One Columbia professor studied boredom's physiology in the laboratory (Barmack, 1938; 1939a; 1939b), psychoanalysts had a brief dalliance with boredom pondering its relationship with repression (Fenichel, 1951; Greenson, 1953), a small handful of behaviorists attempted to explain animals' exploratory behavior by proposing a boredom drive (e.g., Berlyne, 1960; Fowler, 1965), and finally, the military, specifically the Office of

Aviation Medicine, developed a brief interest in boredom elicited by vigilance tasks (e.g., Thackray, 1981; Bailey, Thackray, Pearl & Parish 1976; Thackray, Bailey, & Touchstone, 1977).

The early work on boredom culminated in a 1981 review article, in which Smith summarized boredom's "sporadic" and sparse literature (p. 329), estimating that researchers had produced less than one empirical paper per year since 1926. This relative scarcity of scientific interest and the lack of empirical data have been the most common complaints in the literature. In psychology, boredom has been labeled, "a neglected topic" (Robinson, 1975, p. 141), and in sociology, boredom has been perceived as "socially disvalued" (Darden & Marks, 1999, p. 13) and regarded as a "homely cousin" relative to alienation and anomie (Orcutt, 1984, p. 170).

Perhaps boredom's relegated status in research would have continued, but a key methodological development occurred: two trait boredom scales were created to assess individual differences in boredom proneness and susceptibility (Boredom Proneness Scale; BPS; Farmer & Sundberg, 1986; Boredom Susceptibility Scale; BSS; Zuckerman, 1979; Zuckerman, Eysenck, & Eysenck, 1978). These scales provided personality researchers with the necessary tools to examine trait boredom, and subsequently, research took off (for a review, see Vodanovich, 2003).

This stream of trait boredom research has demonstrated that boredom may have serious implications for individuals' well being, confirming previous speculation of its importance. Trait boredom has been associated with mental health issues such as depression and anxiety (Farmer & Sundberg, 1986; Sommers & Vodanovich, 2003; Vodanovich, Verner, & Gilbride, 1991), hopelessness and a perceived lack of meaning in life (Farmer & Sundberg, 1986; Fahlman, Mercer, Gaskovski, Eastwood, & Eastwood, 2009), guilt (McGiboney & Carter, 1988), loneliness (Farmer & Sundberg, 1986), apathy (Goldberg, Eastwood, LaGuardia, & Danckert, 2011) and anger (Rupp & Vodanovich, 1997; Vodanovich et al., 1991). It has further been implicated in poor impulse control (Leong & Schneller, 1993; Watt & Vodanovich, 1992) and pathological behaviors, including substance abuse (e.g., Iso-Aloha & Crowley, 1991; Johnston & O'Malley, 1986; Petry, 2001) and pathological gambling (Blaszczynski, McConaghy, & Frankova, 1990; Mercer & Eastwood, 2010).

1.2 The Goals of the Present work

In contrast to the dramatic and enduring growth of trait boredom research, state boredom, i.e., the temporary experience of boredom in a given situation, has continued to receive scattered interest from a diversity of researchers studying a diversity of research questions (e.g., Eastwood et al., 2012; Fisher, 1987; Larsen & Zarate, 1991; Merrifield & Danckert, 2014). The current landscape of state boredom is variegated, characterized by significant areas of progress, but also by significant gaps. The focus of this dissertation is to fill three distinct gaps in the state boredom literature.

1.2.1 Exploring Boredom in Everyday Life

Boredom researchers have employed limited measures and methodologies, typically confining their examination of boredom to one-shot surveys and psychological laboratories. Data collected in the field using the Experience Sampling Method (ESM; Csikszentmihalyi & Larson, 1987) can capture an individual's boredom experience over time and across the scope and heterogeneity of naturalistic settings, generating an extensive dataset of situational factors (e.g., location, activity).

In the second essay, "Bored in the USA: Using Experience Sampling to Examine Boredom in Everyday Life," we leverage a unique experience sample with over 1.1 million observations from nearly 4,000 adults to provide a comprehensive account of boredom. Specifically we 1) estimate the prevalence of boredom across a diverse population of US adults, 2) identify the specific demographic and situational factors associated with boredom and 3) explore whether differences across demographic groups can be attributed to situational differences (e.g., whether the gender gap in boredom can be explained by differences in how men and women spend their time). We find that boredom was reported in 2.8% of all reports, and that the majority of the sample (63%) experienced boredom at least once. Boredom was more prevalent among young, less educated, white, low-income and unmarried men. Boredom was more common in certain activities (working, doing nothing, studying), social settings (strangers, coworkers), locations (school, medical facilities), and at certain times (weekdays and in the afternoon). Differences in boredom across demographic groups were partially explained (up to 30%) by situational factors – i.e., how, or with whom, they spent their time.

1.2.2 Creating a Valid Boredom Elicitation

Besides the gap in examining boredom outside of the laboratory, there is a significant methodological gap characterizing tasks used to examine boredom inside the laboratory. Specifically, none of the tasks used to induce boredom in previous research have undergone rigorous validation. This lack of validation can threaten the internal validity of studies, limiting researchers' abilities to make causal claims, and it can also reduce statistical power, complicating the interpretation of null findings. Because of these concerns, researchers studying other emotions, such as amusement, sadness, anger and fear, began developing and validating elicitations decades ago (e.g., McHugo, Smith, & Lanzetta, 1982). However, these emotion researchers neglected to include boredom, and boredom researchers have not yet remedied this oversight.

In the first essay, "Across the Bored: Identifying a Reliable Boredom Induction," we test and compare the effectiveness of six five-minute computerized boredom inductions (peg turning, audio, video, signature matching, 1-back and an air traffic control task). The tasks were evaluated using standard criteria for emotion elicitations: intensity and discreteness (Gross & Levenson, 1995). Intensity, the amount of boredom elicited, was measured using a subset of the Multidimensional State Boredom Scale (MSBS; Fahlman et al., 2013). Discreteness, the extent to which the task elicited boredom and did not elicit other emotions, was measured using a modification of the

Differential Emotion Scale (DES; Gross & Levenson, 1995). In both a laboratory setting and an online setting, participants were randomly assigned to one of seven tasks (six boredom tasks or a comparison task, a clip from *Planet Earth*) before rating their level of boredom using the MSBS and other emotions using the modified DES. In both studies, each task had significantly higher intensity and discreteness than the comparison task, with moderate to large effect sizes. Further, the peg turning task (adopted from Festinger & Carlsmith, 1959) outperformed the other boring tasks in both intensity and discreteness, making it the recommended induction.

1.2.3 Specifying and Testing the Value Theory of Boredom

Historically, boredom researchers have documented various situational determinants of boredom (e.g., repetition, lack of difficulty, lack of meaning), but have not proposed a comprehensive theory. However, Kurzban, Duckworth, Kable, and Myers (2013) recently generated such a comprehensive theory, which states that boredom promotes the efficient use of mental resources, such as attention and working memory. The authors argue that boredom, in addition to other states like mental fatigue and flow, are the products of an evolutionary process, which has selected for feelings that guide effective prioritization – that is, guiding individuals to devote mental resources to more valuable tasks. Prioritization is necessary because mental resources are valuable to survival, and they are limited, in that using resources on one task precludes their use on other tasks. According to the theory, boredom is the result of a cost-benefit analysis of task value and is experienced when resources are being used sub-optimally, relative to the alternative task (i.e., the opportunity cost). Because of its aversive nature, boredom promotes attentional disengagement from the primary task and re-allocation of resources to more valuable tasks, resulting in performance decrement. The theory is based on a comprehensive review of attention and working memory, and Kurzban and colleagues provide evidence of its neural feasibility.

However, the authors do not conduct an empirical test of their theory, e.g., by manipulating a task's value and measuring subsequent boredom. Furthermore, they do not define "value" or enumerate its determinants. Without specifying what makes a task valuable (i.e., what is costly or beneficial), it is impossible to manipulate value and test the theory. The lack of an empirical test, accompanied by an insufficient specification of the theory, represents a significant gap in the advancement of a comprehensive theory of boredom.

In the third essay, "A Specification and Test of the Value Theory of Boredom," we test Kurzban et al.'s (2013) theory using four manipulations of value (difficulty, social approval, performance feedback, and wage rate). In support of the value theory, each manipulation decreased boredom (Experiments 1-4). Further supporting the theory, manipulations of value also positively influenced performance (Experiments 2 and 3). We additionally document that the value manipulation alone is insufficient to capture variation in boredom, indicating the role of endogenous factors. Specifically, we test whether boredom, controlling for the value manipulation, predicts subsequent persistence in a voluntary round of the task (if the exogenous manipulation of value were the only determinant of boredom, then this control would eliminate boredom's predictive power). We found that boredom predicted persistence, even when controlling for value (Experiment 3 and 4). Finally, in an effort to expand the predictions of the theory, we explored boredom at the point when participants voluntarily ended the task. This point is of great theoretical significance in economics, as it reflects an equilibrium in which the task's marginal costs equal its marginal benefits. We predicted that participants engaging in a valuable task would experience more boredom upon quitting (i.e., for a higher value task, participants should be willing to incur a higher cost, boredom). Contrary to our prediction, participants who were paid more reported a lower level of boredom upon quitting. We suggest some explanations for this surprising finding.

These essays provide three distinct contributions to the literature, which we hope will provide researchers with the necessary methodological tools, empirical knowledge, and theoretical framework, to support future work on state boredom.

Chapter 2

Bored in the USA: Using Experience Sampling to Examine Boredom in Everyday Life

with Alycia Chin, Saurabh Bhargava, Karim Kassam, and George Loewenstein

2.1 Introduction

Boredom has historically been a neglected topic in psychology research (Orcutt, 1984; Robinson, 1975; Smith, 1981), but has experienced an upswing in recent years. Rising interest in boredom has been motivated in part by discovery of its ties to mental health issues such as depression, anxiety, anger, loneliness, and hopelessness (e.g., Farmer & Sundberg, 1986; Rupp & Vodanovich, 1997; Sommers & Vodanovich, 2003; Vodanovich, Verner, & Gilbride, 1991). Boredom has also been implicated in substance use and pathological gambling (Iso-Aloha & Crowley, 1991; Blaszczynski, McConaghy, & Frankova, 1990, respectively), and, perhaps not surprisingly, has been found to be associated with negative job outcomes, including absenteeism and decreased job satisfaction (e.g., Kass, Vodanovich, & Callender, 2001).

Boredom is defined broadly as an aversive affective state in which individuals tend to experience a lack of interest, meaning, and attentional engagement (e.g., Eastwood, Frischen, Fenske, & Smilek, 2012; Nett, Goetz, Daniels, 2010; Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013). Boredom can further be classified into trait boredom, which is an individual difference in the tendency to experience boredom, and state boredom, which is the temporary experience of boredom in a given situation. Researchers interested in trait boredom have documented its relationship to specific personality measures and its prevalence in different groups (for a review, see Vodanovich, 2003). Those interested in state boredom have examined boredom's physiological correlates, its causes, and the cognitive appraisals associated with it (e.g., Merrifield & Danckert, 2014; Fisher, 1998; Smith & Ellsworth, 1985, respectively).

These two streams of research have improved our understanding of the nature of boredom and its importance. We add to the rising tide of boredom research by examining boredom over time in naturalistic settings using the experience sampling method (ESM; Csikszentmihalyi & Larson, 1987). To date, the ESM has been rarely been applied to boredom (Larson & Richards, 1991; Nett, Goetz, & Hall, 2011; Stone, Smyth, Pickering, & Schwartz, 1996), and has never examined boredom in a large adult sample.

The ESM provides multiple methodological benefits for examining boredom. First, the quantity of data generated by the ESM provides the statistical power to address issues, such as effect decompositions, that aren't possible with the limited amount of data generated by other methods. Second, because of advances in smart-phone technology, researchers can expand beyond convenience samples (i.e., college students) to reach a more diverse sample of individuals. Third, the ESM captures the heterogeneity of naturalistic settings, generating an extensive dataset of situational factors (e.g., location, activity). In comparison, it is infeasible to manipulate location, social setting, and time of day in a laboratory study. Finally, the ESM produces high quality data by prompting participants to report their experience in-the-moment, thereby avoiding memory biases that can compromise retrospective reports (Sudman, Bradburn, & Schwarz, 1996; Tourangeau, Rips, &

Rasinski, 2000). The quality and quantity of data generated using the ESM can contribute to boredom research by corroborating previously documented findings, generating new empirical findings, and addressing novel research questions.

We provide a new perspective on boredom by documenting its prevalence and correlates using an experience sample of over 1.1 million observations from a diverse set of 3,867 adult subjects. For seven to ten days, participants completed reports every half hour regarding the activity they were engaged in, person(s) they were with, their location, and whether they felt bored. We use these data to 1) estimate the prevalence of boredom across individuals and experiences, 2) document the specific demographic and situational correlates of boredom, and 3) identify the relative importance of situational factors in explaining differences in boredom across demographic sub-groups.

2.2 Literature Review

We first review the literature regarding boredom's prevalence, its demographic and situational correlates, and the source of group differences. Prior estimates serve as baselines, and new contributions are highlighted.

2.2.1 How prevalent is boredom?

Prior research has generated two types of prevalence estimates: how many people experience boredom and how often they are bored. Survey estimates of the first type of prevalence have found that between 30% and 90% of adults experience boredom at some point in their daily lives (Campbell, 1981, as cited in Klapp, 1986; Harris, 2000), as do 91% to 98% of youth (National Center on Addiction and Substance Abuse, 2003; Yazzie-Mintz, 2007, respectively). Two ESM studies estimated the second type of prevalence, and found that adults indicated feeling bored in

0.5% of reports (Stone et al., 1996, p. 1291), and middle school students reported feeling very, quite or somewhat bored in 23% of reports (Larson & Richards, 1991, p. 429).

2.2.2 Who experiences boredom and in what contexts?

Across the demographic characteristics (age, gender, race, education, income, employment, marital, and parental status) and situational factors (activity, social setting, location, day of week, and time of day) explored in this paper, the extent of prior literature varies.

Researchers have consistently found a negative relationship between boredom and age, such that younger individuals report more boredom (Drory, 1982; Harris, 2000; Hill, 1975; Levin & Brown, 1975; Smith, 1955; Stagner, 1975; Vodanovich & Kass, 1990). Studies have also found, quite consistently, that men score higher in trait boredom than women (Farmer & Sundberg, 1986; Sundberg, Latkin, Farmer & Saoud, 1991; Vodanovich & Kass, 1990; Wallace, Vodanovich, & Restino, 2003; Zuckerman, 1979; Zuckerman, Eysenck & Eysenck, 1978; c.f. Watt & Vodanovich, 1992). Studies reporting racial differences are limited in number and sample, only examining high school and college students. These studies have generally found that Black participants report higher trait boredom than White participants (Wegner, Flisher, Muller, & Lombard, 2006; Watt & Vodanovich, 1992; c.f., see Kurtz & Zuckerman, 1978). Although some researchers have not found a relationship between boredom and education (Drory, 1982; Smith, 1955), there is reason to expect that boredom may be associated with particularly low educational attainment, as boredom is correlated with dropping out of school (Fogelman, 1976; Robinson, 1975; Wegner, Flisher, Chikobvu, Lombard, & King, 2008) and low academic achievement (Fogelmann, 1976; Mann & Robinson, 2009; Maroldo, 1986; Robinson, 1975).

There is less research on how boredom varies as a function of situational factors. Boredom has been associated with school- and work-related activities, as well as "doing nothing" (Harris, 2000; Fischer, 1987; Larson & Richards, 1991). There is mixed evidence on the relationship between boredom and time of day. One study found no systematic time of day effects (Thackray, Bailey, & Touchstone, 1977), but others have found that boredom peaks around noon and in the early afternoon (Stone et. al, 1996; Davies, 1926, respectively).

Based on prior research, therefore, we expect to find that boredom is more common in youths, men, Black respondents, and those with lower levels of education. We also expect to find that individuals will report more boredom in work and school-related activities, and when "doing nothing." Beyond these relationships, we examine boredom's association with income, employment, marital and parental status, location, social setting, and day of week.

