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Relationship Between Autonomous Motivation and Ego-Depletion

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Abstract

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MS, Walden University, 2012

Dissertation Submitted in Partial Fulfillment

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Abstract

Previous research has shown that exerting self-control on a demanding task can impair performance on a subsequent demanding self-control task. This phenomenon is known as ego-depletion; however, its underlying mechanisms are not well understood. Notable gaps in the literature exist regarding whether participants' motivation levels can attenuate the depletion effect, and whether trait self-control is related. Drawing from the process model of depletion and the self-determination theory, the goal of the study was to examine whether motivational incentives in the form of autonomy can impact performance on tasks in an ego-depleted state, and the potential relationship of trait self-control. Amazon Mechanical Turk was utilized to conduct this experimental quantitative study with a 2 (ego-depletion: yes or no) x 2 (autonomous reward motivation: incentivized or nonincentivized) between-subjects factorial design. The effects of an autonomous motivational incentive were compared with the effects of no incentive on a convenience sample of online participants (N = 211), half of whom performed a task designed to be depleting of self-control resources, and half of whom performed a nondepleting task instead. Multivariate ANCOVAs showed no significant differences for performance on a subsequent self-control task for any of the experimental groups, and no covariance of trait self-control was found (as measured by the Brief Self-Control Scale). This study will contribute to social change by increasing understanding of the factors contributing to self-control. This knowledge will be useful to anyone intending to strengthen their own willpower and achieve their goals, and may enable practitioners to better assist clients struggling with addictions and other maladaptive behaviors.

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Dedication

This dissertation is dedicated to five individuals who have greatly contributed to my motivation to develop as a scholar practitioner dedicated to social change: My wife, Lisa Heilman, who has consistently supported and encouraged my goal to achieve a Ph.D. Professor L. Kay Sorrell, whose teaching style and enthusiasm motivated me to become a psychologist. Amy Decker, who first encouraged me as a student, then as an adjunct faculty member under her charge. Professor Jim Owens, who instilled the philosophy that we are personally responsible for ourselves and our education, and provided a foundation of resources to encourage personal growth and critical thinking. Additionally, his instruction in APA and writing greatly contributed to my success in graduate school. Last but not least, this dissertation is also dedicated to April Bengal. My desire to study self-regulation was predicated on her brutal death at the hand of her mother.

Acknowledgments

I would like to thank Dr. Tom Diebold for all his assistance in bringing this project to fruition. He has consistently provided constructive criticism and advice that helped to instill confidence in my ability to succeed. Additional thanks go to Dr. Samples for her advice and encouragement as this project evolved. I would also like to thank Laura Holland for her encouragement and for being a positive role model. Finally, I thank Lisa Heilman for the many hours that were required to develop the program necessary for me to collect data.

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Chapter 1: Introduction

Introduction

The phenomena of self-control and lack of self-control (also referred to by related terms such as willpower, self-regulation, impulse control, and delay of gratification) have enormous implications at the individual and societal levels. For example, overeating, overspending, addictions, criminal activities, lack of exercise, unwanted pregnancies, and many others, can be seen in some part as a failure of self-control (Baumeister, Vohs, & Tice, 2007). The results of a recent annual Stress in America survey (American Psychological Association [APA], 2011) showed that the most frequent reason respondents gave for their inability to make healthy lifestyle changes was a lack of self-control.

Prior experimental research has produced a large amount of evidence indicating that capacity for self-control in the current moment can be depleted due to recent self-control exertion (e.g., Baumeister, Bratslavsky, Muraven, & Tice, 1998; Friese, Binder, Luechinger, Boesiger, & Rasch, 2013; Hagger, Wood, Stiff, & Chatzisarantis, 2010). This decreased capacity for self-control is referred to as *ego-depletion* (or alternatively as simply *depletion*). This effect has been studied in a wide variety of domains including overeating, decision-making, rational thinking, and impulsive spending (Hofmann, Strack, & Deutsch, 2008; Vohs, 2006). Studies have shown depletion effects in humans and nonhuman animals such as dogs (Miller, DeWall, Pattison, Molet, & Zentall, 2012). The majority of the research in this area has focused on examining the effects of prior self-control exertion on subsequent self-control attempts. However, the mechanisms that

explain why capacity for self-control would decrease on a subsequent attempt are not well understood. The major points of the study will be explained in this chapter, and more detail will be provided in the following chapters.

Background of the Study

The ego-depletion effect has been shown in hundreds of studies (Hagger et al., 2010). However, the explanation for why it happens is still being debated. Is it, as proponents of the strength model hold, because self-control relies on a limited resource that is used up during the first exertion of self-control (Baumeister et al., 2007)? Is it possible that participants in experiments have a set amount of effort that they are willing to expend, and it is mostly used up during the first task in a sequence? In other words, are participants unable to exert self-control because of ego depletion, or have they become less willing to do so during the second demanding self-control task (Masicampo, Martin, & Anderson, 2014)? The following gaps in the literature have been identified in relation to these questions: (a) researchers do not have a clear understanding of how an individual's motivation affects the capacity for self-control in a depleted state (Hagger et al., 2010; Inzlicht & Schmeichel, 2012; Inzlicht, Schmeichel, & Macrae, 2014), and (b) there is no consensus regarding how trait self-control is involved (Hagger et al., 2010; Imhoff, Schmidt, & Gerstenberg, 2014).

Motivation can originate from external (known as extrinsic) or internal (intrinsic) sources, as defined later in this chapter. This study was conducted to examine the effects of intrinsic motivation on ego-depletion through the use of autonomy. According to the process model put forth by Inzlicht and Schmeichel (2012), the depletion effect may be

explained as a shift in motivation and attention. If participants are autonomously motivated and it is something they want to do, they should be able to do well on a task even if they are in a depleted state.

Statement of the Problem

The phenomenon of ego-depletion has been shown to exist, and it impacts individuals' abilities to repeatedly exert self-control. The extent of this effect may be attenuated by levels of motivation toward the task or decision individuals are faced with, but this is an area that needs further study (Hagger et al., 2010; Inzlicht & Schmeichel, 2012; Inzlicht et al., 2014). The more that is known about self-control and ego-depletion, the more scholars will be able to understand and predict this aspect of human behavior. Further, a clarification of this information could be useful in understanding better ways of communicating with students, children, peers, clients, and others who may be depleted but still need to use their motivation for better self-control.

Purpose of the Study

The intent of this experimental quantitative study was to study whether or not there is a correlation between ego-depletion and motivation. With the idea that the poorer performance on a second demanding self-control task in a sequence may be due to a reduction in motivation to exert control (Inzlicht & Schmeichel, 2012), the possible effects of participants' motivation on their abilities to perform in an ego-depleted state were studied. In this study, there were two independent variables. The first was the participant's motivation, which was manipulated through the use of autonomy as an incentive. The second independent variable was depletion, which was manipulated by

assigning some participants to a depletion condition and some to a nondepletion condition. Independent variables are the variables that are presumed to cause a change in the dependent variable (Frankfort-Nachmias & Nachmias, 2008), which in this study was the performance of a demanding self-control task in an ego-depleted state. Performance of the task was measured as two variables: (a) interference score, the difference in the mean time spent on correct congruent and incongruent trials; and (b) number of errors.

Research Questions and Hypotheses

Research question 1: Do motivational incentives in the form of autonomy impact performance on tasks in an ego-depleted state?

Null hypothesis 1a: While controlling for differences in trait self-control, mean interference scores for correct trials on Task 2 will not differ between groups.

Alternative hypothesis 1a: While controlling for differences in trait self-control, mean interference scores for correct trials on Task 2 will differ between groups.

Null hypothesis 1b: While controlling for differences in trait self-control, mean error rate on Task 2 will not differ between groups.

Alternative hypothesis 1b: While controlling for differences in trait self-control, mean error rate on Task 2 will differ between groups.

Research question 2: Is there a relationship between trait self-control and performance on tasks in an ego-depleted state?

Null hypothesis 2a: Mean interference scores for correct trials on Task 2 will not depend on level of trait self-control.

Alternative hypothesis 2a: Mean interference scores for correct trials on Task 2 will depend on level of trait self-control.

Null hypothesis 2b: Mean error rate on Task 2 will not depend on level of trait self-control.

Alternative hypothesis 2b: Mean error rate on Task 2 will depend on level of trait self-control.

Theoretical Foundation for the Study

The primary theory used in this research project was the process model of depletion. It was developed by Inzlicht and Schmeichel (2012), who used it to study the mechanisms of ego-depletion. In developing this theory, they sought to explain how ego-depletion works and why self-control seems to come from a limited resource. This theory indicates that when completing a sequence of two demanding self-control tasks, an individual's lower performance on the second task is due to shifts in motivation and attention away from the second task. In other words, the participant has already completed one demanding task in an experiment, and is less motivated to perform the second task with the same level of effort. The individual feels depleted as a result of the first task, and is more motivated toward self-gratification than putting forth effort toward the second task (i.e., the individual's motivation has shifted).

This study was also greatly informed by the self-determination theory (Deci & Ryan, 2000), a theory of human motivation. According to this theory, autonomy is one of the three basic psychological needs, along with competence and relatedness. Motivation can be intrinsic or extrinsic. Autonomy and positive feedback are examples of intrinsic

motivators. A reward based upon performance is an example of an extrinsic motivator (Deci & Ryan, 2000).

As applied to the current study, I expected the independent variable of participant motivation to explain differences in performance in an ego-depleted state (the dependent variable) because sufficiently motivated participants should have the ability to succeed at a second task, even if they are ego-depleted. If the participants receive extra motivation for performing the second task, this should theoretically affect their performance on a second task as compared to a control group. It has been noted that in most cases, the tasks in ego-depletion experiments have not been personally relevant to the participants (Beedie & Lane, 2012), which can impact their motivation to self-regulate on a second demanding task.

Nature of the Study

This study was quantitative in nature. Quantitative research is the approach to use when examining the relationship between variables and testing theories (Creswell, 2014). A true experimental design was used to examine the relationship between motivation (the independent variable) and performance of a demanding self-control task in an ego-depleted state (the dependent variable), with trait self-control as a possible covariate. In doing so, I also tested the process model of depletion, which was the primary theoretical framework that was utilized. This experiment followed the dual-task paradigm, which has been established as a way to induce ego-depletion in participants (Hagger et al., 2010). Data was collected using Amazon Mechanical Turk (MTurk), a website with a large

participant pool that has been shown to yield reliable data for research (Buhrmester, Kwang, & Gosling, 2011).

Definitions

Autonomy: Self-directed behavior that is based on freedom of personal choice (Ryan & Deci, 2000).

Ego-depletion: The state of diminished self-regulatory abilities which is brought about by prior exercise of self-control (Baumeister et al., 1998).

Extrinsic motivation: Behavior that is generated based on external cues (e.g., deadlines, obligations, expectations; Ryan & Deci, 2000).

Intrinsic motivation: Engaging in an activity based on the inherent satisfaction (e.g., the enjoyment or challenge), void of external rewards or expectations (Ryan & Deci, 2000).

Motivation: Behavior that is predicated on inspiration to achieve an end result (Ryan & Deci, 2000).

Self-control: The ability to override automatic impulses to facilitate the directing of behavior towards different goal outcomes (Hagger, et al., 2010; Inzlicht et al., 2014).

Trait self-control: The consistent demonstration of overriding impulse tendencies to bring behavior in line with given standards (Tangney, Baumeister, & Boone, 2004); also referred to as dispositional self-control.

