The Effects of Cognitive Reappraisal on Interview Situations

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Abstract

The current study sought to ascertain whether cognitive reappraisal could be used to help lower participants' levels of stress during an anxiety-inducing interview task. Subjects were 35 Tufts undergraduate and graduate students, randomly assigned to cognitive reappraisal writing (CRW), expressive writing (EW), or control groups. Subjects in the CRW and EW groups received three surveys, one per night, for three consecutive nights. Subjects in the CRW group wrote about the most stressful experience of the day, using a cognitive reappraisal framework. Subjects in the EW group wrote about the most stressful experience of that day without aforementioned framework. All participants then returned to the lab on the second day of the study for a number of tasks, including a stressful interview task. Electrocardiography (ECG), skin conductance (SCL), and self-report measures were utilized to ascertain subjects' stress levels during the task. It was hypothesized that CRW participants would experience the lowest levels of stress, utilizing the three measures. However, contrary to the hypothesis, no significant differences in physiological arousal or anxiety self-report measures were found across groups. Likely due to the low statistical power of this study, the present study does not show support for the effect of cognitive reappraisal on individuals' anxiety symptoms during stressful tasks. Further research is necessary to ascertain whether cognitive reappraisal can be used to boost performance in stressful situations.

Keywords: anxiety, cognitive reappraisal, interview, performance

The Effects of Cognitive Reappraisal on Interview Situations

In today's fast-paced world, stress is an almost constant companion. Although many might demonize this response, stress is evolutionarily adaptive. In fact, stress and stress-induced symptoms, such as elevated heart rate, glycogenolysis,[1] and increase in blood pressure, all stemming from stress-induced activation of the sympathetic nervous system, originally developed as neurophysiological responses to danger (Segerstrom & Miller, 2004; Keltner, Oatley, & Jenkins, 2006). Today, stress continues to be useful in situations where individuals are threatened with bodily harm. For example, if an individual is attacked by a bear in the forest, stress will prepare his or her body and mind to either flee or fight the incoming threat (Keltner et al., 2006). Stress is also helpful in non life-threatening situations. According to the Yerkes & Dodson bell curve, a certain level of arousal is required in order to achieve peak performance (Yerkes & Dodson, 1908).

While certain levels of stress have adaptive functions in a myriad of situations, this emotional response becomes maladaptive when individuals either experience an exceptionally high level of stress, such as following a trauma, or experience an elevated level of stress that is sustained for a long duration, such as during a two-week final exam period. In the former case, excessive levels of stress can have lasting post-event repercussions, possibly manifesting as Post Traumatic Stress Disorder (PTSD), sleep loss, difficulty concentrating, and impaired executive functioning (Kassin, Fein, & Markus, 2011). In the latter case, chronic stress can lead to a compromised immune system, mental and

[1] "Glycogenolysis, process by which glycogen, the primary carbohydrate stored in the liver and muscle cells of animals, is broken down into glucose to provide immediate energy and to maintain blood glucose levels" (Encyclopedia Britannica Online)

physical fatigue, and/or an increased likelihood to engage in maladaptive behaviors, such as drug and alcohol use (Kassin, et al. 2011). Studies have additionally shown that high levels of stress can lead to a greater predisposition to psychological disorders (Dohrenwend, 2000).

The maladaptive nature of chronic or inordinate levels of stress has prompted a slew of research on the ways in which individuals use emotion regulation to manage this response. Studies have found that emotion regulation strategies vary in individuals, depending on their age and culture (John & Gross, 2004). Individuals also differ in terms of what situations, tasks, or environments may provoke stressful responses. For example, some people may find job interviews effortless while for others, the mere mention of this activity brings on sweaty palms and elevated heart rate. Regardless of the stress-inducing catalyst, psychologists have isolated five points in the process of generating emotions in which individuals can regulate their emotional responses (Gross, 2014). These regulation processes, with the exception of response modulation, are antecedent focused, meaning that they happen before the onset of a full-blown emotional response and, as a result, may change the emotional response that the emotional stimulus elicits (Gross, 1998; Torre, 2011). They include: situation selection, situation modification, attentional deployment, cognitive change, and response modulation. The present study focuses on cognitive reappraisal, an example of cognitive change (Gross, 1998).

Cognitive Reappraisal is the practice of altering thoughts or the understanding of an emotional stimulus to change the response to the emotional stimulus (Ochsner, & Gross, 2008). Studies show that cognitive reappraisal is linked to lower levels of depression, negative affect, and even increased life satisfaction (Moore, Zoellner, & Mollenholt, 2008).

Researchers have also found that individuals who engage in cognitive reappraisal are better able to cope with stress and have a higher ability to repair negative mood (Gross & John, 2003). Moreover, research has demonstrated that cognitive reappraisal may increase individuals' performance on anxiety-inducing mental and physical tasks (Moore, Vine, Wilson, & Freeman, 2015). For example, in a laboratory experiment, 78 women were tested for their cognitive reappraisal ability (CRA), stress, and depression levels. Experimenters found that participants who were high in CRA were better able to cope with stress, and had lower levels of depression, than individuals low in CRA (Troy, Wilhelm, Shallcross, & Mauss, 2010). In a 2015 laboratory experiment, psychologists instructed participants to complete a competitive and stressful golf-putting task. Results found that individuals in the reappraisal group performed better and experienced fewer stress-induced physiological symptoms than participants in the control group (Moore, et al., 2015). Similarly, in a 2010 experiment, participants who were first taught how to engage in cognitive reappraisal performed better on the GRE standardized test (Jamieson, Mendes, Blackstock, & Schmader, 2010). Psychologists believe that cognitive reappraisal may also lower levels of physiological arousal (Moore et al., 2008) and decrease the likelihood of experiencing symptoms of PTSD or depression after particularly traumatic events (Cavanagh, Fitzgerald, & Urry, 2014).

