Affect labeling of discrete negative emotions as a mechanism of emotion regulation

By

Kelly A. Knowles

Thesis
Submitted to the Faculty of the
Graduate School of Vanderbilt University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS
in
Psychology
May 31, 2017
Nashville, Tennessee

Approved:

Bunmi O. Olatunji, PhD

Jo-Anne Bachorowski, PhD

Steven D. Hollon, PhD

ACKNOWLEDGEMENTS

I would like to thank my committee for their feedback and support on this project: my advisor, Bunmi Olatunji, for his guidance and help in narrowing down my research interests; Jo-Anne Bachorowski, for her critical edits and attention to detail; and Steve Hollon, for his positivity and big-picture perspective on potential applications of my research. Thank you all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Emotions are a fundamental part of the human experience that shape how we view, interpret, and react to our world. Humans regulate their emotions in order to change their internal emotional state as well as to manage their emotional expression in social situations. Emotion regulation refers to a set of processes by which a person can modulate the intensity of the emotion they are experiencing. Emotions can be regulated before an emotional response (antecedent-focused emotion regulation, which includes such strategies as situation selection, situation modification, attentional deployment, and cognitive change) or after an emotional response has been generated (response-focused emotion regulation, such as response modulation; Gross & Muñoz, 1995). For example, Gross (1998) found that those who used reappraisal, a form of cognitive change, during a negative film clip had decreased behavioral and subjective signs of emotions and no elevations during physiological responding; however, those who used suppression, a form of response modulation, had increases in physiological arousal and no change in subjective emotion experience, despite suppressed emotional behavior. Reviews of the literature have suggested that reappraisal is more effective at changing emotional experience than suppression (Gross, 2001, 2002). Although more research is needed examining other antecedent- and response-focused emotion regulation aside from reappraisal and suppression, one study of multiple emotion-regulation strategies found that increased use of antecedent-focused strategies is associated with enhanced well-being (Schutte, Manes, & Malouff, 2009).

Many forms of emotion regulation are intentional, effortful processes, such as distraction, in which a person attends to less negative aspects of their environment to decrease a negative emotion, and reappraisal, in which a person changes the meaning of a given situation in order to change their emotional response (Gross, 2002). However, not all emotion regulation strategies are purposely used to change emotional experience. Affect labeling[1], the act of "putting feelings into words" (Lieberman et al., 2007), is considered an incidental emotion-regulation process; most people do not intentionally label their emotions as a form of emotion regulation (Lieberman, Inagaki, Tabibnia, & Crockett, 2011). Multiple functional magnetic resonance imaging (fMRI) studies have demonstrated that affect labeling in response to emotional images and faces involves increased activation of the right ventrolateral prefrontal cortex (RVLPFC) and decreased activation of the amygdala, mediated by activity in the medial prefrontal cortex (MPFC; Burklund, Creswell, Irwin, & Lieberman, 2014; Hariri, Bookheimer, & Mazziotta, 2000; Lieberman et al., 2007). Psychologically, this suggests that individuals who are labeling their emotions are processing their feelings linguistically, which actively changes them. Thus, a potential neurological mechanism for the effectiveness of affect labeling at down-regulating emotions has been indicated.

Emotion-regulation skills, such as reappraisal, are a key component of cognitive-behavioral therapy (Berking et al., 2008; Moscovitch et al., 2012). However, it has been

[1] Throughout this manuscript, I use the term affect labeling to refer to the process of naming one's emotions, as it has been used in the fields of social neuroscience and psychotherapy research. Some emotion scholars may object to this term due to the differences in emotion, a specific set of feelings, behaviors, and appraisals that are typically of short duration and directed at a specific object, and affect, a broader feeling state consisting of the components of valence (pleasure/displeasure) and activation (Russell & Barrett, 1999). Emotion labeling may be a more accurate term, but I primarily use affect labeling for the sake of consistency in the literature. I thank Jo-Anne Bachorowski for her feedback on this important point.

suggested that reappraisal is more difficult under significant cognitive load (Nolen-Hoeksema, 2012; Ortner, 2015), and thus may be difficult for some patients to utilize in stressful situations. Affect labeling, while not effort-free, involves mere identification of the emotion one is feeling in the moment, which may be a simpler cognitive process for some individuals. One study that directly compared the two processes found slower reaction times in those who were told to reappraise their emotions in contrast to those who were instructed to label them; participants in both groups did not differ on a measure of physiological arousal (skin conductance), meaning that both reappraisal and affect labeling equally down-regulate emotions on a physiological level (Ortner, 2015). A neuroimaging study comparing reappraisal and affect labeling found common neural substrates for both of these emotion-regulation strategies: decreased amygdala activation and increased prefrontal cortex activation, specifically in the inferior frontal gyrus (Payer, Baicy, Lieberman, & London, 2012). If affect labeling is equivalently effective at down-regulating emotions compared to reappraisal but can be done more efficiently under cognitive load, it may be a useful skill to learn, especially for individuals who struggle to regulate their emotions through the methods commonly taught in cognitive-behavioral therapy.

Affect labeling can be used in other psychological interventions as well, but the specific mechanism for its effectiveness is as yet unclear. Two studies examined the effect of affect labeling on symptom reporting in undergraduates and in irritable-bowel-syndrome (IBS) patients. Among undergraduate students, those who labeled images either emotionally or non-emotionally had reduced symptom reporting when viewing unpleasant images (Constantinou, van den Houte, Bogaerts, van Diest, & van den Bergh, 2014). A trend toward reduced symptom reporting was found but did not reach significance in the IBS patient group (Constantinou et al., 2015). Neither of these studies found a specific benefit of affect labeling over content labeling, suggesting that the mechanism of action may be through increased attention or cognitive processing of an image compared to passive viewing. However, a previous fMRI study found that affect labeling of emotional faces led to decreased amygdala activation and increased RVLPFC activation compared to gender labeling (Lieberman et al., 2007). Another study found that objective, but not subjective, labeling of emotional valence (positivity/negativity) reduced physiological arousal in healthy men (McRae, Taitano, & Lane, 2010). These mixed findings merit additional research to determine if affect labeling has a specific emotion-regulation effect above and beyond the act of labeling alone.

Affect labeling may also overlap with acceptance, a mindfulness-based strategy to regulate one's emotions. Acceptance encourages individuals to emotionally disengage rather than attempt to change their emotions. In mindfulness-based interventions, individuals are encouraged to acknowledge the presence of an emotion, label it, and move on, without judging the emotional experience (Hayes & Feldman, 2004; Hayes, Strosahl, & Wilson, 1999). Studies have indicated that trait mindfulness is associated with greater activation in the prefrontal cortex and reduced bilateral amygdala activity during affect labeling. Individuals high in trait mindfulness had a negative correlation between activation in the right ventrolateral prefrontal cortex and activation in the right amygdala during an affect-labeling task, but this correlation was not significant in those low in trait mindfulness (Creswell, Way, Eisenberger, & Lieberman, 2007). Thus, individual differences in emotion-regulation ability and trait mindfulness may moderate the effectiveness of affect labeling such that individuals high in trait mindfulness might see increased benefit from affect labeling compared to less mindful individuals. Alternatively, because affect labeling is a relatively simple and easily learned process, it is possible that individuals with weaker emotion-regulation skills may see a greater benefit after being introduced to this new skill.

In addition to its uses in mindfulness- and acceptance-based therapeutic approaches, affect labeling may also be applied to behavior therapy. According to the inhibitory learning model of extinction, affect labeling may enhance prefrontal cortex engagement and therefore maximize inhibitory control. Improved inhibitory control over the amygdala may improve inhibitory learning and reduce return of fear, suggesting that affect labeling could be used to improve exposure therapy outcomes (Craske et al., 2008; Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014). Three studies have examined affect labeling in exposure. Tabibnia, Lieberman, and Craske (2008) found that labeling negatively valenced images using unrelated words results in reduced physiological arousal to both previously exposed images and novel images after two sessions of exposure. They hypothesized that using unrelated labels led to deeper processing of the images; however, the use of unrelated labels does not fit the definition of affect labeling of "putting one's feelings into words." Alternatively, unrelated emotional labeling may simply be a form of distraction. A follow-up study with spider-phobic patients comparing affect labeling to reappraisal and distraction in exposure found that participants in the affect labeling condition had the greatest decreases in physiological arousal, but no significant differences were observed in self-reported fear and approach behavior (Kircanski, Lieberman, & Craske, 2012). Finally, a third study found that affect labeling during exposure led to reduced physiological arousal during a public speaking task compared to an exposure-only control group, with a greater effect of affect labeling for those with greater deficits in incidental emotion-regulation skills (Niles, Craske, Lieberman, & Hur, 2015). Thus, explicitly encouraging affect labeling during exposure may provide greater benefits to individuals who have trouble automatically identifying their emotions in fearful contexts.

While there is initial support for the effectiveness of affect labeling during exposure, only one study used multiple methods of analysis to measure the down-regulation of emotion, and this study found no effect on a self-report measure of fear (Kircanski et al., 2012). In addition, all three studies focused on either undifferentiated negative or fear-provoking stimuli, without examining the effect of affect labeling on multiple emotions. While fear extinction is the presumed basis of exposure therapy, fear is not the only emotion that is dysregulated in anxiety and related disorders. For example, research suggests that disgust is a prominent emotion in anxiety disorders and obsessive-compulsive disorder (OCD), psychological disorders for which exposure therapy is very effective (Olatunji, Cisler, McKay, & Phillips, 2010). Disgust propensity changes during the course of exposure therapy, suggesting it may also be a potential target for affect labeling during exposure (de Jong, Andrea, & Muris, 1997; Hirai et al., 2008; McKay, 2006; Smits, Telch, & Randall, 2002; Taboas, Ojserkis, & McKay, 2014). The dysregulation of other emotions is a feature of different types of psychopathology, as well. Excessive and enduring sadness is implicated in complicated grief, dysphoria, and depression, although depression is more than the constant experience of sadness and also involves a lack of pleasure (anhedonia; Bonanno, Goorin, & Coifman, 2008). Because depression is often maintained through rumination (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008), affect labeling may not prove to be useful in depressed individuals, as labeling sad experiences may serve to maintain feelings of sadness. An empirical test of this hypothesis is warranted.

