THE ROLE OF POSITIVE EMOTIONS IN FACILITATING THE REGULATION OF EMOTION IN RESPONSE TO NEGATIVE STRESSORS

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THE ROLE OF POSITIVE EMOTIONS IN FACILITATING THE REGULATION OF EMOTION IN RESPONSE TO NEGATIVE STRESSORS

Thesis under the direction of Christian E. Waugh, Ph.D., Assistant Professor of Psychology

The consequences of negative emotions on mental and physical health can be harmful, especially if action is not taken to reduce the strength, duration or frequency of their occurrence. Positive emotions have been shown to be effective in regulating the subjective and physiological experience of negative emotion. However, less is known about how positive emotions achieve these emotion regulatory outcomes. Positive emotions have also been shown to broaden cognition and expand attention. Cognitively-focused regulation strategies, such as reappraisal and adaptive self-reflection, are effective in regulating emotion and require a number of cognitive resources. Therefore, we hypothesized that positive emotions, and the resulting broadened cognition, regulate emotion by facilitating or inducing reappraisal and adaptive self-reflection following a stressful experience. To induce a stressful experience, participants were led to believe that they failed at an anagram-solving task. Next, participants were asked to regulate their emotion using reappraisal or reflection while they watched a positive video or a neutral video. The emotional experience of each participant was measured using self-reported emotion ratings, skin conductance levels, corrugator activity, and orbicularis activity. Results suggest that positive emotions induced emotion regulation among individuals who reflected about the failure task. However, positive emotions did not facilitate emotion regulation among individuals who reappraised the failure task. These findings suggest that one way positive emotions regulate emotion is by prompting adaptive self-reflection when individuals are thinking about a stressful experience.
INTRODUCTION

In many instances, the ability to manage and successfully regulate emotions in response to a negative experience is important for achieving social goals and maintaining mental and physical health. The present research is concerned with how positive emotions facilitate emotion regulation in response to a negative stimulus. Positive emotions have already been shown to facilitate emotion regulation by speeding cardiovascular recovery from negative emotions (Fredrickson, Mancuso, Branigan, & Tugade, 2000) and providing a buffer from depression in the wake of crises among resilient individuals (Fredrickson, Tugade, Waugh, & Larkin, 2003; Ong, Bergeman, Bisconti, & Wallace, 2006). However, less is clear about the mechanisms that might explain how positive emotions facilitate emotion regulation. A large amount of research outlines how positive emotions broaden our cognition and enable us to engage in a wider variety of thoughts and actions. Research also identifies a number of emotion regulation strategies, such a reappraisal and adaptive self-reflection, which require cognitive resources to effectively regulate emotions. Therefore, we expect that positive emotions may facilitate emotion regulation by broadening cognition, thus enabling individuals to better process their thoughts and feelings when they use cognitively-focused emotion regulation processes to think about a stressful experience. Improving the mechanism by which people accomplish the regulation of negative emotion can be helpful in improving their physical, psychological, and social well-being.

Maladaptive Consequences of Negative Emotions

The experience of negative emotion can sometimes be helpful in alerting an individual to an adaptive problem that needs to be solved. Stimuli from the environment
often evoke negative emotions which increase activity in the sympathetic nervous system, such as increased heart rate, increased blood pressure, and perspiration. This increased activity in the sympathetic nervous system functions to allocate the body’s resources to the parts of the body most conducive for efficiently solving an environmental problem (Levenson, 1992). For example, threat may trigger the subjective experience of fear or anger, which prompts increased muscle strength and tension, and a redistribution of blood to relevant parts of the body in order to facilitate action and maximize the physical exertion necessary for dealing with the stressor (Nesse, 1990). This adaptive set of processes is often very helpful in addressing and adaptively coping with a threat. However, sometimes negative emotions can be maladaptive and mislead individuals about a perceived threat or persist long after an adaptive problem has been solved; all of which may ultimately lead to a variety of negative consequences.

Increased physiological and cardiovascular activity resulting from negative emotions can have a detrimental effect on physical health. In one study, registered nurses completed diary and mood assessments and had their blood pressure taken throughout the day. Results suggested that the daily experience of three separate negative moods (anger, stress, anxiety) were each associated with increased blood pressure, a common symptom of hypertension. In a study by Brosschot and Thayer (2003), relative to positive emotions, negative emotions were associated with prolonged increases in heart rate, a common symptom associated with essential hypertension and the occurrence of cardiac arrhythmias. Brosschot and Thayer later attributed these prolonged physiological responses to worry and ruminative thoughts about unresolved problems (Brosschot & Thayer, 2004). If this increased physiological activity is frequent enough or persists long
enough in time, it may eventually lead to over-arching health problems, such as coronary artery disease and heart attack. In one study, researchers examined the autopsies of 100 individuals who died suddenly from coronary artery disease and found that recent acute psychological stress was significantly related to death (Myers & Dewar, 1975). Research also suggests that the occurrence of natural disasters, wars and other traumatic events is associated with increased incidence of heart attacks and cardiac deaths (Meisel et al., 1991). Further, even chronic stressors from everyday life have been linked to cardiovascular problems. In one longitudinal study, individuals with high job strain (defined as jobs with high demands and low decision-making freedom) exhibited higher rates of myocardial infarction and were at four times the risk of cardiovascular related death (Karasek et al., 1988; Karasek, Baker, Marxer, Ahlbom, & Theorell, 1981).

Clearly, the consequences of negative emotions on health can be harmful, especially if action is not taken to reduce the strength, duration and frequency of their occurrence. Fortunately, most individuals have opportunities available to them to regulate their emotions and potentially diminish these harmful effects, albeit with varying degrees of success.

**Regulating Negative Emotion**

Emotion regulation refers to the set of strategies and processes by which individuals alter their emotional feelings, behaviors, or physiological responses (Gross, 1999a). Although emotion regulation is often understood as a conscious process, it can occur outside of consciousness and ranges from effortful, controlled strategies to effortless, automatic strategies. Further, emotion regulation strategies may be used to alter positive or negative emotions in a number of directions. For example, people
regulate their emotions by lessening (down-regulating), intensifying (up-regulating) or maintaining an emotional experience (Gross & Thompson, 2007). Although it is possible to use emotion regulation to feel worse about a negative stimulus, the present study is specifically interested in reducing the impact of a negative experience. Research suggests that down-regulating negative emotion and up-regulating positive emotion are both effective strategies for regulating emotion in response to a negative stimulus (Giuliani, McRae, & Gross, 2008; McRae, Ciesielski, & Gross, 2012).

Although there are a number of strategies and processes by which to regulate emotion, the present research is specifically interested in how positive emotions facilitate cognitively-focused emotion regulation strategies such as reappraisal and adaptive self-reflection. The following section will explore positive emotions, reappraisal, and adaptive self-reflection as means of regulating emotion.

**Positive emotions facilitate emotion regulation.** To better illustrate how positive emotions can be helpful for regulating emotion, it might be important to know the degree to which people are able to experience positive emotions when they’re in the midst of a stressful experience. Research indicates that positive emotions can, and often do, co-occur with negative emotion during times of stress. In one study, compared to non-patients, patients hospitalized for chronic illnesses reported experiencing not only more intense negative emotions, but also more positive emotions as well (Westbrook & Viney, 1982). Another study examining caregivers of people with AIDS found that despite the increase in negative emotions, caregivers experienced a similar level of positive emotions as did the individuals in the nearby community (Folkman, 1997). These findings suggest that even in the wake of highly negative events such as crisis,
trauma, or illness, individuals are still able to experience positive emotions. The ability to experience both positive and negative emotions in the midst of negative events highlights the potential of positive emotions to be a useful tool for regulating emotion. This notion is supported by variety of research, which has outlined the usefulness of positive emotions as a mechanism for regulating emotional responses to stressful experiences.

The ‘undoing hypothesis’ suggests that positive emotions can undo the negative physical and psychological effects caused by negative emotions (Fredrickson et al., 2000). In a series of studies, participants were instructed to prepare to give a public speech to evoke high-activation negative emotions and increase sympathetic arousal. Later, they were instructed to watch one of four films. Two of the films elicited positive emotions (joy and contentment), one elicited negative emotion (sadness) and the other was a non-emotional film. Results indicated that individuals who viewed the positive films showed the fastest cardiovascular recovery relative to individuals who saw a negative film or a non-emotional film (Fredrickson et al., 2000; Fredrickson & Levenson, 1998).

The link between positive emotions and emotion regulation is also evident in research on psychological resilience. Psychological resilience refers to the trait level ability to overcome and bounce back from a negative emotional experience. Research indicates that the ability of resilient individuals to be effective emotion regulators is at least partly due to positive emotions. Fredrickson and colleagues (2003) conducted a study on emotions prior to the September 11th attacks and later retested this sample to examine the benefits of trait resilience and positive emotions following a major crisis. Results indicated that in the wake of crises, resilient individuals not only demonstrated
fewer depressive symptoms, but bounced back beyond their previous emotional state; and that both of these effects were mediated by positive emotions. These restorative qualities of positive emotions are not limited to highly traumatic events, but also prove to be helpful in response to chronic, everyday stressors. In one study, individuals were instructed to record their daily stress, positive and negative emotions in a journal. Compared to low resilient individuals, high resilient individuals exhibited better recovery from negative emotions on stressful days, and this effect was mediated by positive emotions (Ong et al., 2006).

The benefits of positive emotions during stress are many, but how exactly do individuals generate positive emotions during stress? Research suggests that resilient individuals use specific strategies to generate, maintain and utilize positive emotions to regulate negative emotional experiences. One such strategy is the creation of positive events, which involves taking ordinary events and infusing them with positive meaning (Folkman, 1997; Folkman & Moskowitz, 2000; Folkman, Moskowitz, Ozer, & Park, 1997). In a study of caregivers of patients with AIDS, caregivers who infused ordinary events with positive meaning experienced momentary relief from enduring stress (Moskowitz, Folkman, Collette, & Vittinghoff, 1996). These findings suggest that positive emotions might facilitate continued emotion regulation efforts by providing a break from stress to replenish the resources necessary to sustain continued cognitive and emotional effort.

**Cognitive reappraisal.** We know that positive emotions are helpful stress regulators, but what we do not know is the precise cognitive mechanisms through which positive emotions have these emotion regulatory effects. One potential cognitive
mechanism is cognitive reappraisal, which involves altering the meaning of a stimulus to modify its emotional impact (Gross, 1999a, 1999b). Research suggests that, relative to other emotion regulation strategies, reappraisal is not only one of the most flexible emotion regulation strategies, but is also one of the most effective ways to diminish negative emotions following a negative event. Cognitive reappraisal can be used in a variety of ways to serve emotion-related goals. For example, an individual trying to salvage a relationship after an argument might use cognitive reappraisal to achieve this goal by down-regulating negative emotion (e.g., decreasing anger) or up-regulating positive emotion (e.g., increasing gratitude). Each of these forms of reappraisal can be an effective self-regulatory tool in maintaining or improving our general health and well-being.

Cognitive reappraisal is related to a number of healthy affective, physiological and social outcomes. Trait-level research suggests that when compared to those who use reappraisal less frequently, habitual reappraisers experience and express positive emotions more frequently, experience and express negative emotions less frequently, are more well-liked and are rated by peers to have closer relationships and greater social functioning (Gross & John, 2003; John & Gross, 2004). Research also indicates that reappraisal is more effective in regulating emotion relative to other strategies, such as suppression (i.e., behave in a way that an observer cannot tell how you’re feeling). In one study, participants were asked to either reappraise or suppress their feelings while watching a disgust-evoking film. Results indicated that although both reappraisal and suppression were effective in decreasing expressive behavior, only reappraisal was effective in decreasing the subjective experience of disgust. In addition, suppression, but
not reappraisal, led to increased sympathetic nervous system activation (Gross, 1998). Further, individuals who were asked to interact with either a habitual suppressor or a reappraiser, experienced more stress (indexed by increases in blood pressure) when interacting with the suppressor (John & Gross, 2004). This stress was attributed to the lack of relevant social cues expressed by suppressors. These findings suggest that cognitive reappraisal is effective in regulating the subjective experience of emotion without increasing sympathetic arousal, or sacrificing the necessary expressive emotional cues (e.g., facial expressions, body language) conducive to successful social functioning.

