

Emotion Regulation of Fear and Disgust:

Implications for Anxiety Disorders

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## Abstract

Although the emotion of fear has been central to traditional conceptualizations of the development and treatment of anxiety disorders, recent research suggests that the emotion of disgust may also play an important role in anxiety disorders. Since fear and disgust differ with regards to cognitive appraisals, physiology, and time course, the experience of the two emotions may also differ with regards to the influence of emotion-regulation strategies. There is a growing consensus that poor emotion regulation may confer risk for the development of anxiety disorders; thus, a better understanding of how different emotion-regulation strategies influence fear and disgust may then have important treatment implications. In the present study, healthy undergraduate participants (n=95) were randomized to view either a fear-relevant or a disgust-relevant video, and they were instructed to employ either reappraisal or suppression to decrease their emotional experience while viewing the video. Participants in the Reappraise/Disgust group reported significantly lesser increases in distress during the video than all other groups. Subsequent analysis examining the significant interaction revealed that participants that viewed the disgust video experienced a greater increase in fear when they were engaging in suppression versus reappraisal. These findings suggest that reappraisal may be especially effective when in the context of disgust. The implications of these findings for the development and treatment of anxiety disorders that are characterized by excessive disgust reactions will be discussed.

## Emotion Regulation of Fear and Disgust:

## Implications for Anxiety Disorders

*Anxiety and its Disorders*

Anxiety is an unavoidable part of life. Within a normal range, it can keep us alert and enhance performance in stressful or dangerous situations (Sperber, 1961; Yerkes & Dodson, 1908). However, when anxiety is severe or pervasive it can disrupt one's lifestyle and lead to dysfunction in physical, cognitive and social domains. Anxiety disorders, characterized by pathological fear and anxiety, currently affect about 40 million adults in the United States (National Institute of Mental Health, 2006), with a 12-month rate of 18.1% and a lifetime rate of 28.8% (Kessler, Berglund, Demler, Jin, & Walters, 2005; Kessler, Chiu, Demler, & Walters, 2005). Anxiety disorders can have severe and sometimes deadly consequences, as they are closely linked with physical illness (Sareen et al., 2006), substance abuse (National Institute of Mental Health, 2006), and suicide (Sareen et al., 2005). Cognitive-behavioral therapy (CBT) that involves repeated exposure to anxiety-evoking stimuli is a highly efficacious treatment for anxiety disorders, but it is far from universally effective (National Institute for Health and Clinical Excellence, 2006; Greist, 2012; Olatunji, Cisler & Deacon, 2010).

In many cases, anxiety-related psychopathology seems to arise from a precipitating negative event: for example, among individuals with specific phobias, many can recall a traumatic event that initiated their phobia (Muris & Merckelbach, 2011) (Cook, Mineka, Wolkenstein, & Laitsch, 1985). In these instances, anxiety seems to develop through fear conditioning, in which a neutral stimulus is paired with an aversive anxiety-inducing unconditioned stimulus (US) and eventually becomes a conditioned stimulus (CS) that can evoke

anxiety on its own. After this *acquisition* phase, the fear response may extend to other similar stimuli through *generalization*, broadening the scope of anxiety-inducing situations.

Alternatively, one may experience *extinction*, during which the CS is experienced without negative effects frequently enough that the fear response diminishes. Psychologists have focused on this fear-conditioning model as central to the development of anxiety disorders for nearly a century (Pavlov, 1927, Watson & Rayner, 1920), and more recent research continues to point to the potency of conditioning (see Lissek et al., 2005 for a meta-analysis). However, it is unlikely that conditioning alone contributes to anxiety, since many individuals who are exposed to trauma never develop psychopathology. Therefore, a diathesis-stress model for the development of anxiety disorders has been proposed, such that certain predisposing factors may increase the probability that a negative event will lead to psychopathology. Social phobia, for example, has been posited to arise from a combination of traumatic events such as teasing and vulnerabilities such as behavioral inhibition (McCabe, Antony, Summerfeldt, Liss, & Swinson, 2003; Kagan, 1994). Panic disorder also fits into this model: when anxiety-related bodily sensations are paired with traumatic events, an individual may develop a “fear of fear” such that bodily sensations can exacerbate or elicit high levels of anxiety, a phenomenon that seems to be more likely in the presence of vulnerability factors such as trait neuroticism or perceived lack of control (Bouton, Mineka, & Barlow, 2001; Goldstein & Chambless, 1978). Similarly, generalized anxiety disorder is often predicated by uncontrollable and unpredictable negative events, especially in individuals with low perceived control (Barlow, 2002). By contrast, it seems that obsessive-compulsive disorder (OCD) rarely arises from a discrete negative event. However, recent research has shown that conditioning can occur even in the context of observing others acting fearfully (Mineka &

Zinbarg, 1996). Supporting this notion, social learning and verbal transmission of fears seem to play an important role in development the development of OCD (Salkovskis, Shafran, Rachman, & Freeston, 1999), especially in the presence of personality factors such as religiosity (Rassin & Koster, 2003). To summarize, research to date suggests that anxiety disorders arise when stressful life events and fear-learning experiences occur in the context of predisposing biological and psychological traits.

One major diathesis that seems to contribute to the development of anxiety disorders is the construct of anxiety sensitivity. Anxiety sensitivity is defined as a fear that anxiety-related bodily sensations will have harmful physical, psychological or social consequences (Reiss & McNally, 1985). It consists of three dimensions, defined as fears of a) physical symptoms, b) publicly observable anxiety symptoms, and c) cognitive dyscontrol. Anxiety sensitivity has been found to be a premorbid predictor of anxiety disorder diagnosis, and changes in AS correspond with changes in anxiety symptoms during treatment (Calkins et al., 2007; Olatunji & Wolitzky-Taylor, 2009; Schmidt et al., 2006). A recent meta-analysis posited that anxiety sensitivity may arise as a component of trait anxiety, which in turn arises from negative affect (Olatunji & Wolitzky-Taylor, 2009). Furthermore, the three dimensions may correspond to specific anxiety symptoms: fear of physical symptoms may be most strongly associated with panic disorder, fear of publically observable symptoms with social anxiety disorder, and fear of cognitive dyscontrol with generalized anxiety disorder (McWilliams, Stewart, & MacPherson, 2000; Rodriguez et al., 2004; Zinbarg et al., 2001). The development of anxiety sensitivity in childhood seems to be determined both by genetics and patterns of fear learning, and it is a risk factor for anxiety symptoms later in life. (Mattis & Ollendick, 1998; Olatunji & Wolitzky-Taylor, 2009). A second

critical period seems to occur during puberty, where anxiety sensitivity may lead to or exacerbate existing anxiety-related problems (Leen-Feldner, Reardon, & Zvolensky, 2007). Taken together, these findings suggest that anxiety sensitivity may be a powerful predisposing factor in the development and maintenance of anxiety disorders.

The diathesis-stress model of anxiety such that certain factors increase the likelihood that negative events will lead to fear conditioning and, eventually, anxiety is well-supported. In addition to this model, another growing area of study focuses on the emotional processes involved in anxiety. It is clear that fear plays an important role in the development of anxiety, but recent research suggests that other negative emotions are also at play. The following section will describe the specific roles of two negative emotions – fear and disgust – in the development and maintenance of anxiety.

### *Fear and Disgust*

It is well-documented that fear plays a central role in the experience of anxiety. In addition to the large body of research on fear conditioning as it contributes to anxiety development, Reiss's (1991) meta-analysis suggests that trait fearfulness is strongly correlated with specific phobias as well as trait anxiety sensitivity, and Chambless and Gracely (1989) concluded that fear is a distinguishing characteristic of anxiety disorders.

Disgust has recently come into focus as another negative emotion that plays a role in anxiety disorders; it is thought to play a crucial role in OCD as well as blood-injection-injury phobia and animal phobias, (Woody & Teachmann, 2000; Cisler, Olatunji, Lohr, & Williams, 2009). Disgust sensitivity, or the degree of intensity with which one experiences disgust, seems to be central to the development of many specific phobias and is strongly correlated with trait

anxiety (Muris, Merckelbach, Schmidt, & Tierney, 1999) as well as symptoms of agoraphobia and OCD (Muris et al., 2000). Further research found disgust sensitivity to be significantly correlated with both OCD and blood-injection-injury phobia (Olatunji et al., 2007; Olatunji, Sawchuk, de Jong, & Lohr, 2007), and may be predictive of posttraumatic stress disorder in combat-exposed war veterans (Olatunji, Armstrong, Fan, & Zhao, 2014). Fear and disgust often occur together in the context of anxiety; an fMRI study found that spider-phobic individuals showed greater neural activation of both fear and disgust than non-phobic controls when confronted with spider images (Scheinle et al., 2008, Woody & Teachman, 2000). Taken together, these results suggest that fear and disgust are both strongly implicated in anxiety disorders, and that disgust conditioning as well as fear conditioning may be an important factor in the development of psychopathology.

Disgust has been found to play a role in non-anxiety disorders as well. Self-disgust may mediate the pathway from dysfunctional cognitions and depression (Overton, Markland, Taggart, Bagshaw, & Simpson, 2008), and a strong correlation has been found between measures of eating disorder and measures of disgust sensitivity, even after controlling for anxiety and depression (Davey, Buckland, Tantow & Dallos, 1998). Finally, disgust sensitivity has been found to be correlated with hypochondriasis and health anxiety, independently of trait anxiety (Davey & Bond, 2006). This growing body of research on disgust implicates it as a strong factor in anxiety and other psychopathology, and further research is needed to more clearly elucidate its role.

Despite their similarities, fear and disgust are distinct in important ways. Each has a distinctive physiological pattern, communicative signal, and antecedent trigger. (Ekman, 1971).

From an adaptive standpoint, fear is related to escape from danger while disgust is related to avoidance of contamination (Marks & Nesse, 1994; Oaten, Stevenson, & Case, 2009). Fear and disgust also have different neural correlates and physiological outcomes: fear is associated with the amygdala and consistently activates the sympathetic nervous system, (Calder, Lawrence & Young, 2001) while disgust is associated with the insular cortex and basal ganglia and elicits a mixed physiological response that may depend on the disgust-eliciting stimulus (Philips et al., 1997; Rohrmann & Hopp, 2008). In addition, a study regarding attention modulation found that fear increased the attentional blink following a fear stimulus while disgust had the opposite effect following a disgust stimulus. These findings suggest that fear processing may exert a greater inhibitory response on distractors than disgust processing (Vermeulen, Godefroid, & Mermillod, 2009). In addition, separate studies involving contamination fear and spider phobia found that during repeated exposure to disgusting stimuli, participants' feelings of fear declined more quickly than their feelings of disgust; suggesting that disgust may be more resistant to extinction than fear (Adams, Willems & Bridges, 2010; Olatunji, Smits, Connolly, Willems, & Lohr, 2007; Smits, Telch & Randall, 2002). Fallon and colleagues (1984) found that an uncontaminated substance could elicit disgust simply by association with a contaminant, further suggesting that disgust is resistant to extinction. If disgust is indeed more resistant to extinction than fear, new treatments may be needed for anxiety disorders involving disgust, perhaps with a greater focus on extinction of learned disgust. The fundamental differences between fear and disgust seem to have implications for the ways they develop, are experienced, and may be overcome in the context of anxiety. Furthermore, these differences point to a need for further study on the way these emotions are regulated.



*Emotion Regulation: Reappraisal and Suppression*

Given the role of fear and disgust in anxiety disorders, research examining how the two emotions are differentially regulated may have important treatment implications. Emotion regulation, distinct from emotion generation, is defined as the activation of a goal to up- or down-regulate either the magnitude or the duration of an emotional response (Gross, Sheppes, & Urry, 2011). According to the process model of emotion regulation (Gross & Thompson, 2007), an emotion is a five-stage process that moves from the antecedents, the events leading up to an emotional experience, to the response, or one's expression of the emotion. Thus, one can regulate an emotion at any of the five stages.

