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Where There's a Will, There's a Way: Implementing Motivational Strategies to Combat Decision Fatigue

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Table of Contents

Abstract

Recent research suggests we have a limited supply of willpower, termed the “ego”, which becomes depleted by undergoing cognitively demanding tasks. Any acts of volition, including decision-making, self-control, and taking responsibility, reduce this supply of “ego” (Baumeister, 1998), which impedes our ability to further perform these tasks. Decision fatigue, a specific form of ego depletion, is prevalent everywhere from judicial court cases (Danzinger, Levav, & Avnaim-Pesso, 2010) to our daily lives. There is now significant mainstream media exposure and literature on decision fatigue and the activities to which it applies. However, it remains contested how to best handle its negative consequences. The purpose of this paper is to examine methods of addressing the adverse effects of ego depletion, particularly related to motivation.

Introduction

Whether in our daily lives or occupations, we are all faced with a multitude of decisions each day. Do you put on a white shirt or a blue shirt today? What items do you get at the supermarket? Which project should you get started on first? At first glance, these may seem like inconsequential daily actions, with little potential for further examination. However, research suggests there is a limited storage of willpower that can be depleted by making all these choices. In fact, this effect extends to any cognitively demanding task, which draw upon the same resource. By completing these tasks each day, no matter how small, we gradually deplete our temporary capacity for further tasks.

Background Research

Ego depletion. Before examining the concept of decision fatigue, it is important to examine the root of the issue: ego depletion. A couple decades prior, the notion of a depletable supply of "ego" did not exist in scientific circles. Ego depletion primarily deals with acts of volition, which includes making decisions, taking responsibility, initiating behavior, and executing actions. These actions are critical because they are necessary in our daily lives and shape the world around us. On a large scale, a deficiency of these actions contributes to many prevalent global issues, including "addiction, alcohol abuse, drug abuse, eating disorders and binges, unwanted pregnancy, AIDS and other sexually transmitted diseases, debt and bankruptcy", among others (Baumeister, 2002). Research on this topic has also presented a number of significant empirical findings on an individual level, including "depletion effects on information processing, intellectual performance, impression management, and violent responses to provocation by a partner" (Job et al., 2010). The fact that ego depletion has been linked to such a wide variety of examples gives an idea of its far-reaching impact.

In order to understand the rationale behind introducing ego depletion, it is essential to present a snapshot of psychology during this time period (the late 90's). Before this time, psychologists had considered humans to be mostly autonomous beings, exerting "planful or deliberate control by the self" (Baumeister et al., 1998). That is, they believed each decision was made consciously and that people had full agency over what influenced their decisions. Most research conducted involved conscious actions, and little thought was given to the effect of unconscious processes on humans. However, recent research strongly suggests that these these processes can have a substantial effect, particularly on acts of volition.

The primary concept behind ego depletion is that these actions all draw on some form of resource, much like physical strength or energy. Individuals deplete this resource by undergoing acts of volition, and fewer amounts of this resource results in a decreased capacity to further undergo these actions. Social psychologist Roy Baumeister coined this effect as *ego depletion*, named loosely after Freud's concept of the *ego*. Just like the Freudian concept, Baumeister's ego is linked to self-regulation and logical decision-making. *Ego depletion* is formally defined by Baumeister as "a temporary reduction in the self's capacity or willingness to engage in volitional action (including controlling the environment, controlling the self, making choices, and initiating action) caused by prior exercise of volition." (Baumeister, 1998). It is important to specify that the adverse effects of ego depletion are temporary; by undergoing these tasks every day we are not causing permanent damage to our brains.

The idea of ego depletion was pioneered by Baumeister and his colleagues in a pilot study examining its effect on individuals' cognitive performance. The goal of this study was to figure out whether different acts of volition would "undermine self-regulation in a subsequent, unrelated domain, namely persistence at a difficult and frustrating task" (Baumeister, 1998). If

the initial tasks indeed affected the unrelated later task, it would suggest that all of these acts of cognition relied on the same resource. In the study, three groups of participants were assigned to tasks that involved exerting self-control, taking responsibility, and suppressing emotions, respectively. They were then asked to solve a series of puzzles, which is a cognitively demanding task. The study found that each of the three actions decreased performance on the subsequent task, compared to the control group. When participants underwent any of these actions before performing the main task, they not only performed poorly but also gave up up sooner than the others. These results show that these acts of volition significantly affect cognitive performance and are interrelated, which creates an important bridge for the rest of this discussion.

Decision fatigue. It is an often cited statistic that the average individual makes 35,000 decisions a day (Hoomans, 2015). Although this is very likely an exaggerated number, there is no denying that we make countless decisions every day. Before examining the problem of decision fatigue, it is important to define what constitutes a decision. For the purposes of this paper, a decision is defined as “the making up of one’s mind on any point or course of action” (Sahakia & LaBuzetta, 2013). This is a very lax criteria to fit, which means a great number of instances in daily life qualify as decisions. Some may argue that this definition is too permissive, and includes too many insignificant actions. However, that is exactly the point: each of these cognitive actions, no matter how minor, contribute to a gradually decreased “ego”.

Logically, individuals should make the optimal decision in each situation to best benefit themselves and others. Traditional psychology would agree with this line of thinking; for a long time, the field of psychology has focused on the individual as a perfectly logical decision-maker. However, we find that this is seldom the case. Humans often make illogical decisions, some of

which can have disastrous consequences. This applies to not only the average individual, but also some of the most highly trained professionals in the world. Why does this happen?