In light of the research supporting the hypothesis that cognitive reappraisal decreases stress and depression symptoms during anxiety-provoking situations, and increases participants' performance on some anxiety-provoking tasks, it would seem advantageous to educate individuals on how to engage in this regulation process as a means of softening these emotional responses. It would also follow that these increases in

performance, and decreases in stress symptoms, might extend to academic and professional stress-inducing activities, such as public speaking and interview situations. According to the National Comorbidity Survey Replication conducted in 2007, public speaking was the single most common lifetime social fear with a pervasiveness of 21.2% of the sample recruited. Fears of important exams or interviews were classified as affecting 14% of the sample population (Ruscio, Brown, Chiu, Sareen, Stein, & Kessler, 2008).

The current experiment will investigate whether a more rigorous and extensive cognitive reappraisal training task, will decrease participants' levels of arousal during a stressful activity. Although not specifically tested, it is estimated that such a decrease might also increase performance.

Expressive writing was chosen as the vehicle through which to train participants in cognitive reappraisal because of its studied therapeutic qualities. Past studies have found that subjects who repeatedly engage in expressive writing tasks have improved physical and psychological states, in comparison with participants who write about dispassionate or neutral topics (Pennebaker & Beall, 1986; Smyth, 1998). The effects of expressive writing on emotion regulation has also been investigated. Studies have considered that expressive writing has positive effects because it requires participants to engage in emotion regulation (Alparone, Pagliaro, & Rizzo, 2015; Lepore, Greenberg, Bruno, & Smyth, 2002). Research has also been conducted on the effects of cognitive reappraisal expressive writing on depressive symptoms. A recent paper found a significant main effect for three days of cognitive reappraisal expressive writing on depressive symptoms as compared to expressive writing without the cognitive reappraisal prompt (Cochran, 2015). A paper by Raskin et al. found similar results for cognitive reappraisal expressive writing, with

participants writing for six days through a cognitive reappraisal or non-cognitive reappraisal framework. Results showed an indirect decrease in depressive symptoms for individuals in the cognitive reappraisal group (Raskin, Floerke, Vujovic, & Urry, 2015). Research has also been conducted on the effect of cognitive reappraisal expressive writing on public speaking anxiety. A study conducted in 2015 found that individuals who engaged in a relevant cognitive reappraisal expressive writing task before a stressful public speaking task had lower levels of self-report anxiety than individuals in the irrelevant writing or control groups (Wang et al., 2015). These past studies show support for the use of cognitive reappraisal expressive writing in teaching participants to engage in cognitive reappraisal. For these reasons, expressive writing was chosen as the teaching medium in the target experiment.

In the present study, participants were randomly assigned to one of three groups. Subjects in the cognitive reappraisal writing (CRW) group completed three surveys, one per night, for three days. In the surveys, CRW subjects were required to write about the most stressful experience of the day through a cognitive reappraisal lens. Subjects in the expressive writing (EW) group received similar nightly surveys, but completed the expressive writing task without the cognitive reappraisal lens manipulation. Participants in the control group received no nightly surveys. On Day 2 of the study, participants returned to the lab and completed a physiologically arousing interview task. Subjects then completed an expressive writing task about the physiologically arousing task they had just completed. Experimenters collected participant physiological data and self-report responses in order ascertain participant levels of physiological arousal.

Based on previous findings, it is predicted that participants in the CRW group will experience the lowest amount of stress, measured by heart rate, skin conductance, and self-report levels of anxiety and depression, during the sample interview task and subsequent expressive writing task. Those in the expressive writing (EW) group will experience the second lowest amount of stress, and participants in the control group will experience the most stress.

Method

Participants

Thirty-five Tufts University graduate and undergraduate participants were recruited. Of those recruited, two subjects' data were disregarded as a result of a Qualtrics survey error. Subjects were recruited via Tufts SONA Paid and SONA Credit websites and were compensated with $65 for the former and three SONA credits for the latter. Participants were 69.7% female, 66% White and 34% Asian. Participants ranged in age from 18 to 32 (M = 20.2, SD = 3.12).

All participants indicated their informed consent to the study procedures during their first laboratory session, which were approved by the Social, Behavioral, and Educational Research Institutional Review Board at Tufts University and the U.S. Army Natick Soldier Research, Development, and Engineering Center.

Materials

On Day 1 of the study, participants were administered the Well-Being survey (see paragraph below) and issued an armband. Subjects in the CRW and EW groups then completed three surveys, one per night, starting the night of the first day. The surveys

included an expressive writing task and self-report emotion questions. On Day 2, participants returned to the lab, completed an amended version of the Well-Being Survey, and completed a TSST task and an expressive writing task. Other tasks were completed, but not reported due to their irrelevance to the present study hypothesis.

