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# A dimensional assessment of an implicit measure of emotion regulation

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BOSTON UNIVERSITY  
GRADUATE SCHOOL OF ARTS AND SCIENCES

Dissertation

**A DIMENSIONAL ASSESSMENT OF AN IMPLICIT MEASURE  
OF EMOTION REGULATION**

by

**BENJAMIN OWEN EMMERT-ARONSON**

B.S. The Ohio State University, 2006  
M.A., Columbia University, 2007  
M.S., Columbia University, 2009

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2016

Approved by

First Reader

---

Timothy A. Brown, Psy.D.  
Professor of Psychological & Brain Sciences

Second Reader

---

David H. Barlow, Ph.D.  
Professor of Psychological & Brain Sciences

Third Reader

---

Tibor P. A. Palfai, Ph.D.  
Professor of Psychological & Brain Sciences

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**BENJAMIN OWEN EMMERT-ARONSON**

Boston University Graduate School of Arts and Sciences, 2016

Major Professor: Timothy A. Brown, Psy.D., Professor of Psychological & Brain  
Sciences

**ABSTRACT**

Emotion regulation has taken on a growing role in the study of psychopathology, both in research as a process, and as a part of a treatment. The interest in emotion regulation has led to an increase in the assessment of this construct, primarily with explicit measures of emotion regulation. However, explicit measures are limited in that they are retrospective, subject to response biases, and impacted by method effects. Further, explicit measures only assess single strategies of emotion regulation at a time. Implicit measures of emotion regulation are not subject to these limitations.

One implicit measure of emotion regulation is Etkin's Emotional Conflict Task, which conceptually follows the Stroop task. The current study utilized the Emotional Conflict Task, but examined psychopathology dimensionally instead of categorically. This allowed for more precise assessment of psychopathology and increased statistical power, without the loss of information inherent to categorical assessment. Until now, the Emotional Conflict Task has only been examined in a few clinical samples, and only with very small sample sizes. This study examined convergent and divergent validity of the

Emotional Conflict Task as well as incremental validity over current measures of emotion regulation.

Sixty outpatients with anxiety and mood disorders completed the Emotional Conflict Task and a standard battery of questionnaires, along with a semi-structured diagnostic assessment, as part of their intake assessment when presenting for assessment and treatment at the Center for Anxiety and Related Disorders. Convergent validity of the Emotional Conflict Task was assessed by correlating it with two explicit measures of emotion regulation. Next, hierarchical regression was used to examine incremental validity of the Emotional Conflict Task, specifically the amount of variability in functional impairment accounted for, as measured by the Work and Social Adjustment Scale. Finally, this measure was correlated with dimensional measures of psychopathology and temperament to assess the differential relations between these constructs. Results indicated that the Emotional Conflict Task did not correlate with explicit measures of emotion regulation, was not predictive of functional impairment, and was not correlated with dimensional measures of psychopathology or temperament. Potential causes for these null findings and future directions are discussed.

## TABLE OF CONTENTS

ACKNOWLEDGMENTS.....	iv
ABSTRACT.....	vii
TABLE OF CONTENTS.....	ix
LIST OF TABLES.....	xi
LIST OF FIGURES.....	xii
INTRODUCTION.....	1
History of Emotion Regulation.....	1
Importance of Emotion Regulation to Psychological Health.....	5
Emotion Regulation Strategies.....	5
Temporal Emotion Regulation.....	8
Limitations of Current Methods of Explicitly Assessing Emotion Regulation....	12
Limitations of Categorical Assessment of Psychopathology.....	15
Benefits of Implicit Assessment of Emotion Regulation.....	17
Brain Bases of Emotion Regulation.....	21
Behavioral Outcomes of the Emotional Conflict Task.....	23
Current Study.....	24
STUDY AIMS AND HYPOTHESES.....	25
RESEARCH DESIGN AND METHODS.....	27
Participants.....	27
Clinician Rated Measure.....	32
Computer Task.....	32

Self-Report Measures.....	34
Procedures.....	35
Data Analysis.....	36
Power Considerations.....	38
RESULTS.....	38
Aim 1.....	38
Aim 2.....	42
Aim 3.....	44
Exploratory Analyses.....	47
DISCUSSION.....	50
Current Findings.....	50
Implications.....	52
Limitations and Future Directions.....	58
Conclusion.....	61
REFERENCES.....	63
CURRICULUM VITAE.....	83

## LIST OF TABLES

Table 1. Demographic Characteristics of Outpatient Sample.....	28
Table 2. Principal and Additional Diagnoses of Outpatient Sample.....	30
Table 3. Number of Clinical Diagnoses in Outpatient Sample.....	31
Table 4. Incremental Validity of Adaptability Measure, Overall Model Fit and Regression Coefficients.....	43
Table 5. Correlations Among Measures of Adaptability, Explicit Emotion Regulation, Temperament, Psychopathology, and Overall Impairment.....	45
Table 6. Impact of Adaptability Measure on the Relationship Between NFFI-N and GAD-7.....	46
Table 7. Correlations Among Measures of Modified Stroop Effect, Explicit Emotion Regulation, Temperament, Psychopathology, and Overall Impairment.....	49

## LIST OF FIGURES

Figure 1. Scatterplot of adaptability and Difficulties in Emotion Regulation Scale (DERS) – Difficulty Engaging in Goal-Directed Behavior subscale.....	40
Figure 2. Scatterplot of adaptability and Generalized Anxiety Disorder-7 scale (GAD-7). .....	41

## INTRODUCTION

The field of emotion regulation has developed dramatically over the past two decades. The importance of emotion regulation has grown from a concept that was barely discussed to one that is described across many disorders (Jazaieri, Urry, & Gross, 2013), included as the focus of treatments (see Kring & Sloan, 2009, for examples), and suggested as an additional classification system of psychopathology (Berenbaum, Raghavan, Le, Vernon, & Gomez, 2003). This increased focus on emotion regulation's role in psychopathology and treatment has also led to an increased demand for accurate assessment. While a number of measures exist to explicitly assess emotion regulation, the ability to assess it implicitly has been lacking. This study examines an implicit measure of emotion regulation, with the goals of assessing its convergent, divergent, and incremental validity with current measures of emotion regulation as well as its relationship with transdiagnostic, dimensional measures of psychopathology and temperament.

### **History of Emotion Regulation**

A discussion of emotion regulation must begin with a discussion of emotion. The "Modal Model" of emotion is one very common model of emotion, which can be summarized as "a person-situation transaction that compels attention, has particular meaning to an individual, and gives rise to a coordinated yet flexible multisystem response to the ongoing person-situation transaction" (Gross & Thompson, 2007, p. 5). Gross and Thompson identified four aspects of emotion in the modal model: an activating situation, attention, appraisals of the situation, and an emotional response. They note that

because each of these aspects differ from person to person, people experience emotions differently, even given the same situation. Emotion has several functions including survival (e.g., fear of an oncoming car), motivational (e.g., anxiety to meet an upcoming deadline), and social (e.g., happiness at seeing a loved one). This basic model was further updated by Feldman-Barrett, Ochsner, and Gross (2007) who looked at the heterogeneity of responses seen in emotions.

With a basic definition of emotion, we can begin to look at the broad concept of emotion regulation. This is particularly important as there are a variety of definitions of emotion regulation (Bloch, Moran, & Kring, 2009). Bloch and colleagues reviewed an extensive range of definitions, beginning with Dodge's (1989) early, broad definition, the process by which one response domain impacts another response domain. Shortly thereafter, Thompson (1994) described emotion regulation as containing both intrinsic and extrinsic processes to monitor, evaluate, and modify emotion reactions. Also seminal was Gross's definition of "processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (1998, p. 275). Of note, Gross's definition focused solely on one's impact on one's own emotions, neglecting the impact of others. This was changed when Gross and Thompson (2007) combined their ideas resulting in a new definition of emotion regulation: the automatic or controlled, conscious or unconscious process of individuals influencing emotions in self, others, or both. This regulation can involve increasing or decreasing positive or negative emotions, and can occur during any of the four stages of an emotion

(situation, attention, appraisal, or response), or before any of them occur through situation selection.

While this definition has the benefit of being broad and inclusive, it glosses over the fact that emotion regulation is a multi-faceted concept. In their review of neural pathways associated with emotion regulation, Phillips, Ladouceur, and Drevets (2008) found different neural networks affiliated with voluntary as opposed to automatic emotion regulation. They found voluntary emotion regulation focused more on the prefrontal cortex, specifically the dorsolateral prefrontal cortex and orbital frontal cortex. In contrast, automatic processes of emotion regulation focused on the anterior cingulate cortex (ACC), right orbital frontal cortex, and parahippocampal gyrus. Examining a different subject area, but utilizing similar methodology, Ranganath, Smith, and Nosek (2008) completed a multi-method assessment of attitudes using both implicit (e.g., go/no-go task) and explicit (e.g., attitude questionnaire) measures that were both voluntary (i.e., allowed time for reflection) and automatic (i.e., did not allow time for reflection). Utilizing confirmatory factor analysis, they found that a one-factor model of attitude fit the data poorly. In addition, a two-factor model which split the tasks based on the automaticity of the task fit the data better than a two-factor model which split the tasks based on whether they were implicit or explicit measures. This suggests that there are distinct, though certainly related, constructs being tapped by automatic versus controlled reporting, which will allow for complementary data to be gathered by these separate approaches. Given these distinct facets to emotion regulation, and the broad definition of

emotion regulation provided above, this study will focus particularly on the ability to pursue goal-directed behavior in the face of emotional conflict.

Classically, emotion regulation has been examined by dividing it into specific strategies that are used to regulate emotions including acceptance, problem solving, reappraisal, avoidance, rumination, and suppression. These strategies have often been divided into adaptive (acceptance, problem solving, and reappraisal) and maladaptive (avoidance, rumination, and suppression), and extensive studies have examined advantages and disadvantages of each of these strategies (see Aldao, Nolen-Hoeksema, & Schweizer, 2010, for a review of negative emotions, and Carl, Soskin, Kearns, & Barlow, 2013, for a review of positive emotions). However, this idea is under debate with newer lines of research calling it into question. Altamirano, Miyake, and Whitmer (2010) found rumination to be useful when a singular goal requires focus in the presence of distractors. Butler, Lee, and Gross (2007) show that culture moderated the maladaptive nature of suppression, and Shepps, Catran, and Meiran (2009) found reappraisal to be costly and ineffective in highly emotional situations. Further, Shepps, Brady, and Samson (2014) demonstrate that in high stress situations, distraction was more effective and less cognitively demanding than reappraisal. Additionally, there has been a focus on the importance of flexibility in emotion regulation (Bonanno, Papa, Lalande, Westphal, & Coifman, 2004; Westphal, Seivert, & Bonanno, 2010). Bonanno and colleagues show that the ability to use emotion regulation strategies flexibly (specifically suppression and expression) was associated with higher self- and other-rated adjustment in times of stress. It was also associated with lower levels of distress several years after a traumatic event.

This was true even for a classically maladaptive strategy of emotion regulation (i.e., suppression).

### **Importance of Emotion Regulation to Psychological Health**

Difficulties with emotion regulation are identified across psychological disorders and disorder categories. Gross and Levenson (1997) identified emotion regulation difficulties as occurring in nearly half of the Axis I disorders, and all of the Axis II disorders in the *Diagnostic and Statistical Manual of Mental Disorder* (4<sup>th</sup> ed.; *DSM-IV*; American Psychiatric Association [APA], 1994), and emotion regulation has been shown to mediate the relationship between psychiatric disorder and functional impairment (e.g., Au, Dickstein, Steenkamp, Salters-Pedneault, & Litz, 2012). Emotion regulation has been studied in many different ways, including both strategy focused, as well as temporally focus. Below are two reviews of emotion regulation strategies. The first focuses on the most common strategies. The second is organized around the temporal stages of an emotion (i.e., Gross's process model, Gross & Thompson, 2007).

### **Emotion Regulation Strategies**

Six emotion regulation strategies have emerged in the literature as the most commonly examined. They are acceptance, avoidance, cognitive reappraisal, problem solving, rumination, and suppression. A description of each, as well as a brief statement of their efficacy, follows.

Acceptance is a willingness to experience internal experiences without attempting to modify their form, frequency, or intensity (Hayes, Strosahl, & Wilson, 1999), and focuses largely on the appraisal aspect of emotion, though also limits the development of

secondary responses (e.g., anger at feelings of sadness). A lack of acceptance (i.e., experiential avoidance) has been negatively associated with quality of life, distress tolerance, positive affect, and positive life experiences; it has been positively associated with substance abuse, self-harm, posttraumatic stress disorder symptoms, and anxiety symptoms (see Boulanger, Hayes, & Pistorello, 2009, for a review). Acceptance is an explicit target of a number of therapies, including acceptance and commitment therapy (Hayes et al., 1999), mindfulness based stress reduction (Kabat-Zinn, 1982), and dialectical behavior therapy (DBT, Linehan, 1993). Acceptance has generally positive, though inconclusive, support for its effectiveness as an emotion regulation strategy (e.g., Aldao et al., 2010; Kollman, Brown, & Barlow, 2009).

