



Having Used Self-Control Reduces Emotion Regulation—Emotion Regulation as Relying on Interchangeably Used “Self-Control Energy”

Matthew T. Gailliot^{1*}, Anne Zell², Roy F. Baumeister³

¹University of Albany, Albany, USA

²Augustana College, Rock Island, USA

³Florida State University, Tallahassee, USA

Email: mgailliot@gmail.com

Received 7 September 2014; revised 20 October 2014; accepted 23 November 2014

Copyright © 2014 by authors and OALib.

This work is licensed under the Creative Commons Attribution International License (CC BY).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Four studies tested and confirmed the hypothesis that having used self-control reduces subsequent emotion regulation. Participants first completed a task that either did or did not require self-control (attention control, overriding one’s accustomed writing style, or breaking a habit). They later encountered situations designed to activate emotions that typically are downregulated. Participants either met someone new (anxiety), anticipated speaking publicly (anxiety), or recalled times when they felt sad or romantically jealous. Compared to participants who had not completed a self-control task, those who had used self-control task reported feeling of the target emotion to a greater extent. The results from a final study supported the idea that having used self-control reduces emotion regulation rather than increasing the strength of emotion generally.

Keywords

Emotion Regulation, Emotion, Self-Control, Self-Regulation, Ego Depletion

Subject Areas: Psychology, Sociology

1. Introduction

The desire to feel emotionally positive might rank among people’s most important and pervasive goals. To escape negative moods and maintain positive moods, people frequently regulate their emotions [1]. The ability to regulate emotions has been shown to be important across the lifespan and across numerous domains, from in-

*Corresponding author.

terpersonal relationships [2] to work [3]. Successful emotion regulation has been shown to predict several crucial life outcomes, including better mental and physical health [4] and enhanced subjective well being [5].

The current work examines the role of self-control in emotion regulation. The theory is that emotion regulation requires self-control resources. People are more prone to failing at regulating their emotions when self-control resources are low or have been depleted. Thus, prior acts that consume self-control resources should reduce subsequent emotion regulation.

1.1. Self-Control as a Limited Resource

Self-control, or the ability to override thoughts, emotions, impulses, and behavioral tendencies, appears to rely on a limited resource or energy [6] [7]. Engaging in an act of self-control depletes this energy source and consequently impairs later attempts at self-control [8] [9]. For instance, participants in one study who had resisted eating freshly baked cookies quit sooner on a subsequent task requiring effortful persistence, compared to participants who had not resisted the cookies [10]. Resisting the cookies presumably depleted participants' self-control energy that was needed for the subsequent task. Findings from several other studies support the notion that self-control relies on a limited energy source. An initial self-control task has been shown to impair dietary restraint [11] [12], stereotype suppression [13], drinking restraint [14], money management [15], accommodating behaviors in close relationships [16], impression management [17], and aggressive restraint [18] [19]. People also seem more prone to fail at self-control after previous self-control exertion in their day to day lives [20]. One study, for instance, found that high self-control demands throughout the day predicted poor drinking restraint later in the evening [21].

Thus, self-control seems to rely on a limited energy source that can become depleted with use. The current work examined whether depleted self-control would reduce emotion regulation.

1.2. Self-Control and Emotion Regulation

Emotion regulation may rely on self-control energy. Indirect evidence for this idea comes from studies linking good emotion regulation to good self-control. Children and adults with better self-control have been found to cope more easily with aversive emotions and hence to more frequently experience positive mood states [22]-[25]. High self-control predicts greater emotional stability and a reduced incidence of depression, anxiety, anger, and personal distress [26]. Moreover, self-control abilities during childhood have been shown to predict emotional coping years later during adolescence [27].

Other work provides evidence that more directly indicates emotion regulation as relying on self-control energy. After regulating their emotions, people seem more prone to fail at acts of self-control, including dieting, quitting smoking, delaying gratification, and refraining from drug and alcohol use [7]. Amplifying or suppressing positive or negative emotions has been found to undermine impression management [17], accommodating behaviors [16], health related behaviors [28], effortful persistence [29], and intellectual abilities relying on controlled processing [10] [30]-[32]. Emotion regulation thus seems to require self-control energy, insofar as it reduces later self-control.

Why might emotion regulation require self-control? Direct control of emotion is difficult or impossible, and so effortful substitute strategies are needed [33] [34]. Though there are many ways to regulate emotions, people frequently regulate their emotions using effortful cognitive strategies such as suppressing or distracting themselves from unwanted feelings and instead focusing on more pleasant thoughts or feelings [5] [35] [36]. Effortful cognition can require self-control [31], and so the assumption was that emotion regulation would too.

The current work sought to provide a fuller understanding of the link between self-control and emotion regulation by examining whether self-control depletion reduces emotion regulation. To the extent that emotion regulation relies on the same energy source as self-control, then initial acts that require self-control, and therefore deplete self-control energy, should reduce later emotion regulation.

1.3. Overview and Hypotheses of the Current Work

Four studies were conducted to test the hypothesis that self-control depletion reduces emotion regulation. In each study, participants first completed a task that either did or did not require self-control. To provide converging evidence, each study included a different self-control task, namely controlling one's attention (Studies 1 and 2), overriding one's accustomed writing style (Study 3), or breaking a habit (Study 4).

After the initial task, participants underwent a procedure designed to elicit emotion likely to be downregulated. These procedures involved interacting with a stranger (Study 1) or anticipating speaking in front of a large group (Study 2), so as to elicit anxiety, or thinking about an event that had made one previously feel jealous (Study 3) or sad (Study 4). The prediction was that participants who had used self-control would report experiencing stronger emotions, compared to participants who had not used self-control.

Additionally, Study 4 tested an alternative theory—self-control depletion may increase the strength of emotions because emotions themselves increase in strength or because people feel their emotions more intensely, rather than emotion regulation being reduced.

2. Study 1: Social Anxiety

Study 1 examined whether self-control depletion would increase anxiety while meeting someone new. Most people value being accepted and liked by others [37]. People are strongly motivated to make a good impression on others, and concerns over acceptance, self-presentation, and other factors during social interactions can produce anxiety [38] [39]. To the extent that coping with social anxiety requires self-control, then people should experience greater social anxiety when their self-control has been depleted.