Assumptions

The following assumptions were made:

- The dual-task paradigm was an appropriate means of investigating the research problem.
- The tasks that were chosen would demonstrate the expected depletion effect.
- MTurk participants would demonstrate similar depletion effects as typical undergraduate university student participants have in previous research.
- Participants would be honest with their answers.
- Participants would give adequate attention to the tasks.

The literature relating to these assumptions will be reviewed in Chapter 2.

Scope and Delimitations

The scope of this study was to compare the effects of a motivational incentive with no incentive on a convenience sample of online participants, half of whom performed a task designed to be depleting of self-control resources, and half of whom performed a nondepleting task instead. A possible external threat to validity would happen if one were to attempt to generalize the findings from this study to a larger population. This is a limitation due to the selection of the participants from a convenience sample of online workers. To limit this risk to external validity, this type of claim will not be made.

Limitations

Diffusion of treatment was a potential threat to internal validity of this study (Creswell, 2014). This could have happened if participants in the different groups communicated with each other, for example, if members of the control group talked with other participants about the purpose of the study. To reduce the threat of this happening, the debriefing form included a request for the participants not to discuss the survey with other people.

Significance of the Study

The results of this study will help to advance the knowledge about the relationship between motivation and an individual's capacity for self-control performance in an ego-depleted state. The results of this study will also help clarify whether trait self-control has an impact on self-control in an ego-depleted state. This information will help fill the gap in the literature and answer questions about whether self-control is better described as a matter of effectively utilizing a limited resource of energy (Vohs, Baumeister, & Schmeichel, 2013), or if self-control is more dependent upon an individual's motivations and beliefs (Inzlicht & Schmeichel, 2012). The knowledge gained from this study will have many practical uses. A lack of self-control is the primary reason Americans report an inability to make positive lifestyle changes such as losing weight, exercising regularly, saving money, and paying off debt (APA, 2011). An increased understanding of the factors contributing to self-control will be useful to anyone who wishes to strengthen their own willpower and achieve their goals. Further, this knowledge will also enable

practitioners to better assist clients struggling with addictions and other maladaptive behaviors.

Summary

Effective self-control has been identified as a key contributor to success in life. However, studies have shown that engaging in consecutive self-control attempts can be a challenge. Despite decades of research on the phenomenon of ego-depletion, researchers do not have a clear understanding of the factors that mediate its effects. A 2 x 2 between-subjects factorial design was employed to study the effect of motivation on ego-depletion. Two research questions and hypotheses guided this study. This research utilized the theoretical perspective of Inzlicht and Schmeichel's (2012) process model coupled with the self-determination theory to determine if motivation has an effect on capacity for self-control in an ego-depleted state. The next chapter will provide a review of related literature on ego-depletion, motivation, and other concepts relevant to the study.

Chapter 2: Literature Review

Introduction

In this chapter I will establish the need for continued research on the relationship between motivation and ego-depletion. First, I explain the concept of ego-depletion and provide an overview of how it has been identified and studied. The next section offers different explanations for what ego-depletion is and the disagreements between researchers. The third section contains a thorough review of the prevailing theory in the literature, the limited-resource model, and its strengths and weaknesses. The fourth section covers other explanations for ego-depletion, including motivation. The fifth section covers relevant research in the field of motivation. The sixth section surveys literature on the process model of depletion, which is the theoretical framework of this dissertation. The seventh section contains a discussion about individual differences in self-control as a possible covariate. Finally, I discuss limitations of prior research and conclude with an overview of MTurk.

During my graduate coursework, I amassed an impressive collection of articles on the topics of self-regulation, willpower, self-control, and ego-depletion. To make certain that I had reviewed all the relevant literature, I conducted digital searches of databases. These included searches of Thoreau (which searches multiple databases), along with the Proquest and Sage databases, since Thoreau does not search everything (Walden University, 2015). Google Scholar was also utilized. Search terms included *motivation AND willpower, motivation AND ego-depletion, ego depletion* (without hyphen), *depletion, "have to" AND "want to" AND self-control, "dual task paradigm" AND self-*

control. Where possible, the searches were limited to full-text, peer-reviewed academic journals published after 2010 (the year of Hagger et al.'s meta-analysis of ego-depletion research). The reference lists of particularly relevant articles were reviewed for additional sources. Books were also utilized to provide overviews of the topics of self-regulation, self-determination theory, and fatigue.

Ego-Depletion

Ego-depletion is the state of diminished self-regulatory abilities which is brought about by prior exercise of self-control (Baumeister et al., 1998). This exercise of self-control has been shown to include a wide range of activities including impulse control, enduring unpleasant situations, controlling emotions (Vohs, Baumeister, & Ciarocco, 2005), suppressing unwanted thoughts (Muraven, Tice, & Baumeister, 1998), and making difficult decisions (Vohs et al., 2008). According to Hagger et al. (2010), the initial research articles on this topic were published in 1998 by Baumeister et al., as well as Muraven et al. (1998). Both of these articles used a similar experimental approach, which is known as the dual-task paradigm (also known as sequential task paradigm). In the Baumeister et al. (1998) study, participants who resisted temptation and ate radishes instead of chocolates did not persist as long on unsolvable puzzles compared to participants who did not have to resist the chocolates. Other depleting tasks involved suppressing emotions while watching a 10-minute movie clip, making choices, and crossing out the letter *e* on pages from an advanced statistics textbook while following specific rules for when to cross out the *e*'s. In the Muraven et al. (1998) study, participants showed depletion effects after performing any of the following tasks:

suppressing emotions during a movie clip, suppressing thoughts while performing a writing assignment (they were instructed not to think about a white bear), or solving moderately difficult multiplication problems.

The dual-task paradigm is an experimental method that measures participants' performance on two self-control tasks. The second task is after a short time delay, and is seemingly unrelated to the first task (e.g., Inzlicht & Schmeichel, 2012). It has been found that performance on the second task is significantly lower for participants who participated in a demanding self-control task as their first task as compared to a control group who did not. It is this performance decrease that is used to show the effects of ego-depletion. The dual-task paradigm is the typical methodology adopted by researchers to study the phenomenon of ego-depletion (Hagger et al., 2010).

While there have been hundreds of studies that have shown the ego-depletion phenomenon, it should be noted that its existence is doubted by some researchers. For example, Carter and McCullough (2014) criticized the methodology of the meta-analysis by Hagger and colleagues (2010), saying that the effects were overestimated due to publication bias. Their point was that articles that did not support the idea of ego-depletion or the resource model may not have been published, and the calculations of effect size may therefore have been inaccurate. In 2014, Xu and colleagues published a study indicating that they had failed to replicate the depletion effect. A couple possible explanations for this may be the abnormally high compensation ($25), and the fact that the researchers required all participants to not eat for two hours before the study, which could mean that all participants were depleted even before the research started (see

dissertation by Findley, 2014, for an example). Other researchers, such as Kool and Botvinick (2014) did notice a depletion effect but argued for a different interpretation--in their case, a cost-benefit analysis of labor versus leisure cognitive decision making. In addition, Friese et al. (2013) showed evidence of the ego-depletion phenomenon using functional magnetic resonance imaging (fMRI) during two demanding self-control tasks.

Explanations for Ego-Depletion

While prior research has been instrumental in identifying the ego-depletion phenomenon, not much is known about the mechanisms behind it. Ego-depletion has only been identified by viewing the effects; researchers still cannot explain what it specifically *is* (Inzlicht & Schmeichel, 2012). The prevailing theoretical explanation in the literature is the limited-resource model, which is also known as the strength model of self-control.

Limited-resource model. According to this theory, self-control is a limited resource that becomes depleted after use; this is what is known as ego-depletion (e.g., Baumeister et al., 1998). This limited resource is a reserve of energy that is consumed when we spend it on tasks such as resisting temptations or making difficult decisions (see Hagger et al., 2010, for a review). As implied by the use of the term *strength model*, this resource is analogous to a muscle in the way that it loses capacity in the short term after it is used, but over the long term it can be strengthened through repeated exercise (Cranwell et al., 2014; Muraven, Baumeister, & Tice, 1999). In their meta-analysis of 83 studies that reported the results of 198 experiments, Hagger and colleagues found “preliminary support for the ego-depletion effect and strength model hypotheses” (2010, p. 495).

The limited-resource model is both popular and influential. It was recently highlighted in Baumeister and Tierney's (2011) best-selling book on self-control. It has also been used to inform work in most subfields of psychology and beyond (Inzlicht et al., 2014) including behavioral economics (Lowenstein & O'Donoghue, 2004), organizational and consumer behavior (Gino, Schweitzer, Mead, & Ariely, 2011; Hofmann et al., 2008; Pocheptsova, Amir, Dhar, & Baumeister, 2009), leadership behavior (Joosten, van Dijke, Van Hiel, & De Cremer, 2014) and human neuroscience (Wagner & Heatherton, 2013). The APA (2011) has also published materials on how to increase self-control to achieve educational goals using advice based on the limited-resource model.

The limited-resource model has many strengths. It is an attractive explanation and is easy to understand because it can seem as if the human processing system is a resource of some type that needs to balance the needs of many thoughts, actions, and stimuli (Navon, 1984). Another credit to this theory is that since its introduction in 1998, it has spurred a wealth of research, especially in social psychology (Inzlicht & Schmeichel, 2012). As of 2010, over a hundred studies had been conducted. It is also very hard to disprove, like similar resource models in the past (Inzlicht & Schmeichel, 2012; Navon, 1984). The idea of a resource is vague enough and intuitive enough that it has succeeded without a need for measurement or definition of what the resource actually is.

This lack of knowledge about the mechanisms behind this resource and its depletion is a weakness of the limited-resource model. It has only been identified by viewing the effects, but researchers still cannot explain what it specifically is. One

explanation is that it may be due to the lower levels of blood glucose that have been observed in those in a depleted state (Galliot et al., 2007). In other words, the resources that are used for resisting temptations and making difficult decisions also deplete a person's supply of glucose to the brain. It has been shown that drinking a glucose-rich beverage (such as lemonade) between the two self-control tasks results in significantly less depletion effects (Galliot et al., 2007; Hagger et al., 2010).

However, the glucose explanation does not make much sense from an evolutionary or biological standpoint (Beedie & Lane, 2012). Since glucose has been shown to be very important for brain functioning, and additional supplies can be made available when necessary by the liver, Beedie and Lane (2012) argued against the idea that ego-depletion is caused by low blood glucose. A number of studies have attempted to replicate the findings that the performance of demanding self-control tasks results in lower blood glucose levels, but they have had mixed results (Dvorak & Simons, 2009; Kurzban, 2010; F. Lange & Eggert, 2014; Molden, et al., 2012). One of the studies by Molden and colleagues (2012) showed that merely rinsing the mouth with a glucose-rich beverage could lessen the depletion effects, even though this does not impact blood glucose levels.

An interesting challenge to the limited-resource model was identified by Job, Dweck, and Walton (2010), who found that people who believed that self-control is a limited resource were less effective at their second tasks than people who did not believe that self-control is a limited resource. This is an interesting extension of the research on ego-depletion–that a person's thoughts have an impact on the ability to perform a task in a

depleted state. Similarly, Schmeichel and Vohs (2009) found that when participants expressed their core values (self-affirmation) during the period separating two demanding self-control tasks, they did not show a performance decrement on the second task.

Additional studies have shown that many types of activities will moderate the depletion effects; for example, watching television (Derrick, 2012), smoking cigarettes (Heckman, Ditre, & Brandon, 2012), goal priming (Walsh, 2014), or praying (Friese & Wänke, 2014). The resource model fails to account for how these activities could replenish a limited resource, especially if that resource is glucose (Inzlicht et al., 2014).