Reappraisal can have different goals for achieving emotion regulation, which may lead to varying outcomes. For example, individuals might reappraise a stressful experience with the goal of increasing positive emotion or decreasing negative emotion. Research indicates that although successful emotion regulation occurs when positive emotion is up-regulated (increase-positive reappraisal) and when negative emotion is down-regulated (decrease-negative reappraisal), the goal of increasing positive emotions was associated with greater increases in positive emotion and smaller decreases in skin conductance than the goal of decreasing negative emotions (McRae et al., 2012). These findings indicate that increasing positive emotions using cognitive reappraisal may function to change the valence of negative arousal instead of reducing it. Findings such as these are important because they begin to outline the subtleties and differences in outcomes that can be helpful for identifying which strategies will be most helpful in meeting an individual’s specific needs.

**Adaptive self-reflection.** Although effective, cognitive reappraisal is just one possible mechanism through positive emotions might influence emotion regulation.
Another potential mechanism involves not actively reinterpreting the experience with a specific goal, but rather thinking and reflecting naturally about a stressful experience. This type of emotional disclosure is commonly referred to as adaptive self-reflection. Self-reflection refers to the self-focused and introspective evaluation of one’s thoughts, feelings and actions (Grant, Franklin, & Langford, 2002). In contrast with maladaptive forms of self-focus like rumination, self-reflection is often associated with openness to experience instead of neuroticism and is motivated by curiosity and genuine self-interest rather than perceived threats (Takano & Tanno, 2009). In some ways, self-reflection is similar to reappraisal; both processes involve thinking about a negative event and altering the way emotions are experienced. However, these strategies are also distinct. Reappraisal involves more specific goals (e.g., increase positive emotions), while self-reflection is a more unguided type of thinking with less specific goals.

Self-distancing is one form of adaptive self-reflection in which individuals are instructed to think about a negative experience from the perspective of a “fly on the wall” instead of from a self-immersed, first person perspective. Research indicates that self-distancing is an adaptive form of self-reflection associated with decreases in negative emotion and physiological responses. In one study, participants were asked to recall an instance in which they were angry and relive the experience from either a self-immersed perspective or a self-distanced perspective. Results indicated that self-distancing was associated with decreased negative affect and decreased blood pressure during recall as well as faster returns to baseline blood pressure (Ayduk & Kross, 2008).

Those who study adaptive self-reflection theorize that a key reason why self-distancing is an effective emotion regulation strategy is because it induces a broadened
mental state that enables individuals to effectively reconstrue their feelings. Contrary to maladaptive forms of self-reflection (e.g., rumination), which result from recounting the emotion-eliciting, concrete details of past experiences, self-reflection creates enough distance from the negative stimulus to allow individuals to focus on, analyze and understand their emotions in order to reconstrue them (Ayduk & Kross, 2010; Fujita, Trope, Liberman, & Levin-Sagi, 2006).

The inclusion of the reflection group in the present study served two main purposes. First, this group enabled us to separate the effects of how thinking more generally about a stressor might be different than thinking about a stressor with a specific goal of altering the emotional experience. Second, as noted above, there is a fine line that separates maladaptive thinking about a stressor (e.g., rumination) and adaptive thinking about a stressor (e.g., adaptive self-reflection) and we expect that positive emotions might facilitate a shift toward the adaptive processing of a stressful experience.

**How Do Positive Emotions Facilitate Emotion Regulation?**

Research clearly indicates that positive emotions are effective in regulating emotions, but less is known about how they do it. Research also highlights cognitively focused strategies such as reappraisal and adaptive self-reflection as effective emotion regulation processes. Further, a vast amount of emotion theorists have illustrated the cognitive benefits associated with positive emotion. Therefore, it’s possible that positive emotions regulate emotion by facilitating or prompting strategies, such as reappraisal and self-reflection. The following section will outline a number of theories of cognition and emotion, which provide evidence to link positive emotions to reappraisal and self-reflection. The theories presented are not competing theories; instead, each highlights
how positive emotions facilitate cognitive mechanisms that may be helpful for emotion regulation.

**The Broaden and Build Theory of positive emotions.** The Broaden and Build Theory (Fredrickson, 1998; 2001) posits that positive emotions induce in people a broadened cognitive state that enables them to pursue a wider range of thoughts and actions. In our ancestral past, negative emotions often occurred in life threatening situations and served to narrow thought and attention to quick and specific responses necessary for survival. Positive emotions, on the other hand, rarely ever occurred in life threatening situations, so narrowed thought and attention to specific responses was not necessarily needed. Thus, positive emotions evolved to have a complementary effect that expands the range of possible thoughts and behaviors. Specifically, the positive emotions of joy, interest, contentment and love are linked to broadened cognition and expanding an individual’s tendencies beyond habitual thoughts and actions. Positive emotions, such as these, promote play, creativity, exploration, self-expansion, savoring, and openness to new information and new views of the self and of the world (Fredrickson, 1998). Empirical research supports this theory, indicating that positive emotions induce an expanded attentional focus, more efficient holistic processing, and increased attentional flexibility (Derryberry & Tucker, 1994; Johnson, Waugh, & Fredrickson, 2010). Colloquially, these broadened cognitive mechanisms represent the ability to see the forest instead of just the trees.

This cognitively broadened state may be beneficial for emotion regulation strategies, like reappraisal, which are thought to require a number of cognitive resources, such as working memory, inhibition, set-shifting and maintenance. For example, when
reappraising a stressful experience, an individual must be aware of the automatic appraisal of the event, inhibit the automatic appraisal, formulate new interpretations of the stimulus, select the most appropriate reinterpretation, and maintain awareness of the new appraisal of the experience (McRae, Jacobs, Ray, John, & Gross, 2012; Ochsner & Gross, 2008). Therefore, it seems likely that positive emotions may facilitate reappraisal by broadening cognition, allowing a better perspective of the circumstances. Positive emotions might also facilitate reappraisal by expanding thought-action-repertoires, enabling individuals to consider more possibilities for reinterpreting an event (i.e., generate more reappraisals).

The broadened cognition resulting from positive emotions may also be beneficial for adaptive self-reflection. As noted above, a key mechanism for facilitating adaptive self-reflection is a broadened, global perspective. Evidence suggests that self-distancing is a mechanism that drives adaptive self-reflection because it induces a broadened mental state that enables individuals to effectively reconstrue their feelings. Contrary to maladaptive forms of self-reflection (e.g., rumination), which involve recounting the emotion eliciting specific details of past experiences, self-distancing creates enough psychological distance from the negative stimulus to allow individuals to see the ‘big picture, and view events from a global, broadened perspective, thus enabling them to focus on, analyze and understand their emotions in order to reconstrue them (Ayduk & Kross, 2010). Therefore, because they induce a broadened, global perspective, the presence of positive emotions may facilitate adaptive self-reflection. However, without positive emotions, and without this global perspective, reflective thoughts can potentially become ruminative and maladaptive. The present study will address these issues and
explore how positive emotions can be helpful when individuals reappraise or reflect about a stressful experience.

**Moderated hedonic contingency hypothesis.** Whereas the Broaden and Build theory describes how positive emotions broaden cognition, the moderated hedonic contingency hypothesis describes how positive emotions help individuals process emotionally valenced information (Aspinwall, 1998). First, the moderated contingency hypothesis posits that positive emotions help people process information when it is mood-congruent. Research indicates that information is more easily attended to, processed, stored and retrieved when the information is similarly valenced to the individual’s mood (Schwarz & Clore, 2003). Another key component to the moderated hedonic contingency hypothesis is that positive emotions also help individuals process negative information, but only when it’s important or self-relevant. This part of the theory was developed in opposition to competing theories that predicted that positive emotions lead to mood congruent processing, which causes individuals to make more favorable judgments, underestimate the likelihood of negative events, and distract individuals from carefully processing information (see Aspinwall, 1998). According to these theories, positive emotions prompt shallow processing of negative information because people are motivated to maintain their positive emotional state, and are thus prone to ignoring information that might ruin their mood. If this were the case, positive emotions would be maladaptive for many forms of self-regulation, including emotion regulation, because positive moods would lead individuals to select inappropriate goals or neglect relevant information that requires future precautionary behaviors (Aspinwall,
However, more recent research has found that these effects do not hold when information being processed is important.

The moderated hedonic contingency hypothesis suggests that positive mood only induces the above-mentioned shallow processing when information is nonessential and does not occur when information is self-relevant or important to the individual’s goals. This view is supported by empirical research. In one study, high caffeine users were shown caffeine related negative information; some participants were induced with positive emotions and others with a neutral state. Results indicated that high caffeine users paid more attention to the caffeine related negative information if they experienced positive emotions relative to those who were in a neutral state (Reed & Aspinwall, 1998). This suggests that positive emotions may help individuals attend to and process negative information when it is important, while still avoiding careful processing of less-essential negative information that could have significant emotional and cognitive costs.

The moderated hedonic contingency theory provides additional evidence for how positive emotions might facilitate emotion regulation. First and foremost, this theory predicts that individuals who experience positive emotions will regulate negative emotions if they are motivated to believe the information is important or self-relevant; but this might not be the case if individuals are unmotivated or the information is perceived as unimportant. Positive emotions could be especially effective in facilitating the regulation of negative emotion when individuals use strategies like reappraisal and reflection because these strategies elevate the importance and self-relevance of the negative stimuli by specifically instructing individuals to think about the negative experience. Further, the moderated hedonic contingency hypothesis suggests that
positive emotions also facilitate the processing of positive information and enable individuals to better focus on positive aspects of a stressful experience without compromising important or self-relevant information. Further, the benefits of mood congruence may be particularly effective for individuals whose regulation goals are also mood-congruent (i.e., reappraisal with the goal of increasing positive emotion).

The Present Studies

The present studies examine how positive emotions facilitate the regulation of negative emotion, especially when individuals are asked to reappraise or reflect about a negative event. For the purposes of this study, we measured emotion regulation using a multifaceted approach that included measures of the subjective experience of emotion, physiological responses, and facial expressions. We also measured how induced positive emotion, reappraisal and reflection impact thoughts and motivations.

In two studies, we developed a paradigm designed to assess how induced positive emotion facilitates the regulation of emotion following a negative stimulus. In both studies, participants attempted to complete an impossible task, which induced negative emotions. Then participants were asked to regulate their emotions using one of several emotion regulation instructions while watching a positive or neutral video. In the first study, regulation conditions consisted of reappraisal (reinterpret the way you feel about the task to feel less negative), reflection (think naturally about the difficult task), and a no instruction control condition.
STUDY 1

We hypothesized that individuals who reappraised a stressful experience would effectively regulate negative and positive emotion; however, individuals who experienced positive emotions while reappraising the failed task would report a) greater decreases in negative emotion and b) greater increases in positive emotion relative to individuals who were induced with a neutral state.

Second, we hypothesized that individuals who reflected about the failed task would only effectively regulate their negative and positive emotion when positive emotions were present. More specifically, individuals who were in a neutral state while reflecting about the failed task would be unsuccessful in regulating emotion; however, individuals who experienced positive emotions while reflecting about the failed task would report significant a) decreases in negative emotion and b) increases in positive emotion from post-failure to post-regulation.

Third, to explain how individuals experiencing positive emotions while reflecting were able to regulate their emotion, we hypothesized that positive emotions would prompt an increased number of reappraisals for individuals who reflected about the failed task. We also hypothesized that positive emotions would increase the number of reappraisals for individuals instructed to reappraise the failed task.

