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USING TRAIT ANXIETY LEVEL TO PREDICT EMOTION REGULATION DURING AN ANXIETY-INDUCING SPEECH TASK

A Thesis in

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ABSTRACT

Despite the recent increase in emotion regulation research, the way that emotion regulation functions in relation to specific emotions remains relatively unelaborated. The present study focuses on how trait anxiety levels influence choice of emotion regulation strategies and how these variables interact to impact physiological responses to anxiety. Given previous findings linking high anxiety with general tendencies to avoid processing emotions, suppress the behavioral response, and uncontrollably vent emotions, we expected to find that individuals with high trait anxiety would use these strategies more than reappraisal to handle in-the-moment anxiety. To test these hypotheses, we recruited 101 participants to complete a laboratory procedure that utilized a speech task to induce anxiety. After anxiety induction but before giving the speech, participants completed the Emotion Regulation Task (ERT), which instructs individuals to choose a topic to write about to deal with their anxiety. Each topic represents one of four emotion regulation strategies: suppression, reappraisal, avoidance, and venting. Throughout the procedure, physiological indicators of sympathetic arousal were collected. Data analyses indicated that most participants chose avoidance regardless of trait anxiety level, but that high trait anxiety significantly predicted choice of suppression over avoidance. In addition, a non-significant trend emerged suggesting that choice of emotion regulation strategy may moderate the relationship between trait anxiety level and physiological arousal. These findings demonstrate that individual differences, such as trait anxiety level, impact the types of emotion regulation strategies that people use, and further influence changes in sympathetic arousal in an anxiety-provoking situation.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

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Chapter 1

INTRODUCTION

The past decade has witnessed an explosion in the study of emotion regulation as researchers continue to develop an appreciation of how modulating the experience of positive and negative emotions can impact various domains of functioning. In particular, theories of emotion regulation have been applied to understanding such processes as executive functioning, cognitive performance, stress management, social functioning, and mental health outcomes (Thompson, 1994). While the majority of previous research efforts have focused on how the use of specific emotion regulation strategies affects emotional and other outcomes, relatively little research has considered how the experience of certain emotions can affect the use of emotion regulation strategies. The current study seeks to further our understanding of emotion regulation by examining how trait anxiety influences choice of emotion regulation strategy and subsequent physiological and affective responses during an anxiety-inducing speech task.

Emotion Regulation

Several definitions of emotion regulation have been advanced in the literature, with each focusing on or including different aspects of the emotional process. For example, Gross (1998) describes emotion regulation as the process by which an individual influences the emotions they experience, their intensity and timing, and the subjective experience and expression of emotion. Alternatively, some theorists have conceptualized the process as the attempt to control one's emotional experience and expression, especially for negative emotions, leading to a reduction of emotional arousal (Zeman & Garber, 1996; Kopp, 1989). Although these definitions imply an effortful and conscious process, recent research suggests that emotion regulation may also be automatic and subconscious (Mauss, Bunge, & Gross, 2007).

While many definitions of emotion regulation focus on the down-regulation of negative emotions, some have highlighted the importance of considering the function of the emotion being regulated to determine what successful regulation entails. From a functional perspective, emotions inform the individual about positive or negative environmental events (Frijda, 1986; Izard, 1971) and can also provide information regarding one's internal state (Russell, 2003). Thus, regulating emotions by decreasing subjective experience or physiological arousal could lead to negative consequences if valuable information about the environment is lost in the process. For example, failure to engage in emotional processing, which has been linked to high anxiety, could preclude the individual from accurately interpreting internal and external cues, leading to more distress and less adaptive functioning over time (Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006). Adaptive emotion regulation may therefore involve monitoring and evaluating the experience and expression of emotion such that, if the situation calls for it, the emotion could be modified in some way (Thompson & Calkins, 1996; Cole, Michel, & Teti, 1994). Disruption in the normal process of regulating emotions may involve deficits in accessing a full range of emotions, modifying the intensity and duration of an emotional response, shifting smoothly between emotions, displaying situationally appropriate emotions, and appropriately expressing emotions.

A well-studied theory of emotion regulation is Gross' process model, which considers how emotion regulation strategies fit into the overall timeline of the emotional experience from perception of the stimulus to the ultimate response (John & Gross, 2004; Gross, 1998). According to the process model, emotion regulation can occur at any step in this timeline, such as by changing the situation (e.g., choosing whether to enter a potentially emotion-eliciting situation), the cognitive appraisal of the stimulus, or the expression of the resulting emotion.

Although Gross's theory allows for an almost infinite number of emotion regulation strategies, he has focused on two strategies in particular: expressive suppression and cognitive reappraisal. Suppression involves hiding one's behavioral response to an emotion, while reappraisal involves changing the way that one thinks about the situation in order to change the resulting emotion. Two additional emotion regulation strategies that have emerged in the literature as relevant to the study of anxiety are avoidance and venting. Below we review empirical findings pertaining to these four emotion regulation strategies.

Research on Specific Emotion Regulation Strategies

The majority of the studies on specific emotion regulation strategies have explored the implications of employing reappraisal and suppression in daily life, such as in social interactions (Butler et al., 2003), ability to recall details of an event (Richards & Gross, 2000), and anger management (Mauss, Cook, Cheng, & Gross, 2007). These studies have shown that suppression leads to less "effective" regulation of emotions, or decreased behavioral expression but increased physiological arousal and self-reported negative affect, while reappraisal leads to more "effective" regulation, including decreased self-reported negative affect and insignificant change in physiological arousal and behavioral expression (Egloff, Schmukle, Burns, & Schwerdtfeger, 2006; Hagemann, Levenson, & Gross, 2006; John & Gross, 2004; Gross, 2002; Gross, 1998). In addition, suppression leads to decreases in the subjective experience of positive affect when regulating positive emotions.

While suppression and reappraisal are relatively well-studied, avoidance and venting have received less attention as emotion regulation strategies. Avoidance has been studied in the coping literature in terms of an emotion-focused coping strategy. It has been defined as the process of not thinking about an emotion-eliciting event, and in the past has been conceptualized as distraction, worry, or denial (e.g., Borkovec, Alcaine, & Behar, 2004; Carver, Scheier, &

Weintraub, 1989). Carver and colleagues (1989) found that denial was positively correlated with trait anxiety and negatively correlated with optimism and self-esteem. In the emotion regulation literature, avoidance has appeared primarily in relation to handling anxiety among clinically anxious populations (e.g., Stewart, Zvolensky, & Eifert, 2002; Hayes, Wilson, Gifford, Follette, & Strosahl, 1996). In either case, avoidance has generally been associated with negative outcomes.