The debate about using a resource model to explain a limited reservoir of energy available to the human processing system has been going on for decades. For example, Navon (1984) pointed out that similar limited-resource models were being utilized at that time in the study of attention, and it was deemed unnecessary. In the cognitive fatigue literature, Hockey (2011) cited Bartley and Chute (1947) when he stated, "there is little doubt that the energy-depletion perspective has been a source of distraction in the search for a theory of fatigue" (p. 167). The use of a hypothetical resource to explain the capacity for self-control is garnering similar criticism today (Inzlicht & Schmeichel, 2012).

Other explanations for ego-depletion. While the resource model is extremely popular, it is not the only explanation for the decreased performance observed in the dual-task experiments. It has been posited that motivation could be the main reason why participants show a reduced performance in an ego-depleted state. In their meta-analysis, Hagger and colleagues (2010) pointed out a gap in the literature regarding how a

participant's motivation may impact performance in a depleted state. While there is a plethora of research on ego-depletion as a limited resource, there are not many empirical research articles that have directly addressed the relationship between motivation and ego-depletion.

In most ego-depletion studies, participants are asked to accomplish at least two demanding self-control tasks, but they are not tasks that the participants find personally relevant or that they have a good reason for trying to accomplish in the experimental setting. Generally, the participants are college students who are participating for partial course credit or extra credit. It is possible that these students are willing to give a certain amount of effort to the experiment, and it is used up during the first demanding self-control task. As a result, they may then give less effort to the subsequent task(s). This may be a question of motivation (e.g., Inzlicht et al., 2014).

In a recent article Beedie and Lane (2012) theorized that most of the time, even in an ego-depleted state, people could allocate enough resources to exert self-control if it was for a good reason. Inzlicht and Schmeichel (2012) proposed that the resource depletion effects may be caused by reduced motivation and attention during the second task. However, they explained there is a paucity of research that has directly tested whether motivation is lower in a depleted state.

Muraven and Slessareva (2003) found that individuals may be able to compensate for lack of self-control resources when they are sufficiently motivated. Manipulating beliefs about the purpose of the tasks (by explaining the research was for a charitable cause) was used as a way to increase the participants' intrinsic motivation for doing the

tasks, and it was found that the ego-depleted participants performed better when they were motivated in this way. Interestingly, depleted participants actually performed better than nondepleted participants if they thought they were doing the task for a good cause. The experiments in this study were limited, and the authors pointed out the need for further study in this area, but they also stated that this may be an important addition to the explanation of why ego-depletion leads to a loss of self-regulatory ability. Unfortunately, this study was done in 2003 and since then there have been many studies performed using the dual-task paradigm to investigate ego-depletion that have overlooked this important concept.

Vohs et al. (2013) suggested that motivation and beliefs can contribute to moderating self-control in situations where participants are mildly ego-depleted. The type of motivation that was used in their study pertained to a controlled motivation that used incentives to facilitate performance. They further implied that ego-depletion is a state that is inevitable, regardless of beliefs or motivation. This type of statement is contrary to theories such as the learned industriousness theory, which suggests that individuals adapt to the level of effort that is needed from them (Eisenberger, 1992); and studies such as that by Xiao, Dang, Mao, and Liljedahl (2014) who found participants were able to overcome the depletion effect when performing multiple tasks.

Moller, Deci, and Ryan (2006) replicated and extended one of Baumeister et al.'s original experiments from 1998, except the participants were given choices that were less controlled by the researchers. This made a difference in the results, and the participants showed less depletion effects. Muraven and various colleagues conducted studies on

different manipulations of autonomous motivation and their effects on ego-depletion. For example, Muraven, Rosman, and Gagné (2007) studied the effects of performance-contingent versus noncontingent rewards, and found that the noncontingent rewards were less depleting. Muraven (2008) tempted participants with cookies, and discovered that those with more autonomous reasons for not eating the cookies were less depleted when measured by a handgrip duration test. Muraven, Gagné, and Rosman (2008) studied the effects of autonomy-supportive versus controlling instructions, and found that the more controlling versions of the instructions resulted in diminished self-control during the experimental tasks. These studies were all included in the meta-analysis by Hagger and colleagues (2010).

Outside of the ego-depletion literature, motivation has been studied in connection within the larger topic of self-control. Legault and Inzlicht (2013) demonstrated that the type, quality, and quantity of motivation contributed to participants' ability to self-regulate. They found that autonomous motivation, which is predicated on personal choice or relevance, positively correlated with enhanced self-control as compared to participants who were motivated using a controlled type of motivation. Their research further revealed that continuous error processing, the monitoring of emotions, reactions, and performance errors, contributes to self-control.

Although research suggests that ego-depletion may be a separate phenomenon than fatigue (Vohs, Glass, Maddox, & Markman, 2010), there may be overlap between the two constructs. A prominent fatigue researcher described fatigue as "a problem of the management of control rather than energy" (Hockey, 2011, p. 168). While he

acknowledged that fatigue causes decreases in task performance, he also pointed out that long periods of work without rest do not always result in decreased performance. For example, in Csikszentmihalyi's (1990) research on *flow*, individuals can be deeply involved for long periods of time in very challenging and mentally demanding activities and be energized, alert, and sometimes even elated during work they engage in voluntarily. As another example of differences in fatigue levels over long periods of work, Hockey and Earle (2006) found that participants in a simulated office work setting were more fatigued by the effects of time pressure and high workload when they had less control over how the tasks were scheduled. The greater level of fatigue was observed both in performance and subjective state. In terms of the current study, this is an example of a higher amount of autonomy relating to a lower amount of fatigue.

Motivation

In order to study motivation as a possible explanation for the ego-depletion phenomenon, an overview of information from relevant motivation research is needed. According to the self-determination theory (Ryan & Deci, 2000), there are several types of motivation, ranging in relative levels of self-determination from amotivation to extrinsic motivation, to intrinsic motivation. Self-determination refers to the amount of autonomy that is perceived by the individual. At the two ends of the continuum, amotivation is a relative absence of motivation, while intrinsically motivated behaviors are performed because of personal interest or enjoyment.

Extrinsically motivated activities are performed for the purpose of a separable outcome, and there are four levels (listed in order of lowest level of autonomy to highest):

External regulation, introjected regulation, identified regulation, and integrated regulation. Externally regulated activities are those that are done for reasons that are outside of the activity itself. Examples include doing homework to avoid parents' reprimands, or engaging in an activity for monetary reasons (Vallerand & Ratelle, 2002). External regulation is the classic type of extrinsic motivation that has been studied in operant conditioning (Ryan & Deci, 2000).

Introjected regulation is where individuals internalize beliefs about an activity from their environment, and the reasons seem closer to their own beliefs. This is not considered self-determined behavior, because external rewards or consequences from the past have made their way into the person's belief system, but they have an external perceived locus of causality (Ryan & Deci, 2000; Vallerand & Ratelle, 2002). An example is when a student participates in physical education class to avoid feeling guilty (Lonsdale, Sabiston, Raedeke, Ha, & Sum, 2009).

Identified regulation is more autonomous form of extrinsic motivation (Ryan & Deci, 2000). In this type of motivation, individuals personally identify with the importance of the behavior, although it is done for an external reason. A student who studies vocabulary words for the purpose of fulfilling a life goal of becoming a better writer is motivated by identification.

Integrated regulation is the most autonomous form of extrinsic motivation. Actions are performed for internal reasons and behaviors are congruent with the individual's values and needs. This form of motivation shares many qualities with intrinsic motivation; however, it is still considered extrinsic because behaviors are

motivated by an outcome that is separate from the behavior itself (Ryan & Deci, 2000). A ballet dancer who decides not to go to a party so she can get up early for a class in the morning is an example of integrated regulation (Vallerand & Ratelle, 2002).

In their meta-analysis of extrinsic rewards on intrinsic motivation, Deci, Ryan, and Koestner (1999) showed that when participants feel controlled in virtually any way, their intrinsic motivation decreases. They distinguished between different types of rewards: task-noncontingent rewards, task-contingent rewards, and performance-contingent rewards. Task-noncontingent rewards are given regardless of how well the task was performed, and regardless of whether the task was actually completed; as an example, a reward for simply participating in a study. There are two types of task-contingent rewards: completion-contingent rewards are given for completing the target activity, and engagement-contingent rewards are given for engaging in an activity but do not require completion. Performance-contingent rewards are given for performing the activity at a particular standard. These types of rewards are interpreted by the receivers of the rewards to be at varying levels "controllers of behavior versus affirmations of competence" (Deci et al., 1999, p. 628).

While engagement-contingent, completion-contingent, and performance-contingent rewards have been shown to significantly undermine intrinsic motivation, other types of rewards enhance intrinsic motivation (Deci et al., 1999). Positive feedback and unexpected rewards are examples of rewards that can enhance intrinsic motivation. This field of study is important, because prior research has shown that giving extrinsic rewards can possibly undermine the intrinsic motivation for an activity a person willingly

performed in the past, which can adversely affect willingness to perform the same activity in the future. For example, if a student is accustomed to studying for his own interest or enjoyment of a subject and he starts receiving tangible extrinsic rewards for it, this could result in the reward becoming the reason he studies. In the current study, this undermining effect was not a concern due to the short task duration; however, the stimulation or preservation of intrinsic motivation and autonomy via reward condition is very relevant.

As this review of the literature shows, the perception of autonomy can have beneficial effects on motivation. However, it cannot be further inferred that autonomy has beneficial impacts on performance outcomes in a depleted state without a further review of the literature. In a recent journal article introducing an entire issue dedicated to Canadian research on the self-determination theory, Vallerand, Pelletier, and Koestner (2008) indicated that much of the research on the topic of motivational outcomes is correlational in nature, and more experimental research is needed in this area. The study of motivation's effect on performance outcomes in a depleted state is even more limited.

In the ego-depletion literature, the most common reference to the effect of motivational rewards on performance in a depleted state is for Muraven (2003), which was reviewed above. Two different rewards were tested—belief that the research was for a good cause (Alzheimer's research, study 1) and higher cash incentives (study 2). These are both examples of extrinsic motivation; however, participants in the first study would be autonomously motivated. Unfortunately, this study did not measure motivation levels on either task. According to Inzlicht & Schmeichel (2012), in order to facilitate the

effects of motivation on task performance in a depleted state, researchers should actually attempt to measure levels of motivation on the second task. The current project did include this measurement.

A recent experimental study by Englert and Bertrams (2015) showed that aspects of control can also be perceived in the way a request is worded, and this can have an effect on performance. They found a difference in tennis players' performance based on the type of instructions the participants were given on a previous task. Participants were given instructions designed to be autonomy-supportive, controlling, or neutral. The autonomy-supportive instructions included phrases such as "we would like to kindly ask you to", "it would be really nice if you", and "you can stop the task whenever you like" (p. 125). The controlling instructions included phrases such as "you now have to" and "you must follow these instructions and you have to work on the task until the experimenter stops you" (p. 125). Everyone completed the same tasks; however, the only difference was the different instructions that manipulated autonomy. Tennis serve accuracy was improved for the autonomy-supportive group, it declined for the controlling instructions group, and it was about the same or worse for the group who received neutral instructions.

