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Physiological, Behavioral, and Self-Report Outcomes of Acceptance and Regulation Approaches to Exposures for Intrusive Thoughts

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PHYSIOLOGICAL, BEHAVIORAL, AND SELF-REPORT OUTCOMES OF ACCEPTANCE AND REGULATION APPROACHES TO EXPOSURES FOR INTRUSIVE THOUGHTS

by

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ABSTRACT

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Exposure-based cognitive behavioral therapy is the gold standard treatment for obsessive-compulsive disorder, but response rates are less than half at post and about one third at follow-up. Leading theories regarding the mechanisms of exposure focus on fear reduction, and they neglect to include operant processes as mechanisms of change or outcomes of therapy, despite the fact that avoidance, an operant behavior, is a key feature of the disorder. Acceptance-based approaches to exposure do not target fear reduction, but directly target operant behavior. Integrating these perspectives could lead to a more robust understanding of mechanisms of change in exposure and, ultimately, treatments that are more precise, effective, and enduring.

The current study investigated whether acceptance or regulation of distress during exposure for intrusive thoughts led to differential outcomes and whether these were achieved through differing mechanisms of change. Participants with intrusive thoughts were randomized to three groups, Acceptance (*n* = 23), Regulation (*n* = 20), and Control

(n = 21), and completed two behavioral avoidance tests 1 week apart. Active treatment participants completed a 30-minute exposure at session 1 and 6 days of 10-minute exposures at home; Control participants watched videos of the same lengths. Self-report questionnaires were collected at each session, and behavioral, subjective, and physiological repeated measures data were collected at both behavioral avoidance tests.

Results showed that both active conditions decreased on obsessive-compulsive symptom severity, rituals performed during the behavioral avoidance test, subjective units of distress, and skin conductance levels. Acceptance showed lower skin conductance and a trend toward greater willingness than Regulation, as well as greater psychological flexibility than Control. No between condition differences were observed for the number of behavioral avoidance test tasks completed, psychological inflexibility, valued living, or heart rate. This study suggests that psychological flexibility and willingness to experience distress may paradoxically lead to decreased physiological arousal, which has implications for treatment and future research.

(124 pages)

PUBLIC ABSTRACT

Physiological, Behavioral, and Self-Report Outcomes of Acceptance and Regulation Approaches to Exposures for Intrusive Thoughts

Brooke M. Smith

Cognitive-behavioral therapy that includes exposure, or intentionally and systematically confronting feared situations, is the gold standard psychological treatment for obsessive-compulsive disorder. However, less than half of those who begin this treatment are considered to have recovered from their disorder at the end of treatment, and this number is even smaller in the months following the end of treatment. Leading theories regarding how treatment changes occur focus on reducing fear, and they do not include “voluntary” (i.e., operant) behaviors, such as avoidance, that are key features of the disorder. Acceptance-based approaches to exposure do not focus on fear reduction, but directly focus on changing “voluntary” behaviors. Combining these two perspectives could lead to a better understanding of how exposure works and, ultimately, lead to more effective and long-lasting psychological treatments for obsessive-compulsive disorder.

The current study investigated whether accepting distress or attempting to reduce distress during exposure for intrusive thoughts led to different outcomes and whether they led to these outcomes in different ways. Participants with intrusive thoughts were randomized to three groups, Acceptance (n = 23), Regulation (n = 20), and Control (n = 21), and completed two sessions 1 week apart. Participants in the Acceptance and Regulation groups completed a 30-minute exposure at session 1 and 6 days of 10-minute

exposures at home; Control participants watched videos of the same lengths. Self-report questionnaires, measures of behavior, self-ratings, and physiological data were collected at both sessions.

Results showed that Acceptance and Regulation groups decreased on measures of obsessive-compulsive symptom severity, rituals performed, self-rated distress, and skin conductance levels. Acceptance showed lower skin conductance and a statistical trend toward greater self-rated willingness to experience distress than Regulation, as well as greater psychological flexibility than Control. There were no between group differences in the number of exposure tasks completed during a behavioral test, psychological inflexibility, valued living, or heart rate. This study suggests that psychological flexibility and willingness to experience distress may paradoxically lead to decreased physiological arousal, findings which may inform future research and treatment approaches.

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CHAPTER I

STATEMENT OF THE PROBLEM

Obsessive-compulsive disorder (OCD) is a chronic and debilitating psychological condition that affects 1-3% of the population (Karno, Golding, Sorenson, & Burnam, 1988; Kessler, Berglund, et al., 2005; Kessler, Chiu, Demler, & Walters, 2005) and is associated with a high degree of impaired functioning (Torres et al., 2006). Exposure-based cognitive-behavioral therapy (CBT) is the first-line treatment for OCD (Deacon & Abramowitz, 2004; Hofmann & Smits, 2008). Despite its success, however, over 50% of individuals receiving this intervention are classified as nonresponders at post, and over 64% are classified as nonresponders at follow-up (Loerinc et al., 2015). This highlights the importance of understanding the mechanisms of exposure therapy in order to refine our treatments and develop treatments that are more precise, targeted, effective, and enduring. Unfortunately, the underlying mechanisms of exposure therapy are not well understood. Researchers typically conceptualize these mechanisms in terms of either Pavlovian habituation or extinction of fear, with corresponding habituation-based (Foa & Kozak, 1986) and inhibitory learning-based (Craske et al., 2008) theories, respectively. The habituation-based account of exposure therapy emphasizes the reduction of fear during and between exposure sessions, while the inhibitory learning account emphasizes the tolerance of fear and the facilitation of new learning (Abramowitz, 2013). Some studies have shown that exposure from an acceptance perspective may improve outcomes compared to a fear reduction approach (Eifert & Heffner, 2003) and that tolerance of fear may be a better predictor of outcome than fear reduction (Culver, Stoyanova, & Craske,

2012). However, research on acceptance of fear with regard to OCD is still in its infancy. In order to improve our treatment of OCD, it is important to extend studies of fear reduction and tolerance to obsessive-compulsive symptoms in order to see which approach to treatment leads to better outcomes.

Additionally, while operant learning processes are not emphasized in any of the leading theories of exposure therapy, they are clearly of prime importance, as obsessions are defined by the presence of operant avoidance (i.e., obsessions are thoughts, urges, or images that are ignored or suppressed) and compulsions are defined as operant avoidance (i.e., active attempts to regulate obsessions). In addition, life functioning is included as a diagnostic criterion for almost every psychological disorder (American Psychiatric Association [APA], 2013), is comprised of various operant behaviors (e.g., working, attending school, and fulfilling social and familial roles), and is, ultimately, the purpose of therapy. If treatment results in decreased fear and distress, but this has no measurable impact on a client's life, it cannot really be said that therapy was a success. While it is recognized that both approaches to exposure therapy involve operant processes (Abramowitz, 2013; Foa, 2011), functioning is not directly targeted in either habituation- or inhibitory learning-based approaches to exposure therapy, nor are operant behaviors included in the theories underlying these approaches. By focusing only on fear reduction as the outcome of therapy, both approaches implicitly assume that a reduction in fear/distress will lead to better life functioning (Gloster, Hummel, Lyudmirskaya, Hauke, & Sonntag, 2012). However, the relationship between anxiety symptoms and operant processes, including avoidance and functioning, is complex and does not necessarily support this assumption (Brown et al., 2015). A better approach would be to

conceptualize fear and its relationship with operant behaviors as possible treatment mechanisms, with operant behaviors and/or life functioning measures as outcomes.

A more complete understanding of the mechanisms of exposure therapy from both an acceptance and regulation approach is critical if we hope to refine our treatments and ultimately achieve more effective outcomes. The purpose of this study was, therefore, twofold: (1) to determine which approach to the treatment of obsessions, acceptance of distress or regulation of distress, leads to better outcomes; and (2) to determine if a relationship exists between operant and Pavlovian processes within each approach and, if so, the nature of this relationship and its association with treatment outcomes.

CHAPTER II

REVIEW OF THE LITERATURE

Obsessive-Compulsive Disorder

OCD is characterized by the experience of obsessions – recurrent intrusive thoughts, images, or impulses – or compulsions – repetitive overt or mental behaviors conducted in an effort to relieve the distress of obsessions (APA, 2013). Usually, both obsessions and compulsions are present. OCD is a chronic and debilitating disorder with high rates of comorbidity. Some studies estimate that individuals with OCD have the disorder for a mean of 8.9 years following onset, with many cases developing at a young age (Ruscio, Stein, Chiu, & Kessler, 2008). Individuals with OCD have a poorer quality of life than those without it (Olatunji, Cisler, & Tolin, 2007). Two thirds of those with OCD experience significant impairment in functioning (Ruscio et al., 2008) and, compared to those diagnosed with other psychological disorders, individuals meeting an OCD symptom profile have significantly greater impairment, with over half reporting substantial impairment in social activities and nearly three quarters reporting substantial impairment in occupational and regular activities (Torres et al., 2006). Nearly twice as many individuals with OCD reported at least one suicide attempt in their lives compared to individuals with other psychological disorders, a number that is ten times the healthy population (Torres et al., 2006). Additionally, between 60% and 90% of OCD diagnosed individuals also meet criteria for another psychological disorder (Ruscio et al., 2008; Torres et al., 2006). It is important to note that, while the prevalence of OCD is between 1% and 3% in the adult population (Karno et al., 1988; Kessler, Berglund, et al., 2005;

Kessler, Chiu, et al., 2005; Ruscio et al., 2008; Torres et al., 2006), over 28% of the population report having experienced obsessions or compulsions at some point in the their lives, highlighting the fact that obsessive-compulsive (OC) symptoms are experienced by many individuals who may not meet full criteria for the disorder, but who may still experience distress and functional impairment as a result of their symptoms (Ruscio et al., 2008).

Meta-analyses have consistently found that exposure-based cognitive behavioral therapies (CBT), such as exposure and response prevention (ERP), are efficacious and achieve large effects in the treatment of OCD (Deacon & Abramowitz, 2004; Olatunji, Cisler, & Deacon, 2010; Olatunji, Davis, Powers, & Smits, 2013). Efficacy does not appear to be enhanced by the inclusion of medication and, therefore, stand-alone CBT is considered the first-line treatment for this disorder (Foa, Franklin, & Moser, 2002). Despite the strong effects of CBT, however, response rates are surprisingly low. In their systematic review of CBT response rates in the anxiety disorders, Loerinc et al. (2015) found a 43.3% response rate for OCD at post-treatment and a 35.6% response rate at follow-up. In other words, over half of OCD diagnosed individuals receiving CBT do not recover and, in the long term, this number drops to about a third. These numbers highlight the importance of developing treatments that are more effective and enduring. Understanding the mechanisms of exposure-based CBT may facilitate this through the refinement or enhancement of existing treatments. Previous research has demonstrated that clinical outcomes can be improved by identifying mechanisms of change and then developing and applying clinical techniques based on those mechanisms (Craske, 2015).

Mechanisms of Exposure Therapy

It is generally accepted that the critical component of CBT for OCD is exposure, which is the procedure of systematically confronting fear-eliciting situations, either *in vivo* or through visualization, while refraining from compulsive behavior or purposeful distraction (Deacon & Abramowitz, 2004; Olatunji et al., 2010). Various theories have developed over time to account for the mechanisms of exposure therapy, including models based on habituation of fear (Foa & Kozak, 1986; Foa & McNally, 1996) and extinction of fear via inhibitory learning (Craske et al., 2008; Craske, Treanor, Conway, Zbozinek, & Vervliet, 2014). Both habituation-based and inhibitory learning-based models draw on basic behavioral research to inform their approaches along with various cognitive elements.

Habituation-Based Models of Exposure

Drawing on work by Lang (1977, 1979), Mowrer (1947), and Rachman (1980), Foa and Kozak (1986) developed a theory of exposure therapy called Emotional Processing Theory (EPT). According to EPT, “fear memories” are stored in “fear structures,” which are cognitive representations of fear-inducing situations. Fear structures are organized into networks containing information about: (1) the stimulus properties of the feared situation, (2) overt and covert responses to the situation (i.e., verbal, physiological, and overt), and (3) interpretations regarding the meaning of those stimuli and responses. They also function as a “blueprint” for escape and avoidance behavior. For example, a fear structure may contain information about the stimulus properties of a dog, a physiological response of a racing heart, and the threat

interpretation that one is about to get bitten. “Pathological” fear structures contain “excessive response elements” and are resistant to modification (Foa & Kozak, 1986, p. 21).

According to Foa and Kozak (1986), in order to modify pathological fear structures, they must first be activated, which occurs when fear-relevant inputs match part of the fear structure. For example, an individual may see a picture of a dog or have thoughts about getting bitten by a dog. These inputs then generalize to activate the rest of the fear structure. Because the fear structure itself is a hypothetical construct, activation of it must be measured through the convergence of proxy measures, including physiological responses and subjective self-reports of fear. Once activation has occurred, the fear structure can be either strengthened or weakened depending upon whether information in the environment is consistent or inconsistent with the fear memory, respectively. In exposure therapy, fear is reduced through (1) the activation of the fear structure and (2) the provision of information that is incompatible with the pathological elements of the fear structure, both of which are necessary conditions for successful fear reduction. “Corrective learning” occurs once sufficient incompatible information has been integrated. Foa and Kozak (1986) suggested that a new fear structure replaces the old one, but Foa and McNally (1996) updated this view to account for research on the context-specificity of extinction, suggesting that a new fear structure is formed during exposure that competes with the old one. The process of ongoing fear reduction is referred to as “emotional processing.”

During therapy, measures that are thought to reflect the fear structure are used as indicators of emotional processing, or the mechanisms of exposure therapy. Each can be

calculated via physiological measures, such as heart rate or skin conductance, or self-report measures, such as Subjective Units of Distress (SUDS). They include (1) the level of initial fear activation in the first exposure trial, (2) decreases in fear within an exposure session, or within-session habituation, and (3) decreases in fear activation from one session to the next, or between-session habituation. Within-session habituation is considered a necessary precursor for between-session habituation (Foa & Kozak, 1986). EPT is the theory underlying both ERP for OCD and Prolonged Exposure Therapy for posttraumatic stress disorder (PTSD).

Following decades of research, the theoretical mechanisms of exposure therapy as described through EPT have received little empirical support. A recent comprehensive review by Asnaani, McLean, and Foa (2016) considered 31 studies of exposure therapy from 1970 to 2015 that examined the relationships between treatment outcomes and initial fear activation, within-session habituation, and between-session habituation, either directly or indirectly. These studies included samples of participants with OCD, PTSD, panic disorder, and various phobias. Of these, four studies found clear evidence supporting a positive relationship between high initial fear activation and outcome, one study failed to find a relationship, one study found a negative relationship, and three studies had mixed results. Two studies not included in this review also showed a negative relationship between initial fear activation and treatment outcome (Busscher, Spinhoven, & de Geus, 2015; S. A. Hayes, Hope, & Heimberg, 2008). For within-session habituation, seven studies supported a relationship between a decrease in fear during exposure sessions and superior outcome, while 13 studies showed no relationship, one study showed a negative relationship, and three studies had inconsistent results. Two

studies not included in the review also showed no relationship (Busscher et al., 2015; Kircanski & Peris, 2015), and another had mixed results (S. A. Hayes et al., 2008). Finally, for between-session habituation, nine studies showed evidence that fear reduction between exposure sessions predicted superior outcomes, four studies failed to show this relationship, and nine studies were mixed. Two more recent studies also showed no relationship between between-session habituation and outcome (Busscher et al., 2015; Kircanski & Peris, 2015).

In each of the previous studies, those with mixed results tended to show a relationship between a process variable and outcome using some measures of fear (e.g., SUDS, heart rate) but not others, relationships were observed for some outcomes but not others, relationships occurred at post but not follow-up (or vice versa), trends in the data failed to reach statistical significance, or studies had inconsistent results depending upon how process variables were operationalized. The authors concluded that support for initial fear activation as a mechanism of change in exposure is mixed, the majority of studies fail to support within-session habituation as necessary for successful outcomes and, while between-session habituation is better supported, much of this evidence comes from studies that have examined the relationship between between-session habituation and outcome indirectly by identifying common patterns between groups rather than directly through statistical analyses (Asnaani et al., 2016).

In addition, when correlations were calculated between EPT process measures, no relationship between within-session habituation and between-session habituation was found (Baker et al., 2010), failing to support their theorized relationship in EPT. Therefore, based on the preponderance of data collected over the past 45 years, it appears

safe to conclude that none of EPT's purported process measures have been shown to relate consistently to treatment outcome, though only five of these studies have been conducted with participants with OCD. It has been suggested that the reason for this lack of concordance between EPT process measures and outcome is that fear *expression* and fear *learning* represent divergent response systems (Beckers, Krypotos, Boddez, Effting, & Kindt, 2013; Craske et al., 2008), such that fear responses (i.e., self-reports of fear, heart rate, skin conductance) are not a reliable indicator of underlying learning. Basic research on learning also shows that learning can occur in the absence of behavioral performance (Balsam, Drew, & Gallistel, 2010).

Inhibitory Learning-Based Models of Exposure

More recent inhibitory learning-based models of exposure therapy are based on inhibitory learning theory (ILT; Jacoby & Abramowitz, 2016) and use Pavlovian extinction as a framework for describing the mechanisms of learning that result from exposure (Craske et al., 2008). In Pavlovian conditioning, an unconditioned stimulus (US) elicits an unconditioned response (UR) by means of an organism's evolutionary history, in the absence of learning during that organism's individual lifetime. When a previously neutral stimulus is paired with a US, that stimulus can become a conditioned stimulus (CS) that will elicit a conditioned response (CR) topographically similar to the US (Wasserman & Miller, 1997).

During extinction, the CS is repeatedly presented in the absence of the US, which can result in a decrease in the CR. While at one time this decrease was thought to result from an unlearning or erasure of the association between the CS and US (Rescorla &

Wagner, 1972), more recent research on the context specificity of extinction (Bouton, 2004) has suggested that, rather than erasing the original CS-US association, extinction procedures result in new learning, such that the CS becomes associated with the absence of the US, and a new inhibitory CS-noUS association is formed. According to ILT, the CS therefore becomes an ambiguous stimulus with two associations, both of which remain in memory and compete for retrieval. When the CS is encountered following extinction, the context in which it is encountered disambiguates the CS and determines which association is retrieved. If the CS is reencountered in the extinction context, the CS-noUS association is retrieved, inhibiting the CS-US association, and a diminished CR is observed. If the CS is reencountered anywhere but the extinction context (the original conditioning context or a novel context), the CS-US association is retrieved and the undiminished CR is observed (i.e., the CR relapses). Extinction learning is therefore more context-dependent than original learning (Vervliet, Craske, & Hermans, 2013).

Inhibitory learning-based models of exposure account for the differences observed between fear expression and fear learning because the acquisition of inhibitory associations does not depend on levels of expressed fear during exposure but, rather, on the co-occurrence of the CS with the absence of the US. In addition, the degree to which inhibitory associations affect fear expression following extinction depends upon context rather than expressed fear during exposure (Craske et al., 2008). Therefore, according to Craske et al., the critical index of learning is expressed fear following exposure therapy during post and follow-up tests.

An important implication of inhibitory learning models is that fear reduction during exposure therapy is unnecessary and, as a result, techniques based on ILT

encourage clients to be open to and tolerate their fear, rather than attempt to control, reduce, or "fix" it (Craske et al., 2014; Jacoby & Abramowitz, 2016). This approach is similar to that of acceptance-based exposure treatments, such as acceptance and commitment therapy (S. C. Hayes, Strosahl, & Wilson, 2012; see also Bluett, Homan, Morrison, Levin, & Twohig, 2014, for a review of ACT-based exposure studies). In ACT, clients are taught that it is not the experience of fear or distress itself that is a problem but, rather, it is the attempt to reduce, control, or avoid it that ultimately causes problems in their lives. Accordingly, techniques aimed at reducing fear or distress are conceptualized as avoidance behaviors and are discouraged, and exposure exercises are used as opportunities for clients to practice experiencing their distress in an open and welcoming way, while still engaging in behaviors that are meaningful to them (Twohig et al., 2015). The theoretical approach underlying ACT, relational frame theory (RFT; S. C. Hayes, Barnes-Holmes, & Roche, 2001), emphasizes the contextual control of responding and, while RFT is not an associative theory and is in this way distinct from ILT, it is compatible with ILT's overarching premises of new learning and the contextual control of responding (Gloster et al., 2012), and it is therefore consistent with the empirical evidence supporting an inhibitory learning model.

One of the findings that led to an inhibitory learning account of exposure therapy is that extinction learning appears to be specific to the context in which it occurs. "Return of fear" (Rachman, 1989; see also Boschen, Neumann, & Waters, 2009; and Vervliet et al., 2013, for reviews) is a well-documented phenomenon in the basic and analogue literatures in which fear responding can relapse as the result of various procedures following extinction, including testing fear responses outside the original extinction

context (Milad, Orr, Pitman, & Rauch, 2005), after the passage of time (Wood & Mcglynn, 2000), following the re-presentation of the US (Hermans et al., 2005), and following additional pairings of the CS with the US (Ledgerwood, Richardson, & Cranney, 2005). While the apparent mechanism of relapse in renewal is a change of context from extinction to retest, context theory maintains that each of the previously mentioned relapse phenomena also occur as a result of a change in context (Bouton, 2002, 2004), though this theory is not without problems (Shahan & Craig, 2016). Context, therefore, appears to play a critical role during extinction learning and relapse.

Clinical analogue research has also begun to show that tolerance of fear may be more important to clinical outcomes than fear reduction. This has been demonstrated in a handful of studies comparing groups of individuals receiving instructions either to accept/tolerate fear or to attempt to reduce it. For example, in a sample of high anxiety females, those receiving instructions to accept fear were less behaviorally avoidant, experienced fewer and less intense fear symptoms, experienced fewer cognitive symptoms, and engaged in less catastrophic thinking compared to a group receiving instructions to control their fear and an experimental control group (Eifert & Heffner, 2003).

