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Matter over Mind: Comparing Emotion Regulation Techniques with Ego Depletion

AN HONORS THESIS

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by

Kelsey Koch

Abstract

It has been found that tasks that require self-control deplete our willpower gradually over time, and have been linked with glucose levels. This "ego depletion" effect has rarely been tested in emotional regulation. The depletion effect (by means of the mentally challenging Stroop task) was compared with two emotional self-regulation strategies by pairing them in four conditions. Half of all participants underwent the Stroop task, and all received instructions for viewing a video clip asking them to either suppress or reappraise their reaction to the film. Participants were then shown a brief video clip invoking disgust, as measured by an emotional rating scale. It was found that of the four proposed conditions (non-depletion/reappraisal, depletion/reappraisal, non-depletion/suppression, depletion/suppression), there were no significant differences in self-report of arousal or disgust but a main effect approaching significance in self-report of tension. It was also hypothesized that those in both suppression conditions will experience greater change in tension and arousal than reappraisal conditions.

Essentially, it is thought that our glucose levels will be more effective in determining emotional intensity and physiological activation than our conscious strategies.

Matter over Mind: Comparing Emotional Regulation Techniques with Ego Depletion

There has been great interest in the field of emotional research into emotional self-regulation lately, especially since the recent research by Baumeister & Tierney (2011) of the role of glucose level in decision making, willpower, and emotional volatility. Any form of emotional labor (suppression, reappraisal, etc.) reduces emotionally expressive behavior, but reappraisal techniques have been found to be more successful than others (Gross, 1998). However, the effects of these strategies have rarely been directly compared with glucose levels.

Models of Emotion Regulation

Before examining emotional regulation directly, it's important to examine the models of emotion researchers have worked from so as to understand the significance of the methods of regulation they manipulated. Gross (1998) used a process model of emotion in his study of antecedent- and response-focused regulation technique. In this model, an initial evaluation of the internal or external emotional climate leads to a coordinated set of behavioral, physiological, and experiential response tendencies (p. 225). These tendencies are highly adapted to the situation. While this model, like all others, is limited in scope and neglects certain details of the emotional experience, it is well-suited to understanding emotional regulation. Gross manipulated the input of this system to study antecedent-focused regulation (the "reappraisal" method) and compared this to manipulation of the response-focused regulation (the "suppression" method).

Gross expands on this process model in his *Handbook of Emotional Regulation* (2007), renaming it the modal model. In this linear model, the ubiquitous situation and response are separated by a "black box" containing attention and appraisal (Gross & Thompson, 2007). A

situation occurs, most often though not exclusively externally, and we have our attention drawn to it. We muster an appraisal which leads to a modulated set of responses. Gross notes that emotional responses can often change the situation that brought them about, leading to further appraisals.

The relationship between emotions and self-regulation has been conceptualized in many ways. Butler (2011) reviewed three of these as they were related to health. First, she found that our overall self-regulatory system was made up of many fragments, one of which being emotion, and that this system works to adapt our behavioral tendencies and responses to achieve goals and fit the situation. Emotions are cues to the environment and let us know when changes are necessary to be most efficient. For example, if we have a goal of finding a partner and marrying and we feel romantic attraction to one person versus another, we will adapt behaviorally to devote greater courting attention to that person over other viable mates.

Second, Butler (2011) described an internal feedback loop involving the central nervous system, environment, and the rest of the body that works to keep us functionally balanced and performing optimally. This perspective views health as a well-regulated system and psychopathology as dysregulation of affect or physical response to each other or the environment. For example, anxiety can work in a feedback loop during situations prompting an appraisal of danger. We pick up on the cues and feel fear while our sympathetic nervous system responds with physiological preparedness for fight or flight. If we were confronted with a bear alone in the woods, a fearful emotional response and physiological reactivity would be appropriate. If we were swimming in shark-infested waters, anxiety responses that prompted us to be vigilant for dark shapes in the water would also be appropriate. However, a powerful fear response and sympathetic activation in response to a public speaking situation would not be

adaptive or encourage optimal functioning and hence indicative of dysregulation (in this case, social phobia).

Third, Butler (2011) embraced a common research topic that finds emotions themselves can be the focus of self-regulatory attempts. This perspective most directly encompasses the efforts of the current study, and indeed Butler describes Gross' (1998) research with antecedent- and response-focused regulation. For an example of this perspective, I will return to public speaking. If you know that public speaking tends to make you nervous and tense, you may practice relaxation techniques prior to your presentation as a form of antecedent regulation. If you are in the middle of your presentation and notice your hands shaking, sweat on your brow, and find yourself forgetting or garbling your words, you may try to hide your nerves and suppress your physical response as a form of response regulation.