Well-Being Survey. The Well-Being Survey was administered twice during the experiment. One version was administered during the first lab day to establish a baseline, and an amended version was administered during the second lab session on Day 2. The Well-Being Survey included a variety of self-report measures assessing psychological and physiological Well-Being. These included the demographics, participants' race, age, gender, education level, marital status, children, and number of people living with the participant. The survey also included additional emotion regulation and situational questions that will not be reported upon due to their irrelevance to the target study hypothesis. Participants completed the Well-Being Survey in the lab online through Qualtrics (Provo, UT). The survey took approximately 30 minutes to complete. The Day 2 well being survey included an additional debriefing question section, asking participants what they believed the study was researching, as well as whether they believed the researchers should count their data.

Self-Reported Emotions. A number of self-report emotion questions were utilized in the Well-Being survey. Participants were required to indicate their levels of overall stress and happiness on a 0-7 Likert scale and complete two copies of 17 mood triplets—questions about happiness, stress, and life satisfaction (see Table 1,2, and 3). The triplets were structured to include three high-impact descriptor words. For example, one question asked the participants to describe the extent to which they felt "active/alert/keyed up." In addition to the 17 mood triplets, two other questions were incorporated as a manipulation

check, both asking participants to simply mark one of the 7 ratings. Subjects also categorized the event they planned to write about. Categories included “Relationship with my spouse/partner” or “Personal health or wellbeing.” Subjects then rated the level of stress induced by the categorization experience, on a 1-7 Likert scale.

Writing Protocol. The survey writing tasks differed depending on the group (see below). Subjects in both groups wrote for 5 to 15 minutes about their “deepest thoughts and feelings” regarding the stressful event they had chosen. Subjects in the CRW group were asked to reappraise the stressful event in a way that made them feel less stressed (see below).

For the EW group, instructions were as follows: “You described your stressful event as follows: [Participant’s one sentence description]. With this stressful event clearly in mind, we'd like you to write about it in more detail. For the next 5-15 minutes, please write about your deepest thoughts and feelings about the stressful event. Describe what happened, how you felt, and what you were thinking at the time. Also describe how you’re feeling and what you’re thinking now. Importantly, as you write about the event, do your very best to express exactly how you feel and what you think about this event. The goal is to write down whatever thoughts and emotions naturally occur for you. Please do your best to achieve this goal.”

For the CRW group, instructions were as follows: “You described your stressful event as follows: [Participant’s one sentence description]. With this stressful event clearly in mind, we'd like you to write about it in more detail. For the next 5-15 minutes, please write about your deepest thoughts and feelings about the stressful event. Describe what happened, how you felt, and what you were thinking at the time. Also describe how you’re

feeling and what you're thinking now. Importantly, as you write about the event, do your very best to think and write about this event in such a way that you feel less stressed. Specifically, try to reassess the situation in a way that makes you feel better about it. There are many ways to accomplish this goal. Here are several examples of what you might write about:

- Consider whether the negative consequences are actually less negative than imagined
- Consider whether there are positive consequences or opportunities
- Consider the event from an objective perspective, doing your best to separate the facts of the event from your thoughts and feelings about it
- Consider what you'd say to a close friend to help him or her feel less stressed in the same situation
- If another person was the source of the stressful event, consider his or her perspective

Any of these options are fine and you may have other ideas too. The goal is to think and write about this event in such a way that you feel less stressed. Please do your best to achieve this goal."

Before participants engaged in the writing task, they were prompted to describe the task. Subjects were then instructed to begin writing in a separate text box. A timer was placed on the bottom of the screen, visible to the participant, recording the time they had spent on the task. After, subjects completed a series of nine questions about the writing task they had just finished. The questions included statements such as "I enjoyed this writing time today" and "It took a lot of thought to write today." Participants rated these statements on a 7-point Likert scale as to how much each statement aligned with their own personal experience (the data and results of this task have been excluded because of its irrelevance to the target study).

Reappraisal Coding. Two independent research assistants, blind to group assignment, were trained in cognitive reappraisal coding. They reviewed all three survey writing entries for each participant independently. The survey writing entries were coded on a scale of 0-3 (0 being no cognitive reappraisal use evident, and 3 being an extreme amount of cognitive reappraisal used). Inter-rater reliability was assessed, and found to be significant, using an intraclass correlation (average measure ICC = .84).

Trier Social Stress Test (TSST). A modified version of the TSST was used on Day 2 to induce a state of anxiety in the lab temporarily (Kirschbaum et al., 1993). Participants were required to perform a sample interview – speaking about their organizational skills and ability to meet deadlines under pressure. Participants who consented to video and voice recordings were recorded during the TSST task. Subjects were given a three minute period in which to take notes and prepare their speech before the actual speech task. Subjects' notes were then removed before the speech task began. The speech itself lasted for five minutes. All participants viewed their own reflections on the computer monitor for the duration of the speech. If participants paused during the task, the experimenter asked them to continue.

In-Lab Expressive Writing Task. After the TSST, all participants completed a writing task about the sample interview. This task was included in order to ascertain whether individuals in the CRW group experienced less arousal during the writing than individuals in the other two groups. Participants wrote about their thoughts and feelings about the event in the first person perspective. Participants were instructed to write for a minimum of five minutes and a maximum of 15 minutes. After five minutes, subjects had the option of telling the experimenter they were finished. If this happened, the

experimenter would end the task and proceed to the next part of the experiment. Subjects also had the opportunity to write for the full 15 minutes. If this happened, the experimenter would instruct the participant to stop writing after the 15 minutes had elapsed and would proceed to the next part of the experiment (the data and results of the in-lab expressive writing task have been excluded because of its irrelevance to the target study).

