THE EFFECTS OF ACCEPTANCE, REAPPRAISAL AND SUPPRESSION STRATEGIES ON PSYCHOPHYSIOLOGICAL REACTIVITY TO EMOTIONALLY PROVOCATIVE STIMULI IN THE LABORATORY

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ABSTRACT

The Effects of Acceptance, Reappraisal and Suppression Strategies on Psychophysiological Reactivity to Emotionally Provocative Stimuli in the Laboratory
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The present study examined the degree to which acceptance, reappraisal, or suppression based strategies are associated with changes in heart rate, eyeblink startle magnitude, Event-Related Potentials (ERPs), and self-reports of subjective experience in a sample of college undergraduates. Participants were randomly assigned to use one of these strategies during an associative learning task that contained stimuli that signaled either threat or safety from a noxious stimulus as well as during exposure to highly arousing pleasant and unpleasant images. Participants in the reappraisal and suppression groups displayed greater eyeblink startle magnitudes during the emotion induction procedures compared with participants in the acceptance and control groups. No group differences were found with respect to heart rate or ERPs in response to the emotion inductions. Compared with participants assigned to the acceptance and control conditions, participants assigned to the reappraisal and suppression conditions rated unpleasant images as being less unpleasant; however, the groups did not differ in arousal ratings. Participants did not differ in their ratings of discomfort during the associative learning task, nor did they differ in their valence and arousal ratings for pleasant pictures. Findings suggest a possible dissociation of cognition and physiological reactivity for participants using reappraisal and suppression strategies to regulate mood and affect.

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CHAPTER 1

INTRODUCTION

Suppression

Research has shown that a common method of regulating unwanted thoughts and feelings is one in which the individual actively attempts to not attend to or process such thoughts, feelings, memories or stimuli that lead to or influence these internal responses (Wenzlaff & Wegner, 2000). Interestingly, research has found that this method of regulation, commonly referred to as suppression, oftentimes paradoxically results in an increase in the very thoughts, feelings and other internal experiences that the person wishes to suppress. For example, with respect to cognition, Wegner and his colleagues have repeatedly found that although suppressing may work in the moment, it often results in an increase over baseline of the very thoughts the individual is attempting to suppress (Wegner & Gold, 1995, Wegner, Schneider, Carter, & White, 1987). With respect to affect, studies have shown that suppression is associated with reductions in expressive behaviors (i.e., facial expressiveness) but increases in sympathetic activation (Gross & Levenson, 1993; 1997; Kalisch, Wiech, Critchley, Seymour, O'Doherty, Oakley, et al., 2005; Lorig, Singer, Bonanno, & Davis, 1994; Thomas, 1997) Interestingly, some of these studies showed that suppression has no effect on participants' subjective experience of emotion (e.g., Gross & Levenson, 1993), while others have found decreases in subjective experience of emotion (Kalisch et al., 2005).

Reappraisal: An Alternative to Suppression

Given these findings, researchers have postulated that there may be other, more adaptive and successful methods for regulating internal experiences. One method, called reappraisal, involves the conscious reevaluation of a given situation in order to decrease its psychological impact (Gross, 2001).While suppression and reappraisal have the same goal of regulating internal experiences, they vary in the method by which these experiences are to be regulated, as well as the characteristics of those who prefer one to the other. In general, people who primarily reappraise express greater positive emotion and less negative emotion, have better interpersonal functioning, and greater well-being than those who engage in certain types of suppression (Gross & John, 2003).

A number of studies have demonstrated the general effectiveness of reappraisal strategies in ameliorating psychopathology (Butler, Chapman, Forman, & Beck, 2006; Norton, & Price, 2007; Resick, & Schnicke, 1992; Rush & Beck, 1978). In particular, reappraisal has been shown to attenuate physiological reactivity in response to emotionally provocative stimuli across a number of domains including sympathetic activation (Giuliani, McRae, & Gross, 2008), and electrophysiological reactivity (Krompinger, Moser**,** & Simons, 2008; Moser, Hajcak, Bukay, & Simons, 2006; Moser, Krompinger, Dietz, Simons, 2009). Although the results of these studies have suggested that reappraisal strategies may be effective in changing self-reported and physiological responding to emotionally valenced stimuli, we cannot yet draw firm conclusions about the adaptive preference for reappraisal, as none of these studies directly compared reappraisal and suppression strategies on subjective and physiological reactivity.

Acceptance: A Different Alternative

Although some researchers have espoused the notion that reappraisal is a healthier and more adaptive method of regulating our internal experiences, other researchers have suggested that any efforts to get rid of or change one's psychological experiences are maladaptive and only amplify their frequencies and intensities (Hayes, Wilson, Gifford, Folletee & Strosahl, 1996). These attempts are considered a form of experiential avoidance, which is a learned strategy wherein the individual makes repeated attempts to avoid certain unwanted physiological sensations, memories, thoughts and emotions as well as the contexts that give rise to them (Hayes & Wilson, 1994; Hayes et al., 1996). Unfortunately, as already suggested by the work of Wegner and colleagues, it may be the case that any attempt to avoid will produce the very thoughts, feelings and experiences that the individual is attempting to ameliorate. As a result, these investigators have offered an alternative to methods aimed at regulating one's internal experiences. These methods, broadly referred to as acceptance, involve being open to one's experiences and being willing to experience unwanted thoughts, emotions, memories, etc. as a part of everyday life (Bishop, Lau, Shapiro, Carlson, Anderson & Carmody, 2004). In essence, accepting is the antithesis of reappraising or suppressing one's thoughts, feelings, or other aversive internal stimuli.

Some available clinical studies have demonstrated the utility of acceptance (Forman, Herbert, Moitra, Yeomans, & Geller, 2007; Hayes, Wilson, Gifford, Bissett, Piasecki, Batten, 2004; Heffner, Eifert, Parker, Hernandez, & Sperry, 2003; McCracken, & Vowles, 2008; Vowles, & McCracken, 2008; Flessner, Busch, Heideman, & Woods, 2008; Veiga-Martínez, Pérez-Álvarez, & García-Montes, 2008; Woods, Wetterneck, & Flessner, 2006). A number of experimental studies have directly compared the effects of acceptance with those of suppression, with mixed results. Feldner, Zvolensky, Eifert & Spira (2003) recruited forty eight participants high and low on emotional avoidance to participate in a carbon dioxide (CO_2) challenge consisting of four inhalations of 20% carbon-dioxide enriched air. Participants were randomly selected to use either a suppression or acceptance-based strategy to manage their affect. Results showed a main effect for condition, such that participants instructed to suppress demonstrated a decrease in heart rate, whereas those in the acceptance condition had an increase in heart rate, relative to baseline, with a large effect size ($\eta^2 = .43$). For self-reported anxiety there was an emotional avoidance by condition interaction. For participants instructed to suppress, those who were high in experiential avoidance reported greater anxiety during the task compared with those low in experiential avoidance. The two groups did not differ in their self reported anxiety when accepting/observing their emotions. Overall, this result was found to have a medium effect size ($\eta^2 = .11$).

Levitt, Brown, Orsillo, & Barlow (2004) randomly assigned participants with a diagnosis of Panic Disorder into one of three conditions: acceptance; suppression; or no strategy (control) and then exposed them to a 15 minute CO_2 challenge. Prior to the challenge, participants listened to a script detailing the benefits of the strategy they were to use, or, in the case of the control group, listened to a news article. Results of this investigation showed no group differences in physiological responses (i.e., change in heart rate) or self-reported anxiety during the challenge. Interestingly, the only difference that arose was that participants assigned to the acceptance condition were more likely to agree to repeat the challenge.

Campbell-Sills, Barlow, Brown, & Hofmann (2006) used a sample of sixty patients diagnosed with an anxiety or mood disorder to compare the effects of suppression and acceptance-based strategies on self-report and psychophysiology (e.g. heart rate, skin conductance) while watching a 4.5 minute emotionally evocative film clip. Participants were randomly assigned to use either an acceptance or emotional suppression strategy in response to the film clip. Self-report and psychophysiological responses were recorded during three time periods: 2 minute baseline prior to the induction; 5 minute induction (included 30 seconds to provide self-report); 2 minute recovery. Results showed that the acceptance group demonstrated a greater decrease in self-reported negative affect from the emotion induction period to the recovery period than the suppression group, with a medium effect size ($\eta^2 = .11$). The two groups did not differ in heart rate from baseline to the recovery period, but showed a different pattern of heart rate during the film. Compared to the baseline period, participants in the acceptance group had decreased heart rates during the film and an increase in heart rate during the recovery period. Participants in the suppression group displayed the opposite effect, with an increase in heart rate during the emotion induction, followed by a decrease in heart rate during the recovery period, which was still higher than their baseline heart rates. The overall effect of this interaction was medium to large ($\eta^2 = .17$) Groups did not differ on overall skin conductance, nor did their patterns of skin conductance responding differ across the three periods. The authors attributed the decrease in heart rate during the acceptance condition as possible evidence of an increase in cognitive processing. As heart rate has been shown to decrease in response to increases in cognitive load, it was hypothesized that as participants in the acceptance condition were experiencing their emotions to a greater extent than the suppression group, this placed a greater demand on cognitive resources.

To date, only one study has concurrently compared the effects of suppression, reappraisal and acceptance during an experimental emotion induction (Hofmann, Heering, Sawyer, Asnaani, 2009). During this experiment, participants were randomly assigned to one of the three experimental groups. No control group was included. Participants in the acceptance condition were encouraged to experience their emotions fully without any attempt to control or change the emotion they experienced. Participants randomly assigned to the reappraisal condition were explicitly told how to reappraise by encouraging the participants to realize that they were in an experiment and that nothing will harm them. Participants in the suppression condition were told to suppress their expressions of any feelings such that an outside observer would not know what they were experiencing. All participants were informed that they would have to give a ten minute speech, and were to use their assigned strategy in order to deal with any anxiety they might experience during it. Participants' heart rates were continuously collected during a three minute baseline procedure, during the ten minute speech, and during a three minute recovery period. Participants' self-reported anxiety was collected at the end of each of the three time periods. At baseline, groups did not differ on self-reported anxiety or heart rate. Results showed that, relative to the other conditions, the suppression condition showed a greater increase in heart rate change from baseline during the speech, with a small to medium effect size ($\eta^2 = .04$). The suppression condition also reported more anxiety during the speech than the reappraisal condition, but not the acceptance group, with a small to medium effect size ($\eta^2 = .04$). These results support the notion that suppression is a maladaptive strategy for regulating internal experiences and actually may actually result in the very reactions that one is attempting to avoid. The authors concluded that the acceptance reappraisal strategies were more adaptive strategies to regulate mood, and that the reappraisal group in particular was more effective in decreasing subjective anxiety.

Limitations of Previous Research

To summarize, very few experimental studies have directly compared the effects of suppression, reappraisal and acceptance on self-reports of psychological distress and psychophysiological reactions among participants who are exposed to a procedure designed to evoke an unpleasant emotional response. Results of studies that do exist do not provide a clear picture of the superiority of one strategy over another when it comes to managing internal experiences. Importantly, the previous studies suffer from some important limitations, such as: no accounting for strategy history, poor strategy specificity, diffusion of treatment, limited use of experimental manipulations to assess group differences, overreliance on within-subjects designs, and inadequate outcome measurement. Previous studies also have not carefully examined the effects of habituation on their findings.

Strategy History

Only one study, Levitt et al., (2004) attempted to examine the participants' everyday use of these strategies, with no significant differences between the participants in their use of each strategy. Across most of the studies, specifically the Hoffman et al. (2009) study, participants were not assessed for their past use of acceptance, reappraisal or suppression strategies. As such, we can not be sure if differences on outcome measures are a result of effects specific to the strategies, or how familiar a participant is with a measure. For example, in the Campbell-Sills et al. (2006) study, if participants had significantly more experience suppressing rather than accepting their emotions, it stands to reason that the effects of heart rate (lower heart rate during induction for the acceptance group) could be interpreted as a general effect in response to using any new strategy, rather than an effect specific to acceptance strategies. Or, the hypothesized increase in cognitive resources during the acceptance condition could actually be more of a result of the participants learning a new strategy, rather than being specific to the acceptance strategy.

Strategy Specificity

Across many of the studies experimenters have used different forms of the strategies to test their efficacy in the laboratory. For example, some studies (Campbell-Sills et al., 2006; Kalisch et al., 2005; Levitt et al., 2004) encouraged participants to use thought suppression, encouraging them to reduce their negative affect through thought suppression specific to the emotions being elicited during the induction. Other studies (Feldner et al., 2003; Gross & Levenson, 1993; 1997; Hofmann et al., 2009) encouraged participants to use behavioral suppression which encourages participants to restrict the facial expression of their emotion. It is unclear if these two forms of suppression are the same, and as such may have contributed to the inconsistent results found across the aforementioned studies. As such, differences between these studies are not only attributable to different emotion inductions and demographic variables, but also the form of the strategy used.

Diffusion of Treatment

Studies have created experimental strategies that combine aspects of different regulation strategies, which in turn make it difficult to isolate the effects for each strategy. For example, in the Moser et al. (2006) study, event related potentials (ERPs) were collected as participants were presented with positive or negative valenced slides. Participants were told:

> So, when you see the word SUPPRESS, prepare yourself to decrease the intensity of whatever negative emotion you might feel in response to the picture. Prepare yourself to feel the negative emotion less strongly. Suppression of an emotion is not equivalent to replacing that emotion with a different one. . . For example, if you are asked to suppress the fear you feel in response to a picture of a poisonous snake, do not think of something unrelated that generates a positive emotion, e.g., the end of finals week and beginning of winter holiday! However, feel free to focus on a positive aspect of the picture or on a possible positive outcome of the situation in the picture. For example, you can imagine that the poisonous snake is about to be killed, which may help you to decrease the fear you may feel in response to the picture. (Moser et al., 2006, p. 293).

Although the participants are being told to suppress, they are also encouraged to use situation focused reappraisal strategies in order to change their emotion. This experiment found ERP responses to be attenuated in the "suppress" condition, but it is unclear if this result is specific to suppression strategies, reappraisal strategies, or a combination of the two.

Limited Use of Experimental Manipulations

An additional limitation of previous studies is the use of a single experimental manipulation, which limits the generalizabilty of the results. Further, some studies not only used one type of manipulation, but limited this manipulation to negatively valenced stimuli (e.g.

Campbell-Sills et al., 2006; Feldner et al., 2003; Gross & Levenson, 1993; 1997; Hofmann et al., 2009; Kalisch et al., 2005; Levitt et al., 2004). In order to fully explore the differences between suppression, reappraisal and acceptance, it is necessary to include stimuli that vary in their pleasantness and arousal properties and to employ various methods of experimental manipulation.