Gross (1998) directly compared emotional self-regulation strategies, distinguishing between antecedent-focused methods that occur before emotions are fully generated and response-focused methods that occur after an emotion has developed. Participants watched a disgusting film as their physiological responses were recorded, and filled out an emotional rating form before and afterwards to assess baseline and post-film experience. The reappraisal (antecedent-focused) condition was told to "think about the film in such a way that they would feel nothing," while the suppression (response-focused) condition was told to "behave in such a way that someone watching them would not know they were feeling anything" (p. 227). The control condition was simply told to watch the film. Both emotional regulation methods were effective in reducing emotion expressive behavior compared to the control, but the reappraisal method decreased disgust experience and the suppression method increased arousal of the sympathetic nervous system, or the "fight or flight" response. The suppression condition showed

significant decreases in finger pulse amplitude (which indicated what Gross believed to be vasoconstriction, a physiological effect of sympathetic activation) and increases in skin conductance (Gross, 1998; Gross & Levenson, 1993).

Butler (2011) provides a model of self-regulation that is directly connected to the autonomic nervous system. The Neurovisceral Integration Model (NIM) supports a global self-regulatory system encompassing emotion, cognition, and physiology. Butler reviews literature that has found a relationship between high heart rate variability and parasympathetic activation. Hence, she argues that if one trusts the NIM model, then high heart rate variability should be associated with more effective self-regulation, and that low heart rate variability (indicating sympathetic activation) is associated with poorer self-regulation.

The two regulation techniques have a long history of study in very different fields. Gross (1998) notes that the literature exploring psychological health has primarily focused on antecedent methods of regulation taking place before emotions are triggered. The physical health literature, however, is focused more on researching response regulation and dealing with emotions once they are already present (p. 226). For example, in their investigation of the relationship between metabolic syndrome and emotion regulation Kinnunen, Kokkonen, Kaprio, & Pulkkinen (2005) found a significantly positive correlation between low metabolic syndrome factor and high use of "repair" as an emotion regulation technique. The researchers defined "repair" as technique of positive thinking to boost mood and offset current stress, assessed by statements on a survey like "I am imagining something nice to improve my mood" and "I am planning positive things to keep my mood up" (p. 514-515).

Other researchers have created similar studies and found support for differences in emotion regulation. Alberts, Schneider, & Martijn (2012) had participants watch a video that

invoked sadness before performing a self-control task. They knew from previous studies that the

alteration of emotional experience draws upon mental resources, and that performance on a

subsequent self-control test (in this case, the Stroop task) would be diminished. This was the

result for a group instructed to suppress their emotions during the video. Another group,

instructed in acceptance-based coping, however, performed better on the Stroop than both the

suppression group and a control group given no instructions about the video. The researchers

understood that acceptance still required some mental resources due to our natural tendency to

avoid negative emotion, but correctly hypothesized that it required fewer resources than outright

suppression (Alberts et al., 2012).

Personality and Emotion Regulation

Individual differences also play a role in our natural emotion regulation tendencies. It has

been well documented that those with borderline personality disorder have across the board

difficulties in emotion regulation, and one of the key goals of Dialectical Behavior Therapy is to

improve these skills (Linehan, 1993). Therapeutic interventions that focus on alleviating emotion

dysregulation have been effective in reducing self-harm behaviors in borderline patients (Gratz,

Levy, & Tull, 2012).

Emotion regulation relates directly to health, as has already been described, but

personality can mediate the effects emotion regulation has on health. Messerli-Burgy, Kanel, and

Schmid (2012) studied cardiac patients to investigate the relationship between Type D

("distressed") personality type and ineffective emotion regulation. They found that those with

Type D personalities had more maladaptive emotion regulation, depressive affect, and greater

perceived marital stress than those without Type D. In general, past research has demonstrated

that the emotion regulation technique of reappraisal is associated with healthier mood, physiological, and cognitive strategies versus use of suppression (John & Gross, 2004).

Personality differences are influential in our natural use of the emotion regulation strategies of reappraisal and suppression. Gresham and Gullone (2012) studied school-aged children and their use of these two regulation strategies compared with the Five Factor Model of personality. They found that boys more often used suppression, while there was no gender difference in use of reappraisal. In general, higher levels of openness, agreeableness, conscientiousness, and extraversion correlated with greater use of reappraisal, while low levels of agreeableness, openness, and extraversion were correlated with greater use of suppression (Gresham & Gullone, 2012). This is especially interesting in regards to openness because maladaptive emotion regulation often involves rigidity and inflexibility in response to external events and demands. High neuroticism was correlated with greater use of suppression, which is logical considering that those high in the neuroticism trait tend to be emotionally unstable, easily distress, and generally anxious (Gresham & Gullone, 2012).