2.2.3 Why do some groups experience boredom more often than others?

Although researchers have found differences in boredom across demographic groups, they have not generally discussed the source of these differences. The one exception is gender, which has intrigued philosophers and researchers alike. One of the earliest accounts of the gender difference in boredom was provided by Nietzsche (1878/1994, p. 197), who *controversially* observed that, "Many people, especially women, do not experience boredom, because they have never learned to work properly." A recent philosopher (Svendsen, 2005, p. 16) suggested an alternate explanation: "It may be that women to a lesser extent than men verbally express boredom, but that they are affected by it to an equal extent." Finally, in a cross-cultural analysis of trait boredom, Sundberg and colleagues (1991) proposed that men may experience more boredom because of their propensity for overconfidence, causing them to find activities less challenging and more boring (p. 210).

Below, we explore an alternate account—that gender differences may be explained by differences in how men and women allocate their time. Consistent with this idea, we analyze demographic differences in boredom by time use.

2.3 Method

2.3.1 Participants

Participants (N = 3,867) were recruited either in person or over the phone from a larger, nationally representative study, in which they completed extensive demographic and psychographic questionnaires (results from this dataset are reported elsewhere; see Bhargava, Kassam, Morewedge, & Loewenstein, 2014a; 2014b). There were four recruitment waves with approximately 1000 participants each; participants were paid $150 (first wave), $125 (second wave) or $100 (third and fourth waves) for their participation. Participants were not told the purpose of the study.

The final sample, although not nationally representative, was diverse in terms of age ($M \approx$ 44, $SD \approx$ 12[1]), gender (50.9% male), race (75.5% white, 13.4% black, 11.1% other/multiracial), martial status (55.4% currently married, 44.6% single/engaged/ widowed/divorced), parental status (46.7% parents), employment status (57.9% employed full-time, 42.1% employed part-time/not employed), educational attainment (4.7% less than high school degree, 42.5% high school but no college degree, 52.7% college degree), and household income (median = $60,000-$75,000/year, SD ≈ $59,006).

2.3.2 Procedure

During the study, participants were asked to answer questions on a custom-made iPhone app. Participants recorded situational factors (e.g., activity, location), mood, alertness, and emotions (angry, bored, confident, excited, frustrated, happy, hopeful, loving, overwhelmed, relieved, sad, worried, contented, exhausted, indifferent, interested and lonely) every waking half-hour for a period of seven to ten days from 2011 to 2013. To include a diverse set of participants, those without an iPhone were provided a phone which was locked to the app for the duration of the study.

[1] A precise mean age for the full sample is not available because age was reported only as a categorical variable for one of the four waves. For the 3041 people who reported age numerically, mean age was 44.2, with a standard deviation of 12.2. The median age category for the fourth wave was 40 to 44.

Compliance was generally very high; participants failed to make entries on only 374 (0.98%) of the 37,982 total days, resulting in a total of 1,126,113 half-hour reports, an average of 291.21 per person (*SD* = 34.21).

2.3.3 Situational Measures

Using the iPhone app, participants rated what they were doing (*activity*), who they were with (*social setting*), and where they were (*location*). For each situational question, there was a corresponding list of options, presented in a fixed order. Each entry was made on successive screens, and some entries elicited follow-up questions to probe for more information (e.g., a participant who indicated that he was listening to the radio would be subsequently asked what kind of music he was listening to). Participants then rated their mood and alertness level on five-point scales (1 = bad mood, 5 = good mood; 1 = relaxed, 5 = alert). Finally, they reported their emotion by selecting an emotion pictogram (boredom was indicated with the word "bored" accompanied by face with furrowed brows and pursed lips). With the exception of mood and alertness, responses were binary (coded 1 if indicated, 0 otherwise), and participants could select one or more (e.g., having a meal; shopping). For each report, the day of the week and time of day were automatically recorded.

2.4 Results

2.4.1 Prevalence

Sixty three percent of the participants in our sample reported being bored at least once over the study period, consistent with prior estimates of 30-90%. Furthermore, boredom was recorded in 31,395 (2.8%) of the half-hour reports, which is also consistent with prior estimates (0.5%-23%). Of participants who reported being bored at least once, they were bored, on average, 4.6% of the time (*SD* = 8.2%; Max = 91.1%). Although these estimates provide useful descriptions of the population as a whole, they mask considerable variation between individuals and across contexts.

2.4.2 Demographic Correlates

We examine the relationship between boredom and a respondent's observable demographic characteristics by estimating a regression model of the following form:

$$Boredom_{it} = \alpha + X\gamma + \varepsilon_{it}$$

where $Boredom_{it}$ indicates the presence of boredom at time *t* for person *i*, while X is a vector of the demographic covariates of interest (age, age squared, gender, race, education, household income, employment status, marital status, and parental status). Robust standard errors are clustered at the respondent level to account for the non-independence of multiple observations from the same individual. The resulting estimates from this regression, reported in Table 2.1, provide the conditional correlation between each demographic characteristic and average boredom. Because all demographics are included in a single regression, each coefficient represents the change in boredom, holding constant the other demographic variables. As a means of better understanding the magnitudes of these estimates, the table additionally reports each coefficient relative to the average rate of boredom across the entire sample. Means in the text below are raw.

Age. Consistent with past research, younger respondents were more likely to report being bored than older respondents ($b_{age} = -0.005$, $p < .005$, 95% CI [-0.007, -0.004]), but at a declining rate ($b_{agesq} = 0.00005$, $p < 0.001$, 95% CI [0.00003, 0.00007]). The predicted level of boredom for a 25 year old in our sample (6.1%) was nearly 4 times as high as that of a 45 year old (1.6%), but a 45 year old was comparable to a 60 year old (1.7%).

Gender. Consistent with previous research, men were more likely to report being bored than women ($b_{male} = 0.009$, $p < .001$, 95% CI [0.005, 0.013]). The gender difference in boredom was large, with men in our sample reporting over 30% more episodes of boredom than did women ($M_{male} = 0.032$, $SD_{male} = .015$; $M_{female} = 0.024$, $SD_{female} = 0.018$).

Race. In contrast to previous studies, Black participants did not experience more boredom than White participants (b_{Black} = -0.006, *p* = 0.07, 95% CI [-0.013, 0.0004]; M_{Black} = 0.028, SD_{Black} = 0.164; M_{White} = 0.028, SD_{White} = 0.166). However, those in the Other/Multiracial category were less likely to be bored (b_{Other} = -0.011, *p* < .001, 95% CI [-0.017, -0.006]; M_{Other} = 0.026, SD_{Other} = 0.159).

Education. Previous research has reported mixed findings regarding education, finding no effect or a negative effect. In line with the latter, our estimates indicate that high school graduates experience significantly less boredom than dropouts (b_{HS} = -0.023, p = 0.004, 95% CI [-0.04, -0.01]; M_{noHS} = 0.062, SD_{noHS} = 0.242; M_{HS} = 0.026, SD_{HS} = 0.160). However, there was no further reduction in boredom associated with a college degree relative to a high school degree ($b_{college}$ = -0.003, *p* = 0.16, 95% CI [-0.007, 0.001]; $M_{college}$ = 0.022, $SD_{college}$ = 0.146).

Income. There was a small but statistically significant negative relationship between boredom and income ($b_{ln(inc)}$ = -0.003, *p* = 0.03, 95% CI [-0.006, -0.0003]).

Employment Status. The difference in boredom between full-time and part-time/unemployed individuals approached significance, with full-time employees experiencing less boredom ($b_{fulltime}$ = -0.005, *p* = 0.055, 95% CI [-0.010, 0.0001]).

Marital Status. Married respondents were less likely to be bored than those who were not married ($b_{married}$ = -0.009, *p* < .001, 95% CI [-0.013, -0.004]; $M_{married}$ = 0.020, $SD_{married}$ = 0.139; $M_{unmarried}$ = 0.039, $SD_{unmarried}$ = 0.193).

Parental Status. Respondents with children were no more bored than those without children ($b_{children}$ = 0.000, *p* = 0.91, 95% CI [-0.004, 0.004]); $M_{children}$ = 0.025, $SD_{children}$ = 0.156; $M_{nochildren}$ = 0.030, $SD_{nochildren}$ = 0.171).

Overall, our analysis of demographics suggests that the predictors of boredom are: age, gender, high school attainment, race, income, and marital status.

2.4.3 Situational Correlates

Our next set of analyses examined the prevalence of boredom across the following situational factors: activities, social setting, location, day of week, and hour of day. For each set k of factors Z^k, we estimate a regression of the following form:

$$Boredom_{it} = \alpha + Z^k\gamma + \eta_i + \varepsilon_{it},$$

where Z^k is a vector of the situational covariates of interest, and η_i is a set of respondent fixed effects.[2] This specification captures the correlates of boredom after adjusting for idiosyncratic variation in the propensity to be bored across each respondent. Again robust standard errors are clustered at the respondent level. Figures 2.1 to 2.3 display the predicted rate of boredom implied by these estimates for each time-use activity. Figure 2.4 displays the predicted rate of boredom across the days of the week and the time of day.[3]

Activity. Consistent with past findings, the most boring activities were studying, doing nothing in particular, and working (Figure 2.1; b = .045, $p < .001$, 95% CI [0.031, 0.059]; b = .020, $p < .001$, 95% CI [0.016, 0.025]; b = .016, $p = .016$, 95% CI [0.013, 0.018], respectively, relative to an excluded mean of .029).[4] The least boring activities were personal grooming or dressing, sleeping/napping, and sports or exercise (b = -0.011, $p < .001$, 95% CI [-0.012, -0.009]; b = -0.014, $p < .001$, 95% CI [-0.018, -0.011]; b = -0.014, $p < .001$, 95% CI [-0.018, -0.011], respectively). The differences across these activities were large with respondents being 3 to 6 times more likely to express boredom while working and studying than while playing sports or exercising.

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[2] The fixed effects regression was estimated with the constraint that $E(\eta) = 0$.

[3] Because of the limited data collected between midnight and 6am, these times are excluded from the analysis.

[4] The constant (excluded mean) in each regression reflects the average boredom rate among subjects if all situational values (Z^k) were 0.

Social setting. Respondents were often bored when they were in the presence of strangers, their coworkers, or alone (Figure 2.2; b = 0.014, $p < .001$, 95% CI [0.010, 0.019]; b = 0.012, $p < .001$, 95% CI [0.009, 0.016]; b = 0.003, $p < .003$, 95% CI [0.001, 0.005], respectively, relative to an excluded mean of .029). They were rarely bored when with their children, their partner or spouse, and their friends (b = -0.005, $p < .001$, 95% CI [-0.007, -0.003]; b = -0.008, $p < .001$, 95% CI [-0.010, -0.006]; b = -0.013, $p < .001$, 95% CI [-0.016, -0.011], respectively). Respondents were approximately 2.5 times more likely to report boredom when with their coworkers than their friends.

Location. Respondents were most frequently bored in schools/colleges, medical facilities, airports, and at work (Figure 2.3; b = 0.046, $p < .001$, 95% CI [0.034, 0.058]; b = 0.030, $p < .001$, 95% CI [0.018, 0.043]; b = 0.022, $p < .001$, 95% CI [0.004, 0.040]; b = 0.014, $p < .001$, 95% CI [0.011, 0.017], respectively, relative to an excluded mean of .031). They were least bored in a fast food restaurant, restaurant or bar, or a gym/health club (b = -0.012, $p < .001$, 95% CI [-0.016, -0.008]; b = -0.018, $p < .001$, 95% CI [-0.021, -0.015]; b = -0.021, $p < .001$, 95% CI [-0.027, -0.015], respectively). Reports of boredom varied substantially across locations; participants were seven times more likely to report boredom when at school or college than when at a gym or health club.

Day of Week. Boredom was experienced more frequently during the week than during the weekend ($b_{weekend} = -0.002$, $p = 0.01$, 95% CI [-0.004, -0.001], relative to an excluded mean of .028), representing an 8% drop in boredom on the weekend relative to the weekday. However, there were no statistically significant differences among the weekdays (*ps* > .05) or weekend days (*ps* > .05).

Time of day. Responses followed a time trend (Figure 4), with boredom being reported more frequently in the afternoon (noon-6pm) than the morning (6am-noon; $b_{morning} = -0.005$, $p < .001$, 95% CI [-0.006, -0.004], relative to an excluded mean of 0.032) and the evening (6pm-midnight; $b_{evening} = -0.009$, $p < .001$, 95% CI [-0.011, -0.008]). The predicted level of boredom in the afternoon (3.21%) represents a 25% increase relative to the morning (2.56%) and a 43% increase relative to the evening (2.24%). As evident in Figure 2.4, the time trend of boredom was similar on both weekends and weekdays.

2.4.4 Group Differences and Situational Factors

Our analyses demonstrate differences in boredom both across demographic groups and across situations. One question that arises from these findings is the extent to which differences in demographic groups can be explained by differences in how, where, and with whom each group spends their time. Perhaps younger adults are more bored than older adults because they tend to spend more time in boring places or doing boring activities. To explore this question, we employ a decomposition technique first used by economists to understand the causes of inequality in wage, health and achievement across race and gender (e.g., Oaxaca, 1973; Neumark, 1988). This technique involves using a series of regressions to estimate how much of the unconditioned difference in mean boredom across two groups can be accounted for if one group were to adopt the time-use patterns of the other, holding fixed the coefficients of time-use (for recent examples of this technique in psychology, see Bhargava et al. 2014a; 2014b).

We analyze the four demographic variables that significantly predicted boredom in our data: age, gender, income and marital status.[5] Because the exercise involves decomposing a mean difference across two groups into component parts, we performed binary splits on the continuous variables. Specifically, income was partitioned by the median income, and age was divided into groups below or above the age of 30 (the beginning of "young adulthood;" Arnett, 2007). As a point of comparison to time-use, we similarly assess the share of the overall difference in boredom attributable to group differences in other demographic characteristics (e.g., to what extent can

[5] Although individuals with a high school education and those in the multi-racial/other category experienced boredom less frequently, these groups were excluded because of their small sample sizes.

differences in boredom across income be explained by differences in age, employment and other demographic factors).

The analysis, reported in Table 2.2, indicates that differences in time-use explain a non-trivial share of the overall group differences in boredom.

Age. Situational time-use factors (activity, social setting, location) explain 10% of the difference in boredom between younger and older individuals, whereas demographic factors (gender, race, education, income, employment, marital, and parental status) explain 27%.

Gender. Thirty percent of the difference in boredom between men and women is attributable to differences in how men and women allocate their time. Differences in other demographic characteristics account for none of the overall group difference.

Income. Situational factors explain only 9% of the difference in boredom between high- and low-income respondents, whereas other demographic differences explain 73%.

Marital Status. Situational factors explain 18% of the difference in boredom between married and unmarried participants. Other demographic factors explain 26%.
Across the three types of situational factors (i.e., activity, social setting, and location), differences in social setting are most important for explaining differences in boredom across gender and marital status, whereas differences in activity play the most important role in explaining age differences. Overall, the analysis suggests that the differences in boredom across demographic sub-groups may, at least in part, be attributable to differences in how such groups allocate their time.

2.5 Discussion

We estimate the prevalence of boredom across individuals and experiences, document the demographic and situational factors associated with boredom, and analyze the extent to which demographic differences could be attributed to differences in time-use. These three analyses complement existing boredom literature by corroborating previous findings, documenting new situational and demographic factors, and addressing novel research questions.

First, our estimates of boredom prevalence (63% of individuals; 3% of all experiences) are useful for informing debates over the importance of boredom, which often hinge on whether boredom is pervasive (e.g., Anderson, 2004). Furthermore, historians, sociologists, and philosophers (e.g., Spacks, 1995; Klapp, 1986; Russell, 1930) have speculated that boredom has increased over time and is especially prevalent in industrialized societies. These estimates provide a necessary baseline to evaluate such claims. Second, identification of demographic and situational correlates may also be of practical value. Daschmann and colleagues (2011, p. 422) observed the scarcity of research on boredom's determinants and noted that, "knowledge about how and when boredom occurs would allow researchers and educators to develop and implement boredom reducing intervention programmes…" (Whether boredom should be reduced is, of course, worthy of debate, especially given its potential beneficial effects; see Belton & Priyadharshini, 2007). Effective interventions for combating boredom would undoubtedly benefit from insights into who experiences boredom and when they experience it.

With regard to demographic correlates, we found that boredom was more common among older respondents, males, Caucasians and less educated individuals. We newly explored boredom's relationship with other demographic factors, and found that boredom was more prevalent among poorer and unmarried individuals, and that there was no significant difference in boredom among individuals with and without children, and across employment statuses.