Other studies have shown superior outcomes for fear acceptance interventions compared with fear reduction interventions, despite showing no difference in subjective levels of fear between groups during exposure. In a study by Wagener and Zettle (2011), spider fearful individuals completed exposures from either an acceptance-, control-, or information-based approach. Those in the acceptance condition progressed further in a behavioral avoidance test and reported greater willingness to complete the task again

compared to the other two groups, despite no differences in subjective reports of fear between groups. Similarly, in a clinical sample of individuals with fear of public speaking, participants who received acceptance-based exposures over the course of a 6-week group treatment were more likely to achieve remission at 6-week follow-up than those receiving habituation-based exposures. Although subjective fear decreased over time in both groups, it did not do so differentially (England et al., 2012). A recent study by Katz, Breznitz, and Yovel (2019) compared two groups of cockroach fearful participants following in vivo exposures. Participants either attended to the external stimulus (a dead cockroach) or to the external stimulus and their internal distress. Results showed that those who attended to the cockroach showed decreased self-reported distress immediately following the exposure and one week later, while those who attended to both the cockroach and internal distress did not. Both groups showed improvement on a behavioral avoidance test (BAT). One week later, in an ecologically valid environment, the external-only group again showed decreased self-reported distress compared to the external-internal group, but the latter group showed continued behavioral improvement, while the former did not. These studies show that successful behavioral outcomes do not depend on the reduction of distress during exposure.

Finally, two studies did not support the superiority of an acceptance approach to exposure over that of fear reduction. In a sample of individuals who scored highly on a measure of obsessional thoughts, Fabricant, Abramowitz, Dehlin, and Twohig (2013) found no difference in subjective fear or behavioral outcomes between acceptance-based imaginal exposure, traditional imaginal exposure (i.e., fear reduction), and expressive writing control groups. Bluett, Landy, Twohig, and Arch (2016) randomized individuals

with elevated social anxiety to one of four groups: fear reduction/cognitive reappraisal, acceptance, personal values, or experimental control. Following a one-session exposure and exposure homework, each of the three active treatment conditions showed equivalent improvements in anxiety symptomatology and durations of a public speaking task.

Studies focusing on fear toleration as a therapeutic process have supported the role of fear acceptance in clinical outcomes. Deacon et al. (2013) showed that, in high anxiety-sensitive individuals, the differences in self-reported fear measures between groups receiving intensive and standard interoceptive exposures for panic disorder was fully mediated by fear toleration ratings and changes in fear prediction. It has also been shown that sustained fear responding throughout extinction may enhance extinction learning. In a sample of individuals with a fear of public speaking, Culver et al. (2012) showed that less within-session habituation of self-reported fear (i.e., greater sustained arousal) predicted longer durations in a public speaking task.

Finally, research on the neural mechanisms underlying exposure therapy also support an inhibitory learning view. Increased neuronal activity in the amygdala occurs during fear conditioning. During fear extinction, the activity of the amygdala appears to be inhibited by the influence of the medial prefrontal cortex, which plays in important role in executive control and emotion regulation. Additionally, this inhibition may be contextually controlled through the influence of the hippocampus, which is important in contextual learning (Craske et al., 2008; LeDoux, Moscarello, Sears, & Campese, 2017). In summary, inhibitory learning approaches to exposure therapy are beginning to receive empirical support though basic behavioral and neuroscience research, as well as clinical and analogue studies. However, research on acceptance of fear with regard to OCD is still

in its infancy – especially compared to other anxiety disorders. In order to improve our treatment of OCD, it is important to extend studies of fear reduction and tolerance to OCD in order to see which approach to treatment leads to better outcomes.

Problems with Current Theories of Exposure

Although inhibitory learning-based models of exposure do not use fear reduction during exposure as an *index* of learning, they do use fear reduction following exposure (during post and follow-up) as a measure of therapeutic *outcome*. Habituation-based and inhibitory learning-based models therefore focus on fear reduction, the difference being that, in the former, fear reduction is conceptualized as a process of change variable and an outcome and, in the latter, only an outcome. However, as theories, neither emphasize operant processes (such as avoidance) as either a mechanism or outcome of exposure therapy and, yet, operant processes are clearly of prime importance in the etiology and treatment of anxiety and OC-spectrum disorders. Theories of emotion describe fear as an amalgamation of responses across different response systems: verbal (subjective self-report), physiological (Pavlovian), and behavioral (operant; Gross, 2013; Lang, 1979). While the verbal dimension of emotion is represented by SUDS and negative expectancy ratings, and the physiological dimension by physiological measures, the behavioral (i.e., operant) dimension of emotion is conspicuously absent from the leading theories of exposure (Beckers et al., 2013).

In OCD specifically, obsessions are defined by the presence of operant avoidance (i.e., obsessions are thoughts, urges, or images that are ignored or suppressed) and compulsions are defined as operant avoidance (i.e., active attempts to regulate

obsessions). In fact, the majority of anxiety and OC-spectrum disorders include avoidance as a diagnostic criterion (APA, 2013). In addition, life functioning is included as a diagnostic criterion for almost every psychological disorder (APA, 2013), is comprised of various operant behaviors (e.g., working, attending school, and fulfilling social and familial roles), and is, ultimately, the purpose of therapy. If treatment results in decreased fear and distress, but this has no measurable impact on a client's life, it cannot really be said that therapy was a success. While it is recognized that both approaches to exposure therapy involve operant processes (Abramowitz, 2013; Foa, 2011), and Foa and Kozak (1986) state that functioning is *hypothesized* to change as result of fear reduction (p. 22), functioning is not directly targeted in either habituation- or inhibitory learning-based approaches to exposure therapy, nor are operant behaviors included in the theories underlying these approaches. By focusing only on fear reduction as the outcome of therapy, both approaches implicitly assume that a reduction in fear will lead to better life functioning (Gloster et al., 2012). However, this is not necessarily the case.

While successful fear reduction due to traditional exposure therapy has been associated with increased social and physical functioning (Moritz et al., 2005; Rufer et al., 2010; Telch, Schmidt, Jaimez, Jacquin, & Harrington, 1995), most studies have examined only unidirectional relationships between symptom severity and its ability to predict functioning. However, a small number of studies have examined the bidirectional relationships between anxiety symptom severity and functioning. Using a cross-lagged panel design, Brown et al. (2015) found that, following treatment of anxiety disordered individuals with CBT, changes in functioning predicted subsequent changes in anxiety symptom severity to the same degree that changes in symptom severity predicted

subsequent changes in functioning. Similarly, using bivariate latent difference score modeling, Gloster et al. (2014) found that the sequence in which changes in one variable affected changes in subsequent variables depended on the stage of treatment during a course of CBT for panic disorder. Across all phases of treatment, agoraphobic avoidance predicted subsequent changes in panic and agoraphobic symptom severity, while symptom severity predicted subsequent changes in agoraphobic avoidance. During *in vivo* exposure, levels of psychological flexibility (i.e., the ability to change or persist in behavior when doing so serves valued ends; S. C. Hayes et al., 2012), which is operant behavior, predicted subsequent changes in symptom severity at post-assessment. Similar to Brown et al., Gloster et al. also found a bidirectional relationship between symptom severity and functioning, as well as psychological flexibility, across all phases of treatment, with agoraphobic avoidance and psychological flexibility predicting subsequent changes in functioning, and functioning predicting subsequent changes in agoraphobic avoidance and psychological flexibility. Finally, a bidirectional relationship between anxiety sensitivity and functioning was observed, with anxiety sensitivity at baseline predicting subsequent changes in functioning from pretreatment to posttreatment, and vice versa.

Another study by Gloster et al. (2017) used bivariate latent difference score modeling to investigate the temporal relationships between three process variables theoretically related to treatment from an ACT perspective: valued behaviors, struggle (attempts to avoid or reduce anxious thoughts and feelings), and suffering (distress about anxiety) among individuals receiving treatment for panic disorder. Process of change variables were assessed at each of eight sessions, and levels and changes in variables

were analyzed session by session, such that levels of one variable in session 1 were related to changes in another variable from sessions 1 to 2 (and so one through session 8). Results revealed that increases in valued behaviors preceded decreases in suffering, but not vice versa. In addition, levels of struggle in one session predicted change in suffering in the next session, and this relationship was bidirectional, with levels of suffering in one session also predicting changes in struggle in the next session.

As each of these studies demonstrate, the relationship between anxiety symptoms and operant processes, including avoidance and functioning, is complex and does not necessarily support the assumption within traditional CBT that a reduction in fear or distress will automatically lead to better client functioning. Focusing only on fear as the outcome of therapy is problematic for at least two other reasons as well. First, “fear” is operationalized differently by different researchers, with various researchers defining “fear” as subjective units of distress (SUDS), negative outcome expectancies, heart rate, skin conductance, or a combination of measures. It is more the rule than the exception that different outcomes are observed depending on the type of measure chosen. In addition, these differences are rarely interpreted, and the various measures are rarely related to one another. This leads to a tendency to differentially focus on those data that support a particular hypothesis, while disregarding those data that do not. It also produces difficulties when attempting to compare the results of different studies and, ultimately, to conceptual confusion within the field and a poor understanding of the mechanisms of change in exposure therapy.

A more complete understanding of the mechanisms of exposure from both an acceptance and regulation approach is critical if we hope to refine our treatments to more

heavily weight their active ingredients and ultimately achieve more effective treatment outcomes. Rather than focus on self-report and physiological indices of fear reduction as the sole mechanism (Foa & McNally, 1996) and/or the sole outcome of therapy (Craske et al., 2014), a better approach would be to include measures of operant behavior in empirical studies of exposure, to examine the relationships between operant and Pavlovian processes, and to determine the extent to which each, or a combination of each, contribute to outcomes broadly defined.

CHAPTER III

METHODS

Purpose

The purpose of the current study was to determine whether different approaches to exposure for intrusive thoughts, acceptance or regulation of distress, lead to different outcomes at the self-report, behavioral, subjective, and physiological levels of analysis and whether the two treatment approaches achieve these outcomes through different mechanisms of change. The following questions were addressed, with corresponding hypotheses below each question (see Table A1 in the Appendix for specific hypotheses for each measure):

1. Does teaching acceptance of distress versus regulation of distress during exposures lead to better self-reported outcomes for OC symptom individuals?

Hypothesis: At session 2, no differences between active conditions will be observed on measures of symptom severity, and both active conditions will show improvement over the Control condition. At session 2, the both active conditions will show less psychological inflexibility, more psychological flexibility, and more valued action than the Control condition. The Acceptance condition will show change more than the Regulation condition.

2. Does teaching acceptance of distress versus regulation of distress during exposures lead OC symptom individuals to complete more tasks or engage in fewer rituals during a behavioral avoidance test?

Hypothesis: At session 2, both active treatment conditions will complete more tasks and fewer rituals than the Control condition. Because similar previous literature

shows mixed behavioral outcomes, no hypothesis was made regarding differences between the two active conditions.

3. Does teaching acceptance of distress versus regulation of distress during exposures lead to different levels of distress (subjective and physiological) and willingness (subjective) during a behavioral avoidance test for OC symptom individuals?

Hypothesis: At session 2, no differences between active conditions will be observed on measures of distress (subjective and physiological), and both active conditions will show less distress than the Control condition. At session 2, both active conditions will show more willingness than Control, and the Acceptance condition will show more willingness than the Regulation condition.

Research Design

A pre-post between-groups design with three experimental conditions (2 x 3 mixed design) was used to address each question. Experimental conditions included: (1) acceptance of distress (Acceptance), (2) regulation of distress (Regulation), and (3) experimental control (Control). A repeated-measures design with four time points during each of two behavioral avoidance tests was nested within the 2 x 3 mixed design.

Participants and Setting

The study was approved by Utah State University's (USU) Institutional Review Board. A total of 64 participants who struggled with intrusive internal experiences (i.e., thoughts, images, urges, emotions, and physical sensations) were recruited though SONA systems, announcements in classes, and fliers at USU and from fliers, newspaper

advertisements, social media, and other online advertisements in the Logan, Utah area. Participants received psychology course credit (if offered by their instructor) and/or $30 in exchange for participation. Inclusion criteria were: (1) a total score on the Dimensional Obsessive-Compulsive Scale (DOCS) of 14 or higher or a subscale score greater than the mean of that subscale for individuals with a diagnosis of OCD, plus a determination by the researcher that the participant's experiences qualified as obsessions or intrusive thoughts; (2) access to the internet, either by smartphone or computer, in the mornings and evenings; and (3) willingness to participate in both lab-based sessions, complete homework exercises between sessions, and wear the physiological equipment for the duration of both sessions. Exclusion criteria were: (1) a heart, respiratory, or neurological condition which would be likely to affect the physiological data collected and (2) current or past participation in a full course of exposure therapy. No participants meeting inclusion criteria were excluded from the study. Participants completed the in-session components of the study in an office-sized room (4.2 x 2.4 meters) at Utah State University, and they completed the homework component of the study at home on their own using either a smartphone or computer with access to the internet.

Materials and Apparatus

Self-Report Measures

All self-report measures were delivered and completed online using Qualtrics, an online survey platform (Qualtrics, Provo, UT).

Demographics questionnaire. Participants were asked to complete a questionnaire assessing basic demographic variables such as age, race, gender, religion,

level of education, and level of household income, as well as any previous mental health diagnoses and/or treatment.

Dimensional Obsessive-Compulsive Scale (DOCS). The DOCS (Abramowitz et al., 2010) is a 20-item self-report questionnaire that assesses symptoms of obsessive-compulsive disorder across four symptom dimensions corresponding to four subscales: Concerns about Germs and Contamination; Concerns about being Responsible for Harm, Injury, or Bad Luck; Unacceptable Thoughts; and Concerns about Symmetry, Completeness, and the Need for Things to be “Just Right.” The DOCS asks individuals to rate their experiences with thoughts and behaviors related to these OCD dimensions over the past month on a Likert scale from 0 to 4, with higher numbers representing greater levels of symptoms (possible range = 0 to 80). A clinical cutoff score of 18 is used to identify individuals with a diagnosis of OCD from those with no diagnosis (Abramowitz et al., 2010). For the purposes of this study, the DOCS was adapted to reflect the timescales of the study, asking for participants to rate their experiences over the past week (for pre- and post-treatment assessments) and over the past day (for daily diary assessments). In the current sample, internal consistency of the DOCS was $\alpha = 0.94$.

Obsessive-Compulsive Inventory-Revised (OCI-R). The OCI-R (Foa, Huppert, et al., 2002) is an 18-item self-report questionnaire that assesses the level of distress caused by symptoms of OCD over the past month. The OCI-R comprises six subscales: Checking, Hoarding, Neutralizing, Obsessing, Ordering, and Washing. Items are rated on a 5-point Likert scale from 0 (*not at all*) to 4 (*extremely*), with higher scores indicating greater distress (possible range = 0 to 72). A clinical cutoff score of 21 is used to identify individuals with a diagnosis of OCD from nonanxious individuals. For the purposes of

this study, the OCI-R was adapted to ask about distress over the past week. In the current sample, internal consistency of the OCI-R was α = 0.93.

Acceptance and Action Questionnaire-II (AAQ-II). The AAQ-II (Bond et al., 2011) is a 7-item self-report questionnaire that assesses psychological inflexibility. Individuals are asked to rate how true each statement is for them on a Likert scale from 1 (*never true*) to 7 (*always true*), with higher scores representing greater levels of psychological inflexibility (possible range = 7 to 49). A cutoff range of 24 to 28 has been used to identify individuals experiencing psychological distress. The AAQ-II is a valid measure and has shown good test-retest reliability (r = 0.79 - 0.81) (Bond et al., 2011). In the current sample, internal consistency of the AAQ-II was α = 0.94.

Comprehensive Assessment of Acceptance and Commitment Therapy Processes (CompACT). The CompACT (Francis, Dawson, & Golijani-Moghaddam, 2016) is a 23-item self-report questionnaire that assesses general acceptance and commitment therapy (ACT) processes of change. Individuals rate their agreement with various statements on a 7-point Likert scale from 0 (*strongly disagree*) to 7 (*strongly agree*). The CompACT clusters ACT's traditional six processes of change into three dyadic processes, corresponding to three subscales: openness to experience (OE), behavioral awareness (BA), and valued action (VA). The total CompACT score represents psychological flexibility, with higher scores indicating greater flexibility (possible range = 0 to 161). In the current sample, internal consistency of the CompACT was α = 0.92.

Valued Living Questionnaire (VLQ). The VLQ (Wilson, Sandoz, Kitchens, & Roberts, 2010) is a 20-item self-report questionnaire assessing valued living. Using 10

commonly valued life domains (e.g., family relations, education, spirituality), respondents rate how important each valued domain is to them and how consistent their actions have been with respect to this value on two Likert scales of 1 (*not at all important* or *not at all consistent*) to 10 (*extremely important* or *extremely consistent*). For each valued domain, the VLQ results in an importance subscore, a consistency subscore, and a composite score (the product of importance and consistency). A total VLQ score is calculated by averaging the 10 domain composite scores (possible range = 10 to 100). Higher VLQ scores indicate that individuals are living more consistently with values that they find personally meaningful. In the current sample, internal consistency of the VLQ was $\alpha = 0.90$.

Personal Reactions to the Rationales (PRR). The PRR questionnaire (Addis & Carpenter, 1999) assesses the degree to which individuals perceive that an intervention will help them with their psychological struggle. Five questions, adapted for use with intrusive thoughts (e.g., "To what extent do you think that this strategy would help you learn effective ways to cope with your intrusive thoughts?"), are rated on a Likert scale from 1 (*not at all*) to 7 (*extremely*). Higher scores represent a belief that the intervention would be more helpful for dealing with intrusive thoughts (possible range = 5 to 35). In the current sample, internal consistency of the PRR was $\alpha = 0.91$.

Patient EX/RP Adherence Scale, item B (PEAS-B). The PEAS (Simpson et al., 2010) is a 3-item questionnaire that assesses patient adherence to between-session exposures and response prevention in exposure and response prevention (ERP) therapy. There are two forms: the therapist-rated and the self-report. For this study, only item B of the self-report, "How well did you do in the exposures you attempted?" was

administered. Item B is rated on a 7-point scale (1 = *I refused*, 7 = *Excellent*), with higher numbers indicating greater adherence to the assigned exposure exercise.

Psychophysiological Apparatus, Recording, and Data Extraction

All physiological data were collected using a Biopac MP150 system and processed with AcqKnowledge v4.4 software (Biopac Systems, Inc., Santa Barbara, CA). Respiration, electrodermal activity, and electrocardiographic activity were continuously recorded during the two Behavioral Avoidance Tests (BATs), beginning and ending with 5-minute rest periods (baseline and cooldown), and during the 30-minute exposure or control task. All equipment was placed on participants by a trained experimenter. Participants were asked to wear this equipment throughout sessions 1 and 2 (approximately 2 hours and 1 hour, respectively). Respiration was recorded using a Biopac RSP100C amplifier connected to a strain gauge transducer stretched around participants' upper chest, over their clothing. Respiration signals were digitized at 2000 Hz and subjected to a 1 Hz low-pass filter during data acquisition.

Electrodermal activity was recorded using a Biopac EDA100C amplifier. Two 11-mm disposable Ag-AgCl adhesive electrodes were attached via wired leads to the volar surface of the distal phalanges of the first and second fingers of the non-dominant hand. A 0.5% saline isotonic gel was used between the skin and the electrodes, and the electrodes were secured with tape. Prior to electrode placement, participants were asked to clean and dry their hands using soap and water in the restroom. Signals were digitized at 2000 Hz and subjected to a 10 Hz low-pass filter during data acquisition, then resampled offline at 62.5 Hz prior to analysis. Tonic and phasic signals were separated

using the smoothing baseline removal method, and nonspecific skin conductance responses (i.e., skin conductance responses that occur in the absence of the presentation of external stimuli) were automatically scored by the computer software with the threshold for response detection set to .01 microsiemens (μS). Data were then visually inspected by trained research assistants for the detection of artifacts, including those resulting from irregular breathing, and artifacts were manually removed as recommended by (Society for Psychophysiological Research Ad Hoc Committee on Electrodermal Measures, 2012).

In order to obtain a measure of mean skin conductance level that was unaffected by the presence of skin conductance responses, the phasic signal was subtracted from tonic signal. Frequency of nonspecific skin conductance responses and mean skin conductance level were extracted in 5-second bins (epochs).

A live measure of heart rate was obtained by recording electrocardiographic activity using a Biopac ECG100C amplifier. Two 11-mm Ag-AgCl disposable adhesive electrodes were attached via wired leads to participants' chests in a modified Lead II configuration. Electrode gel was used to improve signal conductance, and signals were digitized at 2000 Hz and subjected to a 1 Hz high-pass filter during data acquisition. Heart rate data were visually inspected by trained research assistants and artifacts were manually removed. Mean heart rate was extracted in 5-second epochs.

Behavioral Avoidance Test Measures

Behavioral measures. The Behavioral Avoidance Test (BAT) consisted of four individualized 2-minute tasks in order of increasing distress, as rated by the participant on

a Subjective Units of Distress (SUDS) scale (0 = *no distress*, 100 = *extreme distress*). Participants were told that they were free to refuse any task or to stop in the middle of a task if they did not want to continue. Tasks not completed for the full 2 minutes were considered incomplete. Although participants were asked not to ritualize or distract themselves during the tasks, immediately following each task the experimenter asked the participant how many times they did so, including overt and covert rituals and any purposive distraction. Two behavioral measures were computed: the number of tasks completed (range = 0 to 4) and the number of rituals performed (range = 0 to infinity).

Subjective measures. Participants rated their SUDS at the end of a 5-minute baseline rest period, at the end of each BAT task, and at the end of a 5-minute cooldown rest period. Higher scores indicate greater subjective distress. Willingness to experience distress was rated at the same time points on a 0 – 100 scale, by asking the question, "How much are you fighting against your anxiety and intrusive thoughts?" and then reverse coding the values. Higher scores indicate more willingness to experience distress. Both SUDS and willingness were rated using a visual analogue scale (VAS) placed in front of the participants with anchors at 0 ("not at all"), 50 ("moderately"), and 100 ("extremely").