Avoidance can take several forms, including cognitive, behavioral, and interoceptive avoidance. Early work on behavioral avoidance linked it closely with maintaining psychopathology, particularly anxiety disorders, through the lack of opportunities for extinction (Mowrer, 1947). Consequently, addressing behavioral avoidance is a staple of cognitive behavioral treatments, including transdiagnostic treatments (Fairholme, Boisseau, Ellard, Ehrenreich, & Barlow, 2009). The avoidance of emotions and internal experiences has become a target of treatment (Hayes et al., 1999).

Cognitive reappraisal consists of examining the evidence for and against a thought as well as considering alternative thoughts and their respective evidence, and has been an explicit target of treatment through cognitive therapy for nearly 50 years (Beck, 1967). Extensive research has demonstrated links between psychopathology and negative cognitive biases both in theoretical models (e.g., Beck, 1967) as well as in research (see

Mathews & MacLeod, 2005, for a review). The benefit derived from training in cognitive reappraisal is also well documented (Hanrahan, Field, Jones, & Davey, 2013), though some suggest that it encourages emotional suppression and question its utility (Valdivia-Salas, Sheppard, & Forsyth, 2009).

Problem solving consists of defining a problem and taking steps to formulate a positive solution to it. It frequently includes brainstorming, evaluating potential solutions, picking a solution, and evaluating it. Problem solving deficits are related to depression and self-harm (D'Zurilla, Chang, Nottingham, & Faccinni, 1998), anxiety (Chang, Downey, & Salata, 2004), and aggression (Stegge & Terwogt, 2007). This emotion regulation strategy focuses on changing the situation, and is evident in treatments such as DBT (Linehan, 1993) and problem solving skills therapy (Kazdin, Siegel, & Bass, 1992).

Rumination is the process of passively, repetitively focusing on distress and potential causes for the distress (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). Rumination has been strongly linked with mood and anxiety disorders, particularly major depressive disorder (MDD) and generalized anxiety disorder (GAD; Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Mor & Winqvist, 2002). Recent work has focused on subtypes of rumination and making distinctions between these subtypes (e.g., abstract rumination and experiential mindfulness; Nolen-Hoeksema et al., 2008), finding that not all types are negative.

Suppression is the process of removing emotions from the conscious experience, including internal feelings, external expressions, and thoughts associated with the emotion (Salters-Pedneault, Steenkamp, & Litz, 2009). Suppression can be looked at as

one particular subtype of avoidance, focusing on changing an emotional response that has already begun, the final stage in Gross and Thompson's model (2007). Ironically, suppression has been shown to increase a variety of emotional and physiological experiences, rather than decrease them, including increasing attentional bias toward a suppressed object (Lavy & van den Hout, 1994), increased unpleasant emotions (Campbell-Sills, Barlow, Brown, & Hofmann, 2006), increased physiological arousal (Gross & Levenson, 1993), and decreased behavioral approach toward emotionally evocative tasks (due to increased anxiety; Levitt, Brown, Orsillo, & Barlow, 2004). While suppression has been associated with a range of mood and anxiety disorders, there is also evidence that its periodic and flexible utilization is associated with positive outcomes (Bonanno et al., 2004). This may be due to differential effects of different subtypes of suppression, for example suppressing the expression of emotions as opposed to suppressing the experience of emotions (Webb et al., 2012).

### **Temporal Emotion Regulation**

In contrast to this focus on specific strategies for emotion regulation, Webb and colleagues (2012) focused on the timing of emotion regulation strategies. They began with Gross and Thompson's (2007) process model of emotion, which identifies five salient points in time: situation selection, situation modification, attentional deployment, cognitive change, and response modification. Each of these five offers options for emotion regulation. The first four fall under antecedent-focused strategies, because they all occur before the emotion occurs. Response modulation is a response-focused strategy, and follows the experience of the emotion. Functional imaging studies have supported

this temporal distinction. Ochsner and Gross's (2008) review describes a temporal distinction between reappraisal (antecedent-based) and suppression (response-based) where activation of the prefrontal cortex occurs earlier when participants are asked to use the former strategy, and later for the latter strategy.

Webb and colleagues (2012) assert that the first two strategies have minimal research examining them experimentally, though there are a number of correlational studies examining their impact. Situation selection is the process of limiting or expanding which situations one is likely to be in, in an effort to prevent negative situations and increase positive situations. In one study examining situation selection, D'Zurilla, Chang, and Sanna (2003) found that students who avoided situations had lower self-esteem and positive problem orientation, and higher negative problem orientation, anger, and hostility. Situation modification happens after the situation occurs, but before any emotional reaction. For example, Fabes, Eisenberg, Karbon, Bernzweig, and Speer (1994) found that when mothers were asked to read a distressing story to their kindergartener or second-grader, they would insert more positive emotion when reading to their kindergartener. They also modified their reading of the story if they perceived their child as more emotionally reactive. A different reading of situation selection would argue that avoidance behaviors, particularly common in the mood and anxiety disorders, all represent situation selection, and that the behavioral component of cognitive behavioral therapy targets this stage of emotion regulation. From that perspective, there are a great deal of experimental studies examining the effects of situation selection and situation modification (e.g., Hofmann & Smits, 2008).

The third stage in Gross's process model is attentional deployment. This involves focusing toward or away from particular aspects of the situation. Attentional deployment has been tested in a variety of ways, including directing participants to focus elsewhere (active distraction), increasing demands on working memory (passive distraction), or focusing on an image (concentration or rumination). Extensive research shows the effect of rumination is to increase the emotion being focused on (e.g., Nolen-Hoeksema et al., 2008). Over several experiments, Van Dillen and Koole (2007) exposed participants to neutral, mildly negative, or strongly negative pictures, and then had them complete math problems of varying difficulty. More negative pictures led to a more negative mood. However, the impact on mood was decreased as the demand on working memory increased (i.e., more complex problems). Several neuroimaging studies have directly compared reappraisal (discussed below) and distraction, finding that distraction takes fewer cognitive resources and causes larger decreases in the amygdala, though reappraisal resulted in greater decreases in negative affect (e.g., Kanske, Heissler, Schonfelder, Bongers, & Wessa, 2011; McRae et al., 2010). McRae and colleagues (2010) also found that reappraisal required more attention on the affective stimulus, as it was attended to, and then changed, whereas distraction occurred before the initial affective meaning is created, further supporting the temporal nature of the process model. This interpretation is also supported by studies showing that memory is better for images where reappraisal is used, than images where distraction is used (Sheppes & Meiran, 2007).

The fourth stage is cognitive change, including strategies such as reappraisal. This stage focuses on the meaning that is made of a situation, and may be altered by thinking of alternative possibilities, focusing on the situation objectively, or examining the evidence for and against a particular outcome (e.g., Fairholme et al., 2009). Reappraisal can focus on the emotional response, the emotional stimulus, or the perspective one takes. Webb and colleagues (2012) also included mindfulness, or non-judgmental observation, in the category of cognitive change, under the assumption that people automatically create judgements, and mindfulness represents a reappraisal of those emotions.

The fifth stage of the process model is response modulation, and includes strategies such as suppression. This focuses on influencing physical, emotional, or behavioral processes, once they have already begun (Gross, 2013). Similarly, regulation of emotions at this stage can focus on suppression of the physical expression of emotion (behave so that an observer could not guess what you feel), the emotion itself (suppress all feelings), or thoughts of the emotion-eliciting event. These three styles of suppression behave somewhat differently, though are similar in that all can have ironic effects of increasing the emotional experience, particularly at the physiological level. People are generally able to suppress their behaviors, but their emotional experience and physiological reactions were less controllable, or responded in opposition to their attempts (Webb et al., 2012).

Emotion regulation strategies apply across the temporal stages of an emotion, and also are linked with positive and negative outcomes across the range of psychopathology. This is evident not only in the deficits and their links to psychopathology described

above, but also in the increasing number of psychological treatments that focus explicitly on emotion regulation, such as DBT (Linehan, 1993), acceptance and commitment therapy (Hayes et al., 1999), emotion regulation therapy (Mennin & Fresco, 2009), and the unified protocol (Fairholme et al., 2009). One reason for the broad impact of emotion regulation may be due to its links with temperament (Rothbart & Sheese, 2007). Because of this, Rothbart and Sheese emphasized the need for multi-trait, multi-method approaches such as those described below.

### **Limitations of Current Methods of Explicitly Assessing Emotion Regulation**

Current measures of emotion regulation largely consist of self-report questionnaires and are limited in several ways (see Tram-Quon, 2013, for a review). These measures often overlap with symptoms of psychopathology, yielding inflated relationships due to criterion contamination (e.g., Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Similarly, they also suffer from method effects. Their self-report nature, when combined with self-report questionnaires of other constructs of interest (e.g., psychopathology), will yield inflated correlations due to common-method variance (Nosek & Smyth, 2007). This can be accounted for, and mitigated, through multi-method assessments of both emotion regulation as well as psychopathology.

Self-report measures are also open to reporting bias (e.g., desire to give the “correct” answer). In contrast, implicit measures of emotion regulation do not ask directly about emotion regulation, but measure it indirectly, frequently utilizing reaction time. These implicit measures have very short reaction times relative to explicit measures (several hundred milliseconds), making them difficult or impossible to consciously

control or bias one's response. Egloff and Schmukle (2002) asked participants to present themselves in a positive light, as they would for a job interview, and then administered both an implicit (Implicit Attitudes Test) and explicit (State-Trait Anxiety Inventory) measure of anxiety. They found that participants appeared less anxious on the explicit measure, but not the implicit measure, as compared to a control group. This effect has been replicated across several other domains as well, demonstrating the ability of these measures to reduce or eliminate demand characteristics or social desirability bias (Asendorpf, Banse, & Mucke, 2002; Banse, Seise, & Zerbis, 2001).

Finally, explicit measures are often retrospective. Robinson and Clore (2002) found that people are generally poor retrospective reporters of their emotions. People instead utilize semantic cues to attempt to remember their emotions, which vary significantly from their episodic reports at the time of the emotion. It has been repeatedly found that people are poor reporters of their use of emotion regulation strategies and in addition, even when examined in the moment, they struggle to use emotion regulation strategies as instructed (Demaree, Robinson, Pu, & Allen, 2006). Driving home the disconnect between people's understanding of their emotion regulation and their implicitly assessed emotion regulation, Mauss, Evers, Wilhelm, and Gross (2006) found a negative association between their implicit measure of emotion regulation and self-reported emotion control. Taken together, these reasons make the manipulation of emotion regulation strategies difficult (e.g., randomizing participants to use particular strategies), impairing study of them. This is particularly true when a study depends on

participants understanding of, ability to report on, or ability to utilize specific emotion regulation strategies.

Explicit measures of emotion regulation are also limited in their emphasis on individual strategies of emotion regulation. Aldao and colleagues (2010) found that psychopathology is differentially related to the type of emotion strategy utilized, finding generally that avoidance, suppression, and rumination were maladaptive and problem solving, cognitive reappraisal, and acceptance were adaptive. However, this is currently in question. For example, this conflicts with the findings of Bonanno and colleagues (2004) in their focus on flexibility of strategies. It also speaks to a point elucidated by Carl and colleagues (2013), assessing emotion regulation strategies in isolation may give a biased view, either over or underemphasizing people's emotion regulation abilities. Finally, Butler and colleagues (2007) found that the negative effects of suppression as an emotion regulation strategy are culture dependent. They found that for people holding Western-European values (e.g., flexibility and independence, as measured by the European American Values Scale), suppression was associated with greater self-rated negative emotion, but not for people holding Asian values (e.g., norm conformity and interdependence, as measured by the Asian Values Scale). For people holding Asian values, higher use of suppression was associated with a slight decrease in self-reported negative emotion.

Explicit measures of emotion regulation rely on a focus on individual strategies. This focus hinders study of the actual outcome of interest – how well people regulate their emotions, improving their ability to function in daily life. This focus on individual

strategies of emotion regulation is categorical in nature, examining first one strategy, then another, attempting to divide the construct of emotion regulation along arguably arbitrary lines. Unlike this focus on one strategy at a time, implicit measures allow for cross-strategy assessment. For example, a participant can use both suppression of a negative emotion as well as cognitive reappraisal. It makes no difference to the implicit measure how emotion is regulated, only that it is regulated. This changes the discussion from one of which category of emotion regulation strategy was used, to one of how effectively were emotions regulated, how effectively was the participant able to pursue his or her goals? While not directly analogous, this categorical/dimensional debate reflects a similar one within the psychopathology assessment field, which is also examining attempts to study psychopathology without separating it into individual disorders.

### **Limitations of Categorical Assessment of Psychopathology**

As reviewed in Brown and Barlow (2009), there are significant downsides to a categorical focus on psychopathology. Clinically relevant information as well as statistical variability is lost when artificially dividing dimensional constructs into categories. This is seen when dividing the continuum of severity into clinically interfering or not (i.e., disorder presence or absence), as well as when dividing psychopathology into categorical diagnoses (e.g., GAD and MDD; see Rosellini, Boettcher, Brown, & Barlow, 2015, for a review). When examining the presence or absence of a disorder, falling just above, or just below, the threshold for clinical significance makes a large difference, when in fact the difference in severity might be quite small, smaller than differences between two people who both fall on the same side

of this somewhat arbitrary cut point. Similarly, patients may meet the threshold for interference of a disorder, but lack one symptom from meeting full criteria. Pincus, McQueen, and Elinson (2003) found that these patients were not necessarily meaningfully different from patients who meet full criteria; however, they would be lumped into an undifferentiated not otherwise specified category.