Venting has also appeared as an emotion-focused coping strategy in the coping literature (Carver et al., 1989). We have conceptualized venting as the process of expressing one's subjective emotional experience with the goal of modifying the response by "getting it all out". Related research has frequently demonstrated that venting is an ineffective emotion regulation strategy (see Tice & Bratslavsky, 2000 for a review). Because venting involves focusing on negative emotions and the cause of distress and sustains the physiological response through emotional expression, venting may perpetuate negative affect instead of decrease or regulate it. However, expressing emotions is widely valued in American culture (Matsumoto, 1990). Therefore, it is not clear whether there are circumstances in which venting aids in emotion regulation, or whether it tends to be a less effective strategy overall.

Emotion Regulation and Anxiety

Given the prevalence of uncontrollable anxiety in many psychological disorders and the relative lack of research on how emotion regulation functions in anxiety, it is important to extend our understanding of reappraisal, suppression, avoidance and venting into this clinically-relevant area. Many anxiety disorders have been associated with underlying efforts to avoid internal experiences, including thoughts and emotions (Stewart et al., 2002; Hayes et al., 1996). In general among clinical populations, anxious individuals display a tendency to experience high negative affect in response to any emotion, suggesting greater emotion regulation difficulties

(Hayes, Strosahl, & Wilson, 1999; Cole et al., 1994). Recently, researchers have begun to explore how individuals suffering from various anxiety disorders use emotion regulation strategies to handle negative emotions. For instance, there is some evidence showing that women with post-traumatic stress disorder (PTSD) display higher rates of alexithymia, or an inability to describe emotions and distinguish between indicators of emotional arousal (Cloitre, Scarvalone, & Difede, 1997). In addition, individuals with panic disorder tend to "smother" or "bottle up" their emotions, have greater awareness of internal states, and show deficits in labeling their emotions (Baker, Holloway, Thomas, Thomas, & Owens, 2004). Finally, the role of emotion regulation deficits in generalized anxiety disorder (GAD) has received increasing attention due to Borkovec's theory that uncontrollable and excessive worry – the hallmark feature of GAD – functions as a way for these individuals to avoid processing emotional material (Borkovec, Alcaine, & Behar, 2004). Further examination of the emotion regulation strategies used to deal with anxiety will be important for refining existing conceptualizations and treatment of these disorders.

In studies relating the use of specific emotion regulation strategies with clinical phenomena, suppression has been associated with greater anxiety, depressive symptoms, and rumination, while reappraisal has been negatively correlated with depressive symptoms, rumination, anxiety, and trait neuroticism (Garnefski & Kraaij, 2007; Gross & John, 2003; Roemer & Borkovec, 1994). In addition, Campbell-Sills, Barlow, Brown, and Hofmann (2006a; 2006b) found that, in response to anxiety-eliciting films, those with affective disorders reported using suppression more frequently than healthy participants. Although these results clearly demonstrate the deleterious effects of habitual suppression, it is not clear whether dealing with conditions such as anxiety disorders leads to greater use of suppression, or whether the use of suppression leads to this greater negative affectivity and the subsequent mental health outcomes

(Amstadter, 2008). In either case, the prevailing evidence suggests that increased suppression is consistently linked to greater anxiety.

Recent studies have found that the general tendency to avoid ambiguous situations may also be related to trait anxiety. For example, a study by Dennis (2007) demonstrates that high scores on Carver and White's (1994) Behavioral Inhibition System (BIS), which indicates a tendency to withdraw from potentially rewarding or punishing situations (as opposed to approaching uncertain stimuli and risking negative outcomes) were related to high levels of trait anxiety. These and other similar findings (e.g., Kring & Bachorowski, 1999) suggest that habitual avoidance of emotional situations might also be related to greater trait anxiety.

Use of avoidance as an emotion regulation strategy has received particular attention among individuals with GAD. Salters-Pedneault and her colleagues (2006) demonstrated that analogue GAD and high worrier populations scored high on a measure of general emotion dysregulation and displayed deficits in identifying, accepting, and regulating their emotions. In addition, many studies have supported Borkovec's theory of emotional functioning in GAD by showing that worry interferes with components of the emotional experience such that worry is negatively reinforced by diminished subjective distress and physiological arousal (Borkovec et al., 2004; Borkovec & Roemer, 1995). Specifically, it appears that worrying interferes with processing a subsequent stimulus, particularly when the stimulus is negatively-valenced. Worriers demonstrated an insignificant change in sympathetic arousal between a worry induction (i.e., where participants are asked to worry for a specified amount of time prior) and the introduction of a negative stimulus (e.g., phobic images; Borkovec & Hu, 1990; Borkovec, Lyonfields, Wiser, & Deihl, 1993). Furthermore, worriers experienced decreased heart rate variability (HRV) in response to negative stimuli. Decreased HRV, an indicator of decreased parasympathetic activity, has been linked with less autonomic flexibility (e.g., Hofmann et al.,

2005), suggesting that worry interferes with an individual's ability to process an emotion-eliciting stimulus.

In the literature, venting has been considered as both an adaptive and maladaptive way to handle emotions. In a recent study establishing a new measure of in-the-moment emotion regulation, Soto and colleagues (2010a) found that participants who chose to vent in order to regulate their anxiety scored high on a measure of trait anxiety. Furthermore, Carver and colleagues (1989) found that individuals who endorsed habitually using venting as an emotion-focused coping strategy also scored high on a measure of trait anxiety. Nevertheless, venting predicts good prognosis in psychotherapy, as found by Pennebaker (1997). Venting may typically be used by individuals who have a low tolerance for distress or minimal acceptance of emotions and who therefore either attempt to "get their anxiety out" or are unable to effectively regulate their anxiety internally. This description evokes the often-caricatured, highly neurotic individual whose excessive worry results in uncontrollable expression of their anxiety. Given the findings demonstrating that anxious individuals often regulate their emotions by denying aspects of the emotional experience (i.e., via suppression or avoidance), it is possible that highly anxious individuals may also respond with distress and uncontrollable expression (i.e., via venting) as an alternative strategy for regulating their emotions.