Participants were also asked to rate the level of various emotions they experienced during the BAT in order to help determine which emotions were indicated by the psychophysiological measures. At the end of the BAT, participants were asked, "Please rate the maximum level of each emotion you felt during all the tasks" on a 0 – 100 Emotion Rating Scale (0 = *not at all*, 100 = *extremely*) (ERS; based on Gross, 1998). Emotions included: anger, peace, confusion, anxiety, embarrassment, disgust, pleasure,

shame, fear, pride, guilt, stress, happiness, sadness, and frustration.

Psychophysiological measures. Frequency of nonspecific skin conductance responses was calculated by summing the responses within each BAT task and analyzed at the task level. Skin conductance level and heart rate were analyzed at the epoch level. Skin conductance level was log transformed in order to normalize the distribution of the data, as recommended by the Society for Psychophysiological Research Ad Hoc Committee on Electrodermal Measures (2012). In order to equate the length of baseline with the length of each task, baseline was calculated as the final 2 minutes of the 5-min baseline period for each physiological measure.

Exposure Process Measures

Behavioral measures. Immediately following the exposure, participants rated their adherence to the exposure treatment using item B of the PEAS. Only participants in the Acceptance and Regulation conditions completed this measure; those in the Control condition did not.

Subjective measures. Participants were asked to rate their SUDS and willingness at the onset, offset, and every 5 minutes during the exposure (for the Acceptance and Regulation conditions) or video (for the Control condition). Participants were also asked to complete the ERS at the offset of the exposure or video.

Psychophysiological measures. Frequency of nonspecific skin conductance responses, skin conductance level, and heart rate were averaged across 5-second epochs of the exposure/video.

Daily Exposure Measures

Behavioral measures. If participants ended the at-home exposure exercise before 10 minutes elapsed, this was recorded by Qualtrics software and used as a binary behavioral measure of avoidance. Completed time of the exposure exercise was also recorded, as well as number of exposure exercises attempted (out of six total).

Subjective measures. At the onset and offset of each daily exposure exercise or video, Qualtrics prompted participants to rate their SUDS and Willingness using a slider scale within the online survey. At the end of each exposure exercise or video, participants completed the ERS and individuals in the treatment conditions rated their adherence to the exposure exercise using item B of the PEAS.

Daily Diary Measure

Each evening, participants completed a daily diary assessment, the DOCS, adapted to address experiences over the previous day. Questions were delivered via Qualtrics and were accessible through clicking on a URL on either a smartphone or a computer.

Treatment Conditions

Both active treatment conditions (Acceptance and Regulation) received treatment rationales based on those used by Arch, Twohig, Deacon, Landy, and Bluett (2015), which were found to be significantly more credible than a simple description of exposure therapy alone. Each rationale began with a description of exposure therapy.

Acceptance. The Acceptance condition received a treatment rationale combining the radical acceptance, fear tolerance, and cognitive defusion rationales from Arch et al.

(2015). It explained that anxiety and intrusive thoughts are normal parts of life, and exposure exercises help individuals learn to treat anxiety in a more welcoming way and to see intrusive thoughts as just thoughts. Further, exposure exercises should be completed without the use of strategies to reduce anxiety and, with practice, one can learn to live with anxiety and be much less affected by it. Participants were then told that every time their anxiety level dropped during an exposure exercise, they would be encouraged to push themselves to try something a little harder. By keeping anxiety levels high throughout the exercise, they would have the opportunity to practice what it is like to have anxiety and still live their lives.

Regulation. The Regulation condition received a treatment rationale based on the fear control/relaxation and thought testing rationales from Arch et al. (2015). It explained that anxiety can be managed so it is not such a big part of life. It described exposure exercises as a way of learning to decrease anxiety through the use of strategies such as deep breathing and challenging irrational thoughts, as well as opportunities to see that if one waits long enough in an anxiety-inducing situation, anxiety will eventually reduce. Participants were told that they would begin exposure exercises with a task that makes them anxious and continue with that task until their anxiety decreases. This would help them to learn that they can manage their anxiety and, given enough time, it will decrease on its own.

Control. As the Control condition was intended to control for time spent completing tasks in the lab and at home between sessions, participants in this condition did not receive a treatment rationale, and no mention was made of exposure. Individuals in the Control condition watched a 30-minute video unrelated to psychology. They were

told that the researchers are interested in the ways in which watching this video affects them.

Procedure

Initial Online Assessment

Students who were interested in the study signed up through SONA Systems for research participation at USU or called or emailed the researcher. Individuals were directed to complete a brief online screening questionnaire, the DOCS, delivered via Qualtrics. Individuals who called the researcher were asked the screening questions over the phone. Those individuals who scored 14 or higher on the DOCS, or who scored above the mean for individuals with an OCD diagnosis on any of the DOCS subscales, were prompted to provide contact information if they were interested in participating in the study. Data from the screening questionnaire was not used in any analysis. Eligible participants were contacted via telephone, text, and/or email by the researcher. Participants were asked about their distressing thoughts in order to determine whether these experiences qualified as intrusive. They were then given a description of the physiological equipment (see Psychophysiological Measures) and asked whether they were willing to wear this equipment for two sessions and to have the equipment placed on them by an experimenter. Participants were asked whether they had a diagnosed heart, respiratory, or neurological condition; whether they were currently receiving treatment or had ever received treatment for a psychological disorder and, if so, whether the treatment included exposure therapy; and whether they were currently pregnant (females only). They were then asked whether they had access to the internet, via a computer or

smartphone, during the mornings and evenings and whether they agreed to attend two laboratory-based sessions and complete homework exercises and assessments during the six days between sessions. Willing participants meeting inclusion criteria and not meeting exclusion criteria were invited to participate in the study.

Session 1

Once in the laboratory, an experimenter explained the study procedures and asked if the participant had any questions. After answering questions, participants completed an informed consent form that detailed the study procedures and risks. They were then asked to wash their hands in the bathroom with soap and water, and they were fitted for the psychophysiological equipment (see Psychophysiological Measures). Participants were asked to wear this equipment during an acclimation period of approximately 15 minutes in which they completed a demographics questionnaire and the following self-report questionnaires (see Self-Report Measures) delivered on a computer via Qualtrics: DOCS, OCI-R, AAQ-II, CompACT, and VLQ. Upon completion of the questionnaires, participants received instructions for, and completed, the BAT.

Behavioral avoidance test (BAT). The BAT, based on Steketee, Chambless, Tran, Worden, and Gillis (1996), took approximately 30 minutes to complete. Based on a short interview, participants identified their most distressing thoughts, associated compulsions, and common triggers. For example, a participant who struggles with distressing thoughts about contamination and germs may engage in compulsive hand washing and identify the act of opening a door (and touching the doorknob) as a trigger. As another example, a participant with intrusive thoughts related to what they perceive as

inappropriate sexual behavior may engage in compulsions such as praying repeatedly or avoiding interactions with individuals who they find attractive. A trigger in this case may be a picture of an attractive person. The participant and experimenter then created a fear hierarchy (i.e., a list of triggering situations) of between 5 and 10 items, and the participant gave a SUDS rating for each step of the hierarchy. Participants were reminded that they were not required to complete all the items on the hierarchy and, therefore, to include some items that would be very challenging for them. From this hierarchy, four items with a SUDS ranging between 60 and 100 were selected for the BAT.

Participants then completed the four tasks, each for 2 minutes, in order of increasing difficulty, as determined by their SUDS ratings. Throughout the BAT, psychophysiological responding was continuously recorded, beginning with a 5-minute baseline period and ending with a 5-minute cooldown period. Participants rated their current SUDS and willingness (see Subjective Measures) at the onset and offset of each task and, at the end of each task, the experimenter asked how many times participants ritualized or distracted themselves during the task. The experimenter then asked if the participant would like to continue to the next task or to stop.

After completing the BAT, participants were randomly assigned to one of three conditions: Acceptance, Regulation, or Control. Those in the Acceptance and Regulation conditions mutually agreed upon an exposure task with the experimenter, based on their hierarchy, to be completed during exposure treatment (see Treatment). Tasks were chosen based upon a SUDS rating of approximately 70. Participants in the Control condition did not choose an exposure task.

Treatment. Participants in the Acceptance and Regulation conditions received

the treatment rationale for their respective condition (see Treatment Rationales) and instructions on completing the exposure exercise. They then completed an exposure treatment of 30 minutes. Participants in the Control condition watched a video for 30 minutes and did not receive a treatment rationale. Psychophysiological responding was recorded continuously throughout treatment. Participants began by rating their current SUDS and willingness, and they were asked to rate them again every 5 minutes throughout the exposure or video.

Acceptance condition. In the Acceptance condition, if a participant's SUDS rating fell below 60, the experimenter instructed the participant to further engage in the exposure task. If this did not increase SUDS, another task from the participants' hierarchy was chosen, with the aim of ensuring that SUDS remained at or above 60. After 30 minutes, participants were informed that the exposure exercise was complete.

Regulation condition. In the Regulation condition, if SUDS rating fell below 60 within the first half of the exposure, the experimenter instructed the participant to further engage in the exposure task. If SUDS reached 60 within the second half of the exercise, the experimenter instructed the participant to continue as they were, with the aim of continuing to decrease SUDS during the last 15 minutes of the exercise and ending the exercise with a SUDS below 40. The exposure exercise ended after 30 minutes.

Control condition. In the Control condition, participants watched a 30-minute video about the geology and history of Colorado. Participants were asked for their SUDS and willingness ratings every 5 minutes throughout the video.

Immediately following treatment or video, all participants rated their current SUDS and willingness. Participants then completed the PEAS-B and the PRR delivered

on a computer via Qualtrics. Following this, participants were given instructions for the homework to be completed throughout the following six days. Homework included two Qualtrics surveys that delivered the daily exposure exercises or video and the daily diary. Participants then had the opportunity to ask questions and received $20 in cash for their participation in session 1.

One-Week Homework and Daily Diary Assessment

Daily exposure exercises. As homework during the 6 days between sessions 1 and 2, participants in the Acceptance and Regulation conditions were asked to complete 10-minute daily exposure exercises each day. Participants were told to base the exposures on the same intrusive thought used during exposure treatment at session 1. Instructions for completing the exposure, including a reminder to use skills learned in session, were delivered via a Qualtrics survey with a built-in 10-minute timer, which could be accessed through clicking on a URL on either a smartphone or a computer. Participants in the Control condition were asked to watch a 10-minute videos about geology each day, also accessed through clicking on a URL. The URL was included in a daily prompt, send via text or email.

Session 2

One week after session 1, participants returned to the lab to complete a battery of post-treatment assessments and the BAT. Participants were first fitted for psychophysiological equipment (see Psychophysiological Measures) and asked to wear the equipment while completing the following self-report questionnaires (see Self-Report

Measures) delivered on a computer via Qualtrics: DOCS, OCI-R, AAQ-II, CompACT, and VLQ. Upon completion of the questionnaires, participants received brief reminder instructions regarding the BAT and then completed a post-treatment BAT using the same four tasks they used during session 1. BAT procedures were identical to session 1. Participants were then debriefed, thanked for their participation, and received $10 in cash for their participation in session 2.

Data Analytic Strategy

Preliminary analyses included a series of one-way ANOVAs to determine the degree to which assigned conditions differed on demographic variables and session 1 scores of self-report questionnaires, behavioral and subjective BAT measures, and physiological BAT measures. Treatment usefulness (PRR) and patient adherence to the exposure (PEAS item B) were compared between active conditions (Acceptance and Regulation conditions only) with one-way ANOVAs.

Figure 1 presents the study's nested measurement design, with the three levels at which the different measures were analyzed (from lowest to highest): epoch nested within task, session, and participant; task nested within session and participant; and session nested within participant. Skin conductance level and heart rate were analyzed at the epoch level; the number of rituals performed during the BAT, SUDS ratings, willingness ratings, and the frequency of nonspecific skin conductance responses were analyzed at the task level; and self-report measures and the number of BAT tasks completed were analyzed at the session level. Exposure and homework measures were not analyzed.

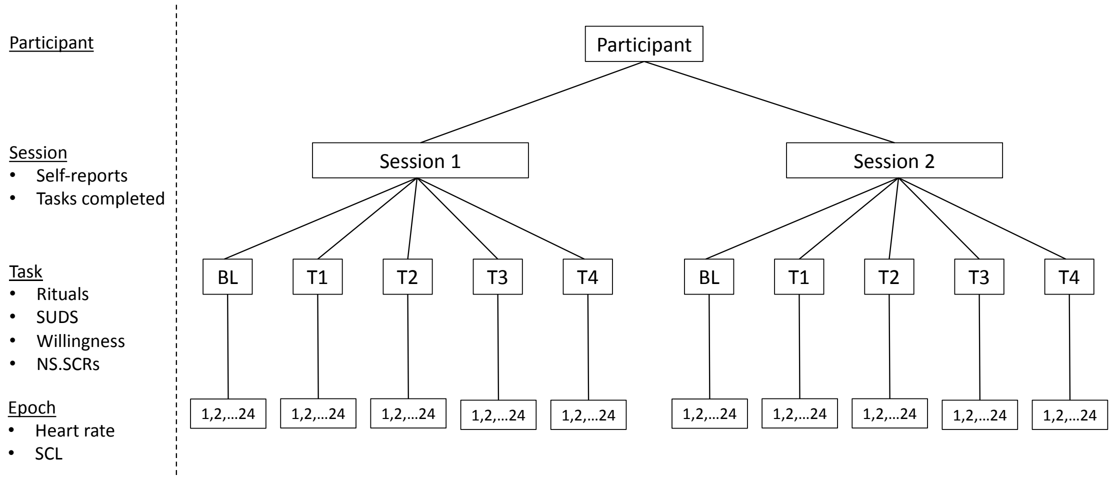

Figure 1. Nested measurement design with measures analyzed at each level (left-hand column).

Analytic strategy is stated below each research question.

1. Does teaching acceptance of distress versus regulation of distress during exposures lead to better self-reported outcomes for OC symptom individuals?

In order to evaluate the impact of treatment condition on session 2 self-reported outcomes, a series of linear regression analyses were conducted with session 2 scores as the dependent variable, condition as the independent variable, and session 1 scores as a covariate for each self-report measure. In order to obtain a direct comparison of the Acceptance and Regulation conditions, a priori contrasts were performed by recoding the condition variable with Regulation as the reference category and re-running the analyses. The standardized mean difference was used as a measure of effect size.

2. Does teaching acceptance of distress versus regulation of distress during exposures lead OC symptom individuals to complete more tasks or engage in fewer rituals during a behavioral avoidance test?

Density plots of the number of BAT tasks completed by each condition during sessions 1 and 2 of the BAT showed negatively skewed distributions (a ceiling effect).

Because the values of this variable ranged from 0 to 4, a beta regression for bounded proportions was conducted with the number of tasks completed represented as a proportion of total possible tasks following the formula presented by Smithson and Verkuilen (2006). Proportion of tasks completed at session 2 was the dependent variable, condition was the independent variable, and session 1 scores (also calculated as a proportion of total possible tasks) were included as a covariate. A contrast in which condition was recoded with Regulation as the reference category was performed in order to directly compare the effects of the Acceptance with the and Regulation conditions.

Visual inspection of the distributions of mean rituals performed by each condition during sessions 1 and 2 of the BAT showed positively skewed for this count variable. Therefore, in order to analyze the within-participant effects of session and task and the between-participant effect of condition, a Poisson generalized linear mixed effects model was conducted with the number of rituals performed at each task of the BAT at both sessions as the time-varying outcome. Because participants completed varying numbers of tasks at each session, and tasks increased in difficulty as they progressed, rituals were compared within participants using the minimum number of tasks completed at either session by that participant. That is, if participant X completed two tasks at session 1 and three tasks at session 2, rituals were analyzed only for the first two tasks of both sessions. This allowed a comparison of rituals that occurred during similarly difficult tasks, and is similar to the yoked procedure used by Steketee et al. (1996). Rituals were measured at the task level.

Models were fit in the following manner: first, a null model (Model 0) was fit to the data with the number of rituals performed at each task as the time-varying outcome

and a design-driven random effects structure (Barr, Levy, Scheepers, & Tily, 2013) that included random intercepts for sessions nested within participants as well as random slopes of condition by participant and session. Fixed effects were then added in the following order: session (Model 1), task (Model 2), and condition (Model 3). Model 4 added the session by condition interaction, and Model 5 added the task by condition interaction. See Figure 2 for model building steps. For each model, the statistical significance of the estimates was determined via Wald tests. If a more complicated model

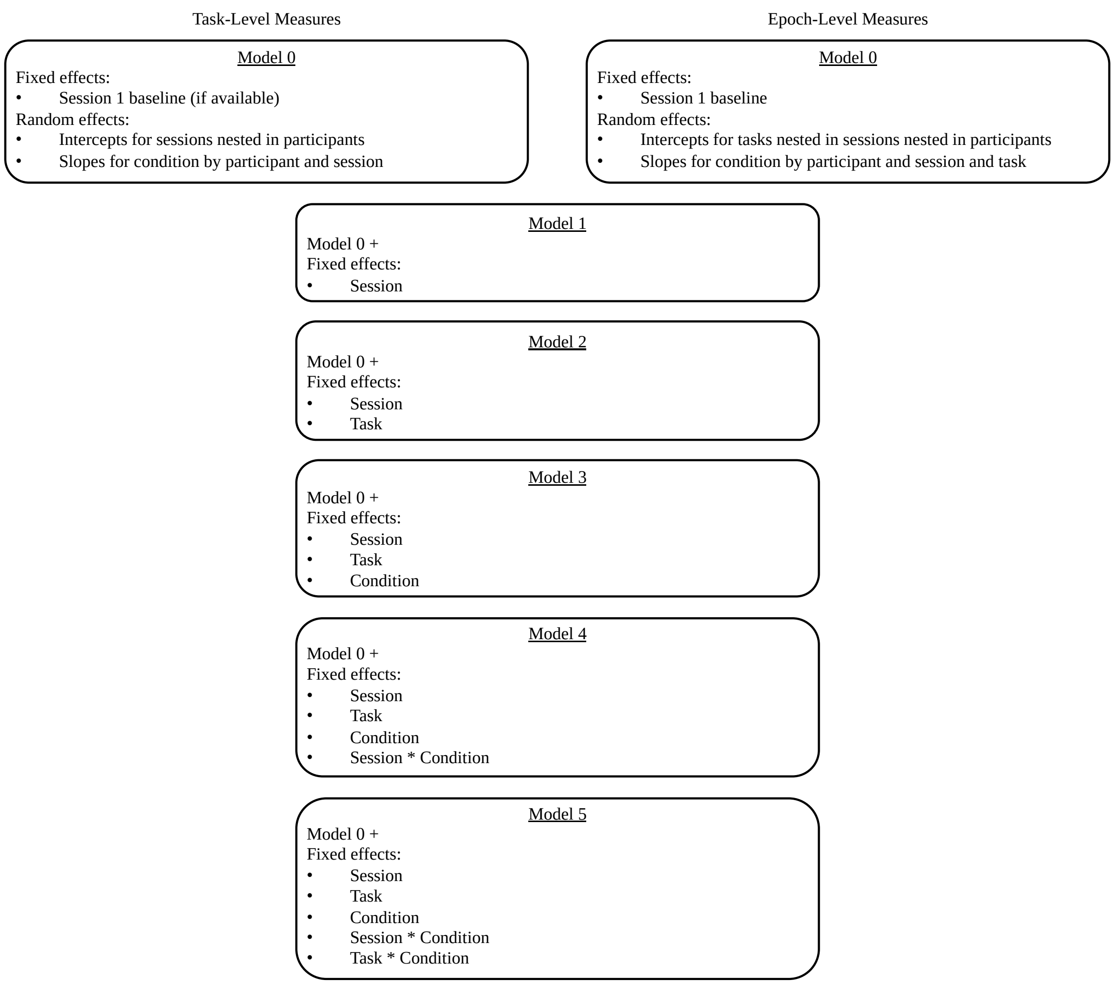

Figure 2. Model building steps for linear mixed effects and generalized linear mixed effects models.

did not add significant predictors, it was dropped. The most parsimonious model with the most significant predictors was retained. If the inclusion of condition or an interaction including condition significantly improved model fit, the best-fitting model was fit again with Regulation recoded as the reference category in order to contrast the Acceptance and Regulation conditions directly. For this research question, the condition by session interaction was of primary interest.

3. Does teaching acceptance of distress versus regulation of distress during exposures lead to different levels of distress (subjective and physiological) and willingness (subjective) during a behavioral avoidance test for OC symptom individuals?

Linear mixed-effects models were used to analyze the within-participant effects of session and task and the between-participant effect of condition on distress variables (SUDS ratings, frequency of nonspecific skin conductance responses, skin conductance level, and heart rate) and the willingness variable (willingness ratings). Similar to the measure of rituals described earlier, each outcome was compared within participants using the minimum number of tasks completed at either session by that participant. Outcomes were time-varying, with SUDS, frequency of nonspecific skin conductance responses, and willingness measured at the task level and skin conductance level and heart rate measured at the epoch level.

Models were fit for each outcome in the following manner: first, a null model (Model 0) was fit to the data with the time-varying outcome as the dependent variable and the session 1 baseline score (calculated as the last 2 minutes of baseline) as a fixed effect covariate. For outcomes measured at the task level, a maximal design-driven random effects structure was specified that included random intercepts for sessions

nested within participants and by participant and session random slopes for the effect of condition. For outcomes measured at the epoch level, the random effects structure included random intercepts for task nested within session nested within participants and random slopes of condition by participant, session, and task. The following fixed effects were then added to this model: session (Model 1), task (Model 2), condition (Model 3), the session by condition interaction (Model 4), and the task by condition interaction (Model 5). See Figure 2 for model building steps. Models were estimated using maximum likelihood estimation and compared for fit using likelihood ratio tests. The best-fitting model was retained, and statistical significance of the coefficients were determined via Wald tests. If the inclusion of condition or an interaction including condition significantly improved model fit, the best-fitting model was fit again with Regulation recoded as the reference category in order to contrast the Acceptance and Regulation conditions directly. For this research question, the condition by session interaction was of primary interest.

