2017

The impact of mindfulness meditation on fear load and fear inhibition : examining parasympathetic activation as an underlying mechanism

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ABSTRACT

THE IMPACT OF MINDFULNESS MEDITATION ON FEAR LOAD AND FEAR INHIBITION: EXAMINING PARASYMPATHETIC ACTIVATION AS AN UNDERLYING MECHANISM

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As demonstrated via fear-potentiated startle (FPS) paradigms, individuals with fear-based disorders exhibit greater startle responses and a lowered ability to distinguish between fear-related stimuli and safe stimuli (i.e., poor fear inhibition). Physiological indicators of self-regulation, such as respiratory sinus arrhythmia (RSA), appear to be related to the startle response. Therefore, increasing self-regulation may reduce fear load and improve fear inhibition. One method for doing so may be through mindfulness meditation. Using a FPS paradigm, the current study explored the use of mindfulness meditation (as compared to relaxation) as a method of decreasing fear load and enhancing fear inhibition by improving self-regulation (measured by RSA). Participants included 54 female undergraduates (*M*age = 20.26) who completed several self-report questionnaires and then underwent the FPS paradigm. Results indicated that both groups exhibited similar increases in self-reported state mindfulness and decreases in tension. Contrary to hypotheses, membership in the relaxation condition predicted greater increase in RSA compared to the mindfulness condition. RSA mediated the relation between study condition and fear inhibition, but not fear load. Results may suggest that longer and/or more frequent mindfulness sessions may be necessary in order for positive effects on RSA to be observed. Limitations and future directions will be discussed.

NORTHERN ILLINOIS UNIVERSITY
DE KALB, ILLINOIS

AUGUST 2017

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BY

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A DISSERTATION SUBMITTED TO THE GRADUATE SCHOOL

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE

DOCTOR OF PHILOSOPHY

DEPARTMENT OF PSYCHOLOGY

Dissertation Director:
Holly K. Orcutt

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CHAPTER 1

INTRODUCTION

Overview

Fear-based psychopathology is highly prevalent in the United States, with a lifetime prevalence rate for anxiety disorders at 34% (e.g., posttraumatic stress disorder, panic disorder; Kessler, Petukhova, Sampson, Zaslavsky, & Wittchen, 2012). In the United States, fear-based disorders cost more than $42 billion annually, accounting for close to one-third of total mental health expenditures (Greenberg et al., 1999). Given the significant impact that fear-based disorders have on individuals and society, research has increasingly explored the ways in which individuals develop fear-based psychopathology, as well as interventions that help to reduce symptomatology. The primary mechanism through which individuals develop fear-based psychological disorders is through fear learning. During a fearful event, individuals may undergo classical conditioning whereby an aversive unconditioned stimulus (US; e.g., an explosion) is paired with a conditioned stimulus (CS; e.g., a green jeep) and results in a conditioned response (CR; e.g., fear response). As demonstrated via fear-potentiated startle (FPS) paradigms, individuals with fear-based disorders tend to exhibit deficits in fear extinction and fear inhibition, indicated by startle in response to a CS that is no longer paired with a US. Indicators of autonomic self-regulation, such as respiratory sinus arrhythmia (RSA), appear to be related to one's ability to inhibit fear (e.g., Pappens et al., 2014; Ruiz-Padial, Sollers, Vila, & Thayer, 2003). Therefore, increasing self-regulatory capacity may improve fear inhibition. One such

method for increasing self-regulation, as indexed by RSA, may be through exercises such as mindfulness meditation.

Using a previously validated FPS paradigm, the current study explored the use of mindfulness meditation as a method of enhancing fear inhibition by improving self-regulation (RSA). A review of fear learning and FPS paradigms will first be presented, followed by clinical and neurological research findings from the FPS literature. Subsequently, autonomic self-regulation and its relations with startle responding will be discussed. Mindfulness, its use as a psychological intervention, and its relations with autonomic functioning will be reviewed. Finally, methodology, results, and implications of the current study will be discussed.

Fear Learning

Classical Conditioning

In the context of behavior, learning refers to a change in the probability of exhibiting a given behavior as a result of experience (Mowrer, 1947). One way in which learning may occur is through classical conditioning. This phenomenon was originally discovered by Ivan Pavlov while studying digestion in dogs. Pavlov noticed that the dogs in his study began to salivate upon the presence of the research technician who normally fed them, regardless of whether the food was present or not (i.e., the dogs had associated the technician, and not just the food, with being fed). As a result, Pavlov began to study learning processes in dogs by pairing the act of being fed with the ringing of a bell. In this case, the food was the US, the bell was the CS, and salivation to the bell was the CR (while salivation to the food was the unconditioned response (UR). One of Pavlov's observations (1927) was that the CR was stronger when more closely

presented in time with the US. In addition, he observed that repeated pairings were typically necessary to elicit the CR in the absence of the US, though repeated pairings are not always necessary for fear learning to occur (Paschall & Davis, 2002). For example, given the intensity of certain fear-inducing situations (such as an explosion), it follows that individuals may learn more quickly (i.e., only a single trial of the association between the explosion and a CS may be needed in order to develop the CR).