Whereas Baumeister's pilot study examined ego depletion as an effect caused by exerting self-control and taking responsibility, this effect reaches far beyond these two tasks. Notably, it applies to decisions we make every single day, no matter how inconsequential they seem. One must remember that Baumeister and his colleagues claimed ego depletion applies to any act of *volition*, in other words a cognitively demanding task. Before examining why decisions contribute to ego depletion, it is crucial to define the threshold that makes a task cognitively demanding. According to psychologists, there are two primary types of mental processes: automatic and controlled. Controlled processes require logical reasoning and drain this supply of "ego". Automatic processes, on the other hand, typically involve rote memory and can be accomplished without significant exertion (Baumeister & Tierney, 2011). As one might imagine, applying logical reasoning to new situations is far more taxing than simply recalling information. This distinction has large real-world implications. Whereas some occupations rely primarily on muscle memory (professional sports), others require constant use of cognition in uncertain situations (law enforcement). This is important because it completely changes the magnitude of decision fatigue people are faced with each day, and subsequently changes the optimal approach for addressing the issue.

The idea that each decision contributes to a depleted ego has created an entire new subfield: decision fatigue. Because it is a controlled process, decision-making has a similar draining effect as other cognitive processes, such as exerting self-control or taking responsibility. The more decisions we make in a period of time, the lower capacity we will have for making

further decisions. This is the effect that causes everyone, even trained professionals, to make questionable decisions at times.

Among the most prominent empirical examples of decision fatigue is judicial parole boards. This example is particularly interesting because it involves highly experienced judges making decisions. Granting parole is a cognitively demanding task due to the multitude of risks and factors involved. Several times a day, these judges have to make the tough decision on whether to grant parole to the prisoner. By granting parole, judges appease the prisoner's family and save taxpayers some money. However, they also risk the defendant proceeding to commit another crime after their release (Baumeister & Tierney, 2011). Rejecting the parole appeal is the far "safer" option, as it prevents a potentially dangerous individual from re-entering society. When considering a parole appeal, particularly from a high-profile defendant, judges need to not only consider the potential impact from the individual but also the potential backlash from the public (Hill, 2010). A quick glance at the statistics suggests this is the much more common option, as only about one in three parole appeals are granted on average. This figure seems completely normal, but a closer look shows that parole rates differ wildly depending on the time of day. One might expect these highly trained judges to make impartial decisions based only on the content of the appeal, but data shows that this is hardly the case. It is no coincidence that criminal justice researchers used to claim these judgments might as well be dependent on "what the judge ate for breakfast" (Baumeister & Tierney, 2011). What exactly contributes to this disparity?

In a study involving 1,112 judicial rulings in Israeli courts, researchers discovered significant correlations between time of day and the likelihood of parole being granted. Although approximately one-third of the appeals were granted parole, the success rates varied wildly

depending on the time of day. In this study, on each day of judicial ruling judges had three separate “decision sessions”, each separated by a short meal break. The researchers found that every judge on the board was more likely to rule in favor of the prisoner at the start of each “decision session”. That is, the start of the day or directly after a meal break were the optimal times for prisoners to receive parole (Danzinger, Levav, & Avnaim-Pesso, 2010). However, this was not just a slight correlation. In fact, the effect of time of day on parole probability found in this study was staggering. Towards the beginning of the day, the judges granted parole about 65% of the time. This rate declines to nearly zero at the end of a “decision session”, and spikes back up to around 65% after a meal break (Danzinger et al., 2010). This finding is highly significant, as it means a prisoner’s chance at a new life could be decided almost entirely by when their hearing occurs, over which they have no control. Furthermore, this correlation was found to be very consistent throughout all 1,112 judicial rulings, which strongly suggests that there is a link between time of day and the probability of parole. Since these surges occurred only after meal breaks, the results strongly support the idea of a depletable “ego”. In all, this data lends strong support to the notion that making repeated judgments is a mentally taxing task, and that some form of resource needs to be replenished. It shows that no one is safe from the adverse effects of decision fatigue, even professionals.

Counterpoints

Even though there is plenty of research supporting the existence of ego depletion, it is important to note that it is not a unanimously accepted theory. Indeed, as a concept barely two decades old, it is still rather fluid in nature and must be examined in a critical light. Before proceeding to solutions to the problem, it is critical to acknowledge and handle critiques of the

theory. We address two primary objections from critics: its pseudoscientific nature and sleep deprivation as a confound.

Pseudoscience. Without a doubt, one of the most common critiques on the idea of ego depletion is its pseudoscientific nature, namely that there is a lack of hard evidence to support the theory. A major reason why this occurs is its mainstream media exposure. Namely, many widely available articles on decision fatigue or ego depletion make sweeping generalizations and are poorly cited. Indeed, it is not difficult to imagine why a critic would be skeptical about accepting this idea.

Aside from its mainstream exposure, the notion of a depletable willpower does not sound like something measurable or concrete, which makes it difficult to create scientific inquiries. It seems that a variety of factors could contribute to a decrease in cognitive ability, and it would be all too convenient to attribute all the causes to one factor. At its inception, there was perhaps some truth to this objection. In fact, for a time it served as a "highly convenient metaphor that explains a broad range of empirical findings" without much physical evidence (Gaillot et al., 2007). The main problem with the initial studies is that they all seemed to confirm each other without offering many alternative explanations. It should be recalled that ego depletion was linked to a wide variety of seemingly unrelated topics, such as "depletion effects on information processing, intellectual performance, impression management, and violent responses to provocation by a partner" (Job et al., 2010). Without evidence on the physiological effects of ego depletion, there is little reason to believe it has a tangible effect on human beings. If there is no tangible effect, then how can the theory be applied to anything?