Overreliance on Within-Subjects Designs

Many of the studies examining the effects of reappraisal used a within-subjects, rather than between-subjects design (e.g., Giuliani et al., 2008; Krompinger et al., 2008; Moser et al., 2006; Moser et al., 2009). Although a within-subjects design reduces the number of participants needed for a study, the experiment is subject to a possible *carryover effect* (Gliner & Morgan, 2000). As a participant in a within-subjects design is exposed to each condition, they can not unlearn whatever strategy they have been taught during a previous part of the experiment. In the case of the studies reviewed here, once a participant learns a strategy, it is unclear that they will no longer use that strategy when instructed to use a new strategy, or the control condition. The use of a within subjects design can also lead to a diffusion of the treatment effects. The demand characteristic that one strategy might be more effective than another is often embedded in the experiment, or, it may be apparent to the participant that an experiment was comparing a particular regulation strategy of interest to a no-strategy control condition. Finally, in many of the previous experiments, participants were asked to engage in a number of different manipulations, wherein they were told to change their emotional experience compared with a control condition. By asking participants to engage in this process, participants may have used each condition as an exemplar or baseline in order to determine how they should feel. For example, if they felt moderately happy during the baseline condition, but were instructed to enhance their emotions, they might compare how they felt during the control condition in order figure out how they feel during the enhance condition. So, when asked to report on their feelings, the report might be based on how they felt previously, and not on their current experience, biasing the results in the direction of the expected outcome.

Inadequate Outcome Measurement

Numerous studies have used changes in heart rate (Campbell-Sills et al., 2006; Feldner et al., 2003; Gross & Levenson, 1993; 1997; Hofmann et al., 2009; Kalisch et al., 2005; Levitt et al., 2004), ERPs (Krompinger et al., 2008; Moser et al., 2006; Moser et al., 2009), or other broad measures of emotional reactivity as outcome measures for studies on the sequelae to attempts to control internal experiences. By using measures that are not specific to emotional reactivity, it is unclear to what extent changes in these outcome measures are due to the regulation instructions or other cognitive processes, thereby adding more error and variability to the results. The eyeblink component of the emotion-modulated startle reflex has been examined extensively among investigators wishing to probe the affective states of individuals; it is reliably potentiated in the context of unpleasant stimuli and attenuated in the context of pleasant stimuli (Bradley & Lang, 2007). As such, it has the potential to be a useful outcome measure to determine the effectiveness of each strategy in attenuating or potentiating physiological reactivity in response to a stimulus.

Unfortunately, previous attempts to examine the effectiveness of strategies to attenuate the startle response have been marred by a lack of instructional specificity during the experiment. Beginning with Jackson, Malmstadt, Larson, & Davidson, (2000), a number of researchers have attempted to use strategies to increase or decrease the magnitude of the startle response (Dillon & LaBar, 2005; Lissek, Orme, Mcdowell, Johnson, Luckenbaugh, Baas, Cornwell, & Grillon, 2007; Piper & Curtin, 2006) . The instruction sets for all of these studies did not include an explicit method for the participant to regulate their mood. For example, in their original instruction set, which other experiments used as well, Jackson et al. (2000) instruct their participants to:

> . .. either suppress, enhance, or maintain the emotion you are currently feeling in response to the picture. Suppose the emotion you are feeling in response to a picture is fear. Whatever fear you might experience in response to the picture, if you are instructed to ENHANCE, we would like you to increase the intensity of fear you feel. If you are instructed to SUPPRESS, we would like you to decrease the intensity of fear you feel. Similarly, if the emotion you experience in response to a picture is disgust and you are instructed to ENHANCE, we would like you to increase the intensity of disgust you feel. If you are instructed to SUPPRESS, we would like you to decrease the intensity of disgust you feel. (Jackson et al. 2000, p. 522).

Although the participants in this particular study were told to suppress, it is unclear how the participants went about doing it. In spite of this, across a number of studies the startle response has been shown to be increased or decreased in the direction of the reappraisal instructional set in response to positive and negative valenced images, and this effect has also been found to extend to threat of shock (Lissek et al., 2007). Although it is clear that the startle response can be regulated by deliberate control strategies, it is unclear which strategies are more effective at attenuating responses or whether these strategies are different from an acceptance-based approach.

Limited Examination of Habituation Effects

Habituation can be defined as a reduction in response magnitude and increased latency of response after repeated stimulus presentation (Catania, 1998). Although some studies have attempted to account for the passage of time during the experiment by analyzing participants' responses during a baseline/anticipation stage, emotion induction, and recovery period

(Campbell-Sills et al., 2006; Hofmann et al., 2009), they have failed to account for possible habituation of physiological responses over the course of the experiment, or whether each control strategy is associated with different patterns of habituation. Due to issues of experimental design in such studies, it is unclear to what extent repeated administration of the stimulus, as well as increased practice using a specific strategy, would influence responding. For example, if suppression leads to a rebound effect, one would expect to see an initial decrease in subjective anxiety early on in the experiment, but an eventual increase in anxiety during the second half of an experiment after repeated presentation of a noxious stimulus.

Present Study

In an attempt to address the limitations of previous research outlined above, the present study examined the effects of these disparate control strategies (suppression, reappraisal, and acceptance) by including all three strategies in the experimental design, employing experimental tasks previously shown to elicit strong emotional responses, and using multiple assessment measures. Specifically, this study examined the degree to which acceptance, reappraisal and suppression strategies were associated with changes in physiological and self-reported emotional reactivity in a non-clinical population. Participants used one of the strategies during two separate emotion induction tasks that employed stimuli varying in arousal and valence. In the first task, participants were presented a series of positively and negatively valenced slides from the International Affective Picture System (IAPS; Lang, Bradley & Cuthbert, 2005). The second task was an associative learning task with a safe condition signaled by the visual presentation of a green square and a threat condition signaled by a red square, during which there was a 33% chance the participant would receive an airpuff to the neck. Rather than relying solely on self-report and one physiological measure, the present study simultaneously examined self-report along with three psychophysiological measures as separate measures of arousal (heart rate), attention and emotional processing (ERP) and valence/arousal (eyeblink startle). These measures were chosen as they have been shown to be sensitive to the experimental manipulations, and could be collected simultaneously with little to no conflict with each other. As eyeblink startle magnitude is closely associated with the valence and arousal of a stimulus, experimental instructions were generally expected to have more consistent and robust effects across positive and negative stimuli on this measure compared with heart rate, which has a biphasic response to arousing stimuli (Bradley & Lang, 2007), and ERPs, which are more general measures of attention and emotion processing (Fabiani, Gratton, & Federmeier, 2007). Both heart rate (Bradley & Lang, 2007) and ERPs (i.e. the Late Positive Potential; Krompinger et al., 2008) have been shown to have similar reactivity when participants have been presented with positive and negative valence stimuli of similar arousal levels.

The reappraisal strategy is generally hypothesized to work by changing the valence and/or arousal of a stimulus, whereas the suppression strategy is hypothesized to initially work by distracting the participant from their subjective experience. Participants in both of these strategy conditions were explicitly told to down-regulate their positive and negative emotions, whereas those in the acceptance group were told to accept their emotions without any active effort to change them; participants in the control group were instructed to give their ratings of subjective experience at the end of each experimental trial. As a result, participants in the reappraisal and suppression groups were generally expected to have lower self-reported discomfort and arousal, as well as report lower valences for both the positive and negative valence IAPS slides compared with the acceptance and control conditions. Physiological responding was expected to correspond with participants' self-reported experiences, such that the reappraisal and suppression groups would attenuate their physiological responses to a greater extent than participants in the acceptance and control conditions. In addition, it was hypothesized that participants in the acceptance condition might demonstrate increased sensitivity to emotional stimuli compared with participants in the other conditions as they were experiencing the stimuli without the benefit of any strategy to regulate their mood. It was also suspected that participants in the reappraisal condition would be able to regulate their mood better than participants in the suppression condition. Participants' self-reported and physiological responding to all stimuli was expected to decrease over the course of the experiment. In addition, this effect was expected to differ across the strategies, with those in the acceptance group showing the greatest habituation.

CHAPTER 2

METHODS

Participants

Participants were 95 undergraduate (30 men, 65 women) students enrolled in Psychology classes at Temple University who chose to participate in exchange for credit towards completion of a course research participation requirement. The mean age of all participants was 20.5 years (SD = 3.52) with a range from 18 to 47 years. The racial background of the sample was diverse, with 60.6% White, 17.4% Black, 15.6% Asian, and 5.5% of mixed racial background.

Procedure

Overview

Prior to arrival, participants were randomly assigned to one of four conditions: Acceptance (n=24), Reappraisal (n=23), Suppression (n=25), or Control (n=23). In each condition, participants were instructed to use the specific regulation strategy to regulate their mood while being exposed to two emotion induction tasks. Instructions for the suppression and acceptance conditions were modified from those of Levitt et al. (2004); the instruction set for reappraisal was modified from Lissek et al. (2007). The control group listened to a news article from the New York Times matched for length of time (Appendix A). The spoken instructions were prerecorded and presented to participants over headphones. Each set of instructions lasted approximately 3 minutes and 30 seconds. All instruction sets included a brief definition of emotions as physical sensations or thoughts that let us know if our needs are being met or not. In each instruction set, emotions were then compared with interoceptive cues, specifically the sensations of hunger and satiation, and the value of positive and negatively valenced emotions was explored. The instructions emphasized that both sides of the emotional valence continuum from positive to negative are needed so that you know when your needs are being met, as well as when they are not being met. The instructions then went on to describe how intense affect can sometimes impede our goals. The example of how intense anxiety during a presentation can impede performance was given. At this point, the instruction sets diverged to explore how the assigned strategy is an adaptive strategy to manage affect.

The emotion suppression instruction set emphasized the utility of volitional control of emotion as an effective strategy for decreasing negative affect. In this condition, participants were encouraged to engage in thought suppression and behavioral suppression (preventing anyone from seeing how you feel) in order to decrease any emotional response.

Participants in the reappraisal group were encouraged to believe that volitional control of emotions is not only possible, but adaptive. Rather than avoiding their emotions and cognitions, participants in this group were asked to use cognitive restructuring/reappraisal techniques as a way to reevaluate situations and eventually decrease the amount of inappropriate emotion being experienced. It was suggested that participants could use either self-focused (e.g. "This is just an experiment and I am not in danger of harm") or situation-focused (e.g. "That woman is crying because she just attended a wedding") reappraisal strategies to decrease their emotion.

Unlike the previous strategies, the instructions for the acceptance-based strategy explored the ways in which attempts to control or manipulate emotions are maladaptive, and how such attempts eventually lead to feelings of defeat and increased negative affect. Instead of controlling their emotions, participants in this condition were encouraged to allow themselves to go through each task without attempting to change any emotion that they experienced. This strategy encouraged participants to accept emotions as experiences that are neither good nor bad, but just are. Participants were specifically told that the successful use of this strategy would not change the arousal or valence of the emotion they are experiencing.

Acclimation Period

Upon entering the laboratory, participants received a brief introduction to the experimental protocol and were shown the psychophysiological equipment to be used, after which time they were asked to if they wished to participate. Those who agreed to participate read and signed an informed consent form. Following signing of the consent form, participants were seated approximately 80 cm away from a 17" viewable monitor while they filled out a number of questionnaire measures (see below). During this period, the electrodes for the psychophysiological recordings were also placed on the participant. Once all the questionnaires were completed, the experimenter placed headphones on the participants' ears and left the room while they listened to the emotion regulation instructions or the reading of the control condition article. During this time, baseline ECG data were also recorded.

Emotion Inductions

Airpuff Task

The current study employed an associative learning task in which certain cues signaled threat or safety from an aversive stimulus. This aversive stimulus consisted of an airpuff to the larynx that was delivered through a specialized neck collar (Grillon et al., 1999). The task consisted of a practice trial followed by 30 experimental trials that were evenly split between two conditions: threat (15 trials) and safe (15 trials). During the practice trial, participants were exposed to the threat condition so that they could experience the airpuff stimulus.

At the beginning of each experimental trial, a colored square was presented against a black background for 15 seconds. A red square signaled the start of a threat trial, while a green square signaled the start of a safe trial. Prior to beginning the experiment, participants were instructed that during the threat condition (i.e., when the red square was displayed) there would be a 33% chance that they would receive an airpuff over the course of the next 15 seconds. Participants were instructed that in the safe condition (i.e., when the green square was displayed) they would not receive an airpuff over the course of the trial. Complete task instructions can be found in Appendix B. After the red or green square had been displayed for 15 seconds, a white square was presented for 2 seconds which signaled the end of the trial. Following the offset of the white square, the screen went black to signal the start of the inter-trial interval (ITI) which lasted approximately 5-7 s. Trials were presented to each participant in a quasi-randomized order, with each participant receiving the same order of presentation (which had been initially randomized).

Participants' level of anxiety during the airpuff task was assessed using the Subjective Unit of Distress Scale (SUDS; Wolpe, 1958). Subjects were asked to verbally tell the experimenter the level of discomfort they were experiencing on a scale of 0 (no discomfort) to 9 (the most uncomfortable/anxious they have felt in their life). The SUDS instructions were modified from Kaplan, Smith, & Coons (1995) and are given in Appendix B. The prompt for participants to give their SUDS rating was a prerecorded message delivered over headphones during the ITI following safe or threat trials. Mean SUDS scores were computed separately for the safe and threat conditions.

Airpuffs were delivered using a custom system comprised of a compressed air cylinder, a regulator, a solenoid valve controlled by an AC switch, two lengths of 4 mm internal diameter polyethylene tubing (1 m length each), and a modified terry cloth 50-cm adjustable Velcro protective hockey collar (Easton Co., Van Nuys, California) with a 3-mm internal diameter metal tube. The first piece of tubing connected the regulator on the compressed air cylinder to the solenoid valve. The second piece of tubing connected the solenoid valve to the collar. The collar held the tube in place with the opening of the tubing affixed at the front center portion of the collar. Foam pads inside the collar set the distance of the tube opening at approximately 15 mm from the participant's throat. Airpuff delivery was controlled by the STIM stimulus presentation system (James Long Company, Caroga Lake, NY). The airpuff was a 50 ms, 100 psi burst of compressed air directed at the larynx. Participants received an airpuff during five of the 15 trials in the threat condition. In two trials, the airpuff occurred 12 seconds after the onset of the threat cue. In the other three trials, the airpuff was delivered at the 3, 5, or 14 second timepoints.