Broader limitations arise when considering the categorical classification of psychopathology. These include high rates of overlap, particularly among mood and anxiety disorders. For example, Brown, Campbell, Lehman, Grisham, and Mancill (2001) found that 67% of patients with a principal diagnosis of MDD would also meet for a diagnosis of GAD, if the *DSM-IV* hierarchy rule were ignored; 90% of those currently diagnosed with a mood disorder (MDD or dysthymia) were also diagnosed with an anxiety disorder. Along with evidence that higher-order factors (i.e., positive affect, negative affect, and autonomic arousal; Brown & Barlow, 2009) explain the shared variability among mood and anxiety disorders, this points to overarching similarities among these disorders, as opposed to clear categorical distinctions. This is also demonstrated in the National Institute of Mental Health's (NIMH) decision to pursue the Research Domain Criteria (RDoC), a methodology emphasizing dimensional assessment across multiple domains (e.g., neuroimaging, behavioral outcomes, clinical presentation), instead of utilizing *DSM-5*, a mainly categorical methodology, for future research (Sanislow et al., 2010). The RDoC criteria focus on dimensional mechanisms of action (e.g., emotion regulation) over categorical disorders, with the eventual goal of identifying specific components that make up mental disorders without the limitations of working

within disorder categories that are due as much to convention as to evidence-base (Sanislow et al., 2010). This focus on dimensionality and multi-level evaluation call for inclusion of multi-method assessment, such as combining implicit and explicit measures of a given concept (e.g., emotion regulation) to utilize the strengths of each methodology while limiting the weaknesses.

### **Benefits of Implicit Assessment of Emotion Regulation**

In light of these shortcomings, it is clear that additional, complementary assessments of emotion regulation are needed. Of particular interest is an implicit measure, one that is not impacted by social desirability, method effects, the limitations of memory, misinterpretations of emotion regulation strategies, or similarities to psychopathology. Many attempts have been made to study emotion implicitly. Gathering psychophysiological data is the most common way of doing this, and includes methods such as skin conductance, facial electromyography, heart rate variability, and functional magnetic resonance imaging (Potter & Bolls, 2012). Some of these measures (e.g., computer algorithms to assess emotion visually via web camera or to assess emotion based on written text) are making their way into commercial use, allowing companies to gather real-time data about the impact that their media content has on users of their websites, as well as allowing them to target advertising more precisely (Lawton, 2014).

While most implicit assessments attempt to measure emotion, as opposed to emotion regulation, a few have attempted to directly assess emotion regulation, though there is debate as to the exact construct measured (e.g., emotion regulation itself or attitudes toward emotion regulation). Mauss and colleagues (2006) developed a variant of

the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998) to assess emotion regulation (Emotion Regulation-IAT) where they paired the words “emotion regulation” with positive items and “emotion expression” with negative items (set 1), and then switched this pairing (set 2). By examining the differences in reaction times between the sets, they calculated an implicit evaluation of emotion regulation relative to emotion expression. This measure was modestly related to explicit measures of emotion regulation, all  $r$ 's  $\leq .21$ . In an anger provocation task, this measure was related to lower reported anger experience, fewer angry thoughts, and a lower threat-based cardiovascular reaction, but not anger behavior. Mauss and colleagues argue that these relationships suggest that the Emotion Regulation-IAT is a valid measure of implicit emotion regulation. Others (e.g., Mierke, & Klauer, 2003) suggest that instead of measuring the association between categories (i.e., emotion regulation and positive), the IAT instead measures other variables such as task switching ability, category salience, or knowledge of cultural stereotypes, or that they measure emotion regulation values as opposed to emotion regulation ability.

Another way of implicitly assessing emotion regulation has been to measure the amount of interference caused by emotional tasks (i.e., emotional Stroop task). Just as the traditional Stroop task has been used for over 75 years to assess mental flexibility and semantic conflict (Stroop, 1935), this task has also been modified to assess emotional conflict by using words that are either emotionally neutral (e.g., apple) or emotionally charged (e.g., death) (MacLeod, 1991).

However, this “emotional Stroop” task is not thought to directly assess emotional conflict, but instead to assess how much the emotional stimuli draw attention away from the task, thus slowing reaction time (Etkin et al., 2006). Because of this, Etkin and colleagues developed their Emotional Conflict Task to more directly assess emotion regulation. Instead of presenting words in various colors of ink that were either emotionally salient or not, they presented a word (i.e., “HAPPY” or “FEAR”) overlaying an emotional face (portraying either happiness or fear). The task is then to identify the emotion portrayed in the face, despite the automaticity of reading the word. Similar to the original Stroop task, incongruent pairs (e.g., “FEAR” over a happy face) take longer to respond to than congruent pairs (e.g., “HAPPY” over a happy face), demonstrating emotional conflict. More interesting though is that when an incongruent pair follows an incongruent pair, reaction time is quicker than when an incongruent pair follows a congruent pair. While the brain bases are discussed below, it is hypothesized this effect occurs because the person recognizes the conflict and brings to bear cognitive resources to adapt to it, so as to be better prepared for the next conflictual task (adaptability; Etkin et al., 2006). Classic models of emotion regulation are focused on explicit behavioral changes to regulate emotion (e.g., Gross’s process model, 1998), which do not correspond well with this adaptability, measured implicitly. From this perspective, the Emotional Conflict Task does have similarities with attentional deployment, as both utilize cognitive resources to regulate emotion. From the emotion regulation strategies, adaptability is reminiscent of problem solving, in that one’s brain recognizes the problem (conflictual information) and takes steps to solve it (albeit automatically instead of

consciously). When partitioning emotion regulation into different stages (e.g., Gratz & Roemer, 2004), this adaptability is conceptually similar to one's difficulty in engaging in goal-directed behavior and to one's impulse control difficulties.

This implicit measure of emotion regulation has a number of benefits. As seen above, emotion regulation applies transdiagnostically. An implicit measure assesses across diagnostic categories, and without the potential inflation due to overlap with *DSM* diagnostic criteria (e.g., as seen with rumination and depression, Treynor et al., 2003). This is particularly relevant given the transition currently underway in the assessment of psychopathology, a movement away from narrowly splitting pathology into distinct disorders, and a focus on the broader, transdiagnostic factors such as neuroticism and extraversion (e.g., Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2014; Rosellini et al., 2015). Just as this focus on the commonalities among disorders helps make sense of patterns of comorbidity and broad treatment response, a broader, outcomes-based measure of emotion regulation helps to clarify the confusion around past conflicting results of specific emotion regulation strategies. The question changes from one of “is this strategy adaptive or maladaptive” to “is this person able to pursue goals despite emotional conflict?”

Additionally, this measure is not dependent on participants' recall, ability to control their use of emotion regulation strategies, or reporting bias. It simply depends on their reaction time. Given this design, it can be used as part of a multi-method assessment, allowing for the examination of method effects when paired with more classic measures of emotion regulation. Finally, and at its core, it is not focused on

particular strategies, which indicate emotion regulation; it is a more direct measure of participants' ability to control their initial responses and act in a desired direction. Our ultimate interest in emotion regulation is in how effectively people are able to pursue their goals in the face of difficulty. This implicit measure of emotion regulation lays aside the detailed and distracting questions often answered in emotion regulation (e.g., which strategy, how often, when in the experience) and focuses simply on how well participants are able to, in the face of distractors, pursue a goal.

### **Brain Bases of Emotion Regulation**

The study of emotion regulation has also focused on the brain correlates of emotion regulation. There have been numerous imaging studies focusing on executive processes, including emotion regulation. Rueda, Posner, and Rothbart (2004) identified three attention networks, with the third network responsible for monitoring and resolving conflicts. This network is made up of the ACC and the lateral prefrontal cortex (PFC; see Ochsner & Gross, 2008 for a review). Emotion regulation is associated with activation in higher- and lower-order systems. For example, reappraisal utilizes activation of lateral, and orbital PFCs and inhibition of the amygdala (Ochsner & Feldman-Barrett, 2001), while distraction utilizes the dorsal ACC (Sheppes & Meiran, 2007). The ACC balances emotional responses, including conflict monitoring and resolving conflicts between higher- and lower-order systems (Holroyd & Yeung, 2012; Ochsner & Feldman-Barrett, 2001). It is connected to several other parts of the brain, from the higher-order frontal cortices to lower-order areas such as the amygdala. The ACC is activated, among other times, when a person is deciding among multiple competing responses such as during the

traditional Stroop task (Bench et al., 1993), or emotional Stroop task (Haas, Omura, Constable, & Canli, 2006). Additionally, in an emotional conflict task similar to the one used by Etkin and colleagues, Haas, Omura, Constable, and Canli (2007) found that the activation of the ACC is associated with neuroticism. Further, they found that it showed specificity within neuroticism, as measured by the Revised NEO Personality Inventory (NEO-PI-R). The NEO-PI-R has several subscales within neuroticism, including one that measures anxious symptoms (N1) and one that measures depressive symptoms (N3). Haas and colleagues found that the emotional task they used was associated with N1, but not with N3. This is similar to findings from Etkin and Schatzberg (2011), discussed below.

It is for these reasons that Etkin and colleagues (2006) examined the ACC, amygdala, and PFC with their Emotional Conflict Task. In the Emotional Conflict Task, during the emotional trials, incongruent trials led to activation of the ACC and dampening of the activity of the amygdala (Etkin et al., 2006). By contrast, when the non-emotional correlates were used (e.g., judging gender of the faces), no activation of the ACC or dampening of the activity of the amygdala was observed. Instead, the fusiform gyrus (responsible for facial recognition) and the PFC were activated (Egner et al., 2008). This illustrates the importance and specificity of the ACC to emotional tasks, and the ability of this Emotional Conflict Task to change the levels of activation in the neural circuitry responsible for emotion regulation.

### **Behavioral Outcomes of the Emotional Conflict Task**

The Emotional Conflict Task provides behavioral outcomes in the form of reaction times. Just as with the original Stroop task, incongruent trials (i.e., where the stimulus word and portrayed emotion do not match) take more time to respond to than congruent trials. This is a measure of emotional conflict. Of particular import, incongruent trials that follow other incongruent trials are responded to more quickly than incongruent trials that follow congruent trials (adaptability; Etkin et al., 2006). Etkin and colleagues found that following an incongruent task, the ACC activates, allowing for more rapid conflict resolution on the next incongruent task. However, this adaptability was not seen in a study comparing people with GAD to a control group. In that case, people with GAD showed just as much delay on incongruent trials that followed congruent trials, as on incongruent trials that followed incongruent trials, suggesting that people with GAD were not utilizing their ACC in the same way that were people without GAD (Etkin et al., 2006). Or, from a behavioral standpoint, their ability to regulate their emotions, allowing them to act in a desired way, was compromised.

Of note, there have been some conflicting findings utilizing the Emotional Conflict Task. A second study compared patients with GAD, major depressive disorder (MDD), or both disorders to participants with no disorders. While patients with MDD, GAD, or both showed increased amygdala activation and deficits in the ventral ACC and a lack of ability to dampen amygdala activity (Etkin & Schatzberg, 2011), the patients with MDD showed increased activity in their lateral PFC. Consequently, the patients with MDD did not show behavioral effects of the lack of amygdalar dampening (i.e., lack of

reaction time adaptability). Etkin and Schatzberg argue that they were able to compensate for their ACC deficits by activating their lateral PFC. Jarcho and colleagues (2013) utilized this task, comparing two samples of adults who, as children, scored high or low on a measure of behavioral inhibition. They failed to find behavioral differences (i.e., adaptability) between the two groups. However, when they re-examined the analyses based on the presence of a lifetime psychiatric disorder, they found that those who had a lifetime diagnosis showed no adaptability, whereas those free from any lifetime diagnosis did adapt to incongruent trials when they followed incongruent trials. While Jarcho and colleagues (2013) found that adaptability was more closely tied with lifetime psychiatric diagnosis than with childhood temperament, they did not address how current temperament and current psychiatric diagnosis relate to adaptability on the Emotional Conflict Task.

### **Current Study**

Thus far, the Emotional Conflict Task has been used with clinical samples only a few times, focusing on one or two disorders at a time. These studies had relatively small sample sizes for the clinical portion of the studies. Etkin, Prater, Hoefl, Menon, and Schatzberg (2010) examined GAD on its own (clinical  $n = 17$ ). Etkin and Schatzberg (2011) compared GAD and MDD ( $n = 57$ , utilizing the previous sample of 17). There have also been several studies focusing on non-clinical samples (e.g., Jarcho et al., 2013; Torres-Quesada, Korb, Funes, Lupianez, & Egner, 2014); however, the assessment of emotion regulation is most relevant within a clinical sample, as this is the population that most struggles with emotion regulation deficits. The question of whether emotion

regulation is more related to diagnostic constructs or dispositional traits is a particularly interesting one, as there is evidence for both hypotheses (e.g., Dennis, 2007; Jarcho et al., 2013). While past studies have compared patients meeting one or two diagnostic categories with healthy control participants, the current study will examine patients across the spectrum of mood and anxiety disorders. Utilizing this dimensional approach to the assessment of psychopathology offers a number of strengths over categorical assessment (e.g., Rosellini et al., 2015). This study will dimensionally assess both psychopathology (e.g., depressed mood, worry, social fear) as well as personality traits of neuroticism and extraversion. This will provide both a richer examination of the Emotional Conflict Task than it has undergone to date, applying the Emotional Conflict Task to a clinical sample that is highly comorbid and diagnostically varied, as well as answering the National Institute of Mental Health's call for transdiagnostic research that cuts across levels of analysis (Insel et al., 2010).