Though older studies have focused primarily on the wide applicability of ego depletion, recent research has given it further validation by presenting its physiological effects. It has

shown that the idea of a perishable “ego” supply has concrete underpinnings. A major recent finding is that the repeated exertion of self-control results in decreased levels of blood glucose, which in turn is linked to poorer performance. In a series of nine studies on the topic, researchers found a consistent correlation between glucose levels and cognitive performance. They found that participants who underwent self-control tasks had decreased levels of glucose in the bloodstream, and in turn performed worse on subsequent tasks (Gaillot et al., 2007). This finding is critical in that it provides ample neurological data for ego depletion, which largely addresses the concern for a lack of evidence.

Sleep deprivation. One other major objection to the concept of ego depletion is that its effect does not uniquely influence individuals. In other words, different factors could contribute to the same depleting effect. A few potential confounding variables have been cited, and perhaps most notable is sleep deprivation.

Sleep deprivation is a particularly important confound due to its prevalence in society. In a self-report survey by the National Sleep Foundation, approximately four in ten Americans reported having enough sleep each night (Marcus, 2010). This has potentially massive consequences for the concepts of ego depletion and decision fatigue if sleep deprivation is determined to be a significant confound. If more than half of the population suffers from a lack of sleep, it can be very difficult to determine whose abilities are impeded by physical fatigue rather than ego depletion or decision fatigue. There are many factors potentially leading to sleep deprivation, both physiological and environmental. From nocturnal occupations such as healthcare and security to a general tendency for prolonged wakefulness, many individuals suffer from a lack of sleep (Alhola & Polo-Kantola, 2007). The widespread nature of sleep deprivation makes it difficult to discern from other factors regarding cognitive performance. People suffer

from different levels of sleep deprivation and respond differently to it, which makes it even more confusing to differentiate.

The main argument for sleep deprivation is that it can contribute largely to a decreased capacity for cognitive tasks, rather than ego depletion. Indeed, common sense dictates that sleep-deprived individuals would display a compromised ability to make sound judgments. Sleep has been found to be critical for a number of mental processes, but especially for memory-related cognitive performance (Maquet, 2001). Without sufficient sleep, this ability is strongly restricted. A lack of sleep has been shown to create lapses in attention and adverse effects on brain structures. Typically, cognitive performance is based on two measures: speed and accuracy. Participants that are subjected to either partial or total sleep deprivation tend to exhibit both lower speed and accuracy, but especially the former (Alhola & Polo-Kantola, 2007).

The issue of sleep deprivation is even more complex because it introduces a new host of problems. Namely, a lack of sleep can result in high blood pressure and elevated levels of cortisol, both of which have been linked to stress (Lac & Chamoux, 2003). Stress is potentially another confound variable influencing cognitive performance, as it can impede our ability to function normally. All of these factors point to sleep deprivation as an important confound in the study of decision fatigue.

Due to the complicated nature of sleep deprivation and the other problems it brings, it can be very difficult to approach the issue. It is challenging to not only identify these problems, but also quantify the impact of sleep deprivation on each individual. Thankfully, research has been done specifically on the effects of sleep deprivation on ego depletion. Specifically, psychologists have found that sleep deprivation had no significant effect on the ability to exert self-control. It should be recalled that self-control is linked to fatigue because they both rely on the same

resource. If resource depletion through self-control is not significantly affected by sleep deprivation, then there is reason to believe that fatigue will also not have a substantial effect on decision-making.

In a study where some of the participants were deprived of sleep for 24 hours, researchers found that the sleep-deprived individuals did not perform significantly differently from the control group in the following task (Vohs et al., 2011). In this experiment, the researchers measured participants' reaction to a disgusting video and loud noises. The intensity of their reaction was largely used as a measure of how much self-control they exerted. This is especially important because a lack of sleep had been previously linked to higher levels of aggression, especially in adolescents (Meijer, Habekothe, & Van Den Wittenboer, 2000). This experiment involved much older individuals, and found that those who were sleep deprived were able to regulate themselves similarly to those who were not (Vohs et al., 2011). This finding suggests that sleep deprivation does not have a substantial effect on ego depletion.

Fatigue may not have a large effect on self-regulation, but it becomes more complicated when applied to decision-making. It is well documented that sleep deprivation leads to a decrease in several areas of cognition, including decision-making. In particular, it impairs higher-level thinking (Harrison & Horne, 2009). Researchers have found that, when subjected to total sleep deprivation, subjects' performance on cognitive tasks decreased dramatically. In one particular study, sleep deprivation was found to have the same effect on cognition as aging; younger subjects who were sleep deprived performed about the same as older subjects, who almost entirely performed worse overall (Goel et al., 2009). This shows the magnitude of the effect of sleep deprivation, as it almost mirrors the negative effects of something as long-term as aging. Not only does sleep deprivation reduce our ability to think, but it also results in

"microsleeps", which are temporary lapses in attention (Doran, Van Dongen, & Dinges, 2001). These results show that sleep deprivation may have a significant effect on cognitive tasks, particularly decision-making. It is not immediately apparent whether sleep deprivation works in tandem with decision fatigue to explain ego depletion, or serves to disprove the theory. However, one thing is certain: sleep deprivation is certainly an important variable to consider when studying decision fatigue.