Cognitive reappraisal, as defined by Gross and his colleagues (e.g., 2004, 1998), requires considering one's subjective experience of an emotion and other potential ways to appraise the emotion-eliciting stimulus. Similar to venting, the subject does not deny or inhibit a part of the emotional experience; however, its association with more adaptive outcomes suggests that reappraisal may involve a more productive level of processing instead of serving to maintain an unhelpful focus on the negative affect.

Measurement Issues

In order to be able to effectively study emotions and emotion regulation, two key methodological concerns need to be addressed: accurate measurement of the emotional response, both before and after regulation, and the assessment of specific emotion regulation strategies as they unfold. Many of the studies discussed above rely primarily on self-reported state emotion or emotion regulation tendencies in order to determine the relationship between high anxiety and emotion regulation. However, Nisbett and Wilson (1977) suggest that people often do not provide reliable information on the highly introspective and elusive concepts studied in psychology. Instead, their reports rely on factors such as social norms or general theories about how humans behave. In addition, many studies utilize retrospective reports of emotion regulation (e.g., Cambell-Sills et al., 2006a and b) instead of assessing for this phenomenon as it occurs in the moment. To provide an additional, objective measure of emotional responding, psychophysiological recording was used in the present study. Furthermore, we employed a new method of measuring emotion regulation that is both more implicit than traditional self-report and measures regulation of anxiety in the moment instead of retrospectively.

Psychophysiological measures of emotion. Many studies have demonstrated that emotion regulation strategies can differentially affect physiological responding (see Gross, 2002 for a review). Activity in the autonomic nervous system (ANS) is particularly expressive of our more private, internal experience of emotion (Levenson, 2003). Emotion regulation can affect physiological responding by interrupting the flow between the event and the response tendency or between the response tendency and the actual response (Gross, 2002). Suppression has been shown to lead to higher sympathetic activation (e.g., greater skin conductance, activation of the cardiovascular system, and respiratory activity) when used to regulate sadness and amusement (Gross & Levenson, 1997), anxiety (Egloff et al., 2006), and other positive and negative

emotions. However, use of reappraisal has been shown to have little to no effect on sympathetic activation in anxiety (Egloff et al., 2006), or has demonstrated a generally more adaptive pattern of cardiovascular functioning, such as in response to anger provocation (Mauss, Cook et al., 2007).

Additionally, Borkovec and Hu (1990) have shown that use of avoidance in phobic populations actually decreases sympathetic activation, which may be reinforcing to the individual. Although there has been little research focusing on the physiological correlates of venting per se, studies have demonstrated support for an increase in autonomic activity, both sympathetic and parasympathetic, when people cry and express sadness (Gross, Fredrickson, & Levenson, 1994). In addition, when participants have been asked to amplify their behavioral expression of emotions, an increase in autonomic activity, particularly sympathetic, has been found (Kunzmann, Kupperbusch, & Levenson, 2005). Due to these findings, the current study utilized physiological indicators of sympathetic arousal to further explicate the process of regulating emotions using the four strategies outlined above.

Emotion Regulation Task. Self-report measures are currently the principal method utilized to assess for emotion regulation. An example is the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), which measures habitual use of expressive suppression and cognitive reappraisal. Although these measures may help in adding to our understanding of emotion regulation, their use relies on accurate self-reporting, which may be difficult for the internal processes involved in emotion regulation (Soto et al., 2010b; Nisbett & Wilson, 1977). This uncertainty about exactly what self-report measures of emotion regulation tap into suggests the need for alternative, less explicit measures of this process. To address these concerns, the current study utilized the Emotion Regulation Task (ERT), a behavioral, implicit measure of in-the-moment emotion regulation recently developed by Soto and colleagues (2010b). In addition,

other measures address emotions more generally or distinguish only between positive and negative emotions. The ERT focuses specifically on the regulation of anxiety, which may differ from how individuals handle other emotions.

The Present Study

It is clear that emotion regulation is an important aspect of an individual's daily functioning, and that deficits in the ability to appropriately regulate one's emotions can create significant dysfunction. In particular, emotion dysregulation has been linked to high anxiety, whether high trait anxiety or specific anxiety disorders. However, the majority of related research has used correlational analyses to demonstrate that people with high anxiety either use strategies such as expressive suppression (e.g., Decker, Turk, Hess, & Murray, 2008; Dennis, 2007), or that this population tends to feel overwhelmed by their emotions and demonstrates limited access to effective emotion regulation strategies (e.g., Salters-Pedneault et al., 2006). The current study serves to extend these results by utilizing a quasi-experimental design to understand how trait anxiety levels predict choice of emotion regulation strategy in an anxiety-provoking situation. Anxiety induction was modeled after a task used by Egloff and his colleagues (2006) where participants give a spontaneous, evaluated speech. In particular, we focused on replicating findings regarding the relationship between anxiety and the emotion regulation strategies of suppression and reappraisal, while also exploring the usage of two additional emotion regulation strategies: avoidance and venting.

Hypotheses

Anxiety level will predict use of specific emotion regulation strategies. We expect that higher levels of trait anxiety will predict more frequent use of avoidance and suppression, in accordance with findings linking high anxiety with less acceptability and more avoidance of the emotional experience (e.g., Salters-Pedneault et al., 2006). Similarly, higher levels of trait

anxiety will predict more frequent choice of venting, consistent with the conceptualization of this process as uncontrolled and unproductive emotional expression (Soto et al., 2010a; Carver et al., 1989). Conversely, we expect that lower levels of trait anxiety will predict more frequent use of reappraisal (John & Gross, 2004).

Trait anxiety, emotion regulation strategies, and physiology. We expect to replicate previous effects regarding emotion regulation and physiological arousal. Specifically, we predict that use of suppression to regulate anxiety will result in increased sympathetic arousal after completing the ERT, while use of reappraisal be associated with a non-significant change in sympathetic arousal, regardless of trait anxiety level. Given prior research on crying and amplification of emotional responses, we predict that those who vent as a means of regulating their emotions will demonstrate an increase in sympathetic arousal. Of primary interest is the expectation that choice of emotion regulation topic will moderate the relationship between trait anxiety level and sympathetic activity after completing the ERT. Due to the finding that individuals with GAD demonstrate lower sympathetic arousal when worrying, anxious participants who use the emotion regulation strategy of avoidance will exhibit lower sympathetic arousal, as indicated by a decrease in cardiovascular activation. However, past research with suppression, reappraisal, and venting does not indicate that these strategies will interact with trait anxiety level.