Slide Viewing (IAPS) Task

In the second task, participants were exposed to 30 color picture stimuli selected from the International Affective Picture System (IAPS; Lang et al., 2005).[1] Based on the ratings provided for the IAPS stimulus set, all the 30 pictures were of highly arousing material. Instructions for this task are included in Appendix B. The IAPS task consisted of one practice trial, followed by 30 experimental trials which showed pictures from one of two conditions: 1) positively valenced stimuli; 2) negatively valenced stimuli. The positive valence set (15 trials, valence = 7.11, arousal = 5.51) included images of food and erotica (nude male and female models). The negative valence (15 trials, valence = 2.46, arousal = 6.48) set included images of mutilation (human and animal), as well as threat (e.g. mugging, carjacking). The selected positive and negative valence pictures significantly differed on standardized valence and arousal ratings, with negative pictures rated more negatively valenced, t (14) = 22.59, p <.001, $d_{\text{effect size}}$ = 2.63 and

[1] The number of IAPS pictures were as follows: negative (1120, 1930, 2352.2, 3030, 3100, 3150, 3170, 3400, 6250, 6370, 6550, 6571, 7380, 9300, 9405) and positive (4652, 4659, 4660, 4664, 4681, 7200, 7230, 7260, 7280, 7330, 7350, 7430, 7460, 7470, 7480).

more arousing, t (14) = 4.15, p =.001, $d_{\text{effect size}}$ = .23, on standardized measures. During the practice trial subjects viewed one neutral valence stimulus that was not part of the main stimulus set. During each trial, a picture was presented to the participant for 15 s, followed by a 2 s presentation of a white square which signaled the end of the trial. The subsequent ITI (in which a blank screen was shown) lasted approximately 5 seconds, during which time subjects were asked to provide a self-report of their subjective experience using the Self-Assessment Manikin (SAM; Lang, 1985). The SAM is composed of two sets of five figures (manikins), used to assess participants' subjective experience of valence and arousal to each IAPS picture. Ratings of each dimension are given on a 9-point scale, with positive valence and high arousal at 1, and negative valence and low arousal at 9. The positive valence set had a mean valence = 2.46 and arousal = 5.51. The negative valence set had a mean valence = 7.11 and of arousal = 6.48. The experimenter recorded the participants' verbal ratings during the ITI at the end of each picture presentation. The manikins are included in Appendix C. Trials were presented to each participant in a quasi-randomized order, with each participant receiving the same order of presentation.

Measures

Diagnostic Measures

The Affective Control Scale (ACS; Williams, Chambless, & Ahrens, 1997) is a 42-item self-report measure assessing fear of emotions and attempts to control emotional experience. The total scores are normally distributed with a mean of 3.37 (SD = 0.78), with acceptable test-retest reliability *(r* = 0.78), Subscales include (1) fear of anxiety (e.g., ''It scares me when I am nervous''); (2) fear of depression (e.g., ''When I get ''the blues'', I worry that they will pull me down too far''); 3) fear of anger (e.g., ''I am afraid that letting myself feel really angry about something could lead me into an unending rage''); and (4) fear of positive emotions (e.g., ''I worry about losing self-control when I am on cloud nine''). Items are scored on a 7-point Likert-type scale (i.e., ''Strongly Agree'' to ''Strongly Disagree''). The subscales have demonstrated satisfactory internal consistency: α = 0.72 anger; α = 0.91 depression; α = 0.89 anxiety; α = 0.84 positive affect (Berg, Shapiro, Chambless, & Ahrens, 1998; Williams et al., 1997). The ACS total score is highly correlated with neuroticism and emotional control (Emotional Control Questionnaire; Rapee, Craske and Barlow, 1989; r = -0.72) and minimally correlated with social desirability (Marlowe-Crowne Social Desirability Scale; Crowne and Marlowe, 1964; r = -0.17) (Berg et al., 1998; Williams et al., 1997). A copy of the measure is included in Appendix D. Both total scores and subscale scores were computed.

The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36-item multidimensional self-report measure assessing individuals' characteristic patterns of emotion dysregulation. It contains six subscales that were theoretically formulated and confirmed through factor analysis. The six subscales are: Nonacceptance of Emotional Responses (NONACCEPTANCE), Difficulties Engaging in Goal-Directed Behavior (GOALS), Impulse Control Difficulties (IMPULSE), Lack of Emotional Awareness (AWARENESS), Limited Access to Emotion Regulation Strategies (STRATEGIES), and Lack of Emotional Clarity (CLARITY). Although the DERS is a relatively new measure, preliminary empirical studies have been promising. It has exhibited good overall internal consistency (α = .93) and adequate subscale reliability with Cronbach's α > .80 for each subscale (Gratz & Roemer, 2004). A copy of the measure is included in Appendix E. Both total scores and subscale scores were computed.

Self-report of Cognitive Behavioral Strategies

The Emotion Regulation Questionnaire (ERQ; Gross & John, 1998) is a 10-item self-report questionnaire that assesses the emotion regulation style of respondents. Regulation style is divided into two subscales that measure a) the extent to which someone regulates their emotions through cognitive reappraisal and b) the extent to which someone suppresses their emotions for purposes of regulation. The measure shows high internal consistency as well as high test-retest reliability (Gross & John, 2003). A copy of the measure is included in Appendix F. Separate subscale scores were computed to assess to what extent participants separately use reappraisal and suppression strategies.

The Mindful Attention and Awareness Scale (MAAS; Brown & Ryan, 2003) is a 15-item questionnaire that assesses a single factor, present attention/awareness. The items are rated on a six-point Likert-type scale ranging from 1 (almost always) to 6 (almost never) with higher scores indicative of more mindfulness. Coefficient alpha has ranged from .82 in an undergraduate sample to .87 in a general adult sample. The MAAS is also associated positively has been shown to be positively correlated with as positive affect (r = .30) and negatively correlated with negative affect (r=.39) on the Positive and Negative Affect Schedule (PANAS;Watson, Clark, & Tellegen, 1988). In contrast, it was inversely related to negative affect. A copy of the measure is included in Appendix G.

Psychophysiological Measures

Electrocardiogram (ECG)

ECG data were collected during a resting baseline condition and throughout both tasks using two disposable self-adhesive electrodes (Kendall Hydro-Snap) placed on the left shoulder and right external oblique muscle of the abdomen of the participant. The ECG signals were amplified with a custom bioamplifier (Gain=250, HPF=1 Hz, LPF=1250 Hz) from SA Instruments (San Diego, CA), and the signal was digitized with Snap-Master data acquisition software (HEM Data Corp.) in combination with a 16-bit analog to digital converter (Input range=+/- 5V). The sampling rate was 1024 Hz and processing of the ECG signal was carried out using the IBI Analysis System from James Long Company (Caroga Lake, NY).

Prior to the computation of heart rate, R-wave detection was carried out offline using a 4-pass self-scaling peak detection algorithm that produced a data file containing the onset times of each detected R-wave in the physiological record (ECGRWAVE software, James Long Company). For artifact editing, the sampled ECG signal was viewed graphically alongside tick marks representing the times of software-detected R-waves. In the rare case of an obscured R-wave that was not detected by the software algorithm, a tick mark was inserted into the graphical ECG record (with the software automatically updating the list of R-wave times). If the undetected R-wave was visible in the ECG, it was marked manually. If the R-wave was not visible, the tick mark was placed based on specific editing rules (Byrne & Porges, 1993). The edited R-wave series was then converted to a time series with a sampling interval of 250 ms. Interbeat intervals spanning two sampling intervals were prorated between these two intervals using a weighted-mean algorithm. Separate mean IBI values were computed for the positive and negative picture presentation conditions of the IAPS task, and for the safe and threat conditions during the airpuff task. These mean IBI values (in ms) were then converted to beats per minute (HR) using the following equation: HR = 60,000/IBI (Berntson, Quigley, & Lazano, 2007).

As the acoustic probe for the eyeblink startle (see below) and/or the presentation of the airpuff would have contaminated the ECG signal, HR data were analyzed only from trials in which a startle probe or airpuff was not presented, or when a startle probe or airpuff was presented at 12s or 14s into the trial. This gave a total of nine trials for which HR data could be analyzed. Of these nine trials, a mean value was only computed for participants who had at least seven usable data points after artifact editing procedures had been carried out.

Eyeblink Startle

Startle responses were collected using two 3mm Ag-Ag/Cl miniature electrodes (Rochester Electro-Medical, Tampa FL). Electrode placement and measurement of the eyeblink startle reflex was based on prior procedures described by Blumenthal, Cuthbert, Filion, Hackley, Lipp & van Boxtel (2005). One electrode was placed at the margin of the bony orbit centered on the iris below the right eye, with the second electrode placed 10 mm lateral to the first. The raw electromyographic (EMG) signals were amplified using a custom bioamplifier from SA Instrumentation (San Diego, CA), with hardware filter settings at 1 Hz (high pass) and 500 Hz (low pass). Bioamplifier gain for the EMG channel was set at 4000. The EMG data were digitized online (1024 Hz sampling rate) to the hard drive of a Pentium IV PC using a 16-bit A/D converter (working range +/-5 V) and Snap-Master acquisition software (HEM Data Corp, Southfield MI).

Prior to analysis, the EMG signals were digitally filtered between 28 and 500 Hz after employing a band-stop 60 Hz filter. The signals were then rectified and smoothed using a boxcar filter (low pass=50 Hz). Peak eyeblink amplitude was determined as the maximal peak value in the 20-120 ms time frame following the onset of the acoustic probe. If two peaks occurred in this time frame, the larger of the two was scored. If no startle response was detectable for a given probe, for a given participant, startle amplitude for that trial was scored as zero. Mean startle amplitude refers to the practice of averaging only those startle responses which were actually determined to have occurred. Mean startle magnitude refers to the practice of including nonresponses, set to zero, within the average. Thus, mean startle magnitude refers not only to the degree of average response, but also the probability of response. In line with the bulk of the adult literature on psychopathy and startle modulation (Carmen, Moltó, Vila, & Lang, 2003; Patrick, Bradley, & Lang, 1993; Sutton, Vitale, & Newman, 2002) analyses will rely on the startle magnitude measure. Separate mean startle magnitudes were computed for participants during positive and negative picture presentations during the IAPS task, and for the safe and threat conditions during the airpuff task.

In order to elicit eyeblink responses, acoustic startle probes (50 ms, 95 dB, burst of white noise with immediate rise time) were presented to the participants over Telephonics headphones. During the IAPS task, participants received a total of 24 probes, split evenly between the positive and negative valence conditions. Probes occurred at 3, 5, 12 or 14 s after stimulus onset, with participants receiving three probes at each of these four time points. During the airpuff task, participants were probed in the same manner as during the IAPS conditions for the safe condition only. During the threat condition participants were probed differently to account for the presentation of the airpuff. For the ten threat trials that participants did not receive an airpuff, startle probes were presented twice during the four probe presentation times for a total of eight probe trials.

In both tasks, startle probes were also presented in the ITI. In order to decrease the predictability of the startle probe, a total of 11 acoustic probes were presented during the ITI at 3s after ITI onset (6 during the positive and negative conditions; 6 during the safe condition; 4 during the threat condition and one after an airpuff). To further decrease the predictability of the probe, and reduce the chances of habituation, the startle probe was not presented during 3 trials of each condition.

Event-Related Potentials

The EEG signal was recorded from 19 scalp sites (Fp1, Fp2, F7, F8, Fz, F3, F4, Cz, C3, C4, Pz, P3, P4, P7, P8, T7, T8, O1, O2) plus both ears, using lycra stretch caps (Electro-Cap) with sewn-in tin electrodes according to the 10-20 system of electrode placement. The signal from the earlobes was collected using clip-on electrodes. Sampling rate was 1024 Hz with bioamplifier filter settings of .1 Hz high pass and 100 Hz low pass (half power cutoff frequencies, 12 dB/octave rolloff). One bipolar EOG channel was recorded from above and below the left eye using similar bandpass settings. The EEG and EOG signals were amplified by a factor of 4000 using a custom bioamplifier from SA Instruments (San Diego, CA).

The EEG signal was digitized onto a PC using a 16-bit A/D converter (+/- 5 V input range) and HEM Snap-Master data acquisition software. Further processing and analysis of the EEG signal was carried out using software from James Long Company. Epochs containing artifactual EEG (+/- 125 μV) were automatically removed from further analysis. Blinks in the EOG signal were regressed out of the EEG using a regression procedure based on methods described in the literature (Lins, Picton, Berg, & Scherg, 1993a, 1993b). The EEG channels were collected referenced to Cz, and then re-referenced offline to an average ears reference configuration. Before derivation of the ERPs, the EEG signal was subjected to digital filtering with a low pass setting of 20 Hz.

Based on prior research (e.g., Moser et al., 2006), the LPP was quantified at the Pz electrode site and was defined as the mean amplitude in the 350-600 ms window following stimulus onset, averaged relative to a 200 ms pre-stimulus baseline. ERPs were computed separately for the onset (LPP1) and offset (LPP2) of positive and negative picture presentation during the IAPS task and for onset (LPP1) and offset (LPP2) of the safe and threat conditions during the airpuff task. Figures 1 through 3 show the timeframes for data collection and stimulus presentation.

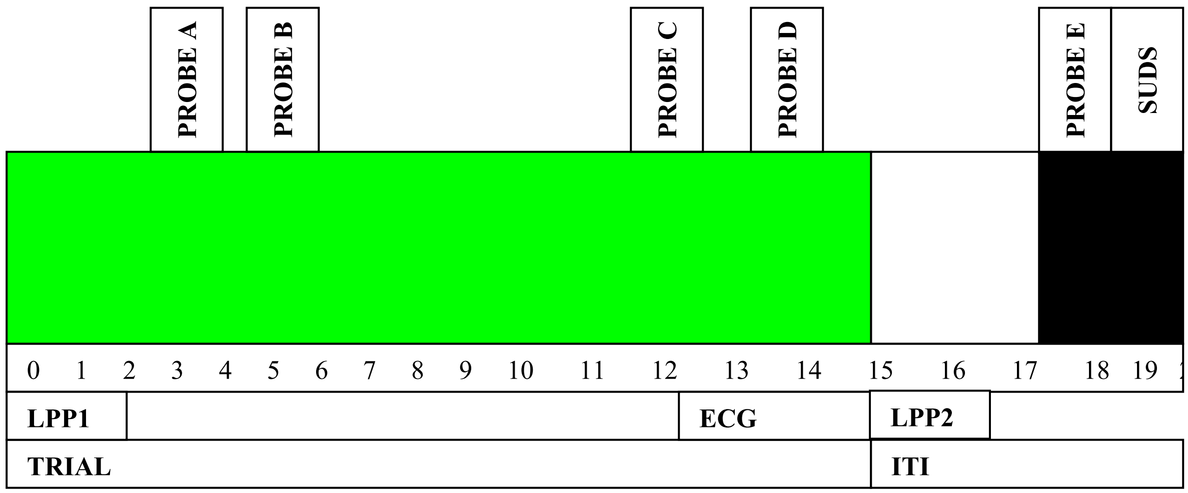

Figure 1. Diagram of stimulus presentation, data recording, and timing for trials. Example is that of a “safe” trial during the airpuff task. The timing of the four possible startle probes are shown, however, only one probe was presented during a trial.