Method

Participants

Participants were 125 undergraduates from Wake Forest University. They were recruited through the university’s introductory psychology subject pool and awarded 30 minutes of course credit for their participation. Three participants were removed from
data analysis because of their suspicion of the authenticity of the failure manipulation. To qualify for removal, participants had to express both explicit suspicion of deception and demonstrate no changes in emotion following the failure manipulation. Additionally, two participants with incomplete data were removed from analysis. Of the remaining 120 participants, 64 were female (53%), 56 were male (47%), 101 were Caucasian (80%), 15 were Asians (12%), 8 were African-Americans (6%), and 2 were Hispanic (2%). The average age was 18.56 ($SD = 1.18$).

**Materials and Procedure**

**Self-reported emotion.** Positive and negative emotions were measured at baseline and after each experimental manipulation (failure, emotion regulation, distraction) throughout the study using a modified paper version of the visual analogue scale. Participants rated their current positive emotion (“How pleasant are you feeling right now?”) and negative emotion (“How unpleasant are you feeling right now”) by drawing a slash along a 157mm continuum ranging from “Not at all” to “Very.” Responses were measured and recorded in millimeters.

**Failure induction.** After rating their current positive and negative emotion, participants engaged in a modified version of an anagram-solving failure task to induce negative emotion (Lyubomirsky & Ross, 1997). All participants were given a list of 20 anagrams and instructed to rearrange the letters into real words (e.g., F-E-L-S could be rearranged into SELF). Of these 20 anagrams, five were unsolvable. Participants were led to believe that they would be completing the task alongside another participant for the study. The other student, however, was an experimental confederate. Participants were expected to complete the task in 10 minutes. After 5 minutes, the experimenter returned
to the room to check the progress of the participant and the confederate. At this time, the experimenter affirmed the confederate for making rapid progress while the real participant received no such praise and was treated with flat affect. After 7 minutes, the confederate completed the task. The experimenter evaluated the answers and informed the confederate that they had successfully completed all the anagrams and would be allowed to proceed to the next portion of the study in the next room. At this time, the experimenter reminded the real participant that they only had a couple more minutes to complete the task. After the 10 minutes were complete, the experimenter returned to the room to evaluate the work of the real participant. The experimenter informed the participant that they had not successfully answered all the anagrams and circled the number incorrect at the top of the packet. Immediately following this task, participants were instructed to rate their current positive and negative emotion.

*Figure 1.* Experimental Design of Study 1.
**Experimental manipulation.** During the experimental manipulation, participants were induced with positive emotion or a neutral state while they were asked to engage in one of three emotion regulation manipulations (see Figure 1).

**Emotion induction.** Following the failure task, participants were instructed to watch either a positive video or a neutral video while engaging in one of three emotion regulation tasks (i.e., reappraisal, reflection, no instructions). Positive emotions were induced with a video clip, “Waves” (3 min), which depicts waves in the ocean and tends to induce contentment, a low-arousal positive emotion specifically associated with cognitive broadening (Fredrickson & Branigan, 2005). A neutral state was induced with a video clip, “Sticks” (3 min), which depicts a series of moving, brightly colored sticks. Videos were adapted from previous research showing that the videos elicit the intended emotion and comparable levels of interest (Fredrickson & Levenson, 1998).

**Emotion regulation manipulation.** While watching one of these videos, participants in each condition were given specific instructions. In the reappraisal condition, participants were instructed to think back to the anagram task and think of different ways in which they could reframe or reinterpret the situation to see things in a new light. More specifically, they were asked to decrease their negative emotion about the task (“Please generate several different things you could tell yourself that might make you feel less negative, and then use those to feel the least negative that you can about the task”). In the reflection condition, participants were instructed to think back to the anagram task and engage in whatever thoughts and feelings came naturally. In the no instruction condition, participants were not asked to think back to the anagram task at all, instead, they were only told to watch the video clip. Participants were given 3 minutes to
engage in these regulation tasks while watching the positive or neutral video clip. When
the 3 minutes were up, participants rated their positive and negative emotion.

**Content of thoughts.** At the end of the study, participants wrote down whatever
thoughts had come to mind during the regulation manipulation. Then, they indicated
whether each thought had made them feel less negative, more negative, or did not change
the way they felt.

Following data collection, two objective coders rated whether each thought was
related to the failure. Thoughts were considered to be related to the failure if the thought
referred to the task (e.g., “I enjoyed the anagrams even though I didn’t get them all
right”), the difficulty of the task itself (e.g., “I needed more time”) or a reason why the
participant was unable to complete the task (e.g., “I was just really tired today”).
Thoughts were considered unrelated to the failure task if they referenced something
irrelevant to the anagram task (e.g., “I’m going to eat ice cream tonight”), or some aspect
of the video they were watching (e.g., “This beach looks nice”). Together, the two
objective coders assessed 160 (25%) thoughts with an inter-rater reliability rate of
88.13%. Then each coder separately rated half of the remaining 446 thoughts.

We evaluated the content of thoughts by separating them into four groups based
on whether or not they were related to the task and whether or not they made the
participant feel less negative. Thoughts were considered **reappraisals** if the thought was
coded as related to the failure and the participant indicated that it made them feel less
negative. Thoughts were considered **ruminations** if the thought was coded as related to
the failure and the participant indicated that it made them feel more negative. Thoughts
were considered to be **positive distractions** if it was coded as not related to the failure and
the participant indicated that it made them feel less negative. Thoughts were considered
to be *negative distractions* if the thought was coded as not related to the failure and the
participant indicated that it made them feel more negative. Although these categories are
not perfect measures, we felt they provided relatively accurate measures of the intended
constructs.

**Statistical Strategy**

**Self-reported negative and positive emotion.** To test the hypotheses that
positive emotions facilitate the regulation of self-reported positive and negative emotion,
we conducted a 3 (Regulation Condition: Decrease-Negative Reappraisal, Reflection, No
Instruction) x 2 (Induced Emotion: Positive Video, Neutral Video) x 2 (Time: Post-
Failure, Post-Regulation) mixed analysis of covariance (ANCOVA), with Regulation
Condition as the between-subjects variable, Time as the within-subjects variable, and
baseline negative emotions (or positive emotions) as a covariate in order to account for
differences in emotion between participants upon entering our lab. Self-reported positive
and negative emotions were separate dependent variables.

**Results**

**Self-Reported Negative Emotion**

We first examined whether the anagram failure task successfully induced negative emotion. Consistent with our expectations, following the anagram task, participants
reported a significant increase in negative emotion, \( t(119) = 10.66, p < .001 \), indicating
that the anagram failure task was successful in inducing negative emotion (Figure 2).

Next we examined the degree to which individuals regulated their reported
negative emotion in response to failure. Consistent with expectations, the 3x2x2
ANCOVA yielded a significant main effect of Time for negative emotion, \( F(1, 113) = \)
9.95, $p = .002$, such that participants reported a decrease in negative emotion from post-failure to post-regulation. Consistent with expectations, the main effect of Time was qualified by a significant two-way interaction of Time and Induced Emotion, $F(2, 113) = 7.51, p = .007$, with participants induced with positive emotion reporting greater decreases in negative emotion from post-failure to post-regulation relative to participants induced with a neutral state. The significant main effect of Time was also qualified by a significant two-way interaction between Time and Regulation Condition, $F(2, 113) = 3.09, p = .049$. Consistent with hypotheses, these effects were qualified by a significant three-way interaction of Regulation Condition, Induced Emotion and Time, $F(2, 113) = 4.53, p = .013$.

To clarify this significant three-way interaction, we conducted three follow-up 2x2 ANCOVAs, one at each Regulation Condition, with Induced Emotion as the between-subjects variable, Time as the within-subjects variable, baseline self-reported negative emotion as a covariate and self-reported negative emotion as the dependent variable.

**No instructions.** We first examined how individuals naturally regulated their negative emotions when they were not given any regulation instructions or asked to think about the stressor. For those who were given no instructions, there was no significant main effect of Time from post-failure to post-regulation, $F(1, 34) = 0.01, p = .913$. These results suggest that when given no instructions, individuals did not report decreased negative emotion. Further, the two-way interaction between Induced Emotion and Time was not significant, $F(1, 34) = 0.08, p = .785$, indicating that there were no differences in reported negative emotion change from post-failure to post-regulation between
individuals induced with positive emotion and individuals induced with a neutral state. These findings suggest that regardless of whether the emotional context was positive or neutral, individuals do not naturally decrease their negative emotion when they are not asked to think about the stressor or given any regulation instructions (Figure 2).

**Hypothesis 1a: Positive Emotions Facilitate Reappraisal**

**Reappraisal.** We hypothesized that when positive emotions were present while individuals reappraised a negative stimulus, they would report greater decreases in negative emotion than when individuals were in a neutral state during reappraisal. Results indicated that, for individuals who used reappraisal, there was a significant main effect of Time, $F(1, 37) = 9.09, p = .005$, such that individuals reported significant decreases in negative emotion from post-failure to post-regulation.

Contrary to hypotheses, planned contrasts revealed that for those who used reappraisal, individuals induced with positive emotions did not report greater decreases in negative emotion from post-failure to post-regulation relative to individuals induced with a neutral state, $F(1,37) = 0.57, p = .456$. These findings suggest that reappraisal was effective in reducing reported negative emotion, however positive emotions did not enhance the effectiveness of reappraisal in decreasing negative emotion (Figure 2).

**Hypothesis 2a: During Reflection, Positive Emotions Induce Emotion Regulation**

**Reflection.** We hypothesized that when positive emotions were present while individuals reflect about a negative stimulus, they would report greater decreases in negative emotion than when individuals were in a neutral state during reflection. For those who reflected about their failure, there was a significant main effect of Time from
post-failure to post-regulation, $F(1, 40) = 4.96, p = .032$, such that individuals reported significant decreases in negative emotion from post-failure to post-regulation.

Consistent with hypotheses, analyses revealed that for those who used reflection, individuals who experienced positive emotions reported greater decreases in negative emotion from post-failure to post-regulation relative to individuals in a neutral state, $F(1, 40) = 14.60, p < .001$. Comparisons of simple effects revealed that for individuals who used reflection, those who were induced with positive emotions reported significant decreases in negative emotion, $F(1, 20) = 18.71, p < .001$, while those induced with a neutral state reported no significant changes in negative emotion, $F(1, 19) = 1.45, p = .243$. These results indicated that, in a neutral state, reflecting about a negative stimulus was not conducive to decreasing negative emotion. However, in a positive emotional state, reflecting about a negative stimulus decreased self-reported negative emotion. Consistent with hypotheses, these findings suggest that positive emotions induce emotion regulation when individuals reflect about a stressful experience.

To follow up these findings, we next examined whether individuals who reflected about the failure and individuals who reappraised their failure while experiencing positive emotion reported equivalent decreases in negative emotion. For individuals who viewed the positive video, post-hoc analyses revealed no significant two-way interaction between Regulation Condition and Time, $F(1, 37) = 0.13, p = .717$, with individuals in the reappraisal condition and the reflection condition reporting similar decreases in negative emotion from post-failure to post-regulation. This suggests that in the presence of positive emotions, reflecting naturally about a stressor is as equally effective in
reducing negative emotion as a specific, directed emotion regulation strategy like reappraisal (Figure 2).

![Figure 2](image_url)

**Figure 2.** Effect of Induced Emotion and Condition on Self-Reported Negative Emotion. Change from baseline self-reported negative emotion over time. Error bars represent standard errors.

**Self-Reported Positive Emotion**

We first examined whether the anagram failure task successfully decreased positive emotion. Consistent with our expectations, following the anagram task, participants reported a significant decrease in positive emotion from baseline, \( t(119) = -8.80, p < .001 \) (Figure 3).

Next we examined the degree to which individuals regulated their reported positive emotion in response to failure. Consistent with expectations, the 3x2x2 ANCOVA yielded a significant main effect of Time for positive emotion, \( F(1, 113) = \)
7.69, \( p = .007 \), such that participants reported an increase in positive emotion from post-failure to post regulation. Inconsistent with expectations, there was no significant two-way interaction of Time and Induced Emotion, \( F(1, 113) = 2.64, p = .107 \), such that participants induced with positive emotion and individuals induced with a neutral state reported similar increases in positive emotion from post-failure to post-regulation. The significant main effect of Time was qualified by a significant two-way interaction between Time and Regulation Condition, \( F(2, 113) = 4.39, p = .015 \). Contrary to hypotheses, there was not a significant three-way interaction of Regulation Condition, Induced Emotion and Time, \( F(2, 113) = 1.12, p = .331 \). However, to qualify the two-way interaction between Time and Regulation Condition on positive emotion, we tested the main effect of Time on self-reported positive emotions for each Regulation Condition.