Regarding situations, the activities most associated with boredom were studying, doing nothing in particular, and working, whereas sports/exercise, sleeping/napping, and personal grooming were rarely boring. Second, boredom was most likely when an individual was in the company of strangers, coworkers or alone, and least likely when they were in the company of friends, their partner or their children. Boredom was especially common when individuals were at school/college, a medical facility, or at the airport, in contrast to being at a gym/health club, or at a restaurant/bar. Finally, boredom peaked in the afternoon and was more frequent on weekdays.

One potential explanation for the variation in boredom across demographic groups is that these groups use their time in different ways. We explored this possibility using a decomposition technique and found that situational factors captured between 9% and 30% of the variation between groups. Overall, however, 18-70% of the variance in group differences could not be explained by observable situational and demographic variables. Explaining the remaining variance is an area for future boredom research to address.

The current work contributes to existing knowledge on boredom, but is not without limitations. Most notably, the results reported in the present research were correlational. Our data revealed the who, what, when, and where of boredom, but a challenge for future researchers is to determine *why* an individual judges a specific situation as boring in the first place (see Bench & Lench, 2013; Csikszentmihalyi, 2000; Fisher, 1987; Van Tilburg & Igou, 2012). Furthermore, because we did not seek out individual conceptions of boredom, it is unclear how each participant defined boredom. Among researchers, there is some consensus about boredom's properties as an aversive experience related to disengagement, low arousal, and a lack of meaning (Fisher, 1993; Mikulas & Vodanovich, 1993; Nett, Goetz, & Daniels, 2010; Eastwood, Cavaliere, Fahlman, & Eastwood, 2007). However, it is currently unknown how laypeople describe and define boredom.

In conclusion, this study contributes to existing boredom research using a powerful methodology: the Experience Sampling Method. Using this method, we estimated the prevalence of boredom in individuals and across experiences, documented the demographic and situational factors associated with boredom, and analyzed the extent to which differences among sub-groups could be attributed to differences in time-use.

Chapter 3

Across the Bored: Identifying a Reliable Boredom Induction

with Alycia Chin, Eric VanEpps and George Loewenstein

3.1 Introduction

A growing interest in state boredom has sparked an increased need for validated methods of boredom elicitation (for a review, see Eastwood, Frischen, Fenske, & Smilek, 2013). Boredom has been defined as an aversive affective state in which individuals tend to experience a slow passage of time and a pervasive lack of interest, meaning, and attentional engagement in current activities (e.g., Nett, Goez & Daniels, 2010; Smith & Ellsworth, 1985; Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013; but see Mikulas & Vodanovich, 1993; Vogel-Walcutt, Fiorella, Carper, & Schatz, 2012). In contrast to the measurement of state boredom, which has received empirical attention (Fahlman et al., 2013; Van Tilburg & Igou, 2012), no researcher has compared the validity or relative effectiveness of tasks used to elicit boredom. This lack of validation can lead to underpowered and confounded studies, making it difficult to resolve conflicting findings (for a discussion of conflicting findings, see Merrifield, 2010, pp. 5-6). The current research addressed this methodological gap in the validation of tasks commonly used to elicit boredom by comparing six boredom tasks in order to identify their relative effectiveness. The availability of validated boredom elicitations will allow researchers to conduct future studies with confidence.

Previous tasks for eliciting boredom can be classified into three broad categories: repetitive kinesthetic, simple cognitive, and media tasks. Repetitive kinesthetic tasks include repeatedly making check marks on paper (Geiwitz, 1966), writing “cd” (London, Schubert & Washburn, 1972; Abramson & Stinson, 1977), screwing bolts and nuts together (Fisher, 1998), a hand-eye coordination task (Barmack, 1939), data entry (Lundberg, Melin, Evans, & Holmberg, 1993), copying references, tracing spirals, and connecting shapes by drawing lines between them (Van Tilburg & Igou, 2011).

Existing simple cognitive tasks vary considerably. Researchers have used Tetris (Chanel, Rebetez, Bétrancourt, & Pun, 2008), proofreading address labels (Fisher, 1998), classifying whether objects are man-made (Jiang et al., 2009), basic addition problems (Locke & Bryan, 1967), quantity approximation tasks (Van Tilburg & Igou, 2011) and counting tasks (Locke & Bryan, 1967; Van Tilburg & Igou, 2011). They also have used signal detection tasks, including monitoring a light on a box (London et al., 1972) and radar detection (Bailey, Thackray, Pearl & Parish, 1976; Hitchcock, Dember, Warm, Moroney, & See, 1999; Thackray, Bailey, Touchston, 1977).

Lastly, researchers have employed media tasks (audio and video clips) to elicit boredom. Rodin (1975) had participants listen to an excerpt from a textbook. Participants have also watched a video of men doing laundry (Merrifield & Danckert, 2014), a lesson of English as a Second Language, and a lecture on computer graphics (Fahlman et al., 2013).

The diversity of these boredom elicitations is a testament to researchers’ creativity in designing experiments, but also reflect the complexity of and uncertainty in what causes boredom and the definition of what constitutes boredom. Differences in tasks make it difficult to resolve conflicting results when they arise. For example, researchers have found that boredom is associated with both an increase (London et al., 1972; Lundberg et al., 1993) and a decrease (Barmack, 1939) in heart rate. Unfortunately, these results were discovered using different inductions: a 30-minute writing task, 90 minutes of slow-paced data entry, and a two-hour hand-eye coordination task, respectively. With such diverse tasks being used, and without rigorous task validation using standardized criteria, it is difficult if not impossible, to evaluate these studies and determine why their results conflict.

Whereas psychometrics, the study of scale development and validation, has an extensive history and has standardized criteria for evaluating scales (c.f., Furr & Bacaharach, 2013), efforts to validate emotion elicitations are recent. The preferred method for evaluating emotion elicitations was established by Gross and Levenson (1995), who identified two criteria for selecting an emotion induction: *intensity* and *discreteness* (for discussions of these criteria, see Rottenberg, Ray, & Gross, 2007; Schaefer, Nils, Sanchez, & Philippot, 2010).

Intensity refers to the amount of an emotion experienced by participants whereas discreteness refers to whether an experimental protocol elicits the target emotion without inducing other emotions. In the case of boredom, high intensity indicates that participants experienced boredom, whereas discreteness indicates that participants experienced boredom more than other emotions. Together, these criteria ensure that there is a strong manipulation of the target emotion—boredom—while reducing the confounding effects of other emotions.

In order to incorporate both intensity and discreteness into the selection of a task, Gross and Levenson (1995, p. 93; see also, Rottenberg, Ray, & Gross, 2007, p. 18) advocated combining both metrics into a single measure, termed a Success Index. This index is calculated by normalizing intensity and discreteness across elicitations and then summing the two z-scores. Preferred elicitations have higher Success Indexes.

One secondary criterion (see Lang, Bradley, & Cuthbert, 1999, p. 2; Rottenberg et al., 2007, p. 18) for emotion inductions is *between subject reliability*, measured by the degree of variance in the induced emotion. Higher between subject reliability, or lower variance, indicates a relatively uniform impact on boredom across individuals. Because higher reliability increases statistical power but does not affect internal validity, it is not included it in the Success Index. However, it is useful for deciding between otherwise matched tasks.

3.2 Task Descriptions

Based on prior research in the area and a short pilot study in which participants rated anticipated boredom in different tasks,[6] six computerized boredom tasks and one comparison task were used. The six tasks span the different modal categories (i.e., repetitive kinesthetic, cognitive, and media). Each task lasted five minutes.

1. *Peg turning*: Participants repeatedly clicked on icons of pegs that were arranged in two rows of four. Each mouse click rotated a peg a quarter turn clockwise, and participants were only able to click one peg at a time (it was highlighted). This repetitive kinesthetic task was adapted from the manual peg turning task used by Festinger and Carlsmith (1959) in their landmark study of cognitive dissonance.
2. *1-back:* Participants viewed a series of digits (3 sec) and fixation crosses (1 sec). Digits were randomly selected with replacement from the set [0, 9]. Participants were instructed to press the spacebar when the digit that appeared was the same as the previous digit (33% of digits were the same as the previous digit).

[6] In an online pilot study (*N*=145), participants rated how bored they would be if they engaged in each of several tasks for 15 minutes. The peg turning, 1-back, signatures, and air traffic control task were all included in this trial, and each elicited a high level of anticipated boredom. The video and audio tasks described were developed and pre-tested separately

3. *Video*: Participants watched a video of a man talking about his work at an office supply company. He described, in a monotone and "boring" manner (Leary, Rogers, Canfield, & Coe, 1986), a conversation with a client, eating lunch at his desk, and the determinants of cardstock prices.
4. *Audio*: Participants listened to the audio track of the video task, with no visual stimulus.
5. *Air traffic control*: Participants saw a series of randomly ordered radar screens (2 sec), each of which showed two diagonal line segments representing airplanes. Radar screens either depicted the two planes on a collision course or on separate, non-colliding paths (3.3% of screens showed impending collisions so participants saw approximately 5 impending collisions during the experiment; Hitchcock et al., 1999). Participants were instructed to press the spacebar when they saw an impending collision.
6. *Signatures:* Participants viewed 20 pairs of signatures in a randomized order. After a forced waiting period of 15 seconds, participants indicated whether the two signatures matched by clicking "yes" or "no" (signatures matched in 95% of cases). The next set of signatures appeared upon selection.
7. *Planet Earth (comparison task)*: Participants viewed a clip from *Mountains,* an episode of the British Broadcasting Company's (BBC) documentary film, *Planet Earth* (Fothergill et al., 2007). This clip depicted nature and animal scenes, and was chosen because it has been shown to elicit interest and amusement without eliciting negative or positive emotions unrelated to boredom (e.g., disgust, relief; Merrifield & Danckert, 2014; Bartolini, 2011). This task was used to ensure that participants would not identify all tasks as boring, and thus provided a benchmark for comparison.

3.3 The Current Research

This research compared six boredom tasks and one comparison task on their relative effectiveness in inducing boredom, as assessed by participants' ratings of the intensity and discreteness of their boredom. Two studies were conducted on different populations to gauge the generalizability of the results.

3.4 Experiment 1

Experiment 1 was designed to test the relative effectiveness of the six boredom inductions in a controlled laboratory setting. As a manipulation check, the intensity and discreteness ratings for each boredom task were compared to those from the comparison task, *Planet Earth*. All six boredom tasks were predicted to be more intense and discrete than the comparison task. Next, intensity, discreteness, and between subject reliability were compared among the six boredom tasks. The Success Index was used to determine the most effective task. *A priori*, there was no hypothesis regarding which boredom task would have the highest Success Index.

3.4.1 Method

Participants. Participants were recruited for a laboratory experiment from the Carnegie Mellon Center for Behavioral Decision Research (CBDR) pool, a pool consisting of undergraduate and graduate students at Carnegie Mellon University and residents of Pittsburgh, Pennsylvania. Participants volunteered for a 10-minute "Attention Study" that was advertised on the CBDR website and were compensated with their choice of course credit or $3. Twenty-five participants

(9.4%) were removed because they failed Task Fidelity screenings (see details below).[7] The final sample consisted of 241 participants (143 female, 184 Caucasian, M_{age} = 31.9, SD_{age} = 13.0).[8]

State Boredom. Participants indicated their agreement (1 = *Strongly disagree;* 7 = *Strongly agree*) with seven statements from a validated measure of state boredom, the Multidimensional State Boredom Scale (MSBS; Fahlman et al., 2013).[6] The seven statements were: "Time was passing by slower than usual"; "I was stuck in a situation that I felt was irrelevant"; "Everything seemed repetitive and routine to me"; "I felt bored"; "I seemed to be forced to do things that have no value to me"; "I wished I were doing something more exciting." Responses were averaged to create a boredom rating (α = .90 and .92 in Studies 1 and 2). Intensity was measured as the mean boredom rating using this seven-item subset of the MSBS, and between subject reliability was measured as the variance of these ratings.

Differential Emotions. The emotion measure was a modified version of the Differential Emotion Scale (DES; Gross & Levenson, 1995) that included a 17-item emotion self-report inventory (i.e., amusement, anger, arousal, boredom, confusion, contempt, contentment, disgust,

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[7] Ten participants had an average Task Fidelity Rating of 4.0 or below; an additional 15 indicated that we should not use their data. When all participants were analyzed, including the participants who did not pass the Task Fidelity screenings, all analyses held.

[8] In the final data set, age was negatively correlated to boredom intensity, $r = -.26$, $p < .001$. There was no significant difference in intensity between sexes ($p = .14$) or between Caucasian and non-Caucasian participants ($p = .60$).

[6] The Multidimensional State Boredom Scale (MSBS; Fahlman, 2008; Fahlman et al., 2013) was developed across multiple experiments using nearly 2,000 participants total to ensure strong psychometric properties. The scale exhibited high reliability (α = .94). It possessed high convergent validity, as established by its moderate to high correlations with two existing measures of trait boredom, and with related constructs, including depression, anxiety, anger, inattention, neuroticism, impulsivity, decreased purpose in life, and decreased life satisfaction. Finally, the authors established the predictive validity of the scale by showing participants either an interesting or boring video clip and then measuring their level of boredom using an open-ended response and the MSBS. As expected, participants in the boring condition described the video clip as "boring" in their open-ended responses and also scored higher on the MSBS. For more details, see Fahlman (2008).

embarrassment, fear, happiness, interest, pain, relief, sadness, surprise, tension). Participants indicated the greatest amount of each emotion they felt during the task on a scale of 0 (*not even the slightest bit*) to 8 (*the most I've ever felt in my life*). Following the procedures of Gross and Levenson (1995; Rottenberg et al., 2007, p. 18), discreteness was measured as the percentage of subjects whose boredom rating was at least one point higher than the other main emotion terms on the modified DES.[9]

Success Index. The Success Index (Gross & Levenson, 1995, pp. 92-93; Rottenberg et al., 2007, p. 18) was calculated as the sum of the normalized intensity and discreteness measures across the six tasks.

Task Fidelity. Participants indicated their agreement (1 = *Strongly disagree*; 7 = *Strongly agree*) with three statements using a 7-point Likert Scale (e.g., "I tried my hardest to do this task as instructed"; α = .70 and .69 in Studies 1 and 2). Respondents who had an average Task Fidelity Rating 4 or below ("Neutral") were dropped. Additionally, participants were dropped who said "no" to the question, "In your honest opinion, should we use your data?" (Meade & Craig, 2012). Finally, in the Amazon Mechanical Turk sample (Experiment 2), observations with duplicate IP addresses were eliminated. All elimination criteria were determined prior to data collection.[10]

[9] We adopt Gross and Levenson's (1995) calculation of discreteness, which uses seven emotion terms: amusement, anger, contentment, disgust, fear, sadness and surprise. When discreteness is calculated using all 17 emotion terms, the same pattern of results holds.

[10] Performance measures were collected for the peg turning, 1-back, air traffic control and signature tasks. There were no performance measures for the video and audio elicitations. Performance on the peg turning task, measured by the total number of pegs rotated, was not significantly correlated with boredom, r = -.19, p = .28. Performance on the other tasks was defined as the number of correct responses (i.e., correctly identifying whether a digit was the same as the previous digit in the 1-back task, correctly identifying collisions and non-collisions in the air traffic control task, and correctly identifying whether pairs of signatures matched or did not match). The performance on the 1-back task was correlated with boredom, r = -.47, p = .003, but performance scores on the air traffic control task and the signature task were not correlated with boredom, r = .03, p = .85; r = -.05, p = .78, respectively.

Procedure. In a between-subjects design, participants were randomly assigned to one of the seven tasks (six elicitations plus one comparison task) and subsequently answered questions about their State Boredom, their Differential Emotional reactions, and their Task Fidelity. The study ended with open-ended comments and demographic questions (age, sex, and ethnicity).