Two commonly-used forms of emotion regulation are reappraisal and suppression. Reappraisal is an *antecedent-focused* form of regulation in which one re-evaluates a potentially emotional situation in order to alter the emotional response before it occurs. For example, an individual watching a sad movie might focus on the fact that the movie is fictional, thereby decreasing her own feelings of sadness. By contrast, suppression is a *response-focused* form of regulation, in which one attempts to hide an emotion that one is currently experiencing. For example, one might experience intense anger during an argument but decide to hide the outward signs of anger by not raising one's voice.

Research suggests that reappraisal is generally an effective strategy for regulating emotion with few negative consequences, while suppression is less effective and leads to negative consequences for physiological arousal, cognitive recall, social functioning, and overall well-being. (Gross & Levenson, 1993; Gross, 1998, Richards & Gross, 2000; Gross, 2002; Siemer, Mauss, & Gross, 2007). Reappraisal has been shown to reduce the internal experience of

negative emotion while suppression has not, suggesting that suppression is an ineffective regulation strategy (Gross, 1998; Jackson, Malmstadt, Larson, & Davidson, 2000).

Reappraisal is also associated with minimal changes in sympathetic nervous system activity, while suppression increases sympathetic arousal. In fact, repeated use of suppression over time may lead to chronic physiological stress, which can compromise one's immune system and lead to future health problems (Glaser & Kiecolt-Glaser, 2005; Gross & Levenson, 1993). Consistent with this idea, one longitudinal study found that successful emotion regulation (defined by the use of effective regulation strategies including reappraisal) predicted decreased risk of heart attack and heart disease over thirteen years (Kubzansky, Park, Peterson, Vokonas, & Sparrow, 2011).

Emotional suppression may also adversely affect cognitive recall. For example, one study showed that suppression instructions caused participants to report poorer memory recall and less confidence in the accuracy of their memories compared to reappraisal instructions or no instructions. This study also found that participants who reported that they habitually suppress their emotions had poorer memory of the episodes of emotion regulation than those participants who reported using different regulation strategies (Richards & Gross, 2000).

Compared to suppression, reappraisal may lead to superior social outcomes as well. Richards and Gross (2000) point out that the loss of recall associated with suppression is often socially undesirable and can incite interpersonal conflict. Indeed, individuals who frequently suppress report poorer memory for past conversations and emotion-regulation episodes (Richards & Gross, 2000). By contrast, those who frequently reappraise tend to have more positive relations with others and are rated by their peers as having closer relationships and being better-

liked than suppressors (English, John, Srivastava & Gross, 2012; Gross & John, 2003.) A longitudinal study of students entering college found suppression to be associated with lower social support, less closeness to others, and lower social satisfaction during the first months of college (Srivastava, Tamir, McGonigal, John, & Gross, 2009). Several possible explanations for the social consequences of suppression have emerged. In one study, habitual suppressors reported being less likely to share both positive and negative emotions with others, showed greater discomfort with social closeness and received less social support from peers than habitual reappraisers (Gross & John, 2003). In another study, during experimental conversations between two participants in which one participant was given emotion-regulation instructions, reappraisal led to lesser increases in blood pressure in the reappraiser's partner compared to control conversations in which neither partner received regulation instructions. Meanwhile, suppression disrupted patterns of communication and led to increased blood pressure in both conversation partners (Butler et al., 2003). This suggests that not only does suppression fail to diminish negative emotions in an individual, it can also induce negative affect in others. Supporting this idea, English and John (2012) found that feelings of inauthenticity mediated the link between habitual suppression and relationship satisfaction, suggesting that the social consequences of suppression may result from the cognitive effort it requires.

The efficacy of reappraisal as a means to alter one's emotional experience is supported by neuroimaging research. Goldin, McRae, Ramel & Gross (2008) found different neural bases for reappraisal versus suppression of emotion while viewing disgust-inducing images. Both strategies led to prefrontal cortex activation, but for reappraisal this activation occurred earlier, supporting the process-model notion that reappraisal occurs during emotional antecedents

whereas suppression occurs after the subsequent emotional response. Reappraisal also led to decreased activation of the amygdala and insula, areas that are both associated with the experience of disgust, and suppression led to increased activation of these areas. These findings support the notion that reappraisal can successfully down-regulate a negative emotion while suppression has the opposite effect. Another study (Pitskel, Bolling, Kaiser, Crowley, & Pelphrey, 2011) suggested that the ventromedial prefrontal cortex (vmPFC) may be implicated in effortful reappraisal. vmPFC activity during regulation seems to decrease from childhood to adolescence, suggesting that reappraisal becomes more automatic and requires less effort across development. In a group of spider-phobic individuals, those who habitually used reappraisal showed greater declines in prefrontal cortex activation while viewing phobic imagery, supporting the view that habitual reappraisal may lead to reappraisal requiring less effort over time (Hermann et al., 2013).

Reappraisal is also currently under examination as a prophylaxis against excessive anxiety. Research on regulatory focus suggests that habitual reappraisal may be linked to decreased anxiety. Promotion-focused regulation, or the tendency toward achievement and advancement, is correlated with diminished anxiety compared to prevention-focused regulation, or the tendency toward harm avoidance. Recent studies have found that promotion-focused regulation is linked with reappraisal, and reappraisal may mediate the link between promotion and diminished anxiety (Llewellyn et al., 2013; Schutz, Benson, & Decuir-Gunby, 2008). These initial findings suggest that habitual reappraisal may serve a protective function against anxiety symptoms.

Reappraisal may also help individuals cope with adversity in ways that suppression cannot. Using reappraisal to up-regulate positive emotions may help increase the experience of those emotions, which may help minimize future negative experiences. (Giuliani, McRae, & Gross, 2008). McRae, Ciesielski, & Gross (2012) examined the use of reappraisal to increase positive emotions in a negative situation. Participants viewed a series of negative pictures and received instructions to either a) reappraise in order to increase positive emotion, or b) reappraise in order to decrease negative emotion. Instructions to increase positive emotion led to significantly greater positive affect than instructions to decrease negative emotion. Compared to “look” trials in which participants reacted naturally to the pictures, increasing positive emotion also led to smaller changes in skin conductance than decreasing negative emotion, suggesting that increasing positive emotions is most effective at diminishing the physiological response to emotion. These results suggest that reappraisal can not only increase positive emotional experience; it can also serve as a buffer against the adverse effects of both present and future negative emotion. (Ehring, Tuschen-Caffier, Schnulle, Fischer, & Gross, 2010).

Olatunji, Forsyth & Feldner (2007) proposed that emotion regulation may explain the difference between individuals who display normative fear learning and those for whom pathological anxiety develops. According to this perspective, fear learning occurs in all individuals, and it only shifts to pathological anxiety when emotion-regulation strategies surrounding negative events are rigid and inflexible. In support of this view, emotion suppression during trauma exposure has been shown to increase the severity of PTSD symptoms, and an inflexible emotion-regulation strategy may prevent extinction of fear learning (Bouton, Mineka, & Barlow, 2001). Campbell-Sills, Barlow, Brown, & Hofmann (2006) found that the effects of

suppression were predictably negative for individuals with mood and anxiety disorders.

Additionally, the inability to use reappraisal may be linked to anxiety disorders. Patients with social anxiety disorder have shown deficits in the ability to reappraise (Goldin et al., 2009).

Cognitive reappraisal self-efficacy, or the belief that one can successfully reappraise one's emotions, may also be a deficit in those with anxiety disorders (Carthy, Horesh, Apter, & Gross, 2010; Goldin et al., 2009; Werner et al., 2011). CBT may lead to increases in cognitive reappraisal self-efficacy for patients with social anxiety disorder, and these increases have been shown to mediate the effects of CBT (Gaudiano & Herbert, 2007; Goldin et al., 2012). Taken together, these results suggest that emotion regulation deficits may play an important role in anxiety disorders, and a focus on improving emotion-regulation strategies may lead to more effective treatment.

### *Regulating Fear and Disgust*

While the literature to date regarding regulation of fear is extensive, relatively little is known about the effects of regulating disgust. Several studies have used videos with content that is likely to elicit a mixed response of both fear and disgust, such as severe burn treatments or amputations (Gross et al., 1993; Gross, 1998; Richards & Gross, 2000). Other studies have used number-counting tasks and negative feedback (Siemer et al., 2007), which elicit fear through anxiety-provoking social situations. To date, there has been no systematic comparison of the effects of emotion regulation on isolated fear and disgust. Accordingly, the present study used fear-specific and disgust-specific stimuli to examine the ways reappraisal and suppression differentially affect these emotions. Consistent with prior emotion-regulation research, it was predicted that 1) suppression instructions would be associated with greater increases in negative

emotion, a greater physiological response, poorer cognitive recall, and diminished communication for both fear and disgust videos. Based on prior research suggesting disgust's resistance to extinction (Olatunji, Smits, Connolly, Willems, & Lohr, 2007), it was also predicted that 2) disgust would be more difficult to regulate, such that the negative effects of suppression would be more pronounced for disgust than for fear, and suppressing disgust would lead to generalization of suppression to subsequent emotions.

## Methods

### *Participants*

Ninety-five undergraduate students (N = 95) were recruited from Vanderbilt University. Participants were randomized into video conditions of fear (n = 47) and disgust (n = 43), and instruction conditions of suppress (n = 45) and reappraise (n = 45). No one ethnic group was targeted or excluded and a diverse range of undergraduate participants was selected for the present study. In order to enhance the generalizability of the findings. All minorities were welcome to participate in this research and it was required that participants be 18 years of age or older (participants who are 18 years of age and older are able to consent to research participation without parental consent). These participants were college-age and enrolled as Vanderbilt students; thus, it was expected that the majority of participants were mentally and psychologically healthy.

### *Measures*

*A Modified version of the Differential Emotion Scale (MDES; Gross & Levenson, 1995)* was used to rate emotional state before and after the videos. The MDES consists of eight

emotion categories, and each is rated on a nine-point scale ranging from 0 = “do not feel the slightest bit of the emotion” to 8 = “the most I have ever felt in my life.”

A self-report emotion regulation measure (adapted from Dunn, Billotti, Murphy, & Dalgleish, 2009) was used to assess participants’ emotion-regulation strategies during the videos. The four-item questionnaire asks participants to rate questions on a scale of 0 “not at all” to 100 “extremely.” The questions were as follows:

1. How much did you find yourself trying to suppress your emotional response to the video?
2. How much did you find yourself trying to change the meaning of the video while you watched it?
3. How much did you find yourself not looking at the video?
4. How much did you find yourself deliberately thinking about other things while watching the video?

Participants completed the following eight measures before the videos (see Appendices A-J):

The *Emotion Regulation Questionnaire* (ERQ; Gross & John, 2003) is a 10-item scale designed to measure respondents’ tendency to regulate their emotions in two ways: Cognitive Reappraisal and Expressive Suppression. Respondents answer each item on a 7-point Likert-type scale ranging from 1 “strongly disagree” to 7 “strongly agree.” Cronbach’s alpha has been reported as adequate for both Cognitive Reappraisal (0.79) and Expressive Suppression (0.73).

The *Disgust Propensity and Sensitivity Scale-Revised* (DPSS-R; van Overveld et al., 2006) is a 16 item measure designed to assess the frequency of disgust experiences (Disgust



Propensity,  $\alpha = 0.89$ ) and the emotional impact of disgust experiences (Disgust Sensitivity,  $\alpha = 0.87$ ). Items are rated on a scale ranging from 1 “never” to 5 “always.” High internal consistency has been reported for both the Disgust Propensity (Cronbach’s alpha = 0.89) and Disgust Sensitivity (Cronbach’s alpha = 0.87) scales.