Chapter 2

METHOD

Participants

Participants were 101 undergraduate students at a large American university. The sample was primarily European American (73.3%, 8.9% African American, 7.9% Asian American, 5.0% Latino American, 4.0% Multiethnic, and 1 participant who did not indicate ethnic background). The mean age was 19.20 (*SD* = 1.26) and both genders were represented (56.4% female, 42.6% male). Participants were recruited from the psychology student subject pool and were compensated with course credit. Due to our desire to recruit a sample with varying levels of trait anxiety, 38 of the 101 participants were recruited via e-mail invitation based on their responses on a pre-screening measure that assessed for level of trait anxiety.

Measures

Anxiety level. The Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995) is a 42-item self-report measure of the symptoms of depression (i.e., anhedonia and negative mood), high trait anxiety (i.e., muscle tension and situational anxiety), and stress (i.e., non-specific arousal such as irritability and nervousness). Items are rated on a Likert-type scale from zero (Did not apply to me at all) to three (Applied to me very much, or most of the time) and refer to how the individual has felt "over the past week". In this sample, the scales demonstrated excellent internal consistency as measured by Cronbach's alpha (.92 for depression, .85 for anxiety, .91 for stress). Scores on the anxiety subscale can range from 0 (low anxiety) to 42 (high anxiety). Although cut-off scores to indicate clinically-significant symptoms have not been determined for the DASS, mean scores in clinical samples with affective disorders typically range from about 5 to 15 on the anxiety subscale (Brown, Chorpita,

Korotitsch, & Barlow, 1997). In the current population, the mean anxiety score was 7.26 (*SD* = 5.78).

Emotion ratings. In order to capture momentary changes in subjective emotional experience, participants provided ratings of thirteen emotions on a Likert-type scale ranging from zero (Not at all) to eight (Very much) at several points throughout the experiment. The emotions included amusement, anger, anxiety, contempt, contentment, disgust, embarrassment, fear, happiness, interest, relief, sadness, and surprise. This rating scale has been utilized in other studies that assess for state emotion and has proven to be useful in sampling a wide variety of emotions experienced in the moment (e.g., Soto, Levenson, & Ebling, 2005).

Momentary use of emotion regulation. The Emotion Regulation Task (ERT; Soto et al., 2010b) was employed to determine which of four emotion regulation strategies (suppression, reappraisal, avoidance, venting) participants used to deal with their anxiety in response to an anxiety-inducing speech task. As part of the task, participants were informed that they had some time to themselves before giving a speech, during which they could write about one of four writing topics in order to help them deal with their emotions. The writing topics were intended to implicitly engage participants in one of four specific emotion regulation strategies: "Write out a list of everything else that you need to get done this week" [Avoidance]; "Write about all of the positive aspects of giving this speech, including what you may learn and how you may grow through the experience" [Reappraisal]; "Write about how you are feeling anxious, but with a smile on your face so that the audience doesn't know how the situation is affecting you" [Suppression]; "Write about your emotions as if in a journal so that they are on a piece of paper and not stuck in your head" [Venting]. The suppression topic used here was from a previous version of the ERT, but was shown to be associated with other measures of suppression (i.e., the Anxiety Regulation Questionnaire, Soto et al., 2010a). After an emotion induction, participants

chose the topic that they wanted to write about and then wrote about it on a piece of paper for two minutes.

Apparatus

Audiovisual. A 36-inch computer monitor presented stimuli to the participants using the ePrime© software program. Participants were videotaped using a remotely controlled video camera.

Physiology. A Biopac© MP150 device consisting of an eight-channel polygraph and a microcomputer was used to collect data on physiological functioning. (1) *Electrocardiography (ECG)*, was measured through three MindWare© pre-gelled, self-adhering, disposable electrodes placed on the right clavicle at the midclavicular line, just above the last bone of the ribcage at the left midaxillary line, and just below the last bone of the ribcage at the right midaxillary line. (2) *Cardiac impedance* was measured by four of the same MindWare© electrodes placed at the base of the back of the neck over the fourth cervical vertebra, on the back over the ninth thoracic vertebra, at the front of the neck on the end of the left clavicle, and over the base of the sternum at about the fourth rib.

AcqKnowledge© software was used to collect and compute second-by-second averages for each of the above-described physiological processes. The resulting data were analyzed using MindwareIMP 2.51© software (MindWare Technologies Ltd., 2001). Impedance cardiography is considered to be a strong indicator of sympathetic activity in the autonomic nervous system (Berntson, Cacioppo, & Quigley, 1994). Stroke volume (SV) is the volume of blood ejected by the left ventricle of the heart in one beat, which is derived from subtracting the afterload from the preload or the volume of blood in the heart after ejection through the aorta from before ejection (Brownley, Hurwitz, & Schneiderman, 2000). Left ventricular ejection time (LVET) is a measure of myocardial contractility and corresponds to the time between the opening and closing

of the aortic valve (mechanical systole). Pre-ejection period (PEP) is an indicator of sympathetic myocardial drive and indicates the interval between onset of the EKG Q-wave and onset of the LVET. These measures, derived from cardiac impedance, represent the functioning of the sympathetic nervous system. LVET and SV typically increase in value as sympathetic activity increases, while PEP decreases. For PEP, SV, and LVET, measurement at the time of reading the speech instructions (i.e., 2 minutes of reading the speech instructions and rating emotions on the keyboard) was subtracted from levels while completing the ERT (i.e., 2 minutes of writing about an emotion regulation topic) for data analysis. This method was intended to take into consideration individual differences in sympathetic activity and to provide a point of comparison for physiological changes for each participant. Because this study purports to understand the effects of emotion regulation after an anxiety-induction, we chose to compare these time periods. Interbeat intervals were edited for artifacts using the MindWare© algorithm and were subsequently verified by visual inspection.

Procedure

After providing written informed consent, participants sat approximately three feet in front of the computer monitor and completed self-report scales, a basic demographic information questionnaire (e.g., age, ethnic background, GPA), and the emotion ratings on the computer. Once finished, a research assistant entered the room and attached the physiological sensors to the participant, while explaining to the participant the purpose of each set of sensors. The research assistant then asked the participant to sit as still as possible, reminded the participant that he/she would be videotaped throughout the remainder of the session, and stated that communication with the research assistant was possible through microphones located in the room.