Despite this conceptual understanding of emotions as distinct and separable, emotion theorists debate the existence of discrete, basic emotion categories, especially at the neural level. The existence of discrete neural pathways for different emotions versus the existence of common neural mechanisms underlying all emotions is debated. For instance, the amygdala is prominently implicated in fear conditioning, but research has also shown that the amygdala responds to novelty and emotional salience rather than fear alone (Anderson & Phelps, 2001). Broader emotional activity in the brain also cannot be functionally reduced to a single system, as demonstrated by inconsistency in definitions of the limbic system and the role of cortical areas in emotion generation and regulation (Ledoux & Phelps, 2008). Additionally, a review of the neuroimaging literature on emotion found that although there was some consistency in brain regions associated with fear and sadness, correspondence between studies was modest and lacked specificity (Barrett & Wager, 2006; Phan, Wager, Taylor, & Liberzon, 2002). Alternative theories of emotions include understanding emotion as consisting of separate dimensions of valence and arousal (Russell & Barrett, 1999), or as the product of the experience of core affect and conceptual knowledge of emotion (conceptual act theory; Barrett, 2006a, 2006b; Barrett & Wager, 2006; Gross & Barrett, 2011). Few neuroimaging studies have examined emotions from a dimensional approach, and their variable methods make it difficult to draw firm conclusions (Murphy, Nimmo-Smith, & Lawrence, 2003; Wager, Phan, Liberzon, & Taylor, 2003). A recent model, similar to the conceptual act model but specifically referencing neural substrates of emotional valence, is called the affective workspace hypothesis. According to this hypothesis, valence is produced through the interaction of multiple systems in the brain, including the salience network, default mode network, and frontoparietal control network (Barrett & Bliss-Moreau, 2009; Lindquist, Wager, Kober, Bliss-Moreau, & Barrett, 2012). A meta-analysis of

397 neuroimaging studies found support for the affective workspace hypothesis (Lindquist, Satpute, Wager, Weber, & Barrett, 2016).

One study directly compared the theory of basic emotions, in which distinct emotions each have a separate network in the brain, with the conceptual act theory of emotion (Touroutoglou, Lindquist, Dickerson, & Barrett, 2014). This study found evidence for the conceptual act model, as variance in the analyzed networks was accounted for by a domain-general network, and the salience network was activated for each analyzed network. However, data in this study were collected using resting-state functional connectivity MRI, rather than scanning the brains of participants who were actively engaged in an emotion task. Conversely, a recent study using multivariate pattern analysis across multiple emotion-induction methods found that different emotions have discrete neural signatures (Saarimaki et al., 2015), avoiding the *a priori* bias of region of interest analyses. This study also specifically used a labeling task, in which participants were given a list of words before scanning and asked to think of or write down a method to elicit this emotion by thinking of a past event, related scene in a movie, or recreating one's bodily state during that emotion. During scanning, participants used imagery for each emotion word viewed to elicit that emotion. Although the issue of how emotions are represented in the brain is far from settled, there is some evidence of specific neural patterns for basic emotions.

As previously mentioned, much of the research on affect labeling suggests a specific neural mechanism for the down-regulation of emotional experience: increased activation of RVLPFC and MPFC, and decreased amygdala activation (Lieberman et al., 2007). However, this research has been conducted primarily with emotional facial expressions (Hariri et al., 2000; Lieberman et al., 2007) and negatively valenced stimuli for which differential effects across emotion categories were not examined (Burklund et al., 2014). If different emotions have distinct neural pathways, the pattern of activation during affect labeling may change during the experience of different negative emotions. However, if the primary effect of down-regulating the amygdala is to decrease response to emotional salience, we might expect affect labeling to similarly dampen affect across equivalently salient emotional contexts. Thus, an examination of affect labeling across multiple emotional contexts, controlling for variance in emotional valence, may provide stronger evidence for the existence of basic emotions or emotions as dimensional entities arising from an affective workspace in the brain.

Although preliminary research on affect labeling is promising, the mechanism that may account for the effectiveness of affect labeling on undifferentiated negative or fear-provoking images is unclear, in part because prior research has failed to employ multiple units of analysis as a dependent measure of affect labeling. Using multiple dependent variables will provide a more precise examination of when and how affect labeling affects emotion, whether through emotional valence, physiological arousal, or a combination of these processes. If the effects of affect labeling are only evident in measures of arousal, it may be that affect labeling primarily affects the arousal dimension of emotion, rather than emotional valence. A significant difference in self-reported emotional intensity across multiple emotions may suggest differences in conscious processing and understanding of emotion after affect labeling.

In the current study, images from three discrete emotional categories (fear, disgust, and sadness) were presented to participants using an image viewing paradigm from a previous experiment (Tabibnia et al., 2008, Study 2). Although images could have been selected from a number of other negative emotion categories, including anger, shame, and embarrassment, the three emotional categories selected for this study are highly relevant to mood and anxiety disorders and have reliably been induced through image presentation in previous laboratory studies (Lang, Greenwald, Bradley, & Hamm, 1993). Additionally, fear and disgust are often targeted in exposure therapy for anxiety disorders and OCD, warranting a direct comparison between them in an affect-labeling exposure paradigm. Sadness was chosen for comparison, as a similarly negative emotion that is typically addressed differently in therapeutic contexts. Images from these three categories were presented to participants in three different conditions, which varied by the context in which images were presented (unlabeled, labeled with a related negative emotion word, and labeled with an unrelated negative emotion word). These labeling contexts were selected in order to clarify the mixed findings on the effectiveness of unrelated and related labels in down-regulating emotions (Tabibnia et al., 2008). Theoretically, for these labeling effects to be specifically attributable to affect labeling, the words following the images must describe the emotion that the participant feels. Unrelated emotion words or content labels would not be expected to demonstrate the same effects.

During the display of each emotional image, peak skin conductance amplitude was measured. Skin conductance is a reliable measure of physiological arousal and is differentially associated with different emotions (Ekman, Levenson, & Friesen, 1983; Lang et al., 1993). In addition to measuring skin conductance, participants rated the intensity of the emotion and overall distress caused by each image after it was presented, and mean emotional intensity and distress scores were computed for each emotion category and compared across labeling conditions. This study therefore provides both objective measures of arousal and subjective measures of overall distress and specific emotional experience.

A follow-up procedure was conducted to provide information about the stability of the effect of affect labeling over time, as well as generalization to novel images. This aspect of the experimental design allows for examination into affect labeling's specific effects, which have implications for its use as a learned emotion-regulation strategy. The effect of affect labeling may be temporary or enduring. It may affect emotion regulation specifically or broadly. Two alternative hypotheses are explored: if affect labeling down-regulates emotional experience, emotional intensity and peak skin conductance will be lowest for images in the negative label contexts across all three conditions. If affect labeling has differential effects across negative emotions, previous research suggests that larger reductions in emotional intensity and peak skin conductance may be seen in fear and disgust labeling compared to sadness labeling.

CHAPTER II

METHOD

2.1 Participants

One hundred twenty participants were enrolled in this study. Participants included Vanderbilt undergraduates recruited from the SONA Psychological Sciences Research Pool as well as Vanderbilt community members recruited from flyers placed on campus. Undergraduates received class credit for participating in the study, while community members received $10 for completing each experimental session ($20 total). Two participants withdrew from the study after the first session, leaving complete data for 118 participants. Mean age was 27.8 years, with a range from 18 to 85. Most participants were Caucasian (63.6%) and female (66.9%). There were no differences on any demographic variables between labeling conditions.

2.2 Measures

The Acceptance and Action Questionnaire (AAQ; Hayes et al., 2004) is a 9-item self-report measure of experiential avoidance, an unwillingness to experience negative emotions. Respondents rate how well items apply to them on a Likert scale from 1 (never true) to 7 (always true). Higher scores on the AAQ are correlated with greater psychopathology and lower quality of life.

The Assessing Emotions Scale (AES; Schutte et al., 1998; Schutte, Malouff, & Bhullar, 2009) is a 33-item self-report scale measuring emotional intelligence. It includes assessment of the ability to recognize emotion in oneself and others, emotional expression, emotion regulation, and how a person utilizes emotion to solve problems. Respondents rate how much each item reflects how they handle their emotions on a Likert scale from 1 "strongly disagree" to 5 "strongly agree." The AES has good internal consistency and good external validity.

The Beck Anxiety Inventory (BAI; Beck & Steer, 1993) is a 21-item self-report measure of anxiety symptoms. Respondents rate how much specific anxiety symptoms have bothered them during the past week from 0 (not at all) to 3 (severely; I could barely stand it). The BAI is widely used and has high internal consistency.

The Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) is a 20-item self-report measure of depressive symptoms. Respondents rate items based on how often they felt a certain way during the past week, from "rarely or none of the time (less than 1 day)" to "all of the time (5-7 days)"; scores range from 0 to 60. The CES-D has high internal consistency in both the general population and in patient samples.

The Disgust Propensity and Sensitivity Scale-Revised (DPSS-R; Olatunji, Cisler, Deacon, Connolly, & Lohr, 2007; van Overveld, de Jong, Peters, Cavanagh, & Davey, 2006) is a 16-item self-report measure of individuals' reactions to disgust. The DPSS-R is made up of two subscales: The Disgust Propensity scale measures how frequently individuals experience disgust, and the Disgust Sensitivity scale measures the emotional impact of experiencing disgust. Respondents answer how often each item is true for them on a Likert scale from 1 (Never) to 5 (Always). In this study, only the Disgust Sensitivity subscale is used, due to the demonstrated relationship between disgust sensitivity and psychopathology (Olatunji et al., 2010; Olatunji & Sawchuk, 2005), and its higher relevance to the study hypotheses.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) is a 10-item self-report measure of how individuals use the strategies of reappraisal and suppression to regulate and control their emotions. Respondents agree or disagree with each item on a Likert scale from 1 (strongly disagree) to 7 (strongly disagree). The ERQ consists of two subscales, the Reappraisal subscale and the Suppression subscale, which form independent factors. The ERQ demonstrates adequate internal consistency.