### **Study Aims and Hypotheses**

**Aim 1:** To assess the convergent and divergent validity of the Emotional Conflict Task as a measure of emotion regulation. It is hypothesized that participants will be slower to respond to incongruent trials than to congruent trials (emotional conflict), but that incongruent trials that follow incongruent trials will not take as long as incongruent trials that follow congruent trials (adaptability). This adaptability will be correlated with explicit measures of emotion regulation (i.e., Multidimensional Experiential Avoidance Questionnaire [MEAQ], Distress Aversion subscale, and Difficulties in Emotion

Regulation Scale [DERS], Difficulty Engaging in Goal-Directed Behavior subscale), more so than the dimensional measures of psychopathology or temperament.

**Aim 2:** To assess the incremental validity of the Emotional Conflict Task. It is hypothesized that the measure of adaptability in the Emotional Conflict Task will account for additional variance beyond the explicit measures of emotion regulation (i.e., MEAQ, Distress Aversion subscale, and DERS, Difficulty Engaging in Goal-Directed Behavior subscale) in predicting overall functional impairment (i.e., Work and Social Adjustment Scale).

**Aim 3:** To assess the relationship between the implicit measure of emotion regulation, dimensional psychopathology constructs, and temperament (specifically neuroticism and extraversion). Following the findings of Jarcho and colleagues (2013), where the presence of a lifetime disorder, as opposed to the presence of high behavioral inhibition, predicted a lack of adaptability, it is hypothesized that emotion regulation will be more strongly related to the dimensional measures of anxiety than to temperament (i.e., Albany Panic and Phobia Questionnaire, Interoceptive subscale, Generalized Anxiety Disorder – 7, Social Interaction Anxiety Scale, and Revised Obsessive-Compulsive Inventory). Because of the mixed findings regarding depression (Hass et al., 2007, Etkin & Schatzberg, 2011), depression as measured by the Beck Depression Inventory-II is not hypothesized to correlate with adaptability. Following the findings of Brown, White, Forsyth, and Barlow (2004) and Bourgeois and Brown (2015), it is hypothesized that adaptability will moderate the relationship between neuroticism and worry. Finally, it is

hypothesized that adaptability will be more strongly related to neuroticism than to extraversion.

## **Research Design and Methods**

### **Participants**

Sixty outpatients were drawn from those assessed upon presentation for treatment at the Center for Anxiety and Related Disorders and who are engaged in the Classification of Depression and Anxiety study. Inclusion criteria consisted of meeting *DSM-5* diagnostic criteria for a current mood or anxiety disorder. Diagnoses were established using the Anxiety and Related Disorders Interview Schedule for *DSM-5* (ADIS-5). Participants were excluded if they endorsed current suicidal or homicidal intent and/or plan or displayed psychotic symptoms or significant cognitive impairment (e.g., diagnosis of dementia, mental retardation) according to *DSM-5* criteria. The average age of participants was 29.78 years ( $SD = 11.09$ ), with a range of 18 – 70. Thirty-six of the participants were women, 24 men. Most participants identified as Caucasian (88.3%), 6.7% identified as Asian, 5.0% identified as African American (see Table 1).

Table 1

*Demographic Characteristics of Outpatient Sample (N = 60)*

Gender	<i>n</i>	%
Female	34	56.7
Male	26	43.3
<b>Race</b>		
Caucasian	53	88.3
African-American	3	5.0
Asian	4	6.7
<b>Ethnicity</b>		
Hispanic	3	5.0
Non-Hispanic	57	95.0
<b>Age</b>		
18-30	40	66.7
31-65	18	30.0
65+	2	3.3

Principal diagnoses were assigned to the disorder deemed to be most interfering. GAD was the most common principal diagnosis (23.3%), followed by obsessive-compulsive disorder (16.7%), and social anxiety disorder (15.0%). Other disorders (e.g., MDD, panic disorder, etc.) were principally interfering in fewer than 10% of the participants (see Table 2). The sample was highly comorbid, with most participants having multiple disorders (see Table 3).

Table 2

*Principal and Additional Diagnoses of Outpatient Sample (N = 60)*

Diagnosis	Principal Diagnosis		Additional Diagnoses	
	<i>n</i>	%	<i>n</i>	%
Generalized Anxiety Disorder	14	23.3	5	8.3
Obsessive-Compulsive Disorder	10	16.7	3	5.0
Social Anxiety Disorder	9	15.0	19	31.7
Other Specified Anxiety Disorder, GAD	5	8.3	4	6.7
Specific Phobia	5	8.3	2	3.3
Major Depressive Disorder	3	5.0	5	8.3
Panic Disorder	3	5.0	5	8.3
Personality Disorder	3	5.0	0	0
Agoraphobia	2	3.3	5	8.3
Persistent Depressive Disorder	2	3.3	0	0
Adjustment Disorder	1	1.7	0	0
Somatization Disorder	1	1.7	2	3.3
Unspecified Anxiety Disorder	1	1.7	2	3.3
Unspecified Depressive Disorder	1	1.7	4	6.7
Illness Anxiety Disorder	0	0	1	1.7
Trichotillomania	0	0	1	1.7
Body Dysmorphic Disorder	0	0	1	1.7
Posttraumatic Stress Disorder	0	0	1	1.7

Table 3

*Number of Clinical Diagnoses in Outpatient Sample (N = 60)*

Number of Clinical Diagnoses	<i>n</i>	%
1	24	40.0
2	25	41.7
3	6	10.0
4	3	5.0
5	1	1.7
6	1	1.7

## **Clinician Rated Measure**

**Anxiety and Related Disorders Interview Schedule for *DSM-5*** (ADIS-5, Brown & Barlow, 2014). The ADIS-5 is a semi-structured clinical interview designed to make reliable current and past diagnosis of the *DSM-5* anxiety, mood, obsessive-compulsive, trauma-related, somatoform, and substance use disorders. The ADIS-5 is administered by doctoral students or doctoral-level psychologists, and requires the assessor to make dimensional ratings (0, not present, to 8, very severe) of the key and associated symptoms of panic disorder, agoraphobia, social anxiety disorder, obsessive-compulsive disorder, GAD, and MDD, whether or not a formal diagnosis is under consideration. Dimensional ratings of other disorders (e.g., specific phobias, post-traumatic stress disorder, bipolar disorder, etc.) are also made. Screening questions for several less common disorders (e.g., psychosis, eating disorders, etc.) are also asked. Previous editions of the ADIS have been shown to reliably diagnose the majority of anxiety and mood disorders (e.g., Brown, Di Nardo, Lehman, & Campbell, 2001).

## **Computer Task**

**Emotional Conflict Task** (Etkin et al., 2006). An Emotional Conflict Task developed by Etkin et al. (2006) was used to evaluate emotion regulation. The task consists of a presentation of 148 slides with happy or fearful expressions drawn from the set of Ekman and Friesen (1976). The slides are cropped to show only the face, and the words “FEAR” or “HAPPY” are written in prominent red letters over the face. Slides are presented for 1000 milliseconds (ms) with a varying inter-stimulus interval (ISI) of 3000-5000 ms (mean ISI = 4000 ms). Total task time is approximately 15 minutes. The slides

were presented in a pseudorandom order to counterbalance for condition (congruent-congruent, congruent-incongruent, incongruent-congruent, and incongruent-incongruent). To prevent repetition priming effects, there were no direct repetitions of the same face on subsequent slides (Mayr, Awh, & Laurey, 2003). Participants were instructed to respond as quickly and accurately as possible by pushing response buttons corresponding to “fear” (right index finger) or “happy” (right middle finger) for the affect expressed in the face. Behavioral data were analyzed in SPSS and consisted of reaction times (excluding error and post-error trials) and accuracy rate. The mean reaction time difference between congruent and incongruent slides was calculated to measure emotional conflict. The mean difference between incongruent slides that follow congruent slides, and incongruent slides that follow incongruent slides, was calculated to measure adaptability. Accuracy rate was examined to assess effort and understanding of the task. To ensure understanding of the task, a training block of 25 slides preceded the task, and an accuracy rate of 85% was required to proceed to the task. Incorrect responses, and the slide immediately following, were not analyzed. Responses more than two standard deviations from the mean were taken as mistaken button presses, and also discarded. The slides were presented on a Lenovo Thinkpad T530 with a 2.90 gigahertz Intel processor and a 15.6-inch monitor. Participants were seated approximately 20 inches away. Participants responded using the left and right arrows on a standard keyboard.

## **Self-Report Measures**

**Beck Depression Inventory-II** (BDI-II; Beck & Steer, 1987). The BDI-II is a 21-item self-report questionnaire designed to assess the occurrence of depression symptoms over the past two weeks. The total score was used as a measure of depressed mood.

**Albany Panic and Phobia Questionnaire** (APPQ; Rapee, Craske, & Barlow, 1994/1995). The APPQ is a 27-item self-report scale designed to assess fear of interoceptive sensations, agoraphobic situations, and social phobia. The 8-item Interoceptive subscale (APPQ-I) was used as a measure of panic.

**Generalized Anxiety Disorder-7 scale** (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006). The GAD-7 is a 7 item self-report questionnaire that measures the frequency of worry and several associated symptoms. It was used as a measure of worry.

**Social Interaction Anxiety Scale** (SIAS; Mattick, Peters, & Clarke, 1989). The SIAS is a 20-item self-report questionnaire, which was used to measure interpersonal social concerns (i.e., distress when initiating and maintaining conversations with friends, strangers, potential mates, etc.).

**Revised Obsessive-Compulsive Inventory** (OCI-R; Foa et al., 2002). The OCI-R is an 18-item self-report measure designed to assess the frequency of obsessions and various compulsive behaviors (e.g., washing, ordering, checking). The total score was used to measure intrusive thoughts and compulsions.

**NEO Five-Factor Inventory** (NFFI; Costa & McCrae, 1992). The NFFI is a 60-item self-report measure of the five-factor model of personality. The neuroticism (NFFI-

N) and the extraversion scales (NFFI-E) were used to measure the personality traits of neuroticism and extraversion.

**Multidimensional Experiential Avoidance Questionnaire (MEAQ;** Gámez, Chmielewski, Kotov, Ruggero, & Watson, 2011). The MEAQ is a 62-item questionnaire that measures six dimensions of experiential avoidance. The 13-item Distress Aversion subscale was used as an indicator of emotion regulation through avoidance of negative feelings.

**Difficulties in Emotion Regulation Scale (DERS;** Gratz & Roemer, 2004). The DERS is a 36-item questionnaire measuring 6 facets of emotion regulation, including understanding and awareness of emotions. The 5-item Difficulty Engaging in Goal-Directed Behavior subscale was used to measure emotion regulation.

**Work and Social Adjustment Scale (WSAS;** Hafner & Marks, 1976). The WSAS is a 5-item measure that assesses the extent to which current symptoms interfere with work, home management, private leisure activities, social activities, and family relationships. It was used as the outcome measure of impairment.

Each of the aforementioned measures is well established in the psychometric and clinical literature and has been shown to possess acceptable reliability and validity.

## **Procedures**

Individuals interested in seeking treatment at the Center for Anxiety and Related Disorders undergo an intake evaluation consisting of an ADIS-5 assessment and a packet of self-report questionnaires of personality and psychopathology. Before beginning this intake evaluation, they have the opportunity to participate in a long-standing study on the

classification of depression and anxiety. For those interested, formal consent was obtained. Following the intake evaluation, patients completed several computer-based cognitive tasks, including the Emotional Conflict Task. These tasks, along with information gathered from the intake assessment (i.e., diagnostic information, questionnaire scores), were used in the current study.

### **Data Analysis**

**Aim 1:** The hypothesis that emotional conflict will result in longer response times for incongruent trials than congruent trials was assessed using paired sample *t*-tests. The hypothesis that adaptability will result in shorter reaction times for incongruent-incongruent trials than congruent-incongruent trials, was also assessed using paired sample *t*-tests. The hypothesis that the adaptability outcome on the Emotional Conflict Task will be strongly related to explicit measures of emotion regulation was assessed using intra-class coefficient (ICC). This will allow for the correlation among multiple measures of emotional regulation (i.e., adaptability, MEAQ Distress Aversion subscale, and DERS Difficulty in Engaging in Goal-Directed Behavior subscale). Divergent validity was assessed by comparing these correlations with bivariate correlations between the adaptability outcome and the measures of psychopathology and temperament. The differential magnitude of these associations was evaluated using the dependent correlations *z*-test presented in Meng, Rosenthal, and Rubin (1992). It is hypothesized that adaptability will be more strongly correlated with the Difficulty in Engaging in Goal-Directed Behavior subscale than with the Distress Aversion subscale, and more strongly

related to both of these measures than to the measures of psychopathology and temperament (e.g., GAD-7, NFFI-N).