CHAPTER IV

RESULTS

Preliminary Analyses

All statistical analyses were completed with R (R Core Team, 2016) in RStudio (RStudio Team, 2016) using the tidyverse (Wickham, 2017), furniture (Barrett, Brignone, & Laxman, 2018), texreg (Leifeld, 2013), betareg (Cribari-Neto & Zeileis, 2010), lme4 (Bates, Mächler, Bolker, & Walker, 2015), and glmmTMB (Brooks et al., 2017) packages. Demographic characteristics of the full sample and each condition are presented in Table 1. In general, participants were late college-aged, with a mean age of 21.9 years (*SD* = 6.7) and a range from 18 to 64 years. Of the total sample of 64 participants, 65.6% were female, 29.7% were male, and 4.7% identified their gender as "other." The majority of participants were White (87.5%) and unmarried (73.4%). Those currently receiving treatment in the form of counseling, psychotherapy, or psychotropic medication comprised 37.5% of the sample. There were no significant between condition differences in age, gender, race, marital status, or current treatment status (*p*s > .05).

Scores on self-report measures for sessions 1 and 2 are presented in Table 2. Mean session 1 scores on the DOCS, OCI-R, and AAQ-II each exceeded clinical cutoffs, suggesting that, in general, participants were experiencing clinically significant OCD symptoms and psychological inflexibility at the time they entered the study. There were no statistically significant between-group differences on session 1 scores of self-report measures (*p*s > .05).

Table 1

Demographic Characteristics in the Full Sample and By Assigned Condition with Between Condition Tests

	Full sample $N = 64$			Condition: Control $n = 21$			Condition: Acceptance $n = 23$			Condition: Regulation $n = 20$				
Characteristic	*N*	*SD*	%	*N*	*SD*	%	*N*	*SD*	%	*N*	*SD*	%	F or χ^2	*p*
Mean age	21.9	6.7		22.7	5.6		20.0	2.3		23.1	10.1		1.36	0.263
Gender													5.40	0.249
Male	19		29.7	9		42.9	5		21.7	5		25		
Female	42		65.6	10		46.7	17		73.9	15		75		
Other	3		4.7	2		9.5	1		4.3	0		0		
Race													10.79	0.214
Asian	1		1.6	1		4.8	0		0	0		0		
Hispanic	4		6.2	2		9.5	0		0	2		10		
Native	1		1.6	0		0	1		4.3	0		0		
White	56		87.5	18		85.7	22		95.7	16		80		
Mixed	2		3.1	0		0	0		0	2		10		
Marital status													5.15	0.524
Single	47		73.4	14		66.7	17		73.9	16		80		
Married	13		20.3	6		28.6	4		17.4	3		15		
Divorced	1		1.6	1		4.8	0		0	0		0		
Engaged	3		4.7	0		0	2		8.7	1		5		
Current treatment[a]													0.08	0.960
Yes	24		37.5	8		38.1	9		39.1	7		35		
No	40		62.5	13		61.9	14		60.9	13		65		

[a] Counseling, psychotherapy, or psychotropic medication

Table 2

Means and Standard Deviations of Self-Report Outcome Measures at Sessions 1 and 2 in the Full Sample and by Assigned Condition with Session 1 Between Condition Tests

			Condition							
	Full sample		Control		Acceptance		Regulation			
Session/variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*
Session 1	*N* = 64		*n* = 21		*n* = 23		*n* = 20			
Session 2	*N* = 59		*n* = 19		*n* = 20		*n* = 20			
DOCS										
Session 1	26.5	11.0	25.9	11.0	25.8	12.1	28.1	9.8	0.29	.753
Session 2	20.2	12.0	24.8	10.9	16.4	11.1	19.6	13.0		
OCI-R										
Session 1	24.6	11.4	23.8	9.7	22.3	11.7	27.9	12.6	1.39	.257
Session 2	19.7	12.2	22.2	10.5	16.4	12.2	20.6	13.1		
AAQ-II										
Session 1	32.0	7.3	32.8	8.1	30.4	7.2	33.0	6.8	0.83	.442
Session 2	31.3	8.7	33.1	8.9	30.4	8.6	30.6	9.0		
CompACT										
Session 1	63.7	14.6	63.9	15.6	62.8	12.5	64.7	16.5	0.09	.918
Session 2	70.9	17.9	65.2	14.9	74.8	19.8	72.4	18.1		
VLQ										
Session 1	49.8	18.3	47.6	21.9	51.3	17.7	50.4	15.5	0.24	.788
Session 2	51.5	17.0	49.7	20.0	52.9	17.0	51.8	14.2		

Note. DOCS = Dimensional Obsessive-Compulsive Scale; OCI-R = Obsessive Compulsive Inventory – Revised; AAQ-II = Acceptance and Action Questionnaire-II; VLQ = Valued Living Questionnaire, CompACT = Comprehensive Assessment of Acceptance and Commitment Therapy Processes.

Summary statistics for behavioral and subjective BAT measures during sessions 1 and 2 are presented in Table 3. In order to test for between-group differences in the number of rituals performed during the BAT, rituals were averaged across tasks (up to four timepoints, depending on the number of tasks that were completed). There were no statistically significant between-group differences on the number of BAT tasks completed or the number of rituals performed during the session 1 BAT (*p*s > .05). Session 1 SUDS

Table 3

Means and Standard Deviations of Behavioral and Subjective BAT Measures at Sessions 1 and 2 in the Full Sample and by Assigned Condition with Session 1 Between Condition Tests

	Full sample		Condition: Control		Acceptance		Regulation			
Session/varriable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*
Session 1	*N* = 64		*n* = 21		*n* = 23		*n* = 20			
Session 2	*N* = 60		*n* = 20		*n* = 20		*n* = 20			
BAT tasks										
Session 1	3.0	1.3	2.9	1.3	3.1	1.3	2.9	1.4	0.14	.867
Session 2	3.1	1.3	3.0	1.3	3.2	1.1	3.0	1.4		
Mean BAT Rituals										
Session 1	2.0	2.9	1.6	2.0	1.9	2.4	2.6	4.1	0.51	.606
Baseline SUDS										
Session 1	31.6	21.5	26.0	22.2	34.1	21.2	34.5	21.0	1.07	.351
Baseline willingness										
Session 1	62.5	28.8	61.7	29.6	61.5	31.4	64.3	26.1	0.06	.941

Note. BAT = Behavioral Avoidance Test; SUDS = Subjective Units of Distress.

and willingness ratings at the end of the 5-minute baseline period, prior to receiving the instructions for the BAT, were compared between groups, with no statistically significant differences (*p*s > .05).

Summary statistics for sessions 1 and 2 physiological measures during the last 2 minutes of the baseline period, prior to receiving the instructions for the BAT, are presented in Table 4. Heart rate and skin conductance level were averaged across all 5-second epochs of baseline, and nonspecific skin conductance responses were summed across baseline. There were no statistically significant between-group differences (*p*s > .05) during session 1.

Table 4

Means and Standard Deviations of Physiological Measures at Session 1 Baseline in the Full Sample and By Assigned Condition with Between Condition Tests

	Full sample (N = 64)		Condition: Control (N = 21)		Condition: Acceptance (N = 23)		Condition: Regulation (N = 20)			
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*
NS SCRs	6.6	5.0	7.3	5.9	5.8	5.1	6.8	3.9	0.50	.608
SCL	12.3	14.6	11.3	15.5	14.9	19.2	10.5	3.5	0.55	.580
Heart rate	75.9	19.4	77.8	18.1	74.1	25.7	75.9	11.7	0.20	.822

Note. NS.SCRs = Frequency of nonspecific skin conductance responses; SCL = Skin conductance level. SCL in microsiemens (µS); heart rate in beats per minute.

Manipulation Checks

Mean scores on the PRR were 26.4 (*SD* = 6.3) in the Acceptance condition and 27.9 (*SD* = 4.7) in the Regulation condition, with no between group differences, $F(1, 62) = 0.51$, $p = .483$. Thus, participants in both groups indicated that they believed the treatments would be likely to benefit them. Mean scores on item B of the PEAS were 5.2 (*SD* = 1.2) and 5.2 (*SD* = 1.1) for the Acceptance and Regulation conditions, respectively, with no between group differences, $F(1, 62) = 0.01$, $p = .914$. This suggests that participants in both active treatment conditions completed the exposure exercise as assigned with minimal compulsions or safety aids.

Self-Report Outcomes

Results of the linear regression analyses are presented in Table 5. Data for five participants were missing at session 2 because of study attrition ($n = 4$) and experimenter

Table 5

Results of Linear Regression Analyses for Self-Report Outcome Measures With A Priori Contrasts Comparing Effects of Acceptance and Regulation Conditions

Variable	*B*	*SE B*	β	*t*	*p*	Adj. R^2
DOCS						0.62
Condition (acceptance)	-7.40	2.37	-0.62	-3.11	.003**	
Condition (regulation)	-6.49	2.37	-0.54	-2.74	.008**	
Regulation-acceptance [a]	-0.91	2.35	-0.08	-0.39	.700	
Intercept	3.68	2.85	0.39	1.29	.203	
OCIR						0.67
Condition (acceptance)	-3.73	2.25	-0.31	-1.65	.104	
Condition (regulation)	-4.60	2.26	-0.38	-2.03	.047*	
Regulation-acceptance [a]	0.88	2.27	0.07	0.39	.701	
Intercept	1.16	2.55	0.21	0.45	.652	
Condition (acceptance)						0.63
Condition (acceptance)	-0.48	1.71	-0.05	-0.28	.781	
Condition (regulation)	-1.94	1.70	-0.22	-1.14	.258	
Regulation-acceptance [a]	1.46	1.69	0.17	0.87	.390	
Intercept	0.34	3.50	0.03	0.10	.923	
CompACT						0.49
Condition (acceptance)	11.00	4.10	0.61	2.68	< .010**	
Condition (regulation)	7.35	4.10	0.41	1.79	.078	
Regulation-acceptance [a]	3.65	4.05	0.20	0.90	.371	
Intercept	12.40	7.82	-0.37	1.59	.118	
VLQ						0.70
Condition (acceptance)	2.90	2.95	0.17	0.98	.330	
Condition (regulation)	1.33	2.95	0.08	0.45	.654	
Regulation-acceptance [a]	1.57	2.92	0.09	0.54	.592	
Intercept	11.22	3.88	-0.09	2.89	.005**	

Note. Each model controlled for session 1 scores. DOCS = Dimensional Obsessive-Compulsive Scale; OCIR = Obsessive-Compulsive Inventory – Revised; AAQ-II = Acceptance and Action Questionnaire – II; CompACT = Comprehensive Assessment of Acceptance and Commitment Therapy Processes; VLQ = Valued Living Questionnaire.

[a] Results of a priori contrasts with Regulation as the reference category.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

error (n = 1). The full model explained 62% of the variance in session 2 DOCS scores, adj. R^2 = 0.62, F(3,55) = 32.48, p < .001. After controlling for session 1 DOCS scores, both active treatment conditions significantly predicted session 2 DOCS scores compared to the Control condition (ps < .01). OCD symptom severity as measured by the DOCS was lower at session 2 for those in the Acceptance condition (M = 16.4, SD = 11.1) and the Regulation condition (M = 19.6, SD = 13.0) than it was for those in the Control condition (M = 24.8, SD = 10.9; see Figure 3). Effect sizes for both comparisons were medium (ES = 0.62 and 0.54, respectively). There was no statistically significant difference in the effects of the Acceptance and Regulation conditions compared to one another (p = .700).

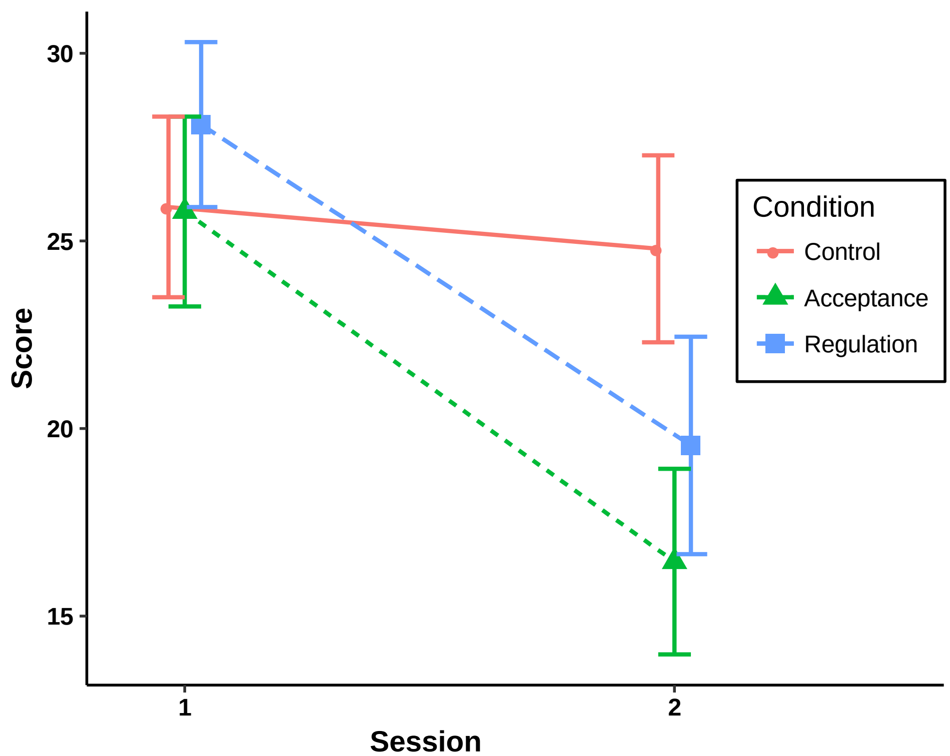

Figure 3. Mean scores on the Dimensional Obsessive-Compulsive Scale at sessions 1 and 2 in each condition (error bars represent standard error of the mean).

As measured by the OCI-R, the Regulation condition was a significant predictor of OCD symptom severity compared to the Control condition at session 2, after controlling for session 1 scores (p = .047). Participants in the Regulation condition had lower OCI-R scores at session 2 (M = 20.6, SD = 13.1) than those in the Control condition (M = 22.2, SD = 10.5) with a small effect (ES = 0.38). Participants in the Acceptance condition also had lower OCI-R scores than Control participants at session 2 (M = 16.4, SD = 12.2); however, this difference was not statistically significant (p = .104; see Figure 4). When the Regulation condition was recoded as the reference category, results showed no statistically significant difference between Acceptance and Regulation conditions (p = .701). The full model explained 67% of the variance session 2 OCI-R scores, adj. R^2 = 0.67, F(3,55) = 40.3, p < .001.

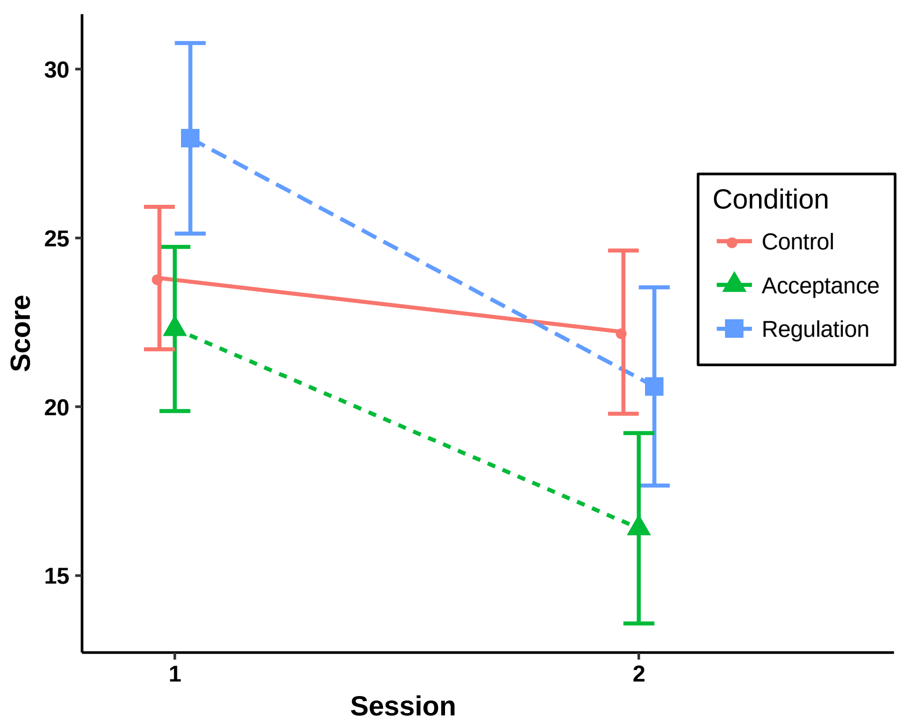

Figure 4. Mean scores on the Obsessive-Compulsive Inventory – Revised at sessions 1 and 2 in each condition (error bars represent standard error of the mean).

The regression model examining session 2 AAQ-II scores accounted for 63% of the variance, adj. $R^2 = 0.63$, $F(3,55) = 34.15$, $p < .001$. Condition was not a significant predictor of AAQ-II scores at session 2 after controlling for session 1 AAQ-II scores (*p*s > .05; see Figure 5). A second model comparing the effects of the Acceptance and Regulation conditions on session 2 AAQ-II scores was also non-significant ($p = .390$).

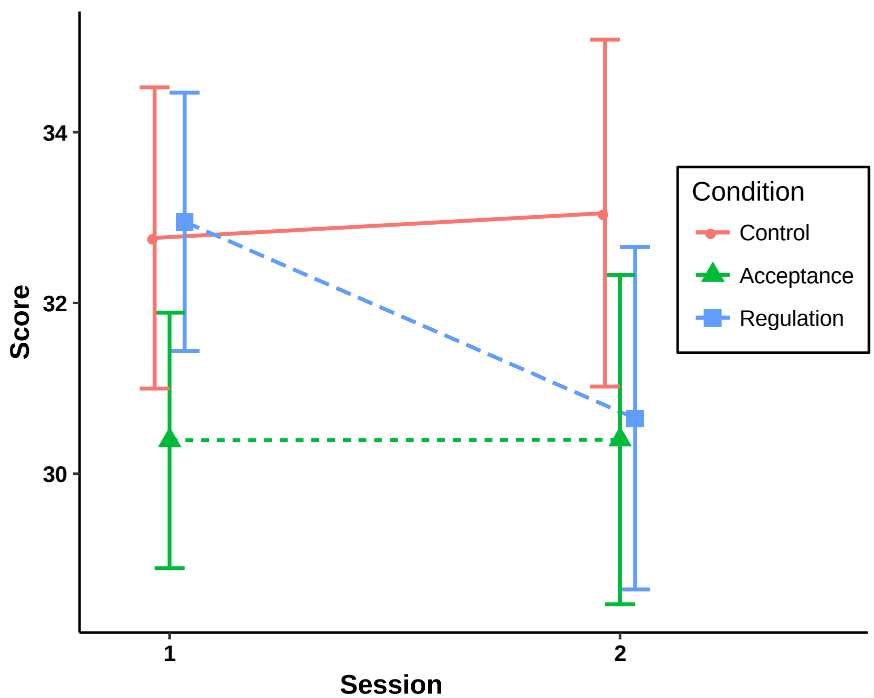

Figure 5. Mean scores on the Acceptance and Action Questionnaire – II at sessions 1 and 2 in each condition (error bars represent standard error of the mean).

Nevertheless, the Acceptance condition was a significant predictor of psychological flexibility as measured by the CompACT at session 2, after controlling for session 1 CompACT scores ($p < .01$). Those in the Acceptance condition reported greater psychological flexibility at session 2 ($M = 74.8$, $SD = 19.8$) than those in the Control condition ($M = 65.2$, $SD = 14.9$) with a medium effect ($ES = .61$). Participants in the

Regulation condition also reported greater psychological flexibility at session 2 (*M* = 72.4, *SD* = 18.1) than those in the Control condition, with the comparison trending toward statistical significance (*p* = .078; see Figure 6). When the Acceptance and Regulation conditions were compared directly, the difference was not statistically significant (*p* = .371). The full model explained 49% of the variance in session 2 CompACT scores, adj. $R^2 = 0.49$, $F(3,55) = 19.65$, $p < .001$.

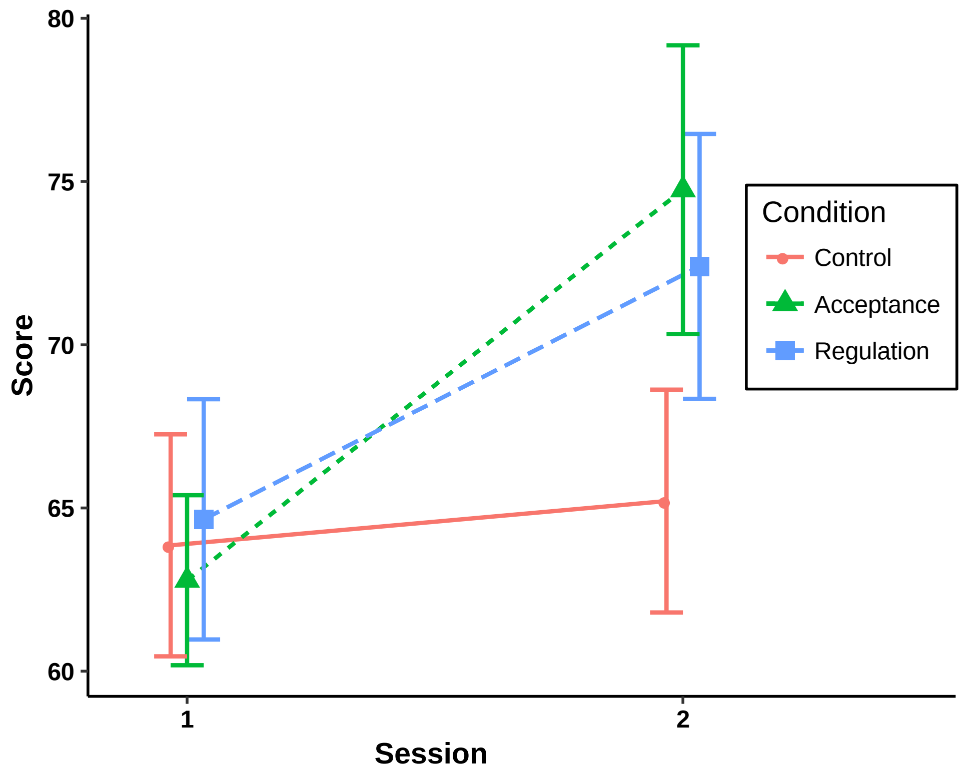

Figure 6. Mean scores on the CompACT at sessions 1 and 2 in each condition (error bars represent standard error of the mean).