**No instructions.** For those who were given no instructions, there was no significant main effect of Time, \( F(1, 34) = 0.45, p = .506 \), such that individuals in the no instruction condition did not report increased positive emotion from post-failure to post-regulation (Figure 3).

**Hypothesis 1b: Positive Emotions Facilitate Reappraisal**

**Reappraisal.** We hypothesized that when positive emotions are present while individuals reappraise a negative stimulus, they will report greater increases in positive emotion than when individuals were in a neutral state during reappraisal. For those who used reappraisal, there was a significant main effect of Time, \( F(1, 37) = 7.69, p = .009 \), such that individuals reported increases in positive emotion from post-failure to post-regulation. But contrary to hypotheses, planned contrasts revealed that for those who used reappraisal, individuals induced with positive emotions did not report greater
increases in positive emotion from post-failure to post-regulation relative to individuals induced with a neutral state, $F(1, 37) = 0.75, p = .365$ (Figure 3).

**Hypothesis 2b: During Reflection, Positive Emotions Induce Emotion Regulation**

*Reflection.* We hypothesized that individuals who experienced positive emotions while they reflected about the failed task would report significant increases in positive emotion from post-failure to post-regulation. Planned contrasts indicated that, for those who reflected about their failure, there was no significant main effect of Time, $F(1, 40) = 0.70, p = .407$, such that individuals reported no significant changes in positive emotion from post-failure to post-regulation. However, this effect of Time on positive emotion appeared to be different between positive and neutral conditions. Further analyses indicated that, for those who used reflection, individuals who experienced positive emotions reported greater increases in positive emotion from post-failure to post-regulation relative to those in a neutral state, $F(1, 40) = 5.05, p = .030$. These findings suggest that reflecting about a negative stimulus may only be conducive to increasing positive emotion when reflection occurs in a positive context (Figure 3).

To follow up these findings, we next examined whether individuals who reflected about their failure and individuals who reappraised their failure reported equivalent increases in positive emotion. We tested the two-way interaction between Regulation and Time on self-reported positive emotion for the Reappraisal and Reflection groups. For individuals who viewed the positive video, post-hoc analyses revealed no significant two-way interaction between Regulation Condition and Time, $F(1, 37) = 1.20, p = .280$, with individuals in the reappraisal condition and the reflection condition reporting similar increases in positive emotion from post-failure to post-regulation. However, further
analyses indicated that individuals who reappraised in a positive context reported feeling more positive following the failure than individuals who reflected, $t(114) = 1.99, p = .049$. These findings suggest that although individuals who reflect or reappraise in a positive context reported similar increases in positive emotion, reappraisers reported feeling more positive overall (Figure 3).

**Figure 3.** Effect of Induced Emotion and Regulation of Self-Reported Positive Emotion. Change from baseline self-reported positive emotion over time. Error bars represent standard errors.
Content of Thoughts During the Regulation Manipulation

To better understand how positive emotions induce emotion regulation among individuals who reflect about a stressful experience, we investigated the content of participants’ thoughts while they reflected. To test these effects, we conducted a 3 (Regulation Condition) x 2 (Induced Emotion) ANOVA, with number of reappraisals, number of positive distractions, number of negative distractions and number of ruminative thoughts as separate dependent variables.

Reflection. To explain how individuals who reflect in a positive context successfully regulated their emotion, we hypothesized that positive emotions would prompt an increased number of reappraisals for individuals who reflected about the failed task. Inconsistent with hypotheses, compared to those induced with a neutral state, planned comparisons indicated that individuals induced with positive emotion during reflection generated no differences in number of reappraisals, $t(54) = 0.97, p = .334$, number of negative distracting thoughts, $t(54) = -1.11, p = .271$, or number of ruminative thoughts, $t(54) = -0.71, p = .481$. However, individuals induced with positive emotion during reflection generated a marginally greater number of positive distracting thoughts, $t(54) = 1.78, p = .078$, relative to those induced with a neutral state.

We also explored how reflecting about a stressful experience compares to the no instructions condition when positive emotions are present. Compared to those who were induced with positive emotions but given no instructions, individuals who reflected about the failure task in a positive context generated no significant differences in number of reappraisals, $t(54) = 0.29, p = .773$, negative distracting thoughts, $t(54) = 1.59, p = .113$,
Ruminative thoughts, \( t(54) = -0.56, \ p = .575 \), or positive distracting thoughts, \( t(54) = -1.21, \ p = .231 \) (Figure 4).

**Reappraisal.** We also hypothesized that positive emotions would increase the number of reappraisals for individuals instructed to reappraise the failed task. Compared to those induced with a neutral state, analyses indicated that individuals induced with positive emotion during reappraisal generated no differences in number of reappraisals, \( t(54) = 0.14, \ p = .888 \), negative distracting thoughts, \( t(54) = -1.62, \ p = .107 \), or ruminative thoughts, \( t(54) = -0.16, \ p = .873 \). However, individuals induced with positive emotion during reappraisal generated a significantly greater number of positive distracting thoughts, \( t(54) = 2.22, \ p = .029 \), relative to those induced with a neutral state.

We also explored how reappraising a stressful experience compares to not thinking or regulating the experience at all when positive emotions are present. Compared to those who were induced with positive emotions but given no other instructions, individuals who reappraised the failure task in a positive context generated more reappraisals, \( t(54) = 3.53, \ p = .001 \), fewer negative distracting thoughts, \( t(54) = 2.71, \ p = .008 \), and fewer ruminative thoughts, \( t(54) = 2.54, \ p = .013 \), but there were no differences in the number of positive distracting thoughts, \( t(54) = 0.78, \ p = .437 \).

Lastly, we explored how reappraising compared to reflecting about a stressful experience when positive emotions are present. Compared to those who reflected, individuals who reappraised the stressful experience generated significantly more reappraisals, \( t(54) = 3.70, \ p < .001 \), and fewer ruminative thoughts, \( t(54) = 2.81, \ p = .007 \), but there were no differences in number of positive distracting thoughts, \( t(54) = 0.30, \ p = .764 \), or number of negative distracting thoughts, \( t(54) = 1.18, \ p = .242 \) (Figure 4).
Discussion

Positive Emotions and Reappraisal

We found that participants who reappraised the failure task reported significant decreases in negative emotion and increases in positive emotion regardless of the valence of induced emotion. Contrary to our hypotheses, for the most part, positive emotions did
not enhance the effectiveness of reappraisal in facilitating the regulation of self-reported emotion. We have marginal evidence that although individuals who experienced positive emotions while reappraising did not report greater increases in positive emotion relative to those in a neutral state, they did ultimately return to higher reported levels of positive emotions following the regulation manipulation. However, it’s possible that these findings can be attributed to the fact that these individuals already reported higher levels of positive emotions before they began reappraising.

Findings also indicated that positive emotions do not increase the number of reappraisals. These findings suggest that the cognitive broadening that results from positive emotions did not help individuals generate more reappraisals. One possible explanation is that there may be a ceiling effect for reappraisal. Research suggests that reappraisal alone is already highly effective in reducing negative emotion (Gross, 1998; Gross & John, 2003; McRae et al., 2012), which may leave little room for improvement, especially when the negative experience is more trivial. In situations where negative emotions are more severe (e.g., divorce, losing a job), longer in duration, or more complex, it’s possible that the benefits of positive emotions while reappraising may begin to emerge. We did, however, find that positive emotions led to increases in the number of positive distracting thoughts among individuals who reappraised. This may be especially helpful for individuals who may need to sustain long periods of reappraisal. Research suggests that positive emotions provide temporary relief from stressful experiences, allowing individuals to replenish the resources necessary for continued emotion regulation (Tedlie Moskowitz et al., 1996). Thus, these positive distractions may fuel the ability to sustain longer periods of emotion regulation, especially under
highly stressful circumstances. Although positive emotions didn’t seem to help with regulating the subjective experience of emotion or enhancing the number of reappraisals in Study 1, maybe positive emotions facilitate reappraisal in a different way.

First, maybe positive emotions facilitate emotion regulation when the goal of reappraisal is mood congruent (i.e., reappraising with the goal of increasing positive emotions). According to research involving mood-congruent processing, information is more easily processed, stored and retrieved when an individual’s mood is similarly valenced (Aspinwall, 1998; Schwarz & Clore, 2003). Within the context of the present study, if individuals reappraise with the goal of increasing positive emotions while experiencing positive emotions, they may be better able to process and attend to positive aspects of the stressful experience, thus facilitating the regulation of emotion. To test this, we added an increase-positive reappraisal condition in Study 2.

Second, maybe positive emotions facilitate reappraisal by impacting future motivation in domains similar to the stressful experience. According to the mood as input theory, individuals are motivated to achieve positive outcomes; and positive emotions provide individuals with input about their relative progress towards their goals (Martin, Ward, Achee, & Wyer, 1993). Aspinwall (1998) suggests that when engaged in a difficult self-relevant task, positive emotions signal to the individual that even though the task is hard, they have sufficient resources available to them to adequately process this negative information and effectively deal with the situation. Within the context of the present study, when individuals are using reappraisal to think about the failure task, positive emotions may facilitate emotion regulation by signaling to the individual that they have sufficient resources available to them to handle the situation – both currently
and in the future. In short, positive emotions may increase an individual’s motivation to engage in future situations similar to the stressful situation.

**Positive Emotions and Reflection**

We also found that positive emotions prompt the regulation of emotion when individuals are reflecting about the failed task. We found that for individuals who reflected about the negative event, only those who experience positive emotions reported significant decreases in negative emotion and increases in positive emotion. These findings suggest that positive emotions prompt the regulation of emotion among individuals who reflected about the situation. To better understand how positive emotions prompted emotion regulation among individuals who reflected about the stressful experience, we investigated the nature of their thoughts during the regulation manipulation. Contrary to expectations, individuals who reflected about the failure while experiencing positive emotions did not induce reappraisal, as individuals did not generate an increased number of reappraisals relative to those in a neutral state. Instead, it appears individuals were distracting themselves from the negative experience. Findings indicated that individuals who reflected about the failure while experiencing positive emotions generated an increased number of positive distracting thoughts relative to those in a neutral state. As noted above, it’s possible that these positive distractions provided a temporary break from stress, allowing individuals to replenish their resources in order to sustain continued emotion regulation efforts (Moskowitz et al., 1996). These findings can also be explained by literature on adaptive self-distancing that highlight the subtle differences between rumination and adaptive self-reflection. Research suggests that rumination occurs when individuals focus on a negative experience from a local,
narrowed perspective, which evokes attention to the specific, emotion-eliciting details of a negative experience. Adaptive self-reflection also involves focusing on a negative experience except individuals think about it from a broadened, global focus, which enables individuals to reconstrue their thoughts and feelings (Ayduk & Kross, 2008, 2010). According to these views, and the Broaden and Build theory (Fredrickson, 2001), positive emotions may have prompted emotion regulation for individuals who reflected about the negative experience because positive emotions evoke a broadened cognitive perspective. Individuals who reflected in a neutral context did not benefit from this broadened perspective which may have caused their thought processes to be less effective for emotion regulation.

We also found that individuals who reflected about the situation in the presence of positive emotions reported experiencing equivalent decreases in negative emotion and increases in positive emotion from post-failure to post-regulation relative to individuals who used reappraisal. This suggests that simply thinking about a negative stimulus while experiencing positive emotion may be equally effective in reducing negative emotion as a specific emotion regulation strategy, such as reappraisal. However, when experiencing positive emotions is not possible, reflection might not be the best choice and an individual would be better suited to use reappraisal to regulate emotion. These findings emphasize the importance of the emotional context in which reflection occurs. If an individual is going to spend time thinking about a negative event, the context in which this takes place could drastically change the way he or she feels.