Participants first watched a video of a woman talking while words appeared on the screen. Participants in the depletion condition were instructed to focus only on the woman and to ignore the words. Because attention automatically focuses on novel stimuli appearing in the environment [40], the task required self-control in that it required the inhibition of pre-potent orienting of attention to the words to maintain attention only on the woman. Participants in the no depletion condition watched the video as they would normally and hence were required to exert little or no self-control.

After the video task, participants engaged in a brief conversation with another participant whom they had never met. We expected that interacting with an unfamiliar person would increase anxiety. To assess anxiety, participants later indicated how anxious they had been during the interaction, how anxious their partner had been, and the extent to which their partner had perceived them as having been anxious. We predicted that depletion would reduce the self-regulation of anxiety during the interaction, and thus depleted participants would score higher on the various measures of anxiety than would non-depleted participants.

2.1. Method

Participants and Procedure

Seventy-two undergraduates (50 women) participated in exchange for course credit. Participants attended in same-sex dyads and were told that the study was investigating factors related to social interactions, attitudes, and task performance.

First, participants completed the video task alone in individual rooms. Participants watched a 6 minute video (without sound) of a woman talking (modified from [41]). In the bottom corner of the screen, common one-syllable words (e.g., hair, hat, pulse) appeared one at a time for 10 seconds. Dyads randomly assigned to the depletion condition were instructed to focus their attention only on the woman's face and to refrain from looking at the words. If they happened to look at the words, they were to re-focus their attention on the woman as quickly as possible. Dyads randomly assigned to the no depletion condition were instructed to watch the video as they would normally. At the end of the task, participants completed the Brief Mood Introspection Scale (BMIS) [42] as a measure of mood valence and arousal.

Next, the experimenter told participants that they (the two participants) would be having an interaction in which they should try to get to know each other. During the interaction, participants discussed their responses to 5 questions (e.g., “What are you majoring in, or what do you think you will major in? Why?”, “What is one of your happiest childhood memories?”, “If you could change one thing about yourself, what would that be?”). Participants were given as much time as they needed to discuss each of the questions. The interactions were timed and videotaped, and participants were aware that they were being videotaped.

Last, participants returned to their individual rooms and rated how anxious they had been during the interaction, how anxious their partner had been, and the extent to which their partner had perceived them as having been anxious, using scales from 1 (*not at all*) to 10 (*extremely*). These items were embedded among other filler items (e.g., ratings of friendliness). Responses to these 3 items served as the dependent measures of social anxiety. As a measure of self-efficacy, participants also indicated on a subsequent item the extent to which they be-

lieved that they had performed well on the video task, using a scale from 1 (*not at all*) to 10 (*extremely*). Participants then were thanked and debriefed.

2.2. Results

2.2.1. Social Anxiety

Gender was marginally related to ratings of anxiety and so was included in the analyses. A 2 (depletion vs. no depletion) \times 2 (gender) MANOVA on ratings of self-anxiety, partner-anxiety, and perceptions of partners' perceptions of anxiety indicated a significant main effect of depletion condition, $F(3, 66) = 3.00, p < 0.05$. Depleted participants scored higher than did non-depleted participants on all 3 measures of anxiety, $F_s > 5.80, p_s < 0.05$ (see **Figure 1**). Depleted participants rated themselves as having been more anxious and as having been perceived by their partner as being more anxious. They also rated their partners as having been more anxious. Hence, multiple measures of anxiety converged in showing that depletion increased anxiety. This is consistent with the idea that depletion reduces emotion regulation.

The main effect of gender approached significance, $F(3, 66) = 2.17, p = 0.10$, such that male participants scored somewhat higher than women across the 3 anxiety measures. The interaction between depletion condition and gender was non-significant, $F = 1.10, ns$. Thus, depletion seemed to increase anxiety equally among both men and women.

2.2.2. Mood, Arousal, Self-Efficacy, and Length of Interaction

The tests of between-subjects effects from the MANOVA reported above on the 3 measures of anxiety remained significant when controlling for mood, self-efficacy, and the duration of the interaction, $F_s > 4.72, p_s < 0.05$. The obtained pattern of results thus does not seem to be due to mood valence or arousal immediately after the video task, feelings of self-efficacy on the video task, or the duration of the interaction.

3. Study 2: Public Speaking Anxiety

Study 1 showed that depletion increased anxiety during an interpersonal interaction. Study 2 examined whether depletion would increase anxious concerns regarding speaking in front of a large group. Public speaking is a prominent fear among many. It therefore seems plausible that people seek to cope with anxious concerns prior to speaking in public, and that depleted self-control might reduce such coping.

Participants first completed the video task used in Study 1. They were then led to believe that they would perform an impromptu speech in front of the other participants and reported how anxious they were immediately before their apparent speech. The prediction was that depletion would reduce the downregulation of concerns over public speaking, and therefore that depleted participants would indicate being more anxious than would non-depleted participants.

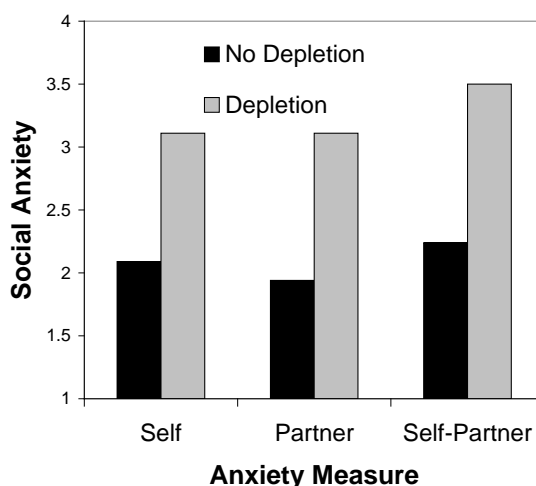


Figure 1. Social anxiety as a function of having used and depleted one's self-control energy (Study 1).

3.1. Method

3.1.1. Participants

Sixty-four undergraduates (41 women) participated in exchange for course credit. Participants were randomly assigned to a self-control depletion or no depletion condition.

3.1.2. Procedure

Participants attended in groups of approximately 30. They were told that the study was investigating how people view themselves and others while making speeches and that a few individuals would be chosen to make a speech in front of everyone toward the end of the experiment.