As suggested by Paschall and Davis (2002), a CS may elicit an unconditioned fear response after only one pairing with an aversive US. Specifically, when an individual is exposed to a frightening or traumatic experience, the fight-or-flight response may be activated via the sympathetic nervous system (SNS). This response involves increased heart rate and blood pressure, vein constriction, and pupil dilation. In this case, the traumatic experience is the US and the fight-or-flight response is the UR. Certain stimuli in the environment of the traumatic experience may serve as CSs, such as smells, sights, and/or sounds. As a result, individuals may learn to fear a particular CS that was associated with the traumatic experience, and therefore exhibit the fight-or-flight response (now a CR) when in the presence of these stimuli that were originally neutral. One way in which to measure this fear response is through examination of fear-potentiated startle (FPS).

Fear-Potentiated Startle

Background of FPS Paradigm

The FPS paradigm is based upon classical conditioning principles, whereby an aversive US is intentionally paired with a CS (which evokes the FPS response), and a CR is observed.

FPS is defined as the relative increase in startle response from baseline to pairing of the CS and US (Jovanovic et al., 2005). While many FPS paradigms have examined fear learning and fear extinction, Myers and Davis (2004) developed an FPS paradigm to examine inhibitory fear learning in rodents (i.e., fear inhibition). Specifically, the Myers and Davis (2004) study is of note because it set the stage for the development of a human FPS paradigm for studying fear inhibition (discussed below). In the Myers and Davis (2004) paradigm, rats were exposed to shocks that were delivered through the metal floors of their cages, and startle was measured using the amount of body displacement in the cage (Myers & Davis, 2004). Results indicated that rats had greater startle responses to an excitatory CS (paired with the US) than to an inhibitory CS (not paired with the US), suggesting that the rats were successfully conditioned to the various stimuli. Further demonstrating that classical conditioning took place, the authors found that the rodents' FPS responding to both the excitatory and inhibitory CSs initially increased (before learning had taken place), and that responding to the excitatory CS continued to increase over time (fear learning), while responding to the inhibitory CS continued to decrease over time (fear inhibition; Myers & Davis, 2004). The difference in startle responses was significant after three training sessions (which contained five presentations each of excitatory and inhibitory CSs), suggesting that 10-15 presentations of each stimulus are necessary for the development of inhibition (Myers & Davis, 2004).

The study by Myers and Davis (2004) represents an important step in translational research because it allows for the study of fear learning in a paradigm that is amenable to adaptation for studying fear learning and fear inhibition in humans. Specifically, the startle response is an objective measure of fear that can be utilized in both animal and human models. In

addition to being objective and translational, measurement of the startle response is further supported because it is noninvasive, reliable, and a valid indicator of psychological phenomena (Filion, Dawson, & Schell, 1998; Grillon, 2002; Grillon & Baas, 2003; Lissek et al., 2010; McTeague et al., 2010; Rothbaum et al., 2014).

In their development of the FPS paradigm for humans, Jovanovic et al. (2005) used a similar conditioning procedure with colored lights as CSs and an airblast to the throat as the aversive US. Jovanovic et al. (2005) had participants use a keypad to indicate whether a given stimulus was perceived as safe (not associated with airblast), threatening (associated with airblast), or ambiguous (if participant was unsure about whether or not the airblast would be delivered). Whereas startle in rats was indicated by the displacement of the whole body in the cage, startle in humans is typically measured using the eyeblink muscle contraction in response to acoustic startle (i.e., the acoustic startle response; Filion et al., 1998). To determine the acoustic startle response, Jovanovic et al. (2005) used facial electromyography (EMG) electrodes under the right eye to measure participants' eyeblinks in response to a sound burst delivered through headphones. A 70-decibel (A weighting; dBA) noise was used as background, and a 104- or 108-dBA noise was used as a startle probe. Results provided support for this human-adapted FPS paradigm, as indicated by significant differences in startle between baseline (noise alone; NA) and excitatory CS trials, and between excitatory CS and inhibitory CS trials (Jovanovic et al., 2005). Further, the authors found that participants who demonstrated greater awareness of whether or not a CS would be followed by an airblast also demonstrated greater startle to the excitatory CS and greater inhibition to the inhibitory CS than participants with less

awareness. The finding regarding awareness of contingencies suggests that attention may play a role in how individuals respond to threatening and non-threatening stimuli.

Norrholm et al. (2006) extended this work by using the FPS paradigm to explore fear inhibition through the process of extinction in humans. Extinction is defined as the reduction in a CR via repeated presentations of the previously reinforced CS without presentation of the US (Myers & Davis, 2002; Norrholm et al., 2006). Given that impaired fear inhibition has been implicated in fear-based psychological disorders (e.g., PTSD), studying this process experimentally is important for understanding how it may contribute to the development and maintenance of psychopathology (Davis, Falls, Gewirtz, 2000; Jovanovic et al., 2009b; Lissek et al., 2005, 2009). Examining fear inhibition through extinction paradigms such as FPS is particularly appealing because the FPS paradigm allows for objective, physiological measurement of fear (i.e., the acoustic startle response). Norrholm et al. (2006) studied extinction in the FPS paradigm with healthy adult participants (i.e., no history of mental illness). Measurement of the startle response, along with the noise burst and airblast components, was identical to that of Jovanovic et al. (2005). Similar stimuli were used, which consisted of two colored lights. Participants were first administered six startle probes (NA; habituation phase), followed by an acquisition phase that consisted of 12 NA trials, 12 trials of A+ (CS paired with airblast), and 12 trials of B- (CS not paired with airblast; Norrholm et al., 2006). These trials were organized by blocks, such that there was a total of three blocks in acquisition, each consisting of 12 trials (four A+, four B-, and four NA in each block). Subsequently, participants underwent extinction, during which the airblast was no longer administered. Extinction consisted of six blocks with 12 trials each (four A-, four B-, and four NA; Norrholm et al., 2006). Results

provided support for using the FPS paradigm as a measure of fear extinction in humans, as indicated by significant reductions in the acoustic startle response between acquisition and extinction sessions. The study also replicated the finding that A+ trials (paired with airblast) resulted in greater acoustic startle than that of the B- trials. These findings suggest that the FPS paradigm used by Norrholm et al. (2006) is a promising tool for measuring conditioned fear learning and fear extinction.