Proposed Solutions

Having examined the current state of decision fatigue and the overarching ego depletion theory, we now examine some solutions to the problem. Before presenting the experiments and solutions of this paper, we first investigate ones that have already been proposed.

Reduce decisions. Perhaps the most obvious way to approach decision fatigue is to simply reduce the number of decisions we make every day. Indeed, this solution would make the most logical sense; the fewer decisions we need to make each day, the more capacity we will have to make further decisions. This solution would be parallel to spending less money; by doing so, we have more resources in our emotional "bank". There are two main ways of accomplishing this: simplifying or delegating decisions.

Simplifying decisions is a proven way of reducing decisions, and this strategy has been used by multiple influential figures. Mark Zuckerberg and Barack Obama are among the most high-profile individuals who employ this strategy. Having some level of awareness over the issue of decision fatigue, they elect to choose from a very small pool of outfits each morning. Zuckerberg wears the same gray t-shirt every single day, whereas Obama wore either a gray or blue suit practically every day during his time as president (Baer, 2015). Logically, these actions reduce the amount of decisions they make each day. Because any insignificant action can

contribute towards depleting this supply of “ego”, any reduction of these actions should be seen as a positive.

Without a doubt, these strategies can be very effective, especially for individuals whose occupations demand a copious amount of decision-making. However, simplifying decisions falls short for two key reasons. First, though it is an effective strategy for a few decisions, it is ultimately limited because there are only a certain number of decisions that can be eliminated. Whereas simple tasks such choosing an outfit can be simplified to one or two choices, many decisions cannot be avoided. Second, it is simply a temporary solution to a bigger problem. By reducing decisions, an individual is not increasing their capability to deal with decision fatigue. Therefore, while it certainly has utility, simplifying decisions is ultimately limited in its scope.

A different way to reduce decisions is to delegate decision-making, especially on inconsequential actions. That is, we can hand off our decisions to someone else in an attempt to reduce decision fatigue. Indeed, this is the preferred method of CEOs to handle their decisions. Because CEOs face a high volume of decision-making every day, it is very important that they employ an efficient method for dealing with these decisions. Due to this volume, many CEOs end up delegating decisions, even when they were more qualified to make the decision than the other person (Graham, Harvey, & Puri, 2015). Additionally, making choices for others has been shown to be less depleting than making choices for ourselves (Polman & Vohs, 2016). Delegating decisions is a tried and true method of reducing the amount of decisions in a day, and undoubtedly leads to a decrease in decision fatigue.

However, the issues with delegating decision-making are two-fold. First, it is simply impractical for the average individual to delegate most of their decisions. It clearly works well for people in higher positions, who have others to hand their decisions to. The reality is that most

people, unlike CEOs, do not have subordinates to whom they can delegate decisions. Thus, this solution is not a practical one for many people. Although both strategies of reducing decisions are useful for their specific purposes, they are definitely limited in their reach.

Training. Another plausible solution to address decision fatigue is training people to make decisions. Theoretically, this is a better solution than reducing decisions because it gives them long-term resilience to the issue. This solution is similar to working out, as it is essentially training the ego "muscle". Through directed practice, they could learn how to make decisions while using lower amounts of resources. This interaction has been tested with college students who were asked to regularly practice acts of volition, such as self-control and emotional regulation. The researchers expected the trained group to perform significantly better than the untrained group, as they had time to strengthen their "ego" muscle (Baumeister & Tierney, 2011). Contrary to their predictions, the trained participants performed no better than the others when they returned to the lab to perform emotional regulation tasks. Curiously, the participants performed much better on the self-control tasks. The researchers concluded that emotional regulation cannot be taught, but the other methodical tasks can be. This disparity suggests that different acts of volition, though they all draw on the same resource, are inherently different from each other. One notable exclusion from this study was decision-making. It remains to be seen whether decision fatigue can be significantly improved through similar training, and it seems that decision-making fits the profile of the "mechanical" tasks. However, it could be difficult to improve especially since each decision is unique.

Motivation. A third solution, very different from the other two, is to increase an individual's base motivation to complete a task. Like training, it is a more permanent and long-term solution than reducing the number of decisions. It has the resilience of the training solution

while being practical, as this method is accessible to anyone. However, that is not to say increasing someone's motivation is a simple task. It is sometimes simply not possible to change one's motivation on certain tasks.

When individuals are properly motivated, it can be a significant force in combating ego depletion. Before examining the effects of motivation, it is important to define its two types: intrinsic and extrinsic. Intrinsic motivation is defined as behavior "evoked from the feeling of pleasure, joy and fun". In other words, it applies to behavior that is done due to pure enjoyment of an activity. On the other hand, extrinsic motivation applies to behaviors for the sake of something else, like reward or recognition (Lee, Cheung, & Chen, 2005). This distinction is critical because these are two very different reasons for accomplishing a task, and subsequently lead to different results. In fact, research has shown that intrinsic motivation is far more resilient than extrinsic in increasing task performance (Rogstadius et al., 2011). This is not surprising, because intrinsic motivation involves performing a task purely for its enjoyment.

Extrinsic motivation has been shown to reduce the effects of ego depletion in individuals. Specifically, when motivated by outside factors such as incentives or seeking social acceptance, people are less affected by ego depletion (Baumeister & Vohs, 2007). It is speculated that this interaction occurs because this motivation gives individuals more resilience to deal with ego depletion. The fact that even extrinsic motivation helps reduce the effects of ego depletion bodes well for the impact of intrinsic motivation.