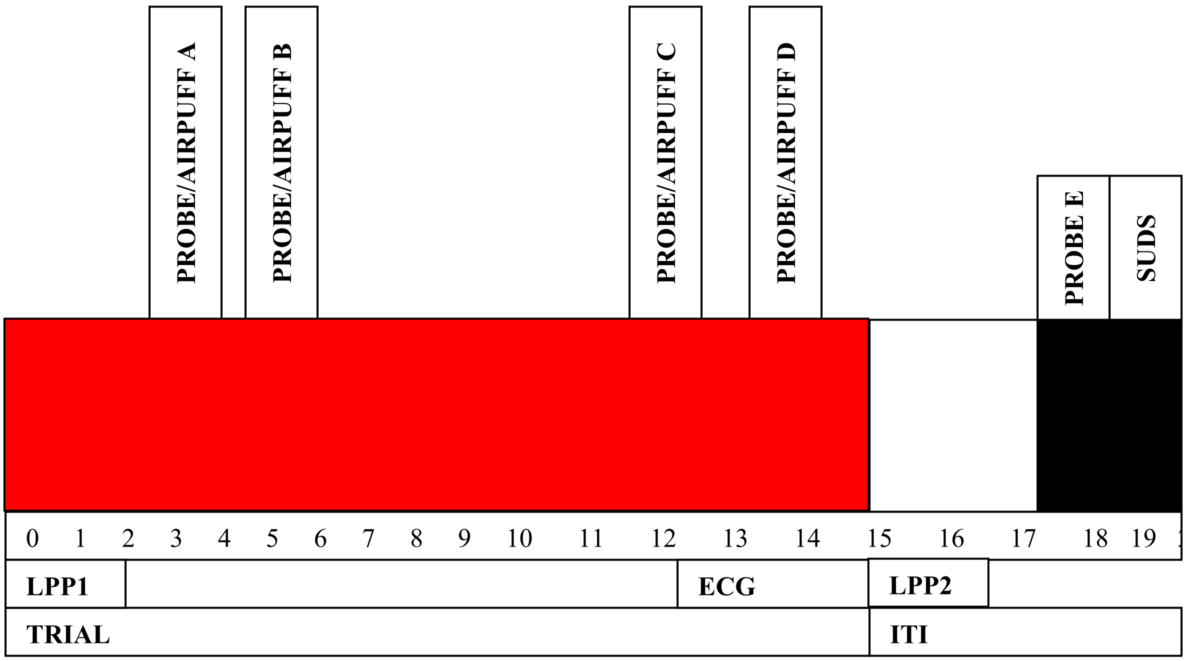

Figure 2. Diagram of stimulus presentation, data recording, and timing for trials. Example is that of a threat trial during the airpuff task. The timing of the four possible startle probes or airpuffs are shown, however, only one probe or airpuff was presented during a trial.

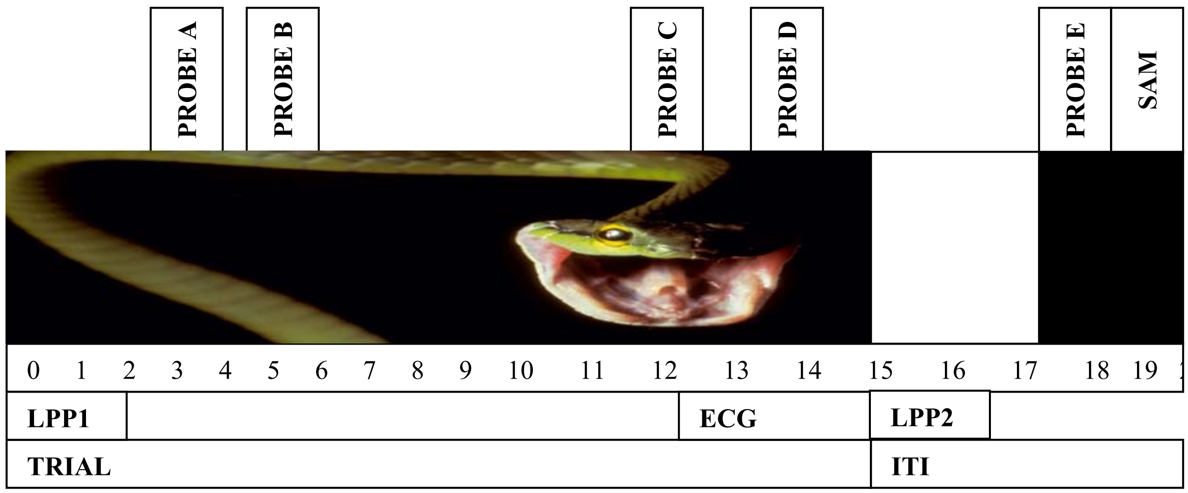

Figure 3. Diagram of stimulus presentation, data recording, and timing for trials. Example is that of a negative valence trial during the IAPS task. The timing of the four possible trial probes are shown, however, only one startle probe was presented during a trial.

Hypotheses and Data Analysis Plan

Self-report of Strategies & Emotional Processing

To assess effective randomization of participants into experimental groups, Analyses of Variance (ANOVAs) were conducted separately for participants' self-report use of cognitive behavioral strategies (ERQ & MASS), and general diagnostic measures of emotional processing (ACS & DERS). Groups were not expected to differ in their use of these strategies and in their overall emotional well being.

Self-report during Emotion Inductions

To examine whether the strategies were associated with changes in participants' report of their experiences, and if this difference varied by the valence of the stimulus, mean SUDS scores were computed separately for the safe and threat conditions for the airpuff task. In addition, mean SAM valence and SAM arousal scores were computed separately for the presentation of the positive and negative valence slides from the IAPS task. Paired sample t-tests were then conducted across conditions (e.g. safe vs. threat). Averaging across groups, participants were expected to rate the negative IAPS slides as more arousing than the positive IAPS slides, and to rate them as more negatively valenced. Participants were also expected to generally report higher SUDS scores during the threat condition of the airpuff task compared with the safe condition.

In order to test the effect of time across the experiment, mean early and late values were computed separately for each valence of the emotion induction. As the number of trials were uneven for all conditions, (fifteen), data were treated as if there were sixteen trials, with the eighth trial included as part of the mean values for both the early and late means. For example, for the SUDS safe condition, a mean score was computed for the first half of the experiment (SUDS $safe_{early}$), which was the average value for the first eight SUDS responses given during the safe condition. This method of computing early and late values was also used for heart rate, and eyeblink startle magnitudes.

Participants in the acceptance group were expected to report higher arousal, valence and discomfort compared with the reappraisal and suppression conditions. The means for the control group were expected to fall between the levels for the acceptance group and the other two groups (reappraisal and suppression). This effect was anticipated to be especially strong during the early part of the experiment, and was expected to diminish towards the end of the experiment such that the acceptance and control groups would not differ from one another at this point. In order to test these hypotheses, four (strategy) by two (time) factor repeated measure Analyses of Variance (ANOVAs) were conducted. Analyses were conducted separately for the different valence components of the emotion inductions, resulting in six ANOVAS (i.e., positive SAM arousal/valence; negative SAM arousal/valence; safe SUDS; threat SUDS). Where appropriate, the Greenhouse–Geisser correction was applied to *p* values for the repeated measures comparisons.

Heart Rate

Previous research comparing the effect of multiple cognitive behavioral strategies on mean HR using between subject designs has produced conflicting results. In a sample of panic disorder patients, Levitt et al. (2004) did not find significant differences in mean HR between acceptance, suppression or a control strategy (in which no explicit instructions were given) during a 15-minute CO_2 challenge. Hofmann et al. (2009) compared mean HR for acceptance, reappraisal and suppression strategies during a ten minute speech episode, with the use of a suppression strategy being found to significantly increase heart rate from baseline compared with the other two conditions. The present study examined heart rate during much shorter time epochs (at most 15s per trial), across multiple measures of arousal and valence, and between two separate forms of emotion inductions. It was hypothesized that there would be significant differences between the experimental groups in mean HR for a given condition (e.g. comparing mean HR during the safe condition), as well as differences in the pattern of heart rate reactivity between the experimental groups (e.g. comparing the differences in HR between the safe and threat conditions). Rather than expect HR increases to the negatively valenced stimuli (e.g., in anticipation of a possible airpuff), it was hypothesized that *fear bradycardia* (i.e., HR decreases; Campbell, Wood, & McBride, 1997) would occur as these stimuli would be moderately arousing to a group of well adjusted college students. During the emotion inductions, averaging across groups, participants were therefore hypothesized to show significantly slower heart rates during the threat compared with the safe condition, and during the negative compared with the positive condition of the IAPS task. In addition, across emotion inductions, participants were expected to demonstrate greater HR slowing during the threat condition compared with viewing negative valence slides, as it was hypothesized that the airpuff condition would generate greater anticipatory physiological reactivity compared with the negative IAPS slides condition. Similarly, participants were also expected to have faster heart rates during the safe condition compared with viewing the positively valenced slides. In order to test these hypotheses, mean HR values were computed separately for the safe and threat conditions from the airpuff task, and the positive and negative conditions from the IAPS task.

Participants in the acceptance condition were expected to demonstrate decreased HR during the negative valence conditions and increased HR during the positive valence condition compared with the reappraisal and suppression groups. The means for the control group were expected to fall between the levels for the acceptance group and the other two groups (reappraisal and suppression). This effect was anticipated to be especially strong during the early part of the experiment, and was expected to diminish towards the end of the experiment such that the acceptance and control groups would not differ from one another at this point. In order to test these hypotheses, four (strategy) by two (time) factor repeated measure Analyses of Variance (ANOVAs) were conducted. Analyses were conducted separately for the different valence components of the emotion inductions, resulting in four ANOVAS (i.e. positive HR; negative HR; safe HR; threat HR). Where appropriate, the Greenhouse–Geisser correction was applied to *p* values for the repeated measures comparisons.

Eyeblink Startle

Eyeblink startle magnitude was expected to be significantly higher for the threat condition compared with the safe condition in the airpuff task, and was expected to be higher for the threat condition compared with the negative condition of the IAPS task (Lissek et al., 2007). Negative pictures were also expected to elicit larger startle magnitudes compared with positive valence pictures. In order to examine these differences, mean startle values were separately computed for the safe, threat, negative and positive conditions.

Between groups, it was expected that participants using reappraisal and suppression strategies would demonstrate significant attenuation of their startle responses (regardless of valence) compared with the acceptance group. The means for the control group were expected to fall between the levels for the acceptance group and the other two groups (reappraisal and suppression). This effect was anticipated to be especially strong during the early part of the experiment, and was expected to diminish towards the end of the experiment such that the acceptance and control groups would not differ from one another at this point. In order to test these hypotheses, four (strategy) by two (time) factor repeated measure Analyses of Variance (ANOVAs) were conducted. Analyses were conducted separately for the different valence components of the emotion inductions, resulting in four ANOVAS (i.e. positive eyeblink; negative eyeblink; safe eyeblink; threat eyeblink). Where appropriate, the Greenhouse–Geisser correction was applied to *p* values for the repeated measures comparisons.

Late Positive Potential

The present study is the first to attempt to elicit an LPP response during an associative learning task (i.e. the airpuff task), rather than to specific complex visual stimuli. In general, it was hypothesized that LPP1 amplitude would be significantly higher during the IAPS task compared with the conditions of the airpuff task. Mean LPP amplitudes were computed for the safe, threat, negative and positive conditions and these values were compared with each other using planned paired-sample t-tests.

To date, three studies have shown the LPP to be sensitive to intentional emotion regulation manipulations (Krompinger et al., 2008; Moser et al., 2007, 2009). These studies employed within-subjects designs, with only a suppression/reappraisal regulation strategy found to be effective in changing LPP amplitude, so it is unclear if attenuated LPPs are a specific result of using suppression strategies, reappraisal strategies, or any instruction to reduce negative affect. Regardless, participants in the acceptance condition were expected to demonstrate the largest LPP amplitude, followed by the control group, with the reappraisal and suppression groups expected to show the smallest LPP amplitudes.

As the ERPs were averaged from all available data, split half analyses could not be conducted. However, it was expected that differences in LPP amplitude could be measured during stimulus onset and offset for each trial. The LPP is traditionally measured 350-600 ms following stimulus onset, but it has also been shown to be sensitive to emotional processing up to 800ms after pleasant picture *offset* and 1000ms after negative picture *offset* (Hajcak & Olvet, 2008). As such, not only was LPP amplitude measured during stimulus onset (denoted as LPP1), the amplitude of this component was also computed for the stimulus offset cue when the white square was presented to signal the end of the trial (denoted as LPP2). This was measured for both the airpuff and IAPS tasks. It was hypothesized that LPP2 amplitude (in relation to LPP1) could be used as a measure of within-trial habituation, and that the LPP2 would be smaller in amplitude to LPP1, indicative of decreased attentional and emotional processing to the stimulus.

In order to test these hypotheses, four (strategy) by two (time) factor repeated measure Analyses of Variance (ANOVAs) were conducted. Analyses were conducted separately for the different valence components of the emotion inductions, resulting in four ANOVAS (positive, negative, safe, and threat). Where appropriate, the Greenhouse–Geisser correction was applied to *p* values for the repeated measures comparisons.

CHAPTER 3

RESULTS

Self-report

Diagnostic Measures

Analyses of Variance (ANOVAs) were conducted on the trait measures of emotional processing, (ACS; DERS) and cognitive behavioral strategies (ERQ; MAAS). As seen in Table 1 below, across the strategies, participants did not differ in their trait emotional processing. ANOVAs were also conducted on the trait measures of cognitive behavioral strategies. There was no main effect of group for trait use of reappraisal strategies, $F(3, 91) = 1.05$, p NS, suppression strategies, $F(3, 91) = .18$, p NS, or mindful attention, $F(3, 91) = .24$, p NS.

SAM Arousal on IAPS Task

As a manipulation check, a paired sample t-test was performed to see if participants differed in their SAM arousal ratings for positive pictures compared with negative pictures in the IAPS task. Across the whole sample, participants rated the negative pictures more arousing than the positive pictures, $t\ (94) = 2.35$, $p <.05$, $d_{\text{effect size}} = .24$.