Process Model of Depletion

The process model of depletion has evolved to address the mechanistic underpinnings of ego-depletion (Inzlicht & Schmeichel, 2012; Inzlicht et al., 2014). In this model, self-control is viewed as a competition between two forces: (a) impulse control and the motivational incentives that contribute to impulse strength, and (b) the

self-control strength that is responsible for overriding impulses. Additionally, these forces can be viewed in combination and as varying contributions from either element in explaining self-control (Inzlicht & Schmeichel, 2012). Contrary to the resource model of self-regulation that has mainly focused on the control aspects of self-control, the process model explores shifts in motivational orientation along with attentional focus, separately and in combination, to facilitate the development of a mechanistic explanation for the phenomenon known as ego-depletion (Inzlicht & Schmeichel, 2012).

One key aspect addressed in the process model is the shift of attention from *have-to* to *want-to* goals. Have-to goals pertain to labor intensive activities, as well as exploitation; for example, being expected to fulfill a class requirement. Want-to goals shift attention and motivation to leisure activities and exploration to find activities that are removed from outside requirements (Inzlicht et al., 2014).

Using the process model, the ego-depletion phenomenon can be explained as a shift in motivation and attention from one goal to another. In the dual-task paradigm, this would explain the performance decrement as a shift in the participants' goals from a goal of successfully completing yet another difficult task to a new goal of finishing the experiment (Inzlicht & Schmeichel, 2012; Inzlicht et al., 2014).

Individual Differences in Self-Control

Individual differences in trait self-control was investigated as a possible covariate in this study. The Brief Self-Control Scale (BSCS; Tangney et al., 2004) was used to measure this construct. In theory, people with higher scores on the BSCS would have higher self-control abilities, and this would enable them to perform better in an ego-

depleted state. In their 2007 study, Schmeichel and Zell used the BSCS and found a correlation between the scores on this scale and the performance on two behavioral control tasks (restraining eye blinks and tolerating pain). However, Imhoff et al. (2014) found that people higher in trait self-control were less able to resist temptation and made riskier decisions in a depleted state. In other words, the performance of participants with higher trait self-control was more impaired than those with lower self-control. It should be noted that Imhoff et al. used a different scale, the self-control subscale from the German Self-Regulatory Skills Questionnaire. They stated that the reason they chose this scale was because the German translation of Tangney et al.'s Self-Control Scale was not available at that time (and their study was conducted in Germany). The relationship between trait self-control and ego-depletion is not well understood, and is one of the additional areas that Hagger et al. (2010) identified as in need of future study in their meta-analysis. This study was designed to provide additional insight into this relationship.

Limitations of Prior Research

As mentioned above, most of the studies on ego-depletion have been conducted on undergraduate college students who were participating for course credit or extra credit. There have been some criticisms in the use of college students and whether or not they are representative of the larger population of adults (e.g., Sears, 1986). The use of MTurk for data collection in the current study will add to the body of knowledge using a more diverse population (Buhrmester et al., 2011).

Amazon Mechanical Turk

MTurk (https://www.mturk.com) was utilized for data collection for this study. Many recent studies have successfully investigated ego-depletion through the use of writing assignment tasks on MTurk. For example, Yam, Chen, and Reynolds (2014) studied ego-depletion and its effects on ethical decision making. MTurk has been used to experimentally collect data that indicate exposure to pictures of nature (J. T. Chow & Lau, 2015) or thoughts about favorite television programs (Derrick 2012, study 1) can potentially counteract the effects of ego-depletion. Milkman (2012, study 4) induced depletion by asking participants to write about uncertainty in their lives, and subsequently observed significant differences in the choices the participants made–they were more likely to choose *wants* over *shoulds*.

In their study investigating the effects of habits on self-control, Neal, Wood, and Drolet (2013) also used a writing assignment as a depleting task in which participants wrote for three minutes without reusing any words. In a recent doctoral study, T. Chow (2014) studied ego-depletion on MTurk by recreating the classic white bear paradigm, in which participants were instructed to complete a thought-listing assignment while following instructions not to think about a white bear. The above studies gave the indication that MTurk participants would demonstrate similar depletion effects as typical undergraduate university student participants have in prior research. In addition, Crump, McDonnell, and Gureckis (2013) replicated the classic Stroop interference effect on MTurk and obtained similar results as non-MTurk studies. The Stroop test was one of the tasks in the current study and is covered in Chapter 3.

MTurk is an online marketplace where *requesters* post work in the form of tasks for *workers* to complete. These tasks are called HITs (Human Intelligence Tasks). There are a wide variety of HITs, representing almost anything (within the terms of the MTurk participation agreement) that can be done or tracked by a computer. Examples of HITs include transcribing receipts, recording and submitting videos, tagging pictures, making up simple questions, completing writing assignments, taking surveys, psychological research, etc. Requesters post information about each HIT, including a description, estimated time for completion, time allotted, and the reward amount (in dollars). Workers view the listing and accept the HIT, then complete the work. Requesters can specify that only workers with particular qualifications can complete their HITs. Examples of qualifications can be in the form of number of HITs completed, approval rate, or geographic location. Requesters can even create their own qualifications; this gives the ability to have potential workers take a prescreening test, or invite (or exclude) workers who have completed previous HITs (Chandler, Mueller, & Paolacci, 2014).

Advantages of using MTurk include the opportunity to reach a larger number of participants, who are more representative of the U.S. population than the traditional research pool of undergraduate college students (Buhrmester et al., 2011). Burhmester et al. reported that "the quality of data provided by MTurk met or exceeded the psychometric standards associated with published research" (2011, p. 5). Another advantage is that participants do not physically interact with the researcher, which can minimize the potential of the experimenter influencing the results (Crump et al., 2013).

Potential concerns of using MTurk could include issues of data quality, for example, whether participants are honest with their answers and whether they give adequate attention to the tasks. These concerns have been investigated by several researchers. Peer, Vosgerau, and Acquisti (2014) recommended the use of workers with approval ratings higher than 95%. Research on compensation rates by Buhrmester and colleagues (2011) showed that data quality was not influenced by compensation rate, but lower rates resulted in longer data collection times. Additionally, Crump and colleagues (2013) noted that the replication of well-known laboratory findings (as they were able to do) will provide greater confidence in the use of MTurk for behavioral research.

Summary

In summary, hundreds of experiments since 1998 have identified the ego-depletion phenomenon and the broad scope of its potential impact throughout everyday life. Careful decision-making, proper diet and nutrition, money management, and even the control of tempers have been shown to be related to self-control and reduced performance when individuals are depleted. The reasons for this performance decrement have been explained as a depleted resource; some say this resource could be glucose, but subsequent research has cast doubt on the glucose theory. Perceptions or state of mind have also been shown to have an impact on the amount of depletion (or if it happens at all). A better explanation for the phenomenon may be that it is a shift in motivation and attention, as posited by the process model. More research is needed to support the tenants of the process model; the present research helped explore the relationship between autonomous motivation and ego-depletion.

Chapter 3: Research Method

Introduction

The purpose of this quantitative study was to examine the relationship between motivation and individuals' capacity for self-control in an ego-depleted state.

The study will be described in this chapter. First, the research design and rationale will be presented. Next, characteristics of the participants will be covered, followed by a description of the sampling procedures and the procedures that were followed for recruitment, participation, and data collection. Then, the instrumentation and operationalization of constructs will be described, including the scales that were utilized. This is followed by the data analysis plan and a review of potential threats to validity and ethical considerations of the participants.

Research Design and Rationale

A true experimental design was utilized for this study. Specifically, this study employed a 2 (ego-depletion: yes or no) x 2 (autonomous reward motivation: incentivized or nonincentivized) between-subjects factorial design. Participants were randomly assigned to one of the four conditions. There were two tasks: the first was a writing task, where half of the participants completed a writing assignment designed to deplete self-control resources, and the other half did not. Before the second task, an intrinsically motivating incentive was offered to half of the participants in each group (depletion and nondepletion). The second task was an active performance task in which accuracy and speed was measured. See Figure 1 for a graphical representation of the experiment

structure. The specific nature of the tasks, experimental manipulation, and measures are described in later sections of the chapter.

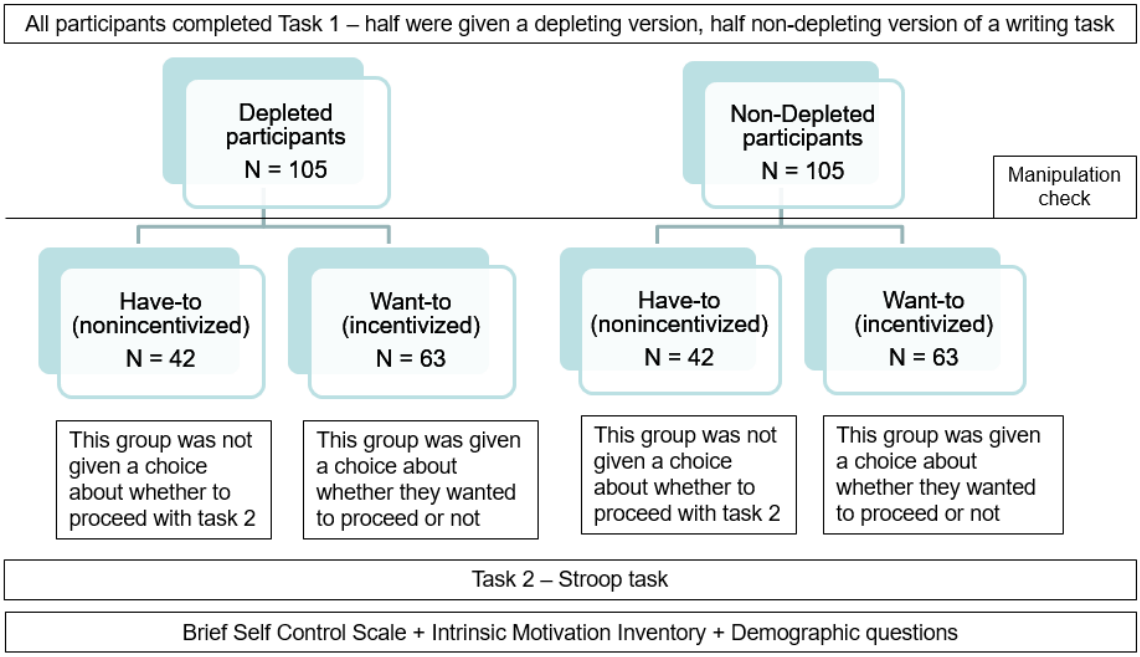

Figure 1. Graphical representation of the experiment structure.

The 2 x 2 factorial design was the most appropriate for this study because it allowed for the manipulation of two variables and analysis of the effects on two other variables (Frankfort-Nachmias & Nachmias, 2008). The classic experimental design, which involves a pretest and posttest, was not as appropriate because the point of this study was not to determine whether there is a significant difference between the first and second self-control tasks. This type of question has been extensively researched (Hagger et al., 2010), and as a result researchers would ordinarily expect a lesser performance on Task 2 for depleted participants. The question of whether a participant's motivation mediates this performance decrement was investigated by manipulating the motivation of

some participants and measuring any differences between these participants and those who did not receive the manipulation.

The entire experiment was developed with the use of JATOS (Just Another Tool for Online Studies; K. Lange, Kühn & Filevich, 2015) and jsPsych (de Leeuw, 2015). It was hosted on a virtual server through Amazon Web Services (https://aws.amazon.com).