Autonomic Physiology. Electrocardiography and electrodermal activity were both recorded during Day 2 of the study in order to ascertain participants' levels of physiological arousal. Data was collected with the Biopac program in a MP150 system (Biopac, Goleta, CA) and processed in ANSLAB (Wilhelm & Peyk, 2005).

Electrocardiography (ECG). ECG was used to measure heart rate (HR), which is innervated by the sympathetic and parasympathetic system of the autonomic nervous system. After wiping the left and right collarbones on the chest with electrode preparation pad, two disposable Ag/AgCl electrodes pre-gelled with 7% chloride (1 cm circular contact area) were placed on the same location. ECG was collected continuously at 1,000 Hz. Offline, the ECG signal was downsampled to 400 Hz and bandpass-filtered from 0.5 to 40 Hz. Interbeat interval series were created by identifying the R-spikes using automated ANSLAB algorithms. R-spikes that were not detected automatically or incorrectly identified were manually included or changed. After such artifact correction, the interbeat interval series was converted to HR in beats per minute. HR data was decimated to 10 Hz and then smoothed with a 1-s prior moving average filter. Mean heart rate in beats per minute was calculated for each task during the laboratory session.

Skin Conductance Level (SCL). SCL was used to measure sympathetic activation of the autonomic nervous system. Two disposable Ag/AgCl electrodes pre-gelled with 0.5%

chloride isotonic gel (1 cm circular contact area) were attached to the distal phalanges of the index and middle fingers of the participant's non-dominant hand. One additional ground electrode for all physiological channels was placed on the back of the neck. SCL was recorded with DC coupling and constant voltage electrode excitation at 31.25 (sensitivity = 0.7 nS). Offline, SCL was smoothed with a 1 Hz low-pass filter and decimated to 10 Hz. Mean skin conductance in microSiemens was calculated for each task during the laboratory session.

Procedures

Participants were recruited via Tufts University SONA Paid and SONA Credit websites for a study that spanned four days. Subjects were randomly assigned to Cognitive Reappraisal Writing (n = 11), Expressive Writing (n = 11), or a Control Non-Writing (n = 11) group. Participants came into the lab on the first day of the study and completed the first Well-Being Survey. Demographic information was then collected, such as the participant's height, weight, dominant-handedness, as well as whether or not the participant smoked. Subjects were then administered an armband and instructed in its daily-required maintenance and upkeep. Participants were then thanked profusely and escorted to the exit. A quick reminder was given to individuals in the CRW and EW groups that they would be receiving their first survey that night. Participants in the CRW and EW groups then completed three surveys, one each day.

The surveys were structured as follows. Participants were first required to indicate their levels of overall stress and happiness on a 0-7 Likert scale. Subjects then completed 17 mood triplets—questions (see Table 1,2, and 3). After the triplets, participants

completed a task in which they were required to summarize, in one sentence, the most stressful event of that day. Subjects were then required to specify the times that the event began and ended, who they were with during the event, and what category of stress the event fit into. Subjects then rated how much stress was induced by the experience on a 1-7 Likert scale. Subjects then completed the 5-15 minute expressive writing task. Finally, subjects completed a repeat of the 17 mood triplets.

All surveys were completed at home and through an emailed link. Participants were sent the link to each survey at 6:00 pm the night it needed to be completed. All surveys were completed and submitted before 11:59pm that same day. The surveys included a writing task and life satisfaction questions described below. Participants in the control group were not emailed any surveys. Participants in the control group were emailed a reminder the night before Day 2, to come into the lab the next day for the last day of the study.

On Day 2, all participants came back into the lab. Participants completed the second Well-Being Survey and were then connected to the ECG and SCL physiological sensors. Subjects then completed a two-minute resting state task in which they were required to stare at a fixation cross. Participants then completed some self-report triplet questions on screen. Participants than completed an interoceptive heart beat counting task. Subjects were then instructed that they had three minutes to prepare for a sample interview in which they would be speaking about their organizational skills and ability to meet deadlines under pressure. Subjects were instructed that, during the actual speech, they would not be able to look at any notes they had taken during the preparation period. After the three minutes had elapsed, the experimenter removed the notes and the participant

began his/her speech. The speech task lasted five minutes. At the end of the five-minute period, participants completed some self-report triplet questions on screen and were required to write about the speech they had just given. Participants wrote about the task for a minimum of five minutes and a maximum of 15 minutes. Participants then either informed the experimenter that they had finished after the five-minute period or were stopped by the experimenter after 15 minutes had elapsed. Participants then completed some self-report triplet questions on screen. Subjects then engaged in a second interoceptive heart beat counting task and finally were shown a comedic clip from *The Office*. After, participants were debriefed and compensated.

Data Retention and Analysis. The data from two participants were disregarded, the first because the participant failed to complete all of his/her surveys, the second because the participant did not receive emails inviting completion of all of his/her surveys.

Results

Preliminary Results

Cognitive Reappraisal Writing Manipulation Check. A one-way ANOVA was used to assess whether individuals in the CRW group utilized cognitive reappraisal with more frequency than individuals in the EW group during the daily survey-writing task. The results of the one-way ANOVA showed that individuals in the CRW group used cognitive reappraisal more in their writing than individuals in EW group, F (1,20) = 6.42, p = .020. Thus, the target task was successful in making individuals in the CRW group (M = 1.71, SD = .74) use cognitive reappraisal with a higher frequency than individuals in the EW group (M = 0.97, SD = .63).