3.4.2 Results and Discussion

Mann-Whitney U comparisons showed that all six boredom tasks induced more intense boredom than *Planet Earth*, *U*s > 57, $p < .001$, with large effect sizes (*r* between .51 and .77; Table 3.1).[11] Furthermore, those who completed a boredom task were more likely to experience boredom as a discrete emotion than those who watched *Planet Earth*, χ^2 (1) > 16.141, $p < .001$, again with large effect sizes (ϕ between .48 and .64; Table 3.1).[12,13]

A Kruskal-Wallis nonparametric test indicated that there were significant differences among the tasks in boredom intensity, $H(5) = 22.53$, $p < .001$. Follow-up comparisons indicated that the peg turning task was significantly more boring than the average of the other five boredom tasks, $U = 1597$, $p < .001$, $r = .30$.[14] Discreteness was not significantly different among the six boredom tasks,

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[11] The effect size of the Mann-Whitney test, *r*, ranges from 0 to 1 and is calculated by dividing the z statistic by the square root of the sample size (for reference, see Corder & Foreman, 2009, pp. 39-40). Cohen (1988; 1993) established conventions for interpreting effect size, with *r* considered to be small (.10), medium (.30) or large (.50).

[12] The effect size of the chi-square test, phi (φ), is calculated as the square root of the chi-square test statistic divided by the sample size. Like *r*, the statistic ranges from 0 to 1, and follows Cohen's (1988; 1993) conventions of .10, .30 and .50 to indicate small, medium or large effects.

[13] The comparison task, *Planet Earth*, had generally higher single-item ratings of amusement, happiness and interest than the six boredom tasks, consistent with the definition of boredom and with past research using this stimulus (Table 3.3).

[14] Additional analyses revealed that every one of the seven items used to measure boredom was highest for the peg turning task (Table

$\chi^2(5) = 3.266$, $p = 0.66$. Between subject reliability was not significantly different among the six boredom tasks, Brown-Forsythe $F(5, 203) = 2.113$, $p = .07$. Overall, the Success Index was highest for the peg turning task, followed by the video.

Experiment 1 indicated that all six of the experimental tasks were rated more boring and more discrete than the comparison task, *Planet Earth*. Furthermore, Experiment 1 provided evidence that the peg turning task elicited significantly more intense boredom than any of the other boredom tasks, and the Success Index was highest for the peg turning task.

Experiment 1 was constrained to local residents and university students who were recruited from a research participation pool. Experiment 2 used identical procedures and measures with participants from a different population to explore whether these patterns generalized.

3.5 Experiment 2

To test the relative effectiveness of the six boredom inductions in a different experimental setting, participants were recruited from Amazon's Mechanical Turk, an online marketplace for computerized work (Buhrmester, Kwang, & Gosling, 2011). As in Experiment 1, the intensity and discreteness of each boredom task were first compared to the comparison task, *Planet Earth*. Then, intensity, discreteness, and between subject reliability were compared among the six boredom tasks. The Success Index was used to determine the most effective induction.

3.5.1 Method

Participants. Participants were recruited using Amazon Mechanical Turk (www.mturk.com; Buhrmester, Kwang, & Gosling, 2011). Participants volunteered for a 10-minute "Attention Study" that was advertised on the website. Eligible participants had at least a 95% approval rating on

3.4).

previous tasks. Participants who failed Task Fidelity screenings were excluded from analysis (N=44).[15] The final sample consisted of 416 participants (166 female, 243 Caucasian, $M_{age} = 33.3$, $SD_{age} = 11.3$).[16,17]

3.5.2 Results and Discussion

All six boredom tasks were rated significantly more boring than the comparison task (Mann-Whitney *U*s > 326, $p < .001$), with moderate to large effect sizes for all tasks (*r* between .39 and .66; see Table 3.2). Additionally, those who completed any of the boredom tasks were more likely to rate boredom as a discrete emotion than those who watched the *Planet Earth* video, $\chi^2(1) > 13.02$, $p < .001$, also exhibiting moderate to large effect sizes (ϕ between .32 and .56; Table 2.2).[18]

A Kruskal-Wallis nonparametric test indicated significant differences among the six tasks in boredom intensity, $H(5) = 27.45$, $p < .001$. Peg turning was rated significantly more boring than the average of the other five boredom tasks, $U = 4410.5$, $p < .001$, $r = .25$.[19] Discreteness was not different among the six boredom tasks, $\chi^2(5) = 10.709$, $p = 0.06$. Between subject reliability among the six boring tasks was significantly different, Brown-Forsythe $F(6, 409) = 3.324$, $p = .003$. However, no single task had a significantly lower variance than the combined variance of the other

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15 Sixteen participants had an average Task Fidelity Rating 4.0 or below, another 7 participants indicated that their data should not be used, and an additional 21 responses from duplicate IP addresses were dropped. When all participants were analyzed, including the participants who did not pass the Task Fidelity screenings and participants with duplicate IP addresses, all analyses held.

16 Age was negatively correlated to boredom ($r = -.35$, $p = .01$). There was no significant difference across sex ($p = .45$) or between Caucasian and non-Caucasian participants ($p = .11$).

17 Performance measures on the four boredom tasks (peg turning, 1-back, air traffic control and signature tasks) were not correlated with boredom scores, $r = .06$, $p = .69$; $r = .11$, $p = .28$; $r = .07$, $p = .56$; $r = .09$, $p = .49$, respectively.

18 As in Experiment 1, the comparison task, *Planet Earth*, was generally higher in single-item ratings of amusement and interest compared to the six boredom tasks (Table 3.5).

19 As in Experiment 1, additional analyses revealed that every one of the seven items used to measure boredom was highest for the peg turning task (Table 3.6).

five boredom tasks, $p > .11$. The Success Index was highest for the peg turning task, followed by the 1-back.

3.6 General Discussion

This research is the first to systematically compare boredom inductions in terms of their overall effectiveness. All six computerized tasks tested here elicited more boredom than the comparison task, *Planet Earth*, with effect sizes ranging from .39 to .77. Additionally, all six tasks induced boredom without eliciting other emotions, with effect sizes of discreteness ranging from .33 to .64. Overall, the peg turning task had the highest Success Index in both samples among the boredom tasks studied, making it the recommended induction. It is impressive that a repetitive motor task designed over 50 years ago by Festinger and Carlsmith emerged as the most boring task in the present day.

The data presented here provide a baseline task that can be used to explore boredom's causes and to test interventions. With only minor revisions to the peg turning task, researchers could evaluate the effect of goals, performance feedback, cognitive load, perceptual stimuli (i.e., background music), task duration and other characteristics on boredom. Manipulations such as these have the potential to inform theory and also practical interventions that minimize boredom in everyday life.

This research also allows researchers to make informed decisions regarding the selection of tasks to fit their study design. For instance, one may prefer to use videos to induce emotions in online participants. The effect sizes, sample sizes, and task details reported here suggest that a comparison of the boredom video and the *Planet Earth* video would require approximately 38 laboratory participants to have .80 power to detect a significant difference in boredom between conditions, using a two-tailed test and setting a conservative alpha of .001 (see Cohen, 1988; 1992, for more detail about using effect sizes to determine statistical power).

3.7 Limitations and Future Directions

All of the tasks in this work were computerized, as one goal of this research was to create flexible stimuli that can be easily adapted by future researchers. However, boredom can emerge in situations that are not reflected in a computerized stimulus. Although the present tasks span the range of boredom inductions used in previous research (i.e. repetitive kinesthetic, cognitive, and media), they still are only an arbitrary selection of possible tasks in daily life. Researchers should be mindful of circumstances in which alternative inductions provide improved external validity.

Second, the evaluation of the boredom tasks depends on the scale used to measure boredom. In this study, boredom was measured with a subset of the MSBS, a measure that includes questions on perceived meaning, repetition, and slowed time. Although most boredom researchers would agree that these characteristics are associated with boredom (for a discussion, see Mikulas & Vodanovich, 1993), adopting a different definition of boredom would result in a different evaluation of the tasks. This concern is partially alleviated because the peg turning task scored the highest on every item in the 7-item MSBS subset (most notably, "I felt bored"), and it also scored the highest on the single-item measure using the modified DES. However, the lack of a consensus regarding the definition of boredom remains a fundamental obstacle facing the field, and necessarily limits the applicability of any single induction.

Finally, the present work does not explicitly test why these tasks induce boredom or why they are differentially effective. Although we did not predict which task would be most effective at eliciting boredom, in hindsight one can speculate on why the peg turning task was the most successful. First, the task is highly repetitive, as participants not only repeatedly click pegs, but are also forced to “start over” after every set of pegs. The association between repetition and boredom has been discussed since the early 1900’s in the context of assembly line work (Wyatt, 1929), and turning pegs exemplifies such repetition. Second, peg turning may be particularly boring because it is not challenging. In his work on boredom and flow, Csikszentmihalyi (2000) suggested that boredom occurs when skill exceeds challenge, that is, when tasks are too easy. In contrast to the other tasks examined in this study, peg turning requires minimal cognitive effort. Finally, peg turning may feel meaningless. Whereas the air traffic control task may have real world parallels that lend it a sense of significance, it is difficult to imagine the usefulness of repeatedly clicking a button to rotate a circle on a screen. Although the current data are limited in their ability to specify what makes each task more or less boring, future work that manipulates tasks characteristics, ranging from repetition to cognitive load to active or passive engagement, may allow researchers to disentangle the multiple elements that drive boredom.

By creating, validating, and demonstrating the effectiveness of six different boredom inductions, the current work provides an important methodological foundation for future researchers interested in studying boredom across a broad range of experimental paradigms. Having validated methods for inducing boredom, assessing their relative effect sizes, and encouraging the application of the new state boredom scale (Fahlman et al., 2013) should facilitate continued research on a wide variety of judgments, choices, and behaviors that may be affected by boredom.

Chapter 4

A Specification and Test of the Value Theory of Boredom

with George Loewenstein

4.1 Introduction

"…researchers know very little about the phenomenon of boredom. There is no agreed definition of the construct or well-developed instrument for measuring it, and there is no comprehensive theory of its causes." (Cynthia Fischer, 1993, p. 395)

In the past ten years, state boredom researchers have made significant progress in addressing Fischer's concerns. First, there is an emerging consensus that boredom is defined as an aversive affective state in which individuals tend to experience a pervasive lack of interest, meaning, and attentional engagement (e.g., Eastwood, Frischen, Fenske, & Smilek, 2012; Fahlman, Mercer-Lynn, Flora, & Eastwood, 2013; Merrifield & Danckert, 2014; Nett, Goetz, Daniels, 2010). Based on this construct, researchers have created and validated a self-report scale that reliably measures boredom in a given situation (Multidimensional State Boredom Scale; MSBS, Fahlman, Mercer-Lynn, Flora & Eastwood, 2013). In addition to defining the construct and developing a measurement tool, researchers have also developed a valid elicitation method that can be used to induce boredom in online and laboratory settings (Markey, Chin, VanEpps, & Loewenstein, 2014). These methodological contributions provide a foundation for boredom research, one that is necessary to test a "comprehensive theory" of boredom and its causes.

Recently, Kurzban and colleagues (2013) proposed such a comprehensive account of boredom. The authors theorized that boredom is the product of a cost-benefit analysis of task value, a conclusion that they derived through the following reasoning. First, mental resources, such as working memory and attention, are limited, and these resources face *simultaneity* constraints, which is to say that, "not everything can be done at once" (p. 664). Second, the solution to simultaneity is *prioritization* (p. 664), which involves evaluating tasks based on their costs and benefits, and then performing the tasks that are relatively more valuable first. Third, the authors argue, boredom, in addition to other states like mental fatigue and flow, are the products of an evolutionary process which has selected for feelings that guide effective prioritization. In this sense, boredom can be understood as "the felt or experienced output of motivational systems, directing behavior toward net positive fitness outcomes and away from net negative fitness outcomes" (p. 665). Finally, these feeling states then result in the re-allocation of mental resources, which drives performance, ultimately resulting in a new cost-benefit analysis.

Despite the strengths of the theory, the authors do not provide an empirical test by demonstrating that changing the costs or benefits of a task results in a change in phenomenology. Furthermore, the theory is insufficiently specified to allow for an empirical test because the authors do not identify what makes a task beneficial or costly.[20] Without specifying the determinants of value, it is impossible to test whether value affects boredom. The purpose of this research then, is

[20] Kurzban and colleagues do argue that the cost of a task is its opportunity costs (i.e., a task is costly in that using limited resources for one task precludes using them for another task). However, calculating the opportunity cost depends on calculating the benefits of the secondary task, which is impossible without specifying what makes tasks beneficial.

two-fold: first, to test the theory by examining the impact of value on boredom, and second, through these tests, to begin identifying specific determinants of value.

4.2 Overview of Studies

In Experiment 1, we investigate the effect of value, as induced by difficulty, on ratings of boredom in a 5-minute task. In Experiment 2, we manipulate value through providing social approval, and we investigate the effect of value on both boredom and performance, again using a 5-minute task. In Experiment 3, we manipulate value by providing performance feedback. In addition to measuring boredom and performance in a 5-minute task, we provide participants an opportunity to engage in the task voluntarily and measure their persistence. Finally, in Experiment 4, we assess the effect of financial rewards on boredom and expand upon previous designs by measuring boredom immediately after participants quit.

4.3 Experiment 1

We examined the effect of difficulty on boredom. Previous researchers have suggested that difficulty, specifically "optimal difficulty," is valuable, because it promotes learning and academic growth (Brophy & Evertson, 1978; Vygotsky, 1978), and it enhances feelings of competence (Deci, Vallerand, Pelletier, & Ryan, 1991). Therefore, we predicted that difficulty would decrease boredom. To test this prediction, participants completed either a boring task, in which they repeatedly clicked on computerized pegs, or they completed a more difficult version of the task, in which the pegs were smaller and moved around. After completing the task, participants rated their level of boredom.

4.3.1 Method

Participants, design and procedures. Participants (*N* = 183, 77 female, 45 Caucasian; M_{age} = 35.97, *SD* = 11.05) were recruited through Amazon's Mechanical Turk, an online labor marketplace (Buhrmester, Kwang, & Gosling, 2011), for an "Attention Study." Only Mechanical Turk workers who had completed 1000 tasks and had earned at least a 95% approval rating were eligible. Seventeen participants with duplicate IP addresses were excluded; this exclusion criterion was determined prior to data collection.

After signing up, participants completed a 5-minute task. They were randomly assigned to either the standard peg turning task (control condition), or a more difficult version (difficult condition). In the standard task, participants repeatedly clicked a set of eight pegs to rotate them by quarter-turns, only to begin the process again when the eighth peg was reached (Figure 4.1, Panel A). Adapted from the physical peg turning task used by Festinger and Carlsmith (1959) in their hallmark study on cognitive dissonance, this computerized version has been shown to induce a high level of boredom (Markey, Chin, VanEpps, & Loewenstein, 2014). In the difficult condition, the pegs were smaller and moved in an unpredictable fashion (Figure 4.1, Panel B). After the 5-minute task, self-report measures were collected, followed by an open-ended comment box and demographic questions (age, sex, and ethnicity).[21]

Measures. Unless otherwise indicated, all items had a 7-point Likert-type response scale anchored at 1 = *strongly disagree* and 7 = *strongly agree*.

Boredom. We assessed the extent to which participants felt bored using six items from the Multidimensional State Boredom Scale (MSBS; Fahlman et al., 2013). The items were: "Time was

[21] Age was not significantly correlated with boredom, $r^2 = .02$, $p = .82$, and boredom was not significantly different among men and women, $F(1, 164) = 0.92$, $p = .34$. Boredom was significantly higher among Caucasian participants ($M = 5.53$, $SD = 1.02$) than non-Caucasians ($M = 4.54$, $SD = .96$), $F(1,164) = 33.48$, $p < .001$.

passing by slower than usual;" "I was stuck in a situation that I felt was irrelevant;" "I wish time would go by faster;" "Everything seemed repetitive and routine to me;" "I felt bored;" "I wished I were doing something more exciting" (α = .75).

Value. We measured perceptions of task value with four statements: "This task was a good use of my time;" "This task was valuable;" "I would recommend this task to another Mechanical Turk Worker;" "I felt like I was wasting time that would have been better spent on something else." The last item was reverse coded (α = .84).

Manipulation check. To ensure that our difficulty manipulation was effective, we asked participants to indicate their level of agreement with the statement, "This task was challenging."