Self-Control

Emotion regulation and self-control have an intimate relationship. Holly (2012) examined instances of non-suicidal self-injury (NSSI) in college students through administration of several assessment measures, and found that self-injurers reported greater issues in emotional self-regulation and poorer self-control compared to non-self injurers. In fact, emotion regulation was the only factor that significantly predicted the possibility that a student would engage in NSSI frequently.

Willpower can be affected by and contained within our bodily limits, and many bodily actions can influence our self-control. Hung & Aparna (2011) had participants tense their muscles prior to completing willpower-depleting activities, and found that firming muscles helped firm their willpower. Participants were better able to avoid food temptation, take unpleasant medication, withstand immediate pain, and deal with disturbing but necessary information. Self-control also influences neurochemical levels in the brain. In her book *Why We Love*, Helen Fisher (2004) explains that dopamine is involved in goal-driven and motivated behaviors. When rewards (like the object of one's affection) are delayed and we are forced to wait for them, dopamine levels increase, as well as potential for aggression and violent behavior. Frustration due to goal unavailability leads to aggression.

Gal & Liu (2011) also found associations between anger and self-control. They found that after exhibiting self-control participants were more likely to display greater interest in faces displaying anger, show preference for anger-themed content, greater agreement and endorsement of anger-framed appeals, and display more irritation with others' attempts to control their behavior. Often, we must delay gratification of immediate rewards to pursue long-term goals (e.g. finishing college, weight-loss plans, etc.). To delay gratification, we must exert self-control and willpower to withstand the pressure, which inevitably drives dopamine levels up.

Self-control also has a relationship with coping styles, mental health, and physical health. Researchers found that higher self-control was associated with fewer symptoms of mental or physical problems and less avoidance coping (Boals, vanDellen, & Banks, 2011). Lower self-control is associated with more unhealthy coping styles, like avoidance instead of problem-focused or emotion-focused coping. Exerting self-control can be depleting on its own, though. Friese, Messner, and Schaffner (2012) found that participation in an emotion-suppression task

diminished performance on a subsequent self-control task. If participants were able to practice mindfulness meditation after the emotion-suppression, however, they performed equally well on the self-control task as a control group that hadn't done the emotion-suppression task at all.

Self-control demands many of our mental resources, but it is not alone. It must compete with other cognitive tasks, leading to high demands on our mental abilities. Bridger and Brasher (2011) surveyed office workers to explore the interaction of different tasks on our cognition and how these demands affect our mental well-being. They found the strongest interaction between cognitive task demands in general (demands of the job at hand, basic activities of their profession) and self-control demands. This interaction indicates that together these two factors have a more powerful effect than either of them alone on our mental well-being in a harmful, destructive direction.

Researchers have also found rumination to be a mediating factor in the relationship between self-control and aggression. Denson, Pederson, & Friese (2011) found that when participants were provoked, rumination reduced self-control and increased instances of aggression. Denson et al. were able to improve participants' performance on measures of inhibitory control after drinking a glucose beverage. As the Friese et al. (2012) study mentioned above found, other activities, like meditation, may also be rejuvenating. Yet glucose has become a significant factor of interest in recent research surrounding willpower, self-control, and executive function.

The Role of Ego Depletion

Baumeister (1998) theorized that decision making, self-control, and willpower might be exhaustible. In "Ego Depletion: Is the Active Self a Limited Resource?" (Baumeister,

Bratslavsky, Muraven, & Tice, 1998), researchers performed several short, simple experiments of will and resistance, finding that the concept best described as "willpower" is, in fact, diminishable. Participants who made themselves eat radishes while avoiding chocolate chip cookies gave up on impossible puzzles faster than those who didn't have to exert self-control. Participants who suppressed emotion in one condition were less successful at solving anagrams than those who had not been forced to emotion-regulate. In general, participants who had to initially perform any act of executive function chose more passive options, gave up faster, succumbed to temptation faster, and were less persistent than control conditions who did not perform such mental actions.