Goals of this Study

On a large scale, the main purpose of this study is to take the existing research on decision fatigue and ego depletion, and present a resilient practical solution to combating these effects. Whereas the groundwork for decision fatigue and ego depletion have largely been laid

out, there is a lack of literature concerning how to practically approach these issues. The purpose of the following experiments is not to examine additional neurological changes dealing with decision fatigue, or to examine how other variables besides decision fatigue may lead to the decreased cognitive ability. The aim of this study is to determine the most effective, ubiquitous, and widely applicable way to combat decision fatigue in daily life.

Experiments

Experiment 1

Introduction. Research on decision fatigue has consistently shown that it is linked to ego depletion, along with a host of other cognitively demanding tasks. These tasks all draw upon the same resource, which in turn powers these actions. A depleted "ego" leads to increased difficulty performing acts of volition, and vice versa. Before attempting to present solutions to decision fatigue, it is important to first tie a few loose ends.

Undoubtedly, much research has shown that all acts of volition are interconnected. However, just because they create similar effects does not mean they are equal. Namely, making decisions could result in a completely different *magnitude* of ego depletion than exerting self-control or taking responsibility. It is important to make this distinction because they are inherently different tasks. In fact, two different experiments presented earlier suggest that the different acts of volition may involve separate processes, even though they are all ego-depleting. For example, sleep deprivation was found to create substantial problems for decision-making (Harrison & Horne, 2009), but almost no consequences for self-control (Vohs et al., 2011). Additionally, in training participants in completing tasks of volition, researchers found that emotional regulation was very different from more methodical tasks, like self-control

(Baumeister & Tierney, 2011). These experiments strongly suggest that decision-making is inherently different from other acts of volition.

Because decision-making is suspected to be different from the other acts of volition, it logically follows that decision fatigue should be treated in a unique way. Since the purpose of this study is to examine a practical solution for tackling decision fatigue, we simply cannot use the research on other acts of volition and blindly apply it to decision-making.

The purpose of this first experiment is to determine whether decision-making and exerting self-control result in the same magnitude of ego depletion. That is, do these two actions impede individuals' cognitive abilities in the same way? Because decision-making and self-control draw upon the same resource but are inherently different processes, it is predicted that they will both result in decreased performance, but at different levels.

Methods. Approximately 60 subjects will participate in this hour-long study. Before the experiment, each subject will fill out an electronic questionnaire with demographic information including age, gender, and socioeconomic status. They will be instructed to not eat anything for 6 hours prior to the experiment, and will be randomly assigned into one of three groups (A, B, C). Participants from group A will answer ten additional multiple-choice items asking them to make various choices. An example of these questions would be: "In the event of an emergency, which of the following items would you be most likely to save?". Group A will be asked to find a seat and arrive at an unorganized workstation, then be told to arrange their desk based on their preference.

Group B will be presented with doughnuts and broccoli (a favorable and unfavorable food) on their desk. They will be instructed to eat only the broccoli and resist eating the doughnuts. No experimental manipulations will be done for Group C. Regardless of group, each

participant will be asked to complete a two-part series of puzzles. Each part should take approximately 25 minutes and these puzzles become increasingly more difficult. Accuracy and time spent on each question will be recorded by computer software to measure performance. All participants will be compensated upon successful completion of this study.

Results. In this experiment, there were two different acts of volition we tested for: decision-making and self-control. Group A was the "decision fatigue" group, group B the "self-control" group, and group C the control. First, we ask whether the effects of making repeated decisions are similar to those of exerting self-control. That is, did making the initial choices before the experiment have the same ego-depleting effect as resisting the doughnuts? The answer to this question is critical, because the purpose of this experiment was to determine whether these effects are the same.

In order to answer this question, we look at how well participants from each group were expected to perform on the puzzle task, on average (Figure 1). First, each participant's score from the two puzzle sections will be averaged out. Overall, these results assume a base 70% accuracy rate for the puzzles. Keeping this average in mind, it is expected that participants in the control condition will score around 70% accuracy overall. Participants in both groups A and B are expected to score much lower on the puzzle tasks since they were subjected to ego-depleting tasks.

Since this is a 1x3 between-subjects design, an ANOVA will be used with this data in order to provide an analysis of means between groups (Field, 2005). This analysis should show that the accuracy of group C differs significantly from that of groups A and B. The accuracy between groups A and B should be different, but not statistically significant. Participants in the decision fatigue group (group A) are expected to perform slightly worse because decision-

making is a potentially more taxing task than self-control. Previous research showed that physical fatigue had a much larger effect on individuals' decision-making than self-control ability (Harrison & Horne, 2009). Based on this data, it is very plausible that decision-making simply requires more resources than other acts of volition, which means it depletes the resources faster. Assuming decision-making depletes the ego faster, participants in the decision fatigue condition are expected to perform worse than those in the self-control condition.

However, this initial ANOVA analysis is only half the story. The other critical variable in measuring performance, besides accuracy, is speed. That is, how long did participants from each group take on the questions? This is a particularly important question because, with enough time, an individual can score just as accurately as someone with a higher cognitive ability (Wickelgren, 1977). In this case, the ego depleted individuals would like take more time than the control group to answer the questions. If this is the case, then it suggests that ego depletion has an even more drastic effect than was shown in the previous analysis (Figure 1). In order to account for the time variable, an ANCOVA analysis will be used to adjust the data (Field, 2005). The covariate in this case is the time spent on each question, as this is an important potential confound in determining accuracy. The base reaction time of the control group will be used to calculate the overall performance of participants. In other words, each participant will be scored as if they spent the same amount of time as the control group.