Although reappraisal and reflection while experiencing positive emotions are similar in regulating the subjective experience of emotion, we are also interested in how
they are different. In Study 1, we also explored how the content of thoughts compared between these groups. Results indicated that individuals in the reappraisal group generated more reappraisals and fewer ruminative thoughts about the stressful experience relative to those who reflected. Nonetheless, individuals who reflected about the stressful experience were still able to regulate the subjective experience of emotion. These findings suggest that maybe reappraisal and reflection achieve emotion regulation through entirely different means. Study 2 continued to explore how reappraisal and reflection are different in order to provide a clearer picture of how each strategy is accomplishing emotion regulation.

**Positive Emotions and No instruction**

We also found that, inconsistent with expectations, individuals in the no instruction condition did not report significant decreases in negative emotion or increases in positive emotion regardless of whether they viewed the positive or the neutral video. One possible explanation is that individuals in this group became bored with watching the video, which may have eliminated the rejuvenating effects of the positive emotion induction. Further, this no instruction condition may lead to varying outcomes because the instructions are so open-ended that individuals could be doing any number of things while they watch the video, therefore it’s difficult to know exactly what these individuals might have been thinking about during this time. It’s possible that individuals were distracting themselves, but that their distracting thoughts may not have overcome the negative emotions associated with the negative stimulus. In light of the moderated hedonic contingency hypothesis (Aspinwall, 1998), for individuals with no instructions, positive emotions may not have facilitated the processing and regulation of negative
information because individuals were not motivated to think about the stressful experience. Although distraction is sometimes useful to provide relief and replenish resources during stress, it may be less effective if individuals are not motivated to regulate their negative emotions at all because the negative emotions associated with the stimulus remain, even if they’re not currently being attended to.

**Conclusion**

The findings from Study 1 indicated that reflecting about a stressful experience within a positive context induces emotion regulation comparable to individuals who reappraise the stressful experience. We also found that positive emotions did not facilitate emotion regulation for individuals who reappraised the stressful experience. Given these findings, a number of questions remain. First, although reappraisal and reflection in a positive context lead to similar degrees of emotion regulation, are these two strategies really the same? We expect that these two strategies may be achieving similar results by different means. Second, is it possible that positive emotions might facilitate reappraisal in another way? We expect that the benefits of mood congruency may enhance the effectiveness of reappraisal with the goal of increasing positive emotions.

Finally, we hope to add some additional measures of emotional responses to Study 2 to better assess emotion regulation from a multifaceted standpoint. To assess physiological responses to emotions, we measured skin conductance levels (SCL) to provide a more complete picture of emotion regulation. As noted in the intro, emotion regulation is most adaptive when individuals are not only able to regulate the subjective experience of a stressful experience, but able to do so without increasing physiological
arousal (Gross, 2002). Research suggests that when individuals are asked to reappraise (with the goal of decreasing negative emotion) or simply watch a video evoking disgust, individuals in both groups decrease physiological arousal, but reappraisal showed slightly greater decreases (Gross, 1998). In another study, individuals who reappraised a sad film showed greater decreases in physiological reactivity relative to individuals who simply watched the film (Shiota & Levenson, 2009). This suggests that individuals who engage in decrease-negative reappraisal or reflection will experience decreases in physiological arousal, but that reappraisal may be more effective.

However, some research suggests that the goal of reappraisal has different effects on outcomes. Previous research indicated that, when individuals were asked to reappraise a series of emotion eliciting pictures, those who engaged in reappraisal with the goal of increasing positive emotions showed smaller decreases in skin conductance than the goal of decreasing negative emotions (McRae et al., 2012). These findings suggest that increasing positive emotions using cognitive reappraisal may function to change the valence of negative arousal instead of reducing it. Therefore, we hypothesized that individuals across groups would decrease physiological arousal; however, individuals in the decrease-negative reappraisal group would show greater decreases in physiological arousal than individuals in the increase-positive, reflection and no instruction conditions.

Even if the subjective experience of negative emotions is regulated, negative social and health outcomes could still become problematic if expressive emotions and physiological arousal are unregulated. Research indicates that expressive emotions are important because facial expressions and emotional responsiveness are important for
eliciting social support, which often proves to be helpful for emotion regulation (Gross, 2002; Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Some evidence suggests that reappraisal may be an effective way to regulate expressive emotion. In one study, individuals were asked to either watch or reappraise a video that elicited sadness. Results indicated that relative to those who simply watched the video, individuals who reappraised showed decreased expressions of negative emotion (Shiota & Levenson, 2009). Based on the above findings, we hypothesized that individuals who reappraised the stressful experience would express fewer negative emotions and more positive emotions relative to those who reflected or did not regulate their emotions.
STUDY 2

The objectives of Study 2 examined three main research goals. First, we explored how reappraisal and reflection in a positive context differ from one another. In Study 1, we found that reappraisal and reflection in a positive context were similar in regulating self-reported emotion but the content of thoughts between these groups was different. In Study 2, we continued to explore the mechanisms and outcomes associated with each strategy to better understand whether or not these strategies achieve successful emotion regulation in different ways. Because the interaction between positive emotions and these conditions on emotion regulation was no longer central to our hypothesis, we removed the neutral conditions for decrease-negative reappraisal, reflection, no instruction.

Second, we investigated how positive emotions facilitate reappraisal with the goal of increasing positive emotions. In Study 1, we found that positive emotions do not facilitate the regulation of self-reported emotion for reappraisal with the goal of decreasing negative emotions, but we expected that when positive emotions are present, mood congruent processing and the moderated hedonic contingency hypothesis may help increase the effectiveness of increase-positive reappraisal. To answer these questions, we added two increase-positive reappraisal groups; one was induced with positive emotions and the other was induced with a neutral state.

Third, we investigated how increase-positive reappraisal compares to decrease-negative reappraisal and reflection in a positive context. In Study 2 we investigated how these strategies compared to one another and explored the varying outcomes. Specific hypotheses will be outlined below.
How Do Reappraisal and Reflection in a Positive Context Differ?

We hypothesized that individuals who reappraised the stressful experience would express fewer negative emotions and more positive emotions relative to those who reflected or received no instructions. We also hypothesized that individuals who engaged in reappraisal or reflection would experience decreases in physiological arousal, but that reappraisal would generate greater decreases. Finally, we hypothesized that only individuals who reappraise would be more motivated to try a more difficult anagram task in the future, relative to a control task.

How Do Positive Emotions Facilitate Increase-Positive Reappraisal?

We hypothesized that individuals who experienced positive emotions while engaging in increase-positive reappraisal would report greater decreases in negative emotion and greater increases in positive emotion relative to individuals who were in a neutral state. We also hypothesized that individuals who experienced positive emotions while engaging in increase-positive reappraisal would express fewer negative emotions and more positive emotions than individuals who were in a neutral state. We also hypothesized that individuals who reappraised while experiencing positive emotions would generate more reappraisals relative to individuals who were in a neutral state. Finally, we hypothesized that only individuals who reappraised while experiencing positive emotions would be more motivated to try a more difficult anagram task in the future, relative to a control task.

How Does Increase-Positive Reappraisal Compare to Other Strategies?

We hypothesized that individuals who reappraised with the goal of increasing positive emotions would report greater decreases in negative emotion than those who
reappraised with the goal of decreasing negative emotion, those who reflected, and those
who received no instructions. We also hypothesized that individuals in the reappraisal
conditions would express fewer negative emotions and more positive emotions than
individuals in the reflection and no instruction conditions. We hypothesized that
individuals in the increase-positive condition would generate an increased number of
reappraisals relative to individuals in the reflection and no instruction conditions. Finally,
we hypothesized that individuals in the decrease-negative reappraisal condition, increase-
positive reappraisal condition and reflection condition would all experience decreases in
physiological arousal; however, individuals in the decrease-negative reappraisal
condition would experience the greatest decreases in physiological arousal relative to the
others.

Method

Participants

Participants were 105 undergraduates from Wake Forest University. They were
recruited through the university’s introductory psychology subject pool and awarded 1
hour of course credit for their participation. Seven participants were removed from data
analysis because of their suspicion of the authenticity of the failure manipulation. To
qualify for removal, participants had to express both explicit suspicion of deception and
demonstrate no changes in emotion following the failure manipulation. Of the remaining
98 participants, 62 were female (63%), 36 were male (37%), 82 were Caucasian (84%), 8
were Asians (8%), 5 were African-Americans (5%), and 3 were Hispanic (3%). The
average age was 18.99 (SD = 0.87).

Materials and Procedure
In Study 2, we used the same general experimental paradigm that we used in Study 1. However, we also added a number of outcome variables, which will be outlined in detail in this section.

**Baseline.** During this period at the beginning of the study, experimenters attached wireless sensors to both the participant and an experimental confederate (see Physiological Acquisition and Processing). During a 5-minute acclimation period, both the participant and confederate filled out a series of questionnaires. Following the acclimation period, they rated their current positive and negative emotion. Next, baseline physiological activity was recorded over a three-minute period.

**Future motivation.** To provide an additional measure of the degree to which individuals had regulated their emotion towards the negative stimulus, we added two additional questions at the end of the study. Participants were told they would be completing two additional tasks: an anagram task similar to the one they had just tried and a word-stem completion task. Participants were then given the opportunity to select the difficulty level for each of these tasks on a scale from 1 (*Easy*) to 5 (*Difficult*). They were also told that, for their reference, the anagram task they had completed earlier was Level 4. Relative to the control task, opting for higher levels of difficulty for the anagram task would suggest the individual had more successfully regulated his/her emotion and was less averse, and more motivated to engage in that activity in the future. Opting for lower levels of difficulty for the anagram task would suggest the individual had less successfully regulated his/her emotion and was more averse to engaging in that activity in the future.

**Physiological Acquisition and Processing**
Physiological data were recorded at a sampling rate of 1000 Hz using an integrated system and software package (Biopac MP150, AcqKnowledge; Biopac Systems, Goleta CA). Skin conductance levels and facial electromyography data were collected during a 180 second baseline, during the final 180 seconds of the anagram failure task, and during the 180 second regulation manipulation. Unfortunately, 20 participants had to be removed due to unusable data due to equipment failure, or participants failing to follow instructions to limit movement during baseline and throughout the study.

**Skin conductance level (SCL).** Continuous skin conductance levels were recorded with two disposable snap-electrodes attached to the palm of the non-dominant hand. SCL data were Low Pass filtered at 10 Hz.

**Facial EMG.** Facial EMG activity was measured using electromyography (EMG). Using guidelines set by Fridlund and Cacioppo (1986), electrodes were placed on the right side of the participants’ face. Of the two corrugator electrodes, one was placed above the brow on an imaginary line that extends vertically from the inner eye fissure, and the other electrode was placed 1 cm lateral to, and slightly superior to the first electrode. Of the two orbicularis electrodes, one was placed 1 cm inferior to the outer eye fissure, and the other electrode was placed 1 cm lateral to and slightly superior to the first electrode. To index emotion-related facial activity, we averaged each muscle’s activity into 5-s bins. Muscles were considered active if the bin’s mean was at least two standard deviations above baseline EMG activity (Johnson et al., 2010). This gave us the number of bins where a smile or frown was present during each period the trial period. Increased occurrences of corrugator supercillii were indicative of negative
emotion (furrowed brows) and increased occurrences of orbicularis oculi were indicative of positive emotion (genuine smiles; Dimberg, Thunberg, & Elmehed, 2000).

Figure 5. Experimental Design of Study 2.

Statistical Strategy

To test the hypotheses we used a series of ANCOVAs and ANOVAS that varied based on the specific Regulation Conditions we were targeting for each hypothesis. To test our first set of hypotheses, we used a 3 (Regulation Condition) x 2 (Time: Post-Failure, Post-Regulation) design to compare only the Positive/Decrease Negative Reappraisal, Positive/Reflection and Positive/No Instruction conditions. To test our second set of hypotheses, we used a 2 (Regulation Condition) x 2 (Time) design to
compare only the Positive/Increase-Positive Reappraisal and the Neutral/Increase-Positive Reappraisal conditions. To test the third set of hypotheses, we used a 5 (Regulation Condition) x 2 (Time) design to compare all five conditions.