Baumeister was not sure at first what this common, replenishing resource could be until he published "The Strength Model of Self Control" (Baumeister, Vohs, & Tice, 2007). With this model, Baumeister et al. demonstrate the centrality of the expendable, renewable source of energy that is our blood glucose and term the condition "ego depletion." Self control behaviors that deplete willpower include controlling thoughts, moderating emotions, overcoming temptations, maintaining attention, and prolonged decision making. A meta-analysis by Hagger, Wood, & Stiff (2010) on studies of ego depletion found that glucose supplementation through methods as simple as drinking a sugary glass of lemonade improved self-control in ego depleted participants (Gailliot, Baumeister, Dewall, & Maner, 2007).

All of these findings demonstrate how important it is to understand our self-control mechanisms. Understanding how we control our emotions and ourselves is vital to our mental health, coping strategies, and experience of anger and aggression. Not only do we regulate our emotional expression and experience with different techniques, but glucose affects this relationship as well. Just how ego depletion and emotional strategies interact is what I aimed to

explore in this study. It was hypothesized that of the four proposed conditions (non-depletion/reappraisal, depletion/reappraisal, non-depletion/suppression, depletion/suppression), the non-depletion/reappraisal condition would be the most successful in moderating emotional experience of disgust and the depletion/suppression condition would be the least successful. As for the other two conditions, it was hypothesized that the non-depletion/suppression technique would be more successful in moderating emotional experience of disgust than the depletion/reappraisal condition. Essentially, it is thought that our glucose levels would be more effective in determining emotional intensity than our conscious strategies.

Two other self-reported emotions were also be examined. Gross (1998) found that sympathetic activation was higher in the suppression condition as measured by physiological tests of skin conductance, finger pulse amplitude, and finger temperature. This study is limited by self-report measures, so participants' self-rated changes in measures of tension and arousal were examined due to their relation to sympathetic activation. It was hypothesized that those in both suppression conditions will experience greater change in tension and arousal than reappraisal conditions.

Method

Participants

The participants for this study were introductory psychology students drawn from a small Midwestern liberal arts college. Eighty-five people responded to the online posting about the experiment, and data from eighty-three participants who completed the study was included for analysis in the present paper. No demographic information was formally collected from participants. Participants were rewarded for participation in the study by satisfaction of an optional academic requirement in their introductory psychology course.

Materials

     Emotion rating scale. An emotion rating scale was adapted from Gross (1998). It implements a 9-point Likert scale to assess the intensity of 16 emotions (tension, sadness, fear, happiness, surprise, etc.). Thirteen are distractor items and disgust, tension, and arousal are the target emotions that were compared across participants. The emotion rating scale was administered upon arrival at the testing site to assess baseline rates and immediately after the video to measure emotional experience.

Stroop Task Accuracy by Page — X axis: Page Number (1–6); Y axis: Mistakes on Average (0–3.5)

Time Spent Per Page on Stroop Task — X axis: Page Number (1–6); Y axis: Time Spent Per Page on Average (0–70)
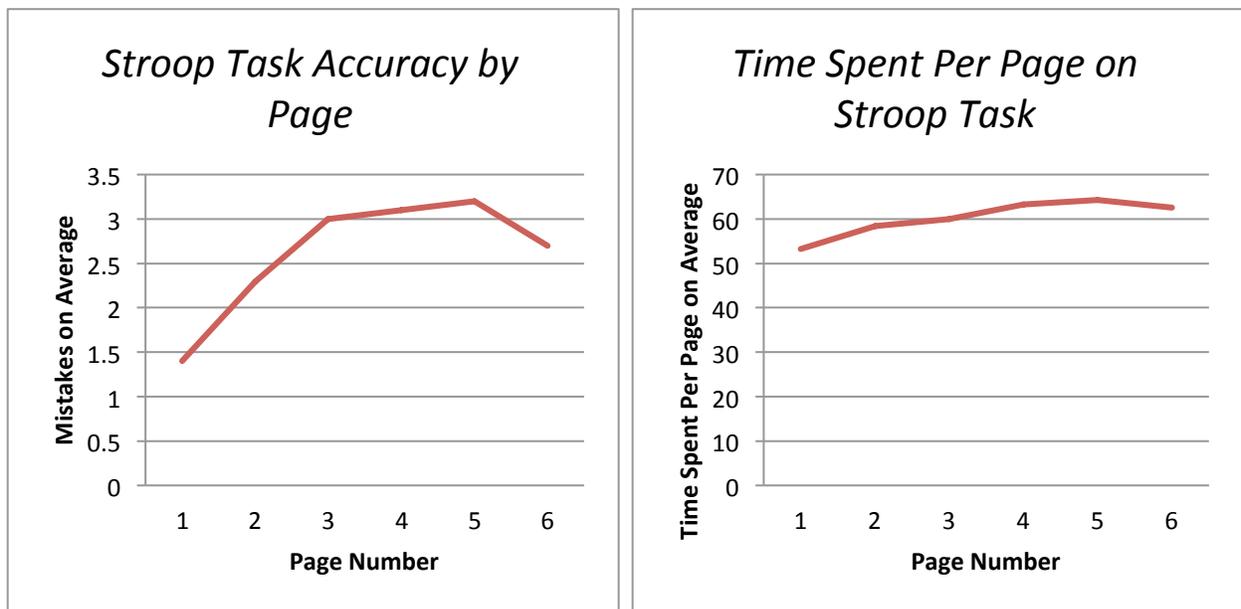
     Stroop task. Half of the participants were assigned to the depletion condition, and underwent a six minute Stroop task. Participants were not measured on accuracy nor timing, so the task was created based on official versions, and included seven pages of material. The first page is an instruction sheet with the directions, "Please say out loud the color of the ink of the words in this task. Ignore what the word says and focus on the ink color. Start at the left-most column and read from top to bottom, and then move on to the next column. Please read all six pages as quickly and accurately as you can, for you will be timed and monitored for mistakes." The first page also includes two practice measures to ensure participants understand the task. The