FPS Clinical Research Findings

Given that the FPS paradigm has demonstrated usefulness in examining fear learning and inhibition, much of the clinical research using FPS has been related to fear-based disorders, such as PTSD (i.e., disorders characterized by fear). Generally speaking, research has demonstrated that both civilians and veterans with PTSD exhibit greater FPS than those without PTSD (Grillon & Morgan, 1999; Jovanovic et al., 2009b, 2010a). Specifically, individuals with PTSD tend to exhibit stronger FPS responses to both danger (CS associated with US) and safety (CS not associated with US) cues compared to those without PTSD, suggesting exaggerated startle responding and poor fear inhibition (Jovanovic et al., 2009b, 2010a; Jovanovic, Kazama, Bachevalier, & Davis, 2012; Norrholm et al., 2011; Sijbrandij, Engelhard, Lommen, Leer, & Baas, 2013). Heightened FPS may be predictive of PTSD symptoms after trauma exposure (Pole et al., 2009). In some cases, trauma exposure alone may demonstrate a unique relation with startle responding, such that individuals with a trauma history exhibit increased baseline startle responding compared to those without a trauma history (even after controlling for PTSD symptoms; Jovanovic et al., 2009a). The exaggerated FPS response observed among those with

PTSD is consistent with clinical symptomatology associated with the disorder, such that individuals with PTSD tend to experience chronic hyperarousal of the sympathetic nervous system (Grillon, Southwick, & Charney, 1996).

FPS research also suggests that individuals with PTSD experience deficits in fear inhibition as evidenced by a lowered ability to distinguish between danger and safety cues compared to individuals without PTSD (Jovanovic et al., 2009b, 2010a, 2012; Sijbrandij et al., 2013). Specifically, a study by Jovanovic et al. (2009b) found that individuals with PTSD were less able to inhibit fear responding when presented with a safety signal in conjunction with a previously reinforced CS. Given that PTSD is often comorbid with depression, a subsequent study examined whether fear inhibition could also be observed among individuals with major depression (both alone and comorbid with PTSD; Jovanovic et al., 2010a). While individuals with comorbid PTSD and depression demonstrated poor fear inhibition, those with only depression did not exhibit such a deficit. This finding provides support for the assertion that impaired fear inhibition is a biomarker specific to PTSD (Jovanovic et al., 2010a, 2012). Further, this deficit may have a long-term impact on PTSD symptoms. In a study of Dutch soldiers, those who demonstrated poor fear inhibition during a FPS paradigm exhibited worse PTSD symptoms two and nine months following deployment (Sijbrandij et al., 2013). It is important to note, however, that fear inhibition was not assessed prior to deployment. Therefore, results of Sijbrandij et al. (2013) do not necessarily suggest that poor fear inhibition leads to PTSD symptoms, though it may be an important maintaining factor. Overall, the FPS findings regarding fear inhibition are particularly relevant to the heightened fear responding that PTSD patients demonstrate in safe situations. For example, if an individual with PTSD sees someone

reach inside their jacket pocket while at a restaurant, he or she may react as if the individual were reaching for a weapon rather than for a wallet. Experiencing fear in an arguably safe situation with no objective indication of danger demonstrates poor fear discrimination (i.e., lack of safety signal learning) and helps to explain the hypervigilance commonly seen among PTSD populations (i.e., constant readiness for threat). What has yet to be demonstrated is whether poor fear inhibition is a risk factor for the development of PTSD or a consequence of the disorder, though both are likely to be true.

In addition to the observed relations among PTSD and both exaggerated startle and fear inhibition, FPS studies have also highlighted deficits in fear extinction (considered a form of fear inhibition). Specifically, Norrholm et al. (2011) found that individuals with PTSD demonstrated greater FPS responding to a previously reinforced CS during extinction compared to those without PTSD. This finding suggests that PTSD is associated with a deficit in the ability to inhibit a previously learned fear response (i.e., individuals have difficulty learning that the CS is no longer associated with the US).

Deficits in extinction have been explained by the presence of a greater “fear load” among individuals with high levels of PTSD symptoms, such that they demonstrate increased fear levels to the CS+ during early extinction and take longer to extinguish as compared to individuals with less PTSD symptomatology (Norrholm et al., 2011, 2014). Among women with PTSD, levels of cycling estrogen appear to moderate this relation, such that women with low levels of estrogen and PTSD demonstrate greater FPS during extinction compared to women without PTSD (Glover et al., 2012). Fear load has also been associated with an increased attentional bias towards threat, such that individuals with PTSD demonstrate both higher fear loads and greater

attentional bias to threat in comparison to those without PTSD (Fani et al., 2012). This finding suggests that PTSD is characterized by an increased likelihood to attend to threatening stimuli in one's environment, and this tendency may help to explain why it is more difficult for individuals with PTSD to extinguish fear (i.e., the attentional system is taken over by hypervigilance, preventing safety learning from taking place). Given the aforementioned findings, it has been suggested that fear load (i.e., the FPS response to the CS+ during early extinction) may represent an intermediate phenotype of fear-based disorders, resulting from increased attentional bias toward threat and leading to higher PTSD symptoms; as such, it may be a transdiagnostic phenomenon (Briscione, Jovanovic, & Norrholm, 2014; Norrholm et al., 2014; Waters et al., 2014).