Table 1

ANOVA results between Strategies for Emotional Processing

Measures	df	F	*p*
		ACS	
ACS Total	3	0.45	0.72
Within Group Error	91	0.55	
ACS Anger	3	0.68	0.57
Within Group Error	91	0.80	
ACS positive	3	1.15	0.33
Within Group Error	91	0.72	
ACS Depressed	3	0.85	0.47
Within Group Error	91	1.36	
ACS Anxiety	3	0.02	1.00
Within Group Error	91	0.96	
		DERS	
DERS Total	3	1.17	0.33
Within Group Error	91	0.12	
DERS NONACCEPTANCE	3	0.84	0.48
Within Group Error	91	0.50	
DERS GOALS	3	0.75	0.52
Within Group Error	91	0.35	
DERS IMPULSE	3	0.68	0.57
Within Group Error	91	0.20	
DERS AWARENESS	3	1.84	0.15
Within Group Error	91	0.23	
DERS STRATEGIES	3	0.92	0.44
Within Group Error	91	0.23	
DERS CLARITY	3	1.99	0.12
Within Group Error	91	0.15	

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted on the arousal ratings for the negative and positive slides to assess the effectiveness of the groups to attenuate arousal ratings. There was no main effect of group on arousal while viewing positive, $F(3, 91) = .02$, p NS, or negative valence slides, $F(3, 91) = .46$, p NS. There was a main effect of time such that participants rated positive slides more arousing earlier in the experiment compared with later, $F(1, 91) = 4.31$, $p <.05$. There was no main effect of time as participants watched negative valence slides, $F(1, 91) = 3.76$, p NS. There was no group by time interaction while viewing positive, $F(3, 91) = 1.57$, p NS, or negative valence slides, $F(3, 91) = .85$, p NS.

SAM Valence in IAPS Task

A paired sample t-test was performed to see if the overall valence ratings for positive pictures were higher than for negative pictures. Over the whole sample participants rated positive pictures significantly more positive than negative pictures, $t\ (94) = 23.74$, $p <.001$, $d_{effect\ size} = 2.44$.

Separate four (strategy) by two (time) factor repeated measures ANOVAs were conducted on the arousal ratings for the negative and positive slides to assess the effect of the groups on subjective valence ratings. There was no main effect of group for positive valence slides, $F(3, 91) = 1.10$, p NS. There was a significant main effect of group for negative valence slides, $F(3, 91) = 4.21$, $p <.01$. There were main effects for time while viewing both positive, $F(1, 91) = 5.45$, $p <.05$, and negative valence slides, $F(1, 91) = 13.89$, $p <.001$, such that participants rated slides in the positive condition as less positive in the late compared with the early stages of the IAPS task, and rated slides in the negative condition as more negatively valenced later compared with earlier in the experiment. There was no group by time interaction while viewing positive, $F(3, 91) = .48$, p NS, or negative valence slides, $F(3, 91) = .68$, p NS.

In terms of the main effect of group for negative slides, follow-up Tukey corrected pairwise comparisons found that participants in the Acceptance group rated negative slides as more negative compared with the suppression group (see Table 2 below).

A post-hoc contrast was conducted on the negative valence ratings to determine if the Acceptance and Control groups reported higher valence ratings compared with the reappraisal and suppression groups. Participants in the acceptance and control groups were found to rate the negative pictures as more negative compared with the reappraisal and suppression groups, t (91) = 3.26, p <.05, $\omega^2 = .09$.

Table 2

Means for Self-Reported Distress and Emotion

	Acceptance	Reappraisal	Suppression	Control
Positive Arousal	5.72	5.70	5.69	5.77
Negative Arousal	5.02	5.48	5.15	4.99
Positive Valence	3.38	3.35	3.63	3.72
Negative Valence	7.41a	6.88	6.61a	7.20
SUDS safe	1.90	2.43	1.93	2.26
SUDS threat	4.79	4.63	4.57	4.52

Note. Means in the same row that share a subscript differ at p<.05 in the Tukey honestly significant difference comparison.

SUDS in Airpuff Task

A paired sample t-test was conducted to see if participants differed in their ratings of discomfort during the safe compared with the threat condition in the airpuff task. Participants reported higher SUDS scores during the threat condition compared with the safe condition, t (94) = 12.66, p <.001, $d_{\text{effect size}}$ = 1.28.

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted on the SUDS ratings for the safe and threat conditions to assess the effect of the strategies on subjective discomfort. There was no main effect for group on SUDS ratings during the safe, F(3, 91) = .81, p NS, or threat condition, F(3, 91) = .12, p NS. There was a main effect for time during the safe, F(1, 91) =16.52, p <.001, and threat condition, F(1, 91) = 26.18, p <.001, such that participants' SUDS scores, regardless of the condition, were higher earlier compared with later in the experiment. There was no group by time interaction during the safe, F(3, 91) = .49, p NS, or threat condition, F(3, 91) = 1.06, p NS.

Psychophysiological Measures

Heart Rate

Due to data collection errors and artifacts (e.g. participant movement) in the ECG signal, data from a total of 16 participants were lost. Data were lost for: 2 participants in the acceptance group (*n*=22); 4 participants in the reappraisal group (*n*=19); 5 participants in the suppression group (*n*=20); and 5 in the control group (*n*=18). To test if the number of participants' data lost differed by group, a 4 (strategy) X 2 (data loss) chi square analysis was performed. Results showed that data loss did not significantly vary by group, $\chi 2$ = (3, N = 95) = 1.82, p NS.

Airpuff Task

A paired sample t-test was conducted to determine if participants' heart rates differed between the safe and threat conditions in the airpuff task. Overall, participants' heart rates were significantly lower during the threat condition compared with the safe condition of the airpuff task, $t\,(79) = 9.38$, $p < .001$, $d_{\text{effect size}} = 1.02$.

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted for the safe and threat conditions to assess the effect of the groups on heart rate. There was no main effect for group during the safe, $F(3, 75) = .13$, p NS, or the threat condition, $F(3, 75) = .13$, p NS. There was a main effect for time during both the safe, $F(1, 75) = 26.07$, $p < .001$, and threat condition, $F(1, 75) = 12.77$, $p = .001$, such that participants' heart rates were significantly slower earlier compared with later in the task. There was no group by time interaction during the safe, $F(3, 75) = .77$, p NS, or threat condition, $F(3, 75) = 2.05$, p NS.

IAPS Task

A paired sample t-test was conducted to determine if participants' heart rates differed between the positive and negative conditions of the IAPS task. Overall, participants' heart rates were significantly slower while viewing negative pictures compared with positive pictures on the IAPS task, $t\,(79) = 3.05$, $p < .01$, $d_{\text{effect size}} = .32$.

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted for the positive and negative conditions to assess the effect of the groups on heart rate. There was no main effect for group while viewing positive, $F(3, 75) = .16$, p NS, or negative valence slides, $F(3, 75) = .31$, p NS. There was a main effect for time while viewing both positive, $F(1,75) = 34.61$, $p < .001$, and negative valence slides, $F(1, 75) = 12.57$, $p < .01$, such that participants' heart rates were significantly slower earlier compared with later in the experiment. There was no group by time interaction while viewing positive slides, $F(3, 75) = 2.41$, *p* NS. There was a significant group by time interaction while viewing negative valence slides, $F(3, 75) = 2.92$, $p < .05$.

Simple effects tests were conducted in order to interpret the group by time interaction for the negative valence condition. Participants' heart rates while viewing negative slides were significantly slower earlier in the task compared with later for the acceptance and suppression groups. In contrast, participants' heart rates did not differ early compared with later in the experiment for the reappraisal and control groups.

Eyeblink Startle Magnitude

Due to data collection errors and artifacts (e.g. participant movement) in the EMG signal, data from a total of 23 participants were lost. Data were lost for: 6 participants in the acceptance group (n=18); 6 participants in the reappraisal group (n=17); 6 participants in the suppression group (n=19); and 5 in the control group (n=18). To test if the number of participants' data lost differed by group, a 4 (strategy) X 2 (data loss) chi square analysis was performed. Results showed data loss did not significantly vary by group, $\chi 2 = (3, N = 95) = .13$, p NS.

Airpuff Task

A paired sample t-test was conducted to determine if the overall magnitude of startle responses differed within the safe and threat conditions of the airpuff task. Participants' startle responses were found to be significantly higher during the threat compared with the safe condition on the airpuff task, $t\,(75) = 7.80$, $p < .001$, $d_{\text{effect size}} = .90$.

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted separately for the safe and threat conditions to assess the effect of the strategies on eyeblink startle magnitude. There was a main effect for group during both the safe, $F(3, 72) = 5.21$, *p*

<.01, and threat conditions, $F(3, 72) = 4.03$, p<=01. There was a main effect of time for both the safe, $F(1, 72) = 39.78$, $p < .001$, and threat conditions, $F(1, 72) = 36.91$, $p = .001$, such that participants' startle magnitudes were significantly higher earlier compared with later in the task. There was no group by time interaction during the safe, $F(3, 72) = 1.14$, p NS, or threat condition, $F(3, 72) = 2.32$, p NS.

The main effects described above were followed up using Tukey corrected pairwise comparisons (Table 3). The Reappraisal and Suppression groups each had higher mean startle magnitudes compared with the Acceptance group during the threat condition. Participants in the Reappraisal group were found to have higher startle magnitudes than those in the Acceptance and Control groups during the safe condition.

Separate post-hoc contrasts were conducted on the mean eyeblink startle magnitudes during the threat and safe conditions to determine if the acceptance and control groups had higher mean magnitudes compared with the reappraisal and suppression groups. Participants in the reappraisal and suppression groups were found to have higher mean startle magnitudes compared with participants in the acceptance and control groups during the safe, $t(68) = 3.69$, $p < .05$, $\omega^2 = .15$, and threat condition, $t(68) = 3.58$, $p < .05$, $\omega^2 = .14$.

Table 3

Means for Psychophysiology

	Acceptance	Reappraisal	Suppression	Control
		Heart Rate		
Safe	77.73	76.80	76.48	75.39
Threat	74.81	74.35	72.94	73.34
Positive	75.39	73.67	73.89	74.00
Negative	74.95	72.76	73.18	72.64
		Eyeblink Startle Magnitude		
Safe	25.39a	72.58a,b	60.09	35.64b
Threat	55.10a,b	117.50a	119.08b	69.55
Positive	16.40a	50.23a	45.26	27.54
Negative	22.97	56.15	47.64	34.27
		Late Positive Potential Amplitude		
Safe	5.67	7.94	3.91	5.43
Threat	5.67	6.82	4.15	7.36
Positive	7.92	7.55	8.59	10.58
Negative	8.82	10.10	8.89	10.63
IAPS	8.37	8.83	8.74	10.81
Airpuff	5.67	8.11a	4.03a	7.43

Note. Means in the same row that share a subscript differ at $p<.05$ in the Tukey honestly significant difference comparison.

IAPS Task

A paired sample t-test was conducted to determine if participants' overall startle responses differed within inductions. Across the whole sample, participants' startle responses were significantly higher while viewing negative pictures compared with positive pictures, t (74) = 4.17, p <.001, $d_{\text{effect size}}$ = .49.

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted for the positive and negative conditions to assess the effect of the strategies on eyeblink startle magnitude. There were main effects for group while viewing the positive valence slides, $F(3, 71)$ =4.01, p<.05, and negative valence slides, $F(3, 71) = 2.93$, $p < .05$. There were main effects for time while viewing positive, $F(1, 71)$ =30.84, p <.001, and negative valence slides, $F(1, 71)$ =9.97, p <.01, such that participants startle magnitudes were significantly higher earlier compared with later in the task. There was a group by time interaction while viewing negative, $F(3, 71) = 3.12$, p <.05, but there was no interaction for viewing positive valence slides, $F(3, 71)$ = 1.58, p NS.

Tukey corrected pairwise comparisons were conducted to follow up the main effect for group while viewing positive valence slides. As seen in Table 3 above, participants in the Reappraisal group were found to have higher startle magnitudes than those in the Acceptance group.

Simple effects tests were conducted in order to interpret the group by time interaction for the negative valence condition. For the acceptance and reappraisal groups, participants' eyeblink startle magnitudes to negative slides were significantly higher earlier in the task compared with later. In contrast, participants' eyeblink startle magnitudes did not differ earlier compared with later in the experiment for the suppression and control groups.

Separate post-hoc contrasts were conducted on the mean eyeblink startle magnitudes during the positive and negative conditions to determine if the acceptance and control groups had higher mean magnitudes compared with the reappraisal and suppression groups. Participants in the reappraisal and suppression groups were found to have higher mean startle magnitudes compared with participants in the acceptance and control groups during the positive, t (68) = 3.69, p <.05, ω^2 = .12, and negative conditions, t (68) = 3.58, p <.05, ω^2 = .08.

Late Positive Potential Amplitude

Due to data collection errors and artifacts (e.g. participant movement) in the EEG signal, data from a total of 4 participants were lost. Data were lost for: 1 participant in the acceptance group (*n*=23); 2 participants in the reappraisal group (*n*=21); 0 participants in the suppression group (*n*=25); and 1 participant in the control group (*n*=22). To test if the number of participants' data lost differed by group, a 4 (strategy) X 2 (data loss) chi square analysis was performed. Results showed that data loss did not significantly vary by group, $\chi 2$ = (3, N = 95) = 2.25, p NS.

Paired sample t-tests were conducted to determine if participants' overall LPP1 amplitudes differed within emotion inductions. Participants LPP1 responses were not found to significantly differ during neither the threat compared with the safe condition in the airpuff task, t (90) = .24, p NS, $d_{\text{effect size}}$ = .01, nor during the negative compared with the positive condition in the IAPS task, t (90) = 1.73, p NS, $d_{\text{effect size}}$ = .17. Between inductions, participants' LPP amplitudes were higher during the IAPS task compared with the airpuff task, t (90) = 4.67, p <.001, $d_{\text{effect size}}$ = .50.

Airpuff

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted for the safe and threat conditions to assess the effect of the groups on LPP amplitudes. There was a main effect for group during the safe condition, $F(3, 87) = 2.81$, $p < .05$, but not during the threat condition, $F(3, 87) = 1.77$, *p NS*. There were main effects for time during the safe, $F(1, 87) = 11.86$, $p = .001$, and threat conditions, $F(1, 87) = 11.97$, $p = .001$, such that LPP1 amplitudes were significantly higher than LPP2 amplitudes within both these conditions. There was no group by time interaction during the safe, $F(3, 87) = 1.24$, *p* NS, or threat condition, $F(3, 87) = .53$, *p* NS.

Tukey corrected pairwise comparisons were conducted to analyze the main effect for group during the safe condition. As seen in Table 3 above, participants in the reappraisal group were found to have higher LPP amplitudes than those in the suppression group.

IAPS

Separate four (strategy) by two (time) factor repeated measure ANOVAs were conducted for the positive and negative conditions to assess the effect of the groups on LPP amplitudes. There was no main effect for group while viewing the positive valence slides, $F(3, 87) = .55$, *p* NS, and negative valence slides, $F(3, 87) = .85$, *p* NS. There was a main effect for time while viewing positive, $F(1, 87) = 52.42$, $p < .001$, and negative valence slides, $F(1, 87) = 61.57$, $p < .001$, such that LPP1 amplitudes were significantly higher than LPP2 amplitudes. There was no group by time interaction while viewing negative, $F(3, 87) = 1.30$, *p* NS, or positive valence slides, $F(3, 87) = .75$, *p* NS.