The *State – Trait Anxiety Inventory* (STAI; Spielberger et al., 1983) consists of two 20-item report measures that assess levels of state (STAI-S) and trait (STAI-T) anxiety. Items are rated on a four-point scale ranging from 1 “almost never” to 4 “almost always.” Good internal consistency has been reported with Cronbach’s alpha ranging from 0.86 to 0.75.

The *Anxiety Sensitivity Index* (ASI; Reiss, Peterson, Gursky, & McNally, 1986) is a 16-item questionnaire that measures fear of anxiety-related symptoms on three subscales: physical, social, and cognitive. Items are rated on a five-point Likert scale from 1 “very little” to 5 “very much.” High internal consistency has been reported with Cronbach’s alpha = 0.88 (Peterson & Heilbronner, 1987).

The *Attentional Control Scale* (ACS; Derryberry, & Reed, 2002) is a 20-item self-report questionnaire measuring the ability to focus and shift attention if necessary. Items are rated on a four-point Likert scale from 1 “almost never” to 4 “always.” Good internal consistency has been reported with Cronbach’s alpha = 0.84 (Olafsson et al., 2011).

The *Obsessive-Compulsive Inventory – Revised* (OCI-R; Gonner, Leonhart & Ecker, 2008) is a self-report scale measuring the major symptoms of OCD on six dimensions: Checking, Washing, Ordering, Hoarding, Obsessing, and Neutralizing. Participants rate the extent to which items have bothered them on a five-point scale from 0 “not at all” to 4 “extremely.” Excellent internal consistency has been reported with alphas on all subscales  $\geq 0.75$ .

The *Center for Epidemiologic Studies Depression Scale* (CES-D; Radloff, 1977) is a 20 item self-report scale designed to assess depressive symptomatology in the general population. The items of the scale are symptoms associated with depression which have been used in previously validated longer scales and assess symptoms on a scale of 0 “rarely or none of the time” to 3 “most or all of the time”. High internal consistency has been reported with Cronbach’s alpha ranging from 0.85 to 0.90.

### *Study Design*

The present study was a randomized single-blind controlled study and used a 2x2 between-subjects design, with video condition (fear, disgust) and instruction condition (suppress, reappraise) as between-subjects variables.

*Phase 1 – Pre-video.* Participants recorded their age, gender and ethnicity on the computer and were then asked to complete a battery of measures on the computer: the Emotion Regulation Questionnaire, the Center for Epidemiologic Studies Depression Scale, Disgust Propensity and Sensitivity Scale-Revised, Attentional Control Scale, Anxiety Sensitivity Index, State - Trait Anxiety Inventory, and Obsessive-Compulsive Inventory – Revised.

*Phase 2 – Video.* Participants were randomly assigned to view one of two ten-minute videos, either a disgust-eliciting video or a fear-eliciting video. The disgust video contained clips of rotting food, people vomiting, and people coming into contact with feces. The fear video contained clips of snakes lunging toward the camera, large spiders, and threatening scenes from horror films. Both videos were made up of a combination of movie scenes and home videos, some with sound and some without sound. The lights were turned off before the instructions and

videos began. Those in the Reappraisal instruction condition were given the following instructions (adapted from Gross, 1998):

*We will now show you a short video clip. It is important to us that you watch the video clip carefully, but if you find the video too distressing, just say "stop." Please try to adopt a detached and unemotional attitude as you watch the video. In other words, as you watch the video clip, try to think about what you are seeing objectively, in terms of the technical aspects of the events you observe. Watch the video clip carefully, but please try to think about what you are seeing in such a way that you don't feel anything at all. Pay close attention to the video clip, because there will be a memory test later.*

Those in the Suppression instruction condition were given different instructions (adapted from Gross, 1998):

*We will now be showing you a short video clip. It is important to us that you watch the video clip carefully, but if you find the video too distressing, just say "stop." This time, if you have any feelings as you watch the video clip, please try your best not to let those feelings show. In other words, as you watch the video clip, try to behave in such a way that a person watching you would not know you were feeling anything. Watch the video clip carefully, but please try to behave so that someone watching you would not know that you are feeling anything at all. Please pay close attention to the video clip, because there will be a memory test later.*

Participants completed the Modified Differential Emotion Scale (MDES) immediately before and after video exposure. Participants in the Disgust condition viewed the disgust-eliciting video, and participants in the Fear condition viewed the fear-eliciting video. Galvanic skin response

(GSR) was assessed for 30 seconds before and during presentation of the video. A research assistant was present in the room during this phase to ensure that the participant watched the duration of the video and did not experience excessive distress.

*Phase 3 – Post-video.* Participants completed a measure of their compliance to emotion-regulation instructions, answered twenty true-or-false questions to assess their memory of the video's content, and were asked to type out a description of the study on the computer.

*Phase 4 – Generalizability.* Participants were asked to view a second video and were presented with the following instructions:

*This time, rather than attempting to control or regulate your emotions, please watch the video as you normally would.*

This time, participants in the Disgust condition viewed the fear-eliciting video, and participants in the Fear condition viewed the disgust-eliciting video. GSR was measured again directly before and during the video, and a research assistant was present in the room during the viewing. Participants completed the MDAS before and after video exposure, and participants then completed the same measure of compliance to regulation instructions after video exposure.

### *Procedure*

Informed consent was obtained from participants by trained Research Assistants in the Emotion and Anxiety Research Laboratory prior to participating in the study. Participants were asked to carefully read and sign a written consent form, which described the study in detail. They had the opportunity to ask any questions about the study and were told that they could refuse to participate at any point during the study without penalty. Consenting participants spent approximately 10-15 minutes on the study questionnaires, and were then joined by a research

assistant who explained that a video exposure would follow and turned out the lights.

Participants viewed regulation instructions on the screen, completed the MDES, and when they were ready, initiated the ten-minute video exposure. After the video exposure participants completed the MDES again. The research assistant turned the lights back on and left the room, and participants completed a memory assessment and were presented with seven blank screens in which to type a description of the study. Next, the research assistant re-entered the room, informed the participant that a second video exposure would begin, and turned out the lights. Participants viewed instructions not to regulate their emotions, completed the MDES, and initiated the video exposure. Afterward, the lights were turned back on and participants completed the MDES a final time and completed the same measure of compliance to regulation instructions a second time. Participants were debriefed after the completion of the study.

## Results

### *Manipulation checks for pre-existing group differences.*

The sample was 65.3% Caucasian with no significant differences in ethnic distribution by group [ $\chi^2 = 12.793, p = .384$ ] or within instruction [ $\chi^2 = 3.065, p = .547$ ] or video [ $\chi^2 = 4.863, p = .302$ ] conditions. The sample was 75.8% female, and significant differences in gender distribution did exist across groups [ $\chi^2 = 9.846, p = .020$ ]. More specifically, there were no significant differences in gender distribution across instruction conditions [ $\chi^2 = .297, p = .586$ ], but gender distribution across video conditions was significant [ $\chi^2 = 9.338, p = .002$ ]: the disgust condition exhibited a significantly higher percentage of females (89.4%) than the fear condition (62.5%). Therefore, when subsequent analyses rendered significant findings, the analyses were

repeated with gender as a covariate. Descriptive statistics for demographic information across groups is provided in Table 1.

To assess group differences in traits relevant to fear, disgust, and emotion regulation, a 2(video condition; fear, disgust) X 2(instruction condition; suppress, reappraise) multivariate ANOVA was conducted on scores for a variety of symptom measures. Video X instruction interactions were not significant for age [ $F(3,91) = .484, p > .05$ ] or for any of the symptom traits measured: trait anxiety [ $F(3,91) = .422, p > .05$ ], disgust propensity [ $F(3,91) = .008, p > .05$ ], disgust sensitivity [ $F(3,91) = .056, p > .05$ ], depressive symptoms [ $F(3,91) = 1.283, p > .05$ ], obsessive-compulsive symptoms [ $F(3,91) = .044, p > .05$ ], habitual reappraisal [ $F(3,91) = .909, p > .05$ ], habitual suppression [ $F(3,91) = 1.396, p > .05$ ], attentional control [ $F(3,91) = .028, p > .05$ ], or anxiety sensitivity [ $F(3,91) = .071, p > .05$ ]. Means and standard deviations for these traits are provided in Table 2.

#### *Self-reported regulation during video exposure*

A 4(regulation question; suppress, change meaning, not look, think about something else) X 2(instruction condition; Suppression; Reappraisal) repeated-measures ANOVA on the post-video regulation questions revealed a significant main effect of regulation question [ $F(3,78) = 76.88, p < .001$ ]. A post hoc paired-samples t-test revealed that participants rated suppressing emotions ( $M = 60.89, S.D. = 2.728$ ) significantly higher than changing meaning ( $M = 42.17, S.D. = 27.879$ ) ( $t = 5.38, p = .000$ ), not looking, ( $M = 13.98, S.D. = 18.24$ ) ( $t = 16.725, p = .000$ ), or thinking about something else ( $M = 30.89, S.D. = 28.83$ ) ( $t = 8.215, p = .000$ ). The repeated-measures ANOVA revealed no significant instruction condition X regulation question interaction [ $F(3,78) = .827, p > .05$ ], contrary to the expectation that participants would respond to the

questions according to the regulation instructions they received. A post hoc one-way ANOVA revealed that while participants did report higher suppression when in the Suppression condition compared to the Reappraisal condition, this difference was not statistically significant [ $F(1,82) = 2.033, p = .158$ ].

A 4(regulation question) X 2(video condition) X 2(instruction condition) repeated-measures ANOVA was then conducted to determine if responses varied as a function of the type of video exposure. This analysis revealed no significant regulation question X video condition X instruction condition interaction [ $F(3, 80) = 2.267, p > .05$ ]. However, the regulation question X video condition interaction was significant [ $F(3,78) = 8.233, p < .05$ ]. As shown in Figure 1, pairwise comparisons revealed that participants in the Disgust Video condition reported changing meaning ( $M = 48.38, S.D. = 28.074$ ) [ $F(1,81) = 4.01, p < .05$ ], not looking ( $M = 20.20, S.D. = 21.414$ ) [ $F(1,82) = 10.51, p < .01$ ], and thinking about something else ( $M = 40.71, S.D. = 4.367$ ) [ $F(1,82) = 10.479, p > .01$ ], significantly more than those in the Fear Video condition ( $M = 36.262, S.D. = 26.693$ ;  $M = 7.905, S.D. = 11.898$ ; and  $M = 21.310, S.D. = 23.154$ , respectively). Responses to the suppression question did not significantly differ between Fear Video ( $M = 61.500, S.D. = 24.165$ ) and Disgust Video ( $M = 60.270, S.D. = 25.831$ ) groups [ $F(1,82) = .05, p > .05$ ]. Due to gender differences between Video conditions, the repeated-measures ANOVA was conducted again with gender as a covariate; the regulation question X video interaction remained statistically significant [ $F(1,81) = 3.604, p = .014$ ]. Means and standard deviations of responses to regulation questions are provided in Table 3.