First, participants completed the video task used in Study 1. Those in the depletion condition were instructed to avoid looking at the words in the video and instead to focus on the woman, whereas those in the no depletion were instructed to watch as they would normally. At the end of the video, participants completed checks of the depletion manipulation by indicating the extent to which they had looked at the words and woman during the video, using scales from 1 (*not at all/never*) to 9 (*a lot/often*). They also completed the UWIST Mood Adjective Checklist [43], which contains 24 items (e.g., sluggish, energetic) indicative of three types of current mood valence and arousal, namely tense arousal, energetic arousal, and hedonic tone. Afterward, participants evaluated the woman in the video on her speaking abilities, intelligence, admirability, and likeability, and completed other filler items ostensibly related to public speaking. These items were included so as to bolster the cover story about making a speech and activate concerns about public speaking.

Next, the experimenter told participants that everyone should prepare to make a speech about how psychology applies to their lives. The experimenter said that 4 participants would be chosen at random to make speeches while the other participants evaluated the speechmakers on the same dimensions on which they had evaluated the woman in the video. All participants were instructed to prepare for the speech in case they were among those chosen to speak in front of the group. Then, after ostensibly looking up participant numbers on the computer, the experimenter announced 4 participants who were to speak in front of the group. Participants could identify whether they were chosen based on a participant number written on their questionnaire packet. Unbeknownst to participants, however, all participants had 1 of the 4 numbers written on their packet. Hence, all participants were led to believe that they had been chosen to make a speech. Participants were then given 2 minutes for the “speechmakers” to prepare for their speech.

Participants then received a questionnaire that assessed their current anxiety level, which included 7 items pertaining to anxiety (*i.e.*, *anxious*, *nervous*, *jittery*, *uneasy*, *worried*, *bothered*, and *calm*) embedded among other filler items (e.g., *drowsy*, *caring*). In keeping with the cover story, participants were told that these items might be related to perceptions of the speechmakers. Participants rated the extent to which the items described their current emotional state, using a scale from 1 (*very slightly or not at all*) to 5 (*extremely*). The 7 anxiety items were combined to form the dependent measure of anxiety ($\alpha = 0.93$).

Afterward, participants completed the 33-item Marlowe-Crowne Social Desirability Scale [44], which allowed us to assess whether any differences in self-reported anxiety might be due to desirable responding rather than actual anxiety. Last, participants were told that no one would actually be making a speech and were probed for suspicion, thanked, and debriefed. Eight participants indicated some suspicion as to whether they would actually be making a speech. Excluding these participants from analysis did not influence the results in any meaningful way, and so their data were retained.

3.2. Results and Discussion

3.2.1. Manipulation Checks

The manipulation check suggested that participants were successful in following the video task instructions. Participants in the depletion condition indicated having looked at the words in the video ($M = 3.21$, $SD = 1.76$) less often and the woman ($M = 6.03$, $SD = 1.21$) more often than did participants in the no depletion condition indicate having looked at the words ($M = 5.16$, $SD = 1.71$) and woman ($M = 4.67$, $SD = 1.56$), respectively, $t_s > 3.89$, $p_s < 0.001$.

3.2.2. Anxiety

Social desirability scores (as assessed by the Marlowe-Crowne) predicted self-reported anxiety at the end of the

study, $r(64) = -0.27$, $p < 0.05$, and self-reported anxiety differed somewhat by gender. Gender therefore was included in the analyses, and social desirability was controlled for.

A 2 (depletion vs. no depletion) \times 2 (gender) ANCOVA, that controlled for social desirability scores, indicated a significant main effect of depletion condition, $F(1, 59) = 4.36$, $p < 0.05$. Depleted participants ($M = 3.36$, $SD = 1.02$) reported higher levels of anxiety than did non-depleted participants ($M = 2.81$, $SD = 1.06$). This is consistent with the notion that depleted self-control reduces coping with aversive emotions.

The main effect of gender approached significance, $F(1, 59) = 2.03$, $p = 0.16$, such that women reported somewhat higher anxiety than men. The interaction between depletion condition and gender was not significant, $F = 1$, *ns*.

3.3.3. Mood and Arousal

The obtained pattern of results seems unlikely to have been attributable to self-reported mood valence or arousal immediately after the video task. The main effect of depletion condition on anxiety in the above ANCOVA remained significant when controlling for either tense arousal, energetic arousal, or hedonic tone, $F_s > 4.06$, $p_s < 0.05$.

4. Study 3: Romantic Jealousy

Romantic relationships can be a meaningful and important aspect of the lives of most individuals. Hence, people are sometimes prone to experience jealousy over romantic relationships, such as when a current partner devotes attention or resources to another individual or when a potential mate is attracted to someone else [45]. Romantic jealousy can evoke powerful emotions and responses that individuals seek to regulate and stifle [46]-[49]. Study 1 examined whether depletion would increase jealous feelings.

Participants first engaged in a task that either did or did not require self-control. For the self-control task, participants wrote an essay without using any words that contained the letters *a* or *n*. Most words in the English language contain the letters *a* or *n*. The task therefore required participants to override their habitual style of writing so as to find words that did not contain an *a* or *n*. For the control task, participants were asked to write an essay without using any words that contained the letters *x* or *z*. Most words do not contain *x* or *z*, and so this task did not require much effort to override any habitual manner of writing. This manipulation has been used successfully in previous research to manipulate self-control depletion [50].

To elicit romantic jealousy with which participants would have to cope, we next asked half of the participants to write about a time when they were jealous romantically and half to write about what they did last week, as a neutral control topic. Participants later indicated the extent to which they felt jealous.

The prediction was that depletion would reduce the regulation of jealousy and therefore that depleted participants who had written about romantic jealousy would be especially jealous, relative to the other groups of participants. Non-depleted participants who had written about jealousy were expected to exhibit relatively low levels of jealousy. Depletion was not expected to influence jealousy among those who had written about the control topic, because these participants would not have had to cope with any feelings of jealousy.

4.1. Method

4.1.1. Participants

Seventy-two undergraduates (40 women) participated in exchange for course credit. This sample excluded 11 participants who failed to follow instructions (see below). Participants were randomly assigned to depletion and emotion conditions.

4.1.2. Procedure

During a mass testing session at the start of the semester, participants completed the Multidimensional Jealousy Scale (MJS) [51]. The MJS contains 24 items divided into 3 subscales that assess the tendency to experience cognitive, emotional, and behavioral facets of intrasexual jealousy. MJS scores were included so as to account for variability in the dependent measure of sexual jealousy.