4.3.2 Results and Discussion

Means and standard deviations by condition appear in Table 4.1. All analyses controlled for age, sex, and ethnicity. In support of the validity of the manipulation on difficulty, an analysis of covariance (ANCOVA) revealed that participants rated the difficult task as more challenging (M = 5.40, SD = 1.62) than the control task (M = 3.74, SD = 1.96), $F(1, 161) = 40.20$, $p < .001$, $\eta^2 = .20$. In line with previous research suggesting that difficult tasks are more valuable, participants who completed the difficult version rated the task as more valuable (M = 4.84, SD = 1.34) than the control condition (M = 4.48, SD = 1.40), $F(1, 161) = 4.57$, $p = .03$, $\eta^2 = .03$. In support of our hypothesis that value affects boredom, participants performing the difficult version were significantly less bored (M = 4.64, SD = 1.08) than participants performing the control task (M = 4.97, SD = 1.03), $F(1, 161) = 5.44$, $p = .02$, $\eta^2 = .03$.[22]

These results provide initial evidence that value, generated by difficulty, decreases boredom.

[22] Perceptions of difficulty likely reflect differences in ability and other factors. However, to further explore the effect of difficulty on boredom, we ran an ordinary least-squares (OLS) regression of boredom on perceived difficulty, controlling for condition. Perceived difficulty significantly predicts boredom, $\beta = -0.37$, $t(160) = -4.86$, $p < .001$.

However, this study only tested one input to value. An alternate explanation for these results is that boredom is affected by difficulty, but value is only tangentially related rather than the driving factor. Also, the study is limited because the manipulation changed the physical task that participants engaged in, which makes it especially difficult to eliminate alternative explanations for the change in boredom (e.g., variety, movement). Finally, we did not restrict our sample to US citizens on Amazon's Mechanical Turk. This may be problematic if language or cultural differences affected participants' responses.

In the next experiment, we evaluate a different input to value and employ a manipulation which has minimal impact on the task itself, thereby reducing confounds. Furthermore, we explore another prediction of the value theory, that value increases performance.

4.4 Experiment 2

In our second study, we examine the effect of social approval on boredom and performance. There is strong empirical evidence that social approval, or esteem by others, is a source of value: social approval serves as a reward that effectively shapes behavior (e.g., Brophy, 1981), individuals self-present in ways that increase expected social approval (e.g., Baumeister & Leary, 1995; Crowne & Marlowe, 1960), and individuals exert more effort in the presence of others (e.g., Bond & Titus, 1983; Zajonc, 1965). Researchers have argued that social approval is inherently valuable (e.g., Becker, 1974; Lindenberg, 1990), and also that it has instrumental value – e.g., social approval promotes a positive self-image (Leary, Tambor, Terdal, & Downs, 1995), which individuals value (e.g., Maslow, 1943; Sedikides, 1993). Because social approval has been repeatedly associated with value, but has not been mentioned in the boredom literature, this input of value is an especially strong test of the theory.

To further test the theory, we measured performance. According to Kurzban and colleagues

(2014, p. 665), value affects phenomenology, which then affects the re-allocation of mental resources, and results in a change in performance. Therefore, increasing task value should be accompanied by an increase in performance. However, the relationship between boredom and performance is less clear because performance is multiply determined by boredom and other states (e.g., frustration, mental fatigue).

In Experiment 2, participants completed the standard peg turning task, during which they either received positive ratings from fictitious observers or completed the task without observation. We predicted that participants who were evaluated and received approval would judge the task as less boring. In addition, we hypothesized that value would increase performance, and we explored the relationship between boredom and performance.

4.4.1 Method

Participants, design and procedures. Participants (*N* = 143, 78 female, 109 Caucasian; M_{age} = 38.52, *SD* = 13.41) were recruited through Amazon's Mechanical Turk for an "Attention Study." Only US based Mechanical Turk workers who had completed 1000 tasks and had earned at least a 95% approval rating were eligible. Two participants were removed because of duplicate IP addresses; this exclusion criterion was established prior to data collection.

Participants were randomly assigned to complete the standard boredom task (control condition), or to complete the task while receiving periodic positive evaluations (social approval condition). In this latter condition, participants were first informed that three different observers would periodically watch their screen and rate their performance on a scale from 0 to 10. During the task, a notice appeared for 10-30 seconds that said, "Observation in Progress," and was followed by a rating that remained on the screen for 5 seconds (Figure 4.2, Panels A and B). Participants were not rated by real observers. All participants were observed at set time intervals (10 sec, 1 min 30 sec, 3 min, 4 min) and after the observation period, all participants received ratings of 8.2, 9.2, 8.6, and

8.5 (Observer 1 supposedly observed twice). After the task, we collected self-report measures and demographics (age, sex, and ethnicity).[23]

Measures. Boredom and task value were measured using the same scales as in Experiment 1 (α = .92, α = .89, respectively).

Performance. Performance was measured as the number of pegs that participants turned (because each click resulted in a quarter turn, performance was calculated as the number of clicks on the peg, divided by four).

Manipulation Check. To assess whether participants attended to the ratings, all participants answered the following manipulation check: "On average, the ratings I received during the task were:" and selected a response: *High (7 and higher)*; *Medium (3-7)*; *Low (3 and below)*; *I did not receive any ratings during the task*. Furthermore, to assess whether participants believed that a real person was providing feedback, participants in the social approval condition answered the following yes/no question: "You received ratings from observers in this experiment. Did you believe that these were from real respondents?"

4.4.2 Results and Discussion

Means and standard deviations by condition appear in Table 4.2. All analyses controlled for age, sex, and ethnicity. Participants attended to the ratings, as the majority of participants (97.2%) in the social approval condition accurately reported that they received high scores, and the majority (86.8%) in the control condition reported that they did not receive feedback; these were significantly different from chance, $\chi^2(3) = 203.33, p < .001$, $\chi^2(3) = 139.88, p < .001$, respectively. However, 75.3% (n = 55) of participants in the social approval condition reported that they did not believe

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[23] Age was not significantly correlated to boredom, $r^2 = -.14, p = .11$, and boredom was not significantly different among the sexes, F(1, 139) = 2.09, p = .15. Caucasian participants reported significantly less boredom (M = 5.34, SD = 1.32) than non-Caucasians (M = 5.93, SD = 1.09), F(1, 139) = 9.04, p = .02.

that a real person was giving them feedback. Despite this, an ANCOVA revealed that participants in the social approval condition reported that the task was more valuable (*M* = 4.10, *SD* = 1.35) than participants in the control task (*M* = 3.18, *SD* = 1.35), F(1, 136) = 32.71, $p < .001$, $\eta^2 = .12$. In support of our hypothesis of the effect of value on boredom, participants judged the task as less boring when evaluated (*M* = 5.10, *SD* = 1.37) than when completing the standard task (*M* = 5.88, *SD* = 1.08), F(1, 136) = 17.20, $p < .001$, $\eta^2 = .11$.

In support of the hypothesis that value affects performance, an ANCOVA revealed that performance was significantly higher in the social evaluation condition (*M* = 192.54, *SD* = 50.17) than the control condition (*M* = 156.99, *SD* = 58.66), F(1, 136) = 14.65, $p < .001$, $\eta^2 = .10$. To explore the relationship between performance and boredom, an ordinary least-squares (OLS) regression analysis was used. Boredom did not predict performance, $\beta = -.05$, $t(136) = -0.58$, $p = .57$.

These results provide some support that social approval, an important source of value, decreases boredom and increases performance. However, one major limitation of this study was that more than three-fourths of participants in the social approval condition reported that they did not believe that a real person was observing them. This proportion likely represents an upper bound given the leading nature of the question, but the failed deception is nevertheless disconcerting. Even so, participants reported that task was more valuable, and they exerted more effort, consistent with prior research on “real” social approval.

There are a few explanations for this finding. First, participants may have exerted more effort because of an increased awareness of experimenter evaluation. This is not problematic, as experimenter approval itself is likely a source of value. A second explanation is that the social approval condition may have elicited the feeling of being evaluated or watched, and that this may have affected perceptions of value through faulty heuristics (see, Haley & Fessler, 2005). If feeling evaluated is typically associated with social evaluation, and positive evaluation is valuable, then individuals may employ a heuristic that uses cues associated with being evaluated as an indicator of value. In line with this, previous studies have found that an image of eyes influences behavior in ways similar to "real" social observation (e.g., Bateson, Nettle & Roberts, 2006; Haley & Fessler, 2005). Furthermore, when participants are knowingly ostracized by a computer, they still experience a decrease in belonging and self-esteem, suggesting that social evaluation heuristics may be deeply ingrained (Zardo, Williams, & Richardson, 2004). This explanation is also consistent with the value theory of boredom. However, besides increasing perceptions of value, the social evaluation condition may have also induced demand effects, such that participants may have tried to please the experimenter by providing biased reports (reporting less boredom than they actually felt). This would be problematic in our study, as it would suggest that boredom ratings were inaccurate, but inaccurate in the direction of our hypothesis, creating a confound. We discuss this possibility in more detail in the general discussion at the end, given that demand effects are a source of concern for Experiments 2-4.

Finally, an alternate explanation is that participants may have thought that the rating was computer-generated, but based on their performance rather than random or pre-determined. In open-ended comments, one participant suggested this: "Its kind of late and Im sure that three people cant watch the experiment all of the time. I did believe however that there was some sort of computer program doing the job since it was a fairly simple task that could be quantified." There is reason to believe that accurate, objective feedback is valuable to individuals, so this interpretation may explain why the manipulation worked, in spite of the failure to convince participants that a real person was watching.

In the next study, we explore this mechanism of value. Providing objective performance feedback eliminates the need for deception and can further specify the theory. In addition, we expand the design in the following studies to address an additional research question – how long participants persist on the task when participation is voluntary.

4.5 Experiment 3

In Experiment 3, we examined the effect of value on boredom by manipulating performance feedback. Most researchers have argued that performance feedback is useful for its instrumental value. Specifically, performance feedback enhances feelings of competence (Arnold, 1976; Deci et al., 1991), facilitates accurate self-knowledge (Sedikides, 1993), and tracking performance over time can provide a sense of progress, which individuals value (Loewenstein & Prelec, 1993; Schunk, 1991). Also, performance feedback, particularly in conjunction with goals, allows individuals to more easily see how their effort translates to outcomes, thereby promoting valuable feelings such as self-efficacy and control (Bandura, 1993; Gist, 1987). Like social approval, feedback as a source of value has been widely discussed, but it has not been mentioned in the boredom literature, making it a stronger test of the value theory.

We extend this study design to capture an additional measure of interest, voluntary persistence. Persistence provides a behavioral measure of value, as it captures the amount of a scarce resource (time) that participants are willing to spend on the task. Therefore, we would expect that providing feedback should result in more persistence.

In Experiment 3, participants completed the standard peg turning task, either with or without performance feedback. After the task, participants reported their level of boredom, and were then given the opportunity to engage in the task again, with the option of quitting at any time, up to five minutes. We predicted that participants who completed the more valuable feedback task would report less boredom, would perform better and would persist longer.

4.5.1 Method

Participants, design and procedures. Amazon Mechanical Turk workers (N = 140, 58 Female, 94 Caucasian; M_{age} = 35.85, SD_{age} = 11.33) volunteered for a "15-minute Attention Study." Only US based Mechanical Turk workers who had completed 1000 tasks and had earned at least a 95% approval rating were eligible. Two participants with duplicate IP addresses were excluded from the analyses; this exclusion criterion was established prior to data collection.

Participants were randomly assigned to complete the standard peg turning task (control condition), or to receive performance feedback (performance feedback condition). In the latter condition, the number of turned pegs was charted at the bottom of the screen, with an additional data point added every five seconds (Figure 4.3). After five minutes of the task, we collected measures of boredom and value. Participants were then given the opportunity to work on the peg turning task a second time, again with or without feedback, but could quit at any point (after five minutes, the experiment automatically moved on). The study ended with open-ended comments and demographic questions (age, sex, and ethnicity).[24]

Measures. Boredom and value were assessed immediately after the 5-minute mandatory round using the same measures as in Experiments 1 and 2 (α = .83, α = .84). Performance was calculated as the number of pegs turned in the 5-minute mandatory round.

Manipulation check. To assess whether participants attended to the performance feedback, participants rated their level of agreement with the question, "I received performance feedback during this task."

Persistence. Persistence was measured as the time spent on the voluntary portion of the task (capped at five minutes).

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[24] Age was marginally correlated with boredom, r^2 = -.16, p = .07. Boredom was not significantly different among the sexes, F(1, 135) = .001, p = .98, or among Caucasian and non-Caucasian participants, F(1, 135) = .06, p = .80.

4.5.2 Results and Discussion

Means and standard deviations by condition are reported in Table 4.3.[25] All analyses controlled for age, sex, and ethnicity. As expected, participants in the feedback condition reported higher levels of agreement with the claim that they received feedback (M = 5.64, SD = 1.72) than participants in the control condition (M = 2.10, SD = 1.66), F(1, 132) = 156.34, $p < .001$, $\eta^2 = .54$. Consistent with prior research, participants receiving feedback reported that the task was more valuable (M = 3.89, SD = 1.25; M = 3.25, SD = 1.25), F(1, 132) = 8.22, $p = .005$, $\eta^2 = .06$. We hypothesized that value, generated by feedback, would decrease boredom. In support of this, boredom ratings were lower when participants received performance feedback (M = 5.66, SD = 1.01) than when completing the standard task (M = 6.01, SD = 0.89), F(1, 132) = 4.23, $p = .04$, $\eta^2 =$ .03.

Performance was significantly higher in the feedback condition (M = 217.69, SD = 50.44) than the control condition (M = 182.28, SD = 58.59), F(1, 132) = 20.06, $p < .001$, $\eta^2 = .13$. Boredom did not predict performance, $\beta = -.13$, t(132) = -1.62, $p = .11$.

The distribution of persistence times in the voluntary round were non-normal in the feedback and control conditions, Shapiro-Wilk W(69) = .724, $p < .001$, W(68) = .657, $p < .001$, respectively. A Mann-Whitney U nonparametric test showed that participants who received performance feedback spent marginally more time on the task (Mdn = 44.92 sec) than the control group (Mdn = 16.27 sec), U = 1903.00, $p = .06$.

As in Experiments 1 and 2, the more valuable condition decreased boredom. Furthermore, in support of the value theory, performance was significantly higher in the feedback condition.

[25] One participant in the control condition was removed from all analyses because his boredom rating was over four standard deviations below the mean. Including him in the analysis on boredom necessitates non-parametric tests due to violations in normality, but these non-parametric tests do not change significance.

Persistence, measured by the amount of time participants voluntarily engaged in the task, was also higher in the feedback condition, which provides another source of evidence that feedback is valuable.

This study is not without limitations. Most notably, in Experiments 1-3, the tasks compared were not identical, which creates potential confounds. For instance, it is possible that the additional visual stimuli in the high-value conditions may have provided cognitive distractions, which could reduce boredom. Furthermore, the studies presented thus far employ manipulations typically associated with intrinsic motivation (Ryan & Deci, 2000), but it is useful to know, for both theoretical and practical purposes, if boredom is also affected by extrinsic rewards. Finally, voluntary persistence was capped at five minutes, at which point the experiment automatically moved on. Because 22.46% (n = 31) of participants reached this limit, the results may mask important differences in distributions of persistence across low- and high-value groups.

In the next study, participants in the low and high value conditions completed identical tasks, and were rewarded with different monetary incentives. Furthermore, in addition to measuring boredom after the 5-minute task, we also measured boredom immediately after participants voluntarily ended the task.

4.6 Experiment 4

Money is perhaps the most obvious and least controversial source of value. And yet, although the effects of financial incentives have been widely explored in the domain of motivation (Camerer & Hogarth, 1999; Deci, Koestner, & Ryan, 1999; Jenkins, Mitra, Gupta, & Shaw, 1998), its effect on boredom is currently unknown.[26] Money is a useful manipulation for two reasons. As

[26] In one early study, Barmack (1939b) introduced a financial incentive half way through a 2-hour hand-eye coordination task, during which participants reported their level of boredom every 15-minutes. Although a statistical analysis of the trend is not reported, it

mentioned, it is an extrinsic source of motivation, which allows us to determine whether the theory extends to purely extrinsic forms of value. Furthermore, from an evolutionary viewpoint, it is a very recent source of value and therefore unlikely to be valuable with regard to reproductive fitness. This is important because Kurzban and colleagues (2013, p. 664) speculated that, "from a functional standpoint, the ultimate (evolutionary) value of an act depends on its eventual net contribution to fitness." Money provides a prime candidate for testing whether the value function reflects strict considerations of reproductive fitness, versus a more general motivational system.