We used a mixed analysis of covariance (ANCOVA) to test hypotheses that required a baseline covariate to control for the emotion of the participants upon entering our lab. We conducted separate ANCOVAs for self-reported positive emotion, self-reported negative emotion, and physiological arousal (SCL). We tested each of these with Regulation Condition as the between-subjects variable, Time as the within-subjects variable, and the appropriate baseline variable as a covariate.

We used a mixed analysis of variance (ANOVA) to test the remaining hypotheses that did not require a baseline covariate. We conducted separate ANOVAs for corrugator activity, orbicularis activity, content of thoughts and future motivation. We tested each of these with Regulation Condition as the between-subjects variable and Time as the within-subjects variable.

Results

Failure Task Manipulation Check

We first examined whether the anagram failure task successfully induced negative emotion. Consistent with expectations and Study 1, following the anagram task, participants reported a significant increase in negative emotion from baseline, \( t(97) = -8.18, p < .001 \), and a significant decrease in positive emotions from baseline, \( t(97) = 5.46, p < .001 \) (Figures 6 & 7). Participants also demonstrated increased corrugator activity, \( t(77) = 4.97, p < .001 \), and decreased orbicularis activity, \( t(77) = 2.92, p = .005 \),
indicating that individuals expressed significantly fewer positive emotions (smiles) and significantly more negative emotions (furrowed brows) relative to baseline.

We also measured physiological arousal; however, contrary to expectations, physiological arousal (i.e., skin conductance levels) did not significantly increase during the anagram task, $F(1, 47) = 0.26, p = .612$, relative to baseline. Because the anagram failure task did not effectively increase physiological arousal, we felt our hypotheses related to physiological arousal could not justifiably be tested, therefore these results will not be reported.

**Self-reported negative emotion.** We examined the degree to which individuals regulated their reported negative emotion in response to failure. Consistent with expectations, the 3x2 ANCOVA yielded a significant main effect of Time on negative emotion, $F(1, 64) = 37.05, p < .001$, such that participants reported a decrease in negative emotion from post-failure to post-regulation across conditions. Consistent with expectations and Study 1, the two-way interaction between Time and Regulation Condition on negative emotion was not significant, $F(2, 64) = 0.80, p = .455$, indicating that there were no significant differences between conditions in negative emotion from post-failure to post-regulation (Figure 6).
Self-reported positive emotion. We examined the degree to which individuals regulated their reported positive emotion in response to failure. Consistent with expectations, the 3x2 ANCOVA yielded a significant main effect of Time on positive emotion, $F(1, 61) = 23.87, p < .001$, such that participants reported an increase in positive emotion from post-failure to post-regulation across conditions. The two-way interaction between Time and Regulation Condition on positive emotion was not significant, $F(2, 61) = 0.29, p = .747$, indicating that there were no significant differences between conditions in positive emotion from post-failure to post-regulation (Figure 7).
**Figure 7.** Reappraisal, Reflection and No Instruction Conditions on Positive Emotion. Change from baseline self-reported positive emotion over time. Error bars represent standard errors.

**How Do Reappraisal and Reflection in a Positive Context Differ?**

**Content of thoughts.** We were interested in how decrease-negative reappraisal, reflection and no instruction while experiencing positive emotions compared to one another. We tested whether our findings from Study 1 would replicate.

**Reflection.** We were interested in how reflecting about a stressful experience compared to not thinking or regulating the experience at all when positive emotions are present. Inconsistent with findings from Study 1, compared to those who were induced with positive emotions but did not regulate the stressful experience, individuals who reflected about the failure task in a positive context generated a significantly greater number of reappraisals, $t(61) = 2.25, p = .031$ and a significantly smaller number of
negative distracting thoughts, \(t(61) = 3.16, p = .002\) (Figure 8). Consistent with findings from Study 1, relative to those who were induced with positive emotions, individuals who reflected about the failure task in a positive context did not generate a significantly different number of ruminative thoughts, \(t(61) = 0.18, p = .862\), or positive distracting thoughts, \(t(61) = 1.32, p = .190\).

**Reappraisal.** We were interested in how reappraising a stressful experience compared to not thinking or regulating the experience at all when positive emotions are present. Consistent with findings from Study 1, individuals who reappraised the failure task in a positive context generated more reappraisals, \(t(61) = 4.48, p < .001\), fewer negative distracting thoughts, \(t(61) = 4.15, p < .001\), and fewer ruminative thoughts, \(t(61) = 2.32, p = .024\), relative to those who were induced with positive emotions but did not regulate the stressful experience (Figure 8). Also consistent with findings from Study 1, there were no differences in the number of positive distracting thoughts, \(t(61) = 1.12, p = .266\).

![Figure 8](image.png)

*Figure 8. Content of Thoughts During Regulation Manipulation. Number of thoughts during regulation manipulation.*
We were also interested in how reappraising compared to reflecting about a stressful experience when positive emotions are present. Consistent with results from Study 1, relative to those who reflected, individuals who reappraised the stressful experience generated significantly more reappraisals, $t(61) = 2.48, p = .016$, and significantly fewer ruminative thoughts, $t(61) = 2.62, p = .011$, but there were no differences in number or positive distracting thoughts, $t(61) = 0.27, p = .792$, and no differences in negative distracting thoughts, $t(61) = 0.90, p = .369$ (Figure 8).

**Corrugator activity.** We examined the degree to which individuals regulated their negative emotion as reflected by their facial expressions during the regulation manipulation. We hypothesized that individuals who reappraise the stressful experience will express fewer negative emotions relative to those who reflect or do not regulate their emotions. Consistent with expectations, the 3x2 ANOVA yielded a marginally significant main effect of Time for corrugator activity, $F(1, 47) = 3.83, p = .056$, such that participants expressed marginally fewer furrowed brows from failure ($M = 6.62, SD = 12.67$) to regulation ($M = 3.74, SD = 9.44$). Consistent with self-reports of negative emotion, but contrary to hypotheses, the two-way interaction between Time and Regulation Condition was not significant, $F(2, 47) = 0.28, p = .758$, indicating that although there was a general decline in corrugator activity, there were no differences between groups in corrugator activity from post-failure to post-reappraisal.

**Orbicularis activity.** We examined the degree to which individuals regulated their positive emotions as reflected by their facial expressions during the regulation manipulation. We hypothesized that individuals who reappraise the stressful experience will express more positive emotions relative to those who reflect or do not regulate their
emotions. Contrary to expectations, the 3x2 ANOVA did not yield a significant main effect of Time for orbicularis activity, $F(1, 47) = 0.02, p = .881$, such that participants did not express significantly more smiles during the regulation manipulation ($M = 1.38, SD = 4.88$) relative to the failure task ($M = 1.34, SD = 4.68$). The two-way interaction between Time and Regulation Condition was also not significant, $F(4, 47) = 0.72, p = .701$. These findings indicated that, inconsistent with hypotheses, participants did not express more smiles from the failure task to the regulation manipulation, and frequency of smiles did not differ by group, therefore, reflection and reappraisal do not lead to the successful regulation of expressive positive emotion.

**Motivation.** We measured how motivated participants would be to engage in another anagram relative to a task in a different domain by measuring what level of difficulty they would prefer for each task. We hypothesized that only individuals who reappraise will be more motivated to try a more difficult anagram task in the future, relative to a control task. Consistent with expectations, the omnibus 3 x 2 two-way ANOVA yielded a marginally significant Emotion Regulation x Task interaction for preferred task difficulty, $F(2, 52) = 2.68, p = .078$. To qualify this marginal omnibus interaction, we conducted three planned contrasts to compare the simple effect of Task on preferred task difficulty for each condition.

We hypothesized that individuals induced with positive emotion while engaging in reappraisal to decrease their negative emotion will be more willing to try a more difficult anagram task than the control task. Consistent with hypotheses, there was a marginally significant simple effect of Task on preferred difficulty for individuals who reappraised with the goal of decreasing negative emotion, $F(1, 21) = 3.66, p = .069$. 

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indicating that these individuals were willing to try a more difficult anagram task relative to the control task. On the other hand, individuals who reflected naturally did not prefer anagrams that were more difficult than the control task, $F(1, 17) = 1.00, \ p = .331$, and individuals in the no instruction group actually preferred their anagrams to be marginally easier than the control task, $F(1, 14) = 3.50, \ p = .082$ (Figure 9). These results indicate that only individuals who used decrease-negative reappraisal in a positive context were motivated to re-try a previously failed task that is more difficult than the level of difficulty they would prefer for a task in another domain.

![Figure 9. Future Motivation to Perform Task in Same-Domain. Future motivation, as measured by preferred difficulty of future anagram task and control task. Error bars represent standard errors.](image)

**How Do Positive Emotions Facilitate Increase-Positive Reappraisal?**

**Self-reported negative emotion.** We hypothesized that positive emotions would facilitate greater decreases in negative emotion for individuals who reappraised the failure task with the goal of increasing positive emotion. Consistent with expectations,
the 2x2 ANCOVA yielded a significant main effect of Time on negative emotion, $F(1,30) = 13.701, p < .001$, such that participants reported a decrease in negative emotion from post-failure to post-regulation across conditions. However, inconsistent with hypotheses, the two-way interaction between Time and Regulation Condition on negative emotion was not significant, $F(1, 30) = 0.72, p = .403$, indicating that there were no significant differences between conditions in negative emotion from post-failure to post-regulation (Figure 10). These findings indicated that reappraisal decreased negative emotions regardless of induced emotion. However, contrary to hypotheses, induced positive emotions did not facilitate greater decreases in negative emotion.

![Figure 10](image_url)

*Figure 10.* Effect of Emotion on Negative Emotion for Increase Positive Reappraisal. Change from baseline self-reported negative emotion over time. Error bars represent standard errors.
**Self-reported positive emotion.** We hypothesized that positive emotions would facilitate greater increases in positive emotion for individuals who reappraised the failure task with the goal of increasing positive emotion. Consistent with expectations, the 2x2 ANCOVA yielded a significant main effect of Time on positive emotion, $F(1,30) = 16.23$, $p < .001$, such that participants reported an increase in positive emotion from post-failure to post-regulation across conditions. However, inconsistent with hypotheses, the two-way interaction between Time and Regulation Condition on positive emotion was not significant, $F(1, 30) = 1.02$, $p = .322$, indicating that there were no significant differences between conditions in positive emotion from post-failure to post-regulation (Figure 11). These findings indicated that reappraisal increased positive emotions for individuals induced with positive emotions and neutral states. Contrary to hypotheses, but consistent with findings involving decrease-negative reappraisers in Study 1, induced positive emotions did not facilitate greater increases in positive emotion for individuals who reappraised with the goal of increasing positive emotions.

*Figure 11. Effect of Emotion on Positive Emotion for Increase Positive Reappraisal. Change from baseline self-reported positive emotion over time.*
**Content of thoughts.** We were also interested in how positive emotions impacted the content of thoughts when individuals reappraised the stressful experience with the goal of increasing positive emotions. We hypothesized that individuals who reappraised while experiencing positive emotions would generate more reappraisals relative to individuals who were in a neutral state. Results indicated that, relative to those induced with a neutral state, those induced with positive emotion during reappraisal generated no differences in number of reappraisals, \( t(31) = 0.67, p = .509 \), number of negative distracting thoughts, \( t(31) = 0.75, p = .461 \), number of ruminative thoughts, \( t(31) = 0.43, p = .671 \), or positive distracting thoughts, \( t(31) = 0.31, p = .755 \) (Figure 12).

![Figure 12](image)

*Figure 12.* Content of Thoughts for Increase-Positive Reappraisal. Number of reappraisals, positive distractions, negative distractions and ruminations during regulation manipulation. Error bars represent standard errors.