The Intolerance of Uncertainty Scale Short Form (IUS-12; Carleton, Norton, & Asmundson, 2007) is a 12-item self-report questionnaire that examines a person's reactions to uncertainty. It consists of two subscales: a seven-item subscale that measures fear and anxiety toward future events (Prospective Anxiety; IUS-PA), and a five-item subscale that discusses inhibition of behavior due to uncertainty (Inhibitory Anxiety; IUS-IA). The IUS-12 demonstrates good convergent validity with the full version of the Intolerance of Uncertainty Scale (Buhr & Dugas, 2002; Freeston, Rheaume, Letarte, Dugas, & Ladouceur, 1994).

The Vividness of Visual Imagery Questionnaire (VVIQ; Marks, 1973) is a 16-item self-report test that examines an individual's ability to visualize in their mind's eye. The test consists of four descriptive scenes, each with a set of four particular details that participants are asked to visualize and then describe the clarity and vividness of their mental picture. The task is designed to be administered twice, first with eyes open and then with eyes closed. Due to time constraints, participants in this study were simply asked to visualize the descriptions once without instruction as to whether their eyes should be open or closed. The VVIQ is a task commonly used in neuroimaging experiments, but limited psychometric information is available.

2.3 Apparatus

Physiological data were collected via a BIOPAC MP150 hardware unit and AcqKnowledge version 4.1 software (BIOPAC Systems, Inc.). Skin conductance level (SCL) was recorded using a GSR100C amplifier, two TSD203 6 mm Ag/AgCl electrodes, and GEL101 electrode paste, placed on the middle phalanges of the second and third fingers of the non-dominant hand and held in place by Velcro straps (BIOPAC Systems, Goleta, CA). SCL data were sampled at a rate of 200 samples per second.

2.4 Procedure

The experiment consisted of two sessions, conducted approximately forty-eight hours apart. Upon arrival to the lab at the first session, participants were given a brief overview of the experiment and signed a consent form agreeing to participate. Sensors were placed on the participant's non-dominant hand to measure skin conductance throughout the experiment. The participant first answered a series of questionnaires on the computer (see Measures above). Next, they provided baseline ratings of two images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1999) from each of three emotion categories: Fear, Disgust, and Sadness. The image sets were matched for mean valence, and the Fear and Disgust image sets were matched for mean arousal. For each image, participants rated the intensity of the specific emotion they experienced while viewing the image, as well as the overall distress they experienced while viewing the image, on a Likert scale from 0 (none) to 8 (most in my life). After image rating was complete, participants viewed a series of images from each of the three emotion categories described above. Participants saw images from all three categories in block randomized order. Images were displayed for 3.5 s, followed by 2.5 s of contextual information (either a word or a fixation cross), and finally 6 s of a black screen. The context in which each image appeared was dependent on the group to which the participant was randomized. One group of participants saw words that related to the emotional content of each image (e.g., GROSS for an image in the Disgust category). A second group saw unrelated emotion words after each image (e.g., ANNOYED for an image in the FEAR category). A third group saw only a fixation cross after each image. Images repeated a total of six times in random order within a given block, and the same word appeared each time an image was repeated. Participants were given a short break in between each block. After viewing all the images, participants again rated the initial six images they saw at the beginning of the experiment for both specific emotional intensity and distress.

Forty-eight hours later, participants returned to the lab to complete the second session of the experiment. All participants underwent the same procedures at Session 2, regardless of group. After sensors were again placed on the participant's non-dominant hand, the participant rated the initial six images viewed at Session 1 for emotional intensity and distress. After rating, image viewing began in block randomized format. Each emotion block consisted of the six images from Session 1 plus two novel images of similar valence and arousal. Images were displayed for 6 s, with 6 s of a black screen displayed in between images. No words were presented after the images at Session 2, in accordance with prior research (Tabibnia et al., 2008; Kircanski et al., 2012). Images repeated five times in random order within each emotion block. Finally, participants completed a final set of ratings of emotional intensity and distress for the original six rated images, and were then debriefed.

2.5 Data Analysis

Planned analyses are specified below, along with specific hypotheses. For repeated-measures analyses of variance (ANOVA) where data did not meet the assumption of sphericity, Huynh-Feldt corrections were used, as all estimates of sphericity were greater than 0.75 (Girden, 1992).

2.5.1 Image Ratings

A three-way repeated-measures ANOVA was conducted to determine if there was an effect of Condition (Exposure Only, Unrelated Labels, or Related Labels) or Emotion (Fear, Disgust, Sadness) on distress and emotional intensity ratings over time, from the initial baseline image rating, to the image rating at the end of Session 1, to the initial image rating at Session 2. The data were examined for two-way interactions between Condition X Time, Condition X Emotion, and Time X Emotion, and for a three-way interaction between Condition X Time X Emotion. For distress ratings, data did not meet the assumption for sphericity for Time, $\chi^2 = 6.03$, $p < .05$, or for Emotion, $\chi^2 = 11.84$, $p < .01$. For emotional intensity ratings, the data did not meet the assumption for sphericity for Time, $\chi^2 = 7.46$, $p = .02$, or for the Time X Emotion interaction, $\chi^2 = 30.78$, $p < .001$.

Hypothesis 1a: Participant distress and emotion intensity ratings will decrease from baseline to Session 2 across all three groups, suggesting emotional habituation to images. *Hypothesis 1b*: There will be a significant interaction of Condition X Time; participants in the related-labeling condition will see the greatest decrease in levels of distress and emotional intensity from baseline to Session 2. *Hypothesis 1c*: There will be a significant three-way interaction of Condition X Time X Emotion; related-affect labeling will be more effective at decreasing the emotional intensity of fear and disgust than sadness.

2.5.2 Skin Conductance

Skin conductance data were available for 87 of the 120 participants; equipment was unavailable for the first 21 participants, and 10 participants were affected by an equipment malfunction. Peak SCL for each image was calculated by finding the peak SCL during the window from 0.5 s after image onset to 4 s after image offset, for a total window of 9.5 s (Boucsein et al., 2012). Peak SCLs were averaged across image category (Fear, Disgust, Sadness) to produce mean peak SCL for each set of images. Each participant therefore had mean peak SCL values for Fear, Disgust, and Sadness images at Session 1, repeated Fear, Disgust, and Sadness images at Session 2, and novel Fear, Disgust, and Sadness images at Session 2, with the exception of two participants whose Sadness data were incomplete. SCL data were positively skewed; thus, a log transformation (log[SCL+1]) was conducted to reduce skewness (Venables & Christie, 1980).

A three-way repeated-measures ANOVA was conducted to determine if there was an effect of Condition (Exposure Only, Unrelated Labels, Related Labels) or Emotion (Fear, Disgust, Sadness) on mean peak SCL from Session 1 to Session 2. The data were examined for two-way interactions between Condition X Time, Condition X Emotion, and Time X Emotion, and for a three-way interaction between Condition X Time X Emotion. SCL data did not meet the assumption for sphericity for Emotion, $\chi^2 = 6.63$, $p = .04$.

Next, a three-way repeated-measures ANOVA was conducted to determine if there was an effect of Condition (Exposure Only, Unrelated Labels, Related Labels) or Emotion (Fear, Disgust, Sadness) on mean peak SCL for Novel vs. Repeated images during Session 2. The data were examined for two-way interactions between Condition X Novel/Repeated, Condition X Emotion, and Novel/Repeated X Emotion, and for a three-way interaction between Condition X Novel/Repeated X Emotion.

Hypotheses for SCL were the same as the hypotheses for image rating data, as at least some concordance was expected between self-reported and physiological measures (Lang et al., 1993; Rachman, 1978). *Hypothesis 2a*: Participant mean peak SCL will decrease from Session 1 to Session 2 across all three groups, suggesting physiological habituation to images. *Hypothesis 2b*: There will be a significant interaction of Condition X Time; participants in the related-labeling condition will see the greatest decrease in mean peak SCL from Session 1 to Session 2. *Hypothesis 2c*: There will be a significant three-way interaction of Condition X Time X Emotion; participants in the related-affect-labeling condition will experience larger decreases in mean peak SCL during fear and disgust images compared to sadness images. *Hypothesis 3*: For participants in the related labels condition, decreases in mean peak SCL will generalize to novel fear and disgust images, but not sadness images.

2.5.3 Individual differences

Finally, individual difference factors were examined with multiple two-way ANOVAs examining the effects of Labeling Condition and emotion-regulation ability on participant distress, emotional intensity, and skin conductance. Emotion-regulation ability was measured by participant scores on the AES, the ERQ, and the AAQ. *Hypothesis 4*: Within the affect labeling conditions, change in levels of mean peak SCL will be greatest in those with weaker emotion-regulation skills, as affect labeling will represent a simplified skill that allows for the greatest improvement in those with a weak repertoire of emotion-regulation strategies.

CHAPTER III

RESULTS

Mean scores on each of the questionnaires are shown in Table 1. No group differences were found across any of these measures. Table 2 displays initial image ratings by group. No group differences were found for image distress or image emotional intensity by group.

3.1 Image Ratings: Distress

A three-way repeated-measures (Condition X Emotion X Time) ANOVA found no significant main effect of Condition on distress ratings, $F(2, 115) = 0.18$, $p = .84$, $\eta_p^2 < .01$. However, there was a significant main effect of Time on distress. Overall, distress ratings significantly decreased over time, $F(1.97, 226.18) = 31.70$, $p < .001$, $\eta_p^2 = .22$. Distress ratings showed a marginally significant decrease from baseline to the end of Session 1, $p = .08$, and a significant decrease from the end of Session 1 to the beginning of Session 2, $p < .001$. A marginally significant effect for Emotion was also found, $F(1.88, 216.23) = 3.00$, $p = .06$, $\eta_p^2 = .03$. Post hoc analyses were conducted to analyze this trend; Disgust images were more distressing than Sadness images, $p = .01$, but not significantly different from Fear images, $p = .82$. Although distress ratings for Fear images were not significantly different from distress ratings for Sadness images, $p = .05$, there was a trend for Fear images to be more distressing than Sadness images.

There were no significant two-way interaction effects for distress ratings; Condition X Time, $F(3.93, 226.18) = 2.02$, $p = .09$, $\eta_p^2 = .03$; Condition X Emotion, $F(3.76, 216.23) = 1.21$, $p = .31$, $\eta_p^2 = .02$; Time X Emotion, $F(4, 460) = 1.81$, $p = .13$, $\eta_p^2 = .02$. The three-way interaction between Condition X Time X Emotion was also not significant, $F(8, 460) = 0.71$, $p = .69$, $\eta_p^2 = .01$. Changes in distress ratings over time by Condition and Emotion are displayed in Figure 1.