**Aim 2:** To assess the incremental validity of adaptability, hierarchical regression was utilized. In the first step, impairment caused by psychopathology (i.e., WSAS) was regressed on the explicit measures of emotion regulation (i.e., MEAQ Distress Aversion and DERS Difficulty Engaging in Goal-Directed Behavior), with adaptability added in step 2. A statistically significant increase in the variance of impairment accounted for in step 2 would indicate incremental validity of adaptability beyond current explicit measures of emotion regulation.

**Aim 3:** To assess the relationship between emotion regulation, dimensional constructs of psychopathology, and temperament, adaptability were correlated with measures of psychopathology (e.g., the GAD-7 to measure worry) and with measures of temperament (e.g., the Neuroticism subscale of the NFFI to measure neuroticism). The differential magnitude of these associations was evaluated using the dependent correlations  $z$ -test presented in Meng and colleagues (1992). It is hypothesized that adaptability will negatively correlate more strongly with the measures of anxiety (i.e., APPQ-I, GAD-7, SIAS, and OCI-R) than with the measure of neuroticism (i.e., NFFI-N). Because of the mixed findings regarding depression (Etkin & Schatzberg, 2011; Hass et al., 2007), depression as measured by the BDI-II is not hypothesized to correlate with adaptability. It is hypothesized that decreased adaptability will increase the strength of the relationship between neuroticism and worry. This was tested by regressing GAD-7 on NFFI-N and adaptability, and then on NFFI-N, adaptability, and their product term.

## Power Considerations

No previous research had examined this question dimensionally, so a direct estimate of effect size was not possible. However, an approximation was drawn from the effects found in Etkin and colleagues (2010), examining the group difference (GAD vs. healthy control groups) in adaptability. They found a significant difference,  $t(39) = 2.39$ ,  $p < .05$ , with a large effect size (Cohen's  $d = 0.8$ ). Given that power is lost when categorizing dimensional groups, using an effect size of  $d = .8$  to estimate the effect of symptom severity on adaptability (i.e., Aim 3) seems appropriately conservative within the current design. A power analysis using G\*Power 3.1 (Faul, Erdfelder, Lang, & Buchner, 2007) showed that given this effect size, an alpha of .05, and a power of .9, the required sample size would be 57 participants.

## Results

### Aim 1

To assess the impact of congruence on reaction time, paired sample  $t$ -tests were run. The mean reaction time (and standard deviation) for congruent trials was 721.09 (119.18) ms; for incongruent trials it was 784.90 (133.63) ms. This led to a significant mean difference of 63.81 ms,  $t(59) = 11.19$ ,  $p < .01$ , with incongruent trials taking longer to respond to than congruent trials, as expected. The reaction time for incongruent trials that followed incongruent trials (iI) was 786.87 (146.85) ms. The reaction time for incongruent trials that followed congruent trials (cI) was 782.21 (123.89) ms. The

difference between these two represents the measure of adaptability, 4.66 (49.80) ms.

This difference was not significantly different from zero,  $t(59) = 0.73, p = .47$ .

Adaptability was approximately normally distributed, skew = 0.56 (0.31), kurtosis = 0.18

(0.61), and Q-Q plot appeared normal. To assess convergent validity, the ICC was

calculated for adaptability, MEAQ, and DERS. This led to a non-significant correlation,

$ICC(1,1) = -.04, F(59, 120) = 0.87, p = .72$ . Adaptability was not significantly correlated

with the MEAQ,  $r(58) = .04, p = .76$ , or the DERS,  $r(58) = .12, p = .35$  (see Figure 1).

The DERS was not more strongly correlated to adaptability than was the MEAQ,  $z =$

$0.47, p = .64$ . When comparing the correlated correlation coefficients using Meng and

colleagues (1992) methods, the omnibus test of heteroscedasticity was non-significant,

$\chi^2(8) = 2.31, p = .97$ . Contrasting the correlations between adaptability and the two

explicit measures of emotion regulation with the correlations between adaptability and

the seven measures of psychopathology and personality also showed a non-significant

difference,  $z = 0.61, p = .54$  (see Figure 2 for an illustration of the association between

adaptability and the GAD-7).



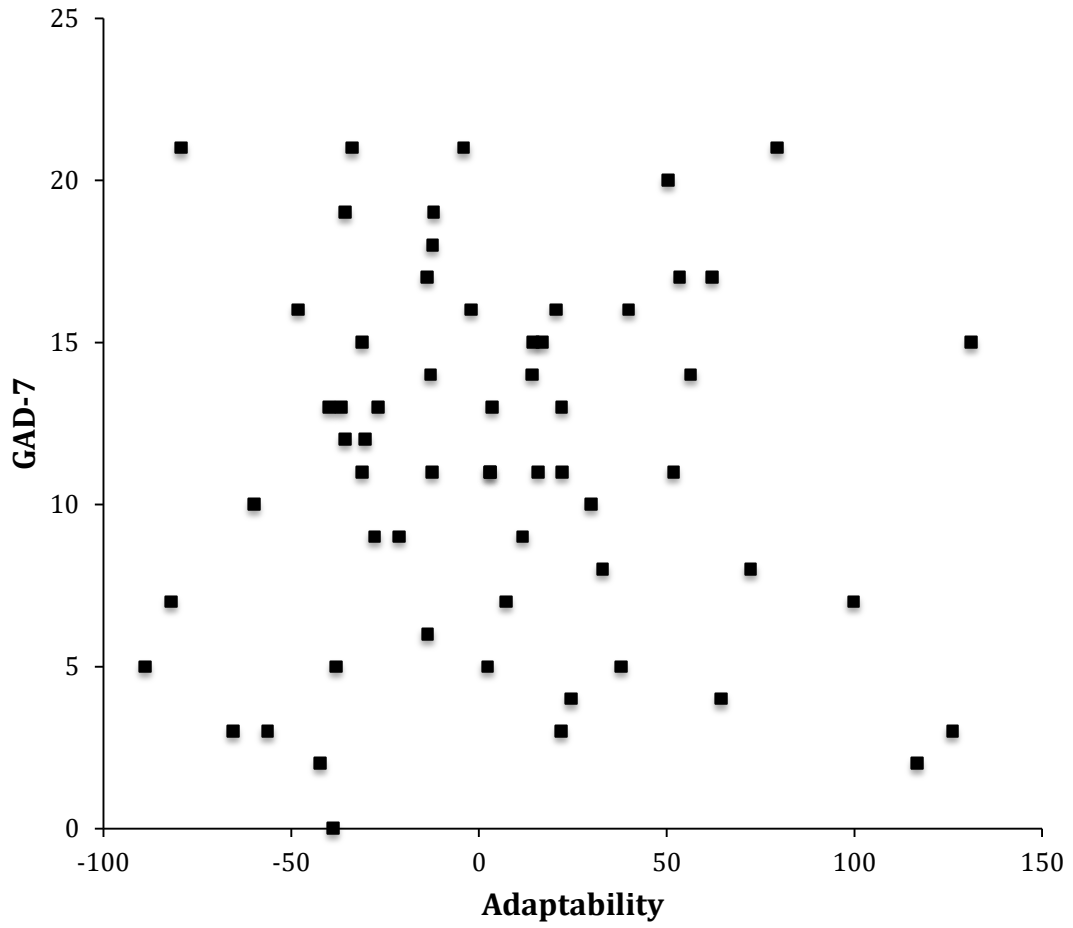


Figure 2. Scatterplot of adaptability and Generalized Anxiety Disorder-7 scale (GAD-7).

## Aim 2

To assess incremental validity over current measures of emotion regulation, the WSAS was regressed on the MEAQ Distress Aversion and DERS Difficulty Engaging in Goal-Directed Behavior subscales (model 1), and then on the MEAQ, DERS, and adaptability (model 2). The omnibus test of model 1 was significant,  $F(2,57) = 3.62, p = .03$ , and model 2 was non-significant,  $F(3, 56) = 2.38, p = .08$  (see Table 4). In model 1, the MEAQ Distress Aversion subscale was not significantly related to WSAS,  $b = -0.00, t(57) = -0.02, p = .99$ , holding DERS Difficulty Engaging in Goal-Directed Behavior constant, though the DERS Difficulty Engaging in Goal-Directed Behavior subscale did predict WSAS beyond the MEAQ Distress Aversion subscale,  $b = 0.65, t(57) = 2.65, p = .01$ . Model 2 adds the measure of adaptability; the MEAQ Distress Aversion subscale remained non-significant,  $b = -0.00, t(56) = -0.01, p = .99$ , the DERS Difficulty Engaging in Goal-Directed Behavior subscale remained significant,  $b = 0.65, t(56) = 2.62, p = .01$ , and adaptability was non-significant,  $b = -0.00, t(56) = -0.13, p = .90$ , all holding the other two measures constant. There was no increase in  $R^2$  (.11 in both models).

Table 4

*Incremental Validity of Adaptability Measure, Overall Model Fit and Regression**Coefficients*

Model <sub>a</sub>	Source	<i>df</i>	Sum of Squares	Mean Square	<i>F</i>	<i>p</i>
1 <sub>b</sub>	Between Groups	2	584.17	292.08	3.62	.03
	Within Groups	57	4600.77	80.72		
	Total	59	5184.93			
2 <sub>c</sub>	Between Groups	3	585.51	195.17	2.38	.08
	Within Groups	56	4599.42	82.13		
	Total	59	5184.93			

a Dependent Variable: WSAS

b Predictors: (Constant), DERS Goals subscale, MEAQ Distress Aversion subscale

c Predictors: (Constant), DERS Goals subscale, MEAQ Distress Aversion subscale, Adaptability

Model <sub>a</sub>		<i>B</i>	<i>SE B</i>	<i>t</i>	<i>p</i>	$\Delta R^2$
1	(Constant)	5.00	4.26	1.17	.25	.11
	MEAQ Distress Aversion subscale	0.00	0.10	-0.02	.99	
	DERS Goals subscale	0.65	0.25	2.65	.01	
2	(Constant)	4.96	4.31	1.15	.26	.00 <sub>b</sub>
	MEAQ Distress Aversion subscale	0.00	0.10	-0.01	.99	
	DERS Goals subscale	0.65	0.25	2.62	.01	
	Adaptability	0.00	0.02	-0.13	.90	

a Dependent Variable: WSAS Final Score

b  $F(1, 56) = .02, p = .90$

*Note.* WSAS = Work and Social Adjustment Scale; DERS = Difficulty in Emotion Regulation Scale; MEAQ = Multidimensional Experiential Avoidance Questionnaire

### Aim 3

To assess the relationship between emotion regulation, dimensional constructs of psychopathology, and measures of temperament, correlations were run between these measures and adaptability. Adaptability was not correlated with either measure of emotion regulation, MEAQ Distress Aversion  $r(58) = .04, p = .76$ , DERS Difficulty Engaging in Goal-Directed Behavior  $r(58) = .12, p = .35$ . Adaptability was also uncorrelated with both measures of temperament, NFFI-N  $r(58) = .03, p = .85$  and NFFI-E  $r(58) = .04, p = .76$ . Correlations with measures of psychopathology ranged from  $-.01$  to  $.16$ . These correlations were all non-significant (see Table 5).

To assess the impact of adaptability on the relationship between neuroticism and worry, the GAD-7 was regressed on NFFI-N and adaptability, before adding the product term of the NFFI-N and adaptability. The omnibus test of model 1 was significant,  $F(2,57) = 13.00, p < .01$ , as was model 2,  $F(3, 56) = 8.64, p < .01$  (see Table 6). In model 1, the NFFI-N subscale was significantly related to GAD-7, controlling for adaptability,  $b = 0.34, t(57) = 5.10, p < .01$ , and adaptability was non-significant, after accounting for NFFI-N  $b = -0.00, t(57) = -0.20, p = .84$ . Model 2 adds the interaction between NFFI-N and adaptability, which was non-significant,  $b = -0.00, t(56) = -0.50, p = .62$ . There was minimal increase in  $R^2$ ,  $.31$  in model 1,  $.32$  in model 2,  $F(1, 56) = 0.25, p = .62$ .

Table 5

*Correlations Among Measures of Adaptability, Explicit Emotion Regulation, Temperament, Psychopathology, and**Overall Impairment*

	Adaptability	MEAQ	DERS	NFFI-N	NFFI-E	GAD-7	BDI-II	SIAS	APPQ-I	OCI-R
MEAQ	.04									
DERS	.12	.18								
NFFI-N	.03	.24	.54**							
NFFI-E	.04	.04	-.09	-.38**						
GAD-7	-.01	.38**	.37**	.56**	-.06					
BDI-II	.01	.41**	.46**	.69**	-.35*	.59**				
SIAS	.16	.19	.42**	.60**	-.57**	.21	.57**			
APPQ-I	.04	.35*	.20	.25	-.04	.46**	.25*	.27*		
OCI-R	.13	.15	.36**	.42**	-.21	.39**	.30*	.28*	.44**	
WSAS	.03	.06	.34*	.28*	-.04	.49**	.49**	.29*	.30*	.39**

*Note.* \* $p < .05$ , \*\* $p < .01$  (two-tailed) MEAQ = Multidimensional Experiential Avoidance Questionnaire; DERS = Difficulty in Emotion Regulation Scale; NFFI-N = NEO Five-Factor Inventory – Neuroticism subscale; NFFI-E = NEO Five-Factor Inventory – Extraversion subscale; GAD-7 = Generalized Anxiety Disorder 7-item scale; BDI-II = Beck Depression Inventory – II; SIAS = Social Interaction Anxiety Scale; APPQ-I = Albany Panic and Phobia Questionnaire – Interoceptive subscale; OCI-R = Obsessive-Compulsive Inventory – Revised; WSAS = Work and Social Adjustment Scale.