In addition to exploring the effect of financial incentives on boredom, we further expand on previous designs by adding a measure of boredom at the end, after participants have voluntarily quit the task. The point at which participants end a task is of great theoretical importance in economics. Specifically, an individual should quit a task when its marginal costs equal its marginal benefits. In light of the value theory, this raises an intriguing question. The theory predicts that, at any given point in time, a valuable task should produce less boredom. However, individuals should also be willing to engage in a valuable task for a longer time period. So the question is, who will be more bored at the end: a high value group that starts at a low level of boredom but persists longer, or a low value group that starts at a high level of boredom but quits early?

Because boredom is aversive and therefore costly, we would predict that the high-value group should be more bored at the stopping point, in order to balance the higher value. As an analogy, we could think of paying someone to stick a needle into his hand. If we paid a lot for each inch, then he should insert the needle deeper and should also be willing to endure more pain than an individual who was paid a paltry amount. In line with this intuition, we expect that participants

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appears that the introduction of a financial incentive reduced boredom. However, the financial incentive was based on a goal derived from participants' performance in the first half, in which if participants outperformed the goal, they got the full incentive but if they did not meet the goal, they received nothing. For a number of reasons, this study design complicates the causal interpretation.

should persist longer on a valuable task, but will also experience higher levels of boredom at equilibrium, i.e., when participants quit.

In Experiment 4, participants completed the standard peg turning task, and were either compensated with a low or high wage. After five minutes of the task, participants reported their level of boredom, and were then given the opportunity to engage in a second, voluntary round of the task, which they could work on for as long as they wanted (up to five hours). Upon quitting, participants reported their level of boredom. In line with Experiments 1-3, we predicted that the mandatory 5-minute round would elicit lower levels of boredom and higher levels of performance in the high-wage condition. Finally, we predicted that participants paid at a higher rate would ultimately report higher levels of boredom upon quitting.

4.6.1 Method

Participants, design and procedures. Amazon Mechanical Turk workers (N = 138, 52 Female, 109 Caucasian; M_{age} = 32.83, SD_{age} = 9.47) volunteered for an "Attention Study." Only US based Mechanical Turk workers who had completed 1000 tasks and had earned at least a 95% approval rating were eligible. Two participants with duplicate IP addresses were removed; this exclusion criterion was established prior to data collection.

All participants completed the standard peg turning task. Participants were randomly assigned to different wage conditions, receiving either a high or low wage (2.5 or 0.5 cents, for each set of eight cogs turned). All participants received a $0.50 base pay. Participants completed five minutes of the peg turning task, followed by self-report measures, including boredom and value. Then, participants were given the opportunity to work on the peg turning task again, at the same wage rate. In this second round, a quit button appeared after one minute, and participants were able to quit at any time (although the experiment expired after five hours). The one-minute delay ensured that participants did not fill out the boredom scale twice, without any gap in between. Participants accumulated earnings in both rounds of the task. Total earnings were displayed at the bottom of the screen, and earnings were capped at $8.00. The earnings cap was disclosed in the consent form, but was not highlighted anywhere else in the study, so as not to introduce a target (participants who reached the cap were indirectly informed, as their earnings display remained at $8.00 regardless of their subsequent clicks). After ending the second round by voluntarily stopping, participants reported their boredom, and then the study concluded with open-ended comments and demographic questions (age, sex, and ethnicity).[27]

Measures. Boredom after the mandatory and voluntary rounds (α = .89; α = .87), value (α = .90), performance, and persistence were assessed using the same measures as previous studies.

Manipulation Check. To ensure that participants differentially valued the low versus high wage, participants rated the bonus payment using a 7-point response scale anchored at 1 = *very low* and 7 = *very high*.

4.6.2 Results and Discussion

Means and standard deviations by condition appear in Table 4.4. All analyses controlled for age, sex, and ethnicity. In support of the validity of the manipulation, participants rated the bonus payment as higher in the high-wage condition (M = 4.76, SD = 1.02) than the low-wage condition (M = 2.66, SD = 1.25), $F(1, 131) = 117.61$, $p < .001$, $\eta^2 = .47$. Furthermore, participants paid at a higher rate reported that the task was more valuable (M = 5.16, SD = 1.02) than participants paid at a lower rate (M = 3.83, SD = 1.38), $F(1, 131) = 40.77$, $p < .001$, $\eta^2 = .24$. In support of our hypothesis that payment affects boredom, participants in the high-wage condition reported less boredom (M = 4.50, SD = 1.34) than the low-wage condition (M = 5.07, SD = 1.41), $F(1, 131) = 5.45$, $p = .02$, $\eta^2 = .04$.

[27] Age was marginally correlated with boredom after the 5-minute task, $r^2 = .11$, $p = .22$. Boredom was not significantly different among the sexes, $F(1, 134) = .003$, $p = .96$, or among Caucasian and non-Caucasian participants, $F(1, 134) = 1.59$, $p = .21$.

Performance was marginally higher in the high-wage condition (*M* = 242.74, *SD* = 59.17) than the low-wage condition (*M* = 220.62, *SD* = 69.10), F(1, 131) = 3.56, $p = .06$, $\eta^2 = .03$. However, boredom did not predict performance, $\beta = -.11$, $t(131) = -1.29$, $p = .20$.

The distribution of persistence times in the voluntary round were non-normal in the high and low wage conditions, Shapiro-Wilk $W(71) = .63$, $p < .001$, $W(65) = .27$, $p < .001$, respectively.[28] A Mann-Whitney U nonparametric test showed that participants who received a higher wage persisted significantly longer (*Mdn* = 250.53 sec) than the control group (*Mdn* = 96.76 sec), *U* = 1462.00, $p < .001$.

Finally, contrary to our hypothesis, participants reported significantly less boredom after voluntarily ending the task in the high wage condition (*M* = 4.32, *SD* = 1.26) than the low wage condition (*M* = 4.97, *SD* = 1.29), F(1, 131) = 8.67, $p = .004$, $\eta^2 = .06$.[29,30]

4.7 General Discussion

Across four experiments, we manipulated value through difficulty, social approval, performance feedback and wage rates, and we found that each decreased boredom (Experiments 1-

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[28] One participant persisted for three and a half hours. He was the only participant in the low-wage condition to earn the $8.00 earnings cap. The next highest time was 1 hour and 13 minutes.

[29] Nine participants reached the maximum amount (11.27% of the high-wage condition, and 1.54% of the low-wage condition). The analyses on persistence and end boredom hold when these participants are excluded, $p = .007$.

[30] One questions is whether participants who persisted longer experienced more boredom at the end, which we would assume if boredom increased over time. Persistence times were not randomly assigned and therefore reflect endogenous factors. However, we can examine the effect of persistence on end boredom using an OLS regression analysis. Controlling for condition, the log of persistence did not predict end boredom, $\beta = .10$, $t(121) = 1.10$, $p = .27$. We can also look at rate of performance (cogs turned divided by persistence time). Controlling for condition, performance rate did predict end boredom, with a faster rate resulting in less boredom, $\beta = -.18$, $t(121) = -2.01$, $p = .05$.

4). These manipulations of value also positively influenced performance (Experiments 2 and 3), and increased persistence (Experiments 3 and 4). These convergent effects of value provide empirical evidence in support for Kurzban et al.'s (2013) theory. Furthermore, our experiments help specify the theory by identifying concrete inputs to value. It is noteworthy that social approval affected perceptions of value and boredom, despite most participants' disbelief in the manipulation. Similarly, money affected perceptions of value and boredom, despite its relatively recent emergence on an evolutionary timeline. These two findings suggest that value calculations may depend more heavily on a generalized motivational system that relies on heuristics to calculate value. Another benefit of identifying specific determinants of value is that these determinants can inform boredom interventions. In particular, teachers, parents, and employers may use these manipulations to guide their own practices in dealing with children and employees to reduce boredom.

Our initial studies explored the effect of value on boredom, holding task time constant at five minutes. In Experiment 4, we explored the effect of value on boredom, at the point when participants voluntarily decided to quit. At the outset, we hypothesized that the costs of engaging in the task include boredom and opportunity costs, and that opportunity costs would be evenly distributed through random assignment. Therefore, we expected that participants who were paid more would be willing to endure higher levels of boredom. Contrary to our predictions, participants in the high-value condition reported lower levels of boredom.

Although initially surprising, these results can be explained in light of participants' responses in an open-ended question asking why they decided to stop when they did. First, many participants cited costs outside of boredom, including discomfort (e.g., "My fingers hurt!") and interruptions (e.g., "I actually would have liked to have kept going but Ive got to leave for an appointment;" "i have to go to the bathroom"). In addition to costs, some participants reported that they used a target as a stopping rule rather than a cost-benefit analysis (e.g., "I wanted at least $1 bonus so I kept clicking until I had it."). In sum, given the complexity of variables factoring into stopping decisions, our predicted pattern of results may be particularly difficult to demonstrate in the real world.

The contributions of Experiments 1-4 must be qualified in light of several important limitations. First, demand effects are a concern. Our value manipulations may have generated feelings of gratitude, such that participants may have provided biased reports in an effort to please the experimenter. This concern is partially alleviated, since the findings held in the first experiment, and it is not clear why difficulty would generate such feelings or bias. Furthermore, in an effort to minimize demand effects, the first self-report question was about time "passing slower than usual." When only analyzing this more neutral question, all patterns of results hold. Arguably the best solution to response bias is to assess boredom using objective measures. Unfortunately, in the case of boredom, no such measures have been established: physiological measures have been inconsistent (Barmack, 1939; London, Schubert, & Washburn, 1972; Lundberg, Melin, Evans, & Holmberg, 1993; Merrifield & Danckert, 2014), and there is currently only one study examining boredom in the brain (Jiang et al., 2009). Future boredom research would greatly benefit from establishing reliable, objective measures of boredom.

A second limitation of our study is that we only administered four value manipulations. Multiple sources of value have been proposed, and for any single source, countless manipulations could be used. Most obviously, consumption is a source value, such that any good that satisfies a basic drive (e.g., hunger, thirst, sex) could be used to manipulate value. Psychologists and economists have also discussed "non-consumption-related" sources of value. Deci and colleagues (e.g., Ryan & Deci, 2000) proposed three sources of intrinsic value: autonomy, competence, and relatedness. Loewenstein (1999) suggested multiple sources of value, including goal completion, fame, desire for mastery, self-signaling and meaning. Other non-consumptive sources of value that have been empirically studied include power (Galinsky, Magee, Inesi, & Gruenfeld, 2006), self-esteem (Rosenberg, 1965), fairness (Fehr & Gächter, 2000), and other's welfare (Dovidio, Piliavin, Schroeder, & Penner, 2006). As far as we know, there has not been an effort in psychology or economics to provide an overarching typology of value, nor a systematic review of empirical work related to value. We believe that future researchers across multiple domains would benefit from such projects.

In addition to only testing a few inputs to value, we also only test part of the relative value theory proposed by Kurzban and his colleagues (2013). First, as our primary interest is boredom, we limited our examination of the effect of value on boredom, whereas the full theory makes predictions about a number of emotions (most prominently, mental fatigue). Future work is needed to test the theory using different subjective states. Second, the theory is based on *relative* value. Kurzban and his co-authors stress that boredom, and other emotions, depend on opportunity costs, i.e., the value of the next best option. With concrete manipulations of value, future researchers could further explore whether boredom is sensitive to changing opportunity costs.

Nevertheless, our research takes a meaningful and necessary step in documenting manipulations of value to help specify the theory, and provides initial support for the value theory of boredom.

Chapter 5

Future Directions

Boredom has historically received sporadic and sparse attention from scientific researchers, as compared to its more advanced emotional peers. However, boredom has finally managed to attract some sustained attention. There has been a steady rise in interest on trait boredom since the development of trait scales, and just recently, there have been some promising advances in the measurement and theoretical development of state boredom (e.g., Fahlman et al., 2012; Eastwood et al., 2013; Kurzban et al., 2013). Despite the increase in boredom research, significant gaps remain regarding empirical knowledge, methodological tools, and theoretical development. This dissertation addressed three existing gaps regarding the examination of boredom in everyday settings, the development and validation of a boredom elicitation, and the empirical evaluation of the value theory of boredom. It is our hope that these three essays will contribute to a greater understanding of boredom, and that the creation of elicitation methods and the refinement of boredom theory will fuel future research on boredom. And, there is plenty of research to fuel. In the comments that follow, we outline a few promising research questions that we hope will receive attention in the next few years.

One area of interest is boredom's consequences. As mentioned, boredom has been termed "the root of all evil" and has been implicated in some nefarious behaviors. Drug users cite boredom as a cause for their abuse (e.g., Lee, Neighbors, & Woods, 2007), as do binge eaters (e.g., Stickney & Miltenberger, 1999). Boredom proneness is correlated with substance abuse (e.g., Iso-Aloha & Crowley, 1991) and pathological gambling (e.g., Blaszczynski, McConaghy, & Frankova, 1990). But because this research is correlational, it is not clear whether boredom actually causes these behaviors, or whether individuals who are prone to boredom also happen to be prone to these destructive behaviors as well. Furthermore, boredom's positive influence has not been documented at all, although writers have suspected that it can enhance creativity and productivity. Examining the consequences of state boredom using a rigorous experimental paradigm could demonstrate whether idle hands are the devil's workshop, or as Faulkner suggested, hands that breed our "better virtues," or alternatively, that it is not the state of idle hands causing anything, but rather the individuals who own them.

Whether boredom ultimately promotes good, evil, some combination of the two, or neither, boredom is aversive, and a second question for future research is how individuals manage and cope with their boredom and which strategies are effective. Relatively little empirical work has been done on coping strategies, although anecdotes and intuitions abound. In his work on boredom and flow, Csikszentmihalyi (1990, p. 52) observed that, "Everybody develops routines to fill in the boring gaps of the day… Some people are compulsive doodlers, others chew on things or smoke, smooth their hair, hum a tune, or engage in more esoteric private rituals that have the same purpose: to impose order in consciousness through the performance of patterned action." In one focus group, students were asked how they cope with boredom (Mann & Robinson, 2009), and their list included: playing games on phone, texting, constructing a shopping list (a personal favorite), talking to a classmate, calculating finances, leaving the classroom, staring into space, zoning out, doodling, writing notes to a friend, and coloring in letters on handout (another classic). Despite the qualitative evidence of individuals' coping strategies and the development of a Boredom Coping Scale (Hamilton, Haier, & Buchbaum, 1984, see also Nett, Goetz, & Daniels, 2010), there is a lack of research on which coping strategies are effective, and why.

Another open question in the literature is how boredom is related to other emotions. It is telling that boredom's "opposite" takes many forms. Schopenhauer (1850/2004, p. 8) observed that, "want and boredom are indeed the twin poles of human life." Russell (1930, p. 35-36) argued that, "the opposite of boredom, in a word, is not pleasure, but excitement." Interest and flow have also been suggested as boredom's antithesis (Wyatt, 1929, p. 170; Fisher, 1998, p. 21), as has learning (Kanevsky & Keighley, 2003), faith (Spacks, 1995, p. 259), depression (Darden & Marks, 1999), and anxiety (Endler & Kocovski, 2001, p. 232). I suspect that flow is the best term we have to convey boredom's opposite. Whereas flow is characterized by intense attentional engagement, boredom is characterized by disengagement; flow masks the passage of time and replaces it with a sense that only moments have passed, whereas boredom draws out time's passage; flow occurs in the presence of goals, meaning, feedback, and challenge, whereas boredom likely occurs in the absence of these motivating influences. Ultimately, more work should be done to connect boredom and its multiple counterparts, which will provide a more rich understanding of boredom qualities and can help fuel a more comprehensive theory of emotion.

At this point, boredom represents a fertile field for future research, as numerous questions remain unanswered. Nevertheless, it is my hope that the research presented in this dissertation provides a few answers to some interesting questions about this interesting emotion.