*Self-reported emotional response to video exposure*

To assess whether the videos elicited the intended emotion, change scores were calculated for disgust and fear ratings on the MDES (e.g., change in fear = post-video fear rating – pre-video fear rating). A 2(emotion change; fear, disgust) X 2(Video; fear, disgust) repeated-measures ANOVA on change scores revealed a significant main effect of emotion change [ $F(1,93) = 11.951, p = .001$ ] and a significant Video Condition X emotion interaction [ $F(1,93) = 43.652, p < .001$ ]. As shown in Figure X, a post hoc one-way ANOVA indicated that increases in fear were greater in the Fear condition ( $M = 3.29, S.D. = 1.901$ ) than in the Disgust condition ( $M = 1.17, S.D. = 2.877$ ) [ $F(1,93) = 18.054, p < .001$ ], while increases in disgust were greater in the Disgust condition ( $M = 3.66, S.D. = 2.496$ ) than the Fear condition ( $M = 2.52, S.D. = 2.093$ ) [ $F(1,93) = 5.815, p < .05$ ]. A subsequent paired-samples t-test revealed that within the Fear condition, changes in fear were significantly greater than changes in disgust ( $t = 2.741, p = .009$ ), while in the Disgust condition, changes in disgust were significantly greater than changes in fear ( $t = -6.189, p = .000$ ). Due to gender differences between Video conditions, the repeated-measures ANOVA was conducted again with gender as a covariate, and the interaction remained statistically significant [ $F(1,94) = 41.136, p < .001$ ]. Means and standard deviations of change scores for fear, disgust and distress are provided in Table 5.

#### *Effects of emotion regulation on fear and disgust*

*Emotion ratings.* A 2 (instruction; reappraisal, suppression) X 2 (video; fear video, disgust video) X 2 (emotion change; fear, disgust) repeated-measures ANOVA in the first video revealed that the predicted three-way interaction was not significant [ $F(3,91) = .090, p > 0.05$ ], nor was the emotion X instruction interaction [ $F(1,93) = 1.98, p > .05$ ]. The analysis did reveal a significant main effect of emotion [ $F(1,93) = 11.95, p = .001$ ]; a post-hoc t-test indicated that



changes in disgust ( $M = 3.08$ ,  $S.D. = 2.360$ ) ( $t = -2.848$ ,  $p = .005$ ) were significantly greater than changes in fear ( $M = 2.24$ ,  $S.D. = 2.645$ ).

As shown in Figure 2, the instruction X video interaction was also significant [ $F(1,93) = 4.540$ ,  $p < 0.05$ ], indicating that levels of overall distress were lower for participants in the Disgust condition when they were also in the Reappraise condition. Distress scores were then computed by averaging the means of MDES change scores for fear and disgust. Pairwise comparisons indicated that in the Reappraise condition, the Fear Video group reported significantly higher distress scores ( $M = 3.083$ ,  $S.D. = 1.8514$ ) than the Disgust Video group ( $M = 1.760$ ,  $S.D. = 2.5500$ ), [ $F(1,47) = 4.291$ ,  $p < .05$ ]. Distress scores in the Suppress condition did not significantly differ between Fear ( $M = 2.729$ ,  $S.D. = 1.6549$ ) and Disgust ( $M = 3.159$ ,  $S.D. = 1.7888$ ) groups. Furthermore, within the Disgust Video condition, those in the Suppress condition reported significantly higher distress than in the Reappraise condition [ $F(1,38) = 4.617$ ,  $p < .05$ ], but distress scores in the Fear Video group did not differ by Instruction. Due to gender differences between Video conditions, the 2(instruction ; reappraisal, suppression) X 2(video; fear video, disgust video) repeated-measures ANOVA was conducted a second time with gender as a covariate; the interaction remained statistically significant [ $F(4,90) = 4.917$ ,  $p < .05$ ]. Means and standard deviations of distress change scores are provided in Table 5.

To determine effects of instruction and video on emotion ratings for the second video, a 2(emotion change; fear, disgust) X 2(video condition; fear video, disgust video) X 2(instruction; suppress, reappraise) was conducted. The analysis indicated a significant main effect of emotion change [ $F(1,82) = 7.24$ ,  $p < .01$ ]. As in the first video, pairwise comparisons revealed that changes in disgust ( $M = 2.25$ ,  $S.D. = 2.74$ ) were significantly greater than changes in fear ( $M =$

1.30, 2.81) ( $t = 2.032, p = .045$ ). The repeated-measures ANOVA also indicated a significant emotion change X video interaction [ $F(1,82) = 136.42, p < .001$ ]; a subsequent paired-samples  $t$ -test revealed that in the Fear condition (in which the second video was the disgust video), changes in disgust ( $M = 3.84, S.D. = 2.21$ ) were significantly greater than changes in fear ( $M = -.34, S.D. = 2.43$ ) ( $t = 9.828, p = .000$ ), while in the Disgust condition (for which the second video was the fear video), changes in fear ( $M = 3.10, S.D. = 1.99$ ) were significantly greater than changes in disgust ( $M = .50, S.D. = 2.15$ ) ( $t = 6.837, p = .000$ ), suggesting that participants displayed emotion changes in response to the second video. The emotion change X instruction interaction [ $F(1,82) = .013, p > .05$ ] and the emotion X video X instruction interaction [ $F(1,82) = .446, p > .05$ ] were not significant. A univariate ANOVA on distress scores for the second video revealed no significant effects of Instruction condition [ $F(1,83) = .096, p > 0.05$ ], Video condition [ $F(1,83) = .018, p > 0.05$ ], or Instruction\*Video interaction [ $F(3,80) = .024, p > 0.05$ ].

*Physiological response.* A repeated-measures 2 (Video; disgust, fear) X 2 (Instruction; suppress, reappraise) X 5 (time point; 2 minutes, 4 minutes, 6 minutes, 8 minutes, 10 minutes) ANOVA was conducted on Galvanic skin response (GSR) amplitude at each of five two-minute intervals throughout the first video in order to examine whether GSR changed over time as a function of emotion regulation. The analysis indicated a significant main effect of time [ $F(4, 88) = 2.93, p < .05$ ]; pairwise comparisons indicated that GSR increased over time with differences between time 1 and times 3 ( $t = 2.507, p = .064$ ), and 5 ( $t = -2.003, p = .048$ ) both statistically significant. The time X instruction interaction was not significant [ $F(4,88) = 1.256, p > 0.05$ ], nor was the time X video interaction [ $F(4,88) = 1.534, p > .05$ ] or the Video X Instruction X

Time interaction [ $F(4,88) = 1.112, p > 0.05$ ]. Means and standard deviations of mean GSR for the first video are provided in Table 6.

The repeated-measures ANOVA was conducted again on GSR amplitude for the second video. The main effect of time was significant again [ $F(4,85) = 16.614, p < .001$ ], and pairwise comparisons indicated that GSR increased over time with skin conductance at 2 minutes significantly lower than at 4 ( $t = -3.52, p = .001$ ), 6 ( $t = -4.45, p = .000$ ), 8 ( $t = -4.90, p = .000$ ), and 10 ( $t = -5.28, p = .000$ ) minutes. The time X video interaction was also significant [ $F(4,85) = 7.86, p < .001$ ]; a subsequent one-way ANOVA indicated that at 2 minutes, those in the fear video condition exhibited significantly lower GSR than those in the disgust video group ( $F(1,90) = 8.98, p < .01$ ) such that the increase in GSR over time was more significant for the fear video group. The Instruction X time interaction was not significant [ $F(4,85) = 2.702, p > 0.05$ ], nor was the Video X Instruction X Time interaction [ $F(4,85) = 1.525, p > 0.05$ ]. Means and standard deviations for GSR in the second video are provided in Table 7.

*Cognitive recall.* A univariate ANOVA on memory scores resulted in a significant main effect of Video Condition [ $F(1,93) = 18.874, p < 0.01$ ]. Pairwise comparisons revealed that participants in the Fear condition performed significantly better on the memory test than those in the Disgust condition [ $F(1,93) = 19.002, p < .01$ ]. The main effect of Instruction Condition was not significant, [ $F(1,93) = .240, p = .625$ ], nor was the Instruction X Video Condition interaction [ $F(1,93) = .019, p = .891$ ]. Means and standard deviations for memory test scores are provided in Table 4.

*Communication.* Word count data for 12 participants was missing due to computer error, leaving  $n=83$  to be analyzed. A univariate ANOVA on the word count of participants' typed

paragraphs revealed no significant effect of Instruction Condition [ $F(1,81) = .044, p > 0.05$ ] or Instruction X Video interaction [ $F(3,79) = 1.082, p > 0.05$ ]. Means and standard deviations for word count are provided in Table 8.

### Discussion

Although fear and disgust have been implicated in the anxiety disorders (Bouton, Mineka, & Barlow, 2001; Cisler, Olatunji, Lohr, & Williams, 2009; Goldstein & Chambless, 1978; Lissek et al., 2005; Olatunji et al., 2007; Olatunji, Sawchuk, de Jong, & Lohr, 2007; Woody & Teachmann, 2000), the effects of distinct emotion regulation strategies on the experience of the two emotions remains unclear. To address this gap in the literature, the present study examined the effects of emotion regulation strategies of suppression and reappraisal during fear and disgust elicitation on self-reported emotion and physiological responding. Exploratory analysis also examined the extent to which the two effects of the emotion regulation strategies as a function of the emotion experienced generalized to domains of cognitive recall and communication. Engaging in reappraisal during the disgust video resulted in significantly less distress than did the three other conditions, a finding that is consistent with a large body of literature outlining the efficacy of reappraisal in diminishing negative emotion (Gross & Levenson, 1993; Gross, 1998; Richards & Gross, 2000; Gross, 2002; Siemer, Mauss, & Gross, 2007), but is contrary to the prediction that suppression would produce greater increases in reported emotions and that these effects would be more pronounced when experiencing disgust. A better understanding of this unexpected finding may require further consideration of the nature of the videos used to elicit fear and disgust. Although both videos primarily elicited the target emotion, the fear video elicited a mixture of fear and disgust while the disgust video elicited

significant disgust and little fear. This finding is consistent with previous literature that describes disgust and fear as frequently co-occurring in primarily fearful situations such as snakes and spiders, both of which were prominently featured in the fear video (Scheinle et al, 2008; Woody & Teachman, 2000). While stimuli such as snakes and spiders are not considered overtly disgusting, these studies suggest that if snake- and spider-phobic individuals were represented in the present sample, they may have experienced elevated disgust in the presence of these stimuli. Furthermore, since disgust sensitivity (the degree of intensity with which one experiences disgust) is implicated in several specific phobias (Muris, Merckelbach, Schmidt, & Tierney, 1999), phobic individuals within the present sample may have experienced greater overall disgust, even to relatively non-disgust-specific imagery in the fear video.

Consideration of differences in self-reported regulation across the Video groups may also offer some insight into the finding that engaging in reappraisal during the disgust video resulted in significantly less distress. Specifically, participants in the disgust video group reported engaged in significantly more looking away, changing meaning, and thinking about something else compared to those in the fear video group. The tendency to look away is consistent with prior literature (Armstrong, McClenahan, Kittle, & Olatunji, 2014; van Hooff, Devue, Vieweg, & Theeuwes, 2013) suggesting that disgust motivates attentional avoidance more than other negative states. The strategies of changing meaning and thinking about something else may both be seen as facets of cognitive regulation in which one changes one's thoughts to down-regulate an emotional experience, and the tendency of the disgust video to elicit these types of regulation may also be linked to avoidance motivation. Thus, the differences in emotion-regulation strategies used between video conditions suggest that the disgust video may have been more

conducive to cognitive strategies, including reappraisal, than the fear video. Participants in the disgust video condition may have engaged in both direct avoidance (by looking away) and cognitive avoidance, using thoughts to divert attention away from the disgust stimulus. This phenomenon may be linked to characteristics of disgust, which are further discussed below.

Although reappraisal during the disgust video was found to result in significantly lesser increases in self-reported distress, this finding was not observed at the physiological level of analysis. Given an extensive literature suggesting that suppression is associated with increased physiological arousal (Glaser & Kiecolt-Glaser, 2005; Gross & Levenson, 1993), it was predicted that suppression would lead to significantly higher skin conductance during video presentations. To the contrary, neither time X instruction nor time X instruction X video interactions were significant for either video presentation. One possible explanation for this unexpected finding is that the videos did not elicit as much distress as stimuli in previous studies that documented the physiological effects of suppression. This may be due in part to the isolation of fear and disgust in the videos; images of blood and violence were excluded from both videos in order to minimize disgust during the fear video or vice versa. The significant main effect of time for both video presentations suggested that participants responded with increasing physiological arousal during both video presentations and across all conditions, but more distressing video content may have led to clearer results regarding the physiological effects of suppression.