first practice includes four boxes colored red, yellow, blue, and green to make sure participants were able to correctly perceive these colors later in the task. The second practice includes the four color words printed in a different color than they describe to ensure participants understood that the color of the ink, not the word, should be said out loud during the task. Once both practices were completed accurately, the task began. Pilot testing demonstrated that accuracy per page decreased while time spent per page increased as the task went on, confirming its validity as a depletion task.

Film clip. The video clip I will be using was taken from Procedures Consult (www.proceduresconsult.com) and depicts a bicep surgery. The clip is 42 seconds long and intended to evoke clearly the emotion of disgust. I chose to invoke disgust because it is a distinct, easily recognizable and recordable emotional experience that participants would not likely display upon arrival at the testing site. Previous literature has tested the emotional regulation strategies I am testing in this study with the same emotion. Gross (1998) used a short clip of a medical procedure to invoke disgust when he compared reappraisal and suppression techniques. I used a medical clip because provided instructions to participants similar to Gross' original instructions for regulation. Invoking any other emotion could cause method discrepancies between this study and previous literature. Of course, all participants were reminded in the pre-video instructions to say "stop" if the video becomes too distressing and were allowed to abandon the experiment after debriefing. The original clip has sound (voices describing the procedure) but I used a silent version of the clip.

Instructions for film clip. Before the video clip begins, participants will be given an instruction sheet. Subjects placed in a suppression condition read these instructions:

"We will now be showing you a short film clip. It is important to us that you watch the film clip carefully, but if you find the film too distressing, just say stop. If you have any feelings as you watch the film clip, please try your best not to let those feelings show. In other words, as you watch the film clip, try to behave in such a way that a person watching you would not know you were feeling anything. Watch the film clip carefully, but please try to behave so that someone watching you would not know that you are feeling anything at all."

Subjects placed in a reappraisal condition read these instructions:

"We will now be showing you a short film clip. It is important to us that you watch the film clip carefully, but if you find the film too distressing, just say stop. Please try to adopt a detached and unemotional attitude as you watch the film. In other words, as you watch the film clip, try to think about what you are seeing objectively, in terms of the technical aspects of the events you observe. Watch the film clip carefully, but please try to think about what you are seeing in such a way that you don't feel anything at all."

Procedure

Before participants arrive at the testing site, they were asked to eat a meal two hours before the experiment, and then abstain from eating or drinking anything else after that meal except water to control for glucose levels. Participants were randomly assigned to one of four conditions (non-depletion/reappraisal, depletion/reappraisal, non-depletion/suppression, depletion/suppression), but only the experimenter and assistants knew the condition. They were told this is an experiment exploring emotional expression. Participants then filled out an emotion rating scale to develop a baseline to compare later results against. Half of all participants were randomly assigned to a depletion condition, and underwent a six minute depletion test, the Stroop task (described in detail below).

Next, all participants were given one of two possible instruction sheets about the video clip they will be watching shortly. The instructions for both the suppression and reappraisal condition are described below. The video clip started after participants finished reading the instruction sheet. The video was approximately 45 seconds long. Immediately after the video clip, a second emotion rating scale was administered to participants. Debriefing occurred after they completed the final emotion scale. Participants were told about the comparison of ego depletion and emotional regulation strategies and informed which of the four conditions they were placed in.