Table 6

*Impact of Adaptability Measure on the Relationship Between NFFI-N and GAD-7*

Model <sub>a</sub>	Source	<i>df</i>	Sum of Squares	Mean Square	<i>F</i>	<i>p</i>
1 <sub>b</sub>	Between Groups	2	582.70	291.35	13.00	<.01
	Within Groups	57	1277.48	22.41		
	Total	59	1860.18			
2 <sub>c</sub>	Between Groups	3	588.45	196.15	8.64	<.01
	Within Groups	56	1271.74	22.71		
	Total	59	1860.18			

a Dependent Variable: GAD-7

b Predictors: (Constant), Adaptability, NFFI-N

c Predictors: (Constant), Adaptability, NFFI-N, NFFI-N \* Adaptability

Model <sub>a</sub>		<i>B</i>	<i>SE B</i>	<i>t</i>	<i>p</i>	$\Delta R^2$
1	(Constant)	1.15	2.08	0.55	.58	.31
	NFFI-Neuroticism	0.34	0.07	5.10	<.01	
	Adaptability	0.00	0.01	-0.20	.84	
2	(Constant)	1.00	2.12	0.47	.64	.00 <sub>b</sub>
	NFFI-Neuroticism	0.35	0.07	5.08	<.01	
	Adaptability	0.01	0.03	0.40	.69	
	NFFI Neuroticism * Adaptability	0.00	0.00	-0.50	.62	

a Dependent Variable: GAD-7

b  $F(1, 56) = .25, p = .62$

Note. GAD-7 = Generalized Anxiety Disorder 7-item scale; NFFI-N = NEO Five-Factor Inventory – Neuroticism subscale; NFFI-E = NEO Five-Factor Inventory – Extraversion subscale.

### Exploratory Analyses

Given the non-significant findings above, several exploratory analyses were conducted. Due to this measure's past significant findings particularly with regard to GAD diagnosis (e.g., Etkin et al., 2010), the sample was divided into two groups based on the severity of their GAD diagnosis. This was done in two different ways, both based on ADIS severity ratings (0 – 8). First, groups were divided by clinically significant impairment versus subclinical impairment (GAD severity ratings of 4 and above vs. 3 and below). Second, they were divided on presence or absence of GAD symptoms (severity ratings of 1 and above vs. 0). Then adaptability was compared between these pairs of groups, again with non-significant results,  $t(58) = .60, p = .55$  and  $t(58) = -1.06, p = .29$ , respectively. Adaptability was then regressed on demographic variables (i.e., sex, age, race, and ethnicity), as well as measures of psychopathology (i.e., BDI-II, GAD-7, SIAS, OCI-R, APPQ-I). This regression was not significant,  $F(9, 50) = 0.59, p = .80$ , and none of the individual variables approached significance (all  $p$ 's > .15). In a final exploration, adaptability was regressed on demographic variables and measures of temperament and overall functional impairment (i.e., WSAS, NFFI-N, NFFI-E). This regression was not significant,  $F(7, 52) = 0.39, p = .90$ , and none of the individual variables approached significance (all  $p$ 's > .15).

Following the lack of significant findings in all analyses examining the measure of adaptability, initial analyses of the modified Stroop Effect were conducted. This examined the time discrepancy for incongruent compared with congruent trials, and the relationship between this measure and measures of psychopathology, personality traits,

and overall impairment. The modified Stroop Effect was not correlated with either measure of emotion regulation, MEAQ Distress Aversion  $r(58) = .05, p = .70$ , DERS Difficulty Engaging in Goal-Directed Behavior  $r(58) = .11, p = .40$ . Adaptability was also uncorrelated with both measures of temperament, NFFI-N  $r(58) = -.02, p = .89$ , and NFFI-E  $r(58) = .11, p = .39$ . Correlations with measures of psychopathology ranged from  $r(58) = -.05$  to  $.19$ . These correlations were all non-significant (see Table 7).

Table 7

*Correlations Among Measures of Modified Stroop Effect, Explicit Emotion Regulation, Temperament, Psychopathology, and Overall Impairment*

	Stroop Effect
MEAQ	.05
DERS	.11
NFFI-N	-.02
NFFI-E	.11
GAD-7	.14
BDI-II	.02
SIAS	-.05
APPQ-I	.17
OCI-R	.00
WSAS	.14

*Note.* All  $p$ 's > .15 MEAQ = Multidimensional Experiential Avoidance Questionnaire; DERS = Difficulty in Emotion Regulation Scale; NFFI-N = NEO Five-Factor Inventory – Neuroticism subscale; NFFI-E = NEO Five-Factor Inventory – Extraversion subscale; GAD-7 = Generalized Anxiety Disorder 7-item scale; BDI-II = Beck Depression Inventory – II; SIAS – Social Interaction Anxiety Scale; APPQ-I = Albany Panic and Phobia Questionnaire – Interoceptive subscale; OCI-R – Obsessive-Compulsive Inventory – Revised; WSAS = Work and Social Adjustment Scale.

## Discussion

### Current Findings

The overarching goal of this study was to validate the Emotional Conflict Task, one of the few implicit measures of emotion regulation. With regard to the behavioral component of the Emotional Conflict Task, the current study is the largest clinical sample examined to date, and the first to also examine current psychopathology dimensionally. Utilizing a rigorous semi-structured clinical assessment and well-validated self-report measures, this study established both categorical diagnoses as well as dimensional measurements of temperament and psychopathology. These assessments were then compared to several measures from the Emotional Conflict Task, principally the measure of adaptability, or participants' ability to adapt to a second incongruent presentation following an initial incongruent presentation.

The current study replicated the lack of adaptability in a clinical sample. However, it did not find support for the Emotional Conflict Task as a dimensional assessment of emotion regulation. It found no relationship with measures of emotion regulation, psychopathology, temperament, or overall impairment. This lack of relationship appeared both at the zero-order level, as well as when accounting for other variables (e.g., adaptability was unrelated to ruminative worry, after accounting for neuroticism). In addition, exploratory analyses examined the Stroop Effect, the increase in reaction time for incongruent presentations over congruent presentations. These analyses found no relationship between the Stroop Effect and explicit measures of emotion regulation, psychopathology, personality, or functional impairment.

This measure has been evaluated previously in a few small samples, where psychopathology was examined categorically (i.e., a healthy control group was compared with a clinical group). Findings in these studies were more robust for differences in fMRI than for differences in behavior (i.e., adaptability), and consistently found lower activation of the ACC in participants with depression or GAD than in healthy controls. Sometimes these studies also found a lack of adaptability in the clinical group (e.g., Etkin & Schatzberg, 2011). In the one prior study of the Emotional Conflict Task that examined temperament dimensionally, the findings were mixed, with adaptability not significantly related to temperament, though it was related to a categorical presence or absence of a lifetime disorder (Jarcho et al., 2013).

Because this study did not precisely replicate prior studies, a direct comparison of effects is not possible; however, the most similar study is Etkin et al. (2010). In that study, exact reaction times for various conditions (e.g., incongruent trials) were not given, but can be approximated from the figures provided. They found that incongruent trials took approximately 80 ms longer than congruent trials, similar to the increase of 63.81 ms in the current study. In that study healthy controls decreased their reaction time for incongruent trials that followed incongruent trials (as opposed to incongruent trials that followed congruent trials) by approximately 30 ms, while patients with GAD increased their reaction time by approximately 15 ms, a large effect,  $d = 0.8$ . In the current study on average participants' reaction times increased by 4.66 ms, and this adaptability was unrelated to measures of psychopathology (see above). Overall, this shows that the basic Stroop Effect was comparable between these studies, but that

adaptability was not related to dimensional measures of mental health.

In addition to examining the implicit measure of emotion regulation, this study also assessed two explicit measures of emotion regulation (i.e., MEAQ Distress Aversion subscale and DERS Difficulty Engaging in Goal-Directed Activities subscale). In examining these two measures of emotion regulation, there were areas of overlap and difference. Both were significantly related to measures of worry and depression; however, the DERS was related to all measures of psychopathology (i.e., also the SIAS and OCI-R) as well as overall impairment (i.e., WSAS). From a cognitive-behavioral perspective, this may reflect a broader transdiagnostic feature of this DERS subscale, namely the ability to accomplish goals during times of distress. In contrast, the MEAQ subscale focuses on the desire to avoid suffering and distress, but does not assess broad behavioral ability. The differential focus of these two emotion regulation measures is further clarified by the non-significant relationship between them.

### **Implications**

The lack of significant findings with the Emotional Conflict Task is somewhat unexpected given that several smaller, categorical studies have found a behavioral effect of the Emotional Conflict Task. Several potential explanations are considered below.

For several reasons this study has increased power over past studies, including both the larger sample size and that variability and hence predictive power is increased when examining constructs dimensionally rather than categorically. It is therefore unlikely that the lack of significant findings is due to a lack of power.

This study looked to validate the Emotional Conflict Task within a clinical

sample, the population where emotion regulation research is most salient. Consequently, it did not include a healthy control condition. The only past study to compare this task with dimensionally assessed constructs was Jarcho and colleagues (2013), who compared it with dimensional measures of temperament. Similar to the current study, they did not find a behavioral relationship between temperament and adaptability. They did find a relationship when splitting the sample categorically based on presence or absence of a lifetime diagnosis (irrespective of current diagnosis). This may be a partial explanation of the lack of results in the current study, as everyone, by definition, had a lifetime diagnosis (i.e., current diagnosis was an inclusion criteria). Of note, in Jarcho and colleagues' (2013) study, neuroimaging found ACC deficits in both analyses, those examining temperament and those examining diagnosis, emphasizing the work still to be done reconciling behavioral measures and neuroimaging.

In addition to Jarcho and colleagues' (2013) study, Etkin has also found in unpublished studies a lack of behavioral differences when examining psychopathology dimensionally. For this reason, he always includes a healthy control group as well as neuroimaging data, which has been more robust than the behavioral outcomes (personal communication, June 24, 2015). For example, Etkin and Schatzberg's (2011) study of patients with GAD and MDD found neurological impairment in both groups, as compared with healthy controls, but only found behavioral deficits in the GAD group, speaking to the limitations of the behavioral aspects of this measure. This also speaks to the importance of publishing null findings to avoid the file drawer effect, and the repetition of studies that have been completed but were not published (Ioannidis, 2005).

Assessing the incremental validity of categorical predictors over dimensional predictors, Oathes, Patenaude, Schatzberg, and Etkin (2015) examined resting state neuroconnectivity using fMRI, examining both categorical disorder labels and continuous measures of disorders. In predicting neural connectivity and neural deficits, including those that underlie the behavioral response to the Emotional Conflict Task, they found that neither a categorical nor a continuous classification of disorders was able to explain as much variance as the combination. That is, the categorical predictors of GAD and MDD diagnosis added significantly beyond the continuous predictors (GAD-7 and BDI-II) in predicting neural connectivity and deficits, highlighting the importance of categorical predictors with this measure. Similarly, in their meta-analysis of neuroimaging studies across psychological disorders, Goodkind and colleagues (2015) found a general deficit in the ACC across disorders, but were able to pinpoint very few distinctions between disorders. These point to the importance of categorical definitions of mental health with this task, as well as broader limitations in our ability to precisely link neuroimaging studies with behavioral outcomes or clinical findings as this task attempts to do.

An alternative hypothesis is that this effect is somewhat transient in nature, that it is not a robust effect. Recent work by Egner, Ely, and Grinband (2010) demonstrated that as the ISI increased, adaptability decreased, and was undetectable when the ISI was greater than 2,500 – 3,000 ms. In the current task, the average ISI was 4,000 ms, and the minimum was 3,000 ms. While this does not explain why past research (e.g., Etkin et al., 2006) has found an effect with this ISI, it may partially explain the inconsistent findings

(e.g., Jarcho et al., 2013), and suggest a change in the methodology used for this task, decreasing the ISI.

Finally, a more recent examination of the Emotional Conflict Task also largely failed to find significant results (Robinson, Safer, Austin, & Etkin, 2015). They examined a sample of participants with binge eating disorder, as compared with healthy controls. Adaptability was not significantly different between the participants with binge eating disorder and the healthy controls, and in fact trended in the opposite direction hypothesized, with healthy controls showing less of an adaptation effect, Cohen's  $d = -.27$ .

Taken together, these findings demonstrate the unreliable nature of the Emotional Conflict Task as an assessment of emotion regulation. Relationships with explicit measures of emotion regulation were not significant in the current study. Measures of temperament and psychopathology were also not significantly related to adaptability. In other studies, these relationships have been inconsistent. Several studies have found a relationship between adaptability and the presence or absence of psychopathology, whereas other studies have failed to find this relationship. Particularly noteworthy is the poorer performance of this measure when utilized with dimensional assessment of psychopathology.