The ANCOVA analysis should further accentuate differences in the results of this experiment (Figure 2). Namely, differences between each group should be even larger due to the speed-accuracy trade-off. Group C should still differ significantly from groups A and B, but even more so than in the previous analysis. In this analysis, the decision fatigue group should now show significantly poorer performance than the self-control group. Since decision-making is

assumed to be more cognitively demanding than exerting self-control, participants in group A should show an overall performance significantly worse than group B when both speed and accuracy are taken into consideration.

Discussion. Though this experiment largely accomplishes its goal of determining a difference between acts of volition, there are several other factors to take into consideration. First, this experiment could produce different results from the ones expected. Just because these results are expected in theory does not mean that any other results cannot be achieved from this experiment. One potentially different outcome is that we may not observe the expected difference between the decision fatigue and ego depletion groups. While it is likely that decision-making is a more ego-depleting task than self-control, it is currently unknown which one actually uses more resources. Additionally, it is important to note that participants are subjected to different proportional amounts of each condition. That is, subjects in the decision fatigue condition had to make decisions only at the start of the experiment, whereas those in the self-control condition had to resist the doughnuts for the duration of the experiment. Due to the difference in exposure, participants in the self-control condition may actually become more depleted, leading to lower performance than the other groups.

Additionally, it is important to consider the possibility of neither group showing significantly different results. If this is the case, then it means that the ego-depleting manipulations were not strong enough. In a future study, participants would need to be subjected to a higher amount of decision-making or self-control. However, this scenario is unlikely because a similar manipulation was performed on self-control and proved to be effective in reducing participants' cognitive abilities (Baumeister, 1998).

One last pressing concern is the exclusion of time spent in the initial analysis. This variable was used as a covariate to adjust performance rates, which may not be entirely accurate. An ANCOVA analysis is an effective way to sort out the results, but it treats the time spent as a confound and not an independent variable. Since the speed-accuracy trade-off is important to effectively measure performance, it may be more useful to treat the time spent on each question as a separate independent variable, rather than setting it to a constant (Field, 2005). This goes beyond the scope of this study, but is a potential consideration for future research.

Experiment 2

Introduction. Experiment 1 showed that decision fatigue and self-control regulation lead to similar ego depleting results on the surface, but different ones when looking at it holistically. It also remains to be seen whether they can be treated the same. This is especially important because, after we have diagnosed the problem, it is necessary to apply the appropriate solution. Before continuing, it is important to remind the reader of the proposed solutions we have already examined.

The current literature, both in scientific and popular circles, suggests that there are several ways of approaching decision fatigue and ego depletion. Simplifying decisions, which is a favorite of several influential figures, is an effective but ultimately limited way of dealing with decision fatigue (Baer, 2015). While delegating decisions to others can also be effective, it is limited due to its narrow applicability (Graham, Harvey, & Puri, 2015). Overall, reducing decisions through any means is limited in its reach, and in the best case scenario provides a temporary solution to a deeply-rooted issue.

A second, more resilient approach is to train individuals to perform certain tasks. The idea is that, after being trained on certain tasks, people will use fewer resources when performing

the task again. This can be an especially effective way of reducing decision fatigue, as training was shown to dramatically increase individuals' acts of volition involving "mechanical" tasks (Baumeister & Tierney, 2011). However, even highly trained individuals are not safe from the effects of decision fatigue (Danzinger et al., 2010). If judges with decades of training experience still suffer from decision fatigue, one can only imagine how little a week of training would affect someone's ability to cope with decision fatigue. Thus, while training is a long-term solution and can be an effective means of helping people perform better at a specific task, it can be less practically useful in tasks requiring constant high-level thinking.

Finally, the last method of approaching decision fatigue is to increase an individual's inherent motivation. First, it is important to remember that there are two primary forms of motivation: intrinsic and extrinsic. The former involves participating in an activity for its pure enjoyment, whereas the latter involves some form of external reward (Lee et al., 2005). Intrinsic motivation has been shown to be far more effective and resilient in improving task performance (Rogstadius et al., 2011) and should thus be the preferred method. Research has shown that extrinsic motivation, driven by factors such as incentives or social acceptance, resulted in decreasing the effect of ego depletion (Baumeister & Vohs, 2007). However, little research has been done on the effect of intrinsic motivation, particularly on decision fatigue. The aim of this experiment is to examine the effect of intrinsic motivation, and illuminate the degree to which it helps cope with decision fatigue.

Methods. In this follow-up experiment, approximately 100 subjects will participate in an hour-long study. Before the experiment, each subject will fill out an electronic questionnaire with demographic information including age, gender, and socioeconomic status. They will be instructed to not eat anything for six hours before the experiment, and will be randomly assigned

into one of five groups (A, B, C, D, E). Participants from groups C and D will answer ten additional multiple-choice items asking them to make choices. An example of these questions would be: “In the event of an emergency, which of the following items would you be most likely to save?”. These participants will also be asked to choose their seats and arrive at an unorganized workstation, then be told to arrange their desk based on their preference. In groups A and B, subjects will be presented with doughnuts and broccoli, in a situation identical to Experiment 1. They will be instructed to eat only the broccoli and resist eating the doughnuts.