Results

It was hypothesized that of the four proposed conditions (non-depletion/reappraisal, depletion/reappraisal, non-depletion/suppression, depletion/suppression), the non-depletion/reappraisal condition would be the most successful in moderating emotional experience of disgust and the depletion/suppression condition would be the least successful. As

for the other two conditions, it was hypothesized that the non-depletion/suppression technique would be more successful in moderating emotional experience of disgust than the depletion/reappraisal condition. Essentially, it was thought that our glucose levels would be more effective in determining emotional intensity than our conscious strategies.

The emotional rating scale adapted from Gross (1998) includes sixteen emotion scales, and although disgust was the emotion of interest and elicited by the film, two other emotions, tension and arousal, were analyzed because of their relation to research questions and possible insights.

Descriptive Means and Standard Deviations by Condition for Arousal, Disgust, and Tension

	Reappraisal/non-depletion	Suppression/non-depletion	Reappraisal/ depletion	Suppression/ depletion
Arousal	X = .1053 SD = 1.9971	X = -.0417 SD = 1.944	X = .2353 SD = 2.107	X = .6957 SD = 1.579
Disgust	X = 2.316 SD = 2.496	X = 2.917 SD = 2.603	X = 1.941 SD = 2.193	X = 2.870 SD = 3.209
Tension	X = -.737 SD = 1.759	X = .3750 SD = 2.300	X = .7647 SD = 2.047	X = .5652 SD = 2.128

Descriptive Statistics

Arousal. The average change in arousal for the reappraisal/non-depletion condition was .105 (SD = 1.997). The median was 0 and the mode was 0. The scale ranged in possible

values from -8 to 8, and the total range for all results was from -5 to 8. The range for the average

change in arousal for the reappraisal/non-depletion condition was from -4 to 4. The average

change in arousal for the suppression/non-depletion condition was -.042 ($SD = 1.944$). The

median was 0, the range was from -4 to 4, and the mode was 0. The average change in arousal

for the reappraisal/depletion condition was .235 ($SD = 2.107$). The median was 0, the range was

from -4 to 4, and the mode was 0. The average change in arousal for the suppression/depletion

condition was .696 ($SD = 1.579$). The median was 0, the range was from -2 to 5, and the mode

was 0.

     Disgust. The average change in disgust for the reappraisal/non-depletion condition was

2.316 ($SD = 2.496$). The median was 1, the range was from -1 to 7, and the mode was 1. The

average change in disgust for the suppression/non-depletion condition was 2.917 ($SD = 2.603$).

The median was 2.5, the range was from -1 to 8, and the modes were 0 and 5. The average

change in disgust for the reappraisal/depletion condition was 1.941 ($SD = 2.193$). The median

was 1, the range was -1 to 6, and the mode was 0. The average change in disgust for the

suppression/depletion condition was 2.870 ($SD = 3.209$). The median was 3, the range was from

-5 to 8, and the modes were 5 and 0.

     Tension. The average change in tension for the reappraisal/non-depletion condition was -

.737 ($SD = 1.759$). The median was 0, range was from -4 to 3, and mode was 0. The average

change in tension for the suppression/non-depletion condition was .375 ($SD = 2.300$). The

median was 0, the range was from -4 to 5, and the mode was 0. The average change in tension

for the reappraisal/depletion condition was .765 ($SD = 2.047$). The median was 0, the range was

from -3 to 4, and the mode was 0. The average change in tension for the suppression/depletion

condition was .565 ($SD = 2.128$). The median was 0, the range was from -3 to 5, and the mode

was 0.

Inferential Statistics

Research interest in this study centered on the changes participants recorded in

experienced emotion from their baseline levels pre-experiment to their manipulated levels post-

experiment. Since participants filled out the same emotional rating scale at the beginning and end

of the experiment, their baseline scores (on an 9-point scale) were subtracted from their final

scores as it was assumed that in emotions of interest most change would occur as an increase in

emotions experienced.

A multivariate analysis of variance was performed and there were no significant

interactions between conditions in the arousal variable for either the depletion manipulation,

$F(1,79) = 1.062$, *n.s.*, or emotion regulation strategy manipulation $F(1,79) = .139$, *n.s.* The

interaction of both manipulations was also statistically insignificant, $F(1,79) = .521$, *n.s.* Arousal

has been shown to increase when using the suppression emotional regulation technique, which

was predicted but not found by the arousal hypothesis. The suppression/depletion group (M

$= .696$, $SD = 1.579$), expected to have the most difficulty overall in managing emotions, did

indeed have the highest overall change in arousal, though non-significant.