For two minutes each, participants sat still watching a cross on the computer screen, hand-copied from a passage that detailed a neutral weather report, and read aloud the same

passage to establish physiological baseline. The computer then displayed directions about the evaluated speech task coming up during which the participants were told they would give a three-minute speech recorded on camera. The directions stated that the principle investigator and research assistant would rate the speech on content, style, and overall persuasiveness, and would provide the participants with feedback on their effectiveness. However, the participants would not be told the topic of the speech until just before starting. At this time, participants rated their emotions using the emotion rating questionnaire.

Before beginning the speech, the directions explained that the participants had some time to write about a topic that would help them deal with their anxiety. Participants read the four ERT options and chose which topic they would like to write about. After choosing a topic, participants wrote about it using a pen and a piece of paper for two minutes. Then, participants rated their current emotions again and sat watching a cross on the screen for two minutes to record physiology.

At this point, participants received the topic of their speech ("Should the death penalty be a legal form of punishment for severe crimes?") and started speaking. While speaking, a countdown appeared on the computer monitor so that participants knew how much time remained of their three minutes. When finished, participants provided a final rating of their emotions. The research assistant then re-entered the room, removed all electrode sensors, and fully debriefed the participants about the nature of the study.

Chapter 3

RESULTS

Preliminary Analyses

Correlations between all variables used in the analyses are presented in Table 1. Before completing the primary analyses, we wanted to conduct a manipulation check of the anxiety induction task. We compared self-reported ratings of anxiety before and after the speech instructions were presented. A *t*-test comparison indicated that participants were significantly more anxious after the anxiety induction ($M = 4.08$, $SD = 2.40$) than at baseline ($M = 3.18$, $SD = 2.16$; $t(100) = -3.98$, $p < .01$). Thus, the speech task appeared to be an effective anxiety induction task.

Trait Anxiety Level and Choice of Emotion Regulation Strategy

The breakdown for choice of writing topics across the sample was as follows: 67.3% chose avoidance, 15.8% chose reappraisal, 12.9% chose venting, and 4.0% chose suppression. Our first hypothesis that trait anxiety level would predict choice of emotion regulation strategy was tested using a multinomial logistic regression. Results showed that trait anxiety level (DASS-A) significantly predicted choice of emotion regulation strategy ($\chi^2 = 9.59$, $df = 3$, $p < .05$). The full results are presented in Table 2, with the avoidance topic as the reference group because it was most frequently chosen (Hosmer & Lemeshow, 2000). Of particular interest are the beta weights associated with DASS-A scores in predicting a particular writing topic and the corresponding odds ratio [Exp(B)]. Trait anxiety level significantly predicted choice of suppression over avoidance, and the odds ratio associated with choosing suppression increased by a factor of 1.22 with each unit increase in DASS-A. Despite the significant fit of the overall model, trait anxiety

did not significantly predict the choice of the reappraisal or venting topics over avoidance. However, they both displayed trends toward increased trait anxiety level predicting choice of

Table 1

Correlations between Variables Used in Analyses

Measure	*1*	*2*	*3*	*4*
1. DASS-A	-			
2. LVET	-.07	-		
3. SV	.06	.44**	-	
4. PEP	-.02	.01	.06	-
5. ERT-S	.25*	.39**	.41**	-.09
6. ERT-R	.10	-.05	.02	-.09
7. ERT-A	-.27**	-.00	.00	.07
8. ERT-V	.13	-.19	-.29**	.06

* $p < .05$. ** $p < .01$. DASS-A = Depression Anxiety Stress Scales-Anxiety subscale; LVET = Left Ventricular Ejection Time; SV = Stroke Volume; PEP = Pre-Ejection Period; ERT-S = Emotion Regulation Task-Suppression topic; ERT-R = Emotion Regulation Task-Reappraisal topic; ERT-A = Emotion Regulation Task-Avoidance topic; ERT-V = Emotion Regulation Task-Venting topic.

Table 2

Multinomial Logistic Regression predicting ERT Choice from Trait Anxiety Level

	ERT choice compared to Avoidance					
	Suppression		Reappraisal		Venting	
Predictor	Wald χ^2	Exp(B)	Wald χ^2	Exp(B)	Wald χ^2	Exp(B)
Intercept	17.91**		17.83**		19.87**	
DASS-A	6.64**	1.22	2.63	1.08	3.48†	1.10

† < .06. * $p < .05$. ** $p < .01$. DASS-A = Depression Anxiety Stress Scales-Anxiety subscale.

these topics more than avoidance. The mean DASS-A scores of each ERT group were 14.25 (*SD* = 8.77) for suppression, 8.56 (*SD* = 4.34) for reappraisal, 6.16 (*SD* = 5.51) for avoidance, and 9.23 (*SD* = 6.04) for venting.

Trait Anxiety Level, Choice of Emotion Regulation Strategy, and Physiology

In order to test our second hypothesis, we computed change scores of sympathetic arousal from the period of speech instruction to the ERT for each physiological measure in order to compare changes within the individual (Manuck, Kasprowicz, Monroe, Larkin, & Kaplan, 1989). We then completed hierarchical regressions with indicators of sympathetic arousal as dependent variables (LVET, SV, and PEP). For each hierarchical regression, we entered DASS-A score in step one, choice of ERT topic in step two, and the interaction between DASS-A and topic choice in step three. DASS-A scores were centered around the mean for all analyses, and interaction terms were calculated by multiplying this score by the dummy coded ERT choices (dummy coded as 0 or 1 indicating non-choice or choice of the topics with avoidance as the reference category).

Step 1, representing the main effect of DASS-A on sympathetic arousal, was non-significant. However, step 2 demonstrated a significant main effect of ERT choice on sympathetic arousal. ERT choice predicted change in sympathetic activity for SV ($R^2 = .24$, $\Delta R^2 = .23$, $\Delta F(3, 84) = 8.54$, $p < .01$) and LVET ($R^2 = .21$, $\Delta R^2 = .20$, $\Delta F(3, 84) = 7.05$, $p < .01$), but not for PEP. The results for SV and LVET are presented in Table 3, and graphs of the regressions are in Figures 1 (for SV) and 2 (for LVET). For SV, participants who chose suppression over avoidance experienced an increase in SV from speech instructions to ERT, while participants who chose venting over avoidance experienced a decrease in SV during the same time frame. For LVET, participants who chose suppression over avoidance experienced an increase in LVET from speech instructions to ERT. These results are significant regardless of

Table 3

Hierarchical Regression predicting Sympathetic Arousal from Trait Anxiety Level and ERT