Each group will be given a series of ten practice questions before the start of the puzzles. Groups A and C will receive additional motivation to complete the puzzles. Their screens will inform them that, based on the results of their questionnaire and practice problems, they were deemed qualified to take the study and their results will contribute to important research in the field of decision-making. Groups B and D will not be given any form of feedback on their answers. Regardless of group, each participant will be asked to complete a two-part series of puzzles. Each part should take approximately 25 minutes and these puzzles become increasingly more difficult. Accuracy and time spent on each question will be recorded by computer software to measure performance. All participants will be compensated upon completion of the study.

Results. From this experiment, we ask whether intrinsic motivation helps participants override the negative effects of decision fatigue. Does introducing motivation reverse the handicap caused by ego depletion? We expect the results to show that intrinsic motivation helps limit the effect of ego depletion in both decision-making and self-control conditions, but does not completely eliminate the effect.

This was a 2x3 between-subjects design, so some form of analysis of means should be used to present the data. Because the ANCOVA analysis was deemed to be more comprehensive

in measuring performance, it will be used over the ANOVA. First, these results are again calculated assuming a base accuracy rate of 70%. Each group had two levels in the study: no motivation and motivation. Since this experiment was identical to experiment 1 in the "no motivation" groups, the results were expected to be the same in these groups. Participants in the control group will perform significantly better than those in the self-control group, who will in turn perform better than those in the decision fatigue group. When using time spent as a covariate, these results will show greater differences.

However, motivation introduces an interesting new variable into the equation. First, participants in all groups are expected to score higher when given intrinsic motivation because it is proven to improve task performance (Rogstadius et al., 2011). It is definitely more resilient than extrinsic motivation, which was already shown to reduce the effects of ego depletion (Baumeister & Vohs, 2007). Because of this, intrinsically motivated individuals are expected to outperform their unmotivated counterparts by a significant amount in each group. Participants in the depleted groups will perform much better, and those in the control group are expected to exceed the base average of 70%. In each of the depleted groups, motivation is expected to increase performance proportionally to the group. That is, since performance in the decision fatigue group was much lower than that of the others, intrinsic motivation should increase these participants' performance more than the others. Motivated participants in the control group should display the least amount of improvement, because there is a limit to how much they can improve.

Discussion. As with the first experiment, there are several factors to consider for Experiment 2. First, many of its assumptions and predictions rely on the expected results of the

initial experiment. If any alternative results were found with the initial experiment, then we cannot use the same assumptions.

Another consideration is the method of motivation. Some may argue that extrinsic motivation is sufficient to increasing performance. This argument certainly has merit, as extrinsic motivation has been shown to reduce ego-depleting effects (Baumeister & Vohs, 2007). It would also be easier to induce, as it could involve giving an increased monetary reward to the subject. However, the main issue is that extrinsic motivation may actually *harm* participants' performance on the tasks. In fact, it has been shown that presenting externally mediated rewards to adolescents dramatically decreases their enjoyment in the task, which in turn leads to poorer performance (Deci, 1971). Verbal reinforcement and positive feedback, on the other hand, are forms of intrinsic motivation proven to increase task performance. This is the much preferred method, and was employed in this study with the motivated groups.

One final consideration is the potential usage of time spent as an independent variable. Just like with the first experiment, it is probably better off treated as a separate variable, and not a covariate. Because the speed-accuracy trade-off dictates that it is an important variable in measuring performance, it probably should be treated as more than a confound. Especially since this second experiment contains multiple levels, adjusting each group according to a constant may obscure some of the results. In all, future studies can conduct a more comprehensive experiment examining the speed-accuracy trade-off in full.

Conclusion

Ego depletion is certainly a fascinating topic of study. From its scientific underpinnings to its mainstream media exposure, it is clear that ego depletion is a prevalent part of society. From trained professionals to the average person, this phenomenon applies to countless

aspects of daily life. Particularly, decision fatigue is an important subfield of ego depletion. It is incredible how such small decisions can gradually reduce our “ego”, which leads to a decreased ability to think. This interaction has immense real-world impact, as many occupations require copious amounts of decision-making. As such, the aim of this paper was to provide a practical solution to addressing this issue. However, before presenting these solutions it was critical to first address critiques on decision fatigue. The two main critiques addressed were the lack of evidence supporting ego depletion and potential confounds to the theory, namely physical fatigue caused by sleep deprivation. The former claim was easily refuted, as there is plenty of neurological evidence on how acts of volition affect the brain. However, the second issue was less clear. Whereas sleep deprivation did not have a significant effect on emotional regulation or self-control (Vohs et al., 2011), it had a large effect on decision-making (Harrison & Horne, 2009). Sleep deprivation as a confound was not tested in this study, but is definitely a consideration for future research. Because decision-making seemed to be affected differently here, it was also expected to have a different ego-depleting effect in the experiments.

In terms of solutions, it was determined that both reducing decisions and training people to make decisions fell short of the third option: motivation. Motivation is a better alternative to the others because it is a more practical and long-term solution. In the experiments, solely intrinsic motivation was given to the subjects. This motivation was expected to dramatically increase performance, as motivation has been shown to have a two-fold effect: it both increases base performance and reduces the effects of ego depletion. Assuming that individuals can be intrinsically motivated consistently, it seems to be a highly effective way of handling decision fatigue. In light of all of this, one major question remains: how can individuals be reliably and

consistently motivated? This study gives a much better understanding of how to approach decision fatigue practically, and the question of motivation is best left for future consideration.