3.2 Image Ratings: Emotional Intensity

A three-way repeated-measures ANOVA found no significant main effect of Condition on emotion intensity ratings, $F(2, 115) = 0.09$, $p = .92$, $\eta_p^2 < .01$. There were, however, significant main effects of Time and Emotion on emotion intensity ratings. Overall, emotion intensity ratings significantly decreased over time, $F(1.94, 223.19) = 28.20$, $p < .001$, $\eta_p^2 = .20$. Emotion intensity ratings did not differ from baseline to the end of Session 1, $p = .25$, but did significantly decrease from the end of Session 1 to the beginning of Session 2, $p < .001$. Emotion intensity ratings differed significantly by Emotion, $F(2, 230) = 19.55$, $p < .001$, $\eta_p^2 = .15$; pairwise comparisons revealed that, as described above, Disgust was significantly more emotionally intense than Fear and Sadness, both *p*s < .001, while Sadness was significantly more emotionally intense than Fear, $p = .03$.

A marginally significant Time X Condition interaction was observed, $F(3.88, 223.19) = 2.37$, $p = .06$, $\eta_p^2 = .04$. Thus, differences in emotion intensity by Condition were analyzed at each of the three time points using a one-way ANOVA. However, no significant differences between conditions were found at any of the three time points, all *p*s > .59. A marginally significant Time X Emotion interaction was also observed, $F(3.82, 439.49) = 2.28$, $p = .06$, $\eta_p^2 = .02$. Thus, differences in emotion intensity by Emotion were analyzed at each of the three time points. At baseline, emotion intensity was significantly different by Emotion, $F(1.92, 220.94) = 19.12$, $p < .001$, $\eta_p^2 = .14$. Disgust was rated as significantly more intense than both Fear and Sadness, both *p*s < .001, while Sadness was also rated as more intense than Fear, $p < .05$. At the end of Session 1, emotion intensity was also significantly different by Emotion, $F(2, 230) = 13.05$, $p < .001$, $\eta_p^2 = .10$. Again, Disgust was rated as significantly more intense than both Fear and Sadness, both *p*s < .001, but Fear was not significantly more intense than Sadness, $p = .10$. At Session 2, emotion intensity was also significantly different by Emotion, $F(2, 230) = 12.33$, $p < .001$, $\eta_p^2 = .10$. Here, Disgust was again rated as significantly more intense than both Fear and Sadness, both *p*s < .01, and Sadness was rated as more intense than Fear, $p = .02$.

The interaction of Emotion X Condition was not significant, $F(4, 230) = 1.03$, $p = .39$, $\eta_p^2 = .02$. Finally, the three-way interaction between Condition X Time X Emotion was not significant, $F(7.64, 439.49) = 0.94$, $p = .48$, $\eta_p^2 = .02$. Changes in emotion intensity ratings over time by Condition and Emotion are displayed in Figure 2.

3.3 Skin Conductance

There were no differences in baseline log SCL across the three conditions, $F(2,84) = 0.08$, $p = .92$. Similarly, there were no differences in the mean peak SCL by condition for each of the three sets of emotion pictures, all *F*s < 1.02, all *p*s > .36. There were also no significant correlations between change in mean peak SCL for Fear, Disgust, or Sadness pictures and any of the self-report measures.

3.3.1 Change in Mean Peak SCL from Session 1 to Session 2

A three-way repeated-measures ANOVA found no significant main effect of Condition, $F(2,82) = 1.78$, $p = .18$, $\eta_p^2 = .04$; Emotion, $F(1.93,158.24) = 0.05$, $p = .95$, $\eta_p^2 < .01$; or Time, *F*(1,82) = 1.24, $p = .27$, $\eta_p^2 = .02$ on mean peak SCL. However, a significant Time X Emotion interaction was found, *F*(2, 164) = 3.40, $p = .04$, $\eta_p^2 = .04$. Paired-samples t-tests were used to examine differences in mean peak SCL from Session 1 to Session 2 for each Emotion. For Fear images, there was a statistical trend toward reduction in mean peak SCL, *t*(86) = 1.73, $p = .09$. For Disgust images, mean peak SCL significantly decreased from Session 1 to Session 2, *t*(86) = 2.49, $p = .02$. There was no significant change in mean peak SCL level for Sadness images, *t*(84) = -1.02, $p = .31$.

There were no significant two-way interaction effects for Condition X Time, *F*(2, 82) = 1.15, $p = .32$, $\eta_p^2 = .03$; or Condition X Emotion, *F*(3.86, 158.24) = 0.64, $p = .63$, $\eta_p^2 = .02$. The three-way interaction between Condition X Time X Emotion was also not significant, *F*(4, 164) = 1.76, $p = .14$, $\eta_p^2 = .04$.

3.3.2 Generalization to Novel Images

A three-way repeated-measures ANOVA found a trend toward a main effect of Condition on mean peak SCL during Session 2, *F*(2,82) = 2.57, $p = .08$, $\eta_p^2 = .06$. This trend was followed up with post hoc pairwise comparisons. Participants in the unrelated labels group had significantly lower mean peak SCL during Session 2 than participants in the related labels group, $p < .05$, and marginally lower mean peak SCL during Session 2 than participants in the exposure only group, $p = .06$; participants in the exposure group and related labels group did not differ from one another. There were no differences in mean peak SCL between novel and repeated images, *F*(1,82) = 0.02, $p = .90$, $\eta_p^2 < .01$. There was a trend toward a difference in mean peak SCL by Emotion, *F*(2,164) = 2.76, $p = .07$, $\eta_p^2 = .03$. Post hoc pairwise comparisons revealed a significantly larger mean peak SCL for Sadness images compared to Disgust images, $p = .02$.

Fear images were not significantly different from Sadness images, $p = .10$, or Disgust images, $p = .64$.

Although the two-way interaction effect for Novel/Repeated X Emotion on mean peak SCL was not significant, a trend was identified, $F(2, 164) = 2.42$, $p = .09$, $\eta_p^2 = .03$. Paired-samples t-tests were used to examine differences in mean peak SCL between Novel and Repeated images for each Emotion. There were no significant differences in mean peak SCL between Novel and Repeated images for any Emotion, $p\text{s} > .08$. A trend toward a difference between Novel and Repeated Fear images was noted, $t(86) = 1.79$, $p = .08$, with larger mean peak SCL in response to novel Fear images compared to repeated Fear images. There were no significant two-way interaction effects for Condition X Novel/Repeated, $F(2, 82) = 0.09$, $p = .92$, $\eta_p^2 < .01$; or Condition X Emotion, $F(4, 164) = 1.86$, $p = .12$, $\eta_p^2 = .04$ on mean peak SCL. The three-way interaction between Condition X Novel/Repeated X Emotion was also not significant, $F(4, 164) = 1.38$, $p = .24$, $\eta_p^2 = .03$.

3.4 Individual Differences in Emotion Regulation

The three-way repeated-measures ANOVA analysis conducted above was repeated, using scores on the AES, AAQ, ERQ Reappraisal, and ERQ Suppression as covariates in separate models, to determine the effect of individual differences in emotion regulation skills on the above findings. There were no significant interactions between AAQ scores or ERQ Reappraisal scores and Emotion, Time, or Condition variables. However, some trends were found with AES and ERQ Suppression scores.

There was a marginally significant interaction for Time X AES score, $F(1, 81) = 3.50$, $p = .07$, $\eta_p^2 = .04$, with participants with higher scores on the AES experiencing a greater decrease in mean peak SCL over time. However, significant correlations between AES score and change in mean peak SCL were not found when examining images by emotion category. While there was no significant interaction between Emotion, Condition, and AES scores in the ANOVA analysis, correlational analyses revealed a significant positive correlation between change in mean peak SCL for Fear images and AES total score, $r(28) = .49$, $p < .01$, for participants in the unrelated-labels condition, with no significant correlations for participants in the other conditions.

There was also a significant interaction between Condition and ERQ suppression scores, $F(1, 81) = 4.83$, $p = .03$, $\eta_p^2 = .06$. For participants in the unrelated labels condition, change in mean peak SCL for Fear images was significantly negatively correlated with ERQ suppression score, $r(28) = -.41$, $p < .05$. No significant correlations were found for any other conditions, or for changes in mean peak SCL for Disgust and Sadness images. Additionally, there was a marginally significant Emotion X Time X ERQ Suppression interaction, $F(2, 162) = 2.86$, $p = .06$, $\eta_p^2 = .03$. For the total sample, ERQ suppression score was negatively correlated with change in mean peak SCL for Fear images at a trend level, $r(86) = -.19$, $p = .09$; there were no significant correlations between ERQ suppression score and change in mean peak SCL for Disgust or Sadness images.

CHAPTER IV

DISCUSSION

The present study revealed that exposure to emotional images led to decreased ratings of image distress and emotional intensity over time, regardless of labeling context or the specific emotional content of the image. However, no differences in the magnitude of these changes were found when comparing labeling conditions to one another. For subjective ratings, it appears that the effects of affect labeling, whether related or unrelated to the emotional content of the image, do not differ from the effects of mere exposure. Although images were selected based on previous ratings that suggested they were equivalently negatively valenced, our participants rated disgusting images as the most distressing, followed by fearful images and then sadness images. Additionally, participants thought that disgust images were more intense than both fear and sadness images, while sadness images were more intense than fear images. One explanation for these divergent findings is that images selected to represent the Fear category were not intense enough to be labeled as “Fear;” participants seemed to be more distressed by these images than specifically afraid of them.

When examining a measure of physiological arousal (skin conductance), differences between emotions emerged. Participants showed evidence of habituation to disgusting and fear-inducing images, but not to sad images. There were no group differences in habituation, suggesting that labeling (related or unrelated) had no specific effect. However, when examining generalization to novel images, a trend emerged for participants in the *unrelated*-labeling condition. These participants demonstrated increased generalized habituation to novel distressing images (of any emotion type) compared to their peers in the related-labeling and exposure only groups, meaning that they showed lower mean peak skin conductance levels during Session 2 compared to other participants, regardless of whether the images were novel or repeated.