	Stroke Volume								
	Step 1			Step 2			Step 3		
Variable	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
DASS-A	.35	.63	.06	-.15	.59	-.03	.11	.70	.02
ERT-S				65.47	16.57	.40**	73.04	21.55	.44**
ERT-R				1.69	9.15	.02	1.71	9.37	.02
ERT-V				-27.69	10.58	-.26**	-27.30	10.91	-.25**
DASS-A × ERT-S							-1.38	2.17	-.09
DASS-A × ERT-R							-.88	2.70	-.03
DASS-A × ERT-V							-77	1.88	-.04
R^2		.00			.24			.24	
F for ΔR^2		.30			8.54**			.19	
	Left Ventricular Ejection Time								
	Step 1			Step 2			Step 3		
Variable	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*	*B*	*SE(B)*	*β*
DASS-A	-.35	.53	-.07	-.84	.51	-.17	-1.02	.58	-.20†
ERT-S				58.62	14.34	.42**	81.68	17.88	.58**
ERT-R				-2.27	7.92	-.03	-2.99	7.77	-.04
ERT-V				13.69	9.16	-.15	-17.10	9.05	-.19†
DASS-A × ERT-S							-3.09	1.80	-.23†
DASS-A × ERT-R							1.94	2.24	.09
DASS-A × ERT-V							2.87	1.55	.19†
R^2		.01			.21			.28	
F for ΔR^2		.43			7.05**			2.64*	

† <.10. * $p < .05$. ** $p < .01$. DASS-A = Depression Anxiety Stress Scales-Anxiety subscale; ERT-S = Emotion Regulation Task-Suppression topic; ERT-R = Emotion Regulation Task-Reappraisal topic; ERT-V = Emotion Regulation Task-Venting topic.

Note: DASS-A was centered around the mean for main effect and interaction terms.

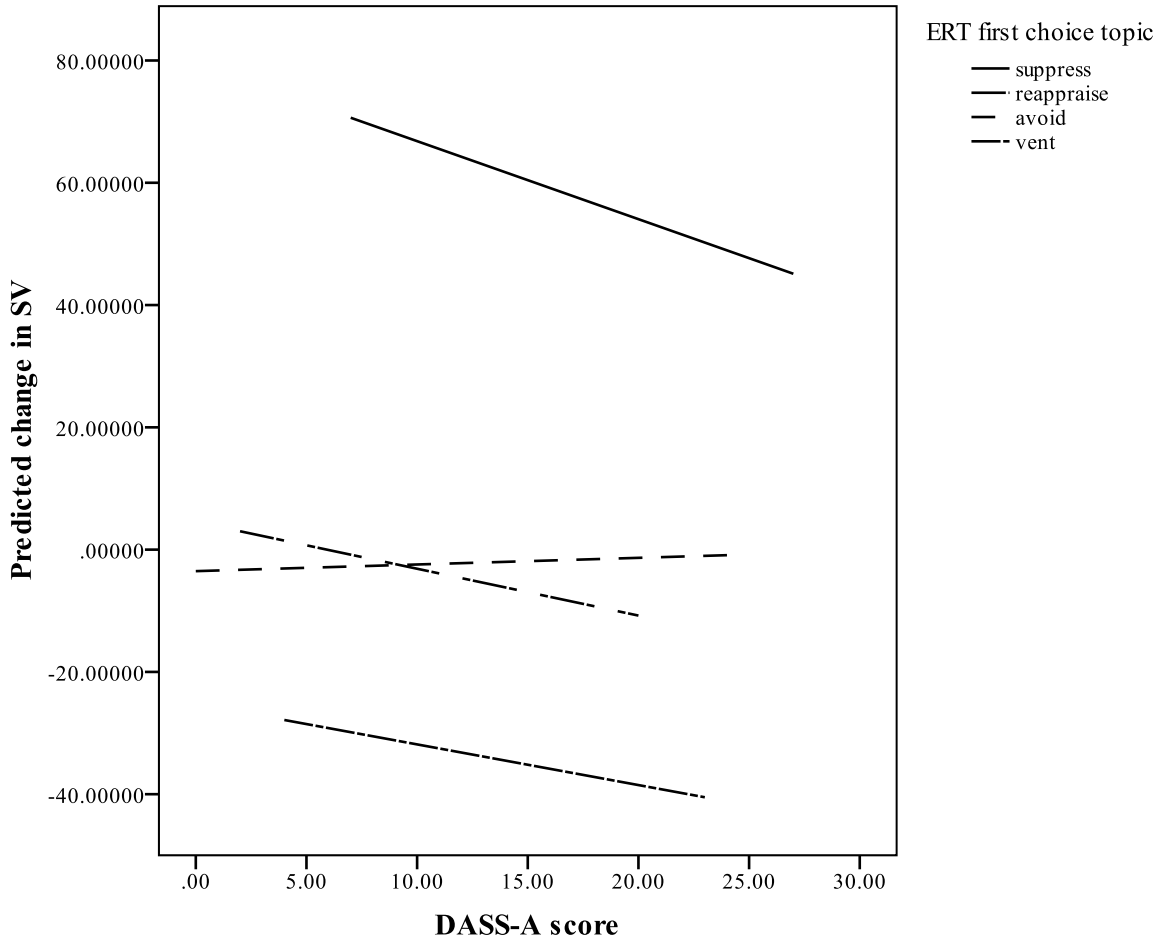

Figure 1. The relationship between DASS-Anxiety subscale and predicted change in stroke volume (SV) for each of the emotion regulation strategies in the ERT.