**Corrugator activity.** We examined the degree to which individuals who reappraised regulated their negative facial expressions during the regulation manipulation. We hypothesized that individuals who experienced positive emotions while engaging in
increase-positive reappraisal would express fewer negative emotions than individuals who were in a neutral state. Inconsistent with expectations, the 2x2 ANCOVA yielded a non-significant main effect of Time for corrugator activity, \( F(1, 26) = 0.01, p = .937 \), such that participants did not express fewer furrowed brows from failure (\( M = 6.61, SD = 12.28 \)) to regulation (\( M = 5.25, SD = 11.20 \)). The two-way interaction between Time and Induced Emotion was also not significant, \( F(1, 26) = 0.58, p = .452 \), indicating that there were no differences between groups in corrugator activity from failure to reappraisal. These findings revealed that, contrary to hypotheses, reappraisal did not significantly decrease expressive negative emotion regardless of induced emotion.

**Orbicularis activity.** We examined the degree to which individuals who reappraised regulated their positive facial expressions during the regulation manipulation. We hypothesized that individuals who experience positive emotions while engaging in increase-positive reappraisal would express greater increases in positive emotion relative to individuals in a neutral state. Inconsistent with expectations, the 2x2 ANCOVA yielded a non-significant main effect of Time for orbicularis activity, \( F(1, 26) = 0.07, p = .794 \), such that participants did not express more smiles from failure (\( M = 1.39, SD = 2.63 \)) to regulation (\( M = 1.14, SD = 1.76 \)). The two-way interaction between Time and Induced Emotion was also not significant, \( F(1, 26) = 0.02, p = .894 \), indicating that there were no differences between groups in orbicularis activity from failure to reappraisal. These findings revealed that, contrary to hypotheses, reappraisal did not significantly increase expressive positive emotion regardless of induced emotion.

**Motivation.** We hypothesized that only individuals who reappraised while experiencing positive emotions would be more motivated to try a more difficult anagram
task in the future, relative to a control task. To test this, we conducted a 2x2 ANOVA for Reappraisers, with Induced Emotion (Positive, Neutral) as the between-subjects variable, Task (Anagram, Control) and preferred difficulty level as the dependent variable. The main effect of Task was not significant, $F(1, 28) = 0.67, p = .419$. Contrary to hypotheses, there was no significant interaction between Task and Induced Emotion, $F(1, 28) = 2.18, p = .151$, indicating that individuals who reappraised while experiencing positive emotions did not prefer more difficult anagram tasks relative to those who were in a neutral state. However, graphically, there appears to be some differences between conditions that are consistent with our predictions. Analyses of simple effects revealed that, individuals who reappraised in a neutral context preferred a marginally easier anagram tasks relative to the control task, $F(1, 15) = 1.73, p = .104$. However, individuals who reappraised in a positive context reported no differences in preferred difficulty between the anagram task and the control task $F(1, 13) = 0.43, p = .671$ (Figure 13). These simple effects provide some evidence that, for individuals who reappraise with the goal of increasing positive emotions, induced positive emotions may increase motivation to engage in activities in the same domain as a previous stressful experience.
Figure 13. Future Motivation for Increase-Positive Reappraisal. Future motivation, as measured by preferred difficulty of future anagram task and control task. Error bars represent standard errors.

How Does Increase-Positive Reappraisal Compare to Other Strategies?

**Self-reported negative emotion.** We hypothesized that individuals who reappraised with the goal of increasing positive emotions would report greater decreases in negative emotion than those who reappraised with the goal of decreasing negative emotion, those who reflected, and those who did not regulate. Consistent with expectations, the 5x2 ANCOVA yielded a significant main effect of Time for negative emotion, $F(1, 92) = 50.05, p < .001$, such that participants reported a decrease in negative emotion from post-failure to post-regulation. Inconsistent with hypotheses, the two-way interaction between Time and Regulation Condition was not significant, $F(1, 92) = 0.68, p = .609$, indicating that there were no differences in negative emotion between conditions from post-failure to post-reappraisal. This finding is not entirely surprising, given that all of our conditions were either induced with positive emotions or asked to reappraise. However, the non-significant two-way interaction indicates that, contrary to
our hypothesis, individuals who reappraised with the goal of increasing positive emotions did not report greater decreases in negative emotion than the other conditions.

**Self-reported positive emotion.** We hypothesized that individuals who reappraised with the goal of increasing positive emotions would report greater increases in positive emotion than those who reappraised with the goal of decreasing negative emotion, those who reflected, and those who did not regulate. Consistent with expectations, the 5x2 ANCOVA yielded a significant main effect of Time for positive emotion, $F(1, 96) = 42.14$, $p < .001$, such that, overall, participants reported an increase in positive emotion from post-failure to post-regulation. However, contrary to hypotheses, the two-way interaction between Time and Regulation Condition was not significant, $F(4, 92) = 0.43$, $p = .786$, indicating that there were no differences in positive emotion between conditions from post-failure to post-reappraisal.

**Content of thoughts.** We hypothesized that individuals in the increase-positive condition would generate an increased number of reappraisals relative to individuals in the reflection and no instruction conditions.

**Relative to decrease-negative reappraisal.** Results indicated that, relative to those who reappraised with the goal of decreasing negative emotions, individuals who reappraised with the goal of increasing positive emotions did not generate a significantly different quantity of reappraisals, $t(92) = 1.42$, $p = .160$, positive distractions, $t(92) = 0.02$, $p = .985$, negative distractions, $t(92) = 0.18$, $p = .861$, or ruminative thoughts, $t(92) = 0.15$, $p = .880$ (Figure 14).

**Relative to reflection.** Results indicated that, relative to those who reflected about the negative experience, individuals who reappraised with the goal of increasing positive
emotions generated a significantly greater numbers of reappraisals, $t(92) = 2.99, p = .002$, and significantly fewer ruminative thoughts, $t(92) = 2.37, p = .020$ (Figure 14). Analyses also revealed that individuals who reappraised with the goal of increasing positive emotions did not generate a significantly different number of positive distractions, $t(92) = 0.21, p = .834$, or negative distractions, $t(92) = 0.69, p = .495$, relative to those who reflected.

**Relative to no instruction.** Results indicated that, relative to those who did not regulate the stressful experience, individuals who reappraised with the goal of increasing positive emotions generated a significantly greater numbers of reappraisals, $t(92) = 4.71, p < .001$, fewer ruminative thoughts, $t(92) = 2.13, p = .036$, and fewer number of negative distractions, $t(92) = 3.80, p < .001$ (Figure 14). Analyses also revealed that individuals who reappraised with the goal of increasing positive emotions did not generate a significantly different number of positive distractions, $t(92) = 0.99, p = .324$, relative to those who received no instructions.

![Figure 14. Content of Thoughts for All Conditions. Number of thoughts during regulation manipulation.](image-url)
Corrugator activity. We hypothesized that individuals in the reappraisal conditions would express fewer negative emotions than individuals in the reflection and no instruction conditions. Consistent with hypotheses, the 5x2 ANCOVA yielded a significant main effect of Time for corrugator activity, $F(1, 73) = 4.21, p = .044$, such that participants across conditions expressed significantly fewer furrowed brows from failure ($M = 6.62, SD = 12.46$) to regulation ($M = 4.28, SD = 10.07$). However, inconsistent with hypotheses, the two-way interaction between Time and Regulation Condition was not significant, $F(4, 73) = 0.37, p = .827$, indicating that no condition expressed significantly different corrugator activity relative to the other conditions.

Orbicularis activity. We hypothesized that individuals in the reappraisal conditions will express more positive emotions than individuals in the reflection and no instruction conditions. Contrary to expectations, the 5x2 ANCOVA did not yield a significant main effect of Time for orbicularis activity, $F(1, 73) = 0.24, p = .629$, such that participants did not smile more often during the regulation manipulation ($M = 1.46, SD = 1.44$) relative to the failure task ($M = 1.38, SD = 4.19$). The two-way interaction between Time and Regulation Condition was also not significant, $F(4, 73) = 0.17, p = .951$. These findings indicated that, inconsistent with hypotheses, participants did not smile more frequently during the regulation task than the failure task. Further, orbicularis activity did not differ by condition, therefore, we cannot conclude that any of the conditions demonstrated increases in expressive positive emotion.

Discussion

In Study 2, we replicated a number of results from Study 1 and answered a number of remaining questions. Consistent across studies, individuals who reflected
about a stressful event while experiencing positive emotions reported decreases in negative emotion and increases in positive emotion similar to individuals who reappraised the stressful event. In Study 2, we asked a number of questions to better understand how each strategy might be different.

**How Do Reappraisal and Reflection Differ?**

We found that although reappraisal and reflection in a positive context similarly regulated the subjective experience of emotion, they also differ in a number of ways. First, individuals who reappraised with the goal of decreasing negative emotion were more motivated to perform a more difficult anagram task relative to a control task. Individuals who reflected were motivated to perform a task of equal difficulty to a control task. This finding shows that individuals in both groups are not averse to the possibility of engaging in an activity similar to a previous stressful activity, but that individuals who engage in decrease-negative reappraisal were more resilient and were willing to try a more difficult anagram task in the future. These findings are consistent with theories outlining how positive emotions provide input to an individual about progress toward their goals. According to the moderated hedonic contingency hypothesis and the mood as input theory (Aspinwall, 1998; Martin et al., 1993), positive emotions send a signal to individuals that they have the sufficient resources necessary for completing a difficult task. In the context of the present study, positive emotions may have signaled to individuals that even though the task was stressful, they have the resources necessary for handling the situation in the future. In conclusion, reappraisal seems to have a particular advantage over reflection in that reappraisers may be better able to motivate themselves to engage in future stressful experiences. These findings have important implications,
especially in situations where individuals would benefit from being motivated to put themselves in a situation similar to one that had previously evoked negative emotion. For example, reappraising with the goal of decreasing negative emotion may be helpful for a student who failed an entrance exam and needs to find the courage to try again.

Reappraisal and reflection also differed in the content of their thoughts relative to individuals who were given no instructions. Individuals who reappraised or reflected generated more reappraisals than those in the no instruction condition; however reappraisers generated the most reappraisals of any group. Because reappraisal requires attending to the negative stimulus, these findings may best be explained by the moderated hedonic contingency hypothesis (Aspinwall, 1998). Using this framework, individuals in the reappraisal and reflection group were motivated to think about the negative stimulus, which enabled positive emotions to facilitate the processing of this negative emotion; thus increasing their ability to generate reappraisals. On the other hand, individuals who experienced positive emotions with no instructions may not have been motivated to process this negative information, resulting in fewer reappraisals.

Individuals who reappraised also generated fewer ruminative thoughts than individuals in the reflection group. This is likely due to the explicit and direct goals of reappraisal which ask that individuals direct their thinking towards changing the meaning of the negative stimulus, thus altering these ruminations to more constructive thoughts. In a clinical setting, these findings may distinguish reappraisal as a preferable emotion regulation strategy for individuals who are specifically having trouble with ruminative thinking.
One thing reappraisal and reflection seem to have in common is that they each reduce the number of negative distractions relative to the no instruction condition. This finding is supported by the framework of the moderated hedonic contingency hypothesis which suggests that positive emotions facilitate the processing of negative information only if the information is important and self-relevant (Aspinwall, 1998). Therefore, positive emotions seem to facilitate the processing of important information that may be helpful for emotion regulation without facilitating the processing of unimportant negative information that could potentially be detrimental to successful emotion regulation.