Approximately 3 months after the mass testing session, participants completed the main phase of the experiment in a classroom setting. Participants were told that the study was examining attitudes, behaviors, and emotions. They received a packet that contained all study materials and instructions. Participants completed the

packet at their own pace.

First, participants completed the manipulation of self-control strength (borrowed from [50]). Specifically, they were asked to write an essay describing what they did yesterday. Participants in the self-control depletion condition were further instructed to avoid using any words that contained an *a* or *n*. Participants in the no depletion condition were instructed to avoid using any words that contained an *x* or *z* (e.g., to write *place where the animals live* instead of *zoo*). Participants were given one sheet of lined paper and asked to work on the task either for 5 minutes or until they had used all of the lines. Participants who failed to follow these instructions (e.g., did not write anything) were excluded from all analyses.

Upon finishing their essays, participants completed a check of the self-control manipulation by indicating the extent to which they had to override or inhibit their typical way of writing in order to follow the instructions, using a scale from 1 (*very little*) to 9 (*a lot*). They also completed a single-item measure of self-efficacy by indicating how well they felt that they had been able to follow the instructions, using a scale from 1 (*very poorly*) to 9 (*very well*). After these items, participants completed the BMIS, as a measure of current mood valence and arousal.

Participants then completed the manipulation of romantic jealousy. Participants in the jealousy condition were instructed to describe briefly 4 or 5 incidents in which they felt jealous or threatened in the context of a romantic relationship. They then wrote in greater detail about one of those events. Participants in the control condition described 4 or 5 activities that they had engaged in during the last week and then wrote about one of those activities in greater detail. Participants were asked to work on this task until they had used up all of the space provided (less than 1/2 of a page). Participants who failed to follow these instructions were excluded from all analyses.

Next, participants completed a single item measuring the extent to which they felt jealous at the present moment, which was embedded among other filler items, using a scale from 1 (*very slightly*) to 5 (*extremely*). They also completed 4 items assessing the extent to which they felt preoccupied with thoughts of jealousy, unable to stop thinking jealous thoughts, overcome or overwhelmed with jealousy, and wrapped up in jealousy, using a scale from 1 (*not at all*) to 9 (*very much*). Responses to the 5 jealousy items were standardized and combined ($\alpha = 0.93$) to form the dependent measure of jealousy. Last, participants were thanked and debriefed. In this and all subsequent studies, we were careful to make sure that no participant left feeling distressed.

4.2. Results and Discussion

4.2.1. Manipulation Check

Participants' responses to the manipulation check indicated that the two writing tasks differed in the amount of self-control they required. Depleted participants ($M = 6.50$, $SD = 0.97$) reported having had to override or inhibit their typical writing style to a greater extent than did non-depleted participants ($M = 1.83$, $SD = 1.23$), $t(71) = 17.28$, $p < 0.001$.

4.2.2. Romantic Jealousy

A 2 (depletion vs. no depletion) \times 2 (jealousy vs. control essay) analysis of covariance (ANCOVA) on jealousy scores that controlled for dispositional cognitive, emotional, and behavioral jealousy indicated that the main effect of jealousy condition was significant, $F(1, 65) = 5.53$, $p < 0.05$, and that the main effect of depletion condition was not significant, $F < 1$, *ns*. Their interaction was significant, $F(1, 65) = 6.75$, $p = 0.01$ (see **Figure 2**).

In the jealousy condition, depleted participants reported feeling significantly more jealous than did non-depleted participants, $F(1, 65) = 4.17$, $p < 0.05$. In the control condition, depleted and non-depleted participants did not differ significantly in self-reported jealousy, $F(1, 65) = 2.91$, $p = 0.09$, and the means were in the opposite direction, such that depleted participants indicated feeling somewhat less jealous. (It is unclear why this trend emerged.) Depletion thus increased jealousy only among participants who had written about feeling romantically jealous. This is consistent with the hypothesis that depletion reduces emotional coping.

Moreover, among depleted participants, those in the jealousy condition indicated feeling more jealous than did those in the control condition, $F(1, 65) = 9.96$, $p < 0.01$. Among non-depleted participants, self-reported jealousy did not differ between the jealousy and control condition, $F < 1$, *ns*. Thus, writing about romantic jealousy increased jealous thoughts and feelings but only when participants' self-control resources had been depleted. Participants whose self-control resources were intact seemingly avoided feelings of jealousy.

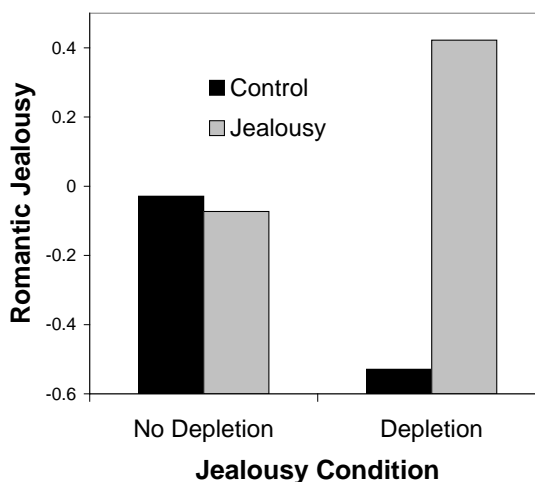


Figure 2. Romantic jealousy as a function of emotional induction condition and of having used and depleted one's self-control energy (Study 3).

No evidence indicated that either gender or any of the cognitive, emotional, or behavioral dispositional jealousy subscales moderated any of the observed effects. Thus, depletion seemed to reduce coping with romantic jealousy regardless of gender and dispositional tendencies to experience jealousy.

4.2.3. Mood, Arousal, and Self-Efficacy

The obtained pattern of results did not appear attributable to mood valence, arousal, or self-efficacy immediately following the self-control manipulation. The interaction between depletion condition and jealousy condition reported above remained significant when controlling for these measures, $F(1, 63) = 7.82, p < 0.01$. This argues against several alternative explanations, such as the possibility that depleted participants simply were highly aroused and misattributed this arousal as jealousy.

5. Study 4: Coping with Sadness

Studies 1, 2, and 3 showed that depletion increased emotions that are often downregulated. Study 4 was designed to assess whether this effect may be attributable to depletion reducing emotion regulation or increasing emotionality. If depletion increases emotionality, then it should increase emotions that are not self-regulated. Study 4 therefore included a happiness induction.