A secondary aim of this study was to examine the extent to which the two effects of the emotion regulation strategies as a function of the emotion experienced generalized to domains of cognitive recall and communication. Findings along these lines were generally not significant.

However, cognitive recall was found to be significantly lower for disgust video than for the fear video. This finding is consistent with previous literature in which disgust decreased recall for high-threat stimuli (Leshner, Bolls, & Wise, 2011) and exerted lesser inhibitory responses on distractors than fear (Vermeulen, Godefroid, & Mermillod, 2009), suggesting that disgust leads to diminished recall and greater subsequent distraction compared to fear. In addition, the notion that disgust is resistant to extinction compared to fear (Adams, Willems & Bridges, 2010; Olatunji, Smits, Connolly, Willems, & Lohr, 2007; Smits, Telch & Randall, 2002) suggests that participants in the disgust condition may have experienced greater emotional arousal for a longer time period after the video exposure was over, which may have further affected their performance on the memory test. The finding that participants in the fear video condition displayed significantly lower skin conductance at the beginning of the second video exposure provides further evidence for this possibility, as those in the disgust condition may have been experiencing residual arousal even after the 5-10 minute interval in between the video presentation and the memory test. While these findings may point to a model of disgust as conducive to distraction and diminished recall, it must be noted that they are contrary to literature (Chapman et al., 2013) that suggests an enhanced recall associated with disgust as compared to fear. One possible explanation lies in differences in stimuli: Chapman et al. (2013) induced emotion using photographs while the present study used videos with sound, suggesting that the present study may have induced greater distress. In addition, Chapman et al. (2013) measured recall at 10-minute and 45-minute intervals; while recall was greater for disgust than for fear at a 45 minute delay, the effect was non-significant at a 10 minute delay. In the present study, the memory test occurred approximately 5 minutes after video exposure. Thus, a later

memory test for fear and disgust videos may have resulted in different findings. Overall, the finding that the disgust video group displayed poorer recall, together with the diminished distress associated with cognitive reappraisal of the disgust video, suggests that the disgust video elicited increased cognitive activity, greater resistance to extinction, and therefore poorer memory after a five-minute interval compared to the fear video.

The finding that those who engaged in reappraisal while viewing the disgust video experienced significantly lesser increases in distress than those in any other condition raises the interesting possibility that reappraisal may be more effective when experiencing disgust than when experiencing fear. In the context of anxiety, it may be useful in treatment to incorporate a focus on emotion regulation, specifically on increasing reappraisal and reappraisal self-efficacy (e.g. Gaudiano & Herbert, 2007; Goldin et al., 2012), into cognitive-behavioral therapy for those individuals whose anxiety disorders are characterized by excessive disgust. One especially useful intervention may be cognitive restructuring, or the correction of automatic negative thinking patterns (Shurick et al., 2012). For example, for those with contamination concerns, cognitive-behavioral therapy could emphasize ways to reappraise distressing thoughts during exposure to potential contaminants. Consistent with this notion, Dorfan & Woody (2006) found that in a healthy sample, appraising a contaminant as static led to significantly greater distress reduction compared to an appraisal of the contaminant as moving. Further investigation of the effects of cognitive reappraisals of disgust will elucidate the potential benefits of cognitive reappraisal for individuals who experience excessive disgust.

Though these preliminary findings hold implications for the role of emotion regulation in anxiety, any inferences must be considered in the context of the study's limitations. One



important limitation is the use of videos to elicit emotion. While the videos did elicit the target emotions, they did so at a relatively low level of arousal compared to the intense fear and disgust experienced in the context of anxiety disorders. Thus, it may be useful in future research to examine the effects of reappraisal in more lifelike situations, such as exposure to real or perceived contaminants in the lab (e.g. Dorfman & Woody, 2006). In addition, this study drew from a primarily nonclinical population, and it is possible that emotion regulation may lead to qualitatively different outcomes in the context of an anxiety disorder. Thus, future study is needed to investigate the effects of emotion regulation in individuals with anxiety disorders, especially the effects of reappraising disgust for individuals whose disorder is characterized by excessive disgust.

In addition, like much of the emotion-regulation literature (e.g. Butler et al., 2003; Gross et al., 1993; Gross, 1998; Richards & Gross, 2000), this study relied on participants' ability to accurately follow emotion-regulation instructions. Participants' responses to subsequent questions about emotion regulation did not correspond to the instructions they received, leaving some question as to the effectiveness of the instructions. There are several possible explanations for this disparity. First, the wording of the regulation questions was not identical to that of the regulation instructions, in order to minimize demand characteristics in which participants might have chosen the "right" answer regardless of the actual emotion-regulation strategies they used. Thus, one possible explanation for the lack of association between instructions and self-reported regulation is that participants did follow the instructions, but did not associate the wording of the questions to the regulation strategy they had employed. Another possibility is that participants were unable to remember or sustain their assigned regulation strategy for the duration of the ten-

minute video, and post-video responses corresponded more closely to lower levels of regulation that were occurring at the end of the video. However, in spite of the disparity between instructions and responses, analyses indicate that the regulation instructions did have a significant impact on participants' emotional experience. Future studies using both clinical and nonclinical populations should employ more in-depth regulation training in the context of more lifelike and salient emotional situations in order to further elucidate the potential role of reappraisal in diminishing anxiety caused by excessive disgust.

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Table 1.

*Descriptive statistics for demographic information.*

| Variable    | Condition |            |          |            |
|-------------|-----------|------------|----------|------------|
|             | Fear      |            | Disgust  |            |
|             | Suppress  | Reappraise | Suppress | Reappraise |
| % female    | 66.7      | 58.3       | 90.9     | 88.0       |
| mean age    | 18.92     | 18.58      | 18.91    | 19.24      |
| % Caucasian | 75.0      | 66.7       | 54.5     | 64.0       |

Table 2.

*Descriptive statistics for self-report trait measures.*

| Variable    | Condition |            |          |            |
|-------------|-----------|------------|----------|------------|
|             | Fear      |            | Disgust  |            |
|             | Suppress  | Reappraise | Suppress | Reappraise |
| STAI        |           |            |          |            |
| <i>M</i>    | 39.13     | 38.71      | 42.36    | 44.40      |
| <i>S.D.</i> | 9.91      | 8.23       | 8.31     | 10.05      |
| DPSSR_DP    |           |            |          |            |
| <i>M</i>    | 22.13     | 22.75      | 21.73    | 22.20      |
| <i>S.D.</i> | 3.86      | 4.11       | 4.278    | 9.97       |
| DPSSR_DS    |           |            |          |            |
| <i>M</i>    | 18.33     | 17.83      | 18.45    | 17.48      |
| <i>S.D.</i> | 5.01      | 5.04       | 4.55     | 4.87       |
| CESD        |           |            |          |            |
| <i>M</i>    | 19.63     | 20.58      | 23.82    | 22.16      |
| <i>S.D.</i> | 5.65      | 5.46       | 5.54     | 5.81       |
| OCIR        |           |            |          |            |
| <i>M</i>    | 13.96     | 12.79      | 14.73    | 14.44      |
| <i>S.D.</i> | 10.43     | 8.81       | 10.83    | 10.74      |
| ERQ_R       |           |            |          |            |
| <i>M</i>    | 30.63     | 30.75      | 28.73    | 26.52      |
| <i>S.D.</i> | 5.66      | 4.99       | 6.64     | 6.42       |
| ERQ_S       |           |            |          |            |
| <i>M</i>    | 16.00     | 14.21      | 12.23    | 12.84      |
| <i>S.D.</i> | 4.90      | 5.12       | 4.45     | 5.26       |
| ACS         |           |            |          |            |
| <i>M</i>    | 51.38     | 50.42      | 50.18    | 49.80      |
| <i>S.D.</i> | 8.31      | 7.84       | 9.18     | 8.00       |
| ASI         |           |            |          |            |
| <i>M</i>    | 17.08     | 17.92      | 21.27    | 20.96      |
| <i>S.D.</i> | 9.03      | 11.31      | 11.40    | 9.97       |

*Note:* STAI = State-Trait Anxiety Inventory, DPSSR = Disgust Propensity and Sensitivity Scale – Revised (Disgust Propensity and Disgust Sensitivity subscales), CESD = Center for Epidemiological Studies Depression Scale; OCIR = Obsessive Compulsive Inventory – Revised; ERQ = Emotion Regulation Questionnaire; ACS = Attentional Control Scale; ASI = Anxiety Sensitivity Index.

Table 3. Responses to regulation questions.

| Regulation question        | Condition |            |          |            |
|----------------------------|-----------|------------|----------|------------|
|                            | Fear      |            | Disgust  |            |
|                            | Suppress  | Reappraise | Suppress | Reappraise |
| Suppress                   |           |            |          |            |
| <i>M</i>                   | 68.57     | 54.43      | 60.84    | 60.24      |
| S.D.                       | 20.44     | 25.97      | 29.44    | 23.42      |
| Change meaning             |           |            |          |            |
| <i>M</i>                   | 36.10     | 36.43      | 50.00    | 46.90      |
| S.D.                       | 28.02     | 25.99      | 27.64    | 29.06      |
| Not look                   |           |            |          |            |
| <i>M</i>                   | 7.29      | 8.52       | 19.74    | 21.57      |
| S.D.                       | 7.49      | 15.27      | 21.50    | 21.87      |
| Think about something else |           |            |          |            |
| <i>M</i>                   | 18.33     | 24.29      | 24.29    | 39.29      |
| S.D.                       | 17.49     | 27.83      | 27.83    | 29.93      |

Table 4.

*Cognitive and communicative effects.*

| Variable     | Condition |            |          |            |
|--------------|-----------|------------|----------|------------|
|              | Fear      |            | Disgust  |            |
|              | Suppress  | Reappraise | Suppress | Reappraise |
| Memory score |           |            |          |            |
| <i>M</i>     | 17.63     | 17.79      | 16.23    | 16.48      |
| S.D.         | 1.28      | 1.29       | 1.95     | 1.50       |
| Word count   |           |            |          |            |
| <i>M</i>     | 251.67    | 199.86     | 195.54   | 230.41     |
| S.D.         | 207.63    | 188.01     | 308.32   | 147.47     |

Table 5.

*Change in emotional response during video exposure.*

| Variable           | Condition |            |          |            |
|--------------------|-----------|------------|----------|------------|
|                    | Fear      |            | Disgust  |            |
|                    | Suppress  | Reappraise | Suppress | Reappraise |
| Change in fear     |           |            |          |            |
| <i>M</i>           | 2.21      | 2.83       | 2.18     | 3.20       |
| S.D.               | 2.09      | 2.10       | 2.38     | 2.36       |
| Change in disgust  |           |            |          |            |
| <i>M</i>           | 3.25      | 3.33       | 2.14     | 0.32       |
| S.D.               | 1.91      | 1.93       | 2.27     | 3.12       |
| Change in distress |           |            |          |            |
| <i>M</i>           | 2.73      | 3.08       | 3.159    | 1.76       |
| S.D.               | 1.65      | 1.85       | 1.79     | 2.55       |

Table 6.