The regression model examining session 2 VLQ scores explained 70% of the variance in, adj. $R^2 = 0.70$, $F(3,55) = 47.07$, $p < .001$. Session 2 VLQ scores were not significantly predicted by condition after controlling for session 1 VLQ scores (*p*s > .05;

see Figure 7). After recoding Regulation as the reference category, results indicated no significant difference in the effects of the Acceptance and Regulation conditions (*p* = .592) on VLQ scores.

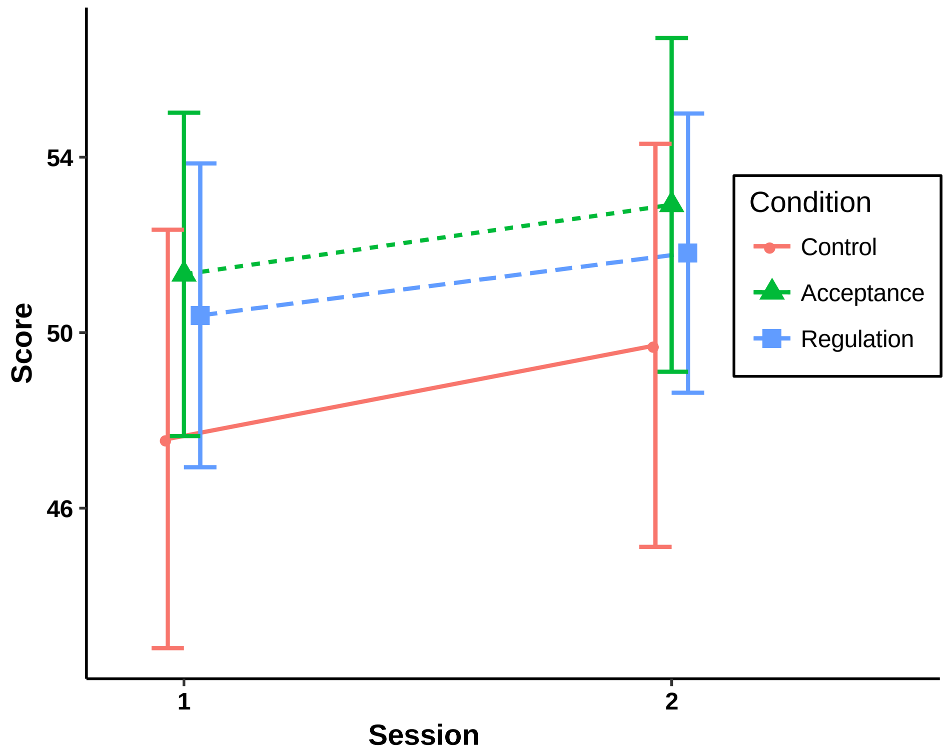

Figure 7. Mean scores on the Valued Living Questionnaire at sessions 1 and 2 in each condition (error bars represent standard error of the mean).

Behavioral Outcomes

Table 3 shows descriptive statistics for the number of BAT tasks completed at each session; Table A2 in the Appendix shows descriptive statistics for the number of rituals performed, SUDS ratings, and willingness ratings at each session in each task. Because these latter three measures were compared within participants using the minimum number of tasks completed at either session by that participant, data were missing for those participants who did not complete any tasks at session 1 or 2 (*n* = 7). In

addition to study attrition, this resulted in the inclusion of 53 participants for each of the repeated measures analyses.

BAT Tasks

Data were missing only for those participants who dropped out of the study before session 2 ($n = 4$), leaving 60 participants for the analysis of BAT tasks. Table 6 presents results from the beta regression analyzing differences in the number of BAT tasks completed in each condition. After controlling for the number of session 1 BAT tasks completed, results revealed that neither the Acceptance ($M = 3.2$, $SD = 1.1$) nor Regulation ($M = 3.0$, $SD = 1.4$) conditions significantly predicted the number of BAT tasks completed at session 2 compared to the Control condition ($M = 3.0$, $SD = 1.3$; *p*s > .05). A second model with the Regulation condition as the reference category did not show a statistically significant difference between the Acceptance and Regulation conditions ($B = 0.21$, $SE = 0.34$, $z = 0.62$, $p = 0.535$; see Figure 8). Note that when

Table 6

Results of Beta Regression Analysis for Number of BAT Tasks Completed With A Priori Contrast Comparing Effects of Acceptance and Regulation Conditions

Variable	*B*	*SE B*	*z*	*p*	Odds ratio (95% C.I.)
Condition (Acceptance)	0.12	0.34	0.35	.730	1.13 (0.57 – 2.21)
Condition (Regulation)	-0.09	0.34	-0.28	.783	0.91 (0.46 – 1.79)
Regulation-Acceptance [a]	0.21	0.34	0.62	.535	1.24 (0.63 – 2.43)
Intercept	-0.85	0.44	-1.93	.054	

Note. Model controlled for session 1 BAT tasks. SE = Standard error; C.I. = Confidence interval.

[a] Results of a priori contrast with Regulation as the reference category.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

condition was included in the precision model of the beta regression, condition became significant. However, the large change in *p* value when condition was removed suggested these results were not stable. Therefore, the more conservative approach of excluding condition from the precision model was taken.

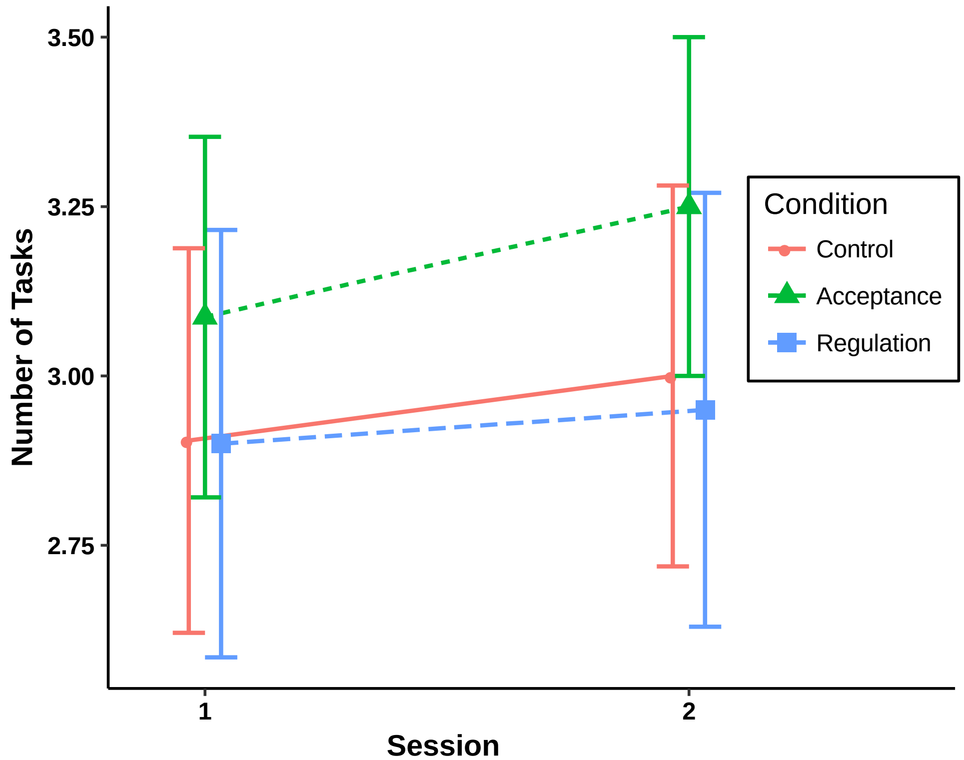

Figure 8. Mean number of BAT tasks completed at sessions 1 and 2 in each condition.

Rituals

Results of the Poisson generalized linear mixed-effects analysis are presented in Table 7. The most parsimonious model with the most significant predictors was Model 4. Results indicated that there was a significant interaction between session and condition. Participants in the Acceptance condition performed fewer rituals from session 1 to session 2 than those in the Control condition (p = .005), as did participants in the

Table 7

Results of Poisson Generalized Linear Mixed-Effects Models Examining Rituals Performed During BAT Tasks

Session/variable	Model 0	Model 1	Model 2	Model 3	Model 4
Session		-1.27*** (0.17)	-1.27*** (0.17)	-1.26*** (0.18)	-0.49 (0.26)
Task			0.35*** (0.05)	0.35*** (0.05)	0.35*** (0.05)
Condition (acceptance)				0.06 (0.48)	0.35 (0.48)
Condition (regulation)				-0.70 (0.71)	-0.29 (0.72)
Session*condition (acceptance)					-0.92** (0.33)
Session*condition (regulation)					-1.29* (0.58)
Intercept	-0.61** (0.22)	0.03 (0.22)	-0.76** (0.26)	-0.68 (0.40)	-0.93* (0.39)

Note. p-values based on Satterthwaite approximations to degrees of freedom.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

Regulation condition ($p = .025$). Participants in the Acceptance condition showed a 92.5% decrease in rituals from sessions 1 to 2 compared to participants in the Control condition, and participants in the Regulation condition showed a 129% decrease in rituals from sessions 1 to 2 compared to participants in the Control condition. When Regulation was recoded as the reference category, there was no statistically significant difference in the number of rituals performed over sessions between the Acceptance and Regulation conditions ($B = 0.37$, $SE = 0.55$, $z = 0.66$, $p = 0.508$). Model 4 also included a significant conditional effect of task. For ease of interpretation, this effect is reported from Model 3,

which included only main effects. Results show that the number of rituals performed increased over the course of tasks, regardless of condition or session (B = 0.35, SE = 0.05, z = 6.84, p < .001).

Visual inspection of these data (see Figure 9) revealed large variability in the number of rituals performed between participants. In particular, one participant in the Regulation condition was identified as an extreme outlier during session 1. This participant was unique in terms of symptoms and inability to identify an obsession (see Discussion section for further discussion of these differences). When this participant was excluded from the analyses, results were notably different. Model 5 included an additional significant parameter: a statistically significant interaction between task and the Regulation condition (B = -0.50, SE = 0.15, z = -3.35, p < .001). This indicates that the number of rituals increased less in the Regulation condition than in the Control condition as tasks progressed. In addition, there was no longer a significant interaction

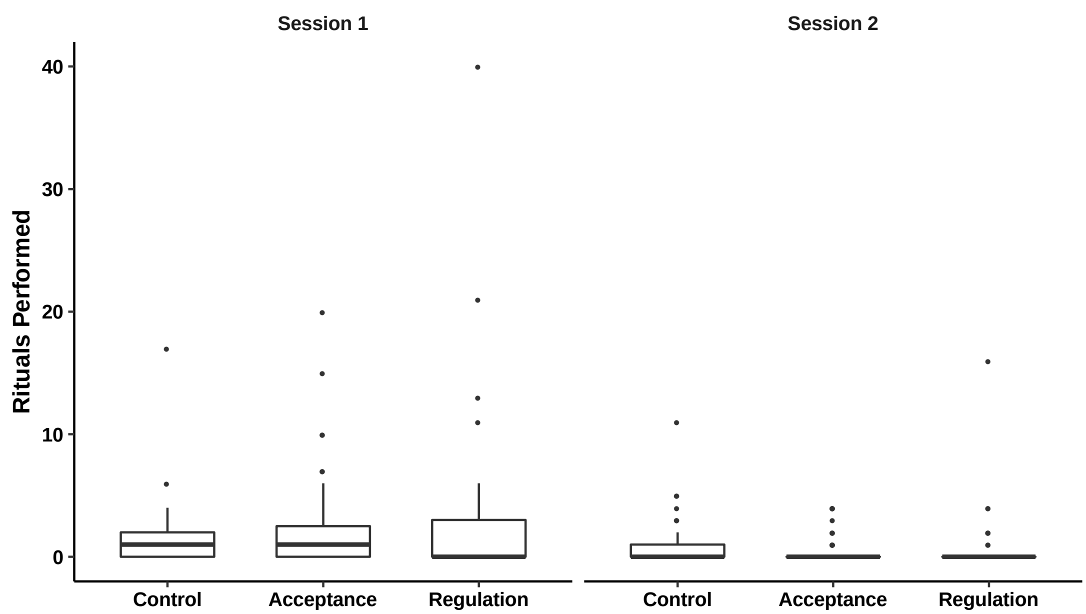

Figure 9. Rituals performed during the BAT at sessions 1 and 2 in each condition.

between session and the Regulation condition, while the interaction with the Acceptance condition remained significant (*B* = -0.92, *SE* = 0.33, *z* = -2.78, *p* = .005). There continued to be no significant differences between active conditions (*B* = -0.28, *SE* = 0.41, *z* = -0.68, *p* = .499)

Subjective Outcomes

Subjective Units of Distress

Table 8 presents the results of the linear mixed-effects analyses examining SUDS ratings, and Figure 10 presents the observed data at each time point. Likelihood ratio tests showed that Model 5 fit the data best, $\chi^2(2) = 11.18$, $p = .003$. Model 5 included significant conditional effects of session and task. For ease of interpretation, these effects are reported from Model 3, which included only main effects and no interactions. After controlling for condition and task, SUDS decreased from session 1 to session 2 in the full sample (*t* = -6.82, *p* < .001). SUDS also increased over the course of tasks after controlling for condition and session (*t* = 11.25, *p* < .001). Results from Model 5 show significant interactions between session and condition and between task and condition. Compared to the Control condition, SUDS ratings from sessions 1 to 2 decreased in the Acceptance condition (*t* = -2.28, *p* = .023) and the Regulation condition (*t* = -1.98, *p* = .048). When the Regulation condition was recoded as the reference category, there was no significant differences in SUDS ratings from sessions 1 and 2 between the Acceptance and Regulation conditions (*B* = -3.25, *SE* = 6.29, *t* = -0.52, *p* = .606). There was also a significant interaction between task and the Regulation condition. Participants in the Regulation condition reported SUDS increasing less over the course of BAT tasks than

Table 8

Results of Linear Mixed-Effects Models Examining Subjective Units of Distress (SUDS) Ratings Following BAT Tasks

Predictors	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
Session		-17.51***	-17.79***	-17.79***	-9.41*	-9.34*
		(2.50)	(2.61)	(2.61)	(4.05)	(4.10)
Task			6.48***	6.49***	6.49***	7.64***
			(0.58)	(0.58)	(0.58)	(1.00)
Condition (acceptance)				-7.76	-0.53	-0.99
				(4.92)	(5.86)	(6.47)
Condition (regulation)				-6.68	-1.04	7.07
				(5.00)	(5.74)	(6.43)
Session*condition (acceptance)					-14.45*	-14.54*
					(6.35)	(6.38)
Session*condition (regulation)					-11.28*	-11.29*
					(5.66)	(5.70)
Task*condition (acceptance)						0.18
						(1.36)
Task*condition (regulation)						-4.07**
						(1.44)
Intercept	53.26***	62.02***	49.00***	51.19***	47.00***	44.73***
	(3.68)	(3.88)	(3.88)	(4.01)	(4.30)	(4.58)
Bayesian information criterion[a]	2867.75	2843.29	2748.66	2757.07	2762.75	2763.12
Log likelihood[a]	-1390.52	-1375.40	-1325.19	-1323.62	-1320.68	-1315.08

Note. Each model controlled for session 1 baseline SUDS. The *p* values based on Satterthwaite approximations to degrees of freedom.

[a]Fit indices.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

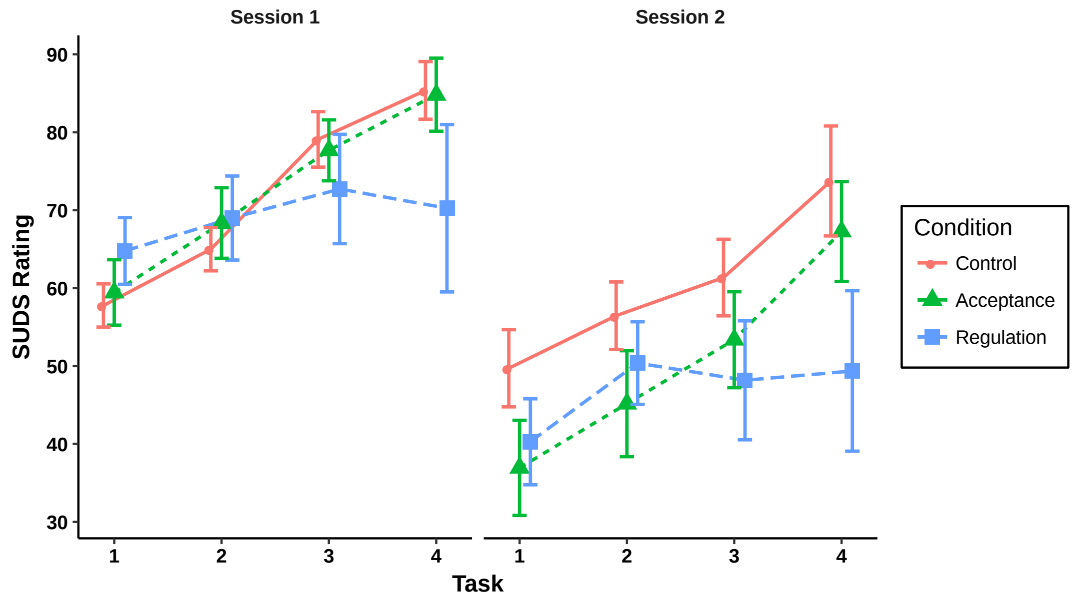

Figure 10. Subjective Units of Distress (SUDS) ratings during each task of the Bayesian Information Criterion at sessions 1 and 2 in each condition.

those in the Control condition (t = -2.83, p = .005) and the Acceptance condition (B = 4.25, SE = 1.38, t = 3.09, p = .002). This was not the case for the Acceptance condition compared to the Control condition (t = 0.14, p = .893).

Willingness

Results of the linear mixed-effects analyses of willingness ratings are presented in Table 9. Likelihood ratio tests indicated that Model 2 fit the data best ($\chi^2(1) = 20.47$, $p < .001$), but there was a strong statistical trend toward Model 4 when compared with Model 2, $\chi^2(4) = 9.22$, p = .056. Therefore, results of both models will be presented. Model 2 showed statistically significant main effects of session and task, such that willingness increased from sessions 1 to 2 (t = 6.05, $p < .001$) after accounting for task and decreased over the course of tasks after accounting for session (t = -4.63, $p < .001$). In Model 4, there was a significant interaction between session and condition. Participants in the

Table 9

Results of Linear Mixed-Effects Models Examining Willingness Ratings Following Bayesian Information Criterion Tasks

Predictors	Model 0	Model 1	Model 2	Model 3	Model 4
Session		18.62***	18.60***	18.60***	8.41
		(3.06)	(3.06)	(3.08)	(5.05)
Task			-3.63***	-3.63***	-3.63***
			(0.78)	(0.78)	(0.78)
Condition (acceptance)				0.13	-11.52
				(7.17)	(8.09)
Condition (regulation)				-4.45	-9.56
				(6.66)	(7.47)
Session*condition (acceptance)					23.31**
					(7.53)
Session*condition (regulation)					10.21
					(6.78)
Intercept	47.44***	38.13***	44.38***	45.30**	50.40***
	(7.19)	(7.35)	(7.34)	(7.96)	(8.21)
Akaike information criterion[a]	2910.32	2888.46	2869.99	2873.48	2868.77
Bayesian information criterion[a]	2967.03	2948.95	2934.26	2945.31	2948.16
Log likelihood[a]	-1440.16	-1428.23	-1417.99	-1417.74	-1413.38

Note. Each model controlled for session 1 baseline Willingness. *p* values are based on Satterthwaite approximations to degrees of freedom.

[a] Fit indices.

† Best-fitting model as determined by likelihood ratio tests.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

Acceptance condition showed increased willingness from sessions 1 to 2 compared to those in the Control condition ($t = 3.10$, $p = .002$). This was not observed for the Regulation compared to Control conditions ($t = 1.51$, $p = .132$). When the Regulation

condition was recoded as the reference category, results showed a statistical trend toward increased willingness from sessions 1 to 2 for those in the Acceptance condition compared to the Regulation condition (B = 13.09, SE = 7.18, t = 1.82, p = .069). See Figure 11 for plots of observed willingness ratings.

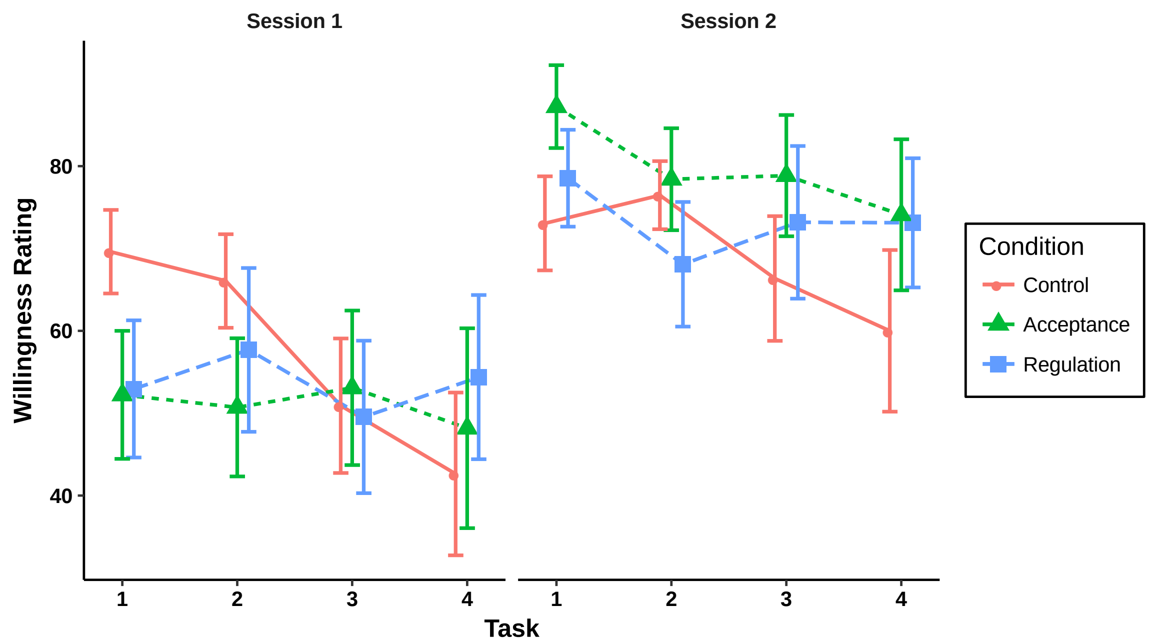

Figure 11. Willingness ratings during each task of the BAT at sessions 1 and 2 in each condition.