One of the proposed pathways through which fear inhibition is related to PTSD may be the hypothalamic-pituitary adrenal (HPA) axis (Jovanovic et al., 2010b). The HPA axis is part of the endocrine system that is responsible for stress regulation and immune function, and its altered functioning has been associated with PTSD symptoms (Yehuda, 2001). In addition, alterations in HPA axis functioning have been associated with anxiety and acoustic startle responding (Keen-Rhinehart et al., 2008; Sutton, Koob, Le Moal, Rivier, & Vale, 1982). For example, Keen-Rhinehart et al. (2008) found that higher levels of corticotropin-releasing hormone (CRH; a hormone released in response to stress) were related to greater startle reactivity. In an examination of HPA axis functioning and FPS in relation to PTSD symptoms, Jovanovic et al. (2010b) found that higher FPS was associated with higher levels of adrenocorticotropin hormone (ACTH; a stress hormone released from the pituitary gland in response to CRH) in individuals with PTSD. Given that higher levels of stress hormones have

been associated with startle responding and psychopathology, Jovanovic et al. (2011) examined whether suppression of cortisol via dexamethasone (a synthetic corticosteroid) would reduce startle responding in the FPS paradigm. The authors observed that administration of dexamethasone reduced the group difference in startle responding between individuals with and without PTSD (i.e., suppressed cortisol resulted in more normative startle responding in the PTSD group; Jovanovic et al., 2011). Overall, these studies suggest that the HPA axis may play a role in fear learning, as indicated by the findings regarding its relations with both startle responding and PTSD symptoms.

In addition to studies of PTSD, the FPS paradigm has also been examined among individuals with various forms of anxiety. Akin to findings among PTSD populations, research has demonstrated that individuals with panic disorder exhibit larger FPS responses and worse fear discrimination (evidenced by increased responding to a safety cue) in comparison to healthy controls (Grillon, Ameli, Goddard, Woods, & Davis, 1994; Larsen, Norton, Walker, & Stein, 2002; Lissek et al., 2009). In a study by Larsen et al. (2002), individuals with panic disorder as well as individuals with social phobia demonstrated greater FPS in response to threat-related words in comparison to healthy controls. Startle magnitudes for panic and social phobia were comparable to one another. Among healthy individuals, high levels of state anxiety (i.e., fear of the US) have also been associated with larger FPS responding (Grillon, Ameli, Foot, & Davis, 1993). This association has not been observed for trait anxiety. Lastly, Gazendam and Kindt (2012) explored the effects of induced worry on FPS responding in healthy adults. During extinction, individuals assigned to a worry condition following acquisition demonstrated greater FPS responses to both danger and safety cues in comparison to controls (Gazendam & Kindt,

2012). Results of this study suggest that worry may decrease one's ability to inhibit the fear response, thus delaying extinction.

Neurological Correlates of Fear Learning

The FPS paradigm has also been useful in examining underlying neurological mechanisms associated with fear learning. One brain region that has been implicated in fear learning is the amygdala. In 2002, Walker and Davis summarized research findings suggesting that receptors in the amygdalae of rats play a role in fear learning and extinction. In particular, experimental drug studies have demonstrated that alterations in amygdala function appear to impact FPS (Stanek, Walker, & Davis, 2000; Walker & Davis, 1997). Further, neurons in the amygdala appear to be altered during fear conditioning and additional drug studies have shown that the disruption of amygdala functioning impairs fear learning, suggesting that the amygdala plays a key role in this process (Stanek et al., 2000). In addition, studies examining FPS have found that the amygdala appears central to the process of fear extinction (Barad, Gean, & Lutz, 2006; Davis, Walker, & Myers, 2003).

Another brain region that has been implicated in fear learning (and particularly in extinction) is the prefrontal cortex (PFC). While the majority of fear learning appears to take place in the amygdala, the PFC becomes more involved during the process of extinction, such that it communicates with the amygdala in order to regulate the fear response (i.e., amygdala suppression; Sotres-Bayon, Cain, & LeDoux, 2006). In this way, extinction may be conceptualized as the product of self-regulation. The PFC's role in self-regulation has long been supported in the literature, as evidenced by dramatic changes in regulatory behavior following

injury to frontal areas of the brain (Bechara, Damasio, & Damasio, 2000; Harlow, 1848). Therefore, it follows that the PFC would be involved in a regulatory component of fear learning (i.e., extinction). A review by Quirk, Garcia, and Gonzalez-Lima (2006) found support for this assertion in the literature, such that studies of rodents demonstrated alterations in extinction following damage to the medial PFC (mPFC), as well as correlations between mPFC activation and extinction. Specifically, lesions to the mPFC resulted in altered fear extinction, but not fear learning, suggesting that the mPFC may represent a neurological correlate unique to the inhibition of fear (Quirk et al., 2006). In 2013, Jovanovic et al. reported findings from a human study that provided further support for the assertions of the rodent literature. Specifically, the authors found that traumatized patients without PTSD demonstrated greater activation of the ventromedial PFC (vmPFC) than those with PTSD in a functional magnetic resonance imaging (fMRI) inhibition task (Jovanovic et al., 2013). In addition, this pattern of vmPFC activation was associated with fear inhibition during an FPS paradigm administered separately from the MRI scan, such that FPS to the CS- during acquisition and FPS to the CS+ during late extinction was negatively correlated with vmPFC activation. Essentially, the subjects who showed the greatest activation of the vmPFC during the fMRI scan also showed the lowest levels of fear to safety signals (i.e. good fear inhibition).