In addition to the inconsistent findings with the Emotional Conflict Task, it is unclear whether the task is a valid measure of emotion regulation. This task purports to measure participants' ability to adapt to emotional conflict, and posits that as emotion regulation. This emotional conflict is ostensibly created by participants' viewing of

emotional faces; however, it is not clear that the simple viewing of emotional faces elicits a salient emotional response. Without any emotional response to regulate, it would be difficult or impossible for the Emotional Conflict Task to assess emotion regulation. Aldao (2013) expresses concerns about the limitations of emotion, and particularly emotion regulation, assessments that utilize relatively passive viewing of standardized images, much like the Emotional Conflict Task. Without eliciting emotions to be regulated, it is likely that this task instead measures cognitive processes involved in emotion regulation (e.g., conflict recognition, conflict resolution), as opposed to emotion regulation itself. Aldao emphasizes the need for increased examination of the ecological validity of emotion regulation assessments, and suggests ecological momentary assessment, allowing for the assessment of emotion in the daily life of participants.

Findings from several neuroimaging studies also raise questions about the specificity of the Emotional Conflict Task to emotional conflict. While neuroimaging studies utilizing the Emotional Conflict Task have focused on the ACC as a whole, and on its role in resolving emotional conflict, alternative explanations exist. Milham and Banich (2005) examined the ACC using the Stroop task, finding that sub-regions respond differently from one another. Specifically, they found that while the anterior ACC responded to conflict specific stimuli, the posterior ACC responded to task-irrelevant information broadly, even when it was non-conflictual. Given the differential response of these sub-regions, Milham and Banich suggest that instead of reflecting conflict resolution per se, the ACC may be more broadly related to either conflict-related or error-related processing, as well as response facilitation and inhibition. Wittfoth and colleagues

(2010) also examined the ACC using a speech task that utilized conflict between semantic content and prosody. They found distinct neural pathways for happy versus angry prosody, further solidifying the idea that the effects of the ACC cannot be explained by a single unifying theory, but are instead nuanced and multifaceted. Overall, these findings call into question the specificity of the ACC for emotional conflict resolution, and thereby emotion regulation.

The Emotional Conflict Task is not alone in this debate about validity. Studies of the one other implicit measure of emotion regulation have also failed to find significant relationships. Using an emotion regulation implicit attitudes test (ER-IAT) Mauss and colleagues (2006) found that higher scores on the ER-IAT were associated with better performance emotionally and physiologically during an anger provocation task. However, the ER-IAT was unrelated to measures of psychopathology including measures of depression (BDI-II), anxiety (State-Trait Anxiety Inventory), anger (State-Trait Anger Expression Inventory), and defensiveness (Marlowe Crowne Scale). Similarly, Hopp, Troy, and Mauss (2011) found that the ER-IAT was unrelated to measures of depression, social adjustment, or psychological well-being, except in a subgroup who used reappraisal at a higher frequency. Mauss et al. (2006) suggest that these results may reflect implicit emotion regulation measures' assessment of participants' responses to specific situations more so than broader traits of emotion regulation. At the same time, it again speaks to the unreliability of these implicit measures at this time.

Another consideration when utilizing implicit measures is the measurement properties of implicit measures. In an examination of the predictive validity of the IAT,

Greenwald, Poehlman, Uhlmann, and Banaji (2009), found that the IAT was moderately correlated with clinical domains (e.g., anxiety and depression), but that explicit measures such as questionnaires were more strongly correlated with these clinical domains. This is similar to the current results in that the explicit measures accounted for significant variability of the measure of overall disorder severity, but different in that in the current study there was no significant correlation for the implicit measure. Perhaps more so than explicit measures, implicit measures are impacted by a wide variety of moderators that may impact the outcome of a study. Perugini, Richetin, and Zogmaister (2010) extensively reviewed potential moderators, finding that the outcomes of studies can depend on factors as disparate as cognitive load, mortality salience, need for cognition, affective focus, time pressure, positive (but not negative) mood, and more. They point out that generally spontaneous behavior is more correlated with implicit measures, while deliberate behavior is more correlated with explicit measures. While emotion regulation is a spontaneous behavior, all the other measures of emotion regulation as well as psychopathology in this study were explicit measures. The combination of shared method variance (i.e., self-report questionnaires for the explicit measures of emotion regulation and the dimensional measures of psychopathology and temperament) and the range of factors that impact implicit measures may be contributing factors to the unpredictable nature of the Emotional Conflict Task's relationship with other measures.

Overall, these findings speak to the complex interplay of neurology, implicit assessment, and psychopathology. It suggests that we are not yet to the point of neuroimaging reliably predicting behavioral outcomes or psychological difficulties, and

also speaks to the imprecision inherent in implicit assessment. This emphasizes that, while this is a rich area of research, it is not yet a reliable or valid predictor of psychopathology useful at the clinical level.

### **Limitations and Future Directions**

While offering several distinct strengths, such as a focus on dimensional assessment and the largest clinical sample size examined for this measure, there were several limitations to this study. One limitation is that the study did not include a healthy control group or neuroimaging. This would have allowed for a full replication of past studies, and may have offered insight into the lack of replication of Etkin's studies (e.g., Etkin et al., 2010). If the behavioral effect appeared between the healthy control group and the clinical group, but not within the clinical group that would offer some validation of its ability to discriminate psychopathology from its complete lack of relationship with psychopathology. A lack of that difference would further call into question the replicability of these results. A similar logic follows from including imaging data, in particular in this case as the neuroimaging results have been more robust across studies than the behavioral assessment.

Implicit measures are clearly a useful area of research for the future, offering clinicians and researchers the ability to assess concepts that patients may be unaware of, uncomfortable disclosing, or simply discrepant from their explicit beliefs. This has clear clinical implications (e.g., suicidal behavior, Nock et al., 2010), social implications (e.g., national discussion of race and police violence; Payne, 2001), and industrial implications (e.g., career aspirations, Rudman & Phelan, 2010). Much as the excitement around

genetic causes of, or empirically supported treatments for, psychopathology were initially hailed as a panacea and then were tempered; our enthusiasm around implicit measures also must now be tempered, as we focus on more nuanced, sophisticated questions of their utility. Roth and Fonagy's (2004) question "What works for whom, under what circumstances?" could not be more applicable.

While this study failed to find the hypothesized effects of the Emotional Conflict Task, it does offer additional guidance about "under what circumstances." Namely, this task generally appears to differentiate between healthy controls and the presence of psychopathology (though not always, e.g., Robinson et al., 2015), as opposed to differentiating among gradations of psychopathology. One potential hypothesis for this finding could be that psychopathology is a categorical construct, with a distinct difference between its presence and absence. However, the preponderance of the evidence does not support this claim. While some studies find taxonic properties, particularly when examining MDD (e.g., Ruscio, Zimmerman, McGlinchey, Chelminski, & Young, 2007), the vast majority of recent research into the taxonomy of psychopathology has found it to be dimensional in nature (e.g., Haslam, Holland, & Kuppens, 2012; Prisciandaro & Roberts, 2005).

Given the inconsistent findings with the Emotional Conflict Task, particularly when assessing psychopathology dimensionally, alternative measures are called for. Given the theoretical and empirical evidence surrounding the importance of being able to behaviorally approach goals in the face of distress, objective or in vivo measures of this ability could prove very useful. Aspects of emotion regulation, such as inhibition, can be

assessed readily through current measures (e.g., go/no-go neuropsychological tasks). Other implicit assessment includes psychophysiological assessment, such as vagal tone. However, there is debate whether this consists of a measure of emotion or of emotion regulation (e.g., Porges, Doussard-Roosevelt, & Maiti, 1994). As seen in this study, the DERS Difficulty in Engaging in Goal-Directed Behavior subscale was associated with a broad range of temperament and psychopathology. One objective measure of emotion regulation would be to create an in vivo assessment of this subscale, exposing participants to a distressing situation, such as was done in Mauss and colleagues study (2006), and then asking them to complete standardized tasks, particularly assessments of concentration and persistence (e.g., continuous performance task, n-back digit addition). There is a small literature demonstrating the impact of stress on concentration (e.g. Schoofs, Preuss, & Wolf, 2008); however, this has not yet been generalized to examine its relationship with psychopathology. It is reasonable to hypothesize that increased ability to concentrate under distressing situations would correlate with measures of emotion regulation, and be predictive of decreased psychopathology, but this is an empirical question which must be answered with future research.

## **Conclusion**

In conclusion, this study provided a strong evaluation of the Emotional Conflict Task. This task was not supported in the dimensional assessment of emotion regulation, and was not found to be related to explicit measures of emotion regulation or to either psychopathology or temperament. Several possible explanations for this were discussed, as well as the current, limited state of neuroimaging and implicit measures' ability to

reliably predict psychopathology. Future research is necessary to continue to clarify questions about the implicit measurement of emotion regulation, with a particular focus on creating more reliable and valid implicit measures.

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- Webb, T. L., Miles, E., & Sheeran, P. (2012). Dealing with feeling: A meta-analysis of the effectiveness of strategies derived from the process model of emotion regulation. *Psychological Bulletin, 138*, 775–808. doi:10.1037/a0027600
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<http://doi.org/10.1093/cercor/bhp106>

## CURRICULUM VITAE

**Benjamin O. Emmert-Aronson**

**Boston University**

Department of Psychology  
Center for Anxiety and Related Disorders  
648 Beacon St. Suite 6  
Boston, MA 02215  
330-807-5754  
[benea@bu.edu](mailto:benea@bu.edu)

### EDUCATION

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2016 (Expected)	<p><b>Ph.D. Candidate, Clinical Psychology</b> Boston University, Graduate School of Arts and Sciences Boston, Massachusetts <i>Advisor:</i> Timothy A. Brown, Psy.D. <i>Dissertation Title:</i> A Dimensional Assessment of an Implicit Measure of Emotion Regulation</p>
2009	<p><b>Master of Science, Applied Statistics</b> Columbia University, Teachers College New York, New York <i>Advisor:</i> Jane Monroe, Ph.D.</p>
2007	<p><b>Master of Arts, Clinical Psychology</b> Columbia University, Teachers College New York, New York <i>Advisor:</i> Jordan Wright, Ph.D. <i>Thesis Title:</i> School Counselor Development Program (SCDP) for the Treatment of Adolescent Depression and Suicidality: A Pilot Study</p>
2006	<p><b>Bachelor of Sciences, Psychology</b> Ohio State University, College of Arts and Sciences Columbus, Ohio <i>Honors Thesis:</i> Risk Assessment and Core Affect</p>

### Honors and Awards

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2016	<p>Division 18 Psychologists in Public Service Student Award - Distinguished Mention <i>Comparison of VA to Community Healthcare Summary of Research</i></p>
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- 2010      The Classification of Anxiety and Mood Disorders – Diversity Supplement  
*Principal Investigator:* Benjamin O. Emmert-Aronson  
*Co-Investigator:* Timothy A. Brown, Psy.D.  
*Title:* A psychometric analysis of the *DSM-IV* diagnosis of major depressive disorder (MDD) using Item Response Theory (IRT).  
*Agency:* National Institute of Health (3R01MH039096-24S1)  
*Award Period:* 5/1/2010-5/31/2012  
*Direct Costs:* \$83,851
- 2006      Graduation with Distinction in Psychology, Ohio State University
- 2006      Honors in the Arts and Sciences, Ohio State University

### Research Experience

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- 2014-present    **Graduate Research Assistant**  
**Strong Families Strong Forces Prevention Project**, *Boston University*  
 Advisor: Ellen Devoe, Ph.D.
  - R01 study in conjunction with STRONG STAR consortium to examine a home-based reintegration program for returning veterans
  - Build and manage study database, analyze outcomes, manuscript preparation
  - Collaborate with researchers across disciplines and locations
- 2007-present    **Founder and CEO of Statistics Simplified**
  - Consulted on varied research projects, including grant preparation, statistical analyses, and manuscript preparation
  - Projects have spanned child and adult clinical psychology, social work, and public health
- 2014-2015      **Graduate Research Assistant**  
**Resilient Warrior Project**, *San Francisco VA*  
 Advisors: Sabra Inslicht, Ph.D. and Thomas Metzler, Ph.D.
  - Analyzed multi-method data from a program of research examining mechanisms and gender differences in PTSD incidence
  - Assisted in manuscript preparation

- 2013-2014     **Graduate Research Assistant**  
**Pain Management, *Boston VA***  
Advisor: John D. Otis, Ph.D.
- Study assessor for comorbid Chronic Pain and PTSD treatment outcome study and CBT for Chronic Headache following a TBI, including CAPS, SCID, and varied neuropsychological measures
  - Study management, including data management, participant recruitment, and manuscript preparation
- 2010-2012     **Graduate Research Assistant**  
**Classification of Mood and Anxiety Disorders, *Boston University***  
Advisor: Timothy A. Brown, Psy.D.
- Study assessor, Anxiety Disorders Interview Schedule – IV and 5
  - Trained junior students on the ADIS
  - Manuscript preparation, advanced statistical analyses (e.g., structural equation modeling, item response theory), and data management
- 2008-2009     **Clinical Research Assistant**  
**Transdiagnostic Treatment Laboratory, *Boston University***  
Advisor: David H. Barlow, Ph.D.
- Study management, including data management, participant recruitment, and manuscript assistance for Unified Protocol pilot study and comorbid alcohol and anxiety treatment-outcome study
- 2007-2008     **Research Assistant**  
**Item Response Theory assessment of Elementary Math Ability, *Columbia University***  
Advisor: Young-Sun Lee, Ph.D.
- Assisted data collection and analysis
- 2006-2008     **Clinical Research Assistant**  
**School Counselor Training in Suicide Prevention, *Columbia University***  
Advisor: Jordan A. Wright, Ph.D.
- Assisted in designing and presenting a suicide prevention training for school counselors
  - Manuscript preparation, data analysis