Individual differences in emotion-regulation abilities appear to play a role in change in physiological arousal to distressing images, but not in the way predicted. Increased emotional intelligence predicted greater decreases in physiological arousal over time. Participants with a greater tendency toward emotional suppression experienced smaller decreases in physiological arousal to fear images (but not disgust or sadness images) over time, suggesting less habituation. These findings support the limited efficacy of suppression on changing one's emotional experience (Gross, 2001, 2002). The only specific interactions between affect labeling and emotion skills were that participants in the unrelated-labeling group with higher emotional intelligence had greater habituation to fear images, and those who endorsed high emotional suppression had significantly less habituation to fear images. This result suggests that affect labeling may not additionally benefit those with poorer emotional intelligence, but may provide a marginal benefit for those who already have good emotion-regulation skills. Participants needed to find ways to connect the images presented with the meanings of unrelated words, a task that might take additional cognitive processing. Individuals with higher emotional intelligence may be the only ones who were able to do this successfully in the short period of time between images.

Although there were no labeling-related differences with respect to specific emotion responses, the finding that participants habituated to fear and disgust images over time, but not sadness images, supports the general use of exposure for fear and disgust, but not sadness.

Increased exposure to the sad images may have promoted rumination, which is associated with depressive symptoms and may also have negative effects on normal experiences of sadness (Conway, Csank, Holm, & Blake, 2000; Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008). These results are in line with existing clinical knowledge and the psychopathology treatment literature. Additionally, they support the differentiation of negatively valenced stimuli in future research on exposure and emotion regulation. Because the action tendencies associated with these emotions are different (i.e., disgust and fear both involve a tendency to escape or avoid, while sadness involves a tendency to withdraw, reflect, and evoke sympathy from others; Bonanno et al., 2008; Frijda, 1987; Frijda, Kuipers, & ter Schure, 1989; Izard, 1977, 1993; Lazarus, 1991), the interventions used to address problems with over-activations of these emotions might therefore differ as well (Beck & Haigh, 2014; Davey, 2011; Mason & Richardson, 2010). Basic research on emotion should continue to examine discrete negative emotions individually, instead of lumping together negative affect, due to the added information regarding cognitive, behavioral, and physiological changes that a discrete emotions model provides (Lench, Flores, & Bench, 2011).

Aspects of the present findings are in line with previous research on affect labeling. Results from Tabibnia and colleagues (2008) were partially replicated, in that participants in the unrelated-labeling condition had greater habituation to novel images. However, this result does not support the claim that affect labeling is an effective, easily learned emotion-regulation strategy. Affect labeling is defined as verbalizing one’s feelings (Lieberman et al., 2007). However, participants who saw distressing images with related emotion words did not experience significant improvements in habituation; only participants who saw emotion words that did not relate to the image they viewed had improved generalization. This is not affect labeling. Participants in this condition would often report during debriefing that the word-image pairings made no sense (providing support for the validity of the unrelated-label condition), and several mentioned that they made up stories in order to remember the word-picture relationship. The finding that greater emotional intelligence and reduced use of suppression as an emotion-regulation strategy was significantly correlated with habituation to fear images in the unrelated-labeling condition further supports the idea that other emotion-regulation strategies may have a stronger effect on fear habituation compared to affect labeling, which did not correlate with emotion regulation skills.

Because we did not design our study to examine other emotion-regulation strategies, it is hard to say exactly what emotion-regulation strategy participants were using in the unrelated-labeling condition. Perhaps they were simply distracted by the incongruous content match and focused less on their emotional experience, or perhaps they were engaging in a deeper level of abstract processing. Tabibnia and colleagues (2008) state:

> "Unrelated words…may promote more elaborate processing of the pictures, such that participants may be thinking more deeply about each picture, in an attempt to find a relationship between it and the label. Such deeper processing may enhance exposure effects at follow-up (Rachman, 1980). That is, unrelated words may require an extra step or level of abstract processing that the related words do not."

This is one possible explanation of our replicated findings, but does not support the efficacy of affect labeling. Additionally, this explanation fits with the emotional processing theory of exposure therapy (Foa & Kozak, 1986), but not with the inhibitory learning model, which suggests affect labeling may enhance inhibitory regulation during exposure (Craske et al., 2008, 2014). This is not to say that emotion regulation is not an important component of exposure; indeed, these results suggest that it is. However, affect labeling is not the emotion regulation strategy on which to focus. In a non-clinical population, distraction may be an effective method of down-regulating emotional experience. Clinical populations may benefit more from learning cognitive reappraisal strategies, as was found in a sample of socially anxious patients who completed cognitive-behavioral therapy (Moscovitch et al., 2012).

It is important to note that these results are at odds with the findings of Kircanski and colleagues (2012), in which affect labeling produced greater reductions in skin conductance to a fearful stimulus compared to reappraisal, distraction, and exposure alone. However, the study design is significantly different between these two studies, in that their participants were facing a live phobic object (a spider) and asked to create a sentence about the spider and speak it aloud. It is possible that affect labeling may be effective at reducing fear, but only within specific contexts: the individual must generate their own description and emotional label of the feared stimulus. This kind of labeling involves increased effort and cognitive processing on the part of the participant, whereas reading a single emotion word that may or may not accurately reflect a participant's emotional experience does not. There may be therapeutic benefits to having exposure therapy clients label their emotions that do not generalize to the population at large. Because basic and applied research of affect labeling show conflicting results, additional research examining mechanisms is needed. Unrelated labeling appears to be effective in laboratory studies, but it is unclear if this technique can be used in clinical contexts, and its mechanism is unexplained. Future studies can examine unrelated-affect labeling using fMRI to provide a clearer picture of what happens in the brain during this kind of emotional processing, and may clarify what is going on at the neural level during the processing of images with unrelated labels. Participants can also be asked to explicitly describe their thought process when viewing an unrelated label.

These results do not lend support to the idea that affect labeling is effective across multiple emotional contexts. Evidence for the superiority of unrelated labels for fear images in those with higher emotional intelligence is the only result from this study that supports differentiation specific to labeling condition. Future research could examine affect labeling in other emotions, such as anger, embarrassment, or guilt, to determine if there is any effect of affect labeling in these conditions. However, based on the results of this study, research efforts may be best directed toward other methods of improving exposure, instead of searching for a use for affect labeling beyond fear. Emotion regulation may indeed be a key to improving clinical outcomes, but affect labeling does not appear to be the solution. Future research should target specific mechanisms of emotion regulation at the neural, physiological, cognitive, and affective levels to determine which emotion regulation skills will be most useful when incorporated into exposure therapy.

Table 1

Means and Standard Deviations for Trait and State Measures by Condition

	Exposure Only *M (SD)* n = 38	Unrelated Labels *M (SD)* n = 40	Related Labels *M (SD)* n = 40	Total *M (SD)* n = 118	F	p
AAQ	32.4 (8.85)	33.7 (7.84)	34.9 (8.64)	33.7 (8.44)	.840	.434
AES	126.8 (11.56)	125.2 (14.09)	126.0 (12.52)	126.0 (12.69)	.146	.865
BAI	10.1 (9.62)	8.0 (6.92)	9.1 (9.19)	9.0 (8.61)	.629	.535
CES-D	15.0 (10.44)	12.5 (9.26)	11.9 (9.08)	13.1 (9.61)	1.122	.329
DPSSR-S	14.2 (4.22)	14.8 (4.88)	14.2 (4.56)	14.4 (4.54)	.254	.776
ERQ_Suppression	13.6 (4.64)	14.4 (5.32)	13.9 (5.06)	13.9 (4.99)	.224	.799
ERQ_Reappraisal	31.4 (5.79)	29.8 (5.24)	31.5 (6.00)	30.9 (5.69)	1.165	.316
IUS*	26.5 (9.35)	27.9 (9.11)	26.4 (7.52)	26.9 (8.57)	.247	.782
IUS-PA*	15.3 (5.07)	16.6 (5.37)	15.3 (4.57)	15.7 (4.97)	.572	.567
IUS-IA*	11.2 (4.54)	11.3 (4.31)	11.1 (3.67)	11.2 (4.12)	.017	.984
VVIQ	2.0 (0.54)	2.2 (0.57)	2.1 (0.51)	2.1 (0.54)	.629	.535