CHAPTER 4

DISCUSSION

The present study examined the effects of acceptance, reappraisal and suppression strategies on physiological and self-reported emotional reactivity among college undergraduates during exposure to two separate emotion induction tasks. This is the first study to not only directly test the effects of these three popular control strategies across more than one emotion induction manipulation, but to also use multiple channels of psychophysiological responses as outcomes. In addition, the present study used a racially and ethnically diverse sample with a reasonable gender balance. An acceptance-based strategy which emphasized embracing ones emotions fully rather than controlling them was expected to be associated with increased psychophysiological and subjective responding during the emotion inductions, compared with the other strategies early in the experiment, but to eventually habituate to the stimuli by the end of the experiment.

Contrary to expectations, participants who had been instructed to use reappraisal and suppression strategies were found to have significantly larger eyeblink startle magnitudes compared with participants who had been instructed to use the acceptance strategy as well as those in the control group. This effect was consistent across both emotion induction tasks and across time within each task. In general, participants' startle magnitudes were found to habituate over the course of the experiment. However, for the viewing of negatively valenced IAPS slides, participants in the reappraisal and acceptance group were found to have significantly larger decreases in startle magnitude during the IAPS task compared with the suppression and control groups. These results are in contrast with the majority of studies that have found the eyeblink startle response to decrease in response to regulation instructions (Jackson et al., 2000; Dillon &

LaBar, 2005; Lissek et al., 2007; Piper & Curtin, 2006). However, unlike the current study, these studies relied upon within- rather than between-subject designs, and did not include specific directions as to how to down-regulate mood.

While viewing negatively valenced slides, participants in the acceptance and suppression conditions demonstrated significantly faster heart rates later in the experiment compared with early in the experiment. These results are similar to the Levitt et al. (2004) study, in which acceptance and suppression strategies were not found to show significant differences in heart rates during a biological challenge compared with the control group. However, the current findings contrast with those of Campbell-Sills et al. (2006) and Hoffman et al. (2009) who found that suppression strategies increased sympathetic arousal. One possibility for the lack of findings here is that the present study did not have sufficient power to detect differences in heart rate. Hoffman et al. (2009) and Campbell-Sills et al. (2006) had approximately 67 and 30 participants per group respectively, whereas the present study had approximately 22-25 participants per group. Assuming a $1 - \beta$ of .80, a power analysis conducted prior to the start of this study estimated the present study would need approximately 12 to 148 participants per condition in order to detect a significant effect for all of the dependent self report and psychophysiological outcome variables (Erdfelder, Faul, & Buchner, 1996). The wide range of participants was a result of the multiple measures being used, as well as the wide range of effect sizes in the studies used to conduct the power analysis. Regardless, as Feldner et al. (2003) had approximately 12 participants per condition and found significant differences between groups it seems feasible that the present study had sufficient power to detect differences between the strategies. In addition, the Hoffman et al. (2009) study used behavioral suppression, which Gross & Levenson (1993) also found to increase sympathetic arousal, and the Campbell-Sill et al. (2006) study used participants with a history of psychopathology, which also likely increased the possibility for increased sympathetic activation. However, Levitt et al. (2004) used a sample of patients diagnosed with Panic disorder with and without Agoraphobia and also found null results. Finally, most other studies examined heart rate over a longer period of time. The present study examined heart rate over multiple trials each lasting approximately 15 seconds, compared with other studies that examined heart rate for much longer time periods ranging from 4.5 (Campbell-Sills et al., 2006) to 10 minutes (Hoffman et al., 2009) of emotion induction.

Contrary to expectations, the acceptance group did not have significantly mean higher LPP amplitudes than the other groups. In fact, the only significant difference for LPP amplitude was between the reappraisal and suppression strategies during the safe condition, wherein in the reappraisal condition was associated with significantly larger overall LPP amplitudes. These results are somewhat in line with Moser et al. (2006) who found that suppressing/reappraising leads to a decrease in overall LPP amplitude compared with attempts to increase emotional responses or to just look at the stimulus. As the instruction set in this study was generally to suppress, but also included some situational reappraisal directions, it seems that the main effect of reduced LPP amplitude in the Moser et al. (2006) study may be attributable to suppressing rather than reappraising.

No between group differences were found for participants' ratings of discomfort during the safe or threat condition, pleasantness ratings for positive pictures, or arousal ratings for positive or negative pictures. These results contradict the Krompinger et al (2008), Lissek et al. (2007) and Moser et al. (2006) studies that found participants were able to not only modulate their positive emotions, but could also modulate negative affect during an associative learning task in addition to a task in which they looked at IAPS pictures. Unfortunately, these studies used within-subjects designs that are sensitive to carryover effects between experimental conditions, and used non-specific instructions, making it difficult to attribute the results to the strategies used or other non-specific factors.

Group differences were found for participants' valence ratings of negative pictures, with participants assigned to the suppression condition rating these pictures as less negative compared with participants assigned to the acceptance condition. These results contrast with those from previous studies that have found suppression to be associated with significantly higher (Campbell-Sills et al., 2006; Feldner et al., 2003; Hoffman et al., 2009) or equal (Levitt et al., 2004) levels of distress or negative valence compared with acceptance. The present study used a similar instruction set and method of presentation for emotion induction as the Campbell-Sills et al. (2006) and Levitt et al. (2004) studies, but differed in the type of emotion induction, (IAPS slides versus film induction and CO_2 challenge respectively) which might partially explain the current results.

One particular point for discussion concerns the contradictory finding of increased startle responses in the reappraisal and suppression conditions compared with the other conditions. This finding leads to a number of possible re-interpretations of the essence of cognitive behavioral strategies, or a reexamination of the meaning of higher eyeblink startle magnitudes. It is possible that this reflects a general long-standing issue in emotion research, which is that self-reported and physiological indices of emotion have often been found to diverge, a phenomenon known as *response desynchrony* (Baker & Brandon, 1990; Craske, Sanderson, & Barlow, 1987). However, the startle pattern is uniformly higher for the reappraisal and suppression strategies compared with the acceptance and control conditions, regardless of the valence of the stimulus. Further, for all strategies, startle responses were higher for the threat and negative valence IAPS conditions compared with the positive IAPS and safe conditions, and self reports followed a similar pattern. Therefore response desynchrony in and of itself does not seem to be a sufficient explanation for the present results.

The motivational priming hypothesis of Lang et al. (1990) posits that defensive reactions (i.e. eyeblink startle magnitude) will be potentiated during aversive emotional states and relatively inhibited during pleasant states. The present results imply that *both* reappraising and suppressing in response to emotional stimuli leads to a paradoxical outcome, i.e. a decrease in subjective interpretation of the valence in stimuli accompanied by an increase in defensive physiology as indexed by the eyeblink startle response. It is possible that the participants' self-reports are more an artifact of the demand characteristics of the instructions rather than a result of the actual strategies. It would also suggest that participants' self-reports are not based on their physiological reactivity, but upon other physiological cues, or the demand characteristics of particular contexts. In other words, reappraising and suppressing may lead participants to focus more on their cognitions and their expectations of improved mood, and less on the actual negative affect they are experiencing.

A second explanation for the startle findings comes by way of Graham's (1977) attention-based theory of changes in eyeblink startle magnitude. According to Graham, the startle response is a measure of the salience of a particular stimulus for the viewer, with increased startle responding occurring as more attentional resources are given to a stimulus. In this case, as both reappraisal and suppression require participants to exert increased cognitive effort to attend, and then either manipulate the image or thought in their mind, or make efforts to not let their emotions show, the significantly higher startle responses indicate an increased attentional load in these conditions. In this light, it would make sense that there would be increased startle responses during both positive and the negative valenced stimuli for the reappraisal and suppression groups. As the control and acceptance groups are not instructed to “work” on their emotional responses, these groups do not show increased startle responses. In this sense, the self-report data would be congruent with the startle responses. The increased startle magnitudes for the reappraisal and suppression strategies during the safe and positive conditions may mean that participants were exerting more effort attempting to decrease their emotional reactions to the stimuli.

It is also possible that the current results can be interpreted differently for the reappraisal and suppression strategies. As discussed before, the reappraisal strategy was associated with increased LPP amplitudes compared with the suppression strategy during the safe condition in the airpuff task. Although this is the only condition with a significant difference, participants’ LPP amplitudes were higher for the reappraisal group compared with the suppression group for all other conditions except for the positive condition of the IAPS. This difference might be indicative of participants attending and processing stimuli differently as they reappraise or suppress, with those reappraising attending more to the stimulus in order to reinterpret the material. As such, Graham’s theory might apply more to those reappraising, indicative of more attentional resources associated with the stimuli, with Lang’s theory applying more to the suppression group, indicative of an increase in defensive responding and further support for the rebound effect of suppression. As the previous interpretations are speculative, further research to disentangle these results is warranted.

In general, participants were expected to have increased psychophysiological and subjective responding during the negative compared with the positive valence conditions within each emotion induction, regardless of the strategy used. Participants rated unpleasant pictures as more negatively valenced and more arousing than pleasant pictures, and rated the threat condition more uncomfortable than the safe condition. Participants' eyeblink startle magnitudes were significantly larger during the negative compared with the positive valence IAPS slides, as well during the threat compared with the safe condition during the airpuff task. Participants' heart rates were significantly slower while watching negatively valenced pictures as well as in anticipation of an aversive physical stimulus (i.e., the airpuff), and this effect was consistent across the experiment. For both conditions of each induction, participants' heart rates were slower early compared with later in the experiment. Initial LPP amplitude was found to be significantly higher in response to complex visual stimuli rather than an orienting stimulus to an associative learning task (i.e., the onset cues in the airpuff task). After 15 seconds of stimulus presentation, the stimulus offset cue elicited significantly higher LPP amplitudes for the associative learning task. The valence of the stimuli was not found to significantly alter LPP amplitudes.

The effect of repeated administration of stimuli did not lead to the hypothesized outcome of a general habituation of participants' self-reported subjective experience across all measures. Instead, the pattern of habituation varied according to stimulus type and measure. Participants were found to rate positive pictures as being more arousing and more positively valenced early in the experiment compared with late in the experiment. Participants' ratings of discomfort also habituated over the course of the experiment during both the safe and threat conditions. Interestingly, participants not only rated negative pictures equally arousing early compared with late in the experiment, but demonstrated sensitization rather than habituation to the valence of the stimuli as they reported the negative valence slides to be more negative during the second half of the experiment. Repeated administration of stimuli did lead to the hypothesized outcome of general habituation of psychophysiological responses, with a decrease in the extent of fear bradycardia, startle magnitudes, and LPP amplitudes across both conditions of each emotion induction task.

Clinical Implications

Overall, although the three experimental conditions were associated with significant differences in psychophysiological reactivity and subjective experience, these data are indicative of the utility of context-specific strategies, rather than the global superiority of one strategy over another. Understanding the mechanisms by which acceptance, reappraisal, and suppression influence emotional dysregulation is not merely an esoteric exercise. Greater understanding of these strategies has significant clinical implications. A number of clinical treatments have been developed that predominantly use one strategy or another. For example, Cognitive Processing Therapy (CPT; Resick, & Schnicke, 1992) is an empirically supported treatment for posttraumatic stress disorder (PTSD) that emphasizes survivors of trauma to reappraise the maladaptive cognitions they have related to the trauma they experienced. In this case, participants are reappraising their thoughts about a past event, in order to decrease the likelihood that they will continue to have maladaptive cognitions in the present and future. In contrast, Acceptance and Commitment Therapy (ACT; Hayes & Wilson, 1994) treats both positive and negatively valenced emotions as equally valued stimulus sets, with both sets of information seen as comments on the current experience. Experiential avoidance is considered the cause of psychopathology, and clients are asked to explore what they value most in life, and the ways in which their avoidance prevents them from achieving what they value. By leveraging the clients desire to achieve their valued goal, they are encouraged to radically accept the emotional experiences life has to offer. This type of strategy can be seen as especially important in treating a wide spectrum of psychopathology, anxiety disorders in particular.

Although CPT and ACT have found to be effective, multiple studies have demonstrated the emergent nature of an integrated CBT treatment approach when compared with using a single strategy alone (Butler et al., 2006). A number of clinical treatment protocols have begun to employ an eclectic array of regulation strategies. Dialectical Behavior Therapy (DBT; Linehan, 1987) uses an integrative approach for the treatment of Borderline Personality Disorder, incorporating behavioral strategies, mindfulness/acceptance, reappraisal as well as suppression strategies to address problematic interpersonal strategies, substance abuse/dependence, as well as suicidal and parasuicidal behavior. Seeking Safety (Najavits, Weiss, Shaw, & Muenz, 1998) uses mindfulness/acceptance, reappraisal, and suppression techniques in the treatment of comorbid PTSD and substance abuse. A similar approach has recently been initiated by David Barlow and associates (Moses & Barlow, 2006). In their unified treatment approach, Barlow and colleagues attempt to integrate reappraisal and acceptance based strategies into a unified treatment intervention. Although these strategies are a step forward in the treatment of psychopathology, few dismantling studies have been done to demonstrate how and when each regulation strategy should be employed, or when they are contraindicated. Future studies would do well to further examine this question, as well as examining what might prevent someone from switching to using a more adaptive strategy in a given situation.

Limitations

One caveat of the results is the present study did not perform systematic manipulation to determine if the pattern of observed results was directly attributable to participants' use of the instructed strategies. When confronted with emotional stimuli, participants have been known to use a variety of strategies to regulate their mood including depersonalization, muscle relaxation and visual or cognitive avoidance (Lissek et al., 2007). In addition, participants may or may have differed in their ability and or comfort with a particular strategy. Although the present study did use random assignment, it is still possible that there may have been an interaction between the strategy used and some unaccounted for idiographic factor specific to a participant. However, this limitation is not specific to the present study, and even in the Lissek et al. (2007) study, participants were not given explicit directions how to respond to the emotional stimuli presented to them, but were asked after the fact what strategies they used to suppress or enhance their mood. The qualitative list collected by Lissek et al. (2007) was not used in a systematic fashion to account for possible idiographic differences in processing the emotion inductions that the participants experienced.

A second limitation of this study is the use of a convenience sample of participants without any psychopathology. As research on intentional emotion regulation is still in its infancy, using this sample makes sense, but it does limit the generalizability of the results to particular groups experiencing clinically significant symptoms of psychopathology. This seems to be a minor limitation, as clinical studies using similar strategies have found similar results. For example, the Levitt et al. study (2004) used a sample of participants diagnosed with Panic Disorder. However, it is unclear how participants with increased sensitivity to emotional stimuli would respond to the different emotion inductions. For example, Borderline Personality Disorder (BPD) is characterized by severe disturbances in emotional reactivity. It is still unclear whether participants in this disorder suffer from deficits in their emotion regulation skills, increased sensitivity to emotional stimuli, or some combination of the two. Given this, participants with BPD or similar forms of psychopathology may be less willing to engage in the acceptance strategy, or, during this strategy, feel more overwhelmed by the emotions they experience.