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Table 2.1. Experienced Boredom and Demographic Characteristics

Demographic Factor	*B* (*SE*)	*Effect Size*
Age	-0.005**	—
	(0.001)	
Age^2	0.000**	—
	(0.000)	
Male	0.009**	31.4%
	(0.002)	
Black	-0.006†	-22.6%
	(0.003)	
Other / Multiracial	-0.011**	-40.6%
	(0.003)	
High school degree	-0.023**	-80.8%
	(0.008)	
College degree	-0.003	-9.8%
	(0.002)	
Ln(Inferred household income)	-0.003*	-12.0%
	(0.002)	
Working full-time	-0.005†	-18.0%
	(0.003)	
Currently married	-0.009**	-31.6%
	(0.002)	
Parent	0.000	1.0%
	(0.002)	
Constant	0.230**	
	(0.025)	
R^2	0.02	
n (observations)	1,123,751	
N (subjects)	3,867	

** $p < .01$, * $p < .05$, † $p < .10$

Note. This table reports the results of regressions at the participant x half hour of experienced boredom on a series of demographic variables. *B* values represent unstandardized regression coefficients. To control for the dependence of errors, robust standard errors are clustered by participant. We infer household income and age by taking the midpoint of the response categories available to participants (e.g., 22 to 24 was converted to 23 and $50,000 to $59,999 was converted to $55,000; for $250,000 or over we used $275,000). Due to the limited number of participants, we combined the following categories to into a single Other/Multiracial category: Asian, American Indian or Alaska Native, Other, and participants who reported more than one race. We re-categorized education into three non-exclusive categories: did not graduate high school, graduated high school, graduated college. Effect sizes, reported in the last column, reflect the magnitude of the marginal effects as a share of average experienced boredom across the entire sample.

Table 2.2. Situational and Demographic Decomposition of Mean Differences in Boredom by Age, Gender, Income and Marital Status

	Demographic Category			
	Young (< 30 years) vs. Old (>= 30 years)	Male vs. Female	High vs. Low Income	Married vs. Unmarried
Unconditioned mean difference (first – second)	**0.045**	**0.008**	**-0.012**	**-0.019**
Proportion explained by differences in:				
Situational factors	**10%**	**30%**	**9%**	**18%**
Activity	5%	8%	6%	4%
Social setting	1%	16%	6%	14%
Location	4%	6%	0%	1%
Other demographic factors	**27%**	**< 0%**	**73%**	**26%**
Age	-	-	26%	15%
Gender	1%	-	< 0%	< 0%
Race	< 0%	-	< 0%	< 0%
Education	9%	-	23%	0%
Income	3%	-	-	18%
Employment	1%	-	19%	0%
Marital status	25%	-	24%	-
Parental status	< 0%	-	< 0%	< 0%

Note. The table reports results of a series of participant-level mean decompositions in experienced boredom across key demographic categories (following Oaxaca, 1973). The first row reports the unconditional mean difference, while remaining rows indicate the share of such difference explained by either other demographic or situational factors. Income categories are defined by whether a participant is above or below the sample median household income of $67,500. For example, the first column indicates that youth (<30) report boredom in 4.5% more periods than non-youth. Variation across other demographic categories explains 27% of this difference, while differences in time-use explain 10% of the overall mean difference.

Table 3.1. Summary Statistics by Task, Experiment 1.

	Intensity			Discreteness			
	Mean	*SD*	Effect Size (*r*)	%	Effect Size (φ)	Success Index	N
1. Peg Turning	5.59 [a,b]	1.02	0.77	61.8[a]	0.544	1.78	34
2. Video	4.90 [a]	1.13	0.68	71.9 [a]	0.636	1.70	32
3. Audio	4.82 [a]	0.87	0.67	68.8 [a]	0.608	1.05	32
4. 1-back	4.53 [a]	1.29	0.55	57.9 [a]	0.504	-1.22	38
5. Air Traffic Control	4.44 [a]	1.37	0.51	56.8 [a]	0.496	-1.59	37
6. Signatures	4.46 [a]	1.10	0.61	55.6 [a]	0.487	-1.72	36
7. Planet Earth (comparison task)	2.91	1.17	—	9.4	—	—	32
Average of Boring Tasks	4.78	1.21	—	61.2	—	—	241

[a]*Planet Earth* comparison, $p < .001$; [b]Average of other five boring tasks comparison, $p < .05$

Note. Boredom was a composite measure with a possible range of 1 to 7. Higher scores indicate more intense boredom. Discreteness was equal to the percentage of subjects whose boredom rating on the Differential Emotion Scale was at least one point higher than the other discrete emotion terms: amusement, anger, contentment, disgust, fear, sadness and surprise. The Success Index was calculated by normalizing intensity and discreteness for all of the tasks and summing the two z-scores. The effect size *r* reflects pairwise comparisons to *Planet Earth* and was computed as the Mann Whitney z statistic divided by the square root of the sample size.

Table 3.2. Summary Statistics by Task, Experiment 2.

	Intensity			Discreteness			
	Mean	*SD*	Effect Size (*r*)	%	Effect Size (φ)	Success Index	N
1. Peg Turning	5.79 [a,b]	1.07	0.66	72.9 [a]	0.557	3.09	48
2. 1-back	5.01 [a]	1.19	0.49	67.8 [a]	0.507	0.50	59
3. Air Traffic Control	5.15 [a]	1.18	0.53	64.2 [a]	0.470	0.48	67
4. Video	4.98 [a]	1.18	0.48	61.5 [a]	0.452	-0.26	52
5. Audio	4.98 [a]	1.44	0.47	52.2 [a]	0.360	-1.26	67
6. Signatures	4.64 [a]	1.22	0.39	48.5 [a]	0.325	-2.55	66
7. Planet Earth (comparison task)	3.37	1.67	—	17.5	—	—	57
Average of Boring Tasks	5.06	1.29	—	60.5	—	—	416

[a]*Planet Earth* comparison, $p < .001$; [b]Average of other five boring tasks comparison, $p < .05$

Note. Boredom was a composite measure with a possible range of 1 to 7. Higher scores indicate more intense boredom. Discreteness was equal to the percentage of subjects whose boredom rating on the Differential Emotion Scale was at least one point higher than the other discrete emotion terms: amusement, anger, contentment, disgust, fear, sadness and surprise. The Success Index was calculated by normalizing intensity and discreteness for all of the tasks and summing the two z-scores. The effect size *r* reflects pairwise comparisons to *Planet Earth* and was computed as the Mann Whitney z statistic divided by the square root of the sample size.

Table 3.3. Differential Emotion Scale in laboratory setting, Experiment 1.

	Peg Turning		Video		Audio		1-back		Signatures		Air Traffic Control		Planet Earth	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Amusement	2.44*	2.29	1.63*	1.56	2.13*	2.14	2.24*	1.91	2.47*	2.08	2.49*	2.01	4.34	1.89
Anger	0.97	1.90	0.72	1.63	0.56	1.08	0.42	1.08	0.78	1.59	0.41	1.07	0.34	0.87
Arousal	0.35	0.98	0.34	0.65	0.47	1.39	0.79	1.47	0.64	1.52	0.32	0.63	1.00	1.48
Boredom	4.59*	2.49	4.66*	2.28	4.13*	1.88	4.05*	2.39	4.06*	2.19	3.62*	1.75	1.91	2.29
Confusion	1.68	2.16	2.09	2.13	1.72	1.69	1.21	1.88	2.19	1.98	0.97	1.61	1.03	1.81
Contempt	0.97	1.75	0.53	1.02	1.00	1.50	0.76	1.52	0.64	1.13	0.38	0.86	0.91	2.07
Contentment	1.24	1.56	2.03	1.64	1.81	1.77	1.74	1.83	1.78	1.71	2.24	2.14	3.63	2.34
Disgust	0.68	1.65	0.63	1.36	0.31	0.86	0.63	1.34	0.67	1.45	0.03	0.16	0.22	0.75
Embarrassment	0.56	1.35	0.31	0.90	0.38	0.94	0.53	0.92	0.36	1.07	0.24	0.64	0.25	1.41
Fear	0.47	1.33	0.06	0.25	0.06	0.25	0.39	1.10	0.25	0.65	0.68	1.51	0.16	0.63
Happiness	1.44*	1.78	1.03*	1.20	1.13*	1.26	1.61*	1.84	1.72*	1.99	1.78*	2.07	3.69	2.10
Interest	2.12*	1.97	2.16*	1.48	2.25*	1.92	3.32	2.34	2.89*	1.98	2.70*	2.00	5.19	2.22
Pain	0.50	1.08	0.38	1.07	0.13	0.55	0.24	0.79	0.28	0.88	0.24	0.72	0.38	1.21
Relief	2.00	2.85	0.59	1.04	1.50	2.02	1.11	1.71	1.33	1.85	1.19	1.82	0.94	1.78
Sadness	0.12	0.41	0.88	1.79	0.44	0.88	0.13	0.48	0.58	1.44	0.19	0.62	0.25	0.67
Surprise	1.21	2.25	0.59*	1.10	0.69*	1.45	0.97	1.64	1.03	1.54	1.16	1.57	2.34	2.31
Tension	2.03	2.36	1.47	1.83	1.34	1.70	1.76	2.05	1.11	1.70	1.54	1.73	0.69	1.18
Discreteness	.618		.719		.688		.579		.556		.568		.094	
N	34		32		32		38		36		37		32	

**Planet Earth* comparison, $p < .001$

Note. Each emotion had a possible range of 0 (*not even the slightest bit*) to 8 (*the most I've ever felt in my life*).

Table 3.4. Multidimensional Boredom Scale Items in laboratory setting, Experiment 1.

	Time was passing by slower than usual.		I was stuck in a situation that I felt was irrelevant.		I wished time would go by faster.		Everything seemed repetitive and routine to me.		I felt bored.		I seemed to be forced to do things that have no value to me.		I wished I were doing something more exciting.		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	N
1. Peg Turning	5.44	1.40	5.68	1.25	5.59	1.37	6.38	0.95	5.76	1.37	4.76	1.71	5.53	1.52	34
2. Video	4.91	1.28	5.25	1.37	4.91	1.51	4.66	1.41	5.00	1.46	4.50	1.55	5.06	1.46	32
3. Audio	4.69	1.20	5.13	1.13	5.09	1.33	4.31	1.26	5.34	1.10	4.25	1.22	4.91	1.45	32
4. 1-back	4.37	1.65	3.89	1.91	5.26	1.45	4.97	1.55	4.79	1.79	3.47	1.86	5.00	1.86	38
5. Air Traffic Control	4.41	1.46	3.59	1.82	4.68	1.77	5.08	1.57	5.05	1.79	3.65	2.00	4.59	1.82	37
6. Signatures	5.00	1.12	3.75	1.68	4.56	1.58	4.67	1.39	4.75	1.54	3.78	1.82	4.72	1.68	36
7. Planet Earth (comparison task)	3.63	1.29	2.75	1.22	3.06	1.50	2.56	1.41	2.75	1.74	2.69	1.51	2.94	1.65	32

Note. Respondents indicated their agreement using a 7-point Likert scale (1 = *Strongly disagree; 2 = Disagree;* 3 = *Somewhat disagree;* 4 = *Neutral;* 5 =*Somewhat agree;* 6 = *Agree;* and 7 = *Strongly agree*)

Table 3.5. Differential Emotion Scale in online setting, Experiment 2.

	Peg Turning		Video		Audio		1-back		Signatures		Air Traffic Control		Planet Earth	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Amusement	2.06*	1.98	2.04*	2.22	1.90*	1.93	2.46*	2.36	2.86*	2.29	2.31*	2.26	4.44	2.01
Anger	1.77*	2.13	1.38	2.05	1.30	2.13	1.31	2.14	0.68	1.17	0.85	1.51	0.44	0.96
Arousal	1.46	2.07	1.04	1.99	1.13	1.89	1.05	1.80	1.00	1.63	0.82	1.39	1.18	1.62
Boredom	5.33*	2.50	4.63*	2.38	4.55*	2.61	4.61*	2.24	3.89	2.09	4.88*	2.43	2.56	2.38
Confusion	2.38	2.28	1.77	1.98	1.97	2.44	1.58	2.20	1.92	2.14	1.45	2.21	1.18	1.79
Contempt	1.98*	2.26	1.27	1.96	1.37	2.13	1.64	1.98	1.17	1.76	1.15	1.86	0.61	1.26
Contentment	2.13	2.10	1.83	1.88	1.85*	2.04	1.59	1.75	2.38	2.06	1.97	2.10	3.07	2.23
Disgust	1.46	2.21	0.94	1.84	1.30	2.10	1.03	1.83	0.59	1.25	0.91	1.73	0.54	1.36
Embarrassment	1.25	2.08	0.77	1.75	0.94	1.94	0.86	1.91	0.56	1.28	0.69	1.35	0.58	1.45
Fear	0.52	1.41	0.40	1.02	0.78	1.86	0.61	1.57	0.53	1.26	0.58	1.47	0.32	0.87
Happiness	2.17	2.43	2.17	2.09	2.19*	2.40	2.07	2.17	2.53	2.34	2.51	2.54	3.68	2.59
Interest	2.42*	2.31	2.79*	2.34	2.96*	2.47	2.97*	2.38	3.82	2.20	3.40*	2.56	5.19	2.13
Pain	1.19	2.08	0.62	1.22	0.96	1.88	0.81	1.91	0.42	1.10	0.55	1.31	0.33	0.93
Relief	1.52	2.05	1.87	2.21	2.03	2.47	1.61	2.13	1.86	2.08	2.00	2.11	1.23	1.89
Sadness	1.13	1.88	0.75	1.38	0.96	1.96	0.68	1.58	0.67	1.27	0.64	1.56	0.46	1.02
Surprise	1.65	2.36	1.25	1.84	1.12*	1.97	1.51	2.28	1.15*	1.68	1.63	2.46	2.58	2.36
Tension	2.06*	1.98	1.65	2.10	1.37	2.25	2.39*	2.54	1.39	1.78	1.94	2.38	0.81	1.70
Discreteness	.729		.615		.522		.678		.485		.642		.175	
N	48		52		67		59		66		67		57	

**Planet Earth* comparison, $p < .001$

Note. Each emotion had a possible range of 0 (*not even the slightest bit*) to 8 (*the most I've ever felt in my life*).

Table 3.6. Multidimensional Boredom Scale Items in online setting, Experiment 2.

	Time was passing by slower than usual.		I was stuck in a situation that I felt was irrelevant.		I wished time would go by faster.		Everything seemed repetitive and routine to me.		I felt bored.		I seemed to be forced to do things that have no value to me.		I wished I were doing something more exciting.		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	N
1. Peg Turning	5.58	1.33	5.71	1.68	6.06	1.04	6.52	0.74	5.67	1.89	5.38	1.62	5.63	1.79	48
2. 1-back	5.02	1.48	4.36	1.63	5.25	1.59	5.36	1.30	5.07	1.72	4.49	1.81	5.54	1.19	59
3. Air Traffic Control	5.25	1.35	4.49	1.71	5.63	1.35	5.69	1.34	5.34	1.60	4.39	1.78	5.27	1.61	67
4. Video	5.10	1.32	5.00	1.48	5.37	1.31	4.46	1.46	5.19	1.69	4.65	1.62	5.12	1.40	52
5. Audio	5.07	1.54	5.09	1.63	5.18	1.68	4.69	1.63	4.87	2.01	4.67	1.80	5.31	1.61	67
6. Signatures	5.00	1.56	3.94	1.52	5.20	1.49	4.92	1.60	4.61	1.75	3.94	1.74	4.88	1.45	66
7. Planet Earth (comparison task)	3.68	1.85	3.25	1.73	3.68	1.95	2.93	1.59	3.11	1.90	3.21	1.79	3.70	2.01	57

Note. Respondents indicated their agreement using a 7-point Likert scale (1 = *Strongly disagree; 2 = Disagree;* 3 = *Somewhat disagree;* 4 = *Neutral;* 5 =*Somewhat agree;* 6 = *Agree;* and 7 = *Strongly agree*)

Table 4.1. Experiment 1 Means by Condition.

	Boredom		Value		Manipulation Check	
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*
Difficult	4.64	1.08	4.84	1.34	5.40	1.62
Control	4.97	1.03	4.48	1.40	3.74	1.96

Note. Difficult *n* = 88; control *n* = 78.

Table 4.2. Experiment 2 Means by Condition.

	Boredom		Value		Manipulation Check	Real Person Rating	Performance (pegs turned)	
Condition	*M*	*SD*	*M*	*SD*	*% Correct*	*% Believed*	*M*	*SD*
Social Approval	5.10	1.37	4.10	1.35	97.2	24.7	192.54	50.17
Control	5.88	1.08	3.18	1.35	86.8	–	156.99	58.66

Note. Social approval *n* = 73; control *n* = 65.

Table 4.3. Experiment 3 Means by Condition.