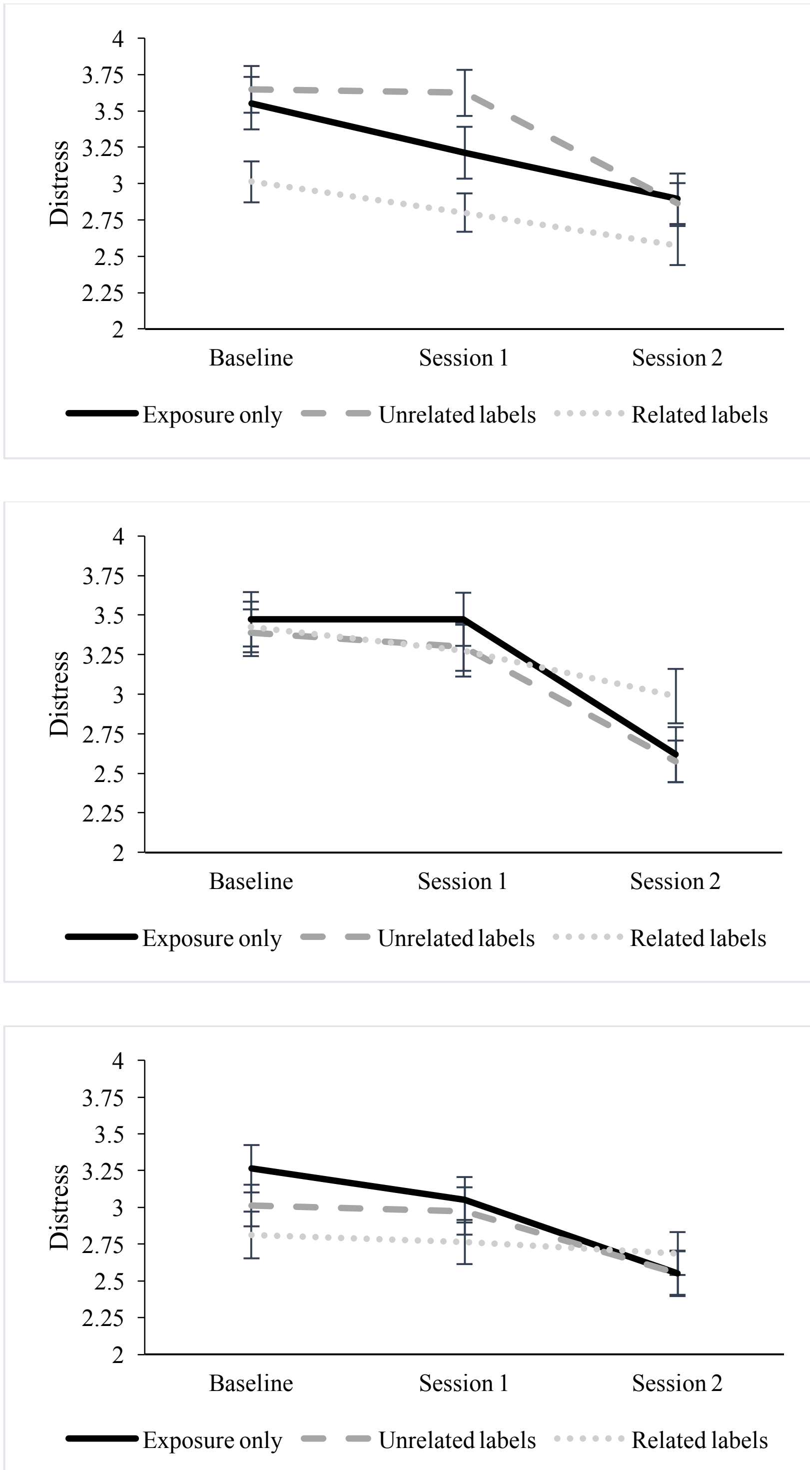
Note: For IUS, IUS-PA, and IUS-IA, total n = 85, as this measure was added later. AAQ = Acceptance and Action Questionnaire; AES = Assessing Emotions Scale; BAI = Beck Anxiety Inventory; CES = Center for Epidemiological Studies Depression Scale; DPSSR-S = Disgust Propensity and Sensitivity Scale-Revised – Sensitivity; ERQ = Emotion Regulation Questionnaire; IUS = Intolerance of Uncertainty Scale Short Form; IUS-PA = Prospective Anxiety; IUS-IA = Inhibitory Anxiety; VVIQ = Vividness of Visual Imagery Questionnaire.

Table 2

Image Ratings for Fear, Disgust, and Sadness by Condition

	Exposure Only *M (SD)* n = 38	Unrelated Labels *M (SD)* n = 40	Related Labels *M (SD)* n = 40	Total *M (SD)* n = 118	F	p
Distress						
Fear	3.55 (2.23)	3.65 (2.04)	3.01 (1.79)	3.40 (2.03)	.018	.982
Disgust	3.47 (2.13)	3.39 (1.87)	3.43 (2.04)	3.43 (2.00)	1.147	.321
Sadness	3.26 (2.00)	3.01 (1.80)	2.81 (2.00)	3.03 (1.93)	.531	.590
Emotional Intensity						
Fear	3.76 (2.10)	3.35 (1.82)	3.08 (2.00)	3.39 (1.98)	.072	.931
Disgust	4.49 (1.93)	4.33 (1.78)	4.39 (1.98)	4.40 (1.88)	1.199	.305
Sadness	3.93 (1.89)	3.48 (1.74)	3.80 (2.05)	3.73 (1.89)	.608	.546

Figure 1



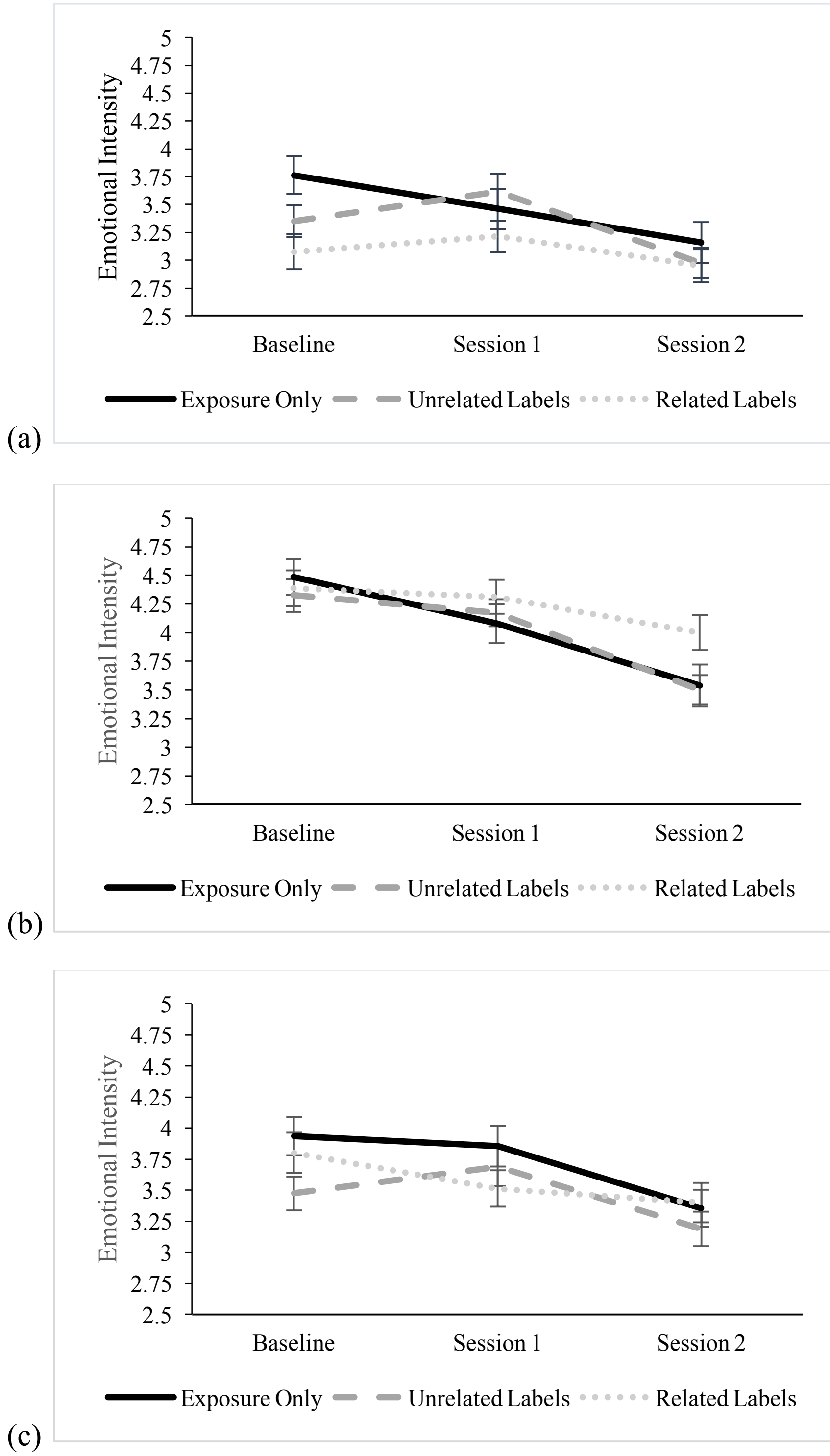
(a)

(b)

(c)

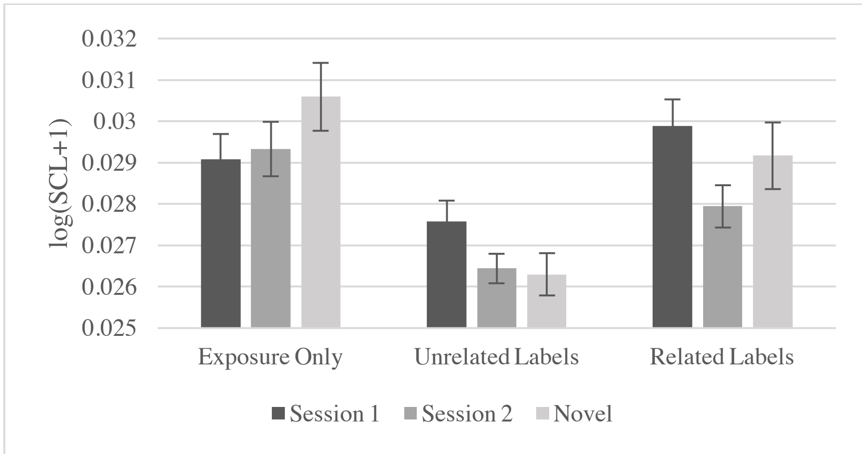
Changes in distress ratings for (a) Fear, (b) Disgust, and (c) Sadness by Condition. Note: Error bars represent one standard error.

Figure 2

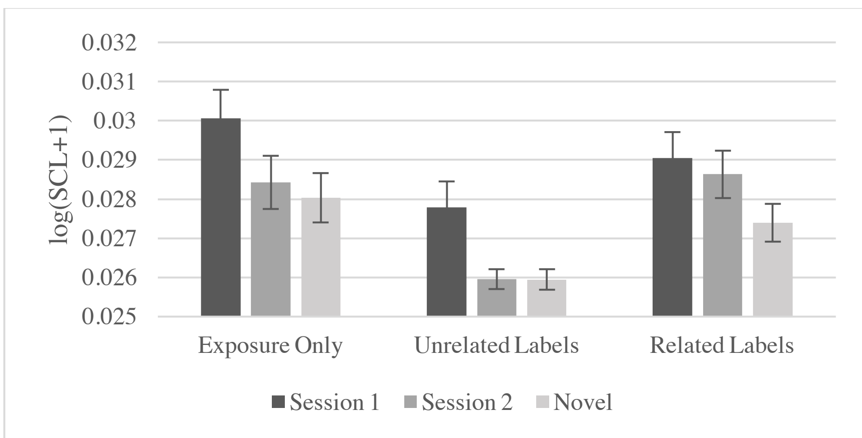


Changes in emotion intensity ratings for (a) Fear, (b) Disgust, and (c) Sadness by Condition.
Note: Error bars represent one standard error.