Summary

Overall, the present study provides further evidence of the utility of combining multiple assessments of emotion, including psychophysiological measures, to elucidate the mechanisms by which psychological control strategies affect emotional experience. These strategies showed considerable effects on the startle response and self-report, with moderate effects on broad measures of arousal and attention. The present results are moderately in line with the mechanisms of change that have been theorized to underlie these strategies, and as such can help further shape treatment selection processes. Reappraisal and suppression strategies seem to be more effective at short term decreases of subjective negative affect, but may increase the reactivity to the stimulus. This might be a result of the effort which the participant may be reinterpreting as another type of feeling, or not attending to as they are spending more time attending to their cognitions rather than interoceptive cues. Although not directly examined during this study, acceptance based strategies have been shown to be effective at helping motivate people to actively change certain behaviors they engage in (e.g. Feldner et al., 2003; Levitt et al., 2004). The results of the present study seem to indicate that as theorized, acceptance is not effective at decreasing subjective and physiological feelings of discomfort, or valence. In addition, acceptance is not associated with an increase in subjective and physiological responding. It is unclear if the increased motivation to engage in repeated administrations of the emotion inductions found in other studies (Feldner et al., 2003; Levitt et al., 2004) is a result of general habituation processes, which decrease the interoceptive cues the participant experiences, or some other mechanism that is currently unexplored.

The current study also shows the importance of multiple measures of assessment in the study of emotion. If the present study only employed one physiological measure, and one method of self-report, many of the observed differences would not have been detected. Although eyeblink startle showed the largest response to the strategies, future studies should continue to employ multiple measures to provide convergent validity to the conclusions drawn from the results.

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APPENDIX A

COGNITIVE BEHAVIORAL STRATEGIES

Strategies

Instructions

You will now listen to an audiotape on which you will hear a description of how we would like you to approach the experiment. After you listen to the taped instructions, you may be given a brief quiz on the main ideas contained in these instructions, so please listen carefully, and try to remember the gist of the information.

Acceptance Script

I am going to spend some time discussing a way that you can approach the upcoming tasks, and your emotions in general. I would like you to listen as I describe this to you, and consider whether this fits with your experience.

What are emotions? Scientists and laypersons alike often have a difficult time coming up with a good working definition for emotion, even though we are constantly experiencing emotions throughout the day. How would you define emotions? (pause) For the sake of argument, let's define emotions as personal physical sensations and thoughts that let us know whether or not certain needs or motivations are being met by the outside world. I know, it sounds like a mouthful. But the most important thing to hold onto in this definition is that emotions provide us with information as to whether or not our needs are being met. If we define emotions this way, emotions aren't so complicated, and we can think of them like other physical reactions the body experiences. For example, we can think of hunger as the body letting us know that we are running low on energy and need to get some fuel pretty soon, kind of like when a car is running low on gas and the low fuel light turns on. The sensation of hunger runs on a continuum, from the sense of starvation when you have almost no food in your body, all the way to feeling full, when your stomach is almost at capacity. The fact is, we need to have both sensations to let us know when we need to start eating, as well as to let us know when we need to stop eating. The same goes for emotions. We have some emotions, like sadness, or anger, that let us know when our needs aren't being met, as well as some, like happiness, that let us know that our needs are being met. When this system is working normally, all of our emotions let us, as well as sometimes those around us, know if our needs are being met, and help motivate us to act, or not to act, depending on the situation.

Often, rather than helping us figure out if our needs are being met, emotions prevent us from meeting our needs or goals. For example, say you had to give a presentation in front of a class. You suddenly start feeling anxious, and the first thing you do is try to control the anxiety by avoiding it. But this just makes the feelings stronger and more frequent. So then, because you tried to control your anxiety, and failed in your effort, you feel even worse, like you've personally failed in some way, or like you are out of control. This leads to a vicious cycle of trying even harder to control your thoughts and feelings until you are left feeling overwhelmed and helpless, not to mention doing a poor job on the presentation.

You see, trying to control, suppress, get rid of, or reduce our unwanted emotions, like those you might experience in the challenge can be a trap On the surface it makes sense but it only leads to more of what you don't want. The harder you try <u>not</u> to feel anxious, the more anxious you get, so why not give up the struggle against your anxiety? Drop the rope in the internal tug of war, accept your feelings, and see what happens. In other words, we are asking you to consider being open to all of your internal experiences during the challenge.(pause)

In a few minutes you are going to go through two emotion inducing tasks. You may experience a range of emotions in response to the tasks; anxiety, excitement, frustration . . . I'd like you to be willing to experience them all fully, and not try to make any of them go away. Instead of trying actively to control them or push them away, I'd like you to try to lean into them, embrace them, and give up the struggle. Remember, the harder you try to "not feel" the more you may end up feeling. Instead of battling with your emotions, try to take a step back from the struggle, be willing to experience them, and see what happens.

Reappraisal Script

I am going to spend some time now discussing a way that you can approach the upcoming tasks, and your emotions in general. I would like you to listen as I describe this to you, and consider whether this fits with your experience.

What are emotions? Scientists and laypersons alike often have a difficult time coming up with a good working definition for emotion, even though we are constantly experiencing emotions throughout the day. How would you define emotions? (pause) For the sake of argument, let’s define emotions as personal physical sensations and thoughts that let us know whether or not certain needs or motivations are being met by the outside world. I know, it sounds like a mouthful. But the most important thing to hold onto in this definition is that emotions provide us with information as to whether or not our needs are being met. If we define emotions this way, emotions aren’t so complicated, and we can think of them like other physical reactions the body experiences. For example, we can think of hunger as the body letting us know that we are running low on energy and need to get some fuel pretty soon, kind of like when a car is running low on gas and the low fuel light turns on. The sensation of hunger runs on a continuum, from the sense of starvation when you have almost no food in your body, all the way to feeling full, when your stomach is almost at capacity. The fact is, we need to have both sensations to let us know when we need to start eating, as well as to let us know when we need to stop eating. The same goes for emotions. We have some emotions, like sadness, or anger, that let us know when our needs aren’t being met, as well as some, like happiness, that let us know that our needs are being met. When this system is working normally, all of our emotions let us, as well as sometimes those around us, know if our needs are being met, and help motivate us to act, or not to act, depending on the situation.

Often, rather than helping us figure out if our needs are being met, emotions prevent us from meeting our needs or goals. For example, say you had to give a presentation in front of a class. You might feel anxious about the possibility of embarrassing yourself in front of the class while you give the presentation, which might lead you to not giving the best performance possible, leading you to getting a worse grade. In this case, the emotion of anxiety would interfere with your goal of achieving a good grade. One way to prevent emotions from interfering with our goals is to use an emotion regulation strategy. There are a number of strategies for us to regulate our emotions, some more appropriate and effective than others, depending on the task at hand.

One strategy is called reappraisal. In reappraisal, people reevaluate and reinterpret their thoughts about a situation, which then changes how they feel. If we go back to the class performance example, someone who reappraises might recognize that part of what is making them so anxious is that they have some negative impressions of what it will be like to give the presentation. They might come to see that they already think of the situation as dangerous, or that everyone will be looking at them and judging them. Someone might reappraise these perceptions thinking differently about the situation. Instead of thinking that the audience is looking at him/her because he/she is doing a poor job, the presenter might think that the audience is looking at him/her because the members of the audience are genuinely interested in what he/she is saying. Such a reappraisal might lead to a decrease in the anxiety being felt by the presenter, allowing them to give a better presentation and get a better grade on their performance.

In a few minutes you are going to go through two emotion inducing tasks. You may experience a range of emotions in response to the tasks; anxiety, excitement, frustration . . .Your goal is to decrease any emotion you might feel by reappraising the situation. You can do this in a number of ways. For example, you could reappraise by focusing on the fact that this is a scientific study, and how you aren't in danger of experiencing any harm during the experiment. You could also reinterpret a picture of a woman crying to be tears of joy at the birth of a new family member. These are just a few examples of how you could reappraise. Remember, the harder you try to reappraise, the less better you will feel.

Suppression Script

I am going to spend some time now discussing a way that you can approach the upcoming tasks, and your emotions in general. I would like you to listen as I describe this to you, and consider whether this fits with your experience.

What are emotions? Scientists and laypersons alike often have a difficult time coming up with a good working definition for emotion, even though we are constantly experiencing emotions throughout the day. How would you define emotions? (pause) For the sake of argument, let's define emotions as personal physical sensations and thoughts that let us know whether or not certain needs or motivations are being met by the outside world. I know, it sounds like a mouthful. But the most important thing to hold onto in this definition is that emotions provide us with information as to whether or not our needs are being met. If we define emotions this way, emotions aren't so complicated, and we can think of them like other physical reactions the body experiences. For example, we can think of hunger as the body letting us know that we are running low on energy and need to get some fuel pretty soon, kind of like when a car is running low on gas and the low fuel light turns on. The sensation of hunger runs on a continuum, from the sense of starvation when you have almost no food in your body, all the way to feeling full, when your stomach is almost at capacity. The fact is, we need to have both sensations to let us know when we need to start eating, as well as to let us know when we need to stop eating. The same goes for emotions. We have some emotions, like sadness, or anger, that let us know when our needs aren't being met, as well as some, like happiness, that let us know that our needs are being met. When this system is working normally, all of our emotions let us, as well as sometimes those around us, know if our needs are being met, and help motivate us to act, or not to act, depending on the situation.

Often, rather than helping us figure out if our needs are being met, emotions prevent us from meeting our needs or goals. For example, say you had to give a presentation in front of a class. You might feel anxious about the possibility of embarrassing yourself in front of the class while you give the presentation, which might lead you to not giving the best performance possible, leading you to getting a worse grade. In this case, the emotion of anxiety would interfere with your goal of achieving a good grade. One way to prevent emotions from interfering with our goals is to use an emotion regulation strategy. There are a number of strategies for us to regulate our emotions, some more appropriate and effective than others, depending on the task at hand.

One strategy is called suppression. Have you ever had a personal problem, and made a big effort to not let it affect your performance in work or school? Even though you felt really upset inside, you somehow managed to push it away long enough to perform well. Well, it's the same with all of your emotions. When what you are feeling isn't helpful you can push the feelings away in order to accomplish the task. That's what I am going to encourage you to do today. Your goal is to try to get through the tasks feeling as little emotion as possible. Instead of letting your emotions be the master of you, you need to be the master of emotions.

In a few minutes you are going to go through two emotion inducing tasks. You may experience a range of emotions in response to the tasks; anxiety, excitement, frustration . . . I would like you to actively try to control them by pushing them away and try not to let those feelings show. In other words, try to behave in such a way that people watching you would not know you were feeling anything. Your goal is to try and maintain a "poker face" throughout the experiment. Remember, the harder you try to "not to feel" the less uncomfortable you will feel, and the better you will do.

Control Condition

Instructions

You will now listen to a brief article. After you listen to the article, you may be given a brief quiz on the main ideas contained in this article, so please listen carefully, and try to remember the gist of the information

Control Script

Entrepreneur Unveils New Tourist Spacecraft

Burt Rutan took the cloak off of his new spacecraft on Wednesday. Mr. Rutan, the creator of SpaceShipOne, the first privately financed craft to carry a human into space, traveled to New York to show detailed models of the bigger SpaceShipTwo and its carrier airplane, WhiteKnightTwo.

“2008 will really be the year of the spaceship,” said Sir Richard Branson, the British serial entrepreneur, at the heavily attended press conference at the American Museum of Natural History in Manhattan. Sir Richard, who founded a company, Virgin Galactic, that promises to take tourists on brief trips to the edge of space, was there to show off the sleek pod of a spacecraft and its spidery carrier plane.

WhiteKnight, a two-fuselage, four-engine plane in its new incarnation, will ferry the smaller spacecraft high into the sky and release it. The spacecraft pilot then fires the craft’s rocket engine, which burns a combination of nitrous oxide and a rubber-based solid fuel, and shoots the vehicle upward to an altitude of more than 62 miles, the realm of black sky. Once there, the pilot is to activate the craft’s innovative feathered wing, which rotates into a position that greatly increases aerodynamic drag and slows the craft for a glider landing back on earth.

In 2004, SpaceShipOne earned Mr. Rutan and his backer, Paul Allen, the $10 million Ansari X Prize when it carried a pilot to the edge of space twice in five days. Since then, Mr. Rutan has been working on the follow-up vehicle for Sir Richard, under his customary heavy secrecy.

Officials at the press conference said that the WhiteKnight aircraft is 70 percent complete and that SpaceShipTwo is 60 percent complete. Test flights of the planes could occur this year. Passenger flights are not expected to begin before late 2009 or 2010.

But Will Whitehorn, the president of Virgin Galactic, said that the company would not yet set a date for the startup of commercial flights, which will depend not just on testing and manufacturing but also on government approval. “We don’t want to make promises that we can’t meet,” Mr. Whitehorn said. “We’re in a race with nobody, apart from a race with safety.”

Mr. Rutan said that the new space travel system would have to be “hundreds” of times safer than present space flight, which he put at the level of safety of the early commercial aircraft of the 1920s.

“Don’t believe anyone who tells you that the safety level of new spaceships will be as safe as the modern airliner,” he said, but the risk must nonetheless be brought to an acceptable level for the customers to come. “This has to be such that the fear of the risk doesn’t hold down the growth of the industry,” he said.

Mr. Rutan’s company encountered tragedy last summer when an explosion killed three of Mr. Rutan’s rocketeers. The blast occurred during a “cold” test of the nitrous system.

Today, however, the rocketeers were focused on the future — and, just as importantly, on the past.

"Most people think of going to space as Saturn V or the Space Shuttle," said Mr. Whitehorn, the company president. But the Rutan model, a descendant of the record-breaking X-15 experimental craft, shows there is another way, he said.The vehicle is meant to open space to a new generation of spacefarers who are more creative than the classically trained astronauts, Mr. Rutan said. And that will bring with it a new way of looking at space travel, just as personal computing opened up the use of computers from a military and academic tool to something that transformed the world.These newcomers, he predicted, will bring "breakthroughs that will come, that will tell us why we're doing this," he said, "and what can we do with it."

Virgin has tested 80 of those customers for the ability to withstand the high-G forces of space flight by taking them for a centrifuge ride. Of the 80 — who included the scientist James Lovelock, who is 88, as well as people who have had heart bypass surgery and limb replacement — only two were unable to take the forces; the company asked three customers to put off flying. Mr. Attenborough said that means the company's initial premise — that one did not need to be in absolutely top physical shape to go to space — is sound. "We've proved that ordinary people can go to space," he said, "and almost all of us have the right stuff."