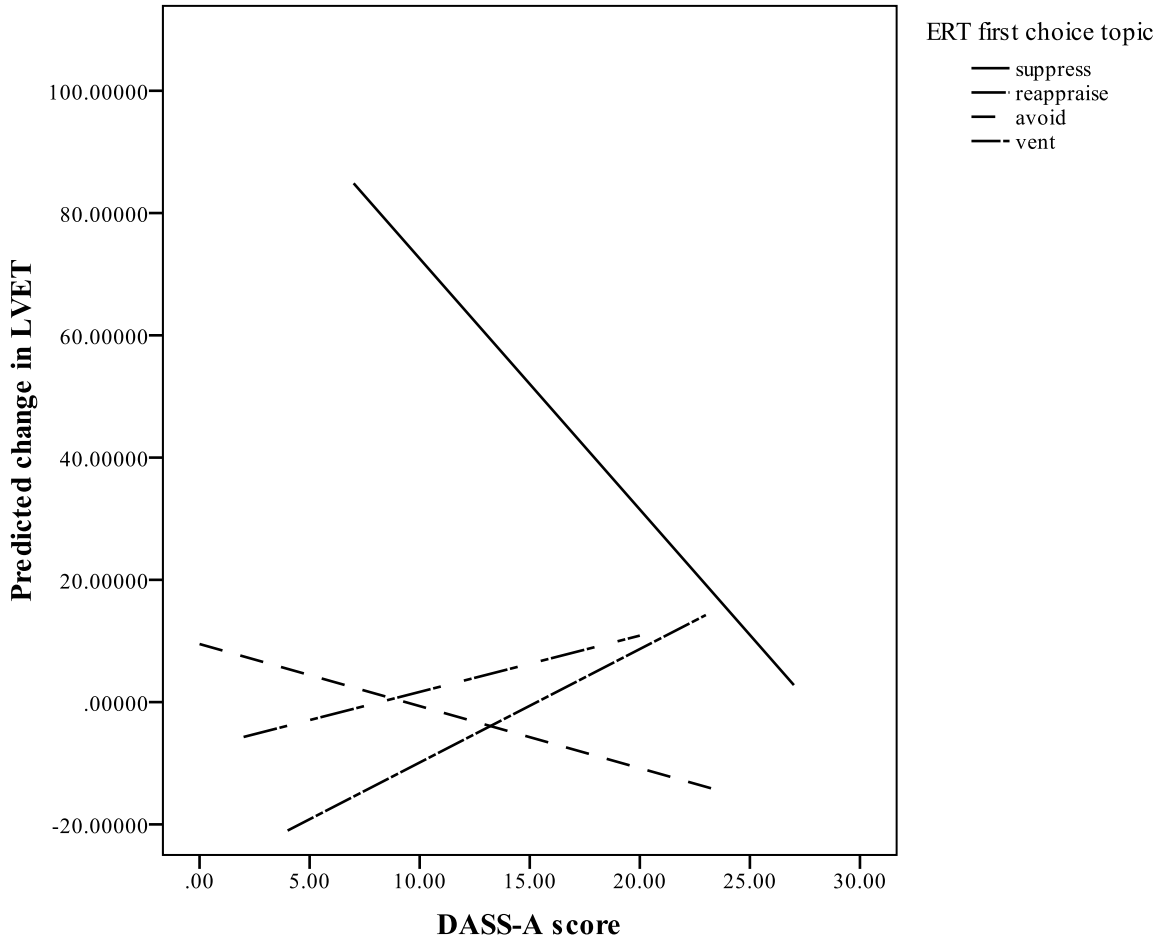

Figure 2. The relationship between DASS-Anxiety subscale and predicted change in left ventricular ejection time (LVET) for each of the emotion regulation strategies in the ERT.

DASS-A. Participants who chose avoidance or reappraisal did not change significantly from the time of speech instructions to ERT.

In step 3, testing the interaction of DASS-A and ERT choice, the contribution of the interaction terms indicated a non-significant trend towards moderation, but only in LVET. These results are also presented in Table 3. For individuals who chose suppression over avoidance, a decrease in DASS-A was associated with a trend toward an increase in LVET from speech instruction to ERT, while those with the highest anxiety scores did not change significantly between time periods. For individuals who chose venting over avoidance, an increase in DASS-A was associated with a trend toward an increase (approaching significance) in LVET. Furthermore, for individuals with the lowest DASS-A scores, venting predicted a decrease (approaching significance) in LVET. Choosing either avoidance or reappraisal did not moderate the relationship between DASS-A and LVET.

Chapter 4

DISCUSSION

In this study, participants with a range of trait anxiety levels completed an anxiety-provoking speech task while their subjective emotional and physiological responses were measured. Through these methods, we aimed to gain a more specific understanding of how anxious and non-anxious individuals regulate their emotions using one of four particular strategies (suppression, reappraisal, avoidance, and venting), and the subsequent effect on physiological responding. The results indicate that trait anxiety level predicts use of emotion regulation strategies and, furthermore, influences sympathetic arousal in a way that may depend on the interaction between trait anxiety level and emotion regulation strategy. Overall, the results serve to further elucidate the relationship between these variables, and suggest ways that future research could continue to build upon our understanding.

Although increased trait anxiety did not predict choice of avoidance, suppression, and venting over reappraisal as predicted, anxious participants did choose suppression over avoidance more than less anxious participants. However, the small number of participants who chose suppression (N = 4) limits our ability to make generalizable conclusions about what this might mean about the relationship between anxiety and suppression. The choice of venting over avoidance as predicted by trait anxiety level approached significance, lending preliminary support for the hypothesis that uncontrollable expression of emotions is a strategy used more by anxious than non-anxious individuals. Future studies are needed to elucidate this finding. One clear finding is that many individuals, regardless of anxiety level, chose avoidance in order to deal with their anxiety. In fact, about two-thirds of the sample chose avoidance over the other emotion regulation strategies, and this group had the lowest mean level of trait anxiety. Therefore, although avoidance may function differently in a highly anxious population (e.g.,

Borkovec et al., 2004), it may be utilized quite frequently in those without clinical levels of anxiety without adverse results.

A consideration of the relationship between trait anxiety, emotion regulation, and psychophysiology demonstrated that these variables are related, and may even interact. In particular, emotion regulation choice approached significance in predicting sympathetic arousal changes between the anxiety induction period and the emotion regulation period, above and beyond the contribution of individual anxiety scores. For participants who chose venting, two of the three indices of sympathetic arousal in our study generally decreased from the time of the anxiety induction to the ERT writing period. However, the data also indicated a non-significant trend where venting was associated with a decrease in sympathetic arousal for participants with lower anxiety levels and an increase in sympathetic arousal for participants with higher anxiety scores. This provides some support of previous findings that anxiety and use of venting are positively correlated (Soto et al., 2010a; Carver & White, 1994), with the caveat that anxious people who vent experience a different physiological outcome from non-anxious people who vent. Tice and Bratslavsky's (2000) proposal that venting does not decrease negative affect (which is often related to increased sympathetic activation) because it involves continuing to attend to the negative stimulus appears to be supported only in people who may have more negative affect to begin with. For those with lower anxiety and negative affect, venting may actually involve "getting out" the anxiety and moving past a negative emotion and the associated physiological experience, while individuals with high anxiety may not be able to "let go" as readily. If this is the case, therapy interventions for anxious clients should focus more on productive processing of emotions as opposed to venting, which could have the unintended effect of increasing the physiological arousal and discomfort that is associated with many anxiety disorders.