Psychophysiological Outcomes

Table A3 in the Appendix presents descriptive statistics for psychophysiological measures at each session in each task. Because these measures were compared within participants using the minimum number of tasks completed at either session by that participant, data were missing for those participants who did not complete any tasks at session 1 or 2 (n = 7). In addition to study attrition, this resulted in the inclusion of 53 participants for each of the repeated measures analyses.

Nonspecific Skin Conductance Responses

Results of the linear mixed effects analyses examining frequency of nonspecific skin conductance responses are presented in Table 10. Model 5 provided the best fit to

Table 10

Results of Linear Mixed-Effects Models Examining Frequency of Nonspecific Skin Conductance Responses During the BAT

Predictors	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
Session		0.43	0.43	0.44	1.04	1.04
		(0.72)	(0.72)	(0.72)	(1.28)	(1.28)
Task			-0.67***	-0.67***	-0.67***	-0.85***
			(0.04)	(0.04)	(0.04)	(0.07)
Condition (acceptance)				-1.06	0.05	-1.04
				(1.53)	(1.81)	(1.82)
Condition (regulation)				0.39	0.49	0.63
				(1.30)	(1.54)	(1.55)
Session*condition (acceptance)					-2.21	-2.21
					(1.93)	(1.93)
Session*condition (regulation)					-0.18	-0.18
					(1.67)	(1.67)
Task*condition (acceptance)						0.52***
						(0.09)
Task*condition (regulation)						-0.08
						(0.10)
Intercept	7.55***	7.32***	8.67***	8.72***	8.41***	8.75***
	(0.84)	(0.91)	(0.90)	(1.43)	(1.52)	(1.53)
Bayesian information criterion[a]	39575.08	39583.65	39302.84	39319.12	39335.36	39303.57
Log likelihood[a]	-19720.74	-19720.57	-19575.71	-19574.94	-19574.16	-19549.36

Note. Each model controlled for session 1 baseline nonspecific skin conductance responses. The *p* values based on Satterthwaite approximations to degrees of freedom.

[a]Fit indices.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

the data, $\chi^2(1) = 49.61$, $p < .001$, with results showing a significant task by condition interaction and a significant conditional effect of task. For ease of interpretation, the conditional effect is reported from Model 3 which included only main effects. Results show the frequency of nonspecific skin conductance responses decreased over the course of tasks after controlling for session and condition ($t = -17.19$, $p < .001$). Results from Model 5 show a significant task by condition interaction, such that the frequency of nonspecific skin conductance responses decreased less in the Acceptance condition than in the Control condition ($t = 5.60$, $p < .001$) or the Regulation condition ($B = 0.60$, $SE = 0.09$, $t = 6.32$, $p < .001$). See Figure 12 for plots of the observed data.

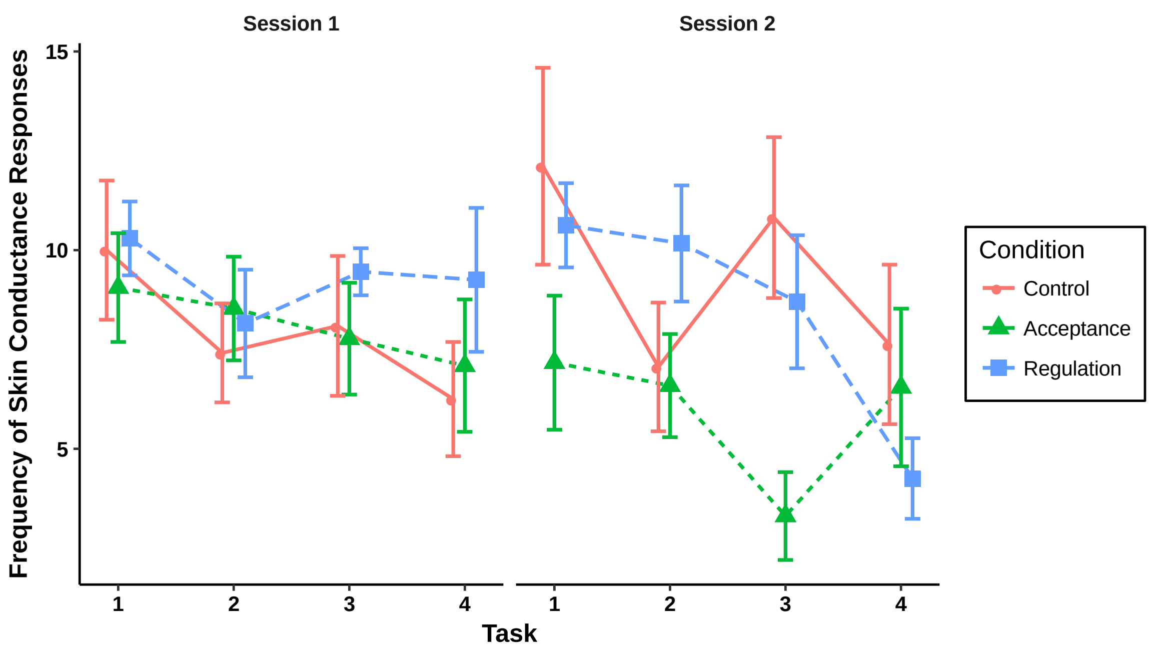

Figure 12. Frequency of nonspecific skin conductance responses during each task of the BAT at sessions 1 and 2 in each condition.

Skin Conductance Level

Table 11 present results of the linear mixed effects analyses of skin conductance

Table 11

Results of Linear Mixed-Effects Models Examining Skin Conductance Level (in Log Units of Microsiemens [μS]) During the BAT

Predictors	Model 0	Model 1	Model 2	Model 3	Model 4
Session		-0.11 (0.07)	-0.11 (0.07)	-0.11 (0.07)	0.25 (0.13)
Task			-0.01 (0.00)	-0.01 (0.00)	-0.01 (0.00)
Condition (acceptance)				-0.13 (0.13)	0.22 (0.16)
Condition (regulation)				0.09 (0.12)	0.27 (0.14)
Session*condition (acceptance)					-0.69*** (0.19)
Session*condition (regulation)					-0.36* (0.16)
Intercept	2.14*** (0.06)	2.20*** (0.07)	2.21*** (0.07)	2.18*** (0.12)	2.01*** (0.13)
Akaike information criterion[a]	-19041.16	-19041.17	-19042.41	-19044.09	-19051.91
Bayesian information criterion[a]	-18896.11	-18889.22	-18883.55	-18871.42	-18865.42
Log likelihood[a]	9541.58	9542.59	9544.21	9547.05	9552.95

Note. Each model controlled for session 1 baseline skin conductance level. *p* values are based on Satterthwaite approximations to degrees of freedom.

[a]Fit indices.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

level. Visual inspection of the distributions of raw skin conductance levels showed positive skew. Therefore, skin conductance levels were log transformed in order to normalize their distributions. Likelihood ratio tests indicated that Model 4 provided the best fit to the data, $\chi^2(1) = 11.81$, $p = .003$. Results show a significant interaction between session and condition, such that the Acceptance condition showed decreased skin

conductance levels from sessions 1 to 2 compared to the Control condition (*t* = -3.67, $p < .001$), as did the Regulation condition (*t* = -2.26, *p* = .024). When the Regulation condition was recoded as the reference category, results indicated that the Acceptance condition showed significant decreases in skin conductance levels from sessions 1 to 2 compared to the Regulation condition (*B* = 0.33, *SE* = 0.16, *t* = 2.07, *p* = 0.039). Figure 13 presents plots of the observed data.

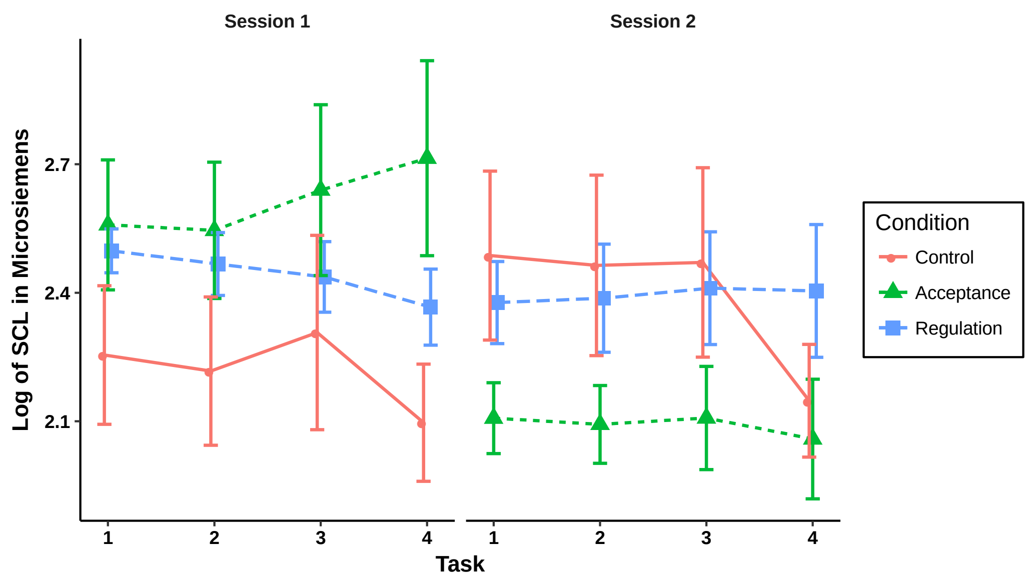

Figure 13. Skin conductance level (SCL) in log units during each task of the BAT at sessions 1 and 2 in each condition.

Heart Rate

Results of the linear mixed effects analyses of heart rate are presented in Table 12 and plots of the observed data are shown in Figure 14. Model 2 provided the best fit to the data ($\chi^2(1) = 5.60$, *p* = .018). Results show a significant main effect of task, such that participants' heart rate increased over the course of tasks after controlling for session (*t* = 2.51, *p* = .013). No other significant effects were observed for heart rate.

Table 12

Results of Linear Mixed-Effects Models Examining Heart Rate (in Beats Per Minute) During the BAT

Predictors	Model 0	Model 1	Model 2
Session		0.35 (1.57)	0.33 (1.57)
Task			0.46 * (0.18)
Intercept	27.49 *** (5.83)	27.31 *** (5.87)	26.57 *** (5.90)
Akaike information criterion[a]	38561.86	38563.81	38560.21
Bayesian information criterion[a]	38704.02	38712.74	38715.91
Log likelihood[a]	-19259.93	-19259.91	-19257.11

Note. Each model controlled for session 1 baseline heart rate. The *p* values are based on Satterthwaite approximations to degrees of freedom.

[a]Fit indices.

* $p < .05$.
** $p < 0.01$.
*** $p < 0.001$.

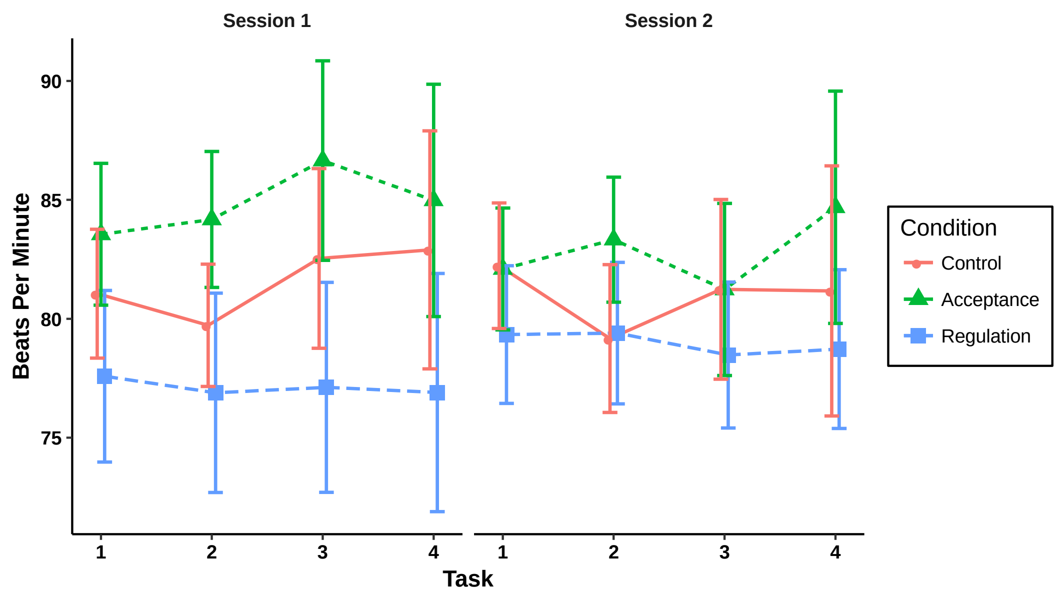

Figure 14. Heart rate in beats per minute during each task of the BAT at sessions 1 and 2 in each condition.

CHAPTER V

DISCUSSION

The purpose of the current study was to determine whether different approaches to exposure for intrusive thoughts, acceptance or regulation of distress, lead to different outcomes and whether these outcomes are achieved through different mechanisms of change. Within the context of a pre-post, between-group design with nested repeated measures, measures were collected at the self-report, behavioral, subjective, and physiological levels of analysis.

Results showed a general decrease in obsessive-compulsive symptoms and distress for both active conditions across all levels of analysis, with some notable differences between conditions. In particular, the Acceptance condition showed lower skin conductance levels compared to the Regulation condition. Acceptance also showed increased psychological flexibility compared to Control, while Regulation did not, and a statistical trend toward increased willingness compared to Regulation and Control. There were no between condition differences in the number of BAT tasks completed at session 2, but both active conditions engaged in fewer rituals during BAT tasks compared to the Control condition.

Research Question 1

The first research question asked whether teaching acceptance versus regulation of distress during exposures leads to better self-reported outcomes. Compared to the Control condition, both active treatment conditions showed decreased obsessive-

compulsive symptoms at session 2, as measured by the DOCS. The Regulation condition also showed decreased symptoms compared to the Control condition as measured by the OCI-R, while the Acceptance condition did not. On both symptom measures, there was no statistically significant difference between the two active treatment conditions. Although both the DOCS and OCI-R are measures of OCD symptom severity, the DOCS assesses for the presence of obsessions, compulsions, distress, and functional impairment related to obsessions and compulsions across the four most common thematic dimensions observed in individuals with OCD. Functional impairment could be conceptualized as the *impact* of obsessions and compulsions, which is separate from the *presence* of obsessions and compulsions. The OCI-R, on the other hand, does not include questions about impairment and assesses only for the presence of obsessive-compulsive symptoms. An acceptance approach to treatment specifically targets the impact of internal symptoms, such as obsessions, “fear,” or distress, while a regulation approach targets the presence of internal symptoms. It may be that changes observed in the Acceptance condition were more related to decreasing the impact of internal symptoms than decreasing their presence and, therefore, were better captured by the DOCS than the OCI-R.

Supporting this interpretation of symptom severity measures, the Acceptance condition showed increased psychological flexibility (as measured by the CompACT) at session 2 compared to the Control condition, while the Regulation condition did not, although there was a statistical trend for Regulation. Psychological flexibility is the ability to flexibly adapt one’s behavior so that it becomes an expression of one’s values, even when doing so entails tolerating or accepting unwanted internal experiences such as obsessions and distress. In the current study, the Acceptance condition was explicitly

instructed in acceptance of distress; therefore, increased psychological flexibility following the intervention is expected and confirms that the intervention functioned through its intended process of change. The statistical trend in the Regulation condition suggests that those in this condition also increased psychological flexibility, but less clearly. It may be that, although participants in the Regulation condition were not directly trained to accept obsessions and distress, they learned to do so indirectly through completing exposure exercises. Twohig et al. (2018) showed a similar finding in a randomized controlled trial, in which the treatment conditions included exposures implemented from a more traditional CBT (i.e., regulation) approach versus an acceptance approach. Both conditions showed large and equivalent decreases in OCD symptom severity and psychological inflexibility as measured by the AAQ-II, indicating that psychological flexibility was in important process of change for both groups, even though it was directly trained only in the ACT+ERP group.

In the current study, changes in psychological flexibility were observed when using the CompACT, but similar changes were not observed on the AAQ-II, a measure of psychological inflexibility, for any of the three conditions. As with the OCD symptom severity measures discussed earlier, the two measures of psychological flexibility/inflexibility differ in some respects. The AAQ-II is the most widely used measure of psychological inflexibility and includes seven questions, assessing primarily for the acceptance and defusion processes of the ACT model. The CompACT is a more comprehensive measure, including 23 questions that load onto three factors relating to each of ACT's core processes of change. The CompACT has shown incremental validity over the AAQ-II, as well as increased content validity (Francis et al., 2016). Additionally,

a recent analysis of the AAQ-II using item response theory showed that the measure performs better in its higher range of scores than when scores are lower. This suggests that the AAQ-II most accurately measures psychological inflexibility as opposed to psychological flexibility (Ong, Pierce, Woods, Twohig, & Levin, 2019). The discrepancy between scores on the CompACT and AAQ-II in the current study may reflect the more comprehensive and content valid nature of the CompACT over the AAQ-II or actual differences in the constructs each measure assesses (e.g., psychological flexibility and inflexibility, respectively). In this latter case, results would suggest that the Acceptance intervention, as well as the Regulation intervention to some degree, impacted psychological flexibility more than psychological inflexibility. Further research is needed to clarify whether these two constructs have an opposite or orthogonal relationship to one another.

Differences between the three conditions were not observed for the VLQ. The VLQ assesses for valued behaviors over the previous week, and it may be that the small dose of intervention participants received (one 30-minute exposure and six 10-minute exposures), was not sufficient to impact well-established patterns of behavior in a meaningful way. Additionally, the timeframe of the VLQ is the same as was the duration of the study (one week), and the VLQ therefore may not have been sensitive to changes within this timeframe. In summary, the two active treatment conditions generally led to decreased symptom severity at session 2, with no differences between them. The Acceptance condition led to increased psychological flexibility, and neither active condition resulted in increased self-reported valued behavior.

Research Question 2

The second research question asked whether teaching acceptance versus regulation of distress during exposures led participants to complete more tasks or engage in fewer rituals during a behavioral avoidance test. No differences were observed between any of the study conditions on the number of BAT tasks completed. Some studies in the literature have failed to show differences between acceptance and regulation conditions on behavioral measures following exposure, and our results are consistent with these studies. For example, no differences between active conditions were found in Bluett et al. (2016) or Fabricant et al. (2013), both of whom used analogue samples to compare acceptance and regulation approaches to exposure. The former study reported differences between active conditions and a non-treatment control (but not between active conditions), while the latter did not employ a non-treatment control and reported no differences between groups. As far as we are aware, Fabricant et al. is also the only study in the literature to compare acceptance- and regulation-based exposures for OC symptoms using a BAT. In that study, as in the current study, the lack of differences between the active conditions and the Control condition suggests that the BAT itself may have been problematic.

Construction of the BAT in the current study required a balance between individualization of tasks and experimental control. OCD is a heterogeneous disorder, and obsessive and compulsive themes can vary extensively between individuals. Adding to this variability, our sample included individuals who struggled with intrusive internal experiences that would not be considered traditional obsessions, such as traumatic

memories or urges to binge eat. Thus, our sample included a wide range of idiosyncratic intrusive experiences and corresponding compulsive behaviors. During piloting, we attempted to use a BAT with the same tasks for each participant following procedures used by Fabricant et al. (2013). However, distress was low for participants whose symptoms did not map well onto the BAT tasks, which made such an approach difficult.

In response to pilot results, we incorporated the use of individual exposure hierarchies into the BAT, similar to what is done in a clinical setting. This increased the distress evoked by the BAT but led to less experimental control than may have occurred had the tasks been the same for all participants. It also added variability to the experimental procedure, making it more difficult to detect differences between groups. Although we modeled our BAT on the one developed by Steketee et al. (1996), there were some differences between the procedures used for the construction of that BAT and the one used in the current study. The BAT validated by Steketee et al. included tasks that were identified over the course of multiple sessions in a clinical setting, and it included three tasks with seven steps each. Additionally, it was conducted with participants who had an OCD diagnosis and who were undergoing treatment. The current study was analogue in nature: it included only two sessions and, therefore, required that BAT tasks be chosen during the first part of session 1, allowing much less time to determine appropriate tasks or to complete those tasks. Because of time constraints, BAT tasks did not include multiple steps. This resulted in a restricted range of possible steps compared to Steketee et al. (0-4 versus 0-21, respectively). Our sample was also subclinical and not necessarily treatment seeking. Therefore, the distress elicited by the tasks chosen may have been less than if we had used a clinical sample.