A multivariate analysis of variance was performed on the variable disgust and there were

also no main effects for the depletion manipulation, $F(1,79) = .125$, *n.s.*, or emotion regulation

strategy, $F(1,79) = 1.644$, *n.s.* The interaction of both manipulations was also statistically

insignificant, $F(1,79) = .075$, *n.s.* It was predicted that the reappraisal/non-depletion condition

would be the most effective in managing emotion and hence have the lowest overall change in

emotion, followed by suppression/non-depletion, reappraisal/depletion, and finally

suppression/depletion.

A multivariate analysis of variance was performed on the tension variable indicating no

significant interaction between the depletion and emotion regulation manipulations, $F(1,79) =$

2.01, *n.s.* There was no significant main effect for the emotion regulation manipulation, $F(1,79)$

= .972, *n.s.*, but there was a main effect approaching significance for the depletion manipulation,

$F(1,79) = 3.34$, $p = .07$. Post-hoc LSD tests demonstrated a significant difference between the

reappraisal/non-depletion and the suppression/depletion conditions, $F(83) = -1.302$, $p < .05$,

which was expected because these two groups have the greatest difference in experience. There

was a significant difference between the reappraisal/non-depletion and reappraisal/depletion

groups as well, $F(83) = 1.502$, $p < .05$, indicating the ego depletion exercise had an effect on

emotion regulation in and of itself. The reappraisal/non-depletion group had an average change

in tension of -.737, indicating a slight decrease which could possibly be contributed to non-

sympathetic activation. The reappraisal/depletion group had an average change in tension

of .764, indicating a slight increase which could be explained by an inability to regulate tension

and sympathetic activation due to the film.

Discussion

It is not possible to make many solid conclusions about the results of this study due to the

general lack of significant results. In particular, it is not possible to make direct conclusions

about participants' ability to regulate emotion effectively because of the lack of significant

results in the target emotion, disgust. Perhaps the video clip was confusing or unclear, or perhaps

these regulation strategies are best measured with physiological assessments rather than self-

report.

However, the depletion main effect and post-hoc significance of tension is very interesting. These results suggest that not only is the suppression technique associated with sympathetic activation, as previous research has suggested (Gross, 1998; Gross & Levenson, 1993), but that the depletion of self-control resources might also be associated with sympathetic activation. The significant difference in change in tension between the reappraisal/non-depletion and suppression/depletion condition indicates that at the very least the two manipulated independent variables (regulation technique and ego depletion) were effective in creating a difference between conditions. The combined effect of the suppression technique and ego depletion by a challenging self-control task was enough to cause a slight increase in tension throughout the study, while reappraisal and non-depletion caused a slight decrease in tension.

The post-hoc significant difference between the reappraisal/non-depletion and reappraisal/depletion conditions isolates the effect of depletion. Both conditions received the same regulation instructions prior to viewing the surgery clip. Perhaps the depleted condition had fewer mental resources to rely on in objectively moderating their experience, which led to greater sympathetic activation in response to the film. This finding is in concordance with a study by Gailliot, Peruche, Plant, and Baumeister (2009), which linked experience of tension to expression of prejudice and use of stereotypes. They manipulated blood sugar levels through sugary beverages, and found that those with normal glucose levels were more likely to use stereotypes than those with low glucose levels (Gailliot et al., 2009).

Limitations

Participants were randomly assigned to each condition, so preexisting differences were controlled for and not to blame for the lack of significant results in this study. The pool they were drawn from, however, may not have been representative. Though no demographic

information was collected during the study, it is known that the electronic system participants

were collected from is comprised of approximately 70 percent females, so the

underrepresentation of male in this study could limit its applicability to the general population.

This study relied entirely on self-report data. While this is a valuable measure of

subjective experience, it cannot be expected to reveal the entire dynamic process of emotion

regulation. Using a multi-method approach that includes physiological measurements would

greatly contribute to analysis of autonomic arousal, especially when examining suppression.

Previous studies that have implemented a multi-method approach have been successful in

demonstrating a link between physiological activity and emotion regulation (Gross, 1998; Gross

& Levenson, 1993), but such methods were beyond the scope of this study.