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Appendix

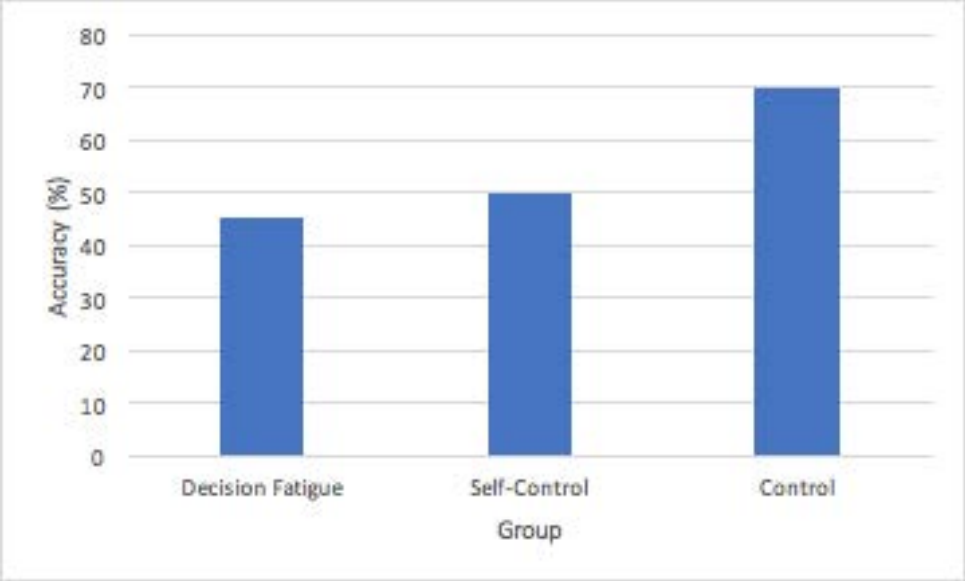

Figure 1. Effect of volition task on puzzle accuracy

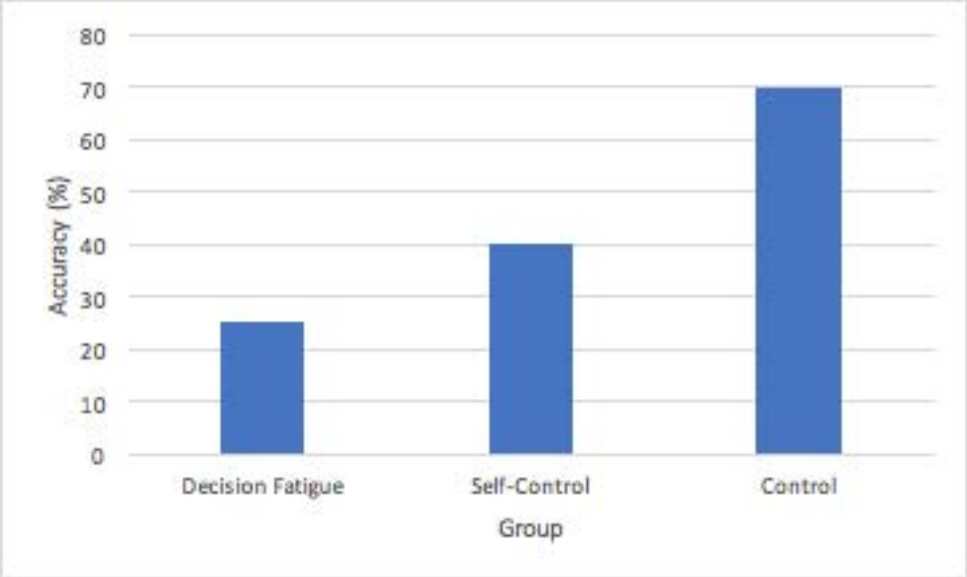

Figure 2. Effect of volition task on puzzle accuracy with covariate speed

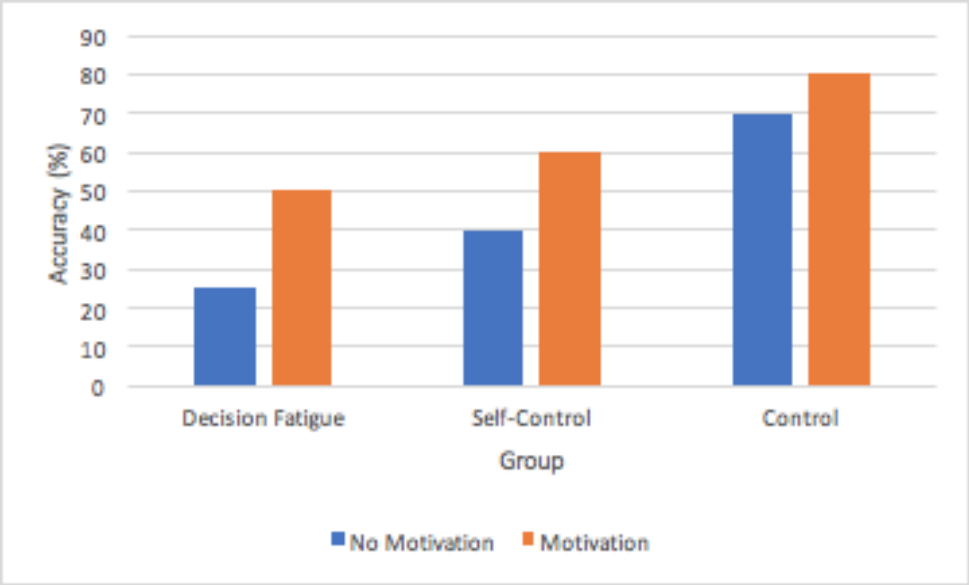

Figure 3. Effect of intrinsic motivation on task performance