The prediction was that depletion would not increase happiness but would increase sadness. People frequently cope with sad or distressing thoughts and feelings. There is some evidence that self-control facilitates coping with sadness. For instance, good self-control has been found to predict less susceptibility to negative mood states and depression [26]. It is possible that this link is attributable to self-control facilitating emotion regulation [52].

To manipulate self-control, participants in the depletion condition first completed a task that established a habit or routine of crossing out *es* on a page of text according to a certain rule and then required them to break this habit by following a new rule. Breaking habits and overriding established routines requires self-control and therefore was posited to deplete self-control resources. Participants in the no depletion condition crossed out *es* on a page of text in a fashion that did not require them to override any habit and hence required little self-control. This manipulation has been used successfully in the past to manipulate self-control exertion [10] [15].

Participants then wrote about one of three topics: sad events, happy events, or what they did yesterday (neutral control). After the writing task, participants reported their mood. The prediction was that depletion would increase sadness only among participants who had written about sadness. Depletion was not expected to influence levels of happiness vs. sadness among participants who had written about happy or neutral topics because happiness is not an emotion that people typically try to regulate. Hence, depleted participants who wrote about sadness were expected to exhibit the highest levels of sadness, relative to all other groups of participants.

5.1. Method

5.1.1. Participants

Ninety undergraduates (49 men) participated in exchange for course credit. This sample excluded 3 participants who failed to complete all required materials. Participants were randomly assigned to a self-control depletion and emotion essay conditions.

5.1.2. Procedure

Participants attended in group sessions in classrooms. They were told that the study was investigating emotion. First, participants completed the 21-item Beck Depression Inventory (BDI) [53], which served as a control for individual differences in the dependent measure of personal sadness.

Next, participants completed the self-control manipulation. Participants were given two copies of a page of journal text. On the first page, participants were to cross out every occurrence of the letter *e*. The page contained a high number (337) of *es* and so participants should have established a well-practiced routine of crossing out *es*. For the second page, participants assigned to the no-depletion condition were asked to follow the same rule as before. Participants in the depletion condition, in contrast, were asked to follow a different rule than before by crossing out all occurrences of the letter *e* except for *es* that were followed by a vowel or *es* that appeared in a word with a vowel appearing two letters before the *e*. At the end of the study, participants completed a check of the manipulation by indicating the extent to which the *es* task had required that they break a habit, using a scale from 1 (*not at all*) to 9 (*a lot*). They also completed a single item measure of self-efficacy by indicating how well they had performed on the task, using a scale from 1 (*very poorly*) to 9 (*very well*). Immediately after the *es* task, participants completed the Positive and Negative Affect Schedule (PANAS) [54], which contains 20 items (e.g., excited, upset) indicative of current mood valence.

Participants then completed the emotion manipulation. Participants in the sadness condition first described briefly 4 or 5 things that made them feel very sad or depressed. They then wrote in greater detail about one of those things. Participants in the happiness condition answered parallel questions about happiness. Participants in the control condition described 4 or 5 activities that they did yesterday and then wrote in greater detail about one of those activities. Participants were given 5 minutes to complete this task.

After the essay task, participants worked on a filler task (*i.e.*, completed a questionnaire) for 5 minutes that served as a delay to provide additional time for participants to think about their feelings.

Next, participants responded to 8 items (*i.e.*, *depressed*, *gloomy*, *happy*, *miserable*, *cheerful*, *unhappy*, *sad*, *content*) that assessed the extent to which they felt sad at the present moment, using scales from 1 (*very slightly or not at all*) to 5 (*extremely*). These items were embedded among other filler items (e.g., *calm*). Participants also completed 8 items indicating the extent to which they felt preoccupied with, unable to stop thinking, overcome or overwhelmed with, or wrapped up in happy thoughts and in sad thoughts, using scales from 1 (*not at all*) to 9 (*very much*). Ratings of happiness correlated highly with those of sadness, thereby justifying combining them into a single measure. Because the two sets of items used different scales, responses to the first 8 sadness items were averaged and standardized and then combined with the standardized average of the last 8 sadness items to form the dependent measure of sadness ($\alpha = 0.81$). Last, participants were thanked and debriefed.

5.2. Results

5.2.1. Manipulation Check

Depleted participants ($M = 5.53$, $SD = 2.49$) indicated that the *es* task had required them to break a habit to a greater extent than did non-depleted participants ($M = 2.84$, $SD = 2.43$), $t(88) = 5.18$, $p < 0.001$. This suggests that the *es* task was successful in requiring different levels of self-control (breaking a habit).

5.2.2. Self-Reported Sadness

The prediction was that depleted participants in the sadness condition would exhibit the highest levels of sadness. All other groups of participants were predicted to report experiencing relatively low and equal levels of sadness.

As a test of this specific prediction, a planned comparison pitted the depleted participants in the sadness condition against the other conditions. It controlled for mood valence (as assessed by the PANAS immediately after the *es* task) and responses to the BDI items so as to account for additional variability in self-reported sadness. The planned comparison was significant and in line with predictions, $F(1, 62) = 6.60$, $p < 0.05$ (see **Figure 3**).

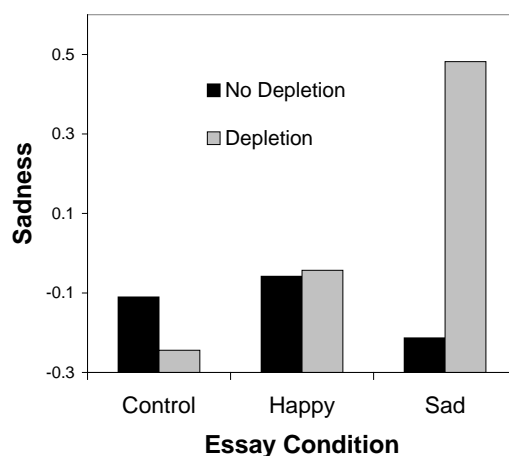


Figure 3. Sadness as a function of emotional induction condition and of having used and depleted one's self-control energy (Study 4).

Participants in the depletion condition who had written about sadness reported being significantly more sad than did participants in the depletion condition who had written about what they did yesterday, $F(1, 62) = 4.75$, $p < 0.05$, and participants in the no-depletion condition who had written about sadness, $F(1, 62) = 3.92$, $p < 0.05$.