TSST Manipulation Check. TSST heart rate was analyzed via a 6 (task: baseline resting state, interoceptive heart-beat counting task 1, pre-TSST preparation period, TSST stressful interview, post-TSST expressive writing period, interoceptive heart-beat counting task 2) x 3 (group: CRW, EW, Control) GLM. This section will only focus on the results relevant to the study. Analysis of the TSST showed a significant effect of task on heart rate F (5,24) = 24.44, p < .001. As shown in Figure 1, heart rate was faster during the preparation period than during the resting baseline period, $M_{difference}$ = 5.95, $SE_{difference}$ = 1.20, p < .001. Heart rate was significantly faster during the TSST stressful interview period than the resting baseline period, $M_{difference}$ = 11.44, $SE_{difference}$ = 1.36, p < .001. There was no significant change in heart rate between the post-TSST expressive writing period and the resting baseline period, $M_{difference}$ = .66, $SE_{difference}$ = 1.71, p = .701.

Skin conductance was analyzed via a 6 (task: baseline resting state, interoceptive heart-beat counting task 1, pre-TSST preparation period, TSST stressful interview, post-TSST expressive writing period, interoceptive heart-beat counting task 2) x 3 (group: CRW, EW, Control) GLM. This section will only focus on the results relevant to the study. SCL data showed a significant effect of task on skin conductance, F (5,24) = 14.38, p < .001. Skin conductance was also higher during the preparation period than during the resting baseline period, $M_{difference}$ = 3.56, $SE_{difference}$ = 0.58, p < .001. SCL was also significantly increased during the TSST stressful interview period, $M_{difference}$ = 3.67, $SE_{difference}$ = 0.61, p < .001. Dissimilar to heart rate, skin conductance was significantly higher for the expressive writing period than for the resting baseline period, $M_{difference}$ = 2.41, $SE_{difference}$ = 0.65, p = .001.

Self-report responses were analyzed via a 6 (task: baseline resting state, interoceptive heart-beat counting task 1, pre-TSST preparation period, TSST stressful interview, post- TSST expressive writing period, interoceptive heart-beat counting task 2) x 3 (group: CRW, EW, Control) GLM. Data showed a significant effect of task on self-report measures of alertness, F (2,28) = 12.01, $p < .001$, feelings of being judged, F (2,28) = 5.79, $p = .008$, levels of confusion, F (2,28) = 3.47, $p = .045$, feelings of loneliness, F (2,28) = 8.75, $p = .001$, connectedness to others, F (2,28) = 3.39, $p = .048$, and levels of serene, F (2,28) = 4.71, $p = .017$. Interestingly no significant self-report effect was found for participants' anxiety ratings, F (2,28) = 0.2, $p = .824$, feelings of stress, F (2,28) = 2.1, $p = .141$ or participant's levels of depression, F (2,28) = 1.51, $p = .238$ (see Table 1,2, and 3).

These results indicate that the TSST task was successful in inducing physiological arousal in participants. Consequently, the TSST worked. The task successfully affected participants' levels of physiological arousal.

Hypothesis Testing

Primary Goal: In the stress-inducing task, did participants in the CRW group respond with lower levels of stress/anxiety than participants in the EW and control groups? A 6 (task: baseline resting state, interoceptive heart-beat counting task 1, pre-TSST preparation period, TSST stressful interview, post-TSST expressive writing period, interoceptive heart-beat counting task 2) x 3 (group: CRW, EW, Control) GLM was used to analyze the differences in heart rate, between tasks, across groups. There was no significant main effect of group, F (2,28) = 0.07, $p = .935$. There also was no significant interaction between group and task on heart rate, F (10,50) = 0.92, $p = .521$ (see Figure 1).

A 6 (task: baseline resting state, interoceptive heart-beat counting task 1, pre-TSST preparation period, TSST stressful interview, post- TSST expressive writing period, interoceptive heart-beat counting task 2) x 3 (group: CRW, EW, Control) GLM was used to analyze the differences in skin conductance, between tasks, across groups. Data showed no significant difference between groups, F (2,28) = .14, p = .87. Data showed no significant interaction between group and task on skin conductance, F (10,50) = 1.36, p = .229 (see Figure 2).

Self-report responses were analyzed via a 6 (task: baseline resting state, interoceptive heart-beat counting task 1, pre-TSST preparation period, TSST stressful interview, post- TSST expressive writing period, interoceptive heart-beat counting task 2) x 3 (group: CRW, EW, Control) GLM. Data showed a significant difference between groups on the items with significant differences between tasks. No difference between groups was seen on self-report measures of alertness, F (2,29) = .01, p =.991, feelings of being judged, F (2,29) = 1.58, p = .224, levels of confusion, F (2,29) = 3.14, p = .045, feelings of loneliness, F (2,28) = 8.75, p = .001, connectedness to others, F (2,28) = 3.39, p = .733, and levels of serene, F (2,29) = .47, p = .629.

The target results indicate that there was no significant difference between physiological or self-report responses as a function of group. Therefore, the hypothesis must be rejected.