Population and Sampling

The population for this study consisted of MTurk workers who resided in the United States and were 18 years of age or older. Only those MTurk workers who had a HIT approval rate of not less than 98% and had completed between 50 and 1000 HITs were eligible. This was designed to help ensure that participants were familiar with completing HITs on MTurk, but yet minimize the possibility that they had previously participated in similar HITs (for a discussion of nonnaiveté among MTurk workers, see Chandler et al., 2014). Participants were required to use a desktop or laptop computer, not a smartphone or a tablet. Participants were offered $1.50 to participate in a HIT that was estimated to take fifteen minutes or less. The sampling frame would have been a complete listing of all workers on MTurk; however, a nonprobability sample based on convenience was used for this study.

The statistical power for this experiment was .80, with alpha = .05 two-tailed. In a meta-analysis of 198 ego-depletion studies, the average population-estimated effect size was Cohen's d = 0.62, 95% CI [0.57, 0.67] (Hagger et al., 2010). Based on these parameters, the target sample size, assuming no covariate effect, was 168 (42 in each group) who completed Task 2. Because some of those in each of the two incentivized

groups could have chosen not to complete Task 2, the initial size of each of the incentivized groups was set at 63, allowing for 33.3% attrition. Thus, the total target sample size in this study was 210, with 42 (40%) in each of the two nonincentivized groups (depleted and nondepleted) and 63 (60%) in each of the two incentivized groups (depleted and nondepleted).

Procedures

Participants were randomly (and unknowingly) assigned to one of four groups, but they all started the experiment in the same way. Everyone read and agreed to an informed consent statement, then (if they agreed), they all performed Task 1 (target n = 210). Task 1 consisted of a writing task with half of the participants completing a depleting version of the task (target n = 105) and the other half completing a nondepleting version of the task (target n = 105). The tasks will be fully described later in this chapter. After Task 1, all participants completed a manipulation check regarding their current energy level and how much effort they expended on Task 1 (each rated on a Likert-type scale from 1-*low* to 7-*high*). Forty percent (target n = 42) of the participants who completed the depleting Task 1 (*depleted nonincentivized* group) and 40% (target n = 42) of the participants who completed the nondepleting Task 1 (*nondepleted nonincentivized* group) then proceeded directly to Task 2, a completely different activity that challenged their self-control. These two groups were informed that both tasks were part of the experiment, using controlling language. They were also told that some participants had a choice about whether or not to proceed. These two groups were

expected to experience a lower amount of autonomy than the other two groups. The wording they received is as follows:

> You will now proceed to the next task, which is a color naming task. Some participants were given a choice about whether to proceed or not, but you are in one of the groups where both of these tasks are included in the HIT. You must follow the instructions on the next screen. Press any key to begin.

The rest of the participants (target $n = 126$) were informed that they had completed the experiment after they had completed Task 1. Half of these participants had completed the depleting version of Task 1 (*depleted incentivized* group) and half had completed the nondepleting version (*nondepleted incentivized* group). They were thanked for their participation, completed the manipulation check described above, then they were asked if they wanted to help with an additional task. If so, they proceeded to Task 2 (target $n \geq 84$, 42 from each level of Task 1). The wording of this request was phrased in a way that was designed to induce autonomous motivation, similar to the Englert and Bertrams (2015) study of tennis players that was reviewed in Chapter 2. The wording was as follows:

> Thank you! You have completed the experiment. Do you want to help with an additional task? We would like to kindly ask you to complete the next task, which is a color naming task. It would be really nice of you if you proceeded to the next task, but you can end now if you like. Thank you so much.

These two groups, by virtue of choosing to continue, were considered to be intrinsically motivated by autonomy. Anyone who decided not to help with this

additional task after the end of Task 1 proceeded to the debriefing screen and then received their completion code for the MTurk HIT.

In effect, all participants completed the same Task 2 (unless they dropped out). The only differences between the groups were whether they completed the depleting version of Task 1 or not, and whether they were given the choice about whether to do Task 2 or not. This choice was considered to be the motivational incentive in this experiment. The manipulation check after Task 1 was used to determine whether the participants who declined to participate further were more depleted than anyone else in the experiment.

After completing both tasks, all participants proceeded from Task 2 to the 13 questions in the BSCS, then the 12 questions from the Intrinsic Motivation Inventory (IMI; Ryan, 1982), and finished with several demographic questions. The next screen informed the participants that they had completed the study, explained the purpose of the experiment (which served as the debriefing), and asked them to keep the information confidential so as not to affect the performance of subsequent HITs. They were then thanked for their participation and given their completion code for the MTurk HIT.

Description of the Tasks

The tasks in this experiment were modeled after those used in previous depletion research. A writing task was utilized as Task 1 in the current study, similar to that used on MTurk by Yam et al. (2014) which itself was adapted from previous versions by Gino et al. (2011) and Schmeichel (2007). The Stroop test was used in the current study as Task 2. The Stroop test is one of the most frequently used dependent tasks in the dual-

task paradigm, according to Hagger et al. (2010), and is “one of the most frequently used measures of self-control” (Galliot et al., 2007, p. 329). The contribution of the current study was designed to help determine if autonomous motivation improves Task 2 performance.

Task 1, writing task. Participants were asked to write for four minutes, describing what they did yesterday. Half of the participants were asked to write the paragraph without using the letters *a* and *n*. This forced these participants to put extra effort into finding alternative words to express their thoughts. The other half of the participants were not asked to exclude any letters, and were able to write freely. The group of participants who were required to exclude the letters *a* and *n* were expected to be ego-depleted.

Task 2, Stroop test. The Stroop test is a widely used measure of self-control performance (Job et al., 2010). Participants must use self-control to override their normal impulses so that instead of automatically reading words, they are asked to name the colors the words are displayed in. There have been many versions of this test; at the beginning (1935), it started with sheets of paper that participants would read aloud, and their responses were timed with stopwatches. The present research utilized a computerized version that was programmed though the use of jsPsych (de Leeuw, 2015). Participants viewed words on a computer screen (*blue*, *red*, or *green*) that were displayed in one of three different colors (blue, red, or green), and they were instructed to press one of three keys corresponding with the color of the font and ignore the semantic meaning of the word (Friese et al., 2013; Hagger et al., 2010). For example, if the word displayed

was *red*, but the font was blue, the correct response was to press the key corresponding with blue. Sometimes the word color and meaning would match (congruent trial) and sometimes they would not match (incongruent trial). At the beginning, there were 10 practice trials, consisting of five congruent and five incongruent trials, to make sure participants understood the instructions. Next there were a total of 96 trials, consisting of 48 congruent and 48 incongruent trials. Each word was displayed on the screen until the participant responded by pressing a key, or until 1500 ms (1.5 s) had elapsed. This was followed by a 700 ms fixation cross, then the next word was displayed and continued on in this manner. Each trial was 2200 ms. The total time to complete Task 2 was less than 4 min, including the practice trials.

Instrumentation and Operationalization of Constructs

This section contains an outline of the variables of interest in this experiment, along with the measurement scales that were administered.

Independent variables. There were two independent variables: motivation and depletion. Motivation was measured as two levels, corresponding to the two groups of participants: 0 (*Nonincentivized have-to*) or 1 (*Incentivized want-to*) as previously described in the procedures section. The motivational incentive condition in this experiment was considered to be the use of autonomy (the choice of whether or not to proceed with Task 2) to induce intrinsic motivation. Depletion was also measured as two levels, corresponding to two groups of participants: 0 (*Nondepleted*) or 1 (*Depleted*). Depleted participants completed the depleting version of Task 1, while nondepleted participants completed the nondepleting version of Task 1.

Dependent variables. Two dependent variables represented the participants' performance on Task 2: (a) interference score, which is the difference in the mean time spent on congruent and incongruent trials; and (b) number of errors. During Task 2 (the Stroop test), some of the participants should have been in an ego-depleted condition. It was hypothesized that participants with a greater amount of self-control resources should have been better able to perform Task 2. Thus, a lower interference score and fewer errors on this task would indicate better performance on this demanding self-control task.

Calculation of the two dependent variables was as follows. Task 2 response times of less than 300 ms were removed, according to the procedures in MacLeod (2005). MacLeod also recommended removing response times greater than 1500 ms; therefore, this was built into the study design when determining the maximum length of time for the word to appear on the screen. As a result, it was not necessary to remove any long response times. Incorrect responses were removed and counted as the second dependent variable, number of errors. Interference scores were then computed by subtracting the mean response time for congruent trials from the mean response time for incongruent trials for each participant. Higher interference scores indicate that more time on average was spent answering the incongruent trials than the congruent trials; this is the Stroop interference effect.

Brief Self-Control Scale. The BSCS (Tangney et al., 2004) was used to measure the level of trait self-control of the participants. The brief version of this scale consists of 13 items; for example, "I am able to work effectively toward long-term goals". See Appendix A for the entire scale. The results have been shown to be similar to the use of

the full 36-item Self-Control Scale (Tangney et al., 2004). Each question is measured on a 5-point Likert-type scale from 1 (*not at all*) to 5 (*very much*), with nine of the questions scored in reverse. Scores can range from a minimum of 13 to a maximum of 65. The BSCS has exhibited high reliability of alpha = .83 and .85, with test-retest reliability of .87 (Tangney et al., 2004). In their 2012 meta-analysis of three self-control scales, de Ridder, Lensvelt-Mulders, Finkenauer, Stok, and Baumeister reported that the majority of studies using the BSCS used student samples (32 of the 50 studies reviewed). The nonstudent samples included community samples and clinical samples. The BSCS scale was used in this experiment to quantify the participants' level of trait self-control as a potential covariate between self-control performance and the motivational incentive. Permission to use the BSCS in this study was obtained and the permission email is included as Appendix B.

Intrinsic Motivation Inventory. Two subscales of the IMI (Ryan, 1982) were utilized as a manipulation check. The interest/enjoyment subscale is "considered the self-report measure of intrinsic motivation" (self-determination theory, 2015, para. 1). There are seven questions in the interest/enjoyment subscale, and they pertain to whether the participant finds the task interesting and enjoyable. In addition, the perceived choice subscale was particularly relevant to this experiment, because the feeling of having an autonomous choice was paramount to the incentive condition. This subscale consists of five questions, including a question similar to "are you doing this task because you want to?" which directly relates back to the have-to and want-to concept in Inzlicht and Schmeichel's (2012) process model.

The IMI has been shown to be both reliable and valid, and the psychometric properties of the scale are not adversely impacted if questions are removed (McAuley, Duncan, & Tammen, 1989). Various subscales of the IMI have been used with diverse populations, for example: Patall, Sylvester, and Han (2014) used a shortened version of the interest/enjoyment subscale (3 items; $\alpha = .92$) with MTurk participants; and Legault and Inzlicht (2013) with undergraduate student participants. Legault and Inzlicht reported $\alpha = .89$ for the interest/enjoyment subscale and $\alpha = .75$ for the perceived choice subscale. Permission to use the IMI in this study was obtained and the terms and conditions document is included as Appendix C; however, permissions do not permit the exact questions to be published.

Demographics and additional manipulation checks. In order to describe the sample, the following demographic information was collected from all participants who completed both tasks: gender, age, highest level of education completed (less than high school; high school or equivalent; vocational/technical school (2 year), some college, college graduate (4 year), master's degree (MS), doctoral degree (PhD), professional degree (MD, JD, etc.)). Participants were also asked to rate the difficulty of each task using a 7-point Likert-type scale (1 = *not at all* to 7 = *very*), as well as a question about whether they had participated in previous studies with similar tasks.

Data Analysis

The research questions and hypothesis presented in Chapter 1 are restated below, along with the analysis plan. All statistical tests were performed using SPSS software.