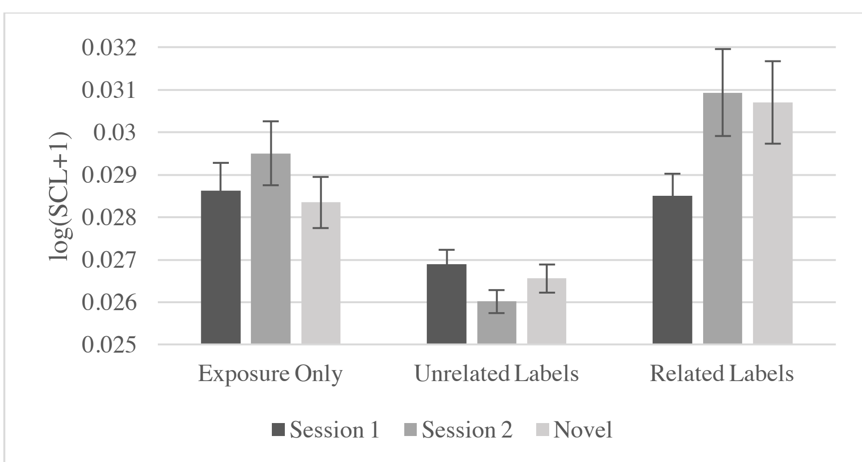
Figure 3



(a)



(b)



(c)

Mean peak SCL for novel and repeated (a) Fear, (b) Disgust, and (c) Sadness images by Condition. Note: Error bars represent one standard error.

REFERENCES

Anderson, A. K., & Phelps, E. A. (2001). Lesions of the human amygdala impair enhanced perception of emotionally salient events. *Nature*, *411*(6835), 305–309. http://doi.org/10.1038/35077083

Barrett, L. F. (2006a). Are emotions natural kinds? *Perspectives on Psychological Science*, *1*(1), 28–58. http://doi.org/10.1111/j.1745-6916.2006.00003.x

Barrett, L. F. (2006b). Solving the emotion paradox: Categorization and the experience of emotion. *Personality and Social Psychology Review*, *10*(1), 20–46. http://doi.org/10.1207/s15327957pspr1001_2

Barrett, L. F., & Bliss-Moreau, E. (2009) Affect as a psychological primitive. *Advances in Experimental Social Psychology*, *41*, 167 –218. https://doi.org/10.1016/S00652601(08)00404-8

Barrett, L. F., & Wager, T. D. (2006). The structure of emotion: Evidence from neuroimaging studies. *Current Directions in Psychological Science*, *15*(2), 79–83.

Beck, A. T., & Haigh, E. A. P. (2014). Advances in cognitive theory and therapy: The generic cognitive model. *Annual Review of Clinical Psychology*, *10*, 1–24. http://doi.org/10.1146/annurev-clinpsy-032813-153734

Beck, A. T., & Steer, R. A. (1993). *Beck Anxiety Inventory Manual*. Psychological Corporation, San Antonio, TX.

Berking, M., Wupperman, P., Reichardt, A., Pejic, T., Dippel, A., & Znoj, H. (2008). Emotion-regulation skills as a treatment target in psychotherapy. *Behaviour Research and Therapy*, *46*(11), 1230–1237. http://doi.org/10.1016/j.brat.2008.08.005

Bonanno, G. A., Goorin, L., & Coifman, K. G. (2008). Sadness and Grief. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of Emotions* (3rd ed., pp. 797–810). New York: The Guilford Press.

Boucsein, W., Fowles, D. C., Grimnes, S., Ben-Shakhar, G., Roth, W. T., Dawson, M. E., & Filion, D. L. (2012). Publication recommendations for electrodermal measurements. *Psychophysiology*, *49*(8), 1017–1034. http://doi.org/10.1111/j.1469-8986.2012.01384.x

Buhr, K., & Dugas, M. J. (2002). The Intolerance of Uncertainty scale: Psychometric properties of the English version. *Behaviour Research and Therapy*, *40*(8), 931–946. http://doi.org/10.1016/S0005-7967(01)00092-4

Burklund, L. J., Creswell, J. D., Irwin, M. R., & Lieberman, M. D. (2014). The common and distinct neural bases of affect labeling and reappraisal in healthy adults. *Frontiers in Psychology*, *5*, 1–10. http://doi.org/10.3389/fpsyg.2014.00221

Carleton, R. N., Norton, P. J., & Asmundson, G. J. G. (2007). Fearing the unknown: A short version of the Intolerance of Uncertainty Scale. *Journal of Anxiety Disorders*, *21*(1), 105–117. http://doi.org/10.1016/j.janxdis.2006.03.014

Constantinou, E., Bogaerts, K., van Oudenhove, L., Tack, J., van Diest, I., & van den Bergh, O. (2015). Healing words: Using affect labeling to reduce the effects of unpleasant cues on symptom reporting in IBS patients. *International Journal of Behavioral Medicine, 22*(4), 512–520. http://doi.org/10.1007/s12529-014-9449-8

Constantinou, E., van den Houte, M., Bogaerts, K., van Diest, I., & van den Bergh, O. (2014). Can words heal? Using affect labeling to reduce the effects of unpleasant cues on symptom reporting. *Frontiers in Psychology, 5*, 807. http://doi.org/10.3389/fpsyg.2014.00807

Conway, M., Csank, P. A. R., Holm, S. L., & Blake, C. K. (2000). On assessing individual differences in rumination on sadness. *Journal of Personality Assessment*, *75*(3), 404–425. http://doi.org/10.1207/S15327752JPA7503_04

Craske, M. G., Kircanski, K., Zelikowsky, M., Mystkowski, J. L., Chowdhury, N., & Baker, A. S. (2008). Optimizing inhibitory learning during exposure therapy. *Behaviour Research and Therapy*, *46*(1), 5–27. http://doi.org/10.1016/j.brat.2007.10.003

Craske, M. G., Treanor, M., Conway, C. C., Zbozinek, T. D., & Vervliet, B. (2014). Maximizing exposure therapy: An inhibitory learning approach. *Behaviour Research and Therapy*, *58*, 10–23. http://doi.org/10.1016/j.brat.2014.04.006

Creswell, J. D., Way, B. M., Eisenberger, N. I., & Lieberman, M. D. (2007). Neural correlates of dispositional mindfulness during affect labeling. *Psychosomatic Medicine*, *69*(6), 560–565. http://doi.org/10.1097/PSY.0b013e3180f6171f

Davey, G. C. L. (2011). Disgust: The disease-avoidance emotion and its dysfunctions. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*, 3453–3465. http://doi.org/10.1098/rstb.2011.0039

de Jong, P. J., Andrea, H., & Muris, P. (1997). Spider phobia in children: Disgust and fear before and after treatment. *Behaviour Research and Therapy*, *35*(6), 559–562. http://doi.org/10.1016/S0005-7967(97)00002-8

Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science*, *221*(4616), 1208–1210.

Foa, E. B., & Kozak, M. J. (1986). Emotional processing of fear: Exposure to corrective information. *Psychological Bulletin*, *99*(1), 20–35. http://doi.org/10.1037/0033-2909.99.1.20

Freeston, M. H., Rheaume, J., Letarte, H., Dugas, M. J., & Ladouceur, R. (1994). Why do people worry? *Personality and Individual Differences*, *17*(6), 791–802. http://doi.org/10.1016/0191-8869(94)90048-5

Frijda, N. H. (1987). Emotion, cognitive structure, and action tendency. *Cognition and Emotion*, *1*(2), 115–143. http://doi.org/10.1080/02699938708408043

Frijda, N. H., Kuipers, P., & ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *Journal of Personality and Social Psychology*, *57*(2), 212–228. http://doi.org/10.1037/0022-3514.57.2.212

Girden, E. R. (1992). *ANOVA: Repeated measures* (Vol. 84). Thousand Oaks, CA: Sage.

Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology, 74*(1), 224–237. http://doi.org/10.1037/0022-3514.74.1.224

Gross, J. J. (2001). Emotion regulation in adulthood: Timing is everything. *Current Directions in Psychological Science, 10*(6), 214–219. http://doi.org/10.1111/1467-8721.00152

Gross, J. J. (2002). Emotion regulation: Affective, cognitive, and social consequences. *Psychophysiology*, 39(3), 281–291. http://doi.org/10.1017.S0048577201393198

Gross, J. J., & Barrett, L. F. (2011). Emotion generation and emotion regulation: One or two depends on your point of view. *Emotion Review*, *3*(1), 8–16. http://doi.org/10.1177/1754073910380974

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*(2), 348–362. http://doi.org/10.1037/0022-3514.85.2.348

Gross, J. J., & Muñoz, R. F. (1995). Emotion regulation and mental health. *Clinical Psychology: Science and Practice, 2*, 151–164. http://doi.org/10.1111/j.1468-2850.1995.tb00036.x

Hariri, A. R., Bookheimer, S. Y., & Mazziotta, J. C. (2000). Modulating emotional responses: Effects of a neocortical network on the limbic system. *Neuroreport*, *11*(1), 43–8. http://doi.org/10.1097/00001756-200001170-00009

Hayes, A. M., & Feldman, G. (2004). Clarifying the construct of mindfulness in the context of emotion regulation and the process of change in therapy. *Clinical Psychology: Science and Practice*, *11*, 255–262.

Hayes, S.C., Strosahl, K., & Wilson, K.G. (1999). *Acceptance and commitment therapy: An experimental approach to behavior change*. NY: Guilford Press.

Hayes, S. C., Strosahl, K., Wilson, K. G., Bissett, R. T., Pistorello, J., Toarmino, D., … McCurry, S. M. (2004). Measuring experiential avoidance: A preliminary test of a working model. *The Psychological Record*, *54*, 553–578. http://doi.org/10.1017/CBO9781107415324.004

Hirai, M., Cochran, H. M., Meyer, J. S., Butcher, J. L., Vernon, L. L., & Meadows, E. A. (2008). A preliminary investigation of the efficacy of disgust exposure techniques in a subclinical population with blood and injection fears. *Behaviour Change*, *25*(3), 129–148. http://doi.org/10.1375/bech.25.3.129

Izard, C. E. (1977). *Human emotions*. New York: Plenum Press.