Discussion

Summary

The purpose of the present study was to ascertain whether repeated cognitive reappraisal expressive writing about daily stressors would influence participants' levels of physiological arousal in stressful situations. This technique could be utilized by students in

situations as benign as class presentations, or by soldiers experiencing events as traumatic as battlefield scenarios.

Contrary to studies conducted by Lepore et al., 2002, and Cochran, 2015, showing evidence for the positive effects of cognitive reappraisal expressive writing on decreasing depression and anxiety symptoms and increasing life satisfaction, in the target study, no main effect was found for manipulation of cognitive reappraisal in writing on these self-report emotion related items, on Day 2, in response to the stressful speech task. This brings into question the validity of the cognitive reappraisal-training task. Although individuals in the CRW group were shown to have utilized cognitive reappraisal with a significantly higher frequency than those in the EW, it is possible that the survey writing training task was not sufficient to inspire subjects to utilize cognitive reappraisal in situations without a clearly stated cognitive reappraisal prompt, as seen in the survey expressive writing tasks for the CRW group. Consequently, it is possible that no main effect was seen because the expressive writing training task was not strong enough, and not because there is no relation between cognitive reappraisal and life satisfaction, depression or anxiety.

The TSST task was successful in inducing high levels of physiological arousal among participants. In contrast to studies conducted by Garnefski et al., 2004, showing a decrease in anxiety among cognitively reappraising participants, no significant difference was found between groups. If the above assumption is correct, and the cognitive reappraisal writing task did not amply train subjects in cognitive reappraisal, it would follow that there would be no change in physiological arousal between groups as a result of the TSST task.

In sum, there was no significant difference in physiological arousal as measured, between groups, by heart rate and skin conductance. There was also no significant difference in self-report responses between groups.

Broader Implications

Had the present study showed a significant effect for cognitive reappraisal expressive writing on physiological arousal, the cognitive reappraisal expressive writing task could be implemented in a myriad of situations. Psychologists could utilize the technique as a supplement to exposure or systematic desensitization therapies. In doing so, cognitive behavioral therapists could help patients with phobias, panic disorder, social anxiety disorder, and generalized anxiety disorder. By decreasing physiological arousal and depression during stressful situations, cognitive reappraisal expressive writing could be used in the military to decrease the likelihood of soldiers developing Acute Stress Disorder or PTSD after experiencing traumatic stress. Cognitive reappraisal expressive writing could help individuals suffering with Major Depressive Disorder or Dysthymia decrease depressive symptoms and increase happiness and life satisfaction.

Cognitive reappraisal expressive writing could also be used to benefit ordinary individuals. Through repeated cognitive reappraisal expressive writing, college students with a fear of tests or presentations could learn how to minimize the physiological arousal or depression symptoms brought on by these tasks. Individuals who find interviews anxiety inducing could be made more relaxed. Even subjects without specific fears or situational-anxieties could benefit from a practice designed to decrease depressive symptoms and increase happiness and life-satisfaction.

Strengths and Limitations

The present study had a number of strengths. Subjects were randomly assigned and systematically tested. Days 1 and 2 of the present study were conducted in a controlled laboratory setting. This allowed researchers to minimize confounding variables. Additionally, the present study made use of physiological measures, in addition to the self-report responses collected. This increased experimental validity because self-report outcomes are subject to demand characteristics. Physiological outcomes are much less susceptible to this kind of experimental problem. The present study also had high internal validity, as indicated by the significant manipulation checks (see above).

The largest limitation of the present study was the low number of participants recruited. Unfortunately, because only thirty-five participants were recruited, the power to detect significant effects was low. Consequently, there is low confidence that the null effects observed in the present study represent true null effects in the population.

The intensity of the cognitive reappraisal-training task may be another limitation of this study. Research has shown a significant effect for cognitive reappraisal on life satisfaction, depression and anxiety symptoms (Garnefski et al., 2004; Dandoy & Goldstein, 1990). Because there was no significant effect on depression and anxiety responses between the CRW and EW groups during the stressful speech task on Day 2 it would follow that the cognitive reappraisal-training task was not sufficient to have trained participants in cognitive reappraisal. This may have been because of the succinctness of the longitudinal experiment. Perhaps, three days was not sufficient to train individuals in cognitive reappraisal using the writing task. It is also possible that, although individuals in the CRW

group employed more cognitive reappraisal in the nightly surveys than participants in the EW group, the writing task utilized in the target experiment was not powerful enough to train CRW participants to engage in cognitive reappraisal without the cognitive reappraisal prompt.

Future Research

Because of the small size of the sample recruited, the results cannot accurately be generalized to the population at large. It is possible that, with a larger sample, the data would indicate significant results for cognitive reappraisal on physiological arousal and self-report depression and anxiety measures. A continuation of the target study would increase the statistical power of the study and, as a result, external validity.

Future studies might also increase the duration of the writing intervention. Although subjects in the CRW group did engage in cognitive reappraisal with a significantly higher frequency in the survey-writing task than individuals in the EW group, there was no significant difference between the two groups in anxiety and depression self-report measures on Day 2. This finding is in partial conflict with the results found in Cochran, 2015. In Cochran, 2015, experimenters implemented the same expressive writing cognitive reappraisal surveys over the three-day period and discovered a significant main effect for cognitive reappraisal writing on self-report depression symptoms. However, the two studies differed in terms of the data analyzed. The Cochran, 2015 experiment analyzed self-report measures collected in the surveys while the present study analyzed data collected in-lab on Day 2. This difference in collection time may have been a cause of this dissimilarity in finding.