Because of the experimental setting constraints, possibilities for hierarchy items were limited to tasks that could be completed in the experimental room while attached to wired physiological equipment. This excluded tasks that might otherwise be completed outside or that required a lot of movement. Tasks that involved social interactions were also limited to that which could be completed with the experimenter or through the use of the internet or mobile phone technology. Therefore, for some participants, it was difficult to identify exposure tasks that evoked high levels of distress. During construction of the hierarchy, when participants rated their expected SUDS for each task, SUDS ratings for task 4 (the most distressing task) ranged from 80 to 100, with a mean of 95.12 (SD = 6.37). However, when participants actually completed the tasks, SUDS following task 4 ranged from 10 to 100, with a mean of 82.59 (SD = 19.47; these numbers include all participants who completed task 4 at session 1, not excluding those who completed fewer tasks at session 2, as was done for the main data analyses). A paired samples t test indicates that this is a statistically significant difference, $t(33) = 4.03$, $p < .001$, suggesting that participants expected tasks to be more distressing than they actually were. Lower levels of actual distress while completing BAT tasks may have contributed to the finding that 50% of participants ($n = 32$) completed all four BAT tasks during session 1. This created a ceiling effect, allowing little room for improvement on this measure. Along with the restricted range of possible scores on the BAT, this may have resulted in less statistical power to detect differences between groups.

The difficulty we experienced creating a BAT for an analogue study of obsessions is perhaps not surprising. BATs are commonly used in studies with specific phobia and, in those studies, one type of phobia is usually chosen, allowing for BAT tasks to be

consistent between participants (Castagna, Davis, & Lilly, 2016). BATs in studies of OCD are less common, an issue that has been attributed to the heterogeneous nature of OCD symptoms (Emmelkamp, Kraaijkamp, & van den Hout, 1999). One possibility for the use of BATs in OCD research is to limit the study to one subtype of OCD and create tasks that are the same for all participants. Najmi, Tobin, and Amir (2010) did this by adapting the BAT from Cougle, Wolitzky-Taylor, Lee, and Telch (2007) and validating it in a college student sample with high contamination-related OCD symptoms. They found the BAT had good psychometric properties and was easy to administer. Taking this approach to the construction of a BAT in future analogue OCD research may be more feasible than using a heterogenous OCD sample with individualized BAT tasks.

In the current study, despite the lack of differences on the number of BAT tasks completed between groups, the two active treatment conditions both decreased in the number of rituals performed during the BAT compared to the Control condition. This provides evidence of behavioral change as a result of treatment, in spite of the BAT's aforementioned problems. When an extreme outlier during session 1 was removed (see Chapter IV, Results), results changed such that only the Acceptance condition showed decreases in rituals performed compared to the Control condition, and decreases in the Regulation condition were no longer significant. These results are consistent with the intent of the Acceptance intervention, which was to target behavior change and not distress. Further examination of the raw data show that the participant to whom the extreme datum point belonged had a qualitatively different symptom profile than the rest of the sample, including skin picking compulsions and no obsessional thoughts or identifiable urges. For these reasons, it is possible that this participant met exclusion

criteria and should have been excluded from the study at the outset.

Although changes in the number of rituals performed between sessions were observed, the measure of rituals used in the current study was not without its problems. Because many rituals are covert (i.e., mental), they are unobservable by the experimenter. Therefore, participants were asked to self-report covert rituals in addition to overt rituals. Not only does this method rely upon participant self-awareness and attention, which may vary between individuals, but it is subjective. What may be considered a ritual by one person may not be considered a ritual by another. Steketee et al. (1996) also used a measure of rituals in their BAT task, but rituals were rated by the experimenter. While this may lead to more objectivity, it also has the drawback of not including covert rituals which, depending upon the participant, could be considerable. Alternative methods for measuring both covert and overt rituals in a more objective manner could be a useful area for future research.

In summary, no differences between groups were observed for the number of BAT tasks completed, which could partially be due to problems with the BAT itself, including a restricted range of scores and a ceiling effect in the data. The two active treatment conditions both decreased the number of rituals they performed from session 1 to 2 compared to the Control condition, with no differences between them. When an outlier was removed, only the Acceptance condition remained significant. This provides evidence of behavior change as a result of treatment and suggests that the Acceptance intervention may have had more impact on behavior change than the Regulation condition.

Research Question 3

The third research question asked whether teaching acceptance versus regulation of distress during exposures led to different levels of distress and willingness during the BAT. We found that physiological arousal, as measured by skin conductance, decreased in both active conditions compared to the Control condition, but decreased more in the Acceptance than in the Regulation condition. This was the case despite the fact that both active conditions reported similar decreases in self-reported distress (SUDS) compared to the Control condition, with no differences between them. In addition, the Acceptance condition showed a statistical trend toward increased willingness compared to both the Regulation and Control conditions.

Table A1 shows mean willingness ratings for each BAT task at both sessions. At session 2, willingness ratings in the Acceptance condition were between 1 and 10 points higher than in the Regulation condition, and they were between 2 and 14 points higher than the Control condition. It is difficult to know whether these represent clinically meaningful differences, as willingness is likely to be a less familiar concept to participants than distress, and they may not be familiar with attempting to estimate it. Willingness ratings scales are also not validated. One approach to determining the clinical significance of willingness ratings would be to study the predictive validity of willingness ratings: whether changes in willingness predict changes in clinically meaningful outcome measures. This may be an area for future research.

One possible explanation for this pattern of findings is that greater willingness reported by participants in the Acceptance condition, as well as greater psychological

flexibility as measured by the CompACT, actually resulted in less physiological arousal for these participants. Such an interpretation is consistent with the theory underlying ACT, which suggests that the more one attempts to control distress, the more distress one will experience. Conversely, when one is willing to experience distress without fighting against it, there is a paradoxical effect in which distress actually decreases (S. C. Hayes et al., 2012). This points to the possibility of a mediational role of psychological flexibility and willingness in the relationship between intervention and physiological arousal. Conversely, it may be that decreased physiological arousal could lead to greater psychological flexibility and willingness. Previous research has shown psychological flexibility can mediate the relationship between intervention and both psychological symptoms and behavioral improvements (Ciarrochi, Bilich, Godsell, 2010). A promising area for future research would be to further investigate the temporal relationships between willingness/psychological flexibility, psychological symptoms, physiological arousal, and behavior change.

The fact that Acceptance participants reported subjective distress at the same levels as Regulation participants, while actually experiencing less physiological arousal, may suggest that they were more aware of their distress than Regulation participants. This may have been the case if Acceptance participants were attending to their experience to a greater degree than Regulation participants. Attending to one’s experience in the present moment is known as mindfulness (Anālayo, 2003), a construct closely related to acceptance. Participants in the Acceptance intervention were instructed to notice present moment experience when doing so facilitated acceptance. If these participants were more mindful of their emotional and physiological experiences than

Regulation participants, it follows that they may have had a heightened awareness of those experiences and therefore rated them as more intense than did Regulation participants, who were not instructed to attend to their experience.

Watford and Stafford (2015) showed that participants who underwent a brief mindfulness intervention reported greater intensity of both positive and negative self-reported emotional experiences following a mood induction than those in a control condition, despite no differences between conditions in skin conductance levels. Although the current study found lower skin conductance levels in the Acceptance group and no differences between active groups on self-reported distress, findings from both studies could be interpreted as resulting from increased awareness of distress and, therefore, increased intensity of self-reported distress relative to physiological arousal. The current study takes this finding one step further because of the comparison to an active treatment condition. It should be noted that other studies in the literature have found decreased levels of self-reported emotional arousal relative to physiological indices within the context of mindfulness interventions (Arch & Craske, 2006; Erisman & Roemer, 2010). However, these studies did not incorporate exposure.

Studies that have examined exposure in conjunction with affect labeling have found that affect labeling enhances the effects of exposure as measured by physiological, but not self-report, indices of distress (Kircanski, Lieberman, & Craske, 2012; Niles, Craske, Lieberman, & Hur, 2015). Presumably, labeling one's affective experience increases awareness of that experience, which again may explain increased levels of self-reported distress in relation to physiological arousal. Explicitly attending to internal distress can also improve behavioral outcomes without affecting self-reported levels of

distress. Katz et al. (2019) showed that attending to internal distress in addition to an external exposure stimulus improved behavioral outcomes, despite no changes in self-reported distress. Similar to the current study, lower levels of physiological arousal were observed in conjunction with higher levels of self-reported distress only for the group that focused on their internal distress.

Finally, no between-group effects were observed for the frequency of nonspecific skin conductance responses or heart rate between sessions 1 and 2. Nonspecific skin conductance responses, like skin conductance level, are a tonic measure of skin conductance; in other words, they are thought to index general levels of physiological arousal. Nonspecific skin conductance responses are skin conductance responses that occur in the absence of external stimulation, but they have been shown to be related to internal stimulation, particularly arousal, negative emotion, thoughts about unfinished activities or goals, and inner speech (Nikula, 1991). Artifactual responses can be triggered by movement, speech, and external stimuli outside of the experimental procedure. Although nonspecific skin conductance responses are usually measured during rest periods (Society for Psychophysiological Research Ad Hoc Committee on Electrodermal Measures, 2012), in the current study, we measured these responses during the BAT, in which participants were engaged in a number of various activities including speaking out loud, writing, looking at pictures, listening to sounds, imagining, and so forth. It may be that, due to engagement in these activities, the measure of skin conductance responses was contaminated with movement and speech artifacts, as well as by activities involving thinking and negative emotion (e.g., imaginal exposures). Therefore, it is unlikely that this measure was able to capture general levels of arousal as

was originally intended, and it is therefore unsurprising that no significant between-groups effects were detected. In the future, researchers should consider such design factors when choosing whether to use nonspecific skin conductance responses in their studies.

Heart rate is another common psychophysiological measure used in the literature, but it is a less clear index of emotional distress than skin conductance measures because it is affected by both the sympathetic and parasympathetic nervous systems. In the current study, heart rate increased over the course of tasks for all participants, but no between group differences were observed. It may be that the measure of heart rate was not precise enough to detect differences in emotional experience between groups. The use of heart rate variability (HRV), or the variability between successive heart beats, may be a more promising physiological measure due to its association with psychological resiliency and an individual’s ability to adapt to the demands of their environment (Shaffer, 2014). Future researchers may consider the use of HRV rather than simple heart rate.

In summary, participants in both active conditions decreased on measures of distress relative to the Control condition, with those in the Acceptance condition showing lower skin conductance levels than those in Regulation, despite no differences on self-reported distress. Acceptance participants also showed a statistical trend toward increased willingness compared to Regulation and Control participants. Combined with the finding that Acceptance participants reported greater psychological flexibility at session 2, this suggests that increased willingness to experience distress may play a role in the relationship between the Acceptance intervention and decreased physiological arousal.

Study Limitations

The current study had some limitations. Most notably, the BAT itself was problematic in that it included individualized BAT tasks for each participant, which decreased experimental control and added variability to the data. This approach was an improvement over the BAT used during piloting, in which tasks were the same for all participants, but it created problems of its own. Specifically, the BAT had a small range of possible scores, which created a ceiling effect in the data. Constraints imposed by the experimental setting, in combination with the heterogeneity of symptoms experienced by participants, led to BAT tasks that were not always well-matched to participant symptoms and may not have evoked sufficient levels of distress for the BAT to be a valid measure of behavioral avoidance. A related limitation was the use of subjective self-report of covert rituals. While this was the most convenient method for collecting these data in the current study, more objective methods for doing so would have been preferable.

We attempted to have the same experimenter conduct both sessions for a particular participant, meaning that the same experimenter who conducted the BAT (and therefore collected data during the BAT) also conducted the 30-minute exposure treatment. This was done in order to build and maintain rapport between the participant and the experimenter and to increase the consistency with which BAT tasks were presented at each session. However, this also entailed that assessment during the BAT was not blind to condition. In order to achieve blind assessment during the BAT, it would be necessary for separate experimenters to conduct the BAT and the exposure treatment,

a consideration for future research.

The use of nonspecific skin conductance responses as a measure of general physiological arousal was problematic due to the high potential for artifacts, especially when measured during periods in which participants were actively engaging in various activities. Fortunately, skin conductance level proved to be a more reliable physiological measure for this particular research design. Similarly, the measure of heart rate may not have been specific enough to capture differences in physiological arousal between groups, and HRV may prove to be a more useful measure for future studies.

Other limitations of the current study include a small sample size. Trends toward significance on a number of measures suggest that greater statistical power may have resulted in more significant between group findings. We also used a primarily White, subclinical, college student sample. This sample limits our ability to generalize to other populations, including those with clinical levels of obsessive-compulsive symptoms. Finally, the analogue design of the current study, by its nature, limits external validity and the generalizability of our findings.

Implications

Despite its limitations, the current study contributes to the body of literature investigating acceptance and regulation approaches to exposure and continues to extend this research to the treatment of obsessive-compulsive symptoms. Our findings support studies that show both acceptance and regulation treatment approaches lead to decreased distress, improved symptoms, and positive behavioral outcomes. They also provide preliminary support for the role of willingness and psychological flexibility in acceptance

approaches to treatment, and they lend further evidence to the theory that willingness to tolerate distress actually leads to decreased distress and improvement in behavioral outcomes, even when subjective distress levels remain the same or do not decrease to the same degree. This finding has important clinical implications because internal experiences, such as thoughts and emotions, can be difficult to change directly. Intervening at the level of behavior by modifying one's responses to these internal experiences may provide a pathway to improved life functioning even in the face of ongoing psychological symptoms.

To our knowledge, the current study is the first to include psychophysiological measures in a comparison of acceptance and regulation approaches to exposure for obsessive-compulsive symptoms. Had we not included physiological measures, our findings would have been consistent with studies comparing acceptance and regulation approaches to exposure for other anxiety disorders, in which few between groups differences have been observed. However, with the inclusion of physiological measures, we detected greater decreases in physiological arousal in relation to self-reported distress for the Acceptance group. This leads to further questions, such as whether this phenomenon is unique to the treatment of obsessive-compulsive symptoms and whether it generalizes to other physiological indices of emotion and well-being, such as HRV.

Finally, our findings have implications for our understanding of the mechanisms of change through which exposure has its effects. We observed similar, and in some cases more, symptom reduction following an intervention aimed at tolerating high levels of distress rather than extinguishing it. Said differently, we found that an intervention aimed at changing operant, rather than Pavlovian, processes had significant impacts on a

Pavlovian response (physiological arousal). This calls into question the assumption of unidirectional change implicit within a traditional CBT approach, in which changes in Pavlovian processes (decreased distress) lead to changes in operant processes (improved functional outcomes). Our findings suggest that high levels of distress and the ability to tolerate that distress may lead to less physiological arousal, decreased symptoms, and functional improvements, supporting the possibility of a bidirectional relationship between operant and Pavlovian processes in exposure therapy. Future research examining the temporal relationships between these various processes of change is thus warranted.

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APPENDIX

ADDITIONAL TABLES

Table A1

Hypothesized Changes at Session 2 in Each Active Condition for Each Measure

Measure	Acceptance	Regulation
Dimensional Obsessive-Compulsive Scale	Lower than Control, no difference from Regulation	Lower than Control, no difference from Acceptance
Obsessive-Compulsive Inventory-Revised	Lower than Control, no difference from Regulation	Lower than Control, no difference from Acceptance
Acceptance and Action Questionnaire-II	Lower than Regulation and Control	Higher than Acceptance, lower than Control
CompACT	Higher than Regulation and Control	Lower than Acceptance, higher than Control
Valued Living Questionnaire	Higher than Regulation and Control	Lower than Acceptance, higher than Control
BAT Tasks	More than Control, no hypothesis for comparison to Regulation	More than Control, no hypothesis for comparison to Regulation
Rituals	Fewer than Control, no hypothesis for comparison to Regulation	Fewer than Control, no hypothesis for comparison to Regulation
Subjective Units of Distress	Lower than Control, no difference from Regulation	Lower than Control, no difference from Acceptance
Willingness	Higher than Regulation and Control	Lower than Acceptance, more than Control
Nonspecific Skin Conductance Responses	Fewer than Control, no difference from Regulation	Fewer than Control, no difference from Acceptance
Heart Rate	Lower than Control, no difference from Regulation	Lower than Control, no difference from Acceptance
Skin Conductance Level	Lower than Control, no difference from Regulation	Lower than Control, no difference from Acceptance

Note. CompACT = Comprehensive Assessment of Acceptance and Commitment Therapy Processes, BAT = Behavioral Avoidance Test

Table A2

Means and Standard Deviations of Behavioral and Subjective BAT Measures by Session and Task

	Task 1 (*n* = 53)		Task 2 (*n* = 47)		Task 3 (*n* = 35)		Task 4 (*n* = 27)	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Session 1								
Full Sample								
Rituals	1.6	2.6	1.9	3.7	1.9	3.0	3.7	8.8
SUDS	60.6	15.9	67.3	16.4	76.6	16.7	80.7	20.5
Willingness	58.4	30.6	58.2	31.4	51.3	30.0	48.4	32.7
Acceptance								
Rituals	1.8	2.8	1.8	2.5	2.2	4.3	3.0	6.0
SUDS	59.4	17.8	68.4	18.7	77.7	14.1	84.8	15.6
Willingness	52.2	33.0	50.7	34.6	53.1	33.8	48.2	40.3
Regulation								
Rituals	1.9	3.4	3.6	6.1	1.2	1.8	5.2	14.0
SUDS	64.8	17.7	69.0	19.5	72.7	23.3	70.2	30.4
Willingness	52.9	34.3	57.7	35.9	49.5	30.7	54.4	28.2
Control								
Rituals	1.1	1.3	0.8	1.1	2.2	2.0	3.2	5.7
SUDS	57.8	11.8	65.0	11.5	79.1	11.8	85.4	10.5
Willingness	69.6	21.5	66.1	23.4	50.9	27.1	42.6	27.9
Session 2								
Full Sample								
Rituals	0.5	1.7	0.8	1.5	0.8	2.7	0.7	1.3
SUDS	42.4	23.5	50.7	22.4	54.3	21.7	63.9	24.7
Willingness	79.6	23.6	74.9	23.3	73.1	27.2	69.6	27.1
Acceptance								
Rituals	0.3	1.0	0.5	1.3	0.7	1.1	0.7	1.2
SUDS	36.9	25.9	45.2	28.0	53.4	22.2	67.3	21.3
Willingness	87.2	21.4	78.4	25.6	78.8	26.5	74.1	30.4
Regulation								
Rituals	0.3	0.7	0.8	1.5	1.5	4.8	0.0	0.0
SUDS	40.3	22.7	50.4	19.1	48.2	25.3	49.4	29.1
Willingness	78.5	24.2	68.1	27.3	73.2	30.8	73.1	22.2
Control								
Rituals	0.9	2.6	1.1	1.6	0.4	0.5	1.2	1.8
SUDS	49.7	21.0	56.5	17.8	61.4	16.3	73.8	20.0
Willingness	73.1	24.2	76.5	17.0	66.4	25.1	60.0	27.8

Note. SUDS = Subjective Units of Distress. Measures compared across sessions using minimum number of tasks completed at either session. For number of BAT tasks completed, see Table 3.

Table A3

Means and Standard Deviations of Psychophysiological Measures by Session and Task

	Task 1 (*n* = 53)		Task 2 (*n* = 47)		Task 3 (*n* = 35)		Task 4 (*n* = 27)	
Measure	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Session 1								
Full Sample								
NS.SCRs	9.8	5.8	8.0	5.14.6	8.4	4.6	7.5	5.0
SCL	14.3	15.0	14.2	15.5	15.6	17.6	14.5	15.7
Heart Rate	80.4	12.5	80.0	12.0	82.2	13.4	81.0	14.4
Acceptance								
NS.SCRs	9.1	5.8	8.5	5.4	7.8	5.1	7.1	5.5
SCL	17.4	20.3	17.1	19.2	19.4	21.6	21.2	23.2
Heart Rate	83.6	11.9	84.2	11.1	86.7	13.9	85.0	14.7
Regulation								
NS.SCRs	10.3	3.8	8.2	4.9	9.5	2.0	9.2	5.1
SCL	12.4	2.7	12.1	2.8	11.8	3.0	11.0	2.7
Heart Rate	76.5	14.2	75.3	14.4	77.1	14.0	74.5	14.0
Control								
NS.SCRs	10.0	7.4	7.4	5.1	8.1	5.8	6.2	4.1
SCL	12.9	15.9	12.9	17.5	14.9	21.0	8.7	3.3
Heart Rate	81.1	11.2	79.7	10.3	82.5	11.3	82.9	14.2
Session 2								
Full Sample								
NS.SCRs	9.9	8.0	7.7	5.9	7.3	6.2	6.2	5.4
SCL	12.9	14.1	13.0	14.7	12.4	12.7	9.7	4.1
Heart Rate	80.7	10.8	80.9	10.9	80.4	11.3	81.9	13.5
Acceptance								
NS.SCRs	7.2	7.2	6.6	5.4	3.3	4.0	6.5	6.6
SCL	8.7	2.9	8.6	3.2	8.9	3.6	8.5	3.3
Heart Rate	82.1	10.9	83.3	10.8	81.2	13.0	84.7	16.2
Regulation								
NS.SCRs	10.6	4.2	10.2	5.1	8.7	5.3	4.2	2.9
SCL	11.5	4.5	11.8	4.9	12.0	4.8	12.0	5.1
Heart Rate	78.7	11.1	79.4	10.3	78.5	9.2	78.7	9.4
Control								
NS.SCRs	12.1	10.5	7.1	6.7	10.8	6.7	7.6	5.7
SCL	18.3	22.8	18.3	23.0	16.8	21.4	9.1	3.4
Heart Rate	80.9	10.7	79.2	11.6	81.2	11.3	81.2	13.9

Note. NS.SCRs = Nonspecific skin conductance responses, SCL = Skin conductance level. SCL in microsiemens (μS); heart rate in beats per minute

CURRICULUM VITAE

BROOKE SMITH

Education

2018 – Present	VA Puget Sound Health Care System, American Lake Division Doctoral Internship in Clinical Psychology (APA accredited) Training Director: Allison Aosved, Ph.D.
Ph.D. 2019	Utah State University Combined Clinical/Counseling Psychology (APA accredited) Dissertation: *Physiological, behavioral, and self-report outcomes of acceptance and regulation approaches to exposures for intrusive thoughts* Chair: Michael P. Twohig, Ph.D.
M.S. 2015	Utah State University Combined Clinical/Counseling Psychology (APA accredited) Thesis: *Effects of differential rates of alternative reinforcement on resurgence of human avoidance behavior: A translational model of relapse in the anxiety disorders* Chair: Michael P. Twohig, Ph.D.
B.A. 2010	University of Nevada Reno Major: Psychology, with distinction Minor: English Literature Undergraduate Honor's Thesis: *The influence of a personal values intervention on cold pressor pain tolerance* Chair: Steven C. Hayes, Ph.D.