*Change in Galvanic skin response at two-minute intervals for first video.*

| Video, time point | Condition |            |          |            |
|-------------------|-----------|------------|----------|------------|
|                   | Fear      |            | Disgust  |            |
|                   | Suppress  | Reappraise | Suppress | Reappraise |
| V1, 1             |           |            |          |            |
| <i>M</i>          | -.048     | .012       | -.031    | -.011      |
| <i>S.D.</i>       | .282      | .059       | .070     | .056       |
| V1, 2             |           |            |          |            |
| <i>M</i>          | .067      | .019       | -.007    | .017       |
| <i>S.D.</i>       | .165      | .034       | .061     | .050       |
| V1, 3             |           |            |          |            |
| <i>M</i>          | -.046     | .012       | .006     | .028       |
| <i>S.D.</i>       | .189      | .056       | .051     | .038       |
| V1, 4             |           |            |          |            |
| <i>M</i>          | .035      | .022       | -.006    | .005       |
| <i>S.D.</i>       | .067      | .058       | .067     | .058       |
| V1, 5             |           |            |          |            |
| <i>M</i>          | .062      | .029       | .012     | .024       |
| <i>S.D.</i>       | .219      | .067       | .072     | .054       |

Table 7.

*Change in Galvanic skin response at two-minute intervals for second video.*

| Video, time point | Condition |            |          |            |
|-------------------|-----------|------------|----------|------------|
|                   | Fear      |            | Disgust  |            |
|                   | Suppress  | Reappraise | Suppress | Reappraise |
| V2, 1             |           |            |          |            |
| <i>M</i>          | -.044     | -.113      | -.007    | .000       |
| <i>S.D.</i>       | .091      | .217       | .066     | .057       |
| V2, 2             |           |            |          |            |
| <i>M</i>          | -.012     | -.052      | -.014    | .003       |
| <i>S.D.</i>       | .085      | .217       | .053     | .061       |
| V2, 3             |           |            |          |            |
| <i>M</i>          | .004      | -.017      | -.010    | .011       |
| <i>S.D.</i>       | .087      | .197       | .057     | .055       |
| V2, 4             |           |            |          |            |
| <i>M</i>          | -.004     | -.002      | .013     | .021       |
| <i>S.D.</i>       | .078      | .160       | .041     | .056       |
| V2, 5             |           |            |          |            |
| <i>M</i>          | .020      | .001       | -.002    | .026       |
| <i>S.D.</i>       | .097      | .180       | .058     | .065       |

Figure Captions

*Figure 1.* Responses to emotion-regulation questions by video condition, first video.

*Figure 2.* Responses to emotion-regulation questions by video condition, second video.

*Figure 3.* Emotion ratings by instruction and video conditions, first video.

*Figure 4.* Emotion ratings by instruction and video conditions, second video.

*Figure 5.* Skin conductance response at two-minute intervals by instruction/video group, first video.

*Figure 6.* Skin conductance response at two-minute intervals by instruction/video group, second video.



First Video

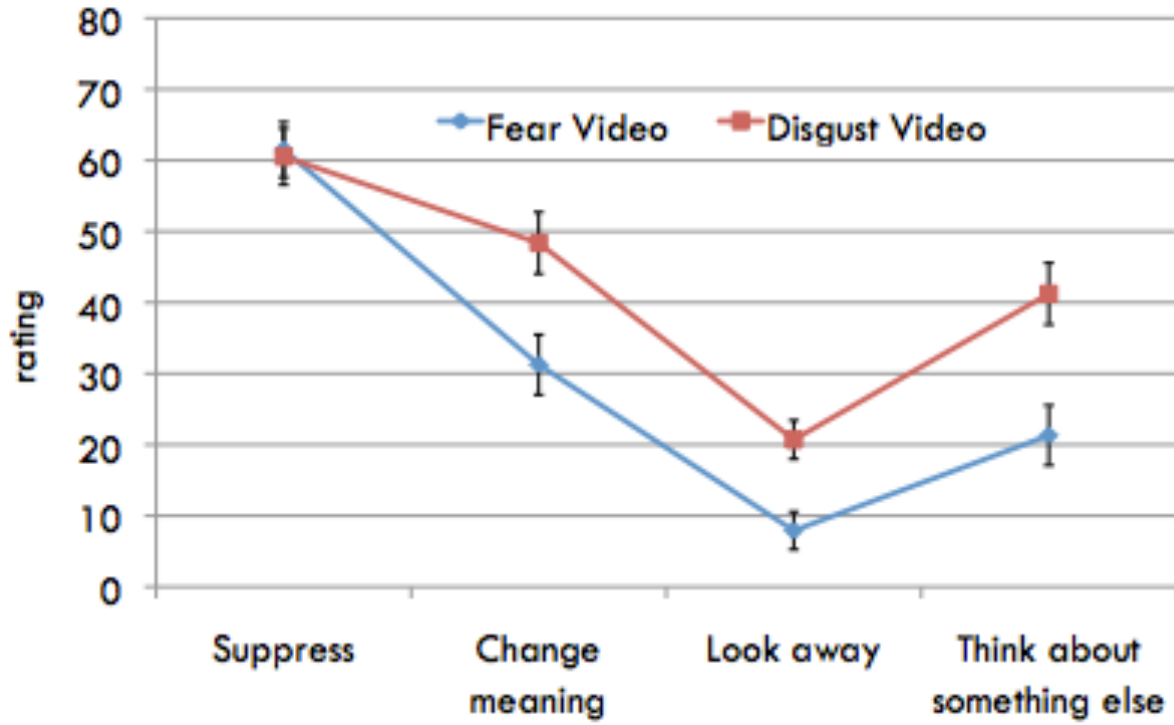


Figure 1.

Second Video

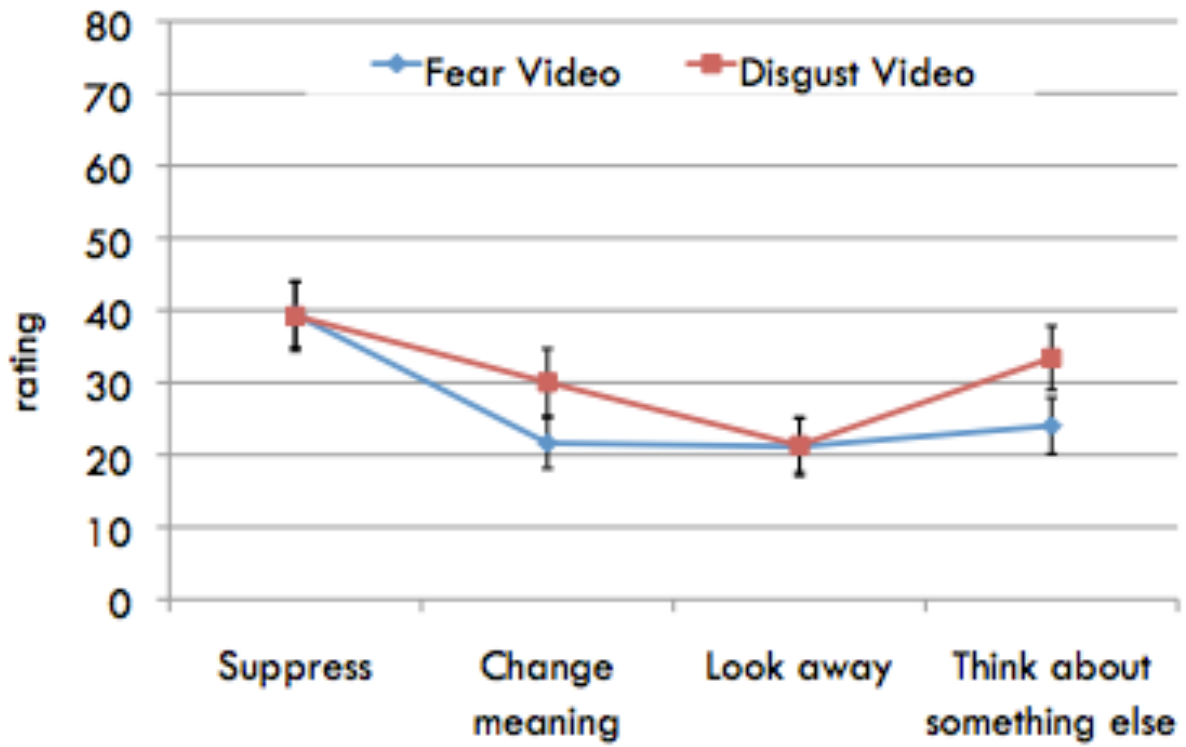


Figure 2.

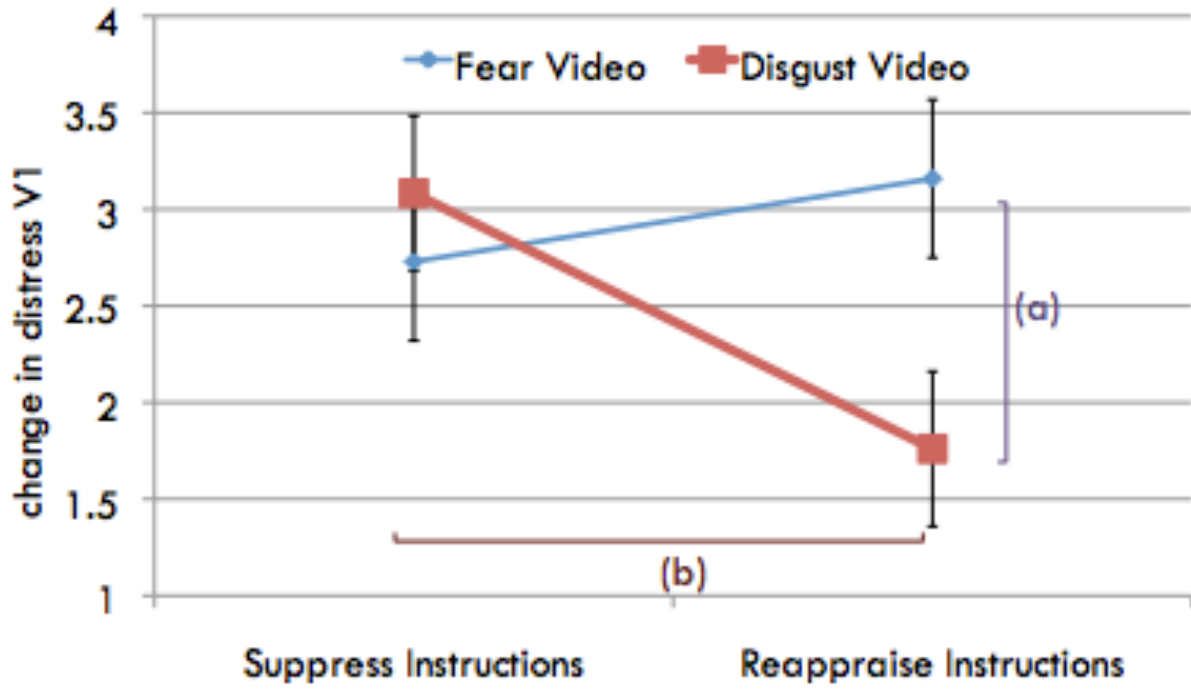


Figure 3.