Izard, C. E. (1993). Four systems for emotion activation: Cognitive and noncognitive processes. *Psychological Review*, *100*(1), 68–90. http://doi.org/10.1037/0033-295X.100.1.68

Kircanski, K., Lieberman, M. D., & Craske, M. G. (2012). Feelings into words: Contributions of language to exposure therapy. *Psychological Science*, *23*(10), 1086–1091. http://doi.org/10.1177/0956797612443830

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1999). *International affective picture system*

(IAPS): Instruction manual and affective ratings. Gainesville: University of Florida, The Center for Research in Psychophysiology.

Lang, P. J., Greenwald, M. K., Bradley, M. M., & Hamm, A. O. (1993). Looking at pictures: Affective, facial, visceral, and behavioral reactions. *Psychophysiology*, *30*(3), 261–273. http://doi.org/10.1111/j.1469-8986.1993.tb03352.x

Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.

Ledoux, J. E., & Phelps, E. A. (2008). Emotional Networks in the Brain. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of Emotions* (3rd ed., pp. 159–179). New York: The Guilford Press.

Lench, H. C., Flores, S. A., & Bench, S. W. (2011). Discrete emotions predict changes in cognition, judgment, experience, behavior, and physiology: A meta-analysis of experimental emotion elicitations. *Psychological Bulletin*, *137*(5), 834-855. http://dx.doi.org/10.1037/a0024244

Lieberman, M. D., Eisenberger, N. I., Crockett, M. J., Tom, S. M., Pfeifer, J. H., & Way, B. M. (2007). Putting feelings into words. *Psychological Science*, *18*(5), 421–428. http://doi.org/10.1111/j.1467-9280.2007.01916.x

Lieberman, M. D., Inagaki, T. K., Tabibnia, G., & Crockett, M. J. (2011). Subjective responses to emotional stimuli during labeling, reappraisal, and distraction. *Emotion*, *11*(3), 468–480. http://doi.org/10.1037/a0023503

Lindquist, K. A., Satpute, A. B., Wager, T. D., Weber, J., & Barrett, L. F. (2016). The brain basis of positive and negative affect: Evidence from a meta-analysis of the human neuroimaging literature. *Cerebral Cortex*, *26*(5), 1910-1922. https://doi.org/10.1093/cercor/bhv001

Lindquist, K. A., Wager, T. D., Kober, H., Bliss-Moreau, E., & Barrett, L. F. (2012). The brain basis of emotion: A meta-analytic review. *Behavioral and Brain Sciences, 35*(3), 121-143. doi:10.1017/S0140525X11000446

Marks, D. F. (1973). Visual imagery differences in the recall of pictures. *British Journal of Psychology*, *64*(1), 17-24.

Mason, E. C., & Richardson, R. (2010). Looking beyond fear: The extinction of other emotions implicated in anxiety disorders. *Journal of Anxiety Disorders*, *24*(1), 63–70. http://doi.org/10.1016/j.janxdis.2009.08.007

McKay, D. (2006). Treating disgust reactions in contamination-based obsessive-compulsive disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, *37*(1), 53–59. http://doi.org/10.1016/j.jbtep.2005.09.005

McRae, K., Taitano, E. K., & Lane, R. D. (2010). The effects of verbal labelling on psychophysiology: Objective but not subjective emotion labelling reduces skin-conductance responses to briefly presented pictures. *Cognition and Emotion*, *24*(5), 829-839. http://dx.doi.org/10.1080/02699930902797141

Moscovitch, D. A., Gavric, D. L., Senn, J. M., Santesso, D. L., Miskovic, V., Schmidt, L. A., … Antony, M. M. (2012). Changes in judgment biases and use of emotion regulation strategies during cognitive-behavioral therapy for social anxiety disorder: Distinguishing treatment responders from nonresponders. *Cognitive Therapy and Research*, *36*(4), 261–271. http://doi.org/10.1007/s10608-011-9371-1

Murphy, F. C., Nimmo-Smith, I., & Lawrence, A. D. (2003). Functional neuroanatomy of emotions: A meta-analysis. *Cognitive, Affective, & Behavioral Neuroscience*, *3*(3), 207–233. http://doi.org/10.3758/CABN.3.3.207

Niles, A. N., Craske, M. G., Lieberman, M. D., & Hur, C. (2015). Affect labeling enhances exposure effectiveness for public speaking anxiety. *Behaviour Research and Therapy*, *68*, 27–36. http://doi.org/10.1016/j.brat.2015.03.004

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*(4), 569–582. http://doi.org/10.1037/0021-843X.100.4.569

Nolen-Hoeksema, S. (2012). Emotion regulation and psychopathology: The role of gender. *Annual Review of Clinical Psychology*, *8*(1), 161–187. http://doi.org/10.1146/annurev-clinpsy-032511-143109

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, *3*(5), 400–424. http://doi.org/10.1111/j.1745-6924.2008.00088.x

Olatunji, B. O., Cisler, J. M., Deacon, B. J., Connolly, K. M., & Lohr, J. M. (2007). The Disgust Propensity and Sensitivity Scale-Revised: Psychometric properties and specificity in relation to anxiety disorder symptoms. *Journal of Anxiety Disorders*, *21*(7), 918–930. http://doi.org/10.1016/j.janxdis.2006.12.005

Olatunji, B. O., Cisler, J. M., McKay, D., & Phillips, M. L. (2010). Is disgust associated with psychopathology? Emerging research in the anxiety disorders. *Psychiatry Research*, *175*(1–2), 1–10. http://doi.org/10.1016/j.psychres.2009.04.007

Olatunji, B. O., & Sawchuk, C. N. (2005). Disgust: Characteristic features, social manifestations, and clinical implications. *Journal of Social and Clinical Psychology*, *24*(7), 932–962. http://doi.org/10.1521/jscp.2005.24.7.932

Ortner, C. N. M. (2015). Divergent effects of reappraisal and labeling internal affective feelings on subjective emotional experience. *Motivation and Emotion*, 563–570.

http://doi.org/10.1007/s11031-015-9473-2

Payer, D. E., Baicy, K., Lieberman, M. D., & London, E. D. (2012). Overlapping neural substrates between intentional and incidental down-regulation of negative emotions. *Emotion*, *12*(2), 229-235. http://dx.doi.org/10.1037/a0027421

Phan, K. L., Wager, T. D., Taylor, S. F., & Liberzon, I. (2002). Functional neuroanatomy of emotion: A meta-analysis of emotion activation studies in PET and fMRI. *NeuroImage*, *16*(2), 331-348. http://doi.org/10.1006/nimg.2002.1087

Rachman, S. (1978). Human fears: A three systems analysis. *Scandinavian Journal of Behaviour Therapy, 7*(4), 237-245. http://dx.doi.org/10.1080/16506077809456104

Rachman, S. (1980). Emotional processing. *Behaviour Research and Therapy*, *18*(1), 51–60. http://doi.org/10.1016/0005-7967(80)90069-8

Radloff, L. S. (1977). A self-report depression scale for research in the general population. *Applied Psychological Measurement*, *1*(3), 385–401. http://doi.org/10.1177/014662167700100306

Russell, J. A., & Barrett, L. F. (1999). Core affect, prototypical emotional episodes, and other things called emotion: Dissecting the elephant. *Journal of Personality and Social Psychology*, *76*(5), 805–819. http://doi.org/10.1037/0022-3514.76.5.805

Saarimaki, H., Gotsopoulos, A., Jaaskelainen, I. P., Lampinen, J., Vuilleumier, P., Hari, R., … Nummenmaa, L. (2015). Discrete neural signatures of basic emotions. *Cerebral Cortex*, 1–11. http://doi.org/10.1093/cercor/bhv086

Schutte, N. S., Malouff, J. M., & Bhullar, N. (2009). The Assessing Emotions Scale. In C. Stough, D. H. Saklofske, & D. A. Parker (Eds.), *Assessing Emotional Intelligence* (pp. 119–134). Springer. http://doi.org/10.1007/978-0-387-88370-0

Schutte, N. S., Malouff, J. M., Hall, L. E., Haggerty, D. J., Cooper, J. T., Golden, C. J., & Dornheim, L. (1998). Development and validation of a measure of emotional intelligence. *Personality and Individual Differences*, *25*, 167–177. http://doi.org/10.1016/S0191-8869(98)00001-4

Schutte, N. S., Manes, R. R., & Malouff, J. M. (2009). Antecedent-focused emotion regulation, response modulation and well-being. *Current Psychology, 28*(1), 21–31. http://doi.org/10.1007/s12144-009-9044-3

Smits, J. A. J., Telch, M. J., & Randall, P. K. (2002). An examination of the decline in fear and disgust during exposure-based treatment. *Behaviour Research and Therapy*, *40*, 1243–1253. http://doi.org/10.1016/S0005-7967(01)00094-8

Tabibnia, G., Lieberman, M. D., & Craske, M. G. (2008). The lasting effect of words on feelings: Words may facilitate exposure effects to threatening images. *Emotion*, *8*(3), 307–317. http://doi.org/10.1037/1528-3542.8.4.551

Taboas, W., Ojserkis, R., & McKay, D. (2014). Change in disgust reactions following cognitive-behavioral therapy for childhood anxiety disorders. *International Journal of Clinical and Health Psychology*, *15*(1), 1–7. http://doi.org/10.1016/j.ijchp.2014.06.002

Touroutoglou, A., Lindquist, K. A., Dickerson, B. C., & Barrett, L. F. (2014). Intrinsic connectivity in the human brain does not reveal networks for “basic” emotions. *Social Cognitive and Affective Neuroscience*, *10*(9), 1257–1265. http://doi.org/10.1093/scan/nsv013

van Overveld, W. J. M., de Jong, P. J., Peters, M. L., Cavanagh, K., & Davey, G. C. L. (2006). Disgust propensity and disgust sensitivity: Separate constructs that are differentially related to specific fears. *Personality and Individual Differences*, *41*, 1241–1252.

http://doi.org/10.1016/j.paid.2006.04.021

Venables, P. H., & Christie, M. J. (1980). Electrodermal activity. In I. Martin & P. H. Venables (Eds.), *Techniques in psychophysiology* (pp. 3–67). New York: Wiley.

Wager, T. D., Phan, K. L., Liberzon, I., & Taylor, S. F. (2003). Valence, gender, and lateralization of functional brain anatomy in emotion: A meta-analysis of findings from neuroimaging. *NeuroImage*, *19*(3), 513–531. http://doi.org/10.1016/S1053-8119(03)00078-8