Awards & Honors

2012 – 2016	Presidential Doctoral Research Fellowship ($20,000 plus tuition per year) Utah State University, Office of Research and Graduate Studies – Logan, UT
2015	Graduate Enhancement Award ($4,000) Utah State University, Graduate Student Council – Logan, UT
2015	Walter R. Borg Applied Practice and Research Scholarship ($3,000) Utah State University, Department of Psychology – Logan, UT

2010	Psi Chi Undergraduate Research Fair Award University of Nevada Reno, Department of Psychology – Reno, NV
2008	Critical Writing Award University of Nevada Reno, Department of English – Reno, NV
2007 – 2009	Dean's List University of Nevada Reno – Reno, NV

Grant Activity

Safe Passage
Funding Period: 9/2017 – 9/2020
Amount: $15,000
Funding Source: Utah State University Diversity Council
Role: Co-Investigator (PI: Litson, K.)
Activities: Co-developed project, co-authored application

Promotion and Understanding of Tolerance/Acceptance of Obsessions
Funding Period: 12/2015 – 12/2017
Amount: $50,000
Funding Source: International OCD Foundation
Role: Project Director (PI: Twohig, M. P.)
Activities: Designed study, co-authored application

Effects of Differential Rates of Alternative Reinforcement on Resurgence of Human Avoidance Behavior: A Translational Model in the Anxiety Disorders
Date submitted: October 2013
Amount: $1,000 (Not Funded)
Funding Source: Society for the Advancement of Behavior Analysis
Role: Principle Investigator

Research Experience

2018 – Present	Predictors of Outcome in Outpatient and Residential Functional Restoration Pain Programs for Veterans with Chronic Pain Data Analyst VA Puget Sound Health Care System, American Lake – Tacoma, WA Supervisors: Jonathan Moore, Ph.D. & Lauren Hollrah, Psy.D.
2015 – 2018	International OCD Foundation Grant: Promotion and Understanding of Tolerance/Acceptance of Obsessions Project Director Center for Clinical Research, Utah State University – Logan, UT PI: Michael P. Twohig, Ph.D.

2012 – 2018 Center for Clinical Research
Graduate Researcher & Graduate Research Assistant
Department of Psychology, Utah State University – Logan, UT
PI: Michael P. Twohig, Ph.D.

2008 – 2011 Contextual Behavioral Science Laboratory
Undergraduate Research Assistant
Department of Psychology, University of Nevada Reno
PI: Steven C. Hayes, Ph.D.

2007 – 2010 Couples and Family DBT Research Laboratory
Undergraduate Research Assistant
Department of Psychology, University of Nevada Reno
PI: Alan E. Fruzzetti, Ph.D.

Clinical Experience

2018 – Present VA Puget Sound Health Care System, American Lake – Tacoma, WA
Psychology Intern

Rotation 1: PTSD Outpatient Clinic
Rotation 2:Psychosocial Rehabilitation and Recovery Center
Rotation 3: Pain Clinic
Supervisors: Alycia Zink, Ph.D.; Kristin Gayle, Ph.D.; Ross Melter, Psy.D.; Lauren Hollrah, Psy.D.

2017 – 2018 Utah State University Health and Wellness Center – Logan, UT
Graduate Assistant Therapist
Supervisor: M. Scott DeBerard, Ph.D.

2012 – 2018 Center for Clinical Research – Logan, UT
Research Therapist & Assessor
Supervisors: Michael P. Twohig, Ph.D. & Jonathan S. Abramowitz, Ph.D.

2015 – 2016 Avalon Hills Residential Eating Disorders Program – Logan, UT
Practicum Student Therapist
Supervisors*:* Jenna Glover, Ph.D. & Tera Lensegrav-Benson, Ph.D.

2014 – 2015 Anxiety Specialty Clinic – Logan, UT
Practicum Student Therapist
Supervisor: Michael P. Twohig, Ph.D.

2015 Brigham City Community Hospital Cardiac Wellness – Brigham City, UT
Graduate Assistant Therapist
Supervisor: M. Scott DeBerard, Ph.D.

2013 – 2014 Utah State University Psychology Community Clinic – Logan, UT
Practicum Student Therapist
Supervisors: Susan Crowley, Ph.D. & Jenna Glover, Ph.D.

2011 – 2012 Fit Learning – Reno, NV
Precision Teaching Instructor & Case Manager
Supervisor: Kendra Newsome, Ph.D., BCBA-D

2010 – 2011 Alliance Family Services – Reno, NV
Psychosocial Rehabilitation Specialist
Supervisor: Christian Conte, Ph.D.

2009 – 2010 University of Nevada Reno Early Childhood Autism Program – Reno, NV
Autism Tutor
Supervisor: Patrick Ghezzi, Ph.D., BCBA-D

Clinical Supervision Experience

2014 – 2015 Utah State University Psychology Community Clinic – Logan, UT
ACT Peer Consultant (2 graduate students)
Supervisor: Susan Crowley, Ph.D.

Publications

Peer-Reviewed Journal Articles

10. Smith, B. M., Ong, C. W., Barrett, T. S., Bluett, E. J., Slocum, T. A., & Twohig, M. P. (2019). Longitudinal effects of a 2-year meditation and Buddhism program on well-being, quality of life, and valued living. *Mindfulness.* doi: 10.1007/s12671-019-01165-z

9. Levin, M. E., Smith, B. M., & Smith, G. S. (2019). The potential benefits of flexibility for dissemination and implementation: Acceptance and commitment therapy as an example. *Perspectives on Behavior Science*.

8. Morrison, K. L., Smith, B. M., Ong, C. W., Lee, E. B., Friedel, J. E., Odum, A. L., Madden, G. A., Ledermann, T., Rung, J., & Twohig, M. P. (2019). Effects of acceptance and commitment therapy on impulsive decision

making. *Behavior Modification*.

7. Twohig, M. P., Abramowitz, J. S., Smith, B. M., Fabricant, L. E., Jacoby, R. J., Morrison, K. L., Bluett, E. J., Reuman, L., Blakey, S. M., & Ledermann, T. (2018). Adding acceptance and commitment therapy to exposure and response prevention for obsessive-compulsive disorder: A randomized controlled trial. *Behaviour Research and Therapy, 108,* 1-9. doi: 10.1016/j.brat.2018.06.005

6. Smith, B. M., Villatte, J. L., Ong, C. W., Butcher, G., Twohig, M. P., Levin, M. E., & Hayes, S. C. (2018). The influence of a personal values intervention on cold pressor-induced distress tolerance. *Behavior Modification.* doi: 10.1177/0145445518782402

5. Galizio, A., Frye, C. C. J., Haynes, J. M., Friedel, J. E., Smith, B. M., & Odum, A. L. (2018). Persistence and relapse of reinforced behavioral variability. *Journal of the Experimental Analysis of Behavior, 109,* 210-237. doi: 10.1002/jeab.309

4. Lee, E. B., Smith, B. M., Twohig, M. P., Lensegrav-Bensen, T., & Quakenbush-Roberts, B. (2017). Assessment of the body image acceptance and action questionnaire in a female residential eating disorder treatment facility. *Journal of Contextual Behavioral Science, 6*(1), 21–28. doi: 10.1016/j.jcbs.2016.11.004

3. Smith, B. M., Smith, G. S., Shahan, T. A., Madden, G. A., & Twohig, M. P. (2017). Effects of differential rates of alternative reinforcement on resurgence of human behavior. *Journal of the Experimental Analysis of Behavior, 107*(1), 191-202. doi: 10.1002/jeab.241

2. Twohig, M. P. & Smith, B. M. (2015). Targeting the function of inner experiences in obsessive compulsive and related disorders. *Current Opinion in Psychology, 2,* 32-37. doi: 10.1016/j.copsyc.2014.12.033

1. Twohig, M. P., Abramowitz, J. S., Bluett, E. J., Fabricant, L. E., Jacoby, R. J., Morrison, K. L., ... Smith, B. M. (2014). Exposure therapy for OCD from an acceptance and commitment therapy (ACT) framework. *Journal of Obsessive-Compulsive and Related Disorders, 6*, 167-173. doi: 10.1016/j.jocrd.2014.12.007

Book Chapters

6. Ong, C. W., Smith, B. M., Levin, M. E., & Twohig, M. P. (in press). Acceptance and mindfulness. In J. S. Abramowitz & S. M. Blakey (Eds.). *Clinical Handbook of Fear and Anxiety: Psychological Processes and Treatment*

Mechanisms. Washington, D.C.: American Psychological Association Press.

5. Smith, B. M., Twohig, M. P., & Levin, M. E. (2017). Acceptance and commitment therapy. In A. E. Wenzel (Ed.), *The SAGE Encyclopedia of Abnormal and Clinical Psychology* (7-9). Thousand Oaks, CA: Sage.

4. Morrison, K. L., Smith, B. M., & Twohig, M. P. (2017). Mindfulness and acceptance therapies for obsessive-compulsive and related disorders. In C. Pittenger (Ed.) *Obsessive-compulsive Disorder: Phenomenology, Pathophysiology, and Treatment* (431-442). New York, NY: Oxford University Press.

3. Morrison, K. L., Smith, B. M., Lee, E. B., & Twohig, M. P. (2017). Acceptance and commitment therapy for OC-spectrum disorders. In J. S. Abramowitz, D. McKay, & E. A. Storch (Eds.) *The Wiley Handbook of Obsessive Compulsive Disorders* (1175-1192). Hoboken, NJ: Wiley-Blackwell.

2. Smith, B. M., Bluett, E. J., Lee, E. B., & Twohig, M. P. (2017). Acceptance and commitment therapy for OCD. In J. S. Abramowitz, D. McKay, & E. Storch (Eds.) *The Wiley Handbook of Obsessive Compulsive Disorders* (596-613). Hoboken, NJ: Wiley-Blackwell.

1. Levin, M. E., Twohig, M. P., & Smith, B. M. (2016). Contextual behavioral science: An overview. In R. Zettle, S. C. Hayes, D. Barnes-Holmes, & A. Biglan (Eds.) *The Wiley Handbook of Contextual Behavioral Science* (17-36). Oakland, CA: New Harbinger.

Other Publications

2. Ong, C. W., Papa, L. A., Reveles, A. K., Smith, B. M., & Domenech Rodríguez, M. M. (2018). *Safe Passages for U: Training Manual.* Logan, UT: Utah State University. Retrieved from: https://osf.io/45kb6/. doi: 10.17605/OSF.IO/45KB6

1. Ong, C. W., Papa, L. A., Reveles, A. K., Smith, B. M., & Domenech Rodríguez, M. M. (2018). *Safe Passages for U: Participant's Manual*. Logan, UT: Utah State University. Retrieved from: https://osf.io/d5bz7/

Manuscripts Under Peer-Review

1. Ong, C. W., Blakey, S. M., Smith, B. M., Morrison, K. L., Bluett, E. J., Abramowitz, J. S., & Twohig, M. P. (under review). Moderators and processes of change in traditional exposure and response prevention (ERP) versus acceptance and commitment therapy-informed ERP for

obsessive-compulsive disorder.

Manuscripts in Preparation

3. Smith, B. M., Smith, G. S., Shahan, T. S., & Twohig, M. P. (in preparation). Resurgence of negatively reinforced target behavior in humans: Effects of differential rates of alternative reinforcement.

2. Smith, B. M., Ong, C. W., Barrett, T. S., Bluett, E. J., Slocum, T. A., & Twohig, M. P. (in preparation). Psychological and health impacts of long-term meditation.

1. Smith, B. M., Ong, C. W., Madden, G. A., & Twohig, M. P. (in preparation). Development and validation of the Behavioral Economic Flexibility Inventory (BE-Flex-i).

Conference Presentations

Presentations prior to 2014 have been adjusted from maiden to married name

Peer-Reviewed Presentations

12. Twohig, M. P. & Smith, B. M. (2018, July). *Mechanisms and outcomes of acceptance and regulation approaches to exposures for intrusive thoughts. An IOCDF-funded study.* Paper presented at the International OCD Foundation Annual OCD Conference, Washington, DC.

11. Smith, B. M., Smith, G. S., Shahan, T. S., & Twohig, M. P. (2017, May). Resurgence of negatively reinforced target behavior in humans: Effects of differential rates of alternative reinforcement. In B. M. Smith (Chair), *Variables affecting resurgence and renewal across species*. Paper presented at the annual meeting of the Association for Behavior Analysis International, Denver, CO.

10. Rudaz, M., Smith, B. M., Potts, S., Levin, M. E., & Twohig, M. P. (2016, June). The effectiveness of a mind-body training to foster self-care in health professionals. In B. Pilecki (Chair), *Which skills for whom? Identifying and applying mindfulness skills in diverse populations.* Paper presented at the annual meeting of the Association for Contextual Behavioral Science, Seattle, Washington.

9. Smith, B. M. & Twohig, M. P. (2015, July). Effects of differential rates of alternative reinforcement on resurgence of human avoidance behavior: A translational model of relapse in the anxiety disorders. In B. M. Smith (Chair), *Toward a coherent model of scientific progress: Translational research in Contextual Behavioral Science.* Paper and symposium

presented at the annual meeting of the Association for Contextual Behavioral Science, Berlin, Germany.

8. Smith, B. M. (2015, July). *Using basic science and RFT to study ACT processes of change.* Symposium chaired at the annual meeting of the Association for Contextual Behavioral Science, Berlin, Germany.

7. Smith, B. M., Villatte, J. L., Twohig, M. P., Levin, M. E., & Hayes, S. C. (2014, November). Influence of a personal values intervention on cold pressor-induced distress tolerance. In M. P. Twohig, *Recent contextual behavioral research targeting psychological inflexibility.* Paper presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Philadelphia, PA.

6. Smith, B. M. (2014, June). *Promoting exposure therapy in practice and research: The role of ACT and citizen science*. Symposium chaired at the annual meeting of the Association for Contextual Behavioral Science, Minneapolis, MN.

5. Abramowitz, J. S., Smith, B. M., Bluett, E. J., Fabricant, L., Jacoby, R. J., Morrison, K., & Twohig, M. P. (2013, November). Predictors of OCD symptom dimensions: Obsessional beliefs and experiential avoidance. In M. Whittal (Chair), *Understanding and treating obsessive-compulsive and related disorders: Methods, meaning, and maximizing treatment gains.* Paper presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Nashville, TN.

4. Brooks Rickard, K., Newsome, W. D., Smith, B. M., & Billett, J. (2013, May). *Demystifying the notions of educators: A clarification of worldviews.* Paper presented at the annual meeting of the Association for Behavior Analysis International, Minneapolis, MN.

3. Newsome, W. D., Ward, T. A., Smith, B. M., Fuller, T. C., Brooks Rickard, K., Smith, G. S., Ward, E., Ward, T., Alavosius, M. P., & Hayes, L. J. (2012, February). *Hungry, will cooperate for food: UNR-BA students put green where mouth is.* Paper presented at the annual Behavior Analysis Research Fair, Reno, NV.

2. Smith, B. M., Newsome, W. D., Brooks Rickard, K., & Billett, J. (2011, December). State your assumptions: Toward a better understanding of special education practices. In W. D. Newsome (Chair), *The cost of philosophical eclecticism in mainstream education and the benefit of stating your assumptions: The Fit Learning model from worldview to practice.* Paper presented at the annual meeting of the Standard Celebration Society, Reno, NV.

1. Billett, J., Brooks Rickard, K., Newsome, W. D., & Smith, B. M. (2011, December). Pushing back with proven principles and practices. In W. D. Newsome (Chair), *The cost of philosophical eclecticism in mainstream education and the benefit of stating your assumptions: The Fit Learning model from worldview to practice.* Paper presented at the annual meeting of the Standard Celebration Society, Reno, NV.

Peer-Reviewed Posters

9. Domenech Rodríguez, M. M., Reveles, A. K., Litson, K., Patterson, C., Smith, B. M., & Ong, C. W. (2018, October). *Development of a measure to assess cultural competence in the general population.* Poster presented at the biennial conference of the National Latina/o Psychological Association, La Jolla, CA.

8. Smith, B. M., Slocum, T. A., & Twohig, M. P. (2017, November). *Longitudinal effects of a 2-year meditation and Buddhism course on psychological and health outcomes.* Poster presented at the Special Interest Group Exposition (Mindfulness & Acceptance SIG) at the annual meeting of the Association for Cognitive and Behavioral Therapies, San Diego, CA.

7. Galizio, A., Friedel, J. E., Smith, B. M., Frye, C. C. J., McIntyre, S., & Odum, A. L. (2015, May). *Reinforced behavioral variability is resistant to change under extinction and reinstatement.* Poster presented at the annual meeting of the Association for Behavior Analysis International, San Antonio, TX

6. Smith, B. M., Brooks Rickard, K., Newsome, W. D., & Humphreys, T. (2012, September). *Utilizing fluency-building to train deictic relational responding in a young child with autism*. Poster presented at the annual meeting of the Nevada Association for Behavior Analysis, Reno, NV.

5. Newsome, W. D., Ward, T. A., Smith, B. M., Fuller, T. C., Brooks Rickard, K., Smith, G. S., Ward, E., Ward, T., & Alavosius, M. P. (2012, August). *"The Patch" cooperative gardening project.* Poster presented at the annual Behavior Change for a Sustainable World Conference, Columbus, Ohio.

4. Smith, B. M. & Brooks Rickard, K. (2012, July). *Utilizing fluency-building to train deictic relational responding in a young child with autism.* Poster presented at the annual meeting of the Association for Contextual Behavioral Science, Washington, D.C.

3. Smith, B. M., Villatte, J. L., Levin, M., & Hayes, S. C. (2010, June). *The influence of a values-only intervention on pain tolerance.* Poster presented at the annual meeting of the Association for Contextual Behavioral

Science, Reno, NV.

2. Smith, B. M., Boulanger, J. L., & Hayes, S. C. (2009, June). *The influence of values on pain tolerance: A pilot study*. Poster presented at the annual meeting of the Association for Contextual Behavioral Science, Enschede, Netherlands.

1. Smith, B. M., Boulanger, J. L., & Hayes, S. C. (2009, May). *Mediators of psychological flexibility in a modern application of clinical behavior analysis.* Poster presented at the annual meeting of the Association for Behavior Analysis International, Phoenix, AZ.

Clinical Trainings Provided

8. Papa, L. A. & Smith, B. M. (2018, January). *USU Safe Passages for U*. Four-hour diversity and multicultural workshop presented for Psychology 6290: Diversity Issues in Treatment and Assessment.

7. Smith, B. M. (2017, October). *Acceptance and commitment training for women in leadership.* Five-hour invited workshop presented for the Center for Women and Gender, Utah State University, Logan, UT.

6. Smith, B. M. & Smith, G. S. (2017, September). *Introduction and application of acceptance and commitment therapy for applied behavior analysts.* Four-hour invited workshop presented at the Chrysalis Behavior Summit, Salt Lake City, UT.

5. Smith, B. M., Lee, E. B., Haeger, J. A., & Smith, G. S. (2017, August). *Introduction to acceptance and commitment therapy for applied behavior analysts.* Three-hour workshop presented at the annual meeting of the Utah Association for Behavior Analysis, Salt Lake City, UT.

4. Smith, B. M. (2016, October). *Acceptance and commitment training: Women's Leadership Initiative.* Five-hour workshop presented for the Center for Women and Gender, Utah State University, Logan, UT.

3. Twohig, M. P., & Smith, B. M. (2016, September). *Introduction to acceptance and commitment therapy and experiential workshop*. Two-day workshop presented at the annual Introduction to Acceptance and Commitment Therapy Workshop Series in Logan, UT.

2. Smith, B. M. (2015, April). *Why can't I stop these thoughts?* Half-hour workshop presented at the annual Mental Health Awareness Week, Utah State University, Logan, UT.

1. Smith, B. M. (2015, March & April). *Stress management 101*. Half-hour workshops presented at Brigham City Cardiac Wellness, Brigham City, UT.

Editorial Activities

Ad Hoc Reviewer
Mindfulness
Journal of Affective Disorders
Journal of Contextual Behavioral Science
Journal of the Experimental Analysis of Behavior
Special Issue on Experimental Manipulations of Delay Discounting & Related Processes
Special Issue on Stimulus-Stimulus Relations

Teaching Experience

Instructor – Utah State University

2015 – 2016 Analysis of Behavior: Advanced (online)
55 undergraduate students (2 courses)

2015 Abnormal Psychology
20 undergraduate students

Graduate Teaching Assistant – Utah State University

2014 – 2015 Integrative Practicum with Adults, Adolescents, and Children
8 graduate students
Supervisors: Susan Crowley, Ph.D. & Scott DeBerard, Ph.D.

2014 Analysis of Behavior: Advanced
25 undergraduate students
Supervisor: Amy Odum, Ph.D.

2013 Intellectual Assessment
11 graduate students
Supervisor: JoAnn Tschanz, Ph.D.

2013 Analysis of Behavior: Basic Principles
15 undergraduate students
Supervisor: Gregory Madden, Ph.D.

Memberships in Professional Organizations

Association for Psychological Science
Association for Contextual Behavioral Science
 Contextual Philosophy of Science SIG
Association for Behavioral and Cognitive Therapies
 Mindfulness & Acceptance SIG
Association for Behavior Analysis International
Association for Psychophysiological Research
Psi Chi, National Honors Society in Psychology
 Vice President UNR Chapter 5/09 – 5/10
American Association for the Advancement of Science

Professional Service

2018 – Present	Intern Representative Education and Didactic Committee VA Puget Sound Health Care System, American Lake – Tacoma, WA

Community Service

2017 – 2018	Co-Founder Cache Valley ACLU People Power Group – Logan, UT
2015 – 2018	Cache Valley Sangha Leadership Group Cache Valley Sangha – Logan, UT
2015	Meditation Co-Instructor Cache County Jail – Logan, UT