The film clip used in the study may have failed to fully elicit the target emotion of

disgust. When blown up on a projector, the details of the surgery were at times blurry, which

could have led to confusion about the subject of the film. It was also decided to mute the video

commentary about the surgery so as not to influence participants' emotions. The commentary

included objective medical explanation of the procedure, and it was thought that it might too

closely resemble the strategy of reappraisal (viewing the film objectively and in an unattached

way) and skew the results of those in the suppression groups. However, the commentary, if

included, may have cleared up confusion about what the video depicted and further engaged

participants in the task. More extensive pilot testing of video clips and their ability to elicit the

target emotion effectively while not becoming overwhelming could clear up these issues in the

future.

This study was limited in its ability to measure or predict ego depletion. The Stroop task

has been demonstrated as an effective willpower-depleting task (Baumeister & Tierney, 2011),

but this study did not attempt to measure the blood glucose levels of participants at any point in the study. All implications of the study refer to the effect mentally challenging tasks like the Stroop have on willpower and self-control, and further parallels to blood glucose levels are strictly speculative and rest on prior research.

Lack of available participants to secure complete power was also a limitation. This issue contributed to the decision to forgo a control condition. Ideally, a control group would have watched the film and reported their emotional responses after receiving no instructions about how to watch the film, but there were simply not enough participants available to warrant this procedure. The decision was made to have only four conditions so that statistical power in condition size could be as high as possible. Future studies would do well to include a control group to ensure group differences are related to the instructions about the video and not just the video itself.

Future Directions

Future research could greatly contribute to this area of the field by integrating blood sugar measurements with Baumeister et al.'s (2011) research. Baumeister reported in several studies that participants' self-control improved upon consumption of a sugary beverage (Baumeister, Vohs, & Tice, 2007; Hagger, Wood, & Stiff, 2010), so it would be interesting to see if blood sugar levels in studies of self-control and emotion regulation would agree with previous support for glucose's role in willpower.

Disgust was chosen as an elicited emotion of interest due to the success of prior research (Gross, 1998) and because it is unlikely that a participant would come into a study showing strong levels of disgust due to external factors. Other emotions that could be elicited by film clips, such as sadness, could be more varied due to preexisting dispositional factors or recent

stressor events. Happiness would be more difficult to trigger directly, and eliciting surprise or fear might increase the risks to participants in the study. However, it would be of interest to future research to focus on other emotions as well to compare to results of disgust target studies. A comparison of emotion regulation in both negative and positive emotions related to willpower would also be fruitful.

Future studies directed towards intervention may also contribute greatly to the field of emotion regulation and self-control. If measures that evaluate our natural coping methods and regulation strategies were utilized at the beginning of a study with goals of exchanging participants' strategies for healthier ones, the health benefits of this change could be examined. Acceptance-based coping (Alberts et al., 2012) and reappraisal have been demonstrated to be more effective and healthy regulation techniques, so perhaps studies that aim to change rather than manipulate our tendencies are warranted.

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Appendix I: Emotion Rating Scale

Please rate each emotion according to your current feelings. Complete both the front and

back of this sheet.   0   1   2   3   4   5   6   7   8

Not at all right now   Very Little   Neutral   Very Much   Completely feeling now

1. Amusement

0   1   2   3   4   5   6   7   8

2. Anger:

0   1   2   3   4   5   6   7   8

3. Arousal

0   1   2   3   4   5   6   7   8

4. Confusion

0   1   2   3   4   5   6   7   8

5. Contempt

0   1   2   3   4   5   6   7   8

6. Contentment

0   1   2   3   4   5   6   7   8

7. Disgust

0   1   2   3   4   5   6   7   8

8. Embarrassment

0   1   2   3   4   5   6   7   8

9. Fear

0   1   2   3   4   5   6   7   8

10. Happiness

0   1   2   3   4   5   6   7   8

11. Interest

0   1   2   3   4   5   6   7   8

12. Pain

0   1   2   3   4   5   6   7   8

13. Relief

0   1   2   3   4   5   6   7   8

14. Sadness

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

15. Surprise

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

16. Tension

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |

Appendix II: Stroop Task Instruction Sheet

COLLEGE OF SAINT BENEDICT/ SAINT JOHN'S UNIVERSITY

COMPARING EMOTIONAL REGULATION TECHNIQUES AND EGO DEPLETION

Stroop Task Instructions

Please say out loud the color of the ink of the words in this task. Ignore what the word says and focus on the ink color. Start at the left-most column and read from top to bottom, and then move on to the next column. Please read all six pages as quickly and accurately as you can, for you will be timed and monitored for mistakes.

PRACTICE #1: Say the color of each box, starting at the top.

PRACTICE #2: Please say the ink color of each word, starting at the top.

BLUE

YELLOW

GREEN

RED

When you're ready to begin, please turn to the next page.