Overall, those who suppressed experienced an increase in sympathetic arousal after the anxiety induction, which supports past findings linking suppression with a decrease in behavioral responding but an increase in autonomic activity (Hagemann, Levenson, & Gross, 2006; Gross & Levenson, 1997). In addition, choice of suppression exhibited a trend towards moderating the relationship between trait anxiety level and sympathetic activity such that those with lower anxiety experienced a larger increase in sympathetic arousal and those with higher anxiety did not change from the time of anxiety-induction. Although these results were significant, the small number of people who chose this strategy limits the conclusions that can be drawn from these data. The findings can only be considered as preliminary trends, and future testing will be necessary to elucidate the relationship between ERT suppression and physiological outcomes.

In this study, anxiety level and use of reappraisal did not predict changes in physiological activity. This lack of change in physiology has been found frequently in past studies, where reappraisal is most often associated instead with a decrease in subjective distress (see Gross, 2002 for a review). In particular, Egloff and colleagues (2006) found a non-significant change in physiological responding following anxiety induction. Furthermore, anxiety level and choice of avoidance did not predict changes in physiological activity from speech instruction to ERT writing task. Previous findings linking avoidance, such as through worry, to decreased autonomic reactivity have primarily studied this phenomenon in anxious populations, such as those with GAD (Borkovec & Hu, 1990). Because trait anxiety level did not predict choice of avoidance, it is possible that these physiological effects are not observed in non-anxious individuals. These findings demonstrate that individual differences, such as anxiety level, play an important role in understanding the effects of emotion regulation on physiology.

Clinical Implications

Disruption in emotional functioning is associated with many forms of psychopathology, including problems in the ability to accurately perceive emotion in others, the subjective experience of emotion, behavioral responses to emotions, and the ability to relate to others in socially appropriate ways (Kring & Bachorowski, 1999). Current clinical theory has recognized the importance of addressing emotional deficits in many approaches to treatment, and research demonstrates that addressing emotional problems within the therapeutic context is an effective intervention technique (Greenberg, 2008). Although the current study utilized a non-clinical sample with a range of trait anxiety levels, the findings may have implications for clinical populations and the ways that clinicians approach therapy with anxious clients. For example, cognitive-behavioral therapy includes the important component of cognitive restructuring, or aiding a client to interpret a situation in a more adaptive way, which corresponds with reappraisal as an emotion regulation strategy. These data suggest that, similar to past studies, participants who chose reappraisal did not experience an increase in sympathetic arousal, even when they scored high on a measure of trait anxiety. Therefore, instructing anxious clients on how to cognitively restructure, or reappraise, their emotions may continue to be a useful tool in therapy.

Furthermore, if venting does indeed serve to increase sympathetic arousal in anxious individuals, as suggested by the data, then encouraging anxious clients to fully experience their anxiety without decreasing unproductive processing is likely to increase physiological discomfort instead of relieve it. The results of this study additionally suggest that avoidance in itself may not be maladaptive, both for anxious and non-anxious individuals. Therefore, considering the venting findings here and past research linking avoidance via worry with deleterious effects, the degree of productive processing that occurs may instead be a better indicator of whether an emotion regulation strategy ultimately aids the individual. Clinicians

that wish to address emotion regulation deficits should consider the degree to which a client is comfortable processing their emotions and regulation strategies that allow the client to do this effectively.

Strengths and Limitations

The present study benefited from multiple methods of assessing for emotional reactivity, including through frequent ratings of subjective affect and physiological measures of sympathetic arousal. In addition, it used an innovative measure of emotion regulation that actually engaged participants in the strategy during the task. Because participants both chose an emotion regulation strategy and utilized it, two levels of analysis were possible: prediction of the choice of emotion regulation strategy and prediction of the strategy's influence on physiological arousal.

Despite these strengths, a number of limitations are noteworthy. First, physiological effects were found in LVET and SV, but did not appear when considering PEP. It is unclear why all three were not consistent, however inconsistencies within studies across different physiological measures are not unusual (e.g., Roberts & Levenson, 2006). In another study that uses a speech task to induce anxiety, Egloff and colleagues (2006) found physiological changes in their peripheral indicators of sympathetic arousal (i.e., skin conductance, finger temperature, finger pulse amplitude) and not in the cardiovascular measure (i.e., heart rate). It is possible that this indicates differential susceptibility of some of these measures to the type of arousal associated with this task.

In addition, the version of the ERT used in this protocol differs slightly from the one validated in by Soto and colleagues (2010b). The suppression topic presented herein received moderate support in prior versions of the ERT but was eventually replaced by a more externally valid topic in the final version. The moderate instead of strong support for this writing topic in

the validation study may at least partially explain the low frequency of participants choosing the suppression topic. Another limitation is the largely non-clinical and homogeneous sample, which may not give a full picture of how these emotion regulation strategies play out in individuals with high or chronic levels of anxiety. However, the significant findings indicate that extending this line of research into a clinical population will be an important and informative future endeavor.

Finally, the structure of this research design does not allow for causal relationships to be determined between variables because (a) we could not manipulate the trait anxiety level of our participants and (b) we did not experimentally manipulate emotion regulation and instead asked participants to choose the strategy that they preferred. Although this design is a strength in that it allowed us to consider how trait anxiety level predicts choice of emotion regulation topic, the effect of emotion regulation on physiology cannot be attributed solely to the choice of emotion regulation writing topic. In future studies, the ERT can be used not only as an outcome measure, but as an experimental manipulation by assigning emotion regulation writing topics to each participant. This will allow researchers to draw causal conclusions about the effects of using specific emotion regulation strategies.

Conclusion

The findings presented here provide initial support for the relationship between trait anxiety, emotion regulation, and physiological arousal. In particular, individual differences, such as trait anxiety level, impact the types of emotion regulation strategies that people use. Furthermore, emotion regulation strategies may differentially influence physiological arousal depending on trait anxiety level, though these results require confirmation. Future studies should aim to identify other individual factors that influence the choice and personal impact of specific emotion regulation strategies, and to build upon these findings in order to continue to understand

how emotion regulation functions within anxiety. With enhanced methodology and continued exploration of the impact of emotion regulation on psychopathology, researchers can move toward a greater understanding of how emotion and its regulation function in anxiety, both at pathological and normal levels, and the ways in which treatment can influence emotional processes.

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