This difference in findings could also be a result of a third variable. One such confounding variable may have been the time-of-year the participants were tested. In both studies, participants were collected from Tufts University. In the present study, subjects were primarily recruited during January and February, the beginning of the second semester of the academic year. In the Cochran, 2015 experiment, participants were recruited from October through February. This means that a large portion of participants completed the experiment in November and December, the final two months of the first semester of the academic year. Subjects likely experienced greater levels of depression in the final two months of the first semester, with midterm and final exams, than participants in the first two months of the second semester. This could explain the difference in self-report depression findings.

Conclusion

In closing, the present experiment did not show a significant effect of cognitive reappraisal writing on stress and physiological arousal in interview situations. The study did, however, have high construct validity. Individuals in the CRW group did employ cognitive reappraisal with a significantly higher frequency than individuals in the EW group on the survey-writing task. Additionally, the TSST task did elevate participants' levels of arousal–as predicted. Continuations of the present study might increase the number of participants recruited, change the cognitive reappraisal-training task, or elongate the time between lab sessions to make room for more opportunities to engage in cognitive reappraisal expressive writing.

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Table 1

Triplet self report responses for the control group

	Control					
	After Resting Baseline		After TSST		After Writing	
TRIPLETS	*M*	*SE*	*M*	*SE*	*M*	*SE*
Active / alert/ keyed up	3.50	0.51	4.50	0.48	3.40	0.46
Judged / scrutinized / evaluated	3.10	0.41	3.90	0.60	3.00	0.56
Anxious / worried / fearful	2.70	0.50	3.10	0.45	3.00	0.44
Embarrassed / humiliated / ashamed	1.70	0.23	2.40	0.35	1.80	0.34
Stressed / stretched thin / overloaded	3.40	0.57	3.60	0.34	2.90	0.49
Rejected / put down / hurt	1.40	0.43	1.70	0.38	1.30	0.35
Confused / indecisive / doubting	2.60	0.49	2.30	0.37	2.00	0.40
Lonely / distant / isolated	2.40	0.56	1.70	0.36	1.90	0.42
Sad / depressed / down	1.70	0.53	1.60	0.37	1.50	0.44
Angry / irritated / provoked	1.60	0.27	1.70	0.24	1.40	0.26
Hating / loathing / resisting	1.10	0.15	1.50	0.22	1.30	0.21
Jubilant / giddy / ecstatic	2,2	0.42	2.00	0.47	2.00	0.53
Affectionate / loving / connected to others	3.40	0.61	3.00	0.60	2.80	0.59
Desiring / wanting / eager	2.60	0.47	2.90	0.50	2.80	0.53
Peaceful / serene / tranquil	4.20	0.52	2.70	0.46	3.10	0.52
Happy / pleased / contented	3.70	0.50	3.10	0.42	3.20	0.59
Self-confident / capable / worthwhile	4.30	0.57	4.10	0.46	3.80	0.57

Table 2

Triplet self report responses for the EW group

	EW					
	After Resting Baseline		After TSST		After Writing	
TRIPLETS	*M*	*SE*	*M*	*SE*	*M*	*SE*
Active / alert/ keyed up	2.91	0.49	4.55	0.45	3.73	0.44
Judged / scrutinized / evaluated	2.00	0.40	2.55	0.57	2.18	0.53
Anxious / worried / fearful	3.00	0.47	3.00	0.43	2.64	0.42
Embarrassed / humiliated / ashamed	0.13	0.22	1.36	0.34	1.36	0.33
Stressed / stretched thin / overloaded	3.82	0.54	3.46	0.38	3.46	0.46
Rejected / put down / hurt	1.64	0.41	1.46	0.36	1.55	0.33
Confused / indecisive / doubting	2.27	0.47	1.64	0.35	1.82	0.38
Lonely / distant / isolated	2.36	0.53	1.73	0.34	1.91	0.40
Sad / depressed / down	2.27	0.50	191.00	0.35	2.00	0.42
Angry / irritated / provoked	1.18	0.25	1.09	0.23	1.09	0.25
Hating / loathing / resisting	1.09	0.14	1.09	0.21	1.00	0.20
Jubilant / giddy / ecstatic	2.55	0.40	2.64	0.45	2.73	0.50
Affectionate / loving / connected to others	3.27	0.58	3.00	0.57	3.09	0.57
Desiring / wanting / eager	2.82	0.45	2.09	0.48	2.46	0.50
Peaceful / serene / tranquil	4.18	0.50	3.64	0.44	3.91	0.49
Happy / pleased / contented	3.55	0.47	3.82	0.40	3.73	0.56
Self-confident / capable / worthwhile	3.64	0.54	4.37	0.44	3.82	0.55