Research question 1: Do motivational incentives in the form of autonomy impact performance on tasks in an ego-depleted state?

Null hypothesis 1a: While controlling for differences in trait self-control, mean interference scores for correct trials on Task 2 will not differ between groups.

Alternative hypothesis 1a: While controlling for differences in trait self-control, mean interference scores for correct trials on Task 2 will differ between groups.

Null hypothesis 1b: While controlling for differences in trait self-control, mean error rate on Task 2 will not differ between groups.

Alternative hypothesis 1b: While controlling for differences in trait self-control, mean error rate on Task 2 will differ between groups.

Analysis 1: Mean interference scores for each experimental group were calculated, and an analysis of covariance (ANCOVA) was utilized to determine if there was a statistically significant difference in Stroop test scores between the four groups, covarying for the individual differences in trait self-control as measured by the BSCS.

Research question 2: Is there a relationship between trait self-control and performance on tasks in an ego-depleted state?

Null hypothesis 2a: Mean interference scores for correct trials on Task 2 will not depend on level of trait self-control.

Alternative hypothesis 2a: Mean interference scores for correct trials on Task 2 will depend on level of trait self-control.

Null hypothesis 2b: Mean error rate on Task 2 will not depend on level of trait self-control.

Alternative hypothesis 2b: Mean error rate on Task 2 will depend on level of trait self-control.

Analysis 2: Level of trait self-control was measured by the participants' scores on the BSCS. An analysis of covariance (ANCOVA) was used to determine if scores on the Stroop test were significantly related to BSCS score.

Manipulation check for intrinsic motivation: Independent sample *t* tests were conducted to determine whether there was a difference in the IMI scores between the groups. The scores for each of the IMI subscales was analyzed separately.

Threats to Validity

The 2 x 2 factorial design has many strengths. All internal threats to validity are addressed (Frankfort-Nachmias & Nachmias, 2008). Since there is no pretest, this eliminates concerns about testing and instrumentation. Additionally, external events and maturation processes can be considered to be the same for all groups, so this removes internal validity concerns related to these topics. This design is also greatly strengthened by its use of random assignment of individuals into the groups, which addresses external validity concerns (Frankfort-Nachmias & Nachmias, 2008). A potential limitation of this design, like many others, would be the potential for research participants to talk with each other and realize differences in the intervention (a social interaction threat to internal validity, Trochim, 2006). For this reason, participants were asked to keep the nature of the experiment confidential as an attempt to control for a social interaction threat in later participants.

Ethical Considerations

The rights of the participants of this study were ensured. Risks were minimized by ensuring that participants were treated according to the guiding principles outlined by Walden University's institutional review board. MTurk's participation agreement and general policies were fully adhered to, and all participants read and agreed to an informed consent form prior to participation in the study. This informed consent form included information about the study, the approximate amount of time required, Walden's institutional review board approval number (12-23-15-0256187), and it informed the participants that they could withdraw from the study at any point in time (as recommended by Frankfort-Nachmias & Nachmias, 2008). However, since the nature of the study was experimental, the participants were not told the exact intent of the research before they participated; they were informed after their participation has ended. The tasks they were asked to perform did not expose them to any risk that is greater than they would encounter in everyday life, so that was not a concern. Participants' privacy was protected by using the MTurk worker ID numbers, which was not tied back to any personal information, thereby separating any identifiable data from the experimental results (Buhrmester et al., 2011). However, MTurk worker ID numbers should not be considered anonymous, since it is possible to perform an Internet search (for example, Google.com) and find information about the workers (Lease et al., 2013). For this reason, appropriate measures were taken to keep the worker ID numbers private. Data will be stored on the researcher's external hard drive in password protected files for five years.

Summary

In summary, a dual-task paradigm experiment was conducted on MTurk. All participants completed a form of Task 1, half completed the easy version and half completed the more difficult version, which was ego-depleting according to previous research. Some participants were given an incentive in the form of autonomy to induce the feeling they were performing the next task because they wanted to. The rest of the participants were given no choice but to proceed to Task 2 (unless they wanted to quit the experiment early and not be paid). This was a 2 (ego-depletion: yes or no) x 2 (autonomous reward motivation: incentivized or nonincentivized) between-subjects factorial design. The target sample size was 210.

Performance on the Stroop test was measured for all participants. The scores were compared to determine whether they were significantly different for the four groups. Scores on the BSCS (Tangney et al., 2004) and the IMI (Ryan, 1982) were used to analyze for covariance (and manipulation check). Demographic information and additional manipulation checks were also obtained from the participants (as shown in Appendix D). Data will be analyzed in Chapter 4 to answer the hypotheses and research questions outlined in this chapter.

Chapter 4: Results

Introduction

Ego-depletion is a widely researched topic in social psychology; however, little is known about the mechanisms behind the phenomenon. In this study, I sought to better understand the phenomenon of ego-depletion, to help clarify whether there is a relationship between ego-depletion and intrinsic motivation, and also to examine the potential relationship between ego-depletion and trait self-control, while using a population other than the undergraduate students who are most commonly used in this area of research. In this chapter, I present a description of the data collection process and the participants, followed by the results of the inferential analyses.

Data Collection

At 10:29 p.m. EST on December 24, 2015, 210 HITs were posted to MTurk. Participants were invited to participate in an online experiment with the title "Psychology experiment – approx. 10-15 minutes." As previously described, participants (or workers, as they are called on MTurk) were randomly assigned to one of four groups. Since the participants in two of the groups were given a choice about whether or not to proceed after Task 1, the experiment was designed to assign 63 participants to these two groups to account for attrition. Forty-two participants were assigned to each of the other two groups. By 10:53 a.m. on December 25, 2015, all HITs had been completed. For some unknown reason, there was a total of 211 results--one more than planned in the nondepleted nonincentivized group. Even though 126 participants had been given the choice to end the experiment after Task 1, 110 decided to proceed. Sixteen participants

chose to end after Task 1 when they were given the autonomous motivation incentive asking if they wanted to help with an additional task or not. This was considered as full completion of the HIT and they were paid as agreed, but their results were excluded because they did not complete Task 2. As a result, there were 195 full results. This was better than the planned target of 168.

In general, after reviewing the results of the study, I was very pleased with the quality of results. The responses for the depleting version of Task 1 (write for four minutes without using the letters *a* or *n*) were very creative. The ratings for all the different scales (BSCS, IMI, and manipulation checks) were sufficiently different to show that thought was put into the answers. In other words, it appeared that the workers took this experiment seriously.

Data Cleaning

During the experiment, two participants sent me emails. One said, "About two thirds into the color naming test all the words lost their color and were displayed in blue boxes as white words? After about 20 of those, they came back to the normal colored words." Because of these technical difficulties, her results were excluded from the final analysis. The other participant said that she had originally made a choice to continue with the second task, but she saw a blank screen instead. So, she hit the back button and chose to end. Since this worker ended the experiment at this point, her results were already not included in the final results. In addition, one participant did not have any correct incongruent trials in the Stroop test, so there was no way to calculate an interference score and this result was excluded.

A review of the data showed that there was one participant whose Stroop interference score was considerably higher than that of anyone else. This result was identified as an outlier by using the outlier labeling rule with a *k* value of 2.2 (Hoaglin, Iglewicz, & Tukey, 1986), so this result was excluded. A total of three records were removed from the analysis, leaving a total of 192.

The experiment was designed so that all questions were required to be answered; thus there were no missing values. Also, as described in Chapter 3, Stroop trials of less than 300 ms and more than 1500 ms were excluded from the calculations of the Stroop scores (the dependent variables of interference score and error rate). As a result, no additional data cleaning was required.

Descriptive Statistics

Gender, highest level of education, and age were obtained from each of the 192 MTurk workers who participated in the study. Thirty-nine percent of the participants were male (n = 75) and 59.9% were female (n = 115), with 1% preferring not to answer the gender question (n = 2). The distribution of the highest level of education for participants included one (0.5%) with less than high school, 23 (12.0%) high school or equivalent, 10 (5.2%) vocational/technical school (2 year), 73 (38.0%) some college, 63 (32.8%) college graduate (4 year), 17 (8.9%) master's degree, 3 (1.6%) doctoral degree (PhD), and 2 (1.0%) professional degrees (MD, JD, etc.). The mean age of the workers for this study was 34.4 years (SD = 11.9), ranging in ages from 19 to 69.

Data collection resulted in eight categorical and continuous variables, which included participants' ratings of effort level expended on Task 1, energy level for Task 1,

Task 1 difficulty level, and Task 2 difficulty level. Participants scored these variables as a number from 1 (*low*) to 7 (*high*). A composite score was calculated for each of the following variables based on the questions in their respective instruments: BSCS total score, IMI perceived choice subscale score, and the IMI interest/enjoyment subscale. A final question recorded whether or not the workers had previously participated in studies with similar tasks. Most of these variables were collected as manipulation checks. Refer to Table 1 for a summary of these variables by experimental group.

Table 1

Summary of Means and Actual Ranges for Scores by Group

Condition	Group 1 (n = 54)		Group 2 (n = 41)		Group 3 (n = 54)		Group 4 (n = 43)	
Motivation incentive	Y		N		Y		N	
Depletion group	Y		Y		N		N	
Scale Name	*M*	Range	*M*	Range	*M*	Range	*M*	Range
Task 1 Effort	6.35	2-7	6.39	4-7	5.65	2-7	6.07	4-7
Task 1 Energy	5.07	1-7	5.20	2-7	4.80	2-7	4.74	2-7
Task 1 Difficulty	5.52	1-7	5.73	1-7	2.41	1-7	2.28	1-6
Task 2 Difficulty	3.41	1-7	3.51	1-7	3.72	1-6	3.91	1-7
BSCS Total Score	42.76	21-62	40.80	23-63	39.61	20-61	41.56	21-61
IMI Perceived Choice	5.45	2.2-7.0	5.06	1.2-7.0	5.53	2.6-7.0	5.03	1.0-7.0
IMI Interest/Enjoyment	4.02	1.0-7.0	4.63	1.3-7.0	4.17	1.0-7.0	3.89	1.0-7.0

Note. BSCS = Brief Self-Control Scale, IMI = Intrinsic Motivation Inventory. For all scales, higher scores indicate more of the factor being measured.

Manipulation Checks

Effort and Energy

After all the participants completed the first task, they were asked to complete a manipulation check regarding how much effort they expended on Task 1 and their current energy level (each rated on a Likert-type scale from 1-*low* to 7-*high*). The manipulation

checks for effort and energy were gathered to help determine whether the participants who declined to participate further were more depleted than those who continued. An independent-samples *t* test was conducted to compare the effort level of participants who decided to continue with those who decided not to continue. There was no significant difference in the effort scores between those who continued (M = 6.10, SD = 0.98) and those who chose not to continue (M = 6.00, SD = 1.00); $t(205)=-0.38$, p = .708. Similarly, an independent-samples *t* test was conducted to compare the energy level of participants who decided to continue with those who decided not to continue. There was no significant difference in the energy scores between those who continued (M = 4.95, SD = 1.44) and those who chose not to continue (M = 5.00, SD = 1.13); $t(205)=0.14$, p = .891. These results suggest that those who declined to participate further were not more depleted than the other participants.

Intrinsic Motivation Inventory (IMI)

After Task 2 was completed, workers completed the BSCS, the IMI, and a demographics screen. The BSCS was utilized as a covariate for the hypothesis testing, so it will be discussed later in this chapter. Two subscales of the IMI were given. The perceived choice subscale consists of 5 questions, which are rated on a scale of 1 (*not at all*) to 7 (*very true*). Three of the questions are reverse scored. The interest/enjoyment subscale consists of 7 questions, one of which is reverse scored. The individual answers are averaged together to obtain a score for each subscale.