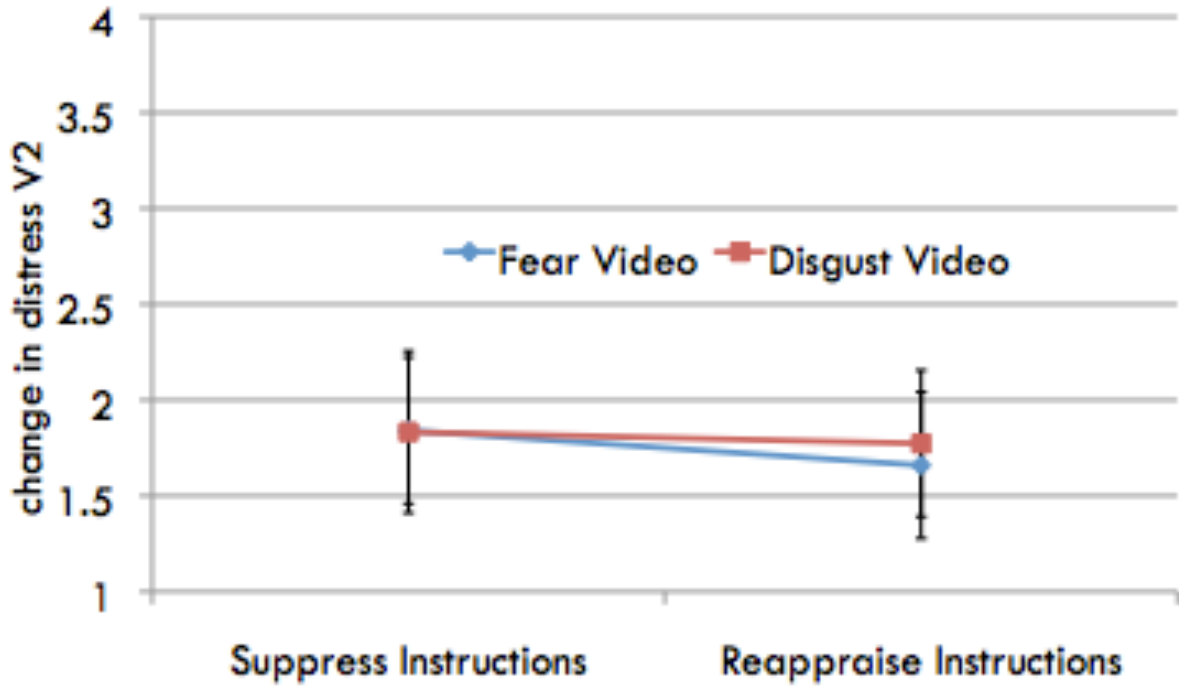


Figure 4.

First Video

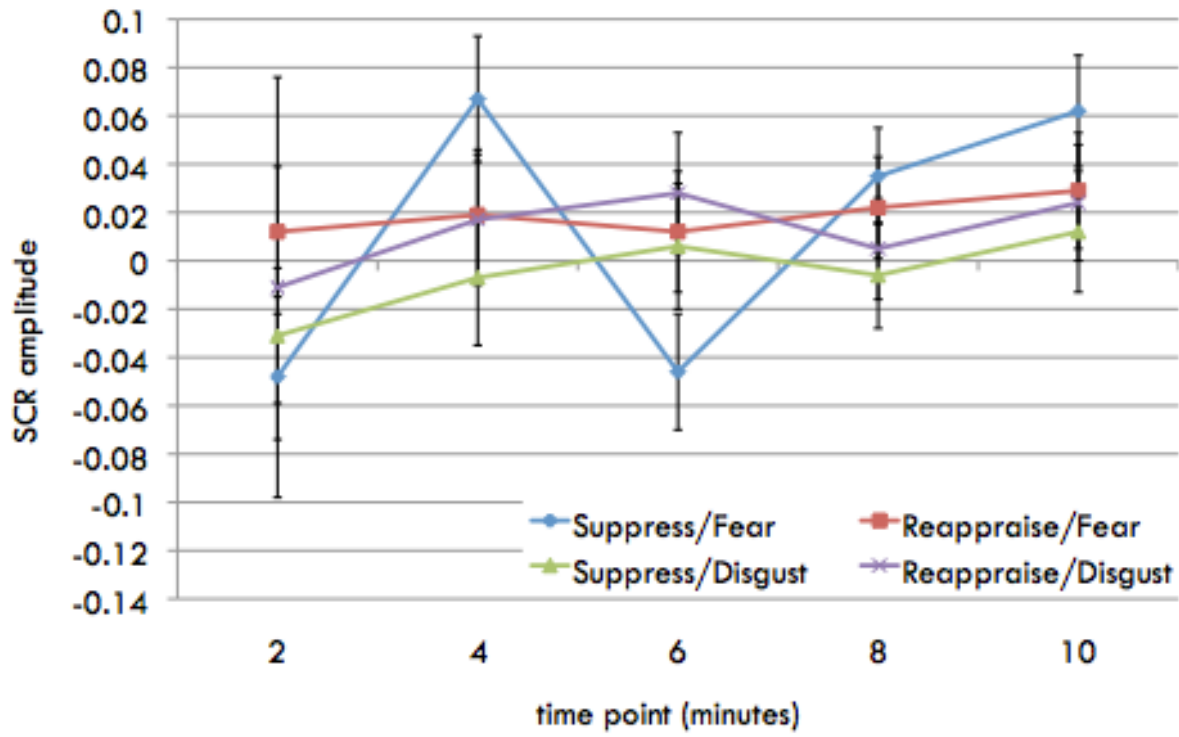


Figure 5.

Second Video

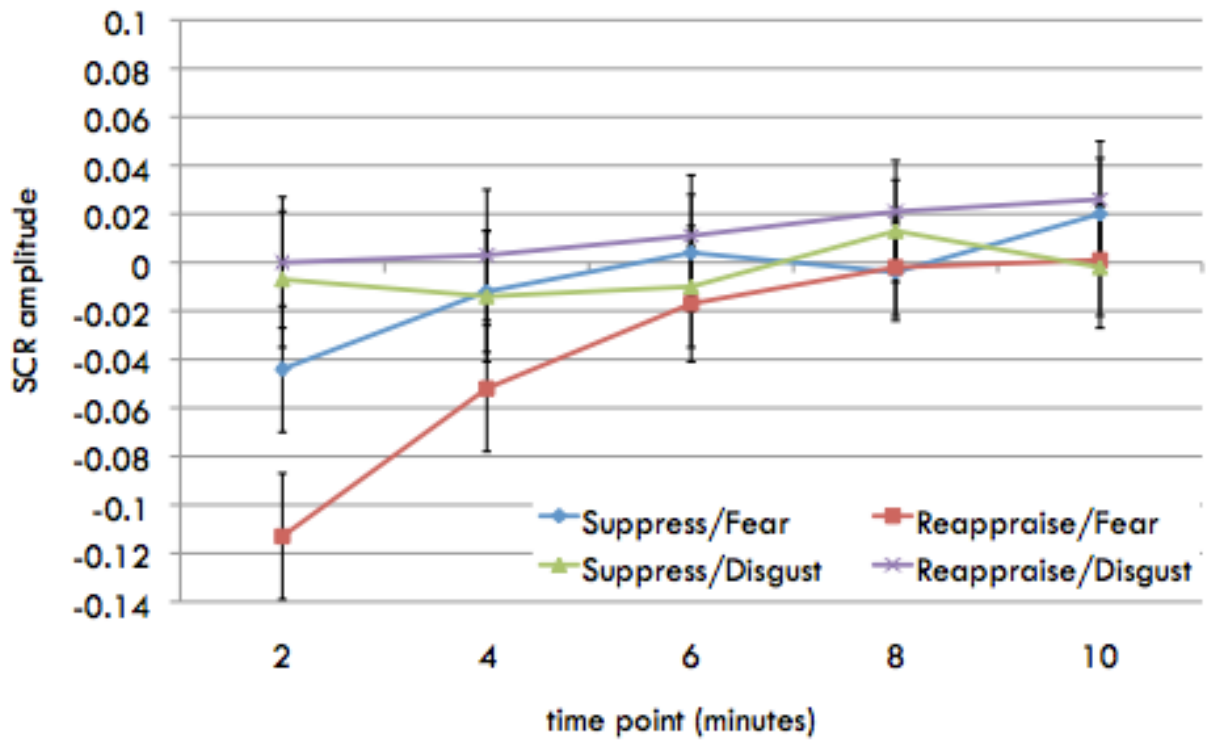


Figure 6.

**Appendix A**  
**The State-Trait Anxiety Inventory, Form Y**  
**STAI Form Y-2**

Instructions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

|  | NEVER | ALMOST<br>SOMETIMES | OFTEN | ALMOST<br>ALWAYS |
|--|-------|---------------------|-------|------------------|
| 1. I feel pleasant   | 1     | 2                   | 3     | 4                |
| 2. I feel nervous and restless   | 1     | 2                   | 3     | 4                |
| 3. I feel satisfied with myself  | 1     | 2                   | 3     | 4                |
| 4. I wish I could be as happy as others seem to be   | 1     | 2                   | 3     | 4                |
| 5. I feel like a failure   | 1     | 2                   | 3     | 4                |
| 6. I feel rested   | 1     | 2                   | 3     | 4                |
| 7. I am "calm, cool, and collected"  | 1     | 2                   | 3     | 4                |
| 8. I feel that difficulties are piling up so that I<br>cannot overcome them                    | 1     | 2                   | 3     | 4                |
| 9. I worry too much over something that doesn't<br>really matter                               | 1     | 2                   | 3     | 4                |
| 10. I am happy   | 1     | 2                   | 3     | 4                |
| 11. I have disturbing thoughts   | 1     | 2                   | 3     | 4                |
| 12. I lack self-confidence   | 1     | 2                   | 3     | 4                |
| 13. I feel secure  | 1     | 2                   | 3     | 4                |
| 14. I make decisions easily  | 1     | 2                   | 3     | 4                |
| 15. I feel inadequate  | 1     | 2                   | 3     | 4                |
| 16. I am content   | 1     | 2                   | 3     | 4                |
| 17. Some unimportant thought runs through my<br>mind and bothers me                            | 1     | 2                   | 3     | 4                |
| 18. I take disappointments so keenly that I can't<br>put them out of my mind                   | 1     | 2                   | 3     | 4                |
| 19. I am a steady person   | 1     | 2                   | 3     | 4                |
| 20. I get in a state of tension or turmoil as I think<br>over my recent concerns and interests | 1     | 2                   | 3     | 4                |

**Appendix B**  
**DPSS-R**

Instructions: this questionnaire consists of 16 statements about disgust. Please read each statement and think how often it is true for you, then place a 'X' in the box that is closest to this.

|    |  | Never | Rarely | Sometimes | Often | Always |
|----|--|-------|--------|-----------|-------|--------|
| 1  | I avoid disgusting things                                  |       |        |           |       |        |
| 2  | When I feel disgusted, I worry that I might pass out       |       |        |           |       |        |
| 3  | It scares me when I feel nauseous                          |       |        |           |       |        |
| 4  | I think disgusting items could cause me illness/infection  |       |        |           |       |        |
| 5  | I feel repulsed  |       |        |           |       |        |
| 6  | Disgusting things make my stomach turn                     |       |        |           |       |        |
| 7  | I screw up my face in disgust                              |       |        |           |       |        |
| 8  | When I notice that I feel nauseous, I worry about vomiting |       |        |           |       |        |
| 9  | When I experience disgust, it is an intense feeling        |       |        |           |       |        |
| 10 | I experience disgust                                       |       |        |           |       |        |
| 11 | It scares me when I faint                                  |       |        |           |       |        |
| 12 | I become disgusted more easily than other people           |       |        |           |       |        |
| 13 | I worry that I might swallow a disgusting thing            |       |        |           |       |        |
| 14 | I find something disgusting                                |       |        |           |       |        |
| 15 | It embarrasses me when I feel disgusted                    |       |        |           |       |        |
| 16 | I think feeling disgust is bad for me                      |       |        |           |       |        |

Scoring key: Never =1, Rarely = 2, Sometimes =3, Often = 4, Always = 5

Disgust Propensity: sum of items 1, 4, 5, 6, 8, 10

Disgust Sensitivity: sum of items 2, 3, 7, 9, 11, 12



**Appendix C**

**CES-D**

Instructions: Indicate how often you have felt the following way during the past week. Rate your replies as follows:

**0 = none of the time (< 1 day); 1 = some (1-2 days); 2 = occasionally (3-4 days); 3 = most of the time (> 5 days)**

- \_\_\_\_\_ 1. I was bothered by things that usually don't bother me.
- \_\_\_\_\_ 2. I did not feel like eating; my appetite was poor.
- \_\_\_\_\_ 3. I felt that I could not shake off the blues even with help from my family or friends.
- \_\_\_\_\_ 4. I felt I was just as good as other people.
- \_\_\_\_\_ 5. I had trouble keeping my mind on what I was doing.
- \_\_\_\_\_ 6. I felt depressed.
- \_\_\_\_\_ 7. I felt that everything I did was an effort.
- \_\_\_\_\_ 8. I felt hopeful about the future.
- \_\_\_\_\_ 9. I thought my life had been a failure.
- \_\_\_\_\_ 10. I felt fearful.
- \_\_\_\_\_ 11. My sleep was restless.
- \_\_\_\_\_ 12. I was happy.
- \_\_\_\_\_ 13. I talked less than usual.
- \_\_\_\_\_ 14. I felt lonely.
- \_\_\_\_\_ 15. People were unfriendly.
- \_\_\_\_\_ 16. I enjoyed life.
- \_\_\_\_\_ 17. I had crying spells.
- \_\_\_\_\_ 18. I felt sad.
- \_\_\_\_\_ 19. I felt that people dislike me.
- \_\_\_\_\_ 20. I could not get "going."