Depletion did not appear to influence emotional states with which participants likely would not have coped during the experiment. In the happiness condition, depleted and non-depleted participants did not differ in reported sadness, $F < 1$. If depletion influenced emotions other than those that people typically try to regulate, then one would have expected that depleted participants who had written about happiness would have scored especially low in sadness (or high in happiness). But, they did not.

5.2.3. Depression and Self-Efficacy

Regression analyses indicated that the observed findings were not moderated by dispositional differences in depression (BDI scores). The above analyses included mood valence (as assessed immediately after the *es* task) as a covariate, which indicated that the effect of depletion on sadness likely was not attributable to any direct effects of depletion on mood. Similarly, the obtained pattern of results did not appear to be due to self-efficacy, such that the above planned comparison remained significant even when controlling for perceptions of how well participants had performed on the *es* task, $F(1, 61) = 6.83$, $p < 0.05$.

6. General Discussion

In situations designed to activate a target emotion that is typically downregulated—either anxiety, jealousy, or sadness—participants who had previously completed a self-control task reported experiencing these emotions to a greater extent, compared to participants who had not previously completed a self-control task. These findings are consistent with the idea that self-control relies on an energy that is used interchangeably across different processes, including emotion regulation. The theory is that completing a self-control task depletes this energy, thereby reducing later emotion regulation.

There are at least a few plausible mechanisms through which these effects occur. Most consistent with the extant literature and the current findings is the explanation that using self-control reduces later emotion regulation, and so emotions that typically are downregulated increase in strength. This effect may occur because, after using self-control, people lack the ability to control their emotions, or they may be less motivated to do so.

Other explanations concern changes in emotion, rather than their regulation. It is plausible that using self-control increases later emotion because the emotion itself becomes stronger or because people become more sensitive to their emotions. A final study suggested against this idea—having used self-control did not increase happiness following a happiness induction. It is plausible that having used self-control increases only emotions that typically are self-regulated, without the effect involving reducing emotion regulation, but there is no clear rationale to support this idea.

Each study may be improved in various ways, but the variety of methods used provides reasonable convergence supporting the hypothesis. For instance, participants in some studies first either did or did not use self-control. They then wrote about an emotionally evoking topic. It is plausible that having used self-control influenced the writing task, such as the events that participants recalled. This limitation does not, however, apply to the other studies.

The studies we used focused on the self-control of negative emotions, yet the same pattern may exist for the control of positive emotions. People sometimes downregulate happiness, for instance, and having used self-control may reduce its regulation as well.

There are different ways through which people regulate emotion, and self-control seems more relevant to some than to others. Antecedent and response-focused emotion regulation [55] may require self-control in the form of attention regulation and thought control [5]. Emotion regulation processes requiring complex thought, such as cognitive reappraisal [35] [36] and downward social comparison [56], may relate to self-control to the extent that the same energy underlies both self-control and complex thought [31].

In short, we suggest that initial acts of self-control may significantly impact emotion regulation. Emotion may be shaped by many other aspects of their lives, and the costs may be high—ranging from mild, unpleasant experiences to full-blown negative emotionality and accompanying behavioral consequences.

References

- [1] Isen, A.M. (1970) Success, Failure, Attention, and Reactions to Others: The Warm Glow of Success. *Journal of Personality and Social Psychology*, **36**, 1-12. <http://dx.doi.org/10.1037/0022-3514.36.1.1>
- [2] Eisenberg, N., Fabes, R.A., Guthrie, I.K. and Reiser, M. (2000) Dispositional Emotionality and Regulation: Their Role in Predicting Quality of Social Functioning. *Journal of Personality and Social Psychology*, **78**, 136-157. <http://dx.doi.org/10.1037/0022-3514.78.1.136>
- [3] Judge, T.A. and Larsen, R.J. (2001) Dispositional Affect and Job Satisfaction: A Review and Theoretical Extension. *Organizational Behavior and Human Decision Processes*, **86**, 67-98. <http://dx.doi.org/10.1006/obhd.2001.2973>
- [4] Gross, J.J. (1998) The Emerging Field of Emotion Regulation: An Integrative Review. *Review of General Psychology*, **2**, 271-299. <http://dx.doi.org/10.1037/1089-2680.2.3.271>
- [5] Larsen, R.J. and Prizmic, Z. (2004) Affect Regulation. In: Baumeister, R.F. and Vohs, K.D., Eds., *Handbook of Self-Regulation: Research, Theory, and Applications*, Guilford, New York, 40-61.
- [6] Baumeister, R.F., Gailliot, M., DeWall, C.N. and Oaten, M. (2006) Self-Regulation and Personality: How Interventions Increase Regulatory Success, and How Depletion Moderates the Effects of Traits on Behavior. *Journal of Personality*, **74**, 1773-1801. <http://dx.doi.org/10.1111/j.1467-6494.2006.00428.x>
- [7] Muraven, M. and Baumeister, R.F. (2000) Self-Regulation and Depletion of Limited Resources: Does Self-Control Resemble a Muscle? *Psychological Bulletin*, **126**, 247-259. <http://dx.doi.org/10.1037/0033-2909.126.2.247>
- [8] Richeson, J.A. and Shelton, J.N. (2003) When Prejudice Does Not Pay: Effects of Interracial Contact on Executive Function. *Psychological Science*, **14**, 287-290. <http://dx.doi.org/10.1111/1467-9280.03437>
- [9] Richeson, J.A. and Trawalter, S. (2005) Why Do Interracial Interactions Impair Executive Function? A Resource Depletion Account. *Journal of Personality and Social Psychology*, **88**, 934-947. <http://dx.doi.org/10.1037/0022-3514.88.6.934>
- [10] Baumeister, R.F., Bratslavsky, E., Muraven, M. and Tice, D.M. (1998) Self-Control Depletion: Is the Active Self a Limited Resource? *Journal of Personality and Social Psychology*, **74**, 1252-1265. <http://dx.doi.org/10.1037/0022-3514.74.5.1252>
- [11] Kahan, D., Polivy, J. and Herman, C.P. (2003) Conformity and Dietary Disinhibition: A Test of the Ego-Strength Model of Self-Regulation. *International Journal of Eating Disorders*, **33**, 165-171. <http://dx.doi.org/10.1002/eat.10132>
- [12] Vohs, K.D. and Heatherton, T.F. (2000) Self-Regulatory Failure: A Resource-Depletion Approach. *Psychological Science*, **11**, 249-254. <http://dx.doi.org/10.1111/1467-9280.00250>
- [13] Gordijn, E.H., Hindriks, I., Koomen, W., Dijksterhuis, A. and Van Knippenberg, A. (2004) Consequences of Stereotype Suppression and Internal Suppression Motivation: A Self-Regulation Approach. *Personality and Social Psychology Bulletin*, **30**, 212-224. <http://dx.doi.org/10.1177/0146167203259935>
- [14] Muraven, M., Collins, R.L. and Neinhuis, K. (2002) Self-Control and Alcohol Restraint: An Initial Application of the Self-Control Strength Model. *Psychology of Addictive Behaviors*, **16**, 113-120. <http://dx.doi.org/10.1037/0893-164X.16.2.113>
- [15] Faber, R.J. and Vohs, K.D. (2004) To Buy or Not to Buy? Self-Control and Self-Regulatory Failure in Purchase Be-