An independent sample *t* test revealed that participants in the motivational incentive condition had significantly higher scores on the perceived choice subscale of

the IMI (M = 5.49, SD = 1.17) than those who were in the nonincentivized condition (M = 5.05, SD = 1.55); $t(190) = -2.27$, $p = .024$. This shows that the participants who were given the motivational incentive did feel that they had a choice about whether to proceed or not. An independent sample t test was also conducted using the interest/enjoyment subscale; however, no significant difference was found between those in the incentivized condition (M = 4.09, SD = 1.57) and the nonincentivized condition (M = 4.25, SD = 1.63); $t(190) = 0.67$, $p = .502$. This result suggests that the incentivized participants were not significantly different in intrinsic motivation than the nonincentivized participants.

Task Difficulty Levels

The demographics screen included questions about the difficulty of both tasks on a scale of 1 (*not at all*) to 7 (*very*). An independent sample t test revealed that workers who completed the depleting version of Task 1 rated Task 1 significantly more difficult (M = 5.61, SD = 1.57) than the workers who completed the nondepleting version of Task 1 (M = 2.35, SD=1.53), $t(190) = -14.60$, $p < .001$. This result is as expected – the depleting version of the task was designed to be more difficult. An independent sample t test was also conducted for the difficulty of Task 2. No significant difference was found between the depleted (M = 3.45, SD = 1.58) and nondepleted (M = 3.80, SD = 1.59) groups; $t(190) = 1.53$, $p = .127$. These results suggest that participants in the depletion condition did not perceive Task 2 as significantly more difficult than those in the nondepletion condition. There was no difference in Task 2 between the groups, so this was an expected result.

Previous Participation

The final manipulation check asked the question "have you participated in previous studies with similar tasks?" One of the qualifications for this MTurk task was that only those MTurk workers who had completed between 50 and 1000 HITs were eligible. This was an attempt to weed out "professional participants" as described by Chandler, et al. (2014, p. 120), who may have different characteristics than less experienced workers. For example, they may be more familiar with psychological research and may be more focused. Previous work on similar tasks may not have an impact on Stroop scores, but it could potentially take away from the depleting effects of trying to write a paragraph without using certain letters.

In this study, 37 workers (19.3%) answered yes to this question. An independent sample *t* test found no significant difference between Stroop interference scores for workers who answered yes (M = 136.30, SD = 87.88) and those who answered no (M = 133.81, SD = 69.51) to this question; $t(190) = -0.19$, $p = .853$. An independent sample *t* test was also conducted to compare the Task 1 difficulty scores between the two groups. Workers who had not participated in previous studies with similar tasks did not rate Task 1 as significantly more difficult (M = 4.04, SD = 2.22) than those who had (M = 3.65, SD = 2.37); $t(190) = 0.95$, $p = .344$. These results show that a minority of the participants had participated in similar tasks in the past, and this previous participation did not seem to have an impact on the results of the current study.

Inferential Statistics

The research questions and associated hypotheses were analyzed using inferential statistics in SPSS and are presented here. All decisions on the statistical significance were made using a criterion alpha level of .05.

Research Question 1

Research question 1: Do motivational incentives in the form of autonomy impact performance on tasks in an ego-depleted state?

Null hypothesis 1a: While controlling for differences in trait self-control, mean interference scores for correct trials on Task 2 will not differ between groups.

Alternative hypothesis 1a: While controlling for differences in trait self-control, mean interference scores for correct trials on Task 2 will differ between groups.

Analysis 1a: Interference scores were calculated (see Table 2), and a 2 (ego-depletion: yes or no) x 2 (autonomous reward motivation: incentivized or nonincentivized) factorial analysis of covariance (ANCOVA) with BSCS score as a covariate, was conducted. A preliminary analysis evaluating the homogeneity-of-regression assumption indicated the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variables, $F(3,185) = 0.71$, $p = .546$.

Table 2

Means and Standard Deviations for Interference Scores by Group

	Nondepleted			Depleted			Total		
Motivation	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*	*Mean*	*SD*	*n*
Nonincentivized	125.66	74.21	43	121.64	65.53	41	123.70	69.71	84
Incentivized	130.65	67.36	54	154.40	80.86	54	142.52	75.02	108
Total	128.44	70.15	97	140.26	76.03	95	134.29	73.16	192

Note. Lower interference scores indicate less of a difference between congruent and incongruent trials on the Stoop test, therefore better self-control.

The results of the ANCOVA indicated no significant main effect for depletion condition $F(1, 187) = 1.08$, $p = .299$, nor motivation condition $F(1, 189) = 3.23$, $p = .074$. There also was no significant interaction effect between depletion condition and motivation condition, $F(1, 187) = 2.20$, $p = .140$. (See Table 3). Based on these findings, it appears that participants in either the depletion or motivation conditions did not differ significantly in interference scores for the Stroop task after controlling for trait self-control. Somewhat surprisingly, nonincentivized participants had lower interference scores ($M = 123.70$, $SD = 69.71$), which indicates better self-control performance than the incentivized participants ($M = 142.52$, $SD = 75.02$), although this was not significant. As a result, the null hypothesis is retained.

Table 3

Summary Table for ANCOVA of the BSCS Total Score and Group on Stroop Interference Score

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Corrected Model	47504.41	4	11876.10	2.28	.063	.05
bscsTotalScore	15183.47	1	15183.47	2.91	.090	.02
Motivation	16831.62	1	16831.62	3.23	.074	.02
Depletion	5644.86	1	5644.86	1.08	.299	.01
Motivation x Depletion	11471.90	1	11471.90	2.20	.140	.01
Error	974879.15	187	5213.26			
Total	4484772.98	192				
Corrected Total	1022383.56	191				

Null hypothesis 1b: While controlling for differences in trait self-control, mean error rate on Task 2 will not differ between groups.

Alternative hypothesis 1b: While controlling for differences in trait self-control, mean error rate on Task 2 will differ between groups.

Analysis 1b: The same analyses were conducted again, except the total incorrect count for the Stroop task was used as the dependent variable (see Table 4). A 2 (ego-depletion: yes or no) x 2 (autonomous reward motivation: incentivized or nonincentivized) factorial analysis of covariance (ANCOVA) was conducted, with BSCS as the covariate. A preliminary analysis evaluating the homogeneity-of-regression assumption indicated the relationship between the covariate and the dependent variable did not differ significantly as a function of the independent variables, $F(3,185) = 0.38$, $p = .765$. This indicates that the BSCS score was not significantly different between the different groups.

Table 4

Means and Standard Deviations for Error Rate for Stroop Task by Group

	Nondepleted			Depleted			Total		
Motivation	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*	*Mean*	*SD*	*N*
Nonincentivized	3.56	3.95	43	4.63	5.76	41	4.08	4.91	84
Incentivized	4.02	5.10	54	4.00	4.50	54	4.01	4.79	108
Total	3.81	4.61	97	4.27	5.06	95	4.04	4.83	192

The results of the ANCOVA indicated no significant interaction between motivation and depletion, $F(1, 187) = 0.54$, $p = .465$, and no evidence of statistically significant differences for the two main effects of depletion or motivation. (See Table 5). Based on these findings, it appears that participants in either the depletion or motivation conditions did not differ significantly in the number of incorrect responses for the Stroop task. As a result, the null hypothesis is retained.

Table 5

Summary Table for ANCOVA of the BSCS Total Score and Group on Error Rate for the Stroop Task

Source	*SS*	*df*	*MS*	*F*	*p*	η_p^2
Corrected Model	27.99	4	7.00	.30	.881	.01
bscsTotalScore	3.42	1	3.42	.14	.704	<.01
Motivation	.36	1	.36	.02	.903	<.01
Depletion	13.98	1	13.98	.59	.443	<.01
Motivation x Depletion	12.68	1	12.68	.54	.465	<.01
Error	4427.68	187	23.68			
Total	7592.00	192				
Corrected Total	4455.67	191				

Research Question 2

Research question 2: Is there a relationship between trait self-control and performance on tasks in an ego-depleted state?

Null hypothesis 2a: Mean interference scores for correct trials on Task 2 will not depend on level of trait self-control.

Alternative hypothesis 2a: Mean interference scores for correct trials on Task 2 will depend on level of trait self-control.

Analysis 2a: Level of trait self-control was measured by the participants' scores on the BSCS. An analysis of covariance (ANCOVA) was conducted to determine if interference scores on the Stroop test were significantly related to BSCS score. The ANCOVA that was utilized to investigate null hypothesis 1a found no significant relationship between BSCS scores and mean interference scores for correct trials on Task 2, regardless of depletion condition. Therefore, the null hypothesis is retained.

Null hypothesis 2b: Mean error rate on Task 2 will not depend on level of trait self-control.

Alternative hypothesis 2b: Mean error rate on Task 2 will depend on level of trait self-control.

Analysis 2b: Level of trait self-control was measured by the participants' scores on the BSCS. An analysis of covariance (ANCOVA) was used to determine if error rates on the Stroop test were significantly related to BSCS score. The ANCOVA that was utilized to investigate null hypothesis 1b found no significant relationship between BSCS

scores and mean error rate on Task 2, regardless of depletion condition. Therefore, the null hypothesis is retained.

Summary

A true experiment with a 2 (ego-depletion: yes or no) x 2 (autonomous reward motivation: incentivized or nonincentivized) between-subjects factorial design was conducted on MTurk. The variables that were obtained for manipulation checks were analyzed and reported in this chapter. The analysis indicated that there were no significant differences in the effort and energy scores between those who continued and those who chose not to continue, suggesting that those who declined to participate further were not more depleted than the other participants. Participants in the motivational incentive condition had significantly higher scores on the perceived choice subscale of the IMI than those who were in the nonincentivized condition, but there was no significant difference for the interest/enjoyment subscale. This result suggests that participants in the motivational incentive condition were more autonomously motivated but not significantly different in intrinsic motivation than the nonincentivized condition.

As expected, workers who completed the depleting version of Task 1 rated Task 1 significantly more difficult than the workers who completed the nondepleting version of Task 1. And for Task 2, which was the same for all groups, no significant difference was found between the depleted and nondepleted groups. Manipulation check results also indicated that a minority of the participants had participated in similar tasks in the past, and this previous participation did not seem to have an impact on the results of the current study.

Analyses of covariance indicated no statistically significant differences between Stroop scores for participants who completed the depleting version of Task 1 and those who completed the nondepleting version of Task 1, whether the Stroop scores were based on interference scores or by number of incorrect responses. Likewise, analyses of covariance indicated no statistically significant differences between Stroop scores for participants who were given the autonomous motivational incentive of the choice to proceed and those who were not, whether the Stroop scores were based on interference scores or by number of incorrect responses. No covariance of individual differences in self-control were found, based on the BSCS scores. Based on these results, the null hypotheses developed for the study were all retained. Interpretation of these findings, along with recommendations for future study and implications for social change are presented in Chapter 5.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

The primary purpose of this experimental study was to study whether or not there is a correlation between ego-depletion and motivation. In addition, trait self-control was researched as a potential covariate. A factorial analysis of covariance was used to determine if Stroop test scores (measured as interference scores and as number of errors) differed by depletion condition or motivation condition after adjusting for differences in trait self-control using the BSCS.