Overall, these findings suggest that PFC activation is an indicator of one's ability to inhibit the fear response in the presence of safety. Further, neurological studies of fear learning appear to indicate that the majority of fear learning takes place in the amygdala, which is then regulated by activation of the PFC, promoting fear inhibition. This pattern suggests a top-down process, such that lower-order, more automatic processes taking place in the amygdala are

regulated by higher-order, more controlled processes taking place in areas of the PFC. Therefore, regulatory processes and physiological (i.e., objective) indicators of such processes are important to consider in relation to fear learning. In particular, autonomic regulation provides a mechanism for examining self-regulatory processes of the PFC and amygdala via peripheral measures (i.e., without the need for direct brain measures, such as fMRI or EEG).

Autonomic Regulation

The Polyvagal Perspective

Polyvagal theory provides a neurophysiological model for understanding the relation between autonomic regulation and psychological phenomena, such as stress and fear (Porges, 2007; Porges, Doussard-Roosevelt, & Maiti, 1994). Specifically, polyvagal theory focuses on individual differences in the parasympathetic nervous system (PNS) and how they relate to self-regulation. While the sympathetic nervous system (SNS) is responsible for fight-or-flight responses (e.g., the fear response), the PNS is responsible for "rest and digest" responses (i.e., pupil contraction, decreased heart rate, dilation of blood vessels; Porges et al., 1994). Both the SNS and PNS are components of the autonomic nervous system (ANS), and together they regulate homeostasis.

In polyvagal theory, the PNS is central because it represents the less automatic, more regulatory aspect of the ANS, lending itself to self-regulation. Porges et al.'s (1994) polyvagal theory utilizes Darwin's original conceptualization of the relation between emotions and neurophysiological processes, which states that emotions result in changes in heart beat that

subsequently affect brain activity, and that structures in the brain stem stimulate the heart via the vagus nerve. The vagus is a multidirectional cranial nerve that facilitates communication between the brain stem and various organs in the body. It stimulates the heart by affecting the sino-atrial (SA) node, which regulates heart rate. Stimulation of the SA node via the vagus nerve results in slowed heart rate, while withdrawal results in increased heart rate (Porges et al., 1994). Therefore, vagal influences on heart rate provide insight into self-regulation because these influences are indicators of one's ability to maintain homeostasis (i.e., the ability of an individual's vagus nerve to stimulate the SA node, resulting in slowed heart rate – PNS activation). This theory is particularly relevant to fear learning because it provides an explanation for the way in which classical conditioning and physiological responses interact and lead to fear responses, including both fear acquisition (SNS) and fear inhibition (PNS).

RSA

According to polyvagal theory, the best way to determine vagal influences on the heart is to obtain measurements of RSA (Berntson et al., 1997; Berntson, Cacioppo, & Quigley, 1993; Porges et al., 1994). RSA is defined as variability in heart rate relevant to respiration, such that increased heart rate is indicative of inspiration, while decreased heart rate is indicative of expiration. RSA is obtained by measurement of heart rate, and specifically, the time period between heart beats; this is combined with respiration rate to determine RSA. When individuals experience a stressful or fear-inducing situation, increased RSA should be observed as an indicator of attempts to maintain homeostasis via vagal control (Porges et al., 1994). According to polyvagal theory, this process is as follows: perception of fearful stimuli → stimulation of

amygdala → amygdala stimulates nucleus ambiguus → nucleus ambiguus stimulates SA node and determines heart rate → vagus regulates heart rate by communicating with SA node (indexed by RSA; Porges et al., 1994). This process is synchronized with that of the PFC and amygdala as described previously, such that the amygdala becomes activated upon the perception of fearful stimuli and is then suppressed by activity in the PFC (i.e., amygdala suppression). Essentially, output from a series of brain structures beginning with the PFC (including other prefrontal regions, the amygdala, hypothalamus, and several nuclei) is sent through sympathetic and parasympathetic neurons which then innervate the heart through the stellate ganglia and vagus nerve (Thayer, Hansen, Saus-Rose, & Johnsen, 2009). In this way, RSA and other measures of parasympathetic activation are indicators of how well this top-down process is working (Thayer et al., 2009; Wendt, Neubert, Koenig, Thayer, & Hamm, 2015). Any disruption in this process could result in poor self-regulation and/or psychopathology.