APPENDIX B

EMOTION INDUCTION INSTRUCTIONS

IAPS

During the next fifteen minutes you will see a number of different pictures presented on the computer screen in front of you. Your goal is to look at the screen for the entire time the picture is on the screen. After looking at the picture a white square will appear, indicating the trial is over. At the end of each trial you will be presented with two sets of figures arranged along a continuum. We call this set of figures SAM, and you will be using these figures to rate how you felt while viewing each picture. The first SAM scale is the happy-unhappy scale, which ranges from a smile to a frown. When you see this scale, please call out a number from 1 to 9 which corresponds how happy or unhappy you felt watching the picture. The second scale is the excited vs. calm scale. Similar to the first scale, when this scale is presented, please call out a number from 1 to 9 indicating how excited or calm you were while watching the picture. Throughout the trial you will hear brief noises from time to time over the headphones. You should try to ignore these noises as best as you can. Finally, throughout the experiment please refrain from moving, clenching your teeth, or swallowing hard.

AIRPUFF

During the next 15 minutes we will be measuring your reactions as you are exposed to a couple of different conditions. As you watch the screen a colored square will appear. If the square is red, there is a 33% chance that you will receive an airpuff during the next 20 seconds. If a green square appears, it means you will not receive an airpuff over the course of the next 20 seconds. Either way, at the end of the 20 seconds a white square will appear, indicating the trial is over.

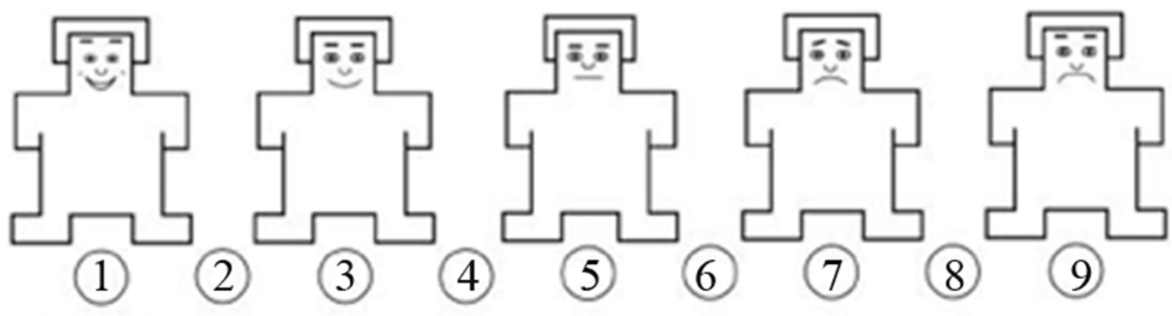
Although we are measuring your body's reactions we also want to know your personal experience during the trial. We will now use a different scale from the previous section, and it is called a SUDS score. The SUDS score is a scale from 0 to 9 indicating how uncomfortable or anxious you feel, with scores of 0 to 2 indicating relative calm with higher scores of 8 or 9 indicating the most anxiety you have felt in your life. When you hear SUDS over the headphones please quickly say out loud your overall level of discomfort during the trial. Similar to the last section, try to ignore the brief noises over the headphones and refrain from moving, clenching your teeth, or swallowing hard during the experiment. Any questions?

APPENDIX C

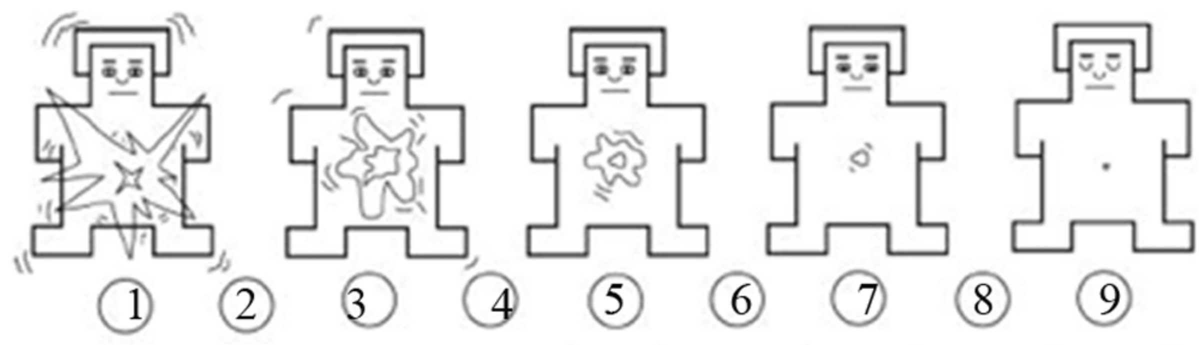
SELF-ASSESSMENT MANIKIN (SAM)

Manikins

Valence



Arousal



APPENDIX D

AFFECTIVE CONTROL SCALE (ACS)

Name ________________________ Date ____________________

Please rate the extent of your agreement with each of the statements below by circling the appropriate number below each statement.

1	2	3	4	5	6	7
very strongly disagree	strongly disagree	disagree	neutral	agree	strongly agree	very strongly agree

---

1. I am concerned that I will say things I'll regret when I get angry.

1 2 3 4 5 6 7

2. I can get too carried away when I am really happy.

1 2 3 4 5 6 7

3. Depression could really take me over, so it is important to fight off sad feelings.

1 2 3 4 5 6 7

4. If I get depressed, I am quite sure that I'll bounce right back.

1 2 3 4 5 6 7

5. I get so rattled when I am nervous that I cannot think clearly.

1 2 3 4 5 6 7

6. Being filled with joy sounds great, but I am concerned that I could lose control over my actions if I get too excited.

1 2 3 4 5 6 7

7. It scares me when I feel "shaky" (trembling).

1 2 3 4 5 6 7

1	2	3	4	5	6	7
very strongly disagree	strongly disagree	disagree	neutral	agree	strongly agree	very strongly agree

8. I am afraid that I will hurt someone if I get really furious.

1 2 3 4 5 6 7

9. I feel comfortable that I can control my level of anxiety.

1 2 3 4 5 6 7

10. Having an orgasm is scary for me because I am afraid of losing control.

1 2 3 4 5 6 7

11. If people were to find out how angry I sometimes feel, the consequences might be pretty bad.

1 2 3 4 5 6 7

12. When I feel good, I let myself go and enjoy it to the fullest.

1 2 3 4 5 6 7

13. I am afraid that I could go into a depression that would wipe me out.

1 2 3 4 5 6 7

14. When I feel really happy, I go overboard, so I don't like getting overly ecstatic.

1 2 3 4 5 6 7

15. When I get nervous, I think that I am going to go crazy.

1 2 3 4 5 6 7

16. I feel very comfortable in expressing angry feelings.

1 2 3 4 5 6 7

1	2	3	4	5	6	7
very strongly disagree	strongly disagree	disagree	neutral	agree	strongly agree	very strongly agree

17. I am able to prevent myself from becoming overly anxious.

1 2 3 4 5 6 7

18. No matter how happy I become, I keep my feet firmly on the ground.

1 2 3 4 5 6 7

19. I am afraid that I might try to hurt myself if I get too depressed.

1 2 3 4 5 6 7

20. It scares me when I am nervous.

1 2 3 4 5 6 7

21. Being nervous isn't pleasant, but I can handle it.

1 2 3 4 5 6 7

22. I love feeling excited -- it is a great feeling.

1 2 3 4 5 6 7

23. I worry about losing self-control when I am on cloud nine.

1 2 3 4 5 6 7

24. There is nothing I can do to stop anxiety once it has started.

1 2 3 4 5 6 7

25. When I start feeling "down," I think I might let the sadness go too far.

1 2 3 4 5 6 7

26. Once I get nervous, I think that my anxiety might get out of hand.

1 2 3 4 5 6 7

1	2	3	4	5	6	7
very strongly disagree	strongly disagree	disagree	neutral	agree	strongly agree	very strongly agree

27. Being depressed is not so bad because I know it will soon pass.

1 2 3 4 5 6 7

28. I would be embarrassed to death if I lost my temper in front of other people.

1 2 3 4 5 6 7

29. When I get "the blues," I worry that they will pull me down too far.

1 2 3 4 5 6 7

30. When I get angry, I don't particularly worry about losing my temper.

1 2 3 4 5 6 7

31. Whether I am happy or not, my self-control stays about the same.

1 2 3 4 5 6 7

32. When I get really excited about something, I worry that my enthusiasm will get out of hand.

1 2 3 4 5 6 7

33. When I get nervous, I feel as if I am going to scream.

1 2 3 4 5 6 7

34. I get nervous about being angry because I am afraid I will go too far, and I'll regret it later.

1 2 3 4 5 6 7

35. I am afraid that I will babble or talk funny when I am nervous.

1 2 3 4 5 6 7

1	2	3	4	5	6	7
very strongly disagree	strongly disagree	disagree	neutral	agree	strongly agree	very strongly agree

36. Getting really ecstatic about something is a problem for me because sometimes being too happy clouds my judgment.

1 2 3 4 5 6 7

37. Depression is scary to me -- I am afraid that I could get depressed and never recover.

1 2 3 4 5 6 7

38. I don't really mind feeling nervous; I know it's just a passing thing.

1 2 3 4 5 6 7

39. I am afraid that letting myself feel really angry about something could lead me into an unending rage.

1 2 3 4 5 6 7

40. When I get nervous, I am afraid that I will act foolish.

1 2 3 4 5 6 7

41. I am afraid that I'll do something dumb if I get carried away with happiness.

1 2 3 4 5 6 7

42. I think my judgment suffers when I get <u>really</u> happy.

1 2 3 4 5 6 7

APPENDIX E

DIFFICULTIES IN EMOTION REGULATION SCALE (DERS)

Please indicate how often the following statements apply to you by writing the appropriate number from the scale below on the line beside each item:

1	2	3	4	5
almost never (0-10%)	sometimes (11-35%)	about half the time (36-65%)	most of the time (66-90%)	almost always (91-100%)

_______ 1) I am clear about my feelings.

_______ 2) I pay attention to how I feel.

_______ 3) I experience my emotions as overwhelming and out of control.

_______ 4) I have no idea how I am feeling.

_______ 5) I have difficulty making sense out of my feelings.

_______ 6) I am attentive to my feelings.

_______ 7) I know exactly how I am feeling.

_______ 8) I care about what I am feeling.

_______ 9) I am confused about how I feel.

_______ 10) When I'm upset, I acknowledge my emotions.

_______ 11) When I'm upset, I become angry with myself for feeling that way.

_______ 12) When I'm upset, I become embarrassed for feeling that way.

_______ 13) When I'm upset, I have difficulty getting work done.

_______ 14) When I'm upset, I become out of control.

_______ 15) When I'm upset, I believe that I will remain that way for a long time.

_______ 16) When I'm upset, I believe that I'll end up feeling very depressed.

_______ 17) When I'm upset, I believe that my feelings are valid and important.

_______ 18) When I'm upset, I have difficulty focusing on other things.

_______ 19) When I'm upset, I feel out of control.

1	2	3	4	5
almost never	sometimes	about half the time	most of the time	almost always
(0-10%)	(11-35%)	(36-65%)	(66-90%)	(91-100%)

______ 20) When I'm upset, I can still get things done.

______ 21) When I'm upset, I feel ashamed with myself for feeling that way.

______ 22) When I'm upset, I know that I can find a way to eventually feel better.

______ 23) When I'm upset, I feel like I am weak.

______ 24) When I'm upset, I feel like I can remain in control of my behaviors.

______ 25) When I'm upset, I feel guilty for feeling that way.

______ 26) When I'm upset, I have difficulty concentrating.

______ 27) When I'm upset, I have difficulty controlling my behaviors.

______ 28) When I'm upset, I believe that there is nothing I can do to make myself feel better.

______ 29) When I'm upset, I become irritated with myself for feeling that way.

______ 30) When I'm upset, I start to feel very bad about myself.

______ 31) When I'm upset, I believe that wallowing in it is all I can do.

______ 32) When I'm upset, I lose control over my behaviors.

______ 33) When I'm upset, I have difficulty thinking about anything else.

______ 34) When I'm upset, I take time to figure out what I'm really feeling.

______ 35) When I'm upset, it takes me a long time to feel better.

______ 36) When I'm upset, my emotions feel overwhelming.

APPENDIX F

EMOTION REGULATION QUESTIONNAIRE (ERQ)

Instructions and Items

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1-----------------2-----------------3-----------------4-----------------5-----------------6-----------------7
strongly disagree | **neutral** | **strongly agree**

1. ____ When I want to feel more *positive* emotion (such as joy or amusement), I *change what I'm thinking about*.

2. ____ I keep my emotions to myself.

3. ____ When I want to feel less *negative* emotion (such as sadness or anger), I *change what I'm thinking about*.

4. ____ When I am feeling *positive* emotions, I am careful not to express them.

5. ____ When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm.

6. ____ I control my emotions by *not expressing them*.

7. ____ When I want to feel more *positive* emotion, I *change the way I'm thinking* about the situation.

8. ____ I control my emotions by *changing the way I think* about the situation I'm in.

9. ____ When I am feeling *negative* emotions, I make sure not to express them.

10. ____ When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation.

APPENDIX G

MINDFUL ATTENTION AND AWARENESS SCALE (MAAS)

Instructions: Below is a collection of statements about your everyday experience. Using the 1-6 scale below, please indicate how frequently or infrequently you currently have each experience. Please answer according to what *really reflects* your experience rather than what you think your experience should be. Please treat each item separately from every other item.

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I could be experiencing some emotion and not be conscious of it until some time later.
1 2 3 4 5 6

I break or spill things because of carelessness, not paying attention, or thinking of something else.
1 2 3 4 5 6

I find it difficult to stay focused on what's happening in the present.
1 2 3 4 5 6

I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.
1 2 3 4 5 6

I tend not to notice feelings of physical tension or discomfort until they really grab my attention.
1 2 3 4 5 6

I forget a person's name almost as soon as I've been told it for the first time.
1 2 3 4 5 6

It seems I am "running on automatic," without much awareness of what I'm doing.
1 2 3 4 5 6

I rush through activities without being really attentive to them.
1 2 3 4 5 6

1	2	3	4	5	6
Almost Always	Very Frequently	Somewhat Frequently	Somewhat Infrequently	Very Infrequently	Almost Never

I get so focused on the goal I want to achieve that I lose touch with what I'm doing right now to get there.
1 2 3 4 5 6

I do jobs or tasks automatically, without being aware of what I'm doing.
1 2 3 4 5 6

I find myself listening to someone with one ear, doing something else at the same time.
1 2 3 4 5 6

I drive places on 'automatic pilot' and then wonder why I went there.
1 2 3 4 5 6

I find myself preoccupied with the future or the past.
1 2 3 4 5 6

I find myself doing things without paying attention.
1 2 3 4 5 6

I snack without being aware that I'm eating.
1 2 3 4 5 6