- havior. In: Baumeister, R.F. and Vohs, K.D., Eds., *Handbook of Self-Regulation: Research, Theory, and Applications*, Guilford Press, New York, 509-524.
- [16] Finkel, E.J. and Campbell, W.K. (2001) Self-Control and Accommodation in Close Relationships: An Interdependence Analysis. *Journal of Personality and Social Psychology*, **81**, 263-277. <http://dx.doi.org/10.1037/0022-3514.81.2.263>
- [17] Vohs, K.D., Baumeister, R.F. and Ciarocco, N.J. (2005) Self-Regulation and Self-Presentation: Regulatory Resource Depletion Impairs Impression Management and Effortful Self-Presentation Depletes Regulatory Resources. *Journal of Personality and Social Psychology*, **88**, 632-657. <http://dx.doi.org/10.1037/0022-3514.88.4.632>
- [18] DeWall, C.N., Baumeister, R.F., Stillman, T.F. and Gailliot, M.T. (2007) Violence Restrained: Effects of Self-Regulation and Its Depletion on Aggression. *Journal of Experimental Social Psychology*, **43**, 62-76. <http://dx.doi.org/10.1016/j.jesp.2005.12.005>
- [19] Stucke, T.S. and Baumeister, R.F. (2006) Ego Depletion and Aggressive Behavior: Is the Inhibition of Aggression a Limited Resource? *European Journal of Social Psychology*, **36**, 1-13. <http://dx.doi.org/10.1002/ejsp.285>
- [20] Baumeister, R.F., Heatherton, T.F. and Tice, D.M. (1994) *Losing Control: How and Why People Fail at Self-Regulation*. Academic Press, San Diego.
- [21] Muraven, M., Collins, R.L., Shiffman, S. and Paty, J.A. (2005) Daily Fluctuations in Self-Control Demands and Alcohol Intake. *Psychology of Addictive Behaviors*, **19**, 140-147. <http://dx.doi.org/10.1037/0893-164X.19.2.140>
- [22] Gailliot, M.T., Schmeichel, B.J. and Baumeister, R.F. (2006) Self-Regulatory Processes Defend against the Threat of Death: Effects of Self-Control Depletion and Trait Self-Control on Thoughts and Fears of Dying. *Journal of Personality and Social Psychology*, **91**, 49-62. <http://dx.doi.org/10.1037/0022-3514.91.1.49>
- [23] Eisenberg, N., Smith, C.L., Sadovsky, A. and Spinrad, T.L. (2004) Effortful Control: Relations with Emotion Regulation, Adjustment, and Socialization in Childhood. In: Baumeister, R.F. and Vohs, K.D., Eds., *Handbook of Self-Regulation: Research, Theory, and Applications*, Guilford Press, New York, 259-282.
- [24] Fabes, R.A., Eisenberg, N., Jones, S., Smith, M., Guthrie, I., Poulin, R., Shepard, S. and Friedman, J. (1999) Regulation, Emotionality, and Preschoolers' Socially Competent Peer Interactions. *Child Development*, **70**, 432-442. <http://dx.doi.org/10.1111/1467-8624.00031>
- [25] Gramzow, R.H., Sedikides, C., Panter, A.T. and Insko, C.A. (2000) Aspects of Self-Regulation and Self-Structure as Predictors of Perceived Emotional Distress. *Personality and Social Psychology Bulletin*, **26**, 188-205. <http://dx.doi.org/10.1177/0146167200264006>
- [26] Tangney, J.P., Baumeister, R.F. and Boone, A.L. (2004) High Self-Control Predicts Good Adjustment, Less Pathology, Better Grades, and Interpersonal Success. *Journal of Personality*, **72**, 271-324. <http://dx.doi.org/10.1111/j.0022-3506.2004.00263.x>
- [27] Shoda, Y., Mischel, W. and Peake, P.K. (1990) Predicting Adolescent Cognitive and Self-Regulatory Competencies from Preschool Delay of Gratification: Identifying Diagnostic Conditions. *Developmental Psychology*, **26**, 978-986. <http://dx.doi.org/10.1037/0012-1649.26.6.978>
- [28] Muraven, M. and Slessareva, E. (2003) Mechanisms of Self-Control Failure: Motivation and Limited Resources. *Personality and Social Psychology Bulletin*, **29**, 894-906. <http://dx.doi.org/10.1177/0146167203029007008>
- [29] Muraven, M., Tice, D.M. and Baumeister, R.F. (1998) Self-Control as a Limited Resource: Regulatory Depletion Patterns. *Journal of Personality and Social Psychology*, **74**, 774-789. <http://dx.doi.org/10.1037/0022-3514.74.3.774>
- [30] Schmeichel, B.J., Demaree, H.A., Robinson, J.L. and Pu, J. (2006) Ego Depletion by Response Exaggeration. *Journal of Experimental Social Psychology*, **42**, 95-102. <http://dx.doi.org/10.1016/j.jesp.2005.02.005>
- [31] Schmeichel, B.J., Vohs, K.D. and Baumeister, R.F. (2003) Intellectual Performance and Ego Depletion: Role of the Self in Logical Reasoning and Other Information Processing. *Journal of Personality and Social Psychology*, **85**, 33-46. <http://dx.doi.org/10.1037/0022-3514.85.1.33>
- [32] Vohs, K.D. and Schmeichel, B.J. (2003) Self-Regulation and the Extended Now: Controlling the Self Alters the Subjective Experience of Time. *Journal of Personality and Social Psychology*, **85**, 217-230. <http://dx.doi.org/10.1037/0022-3514.85.2.217>
- [33] Hochschild, A.R. (1983) *The Managed Heart: Commercialization of Human Feeling*. University of California Press, Berkeley.
- [34] Wegner, D.M., Erber, R. and Zanakos, S. (1993) Ironic Processes in the Mental Control of Mood and Mood-Related Thought. *Journal of Personality and Social Psychology*, **65**, 1093-1104. <http://dx.doi.org/10.1037/0022-3514.65.6.1093>
- [35] Tamres, L.K., Janicki, D. and Helgeson, V.S. (2002) Sex Differences in Coping Behavior: A Meta-Analytic Review and an Examination of Relative Coping. *Personality and Social Psychology Review*, **6**, 2-30. http://dx.doi.org/10.1207/S15327957PSPR0601_1