Indeed, research has consistently demonstrated that infants and children with low RSA tend to be worse at managing stress and regulating emotions (Beauchaine, 2001; Bornstein & Suess, 2000; Calkins & Dedmon, 2000; Porges, 1995; Porges & Furman, 2011). Among adults, low RSA has generally demonstrated relations with increased negative affect and decreased ability to effectively manage emotions (Beauchaine, 2001; Demaree, Robinson, Everhart, & Schmeichel, 2004; Pu, Schmeichel, & Demaree, 2010). In a study of the relation between RSA and response to emotional stimuli, Demaree et al. (2004) examined levels of RSA among adults who watched a positive or negative film. Some participants were instructed to watch the film naturally (i.e., not control their responses), while others were told to exaggerate their facial expressions. Self-reported affect, as well as affect coded from video recorded facial expressions,

were obtained. Results suggested that individuals with lower levels of RSA experienced more negative affect while watching a negative film than those with higher levels of RSA (among individuals in the natural condition; Demaree et al., 2004). Among those in the exaggerate condition, individuals with low RSA were less successful at amplifying their facial responses to the negative film as compared to those with high RSA. In a similar study examining emotional responses to films, Pu et al. (2010) found that among individuals with high RSA, self-reported affect in response to a negative film was not related to the facial expression of negative affect. This finding suggests that individuals with higher levels of RSA are better able to spontaneously modulate their emotional expression than those with lower RSA (i.e., demonstrate more control and flexibility with emotions; Pu et al., 2010). In addition, individuals with high RSA may choose to utilize emotion modulating strategies that are more effective (e.g., reappraisal) than those with low RSA (Volokhov & Demaree, 2010). A study by Rash and Prkachin (2013) further supports this finding, such that individuals with greater emotional intelligence (the ability to infer emotions) demonstrated higher levels of RSA during induced sadness. Overall, results of these studies suggest that individuals with higher levels of RSA appear to have greater regulatory flexibility, choose more effective regulatory strategies, and demonstrate greater knowledge about emotions in comparison to individuals with low RSA. Results of these studies may suggest that low RSA is a vulnerability factor for poor emotion regulation.

Given that fear inhibition is a specific form of self-regulation relevant to fear-based disorders (i.e., the ability to inhibit the fear response in the presence of safety), studies have begun examining RSA in relation to the startle response.

Autonomic Functioning and Startle

Though few studies have examined autonomic functioning in the context of FPS paradigms, several have done so using other startle procedures, such as emotion-modulated startle. Among healthy females, higher levels of heart rate variability (HRV; RSA can be assessed using HRV in the high frequency band; Berntson et al., 1997) have been associated with lower startle responding to affective stimuli (Ruiz-Padial et al., 2003). Similar results have been found among women with bulimic symptoms, such that those with low HRV exhibited higher startle in response to affective stimuli than those with bulimic symptoms and high HRV (Rodríguez-Ruiz, Guerra, Moreno, Fernández, & Vila, 2012). Among college students, Gorka and colleagues (2012) demonstrated that low resting RSA was associated with higher startle responding to unpredictable, but not predictable threat (electric shock delivered with or without warning). A later study by Gorka et al. (2013) examined RSA and startle in three independent samples. The authors found that RSA was related to startle habituation in two of the samples, such that individuals with higher RSA demonstrated greater reductions in startle over time (i.e., greater habituation) in comparison to those with lower RSA. Non-significant findings in the third sample appeared to be related to the control of contextual anxiety, such that only startle probes (and not shocks) were delivered. The authors concluded that low RSA may be associated with poor habituation to only contextual anxiety (Gorka et al., 2013).

Relations between HRV and startle have also been observed among individuals with differing levels of anxiety sensitivity, as well as panic disorder. Using a FPS paradigm, Melzig, Weike, Hamm, and Thayer (2009) examined differences in HRV among students with high and low anxiety sensitivity as well as individuals with panic disorder. In line with the findings of

Gorka et al. (2013), the authors found that when students were grouped by HRV (but not by anxiety sensitivity level), those with high HRV exhibited greater startle habituation than those with low HRV (Melzig et al., 2009). In addition, individuals with panic disorder demonstrated lower HRV and greater startle magnitudes compared to controls with high HRV (Melzig et al., 2009). Lastly, Pappens et al. (2014) examined HRV and startle responding in an interoceptive FPS paradigm using obstructed breathing as the US. The authors found that individuals with high HRV demonstrated greater fear inhibition and fear extinction compared to those with lower HRV (Pappens et al., 2014).

The above studies suggest that autonomic functioning and startle responding are related physiological indicators that may provide insight into how individuals inhibit fear. Therefore, ways in which autonomic functioning may be improved could have beneficial effects on fear inhibition as indexed by reduced startle. One such method may be mindfulness meditation.

Mindfulness

Definition

Mindfulness generally refers to non-judgmental, present-centered awareness in which thoughts, feelings, and sensations are accepted as they are (Kabat-Zinn, 1990). In 2004, Bishop and colleagues provided an operational definition of mindfulness that consisted of two main components: self-regulation of attention (attending to one's internal and external experiences) and orientation to experience (taking a perspective of openness, curiosity, and acceptance). Expanding upon this definition, Shapiro, Carlson, Astin, and Freedman (2006) proposed a model of mindfulness consisting of three components: intention, attention, and attitude. Intention refers

to one's purposefulness in being mindful, such that an individual has a personal vision for why he or she is practicing mindfulness (e.g., to increase well-being; Kabat-Zinn, 1990; Shapiro et al., 2006). Attention refers to one's moment-to-moment awareness of his or her current internal (e.g., thoughts, physical sensations) and external (e.g., sounds, smells) experiences (Shapiro et al., 2006). This component is similar to Bishop et al.'s (2004) self-regulation of attention facet. Attitude refers to the manner in which an individual may pay attention, which is with openness and without judgment or criticism (Shapiro et al., 2006). This component is similar to Bishop et al.'s (2004) orientation to experience facet. The model suggests that these three components are the mechanisms through which mindfulness meditation increases one's ability to re-perceive or to shift their perspective regarding thoughts and/or emotions (i.e., decenter from thoughts or emotions – akin to cognitive distancing, whereby individuals treat thoughts as hypotheses rather than facts; Hollon & Beck, 1979; Shapiro et al., 2006).