Two research questions were the foundation for the hypotheses: Do motivational incentives in the form of autonomy impact performance on tasks in an ego-depleted state? Is there a relationship between trait self-control and performance on tasks in an ego-depleted state?

The first hypothesis examined whether there were differences in performance on a demanding self-control task between participants who had previously performed a demanding self-control task (or a simple version) and those who were offered a motivational incentive in the form of autonomous choice (or were not offered a choice), covarying for trait self-control. The results of the 2 x 2 factorial ANCOVA revealed no statistically significant difference for the two main effects of depletion or motivation, or for their interaction. Therefore, the null hypothesis (1a) of *no difference in mean interference scores for correct trials on Task 2* was retained. The null hypothesis (1b) of *no difference in mean error rate on Task 2* was also retained.

The second hypothesis explored whether there was a relationship between trait self-control and performance on tasks in an ego-depleted state. The results of the 2 x 2 factorial ANCOVA showed no significant difference in the BSCS between the groups. Therefore, the null hypotheses of (2a) *mean interference scores for correct trials on Task 2* and (2b) *error rates on Task 2 will not depend on level of trait self-control* were retained.

In summary, the null hypothesis was retained for all of the hypotheses. The analysis of the effects of depletion and motivation on performance of a demanding self-control task while controlling for individual levels of trait self-control revealed no significant differences.

Interpretation of the Findings

At the core of these results is that there was no significant decrease in performance for depleted participants compared with nondepleted participants. In other words, this study's results did not replicate the ego-depletion effects that have been observed in hundreds of previous studies. A number of explanations for this result can be considered.

First, it is possible that estimates of the depletion effect have been overstated. According to the meta-analysis by Hagger et al. (2010), the overall depletion effect size was estimated to be $d = 0.62$ (95% confidence interval [0.57, 0.67]). However, Carter and McCullough (2014) posited that the effect size calculated in the meta-analysis would be more influenced by publication bias than Hagger and colleagues had controlled for. Carter and McCullough's bias-corrected estimates for effect size were much lower ($d =$

.25 at most, and possibly zero). If this is correct, this would indicate that sample sizes should be considerably larger (250 participants per condition for 80% power, according to Inzlicht & Berkman, 2015). The Association for Psychological Science (2014) has recently commissioned a registered replication project, so this should help answer questions of this nature in the future. The results will be published in a future issue of *Perspectives on Psychological Science*.

Second, it is possible that all participants were already depleted. Since most of the HITs were completed on Christmas Eve, and the rest on Christmas morning, it is worth considering the possibility that the participants were already in a depleted state when they started the experiment. However, there are a couple indications that this may not have been the case. Although ego-depletion is not simply defined as current energy level, the answers to participants' self-reported energy levels after Task 1 give some indication as to whether they may have felt ego-depleted. The answers to this question ranged from 1 (*low*) to 7 (*high*). There was only one response for the lowest level, and 30 workers rated their energy level at 7. Additionally, it is counterintuitive to think that if people were too depleted that they would decide to look for HITs to work on MTurk, but it is possible. Studies with MTurk participants do not always report what time of day the HITs were posted, but it would be interesting to investigate potential differences in performance for tasks posted at different times of the day.

Third, it is possible that ego-depletion is a phenomenon that is mostly experienced in laboratory studies of undergraduate students, and that it is less likely to happen for MTurk workers. The overwhelming majority of past research on this topic has utilized

undergraduate university students, but there have been studies using other populations, including MTurk, as reviewed in Chapter 2. There do not appear to be any notable differences in demographics between this study and the previously reviewed studies (e.g., J. T. Chow & Lau, 2015; Derrick, 2012; Milkman, 2012; Yam et al., 2014), although some of the articles did not go into much detail about their worker requirements. This shows that the depletion effect can be replicated on MTurk, but it does not help to explain why it happens or what it is. If a relatively difficult four-minute task can cause noticeable impacts on performance of the next task, how could MTurk workers (or anyone, for that matter) sit for hours successfully completing multiple sequential tasks? Perhaps the explanation is that ego-depletion is really just a form of mental fatigue (Inzlicht & Berkman, 2015), and people retain the capacity to expend further effort if they decide to. This would also be consistent with both of the theoretical foundations for this study, the process model of depletion and the self-determination theory.

A closely related fourth possibility is that all participants were similarly motivated, regardless of which experimental manipulation they were given. This study was designed to manipulate autonomous motivation, with the idea that more autonomous motivation would help alleviate the effects of depletion. If everyone already felt autonomously motivated to perform tasks on MTurk, it is possible that the manipulation did not have an additional impact.

Limitations of the Study

One of the limitations of this study is the nonprobability sampling method. The sample for this study was obtained from a convenience sample of MTurk workers. Since

this is a nonprobability sample, it will not be possible to generalize the results of this study to the broader population of MTurk workers or beyond. The results of this study will need to be viewed as part of a larger context of studies on this topic.

Another possible limitation for this study is known as diffusion of treatment (Creswell, 2014). The possibility exists that participants could have discussed the study with each other. MTurk workers have online forums, and it is also conceivable that friends could tell each other about HITs using other forms of communication. However, a quick Google search did not find any results for my name in conjunction with MTurk, and the risk of prior knowledge about the study's true intentions affecting performance is low. Regardless, the debriefing form contained a request for the participants not to discuss the study with others to help safeguard against the potential for diffusion of treatment.

Recommendations

In this study, I extended the research on depletion, motivation, and the impact of trait self-control in a nontraditional sample. Future research should include much larger sample sizes, as recommended by Carter and McCullough (2014), and as is currently being coordinated by the Association for Psychological Science replication project. Future studies that use MTurk should also investigate whether there are differences in performance levels at different times of the day. I also recommend the use of much more difficult tasks to induce depletion.

Perhaps the most beneficial action that researchers could take is to align the depletion research with research on mental fatigue as recommended by Inzlicht and

Berkman (2015). Fatigue has been researched for over a hundred years, and it has a lot in common with ego-depletion. As Inzlicht and Berkman (2015) explained, the onset of depletion seems to happen more quickly, but otherwise depletion and fatigue appear to be essentially the same phenomenon. Additionally, when the resource model analogizes self-control to a muscle that is depleted after use, this lends itself to the idea that the phenomenon being described is actually fatigue. Future research should do more to integrate these concepts.

Implications for Social Change

This research project was undertaken with a goal of understanding more about the mechanisms behind the phenomenon of ego-depletion and its effect on self-control. The more that is known about what specifically is being observed in the studies on this topic, the better this knowledge can be used for positive social change. As an example, if people know that they will be depleted in certain conditions, they can use this information to make better choices. Anyone who is working to achieve a goal may be better able to utilize their self-control if they understand factors that may potentially cause their energy to wax and wane. Practitioners will also be better able to help their clients if they have an increased understanding of the factors contributing to self-control.

Conclusion

The purpose of this experiment was to study whether or not there is a correlation between ego-depletion and motivation, while also helping to clarify the potential impact of trait self-control in a sample that is more representative of the U.S. population than the traditional research pool of undergraduate college students. While the analyses of the data

did not show significant findings, this is still an extension of the ego-depletion research and the information is valuable. This project is a snapshot of what happened at one particular time with one sample of participants, and is thus one sentence in the bigger conversation of research pertaining to self-control and motivation.

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Appendix A: Items from the Brief Self-Control Scale

1. (R) I have a hard time breaking bad habits.

2. (R) I am lazy.

3. (R) I say inappropriate things.

4. (R) I do certain things that are bad for me, if they are fun.

5. I refuse things that are bad for me.

6. (R) I wish I had more self-discipline.

7. I am good at resisting temptation.

8. People would say that I have iron self-discipline.

9. (R) Pleasure and fun sometimes keep me from getting work done.

10. (R) I have trouble concentrating.

11. I am able to work effectively toward long-term goals.

12. (R) Sometimes I can't stop myself from doing something, even if I know it is wrong.

13. (R) I often act without thinking through all the alternatives.

Participants are asked to rate the degree to which each of the statements reflects how they typically are. All responses are given on a five point scale, with 1 representing "Not at all like me" and 5 representing "Very much like me".

Appendix B: Permission to Use Brief Self-Control Scale

Gmail by Google

Mark Heilman <mark.heilman@waldenu.edu>

Re: Request to use Brief Self Control Scale in Doctoral Research

1 message

June P Tangney <jtangney@gmu.edu> Wed, Jun 17, 2015 at 8:33 AM
To: "mark.heilman@waldenu.edu" <mark.heilman@waldenu.edu>

Hello Mark,

You are more than welcome to use our measures. I am attaching the Brief Self-Control Scale along with scoring information. Please do keep in touch and let us know how your research develops. I would be grateful for a summary of the results whenever they become available.

Best wishes,

June T.

From: Mark Heilman [mailto:mark.heilman@waldenu.edu]
Sent: Monday, June 15, 2015 7:49 PM
To: June P Tangney
Subject: Re: Request to use Brief Self Control Scale in Doctoral Research

Hello, Dr. Tangney -

Can you please let me know the procedure for obtaining permission to use the BSCS in my doctoral research?

Thank you,

Mark Heilman, A00256187

Student, Ph.D. in Psychology – Social Psychology

Walden University

Appendix C: Permission to Use Intrinsic Motivation Inventory

Self-Determination Theory
An Approach to Human Motivation and Personality
Questionnaires

Research on Self-Determination Theory has included laboratory experiments and field studies in several different settings. In order to do this research, we have developed many questionnaires to assess different constructs contained within the theory. Each questionnaire page will typically include not only the scale itself, but also a description of the scale, a key for the scale, and references for articles, which describe studies that used the scale.

In order to access these questionnaires you must first register and log into the website. On registration page you will be asked to agree terms and conditions stating that you will only use the scales for academic research. Once this is complete you will have access to the scales while logged in to the website.

*** Please note that all questionnaires on this web site, developed for research on self-determination theory, are copyrighted. You are welcome to use the instruments for academic (non-commercial) research projects. However, you may not use any of them for any commercial purposes without written permission to do so from Edward L. Deci and Richard M. Ryan.

General Causality Orientations (GCOS)
Perceived Autonomy Support
Self Regulation Questionnaires (SRQ)
Perceived Competence Scale (PCS).
Intrinsic Motivation Inventory (IMI).
Health Care SDT Packet (HC-SDT).
Aspirations Index (AI).
Basic Psychological Needs Scale (BPNS)
Self Determination Scale (SDS)
Subjective Vitality Scale (VS)
Motivators Orientation
Perception of Parents Scale (POPS)
Christian Religious Internalization
Treatment Motivation Questionnaire
Motives for Physical Activity
Measure (MPAM-R)
Mindful Attention Awareness Scale
Problems in Schools Questionnaire:
Adults Orientation toward Control (PIS)

www.selfdeterminationtheory.org

Appendix D: Demographic Questions and Manipulation Checks

The following questions were asked to gather demographic information and to use as manipulation checks:

What is your age? _____

What is your gender?

- □ Male
- □ Female
- □ Prefer not to answer

What is the highest level of education you have completed?

- □ Less than high school
- □ High school or equivalent
- □ Vocational/technical school (2 year)
- □ Some college
- □ College graduate (4 year)
- □ Master's Degree (MS)
- □ Doctoral Degree (PhD)
- □ Professional Degree (MD, JD, etc.)

On a scale of 1 – 7 (1 = *not at all* to 7 = *very*)
Please rate the level of difficulty of task 1: _____
Please rate the level of difficulty of task 2: _____

Have you participated in previous studies with similar tasks?

- □ Yes
- □ No