	Boredom		Value		Manipulation Check		Performance (pegs turned)		Persistence (sec)
Condition	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*Median*
Performance Feedback	5.66	1.01	3.89	1.25	5.64	1.72	217.69	50.44	44.92
Control	6.01	0.89	3.25	1.25	2.10	1.66	182.28	58.59	16.27

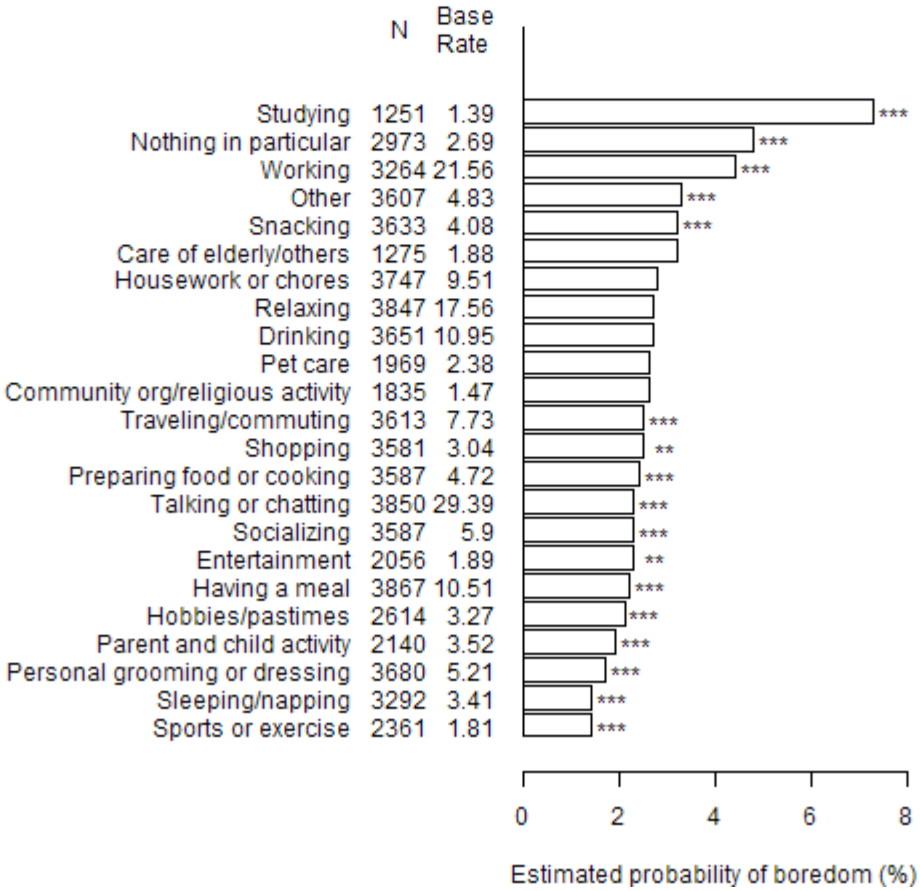
Note. Performance feedback $n = 69$; control $n = 68$.

Table 4.4. Experiment 4 Means by Condition.

	Boredom		Value		Manipulation Check		Performance (pegs turned)		Persistence (min:sec)	End Boredom	
Wage	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*Median*	*M*	*SD*
High	4.50	1.34	5.16	1.02	4.76	1.02	242.74	59.17	4:01	4.32	1.26
Low	5.07	1.41	3.83	1.38	2.66	1.25	220.62	69.10	1:37	4.97	1.29

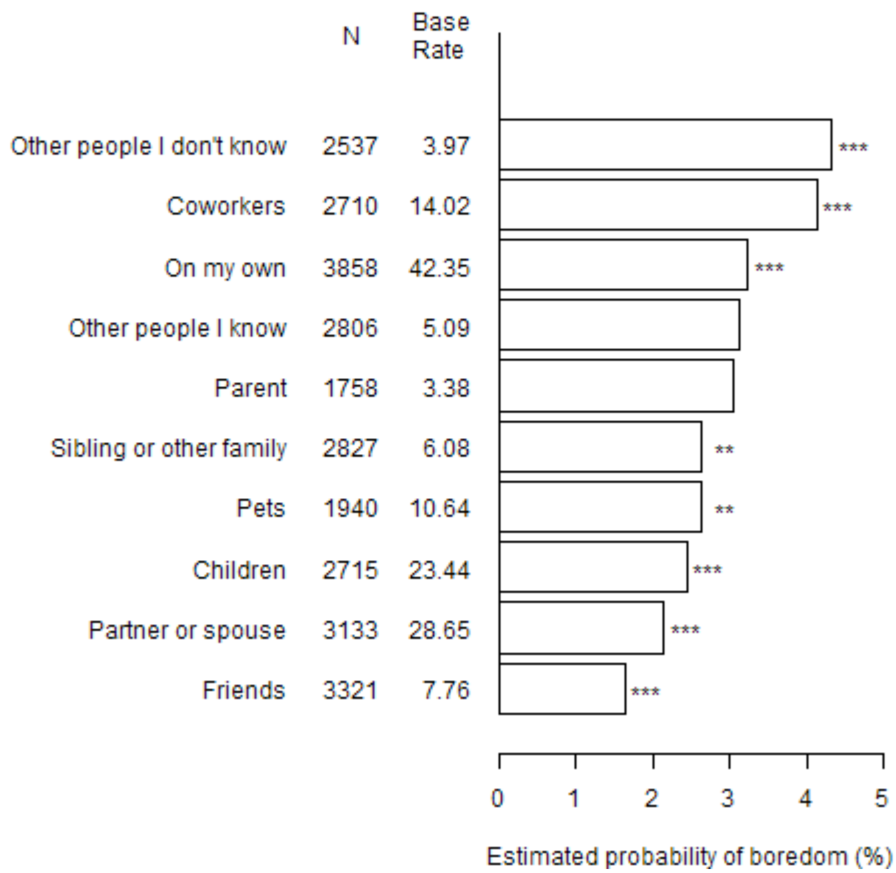
Note. High-wage n = 71; low-wage n = 65.

Figure 2.1. Predicted Boredom by Activity.



Note. N designates the number of respondents (out of 3,867) who ever report doing that activity while the base rate is the percent of reports (out of 1,126,116) where respondents report that activity. Respondents could indicate more than one activity per report. Predicted boredom rates and significance levels are derived from a regression with categorical activity variables, respondent-level fixed effects, and robust standard errors clustered at the respondent level.
*** $p < .001$, ** $p < .01$

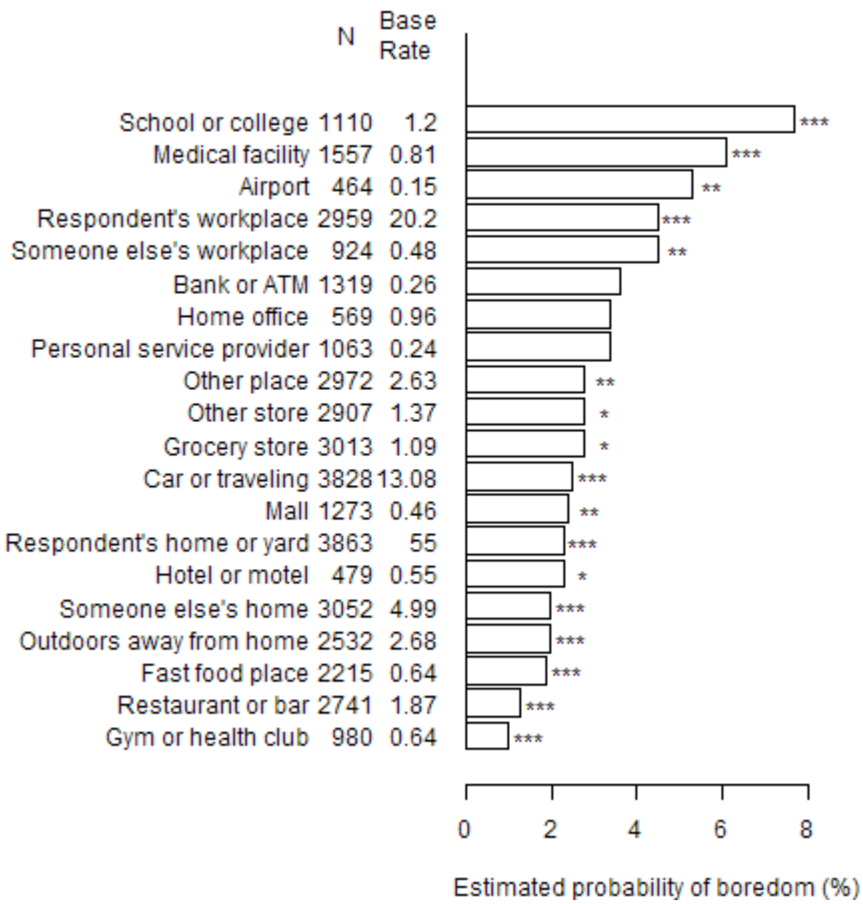
Figure 2.2. Predicted Boredom by Social Setting.



Note. N designates the number of respondents (out of 3,867) who ever report being in that social setting while the base rate is the percent of reports (out of 1,126,116) where respondents report that social setting. Respondents could indicate more than one social setting per report. Predicted boredom rates and significance levels are derived from a regression with categorical social setting variables, respondent-level fixed effects, and robust standard errors clustered at the respondent level.

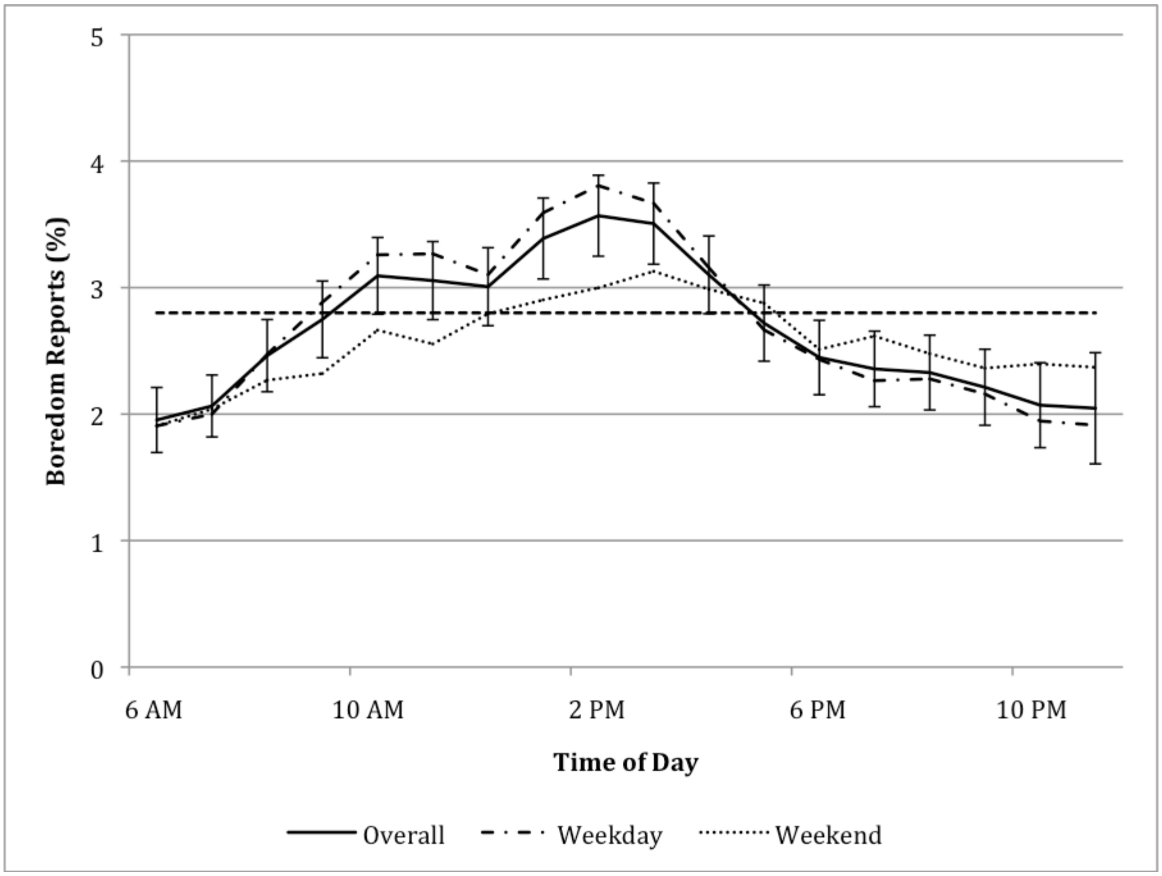
*** $p < .001$, ** $p < .01$

Figure 2.3. Predicted Boredom by Location.



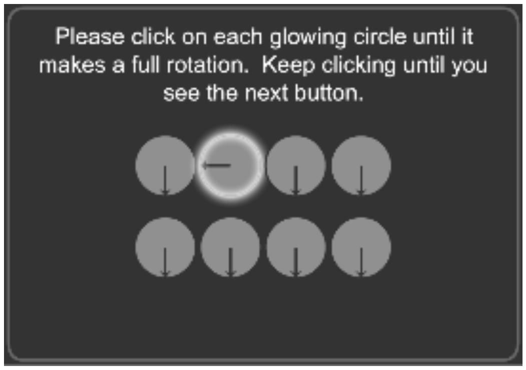
Note. N designates the number of respondents (out of 3,867) who ever report being in that location while the base rate is the percent of reports (out of 1,126,116) where respondents report that location. Respondents could indicate more than one location per report. Predicted boredom rates and significance levels are derived from a regression with categorical location variables, respondent-level fixed effects, and robust standard errors clustered at the respondent level.
*** $p < .001$, ** $p < .01$, * $p < .05$

Figure 2.4. Predicted Boredom by Time of Day.



Note. Estimated boredom rates are derived from three regressions (overall, weekday, weekend) with categorical time variables, respondent-level fixed effects, and robust standard errors clustered at the respondent level, excluding reports from midnight to 6am. Around each overall mean, 95% confidence intervals are plotted. The average boredom rate (2.8%) is indicated by the horizontal line.

Figure 4.1. Experiment 1 Standard Peg Turning Task (Panel A) and Difficult Version (Panel B).



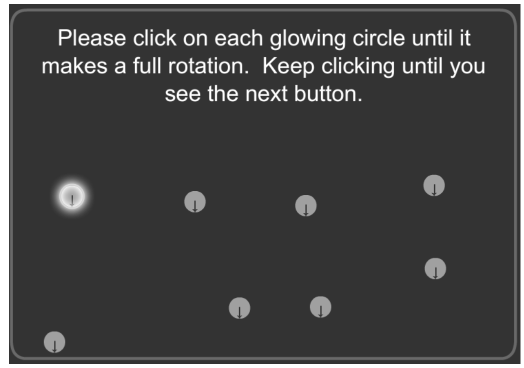


Figure 4.2. Experiment 2 Social Evaluation Condition during Observation (Panel A) and during Evaluation (Panel B).

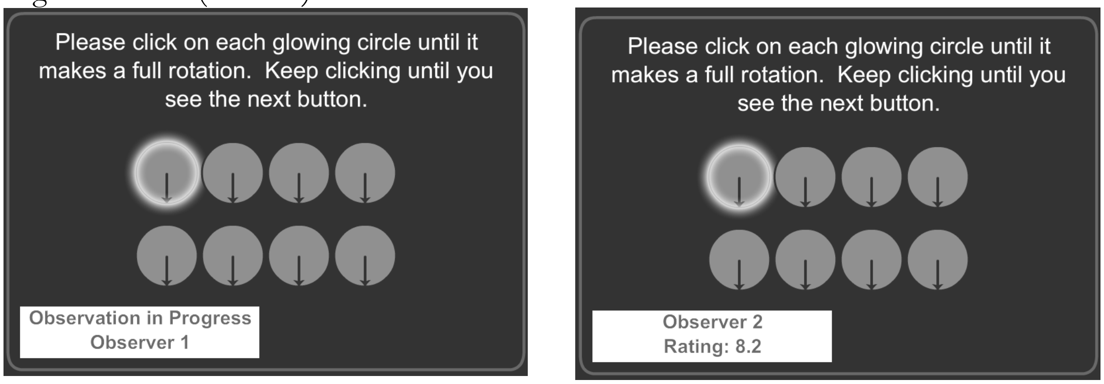


Figure 4.3. Experiment 3 Performance Feedback Condition.