- [36] Tennen, H. and Affleck, G. (2005) Benefit-Finding and Benefit-Reminding. In: Snyder, C.R. and Lopez, S.J., Eds., *Handbook of Positive Psychology*, Oxford University Press, Oxford, 584-597.
- [37] Baumeister, R.F. and Leary, M.R. (1995) The Need to Belong: Desire for Interpersonal Attachments as a Fundamental Human Motivation. *Psychological Bulletin*, **117**, 497-529. <http://dx.doi.org/10.1037/0033-2909.117.3.497>
- [38] Leary, M.R. (1996) *Self-Presentation: Impression Management and Interpersonal Behavior*. Westview Press, Boulder.
- [39] Leary, M.R. and Kowalski, R.M. (1995) The Self-Presentation Model of Social Phobia. In: Heimberg, R.G., Liebowitz, M.R., Hope, D.A. and Schneier, F.R., Eds., *Social Phobia: Diagnosis, Assessment and Treatment*, Guilford Press, New York, 94-112.
- [40] Shiffrin, R.M. and Schneider, W. (1977) Controlled and Automatic Human Information Processing: I. Detection, Search, and Attention. *Psychological Review*, **84**, 1-66. <http://dx.doi.org/10.1037/0033-295X.84.1.1>
- [41] Gilbert, D.T., Krull, D.S. and Pelham, B.W. (1988) Of Thoughts Unspoken: Social Inference and the Self-Regulation of Behavior. *Journal of Personality and Social Psychology*, **55**, 685-694. <http://dx.doi.org/10.1037/0022-3514.55.5.685>
- [42] Mayer, J.D. and Gaschke, Y.N. (1988) The Experience and Meta-Experience of Mood. *Journal of Personality and Social Psychology*, **55**, 102-111. <http://dx.doi.org/10.1037/0022-3514.55.1.102>
- [43] Matthews, G., Jones, D.M. and Chamberlain, A.G. (1990) Refining the Measurement of Mood: The UWIST Mood Adjective Checklist. *British Journal of Psychology*, **81**, 17-42. <http://dx.doi.org/10.1111/j.2044-8295.1990.tb02343.x>
- [44] Crowne, D.P. and Marlowe, D. (1960) A New Scale of Social Desirability Independent of Psychopathology. *Journal of Consulting Psychology*, **24**, 349-354. <http://dx.doi.org/10.1037/h0047358>
- [45] Harris, C.R. (2003) A Review of Sex Differences in Sexual Jealousy, Including Self-Report Data, Psychophysiological Responses, Interpersonal Violence, and Morbid Jealousy. *Personality and Social Psychology Review*, **7**, 102-128. http://dx.doi.org/10.1207/S15327957PSPR0702_102-128
- [46] Francis, J.L. (1977) Toward the Management of Heterosexual Jealousy. *Journal of Marital and Family Therapy*, **3**, 61-69. <http://dx.doi.org/10.1111/j.1752-0606.1977.tb00486.x>
- [47] Mullen, P.E. and Martin, J. (1994) Jealousy: A Community Study. *The British Journal of Psychiatry*, **164**, 35-43. <http://dx.doi.org/10.1192/bjp.164.1.35>
- [48] Pines, M. and Aronson, E. (1983) Antecedents, Correlates, and Consequences of Sexual Jealousy. *Journal of Personality*, **51**, 108-136. <http://dx.doi.org/10.1111/j.1467-6494.1983.tb00857.x>
- [49] Sabini, J. and Silver, M. (2005) Gender and Jealousy: Stories of Infidelity. *Cognition and Emotion*, **19**, 713-727. <http://dx.doi.org/10.1080/02699930441000490>
- [50] Schmeichel, B.J., Gailliot, M.T. and Baumeister, R.F. (2005) Choice, Memory, and the Executive Function of Self. Manuscript submitted for publication.
- [51] Pfeiffer, S.M. and Wong, P.T.P. (1989) Multidimensional Jealousy. *Journal of Social and Personal Relationships*, **6**, 181-196. <http://dx.doi.org/10.1177/026540758900600203>
- [52] Tomarken, A.J. and Keener, A.D. (1998) Frontal Brain Asymmetry and Depression: A Self-Regulatory Perspective. *Cognition and Emotion*, **12**, 387-420. <http://dx.doi.org/10.1080/026999398379655>
- [53] Beck, A.T., Steer, R.A. and Brown, G.K. (1996) *BDI-II: Beck Depression Inventory Manual*. 2nd Edition, Harcourt Brace, Boston.
- [54] Watson, D., Clark, L. and Tellegen, A. (1988) Development and Validation of Brief Measures of Positive and Negative Affect: The PANAS Scales. *Journal of Personality and Social Psychology*, **54**, 1063-1070. <http://dx.doi.org/10.1037/0022-3514.54.6.1063>
- [55] Gross, J.J. (1999) Emotion Regulation: Past, Present, Future. *Cognition and Emotion*, **13**, 551-573. <http://dx.doi.org/10.1080/026999399379186>
- [56] Suls, J. and Wheeler, L. (2000) *Handbook of Social Comparison*. Springer Publishing, New York. <http://dx.doi.org/10.1007/978-1-4615-4237-7>