Table 3

Triplet self-report responses for the CRW group

	CRW					
	After Resting Baseline		After TSST		After Writing	
TRIPLETS	*M*	*SE*	*M*	*SE*	*M*	*SE*
Active / alert/ keyed up	3.00	0.49	4.64	0.45	3.64	0.44
Judged / scrutinized / evaluated	2.09	0.40	3.27	0.57	3.18	0.53
Anxious / worried / fearful	2.91	0.47	2.27	0.43	2.46	0.42
Embarrassed / humiliated / ashamed	1.36	0.22	1.91	0.34	2.00	0.33
Stressed / stretched thin / overloaded	3.00	0.54	2.82	0.38	2.91	0.46
Rejected / put down / hurt	1.64	0.41	1.27	0.36	1.46	0.33
Confused / indecisive / doubting	2.46	0.47	1.64	0.35	2.09	0.38
Lonely / distant / isolated	2.64	0.53	1.36	0.34	2.18	0.40
Sad / depressed / down	2.18	0.50	1.64	0.35	1.73	0.42
Angry / irritated / provoked	1.64	0.25	1.27	0.23	1.55	0.25
Hating / loathing / resisting	1.55	0.14	1.36	0.21	1.27	0.20
Jubilant / giddy / ecstatic	2.27	0.40	2.00	0.45	1.91	0.50
Affectionate / loving / connected to others	3.27	0.58	2.64	0.57	3.18	0.57
Desiring / wanting / eager	2.27	0.45	1.91	0.48	2.55	0.50
Peaceful / serene / tranquil	3.82	0.50	3.18	0.44	3.82	0.49
Happy / pleased / contented	3.73	0.47	3.55	0.40	3.82	0.56
Self-confident / capable / worthwhile	3.91	0.54	3.64	0.44	4.00	0.55

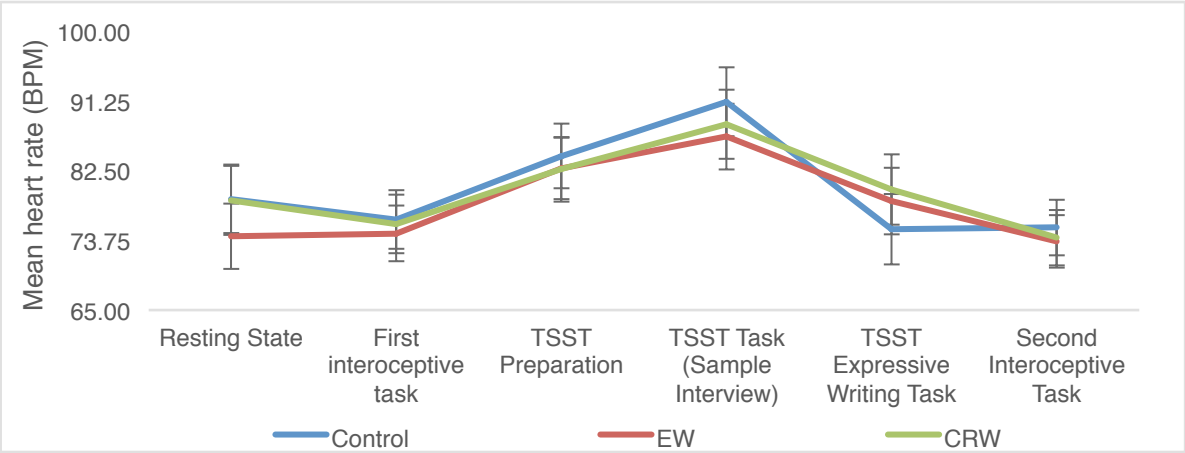

Figure 1. The graph above shows that participants' heart rates significant differed depending on the experimental task they were completing. Heart rate was highest, across groups, during the TSST sample interview task. There was however, no significant difference in heart rate values across groups. The error bars extend one standard error above and below the heart rate values

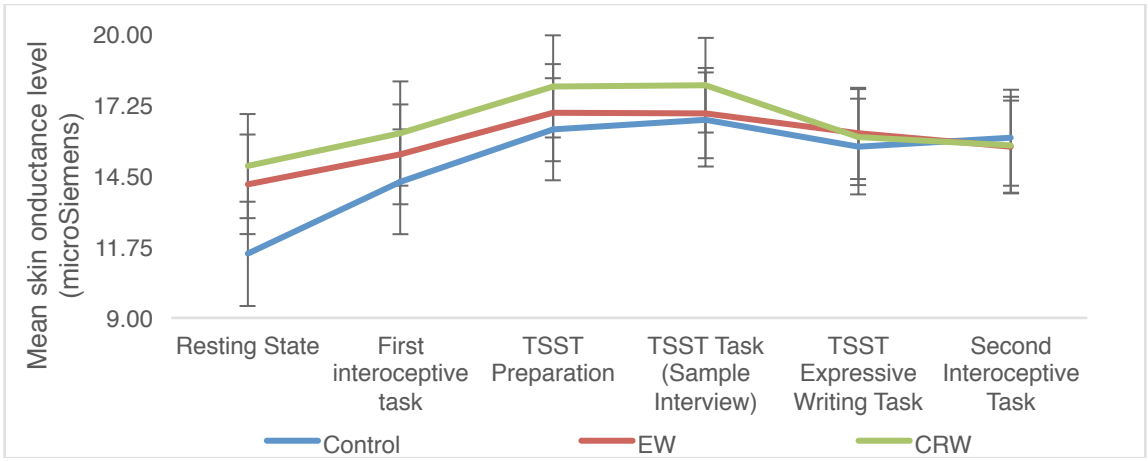

Figure 2. This graph above shows that participants skin conductance levels significantly differed depending on the experimental task they were completing. Skin conductance was highest during the TSST preparation and TSST sample interview tasks. The graph shows no significant main effect for group on skin conductance levels. The error bars extend one standard error above and below the skin conductance values.