**Appendix D**  
**OCI-R**

Instructions: The following statements refer to experiences that many people have in their everyday lives.

Circle the number that best describes **HOW MUCH** that experience has **DISTRESSED or BOTHERED you during the PAST MONTH**. The numbers refer to the following verbal labels:

- |                |               |
|----------------|---------------|
| 0 = Not at all | 3 = A lot     |
| 1 = A little   | 4 = Extremely |
| 2 = Moderately |               |

- |   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1. I have saved up so many things that they get in the way.   | 0 | 1 | 2 | 3 | 4 |
| 2. I check things more often than necessary.  | 0 | 1 | 2 | 3 | 4 |
| 3. I get upset if objects are not arranged properly.  | 0 | 1 | 2 | 3 | 4 |
| 4. I feel compelled to count while I am doing things.   | 0 | 1 | 2 | 3 | 4 |
| 5. I find it difficult to touch an object when I know it has been touched by strangers or certain people. | 0 | 1 | 2 | 3 | 4 |
| 6. I find it difficult to control my own thoughts.  | 0 | 1 | 2 | 3 | 4 |
| 7. I collect things I don't need.   | 0 | 1 | 2 | 3 | 4 |
| 8. I repeatedly check doors, windows, drawers, etc.   | 0 | 1 | 2 | 3 | 4 |
| 9. I get upset if others change the way I have arranged things.   | 0 | 1 | 2 | 3 | 4 |
| 10. I feel I have to repeat certain numbers.  | 0 | 1 | 2 | 3 | 4 |
| 11. I sometimes have to wash or clean myself simply because I feel contaminated.                          | 0 | 1 | 2 | 3 | 4 |
| 12. I am upset by unpleasant thoughts that come into my mind against my will.                             | 0 | 1 | 2 | 3 | 4 |
| 13. I avoid throwing things away because I am afraid I might need them later.                             | 0 | 1 | 2 | 3 | 4 |
| 14. I repeatedly check gas and water taps and light switches after turning them off.                      | 0 | 1 | 2 | 3 | 4 |
| 15. I need things to be arranged in a particular order.   | 0 | 1 | 2 | 3 | 4 |
| 16. I feel that there are good and bad numbers.   | 0 | 1 | 2 | 3 | 4 |
| 17. I wash my hands more often and longer than necessary.   | 0 | 1 | 2 | 3 | 4 |

18. I frequently get nasty thoughts and have difficulty  
in getting rid of them.

0 1 2 3 4

## Appendix E

### Emotion Regulation Questionnaire (ERQ)

The Emotion Regulation Questionnaire is designed to assess individual differences in the habitual use of two emotion regulation strategies: cognitive reappraisal and expressive suppression.

#### 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*.

Do not change item order, as items 1 and 3 at the beginning of the questionnaire define the terms “positive emotion” and “negative emotion”.

#### Scoring (no reversals)

Reappraisal Items: 1, 3, 5, 7, 8, 10; Suppression Items: 2, 4, 6, 9.

**Appendix F**  
**Attentional Control Scale**

Items are scored on a 4-point scale (1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*)

1. It's very hard for me to concentrate on a difficult task when there are noises around.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
2. When I need to concentrate and solve a problem, I have trouble focusing my attention.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
3. When I am working hard on something, I still get distracted by events around me.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
4. My concentration is good even if there is music in the room around me.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
5. When concentrating, I can focus my attention so that I become unaware of what's going on in the room around me.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
6. When I am reading or studying, I am easily distracted if there are people talking in the same room.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
7. When trying to focus my attention on something, I have difficulty blocking out distracting thoughts.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
8. I have a hard time concentrating when I'm excited about something.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
9. When concentrating I ignore feelings of hunger or thirst.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
10. I can quickly switch from one task to another.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
11. It takes me a while to get really involved in a new task.  
1 *\_ almost never*; 2 *\_ sometimes*; 3 *\_ often*; 4 *\_ always*
12. It is difficult for me to coordinate my attention between the listening and writing required when taking notes during lectures.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

13. I can become interested in a new topic very quickly when I need to.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

14. It is easy for me to read or write while I'm also talking on the phone.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

15. I have trouble carrying on two conversations at once.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

16. I have a hard time coming up with new ideas quickly.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

17. After being interrupted or distracted, I can easily shift my attention back to what I was doing before.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

18. When a distracting thought comes to mind, it is easy for me to shift my attention away from it.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

19. It is easy for me to alternate between two different tasks.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

20. It is hard for me to break from one way of thinking about something and look at it from another point of view.

1 \_ *almost never*; 2 \_ *sometimes*; 3 \_ *often*; 4 \_ *always*

**Appendix G****ASI-3**

Instructions: Please circle the number that best corresponds to how much you agree with each item. If any items concern something that you have never experienced (e.g., fainting in public) answer on the basis of how you think you might feel *if you had* such an experience. Otherwise, answer all items on the basis of your own experience. Be careful to circle only one number for each item and please answer all items.

|  | <b>Very Little</b> | <b>A little</b> | <b>Some</b> | <b>Much</b> | <b>Very much</b> |
|--|--------------------|-----------------|-------------|-------------|------------------|
| 1. It is important for me not to appear nervous.   | 0                  | 1               | 2           | 3           | 4                |
| 2. When I cannot keep my mind on a task, I worry that I might be going crazy.                        | 0                  | 1               | 2           | 3           | 4                |
| 3. It scares me when my heart beats rapidly.   | 0                  | 1               | 2           | 3           | 4                |
| 4. When my stomach is upset, I worry that I might be seriously ill.                                  | 0                  | 1               | 2           | 3           | 4                |
| 5. It scares me when I am unable to keep my mind on a task.  | 0                  | 1               | 2           | 3           | 4                |
| 6. When I tremble in the presence of others, I fear what people might think of me.                   | 0                  | 1               | 2           | 3           | 4                |
| 7. When my chest feels tight, I get scared that I won't be able to breathe properly.                 | 0                  | 1               | 2           | 3           | 4                |
| 8. When I feel pain in my chest, I worry that I am going to have a heart attack.                     | 0                  | 1               | 2           | 3           | 4                |
| 9. I worry that other people will notice my anxiety.   | 0                  | 1               | 2           | 3           | 4                |
| 10. When I feel "spacey" or spaced out I worry that I may be mentally ill.                           | 0                  | 1               | 2           | 3           | 4                |
| 11. It scares me when I blush in front of people.  | 0                  | 1               | 2           | 3           | 4                |
| 12. When I notice my heart skipping a beat, I worry that there is something seriously wrong with me. | 0                  | 1               | 2           | 3           | 4                |
| 13. When I begin to sweat in a social situation, I fear people will think negatively of me.          | 0                  | 1               | 2           | 3           | 4                |
| 14. When my thoughts seem to speed up, I worry that I might be going crazy.                          | 0                  | 1               | 2           | 3           | 4                |
| 15. When my throat feels tight, I worry that I could choke to death.                                 | 0                  | 1               | 2           | 3           | 4                |
| 16. When I have trouble thinking clearly, I worry that there is something wrong with me.             | 0                  | 1               | 2           | 3           | 4                |
| 17. I think it would be horrible for me to faint in  | 0                  | 1               | 2           | 3           | 4                |

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| public.   |   |   |   |   |   |
| 18. When my mind goes blank, I worry there is something terribly wrong with me. | 0 | 1 | 2 | 3 | 4 |



**Appendix H**  
**Memory Assessment: Fear Video**

| Question  | Correct response |
|---|------------------|
| 1. A man tried to take a picture of a large spider when it jumped toward the camera.        | TRUE             |
| 2. A woman holding a blue umbrella was hit by a car.  | TRUE             |
| 3. A woman was holding a snake.   | FALSE            |
| 4. A car and a motorcycle collided at an intersection.                                      | FALSE            |
| 5. A man let a black spider crawl around on his hand.                                       | TRUE             |
| 6. A silver car hit a woman crossing the street with her baby.                              | TRUE             |
| 7. A car was driving on the highway when another car crossed the median and hit it head-on. | TRUE             |
| 8. A person's feet were floating above the ground in an elevator.                           | TRUE             |
| 9. A man struggled to get his son's seatbelt on.  | FALSE            |
| 10. A man was trying to escape out the bathroom window, but couldn't get out.               | FALSE            |
| 11. A boy's friends made him go into an enclosed space, but the door got stuck.             | FALSE            |
| 12. Two people had a conversation in the elevator.  | FALSE            |
| 13. A black snake lunged forward toward the camera.   | TRUE             |
| 14. An elevator went from the 2nd floor to the 5th floor.                                   | FALSE            |
| 15. A large dog attacked a yellow car.  | TRUE             |
| 16. A large tarantula crawled around on a bedspread.  | TRUE             |
| 17. Two motorcycles collided at an intersection.  | TRUE             |
| 18. A snake was shown attacking a blue balloon  | FALSE            |
| 19. A woman in pink tried to protect her car from a large dog.                              | TRUE             |
| 20. A large snake was wrapped around a man, who struggled to escape.                        | TRUE             |

**Appendix J**  
**Memory Assessment: Disgust Video**

| Question   | Correct response |
|--|------------------|
| 1. There were two white dishes of rotting food: one with fruit and one with bread.           | FALSE            |
| 2. A woman in a pink shirt was vomiting into the toilet.                                     | TRUE             |
| 3. There was a woman vomiting in a bathroom with dark green wallpaper.                       | FALSE            |
| 4. A pile of garbage, including an apple core, was rotting and growing mold.                 | TRUE             |
| 5. A young boy holding a photograph jumped into a pit of waste.                              | TRUE             |
| 6. A rotting sandwich surrounded by salad was sitting on a white surface.                    | TRUE             |
| 7. A man was alone vomiting into a toilet.   | TRUE             |
| 8. An apple against a blue background was growing mold.                                      | FALSE            |
| 9. A car drove into a pit of waste.  | FALSE            |
| 10. A man was vomiting onto the sidewalk.  | FALSE            |
| 11. Two babies were having their diapers changed on the same table.                          | FALSE            |
| 12. A man in a white shirt was vomiting into the toilet.                                     | TRUE             |
| 13. A man and woman were both vomiting in the same room.                                     | FALSE            |
| 14. An orange was growing mold.  | FALSE            |
| 15. A baby was lying on a green blanket.   | TRUE             |
| 16. A woman came to breakfast carrying soiled sheets.  | FALSE            |
| 17. A family was eating beans, eggs and sausage when someone entered carrying soiled sheets. | TRUE             |
| 18. A woman wearing blue attempted to take the soiled sheets.                                | FALSE            |
| 19. An apple was growing mold.   | TRUE             |
| 20. There was a plate of meat that became infested with maggots.                             | TRUE             |