A similar framework for mindfulness was identified via factor analysis, whereby analyses of self-report measures of mindfulness demonstrated support for a five-factor structure of the construct (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). These five factors include: observing (noticing internal and external experiences), describing (labeling or expressing one's experiences), acting with awareness (being cognizant of the present moment), non-reactivity (noticing one's experiences without engaging with certain thoughts), and non-judgment (accepting experiences for what they are, rather than criticizing oneself for having them; Baer et al., 2006).

Conceptualizations of mindfulness have treated the construct as either a trait or state variable. For example, self-report measures of trait mindfulness ask individuals to state the

frequency with which they are generally mindful (e.g., how often they tend to observe thoughts, how often they judge themselves for having negative thoughts; Baer et al., 2006; Brown & Ryan, 2003; Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). Alternatively, measures of state mindfulness ask individuals to assess their current levels of mindfulness (e.g., how curious and aware of experiences they were during a mindfulness exercise; Lau et al., 2006). In particular, the Toronto Mindfulness Scale (TMS) was developed as a measure of state mindfulness that can be administered immediately following a mindfulness exercise to determine whether or not mindfulness was increased (Lau et al., 2006). The TMS, along with measures of trait mindfulness and psychopathology, have been increasingly used as indicators of the efficacy and effectiveness of mindfulness as a psychological intervention (Khoury et al., 2013).

Mindfulness as a Psychological Intervention

One of the most prevalent mindfulness interventions is Mindfulness-Based Stress Reduction (MBSR), which was originally developed with individuals suffering from chronic pain (Kabat-Zinn, 1982, 1990). In MBSR, individuals are guided through sitting meditation (attending to the breath), yoga (breathing, stretching, and posturing), and body scan (attending to the body sequentially; Kabat-Zinn, 1990). In addition to decreasing stress among individuals with physical health complaints, such as chronic pain and cancer, MBSR appears to be effective in reducing stress among healthy individuals (Chiesa & Serretti, 2009; Grossman, Niemann, Schmid, & Walach, 2004; Ledesma & Kumano, 2008).

In a recent meta-analysis, Hofmann, Sawyer, Witt, and Oh (2010) examined the effect of MBSR and other mindfulness-based interventions on anxiety and depressive symptoms. In

clinical samples, mindfulness-based interventions demonstrated moderate to large effect sizes in reducing symptoms of anxiety (Hedge's *g* = .63 - .97) and depression (*g* = .59 - .95), suggesting that these types of interventions appear to be effective in reducing certain types of psychopathology. Further support for these findings was provided by Khoury et al. (2013) in an updated meta-analysis. The Khoury et al. (2013) study found that mindfulness-based interventions were superior to psychoeducation (*g* = .61), supportive therapy (*g* = .37), relaxation (*g* = .19), imagery (*g* = .26), and art therapy (*g* = .59) in a number of different samples. Mindfulness-based interventions demonstrated large effects in the treatment of anxiety and depression (*g* = .89 - .91 and .69 - .75, respectively), and moderate effects in fostering higher levels of mindfulness (*g* = .42 - .69; Khoury et al., 2013).

Given that mindfulness meditation includes aspects of relaxation, three studies have compared the effectiveness of these interventions. In the first study, a mindfulness meditation (modified from MBSR) was compared to relaxation among university students who reported distress (Jain et al., 2007). After one month of practice, both groups demonstrated large effects for decreases in distress (Cohen's *d* = 1.36 for mindfulness, .91 for relaxation), and the effect for increased positive mood in the mindfulness group (*d* = .71) was larger than that of the relaxation group (*d* = .25; Jain et al., 2007). Compared to a waitlist control, the mindfulness group demonstrated decreased distractive (*d* = .57) and ruminative thoughts (*d* = .25), while the relaxation group did not (Jain et al., 2007). In another study of undergraduates, Feldman, Greeson, and Senville (2010) compared a mindful breathing exercise to loving kindness meditation (where participants are encouraged to be compassionate and loving towards themselves) and passive progressive muscle relaxation; all exercises were 15 minutes long.

Specifically, the authors examined how each of these exercises affected decentering and negative reactions to repetitive thoughts. Individuals in the mindful breathing condition demonstrated higher levels of decentering than individuals in the loving kindness or progressive muscle relaxation conditions (d = .36). In addition, for individuals in the mindful breathing condition, the strength of the relation between the amount of repetitive thoughts and negative reactions to such thoughts was weak (r = .23), whereas this relation was strong for the loving kindness (r = .56) and progressive muscle relaxation conditions (r = .63; Feldman et al., 2010). This finding suggests that the mindful breathing exercise was more successful than the other conditions at reducing reactivity to thoughts, which is consistent with the group's higher levels of decentering. Lastly, Vinci et al. (2014) compared the impact of mindfulness meditation versus passive progressive muscle relaxation in reducing negative affect and urge to drink among college student drinkers; both exercises were 10 minutes long and compared to a control condition. The authors also examined state mindfulness and relaxation among all groups. Individuals in the mindfulness condition demonstrated greater increases in decentering ($F(2,206) = 7.39$, $p = .001$) and curiosity ($F(2,206) = 7.11$, $p = .001$) than those in the relaxation and control conditions (Vinci et al., 2014). Negative affect was decreased in both the mindfulness and relaxation conditions, but not in the control. The authors did not find support for their hypothesis that mindfulness would reduce the urge to drink.