**How Do Positive Emotions Facilitate Increase-Positive Reappraisal?**

We also found that individuals who engaged in increase-positive reappraisal while experiencing positive emotions were willing to try an anagram task of equal difficulty to the control task. However, individuals who engaged in increase-positive reappraisal while in a neutral state preferred a marginally easier anagram task relative to the control task. These findings also highlight how positive emotions may facilitate emotion regulation by allowing individuals to regulate their experience to the extent that they are not averse to the possibility of engaging in a similar stressful situation in the future. These findings are also best understood using the framework of the hedonic contingency hypothesis (Aspinwall, 1998). Using this framework, the absence of positive emotions in the neutral group may have led to less efficient processing of positive information and important negative information. Individuals who reappraised while experiencing positive emotions may have also benefited from the replenishing effects of positive emotions. The undoing hypothesis provides evidence that positive emotions diminish the lingering psychological and physiological after-effects following a stressful experience and
replenish resources (Fredrickson et al., 2000). Using this framework, reappraisers who experience positive emotions may have felt fewer after-effects of the stressful experience, thus increasing their willingness to engage in a similar situation in the future. Although the effects of positive emotions on reappraisal did not lead to differences in the subjective experience of emotion, they did translate to motivational states. These findings may be especially useful in situations where individuals require sustained effort in stressful situations over time.
GENERAL DISCUSSION

For individuals who reflect, positive emotions play an especially important role in the subjective experience of emotion. We found that positive emotions induced decreased negative emotion and increased positive emotions among individuals who reflected about the stressful experience. Research on self-focused thinking outlines the subtle differences between adaptive self-reflection and ruminative thinking which ultimately lead to drastically different mental and physical outcomes. Rumination tends to lead to maladaptive emotion regulation outcomes while adaptive self-reflection tends to be an effective way to regulate stressful experiences (Ayduk & Kross, 2008). A broadened, global perspective is thought to facilitate self-reflective thinking while a narrowed, local perspective often leads to rumination (Ayduk & Kross, 2010). Positive emotions tend to induce a broadened cognition and an expanded, global attentional focus. Therefore, we hypothesized that positive emotions would facilitate emotion regulation among individuals who reflect about a stressful experience. Consistent with hypotheses and the above-mentioned theories, we found that individuals who experienced positive emotions while reflecting were able to effectively regulate the subjective experience of emotion. Therefore, positive emotions may be a possible mechanism for facilitating reflective thinking away from maladaptive rumination and towards adaptive emotional outcomes.

For individuals who reappraised, we found that positive emotions did not facilitate the regulation of subjective emotion. However, we did find that individuals who engaged in decrease-negative reappraisal were more motivated to re-try a more difficult anagram task relative to a control task. These findings provide new insight into the
beneficial outcomes of reappraisal. In many cases, people experience stressful situations on a daily basis; and sometimes, it’s not possible to avoid these situations. Based on the present research, reappraisal in a positive context may help people regulate their emotions in such a way that they can motivate themselves for future, potentially stressful situations. We also found that individuals who used reappraisal were susceptible to fewer ruminative thoughts. This finding is important because rumination is a widespread problem and a common contributor to clinical depression (Grant et al., 2002). Therefore, individuals who may suffer from ruminative thinking may find reappraisal to be the optimal solution for reducing these maladaptive thoughts.

Limitations and Future Directions

Future studies may benefit from how individuals regulate their emotional experience in response to different discrete negative emotions. Although the failure task was highly effective in inducing a generalized form of negative emotion, it is not a discrete emotion itself. Research on challenge and threat appraisals suggests that evaluative tasks, such as the anagram failure task, can elicit varying emotional responses depending on how an individual’s personal resources meet the demands of the situation (Blascovich, 2008). Individuals feel threatened when they perceive their resources to be insufficient for the situation. On the other hand, individuals feel challenged when they feel they have sufficient resources to meet the demands of the situation. Each of these responses leads to different subjective and physiological responses to the negative stimuli. This could also explain the lack of significant results for the physiological and facial expression data. However, although the failure task may not have elicited a discrete
negative emotion, this manipulation was effective in eliciting generalized negative emotions and generating a realistic scenario that individuals might encounter in life.

Another potential future direction of the present study is to see how varying discrete positive emotions impact these emotion regulation strategies and thought processes. Some research indicates that certain positive emotions, such as desire, do not induce a cognitive broadening but instead induce a cognitive narrowing, which may not be conducive to facilitating emotion regulation. However, people often use high arousal positive emotions to cheer themselves up after a negative event in daily life, therefore it may be worthwhile to see how these positive emotions impact other emotion regulation strategies. Future research should also investigate how high arousal positive emotions, such as amusement, facilitate emotion regulation.

One potential limitation of the present study is the highly variable results from the no instruction condition. For individuals who did not receive instructions, we found that induced positive emotion led to significant decreases in negative emotion and increases in positive emotion in Study 2. Although we expected induced positive emotions alone to be helpful for emotion regulation, we did not expect these decreases in negative emotion and increases in positive emotion to be equally as effective as strategies like reappraisal. Across both studies, the no instruction group seems to have highly variable and inconsistent results. Because they were given no instructions other than to watch the video, these individuals could have been thinking about a wide variety of things during the regulation manipulation which could explain why they experienced drastic shifts in emotion in Study 2, but no changes in emotion in Study 1. In future studies, it may be helpful to give individuals in this no instruction group a task that is equally engaging as
the tasks in other conditions to better control the potential for highly variable thoughts during this task and also reduce boredom.

**Conclusion**

We found that positive emotions play a key role in successful emotion regulation when individuals are reflecting naturally about a negative stimulus. Our findings indicated that reflection about a negative experience in the absence of positive emotion is not a helpful way to regulate emotion. However, when positive emotions are present, reflection is an effective way to reduce the subjective experience of negative emotion and increase positive emotion. In fact, reflection in a positive context is equally effective as reappraisal in regulating the subjective experience of emotion. We also found that positive emotions enhance reappraisal by increasing motivation to re-try an activity that previously evoked stress. This finding emphasizes how reappraisal in a positive context can be beneficial for people who may require sustained effort in a stressful task. We also found that individuals who reappraise while experiencing positive emotions are less prone to ruminative thoughts and negative distractions, which may deem this strategy most helpful for individuals who suffer from depression and ruminative thinking.

Combined, these findings begin to shed light on how positive emotions facilitate successful emotion regulation in response to stressful experiences. With a better understanding of how positive emotions impact the processes, mechanisms and outcomes of emotion regulation, we can continue to improve the mental and physical health of people.
REFERENCES


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RESEARCH INTERESTS

Emotions, emotion regulation, cognitive reappraisal, self-regulation, humor and laughter, evolutionary psychology, neuroimaging and psychophysiology methods

PUBLICATIONS


RESEARCH EXPERIENCE

Graduate Master’s Thesis, Wake Forest University  2011 – 2013
Department of Psychology
Project: The Role of Positive Emotions in Facilitating the Regulation of Emotion in Response to Negative Stressors
Supervisor: Dr. Christian Waugh, PhD
- Worked closely with faculty advisor in the development, implementation and refinement of experimental research project on emotion regulation
- Trained and managed a team of undergraduate lab assistants
- Produced an APA-style empirical research paper to serve as the basis for a Master’s thesis and publication.

Undergraduate Senior Honors Thesis, Texas Christian University 2009 - 2010
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Project: The effects of gratitude on perseverance
Supervisor: Dr. Sarah Hill, PhD
- Designed and conducted original experimental research with the help of a faculty advisor
- Funded by the Undergraduate Student Research and Creativity Grant
- Produced an Honors Thesis in APA style

TEACHING EXPERIENCE

Teaching Assistant, Wake Forest University 2011 - 2013
Department of Psychology
Research Methods in Psychology I
- Taught weekly lab section designed to review concepts and procedures covered in lecture
- Topics covered: basic statistics (e.g., correlational analysis, multiple regression), use of statistical software (SPSS), scientific writing in APA style.
- Average Student Evaluation: 4.7/5.0

AWARDS, GRANTS, & HONORS

1st place award for poster presentation at Society of Southeastern Social Psychology Conference 2012
Summer Research Support Scholarship – Wake Forest University 2012
Teaching assistantship stipend – Wake Forest University 2011 - 2012
Full tuition scholarship – Wake Forest University 2011 - 2012
Phi Beta Kappa 2010
Class of 2010 Senior Legacy Award 2010
Lance Kearns Legacy Award for Outstanding Senior Project – Chancellor’s Leadership Program 2010
Undergraduate Student Research and Creative Activity Grant 2009
TCU International Study Award 2009
Alan Bedford Award for Outstanding Leadership in Student Government 2008
Pillar University Leadership Award 2008
Brachman International Study Grant 2008
Balanced Man Sophomore of the Year 2008
Order of Omega Honors Society 2008
John V. Roach Honors College: Texas Christian University 2006 – 2010
Dean’s Scholarship: Texas Christian University 2006 – 2010

PROFESSIONAL PRESENTATIONS

**Major, B., & Waugh, C. & McRae, K.** (January, 2013). *The additive effects of positive emotions and cognitive reappraisal on the regulation of negative emotions.* Professional presentation at the data blitz session of the SPSP Self-Regulation Pre-Conference, New Orleans, LA.


**Major, B., Waugh, C. & McRae, K.** (October, 2012). *The additive effects of positive emotions and cognitive reappraisal on the regulation of negative emotions.* Poster presentation at the 34th annual meeting of the Society of Southeastern Social Psychologists, Gainesville, FL.

**Major, B.** (April, 2010). *The effects of gratitude on perseverance.* Formal presentation of original independent research for the John V. Roach Honors College, Fort Worth, TX.

**Major, B.** (April, 2010). *The effects of gratitude on perseverance.* Poster presentation at the annual Student Research Symposium of Texas Christian University, Fort Worth, TX.
CONFERENCES ATTENDED


SPSP Emotion Pre-Conference, January 26, 2012, San Diego, CA

Annual Meeting of the Society for Personality and Social Psychology, January 27-29, 2011, San Antonio, TX

SPSP Psychology of Humor Pre-Conference, January 27, 2011, San Antonio, TX

Gallup Wellbeing Forum, October 7-8, 2010, Washington, D.C.

RELEVANT EMPLOYMENT

Texas Christian University 2010 – 2011
Student Affairs Intern, employed by Student Development Services
• Led the campaign, application process, and implementation of the Gallup Wellbeing Consortium. This consortium involves a five-year longitudinal study of well-being at TCU.
• Directed Leadership for Life program which trains upperclassmen students to coach and mentor first-year students
John V. Roach Honors College, academic advisor
• Served as an academic advisor to undergraduate students in the Honors College
• Provided academic direction to upper-classmen conducting independent research within their department

SKILLS

Technology
• Proficient in SPSS, HLM6 and Microsoft Office
• Working knowledge of Matlab

Research tools
• Proficient with Qualtrics, and experience with E-Prime, AcqKnowledge, ANSLab, BIOPAC MP150 Systems
• Experience with the acquisition and preprocessing of several physiological measures (including electrocardiography, impedance cardiography, galvanic skin response, blood pressure, and respiratory rate) and several electromyography
measures (including corrugator, orbicularis oculi, and the zygomatic muscle response).

CAMPU S INVOL V EM E N T

Student Body Vice President, January 2008–January 2009
- Supervised the internal workings of the Student Government Association
- Served as chair of Campus Advancement Committee
- Presented on behalf of the student body to the TCU Board of Trustees

Founder of the One Book, One TCU program, Fall 2009
- Campus-wide initiative encouraging students, faculty and staff to read the same book
- Goal to promote an intellectual environment at TCU and foster a sense of community through literature and discussion

Orientation Student Director, January 2008-January 2009
- Assisted first year students with completing class schedules and understanding the college experience at TCU
- Aided in the training, development, and management of orientation staff

Best Buddies Activities Coordinator, January 2007-January 2009
- Re-established Best Buddies chapter at TCU in Spring 2007
- Formed one-to-one friendships between college students and adults with disabilities
- Served as Activities Coordinator and planned monthly activities for the TCU chapter

Bike & Build rider, May 2010 – August 2010
- Rode 3800 miles across the US on a bike from Providence, RI to Seattle, WA
- Non-profit organization that raises money for affordable housing
- Team of 30 raised and donated $70,000 to affordable housing organizations nationwide
- Made nightly presentations on affordable housing issues in communities across the US

PROFESSIONAL AFFILIATIONS

American Psychological Association of Graduate Students

Society for Personality and Social Psychology

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REFERENCES

**Dr. Christian Waugh**
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