- 2005-2006    **Honors Thesis Student**  
**Psychology Department, *Ohio State University***  
 Advisor: Robert Billings, Ph.D.
- Designed and implemented a randomized controlled study to assess the impact of affect on risk assessment
  - Ran participants, analyzed data, prepared thesis manuscript, and completed oral defense

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### Clinical Experience

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- 2015-2016    **Predoctoral Internship**  
**Mental Health, *San Francisco VA***
- Provide clinical care across a broad range of settings, including inpatient and outpatient, individual, couples, and groups
  - Learned and applied a range of empirically supported treatments including Cognitive Processing Therapy (CPT), Dialectical Behavior Therapy (DBT), Interpersonal Therapy (IPT), Time-Limited Dynamic Therapy (TLDP), and Emotion Focused Therapy (EFT)
- 2012-2014    **Student Supervisor**  
**Psychological Services Center, *Boston University***  
 Supervisor: Lisa Smith, Ph.D.
- Supervise junior students in doctoral program and provide biannual feedback
  - Participate in weekly supervision, including live and audio supervision
- 2012-2013    **Practicum Student**  
**Center for Anxiety and Related Disorders, Child Program, *Boston University***  
 Supervisor: David Langer, Ph.D.
- Conduct semi-structured intake assessments
  - Provide individual cognitive behavioral therapy with children, including separation anxiety, selective mutism, generalized anxiety disorder, and features of autism spectrum disorder
  - Attend one-hour weekly supervision including symptom assessment, case formulation, and intervention implementation

- 2009-2013     **Center Therapist**  
**Center for Anxiety and Related Disorders, Adult Program, Boston University**  
Supervisors: Heather Murray, Ph.D., Lisa Smith, Ph.D., Todd Farchione, Ph.D.
- Utilize empirically supported treatments, including CBT, ACT, Motivational Interviewing, and Mindfulness-Based relaxation training
  - Conduct case formulation and treatment planning
  - Attend weekly supervision

- 2011-2012     **Practicum Student**  
**Substance Abuse Residential Rehabilitation Treatment Program, Boston VA**  
Supervisors: Glenn Trezza, Ph.D., Monica Roy, Ph.D.
- Conduct intake assessments for both inpatient and outpatient presentations
  - Conduct individual therapy for substance use and comorbid conditions
  - Conduct group therapy, including ACT and Relationship groups

#### **Teaching Experience**

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- 2012-2013     **Teaching Fellow** – Introductory Statistics  
**College of Arts and Sciences, Boston University**  
Supervisor: David Langer, Ph.D.
- 2009-2010     **Teaching Fellow** – Introductory Psychology  
**College of Arts and Sciences, Boston University**  
Supervisor: Tracey Dunne, Ph.D.
- 2007-2008     **Teaching Fellow** – Graduate-level Statistics  
**College of Arts and Sciences, Columbia University**  
Supervisor: Jane Monroe, Ph.D.
- 2008-2008     **Mathematician in Residence**  
Carrie E. Tompkins Elementary School
- Taught enrichment mathematics for first and second grade students

#### **Professional Associations**

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- 2010-present     Association for Psychological Science
- 2009-present     Society for a Science of Clinical Psychology
- 2009-present     Association for Behavioral and Cognitive Therapies
- 2009-present     American Psychological Association

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### Professional Service

2015-2016	Multicultural and Diversity committee member at San Francisco VAMC
2015-2016	Intern Representative to Psychology Training Committee at San Francisco VAMC
2010-2014	Student Representative for Curriculum Committee at Boston University
2009-2010	Student Representative to Clinical Psychology Faculty at Boston University

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### Editorial Experience

#### *Ad Hoc Reviewer*

Psychiatry Research  
 Behavior Therapy  
 Psychopathology & Behavioral Assessment  
 Journal of Affective Disorders

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### Publications and Presentations

#### Peer Reviewed Publications

1. Emmert-Aronson, B. O., & Brown, T. A. (2015). An IRT Analysis of the Symptoms of Major Depressive Disorder. *Assessment*, 22, 332-340.
2. Emmert-Aronson, B. O., Moore, M. T., & Brown, T. A. (2014). Differential item functioning of the symptoms of major depression by race and ethnicity: An item response theory analysis. *Journal of Psychopathology and Behavioral Assessment*, 36, 424-431.
3. Cooper-Vince, C. E., Emmert-Aronson, B. O., Pincus, D. B., & Comer, J. S. (2014). The diagnostic utility of separation anxiety disorder symptoms: An item response theory analysis. *Journal of Abnormal Child Psychology*, 42, 417-428. doi: 10.1007/s10802-013-9788-y
4. Rosellini, A. J., Rutter, L. A., Bourgeois, M. L., Emmert-Aronson, B. O., & Brown, T. A. (2013). The relevance of age of onset to the psychopathology of social phobia. *Journal of Psychopathology and Behavioral Assessment*, 35, 356-365. doi:10.1007/s10862-013-9338-5
5. Layton, A. M., Gaber, C. E., Thomashow, B. M., Gerardo, R. E., Emmert-Aronson, B. O., Armstrong, H. F. ... & Bartels, M. N. (2011) Exercise Ventilatory Kinematics in Endurance Trained and Untrained Men and Women. *Respiratory Physiology & Neurobiology*, 178, 223-229.
6. Bartels, M., Armstrong, H., Gerardo, R., Layton, A., Emmert-Aronson, B. O., Sonett, J., & Arcasoy, S. (2011). Evaluation of Pulmonary Function and Exercise Performance by Cardiopulmonary Exercise Testing Before and After Lung Transplantation. *Chest*, 140, 1604-1611.

7. Zimmerman, M., Emmert-Aronson, B. O., & Brown, T. A. (2011). Concordance between a simpler definition of major depressive disorder and Diagnostic and Statistical Manual of Mental Disorders: an independent replication in an outpatient sample. *Comprehensive Psychiatry*, 52, 261-264.
8. Wright, A. J., & Emmert-Aronson, B. O. (2008). School counselor development program (SCDP) for the treatment of adolescent depression and suicidality: A pilot study. *Journal of School Counseling*, 6(23).
9. Wright, A.J., Blount, M.C., & Emmert-Aronson, B.O. (2007). School Counselor Development Program (SCDP): Adolescent depression and suicidality. New York: Teachers College.

### Manuscripts in Preparation

1. Emmert-Aronson, B. O., Cardoos, S., Borsari, B., & Lemle, R. (2016). *Comparison of VA to community healthcare summary of research 2000 – 2016*. Manuscript in Preparation.
2. Ross, A. M., Emmert-Aronson, B. O., Paris, R., DeVoe, E. R. (2016). *Social support and psychological distress in military spouses: Examination of the stress-buffering and support erosion hypotheses*. Manuscript submitted.
3. Freed, R. D., Emmert-Aronson, B. O., Alschuler, K. N., & Otis, J. D. (2016). *Confirmatory factor analysis of the Coping Strategies Questionnaire - Revised in veterans with chronic pain*. Manuscript submitted.
4. DeVoe, E. R., Ross, A. M., Paris, R., Emmert-Aronson, B. O., Acker, M. (2016). *Efficacy evaluation of a home-based reintegration program for military families with very young children*. Manuscript in preparation.
5. DeVoe, E. R., Ross, A. M., Emmert-Aronson, B. O., Paris, R. (2016). *Supporting adaptive reintegration among military service members with very young children: Lessons learned from the Strong Families Strong Forces program*. Manuscript in Preparation.
6. Wang, C. L., Emmert-Aronson, B. O., Gonzalez, R. (2016). *A randomized trial of the clinical utility of genetic testing for obesity: Design and implementation considerations*. Manuscript in preparation.

### Paper Presentations

1. Wang, C., Gonzalez, R., Emmert-Aronson, B. O., Parrott, R., Capella, J., & Miller, S. M. (2016, March). *Psychosocial impact of communicating of genetic and environmental causes of colorectal cancer: A factorial experiment*. In K. Kaphingst (Chair). *Genomic literacy and communication for health promotion: Insights across health conditions*. Symposium presented at the 37<sup>th</sup> annual meeting of the Society of Behavioral Medicine, Washington, DC.

2. Emmert-Aronson, B. O. & Brown, T. A. (2014, May). *An initial evaluation of agoraphobia in DSM-5*. In T. Chou (Chair). *Square Pegs and Round Slots: Evaluating Key DSM-5 Changes for Anxiety Disorders*. Symposium presented at the 26<sup>th</sup> annual meeting of the Association for Psychological Science, San Francisco, California.
3. Emmert-Aronson, B. O. & Brown, T. A. (2012, May). *An Item Response Theory analysis of the symptoms of major depression*. In B. Emmert-Aronson (Chair). *ESEM, IRT, DIF, and other earth-shattering statistics: Practical applications to clinical science and questions of diversity*. Symposium presented at the 24<sup>th</sup> annual meeting of the Association for Psychological Science, Chicago, Illinois.
4. Cooper-Vince, C. V., Emmert-Aronson, B. O., Pincus, D. B., & Comer, J. S. (2012, May). *The diagnostic utility of separation anxiety disorder symptoms: An item response theory analysis*. In B. Emmert-Aronson (Chair). *ESEM, IRT, DIF, and other earth-shattering statistics: Practical applications to clinical science and questions of diversity*. Symposium presented at the 24<sup>th</sup> annual meeting of the Association for Psychological Science, Chicago, Illinois.
5. Emmert-Aronson, B. O., & Brown, T. A. (2010, November). *Using Item Response Theory to analyze Major Depressive Disorder*. In M. Moore (Chair). *Functions and thresholds: Issues related to the dimensional assessment of the mood disorders*. Symposium presented at the 44<sup>th</sup> annual meeting of the Association of Behavioral and Cognitive Therapies, San Francisco, California.

### Conference Posters and Other Presentations

1. Emmert-Aronson, B. O., & Brown, T. A. (2016, May). *An Implicit Measure of Emotion Regulation*. Poster session presented at the annual meeting of the Association for a Psychological Science, Chicago, Illinois.
2. Ross, A.M., Emmert-Aronson, B.O., DeVoe, E.R. (2014, August). *A mixed methods examination of concordance between self-reported veteran mental health and spousal perceptions of symptom severity and their effects on parenting stress*. Poster session presented at the annual meeting of the American Psychological Association, Washington, DC.
3. Cooper-Vince, C. V., Emmert-Aronson, B. O., Pincus, D. B., & Comer, J. S. (2012, August). *The diagnostic utility of separation anxiety disorder symptoms: An item response theory analysis*. Poster session presented at the annual meeting of the European Association for Behavioral and Cognitive Therapies, Geneva, Switzerland.
4. Rosellini, A. J., Emmert-Aronson, B. O., St. Paul, M. S. & Brown, T. A. (2011, November). *The relevance of age of onset to the psychopathology of social phobia*. Poster session presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Toronto, Ontario.

5. Emmert-Aronson, B. O., & Brown, T. A. (2010, May). *An IRT analysis of depression*. Poster session presented at the annual meeting of the Association of Psychological Science, Boston, Massachusetts.
6. De Nadai, A., Leyfer, O., Smith, L., Farchione, T. J., Emmert-Aronson, B., & Barlow, D. H. (2008, November). *Individual versus group treatment for social anxiety disorder in a clinical setting*. Poster session presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, Florida.
7. De Nadai, A., Smith, L., Farchione, T. J., Emmert-Aronson, B., & Barlow, D. H. (2008, November). *Effectiveness of cognitive behavioral therapy for anxiety and depression in a clinical setting*. Poster session presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, Florida.
8. De Nadai, A., Smith, L., Farchione, T. J., Emmert-Aronson, B., & Barlow, D. H. (2008, November). *Effectiveness of therapists-in-training under supervision*. Poster session presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, Florida.
9. De Nadai, A., Smith, L., Farchione, T. J., Emmert-Aronson, B., & Barlow, D. H. (2008, November). *Robustness of cognitive behavioral therapy with heterogeneous clinical populations*. Poster session presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, Florida.

### References

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Timothy A. Brown, Psy.D.  
 Professor of Psychology  
 Boston University  
 Phone: 617-353-9610  
 Email: TABrown@bu.edu

John D. Otis, Ph.D.  
 Director of Pain Management  
 Boston VA  
 Phone: 857-364-5740  
 Email: John.Otis@va.gov

Kellie Rollins, Psy.D.  
 Director of Training, San Francisco VA  
 Assistant Clinical Professor, UCSF  
 Phone: 415-221-4810  
 Email: Kellie.Rollins2@va.gov

Russell Lemle, Ph.D.  
 Chief Psychologist, San Francisco VA  
 Associate Clinical Professor, UCSF  
 Phone: 415-221-4810  
 Email: [Russell.Lemle@va.gov](mailto:Russell.Lemle@va.gov)