While studies have provided support for the use of mindfulness as a psychological intervention, its mechanisms of action are still in need of exploration. One such mechanism may be increased self-reported levels of mindfulness, as suggested by Khoury et al. (2013). In addition, emerging research suggests that mindfulness may also impact autonomic functioning.

Mindfulness and Autonomic Functioning

Using the body scan portion of MBSR, Ditto, Eclache, and Goldman (2006) examined the impact of mindfulness on RSA in a sample of healthy adults. Body scan meditation was compared to progressive muscle relaxation and a control condition. Following one month of practice, individuals who engaged in body scan meditation exhibited greater increases in RSA compared to the other groups (i.e., more effective regulation; Ditto et al., 2006). Although smaller in comparison to the differences at one month, increased RSA was also observed in the body scan group after only the first session, which lasted 20 minutes (prior to the one month practice). This suggests that increases in RSA may occur relatively quickly (within an initial session), and that RSA may continue to increase with additional meditation practice.

Similarly, increases in HRV have been found following mindfulness meditation in community participants engaged in a smoking cessation program (Libby, Worhunsky, Pilver, & Brewer, 2012). Specifically, Libby et al. (2012) found that most participants experienced an increase in HRV following a mindfulness meditation. Among participants for whom HRV increased, fewer cigarettes were smoked in comparison to individuals for whom HRV decreased.

In studies of Vipassana meditation (a specific form of mindfulness meditation), increased HRV has been demonstrated following 30 minutes of meditation, and researchers have suggested that alterations in HRV may indicate improvements in autonomic regulation (Delgado-Pastor, Perakakis, Subramanya, Telles, & Vila, 2013; Krygier et al., 2013). It is important to note, however, that all participants in the Delgado-Pastor et al. (2013) study were experienced meditators. Therefore, it is not clear whether the results may generalize to non-meditators,

though results from previous studies suggest that prior experience with meditation is not necessary to achieve beneficial effects (Ditto et al., 2006; Libby et al., 2012).

Lastly, the association between trait mindfulness and HRV has also been examined (Mankus, Aldao, Kerns, Mayville, & Mennin, 2013). In a study of undergraduate students, Mankus et al. (2013) assessed levels of general anxiety symptoms and trait mindfulness while collecting HRV data. The authors found that trait mindfulness demonstrated a significant association with HRV, and that this association was moderated by general anxiety. Specifically, the association between trait mindfulness and HRV was significant among individuals with high, but not low, general anxiety symptoms (Mankus et al., 2013). Consistent with prior research examining mindfulness exercises (Ditto et al., 2006; Libby et al., 2012), the association between trait mindfulness and HRV was positive, such that greater levels of mindfulness reflected increased regulatory capacity.

Given that mindfulness appears to impact autonomic regulation via influences on RSA, and since RSA represents an indicator of self-regulatory processes related to startle, mindfulness may be a useful tool for affecting fear inhibition (i.e., the self-regulation of one's fear response).

Summary

FPS paradigms have provided an experimental way in which to examine the processes of fear learning and fear inhibition in both rodents and humans, and research supports their use as a translational tool for the assessment of these processes. In addition, FPS paradigms have provided insight into brain mechanisms associated with fear learning and inhibition. Given the self-regulatory implications of such research (e.g., prefrontal areas of the brain), physiological

indicators of self-regulation, such as RSA, may provide additional information about the physiological substrates of fear learning and inhibition. This is further evidenced by the observed relations among fear responding and autonomic functioning. One way in which RSA may be increased (leading to improved self-regulation) may be through mindfulness meditation. Therefore, the use of mindfulness may provide a mechanism (RSA) through which self-regulation of the fear response (i.e., fear inhibition) could be improved, which may have implications for fear-based psychological disorders. Although any exercise that engages one's attention should garner more frontal activation in the brain (e.g., a simple math problem, reading a neutral story, purposeful muscle relaxation), mindfulness is expected to go beyond simple frontal activation because as a regulatory strategy, it elicits amygdala suppression (i.e., emotion regulation) and greater vagal control (resulting in greater RSA). Therefore, relaxation may engender parasympathetic activation, but theory and previous research (e.g., Ditto et al., 2006) suggests that it does so to a lesser extent than that of mindfulness meditation (given the regulatory nature of mindfulness).

The manipulation of FPS responding through mindfulness is a novel approach, though two previously-mentioned studies have examined change in FPS as the result of other interventions. In 2011, Jovanovic et al. reported that the administration of dexamethasone resulted in decreased FPS among individuals with PTSD. Another study examined the impact of induced worry on FPS responding. Gazendam and Kindt (2012) found that among individuals in a worry condition, FPS responding was increased, while it was not increased among those in a control condition.

Given the aforementioned impact of fear-based disorders on individuals and society (Greenberg et al., 1999), it is necessary to study mechanisms that may improve symptomology and thus advance understanding of how current intervention efforts operate. Previous research suggests that fear load and fear inhibition are two aspects of fear learning that are impaired among many individuals with fear-based disorders (Jovanovic et al., 2009b, 2010a; Norrholm et al., 2011). Specifically, fear load refers to the FPS response during the early portion of extinction (Norrholm et al., 2011). It may be defined as the amount of fear that an individual has in relation to the CS+ as a result of fear conditioning that took place during the acquisition session (i.e., carryover of fear). FPS response to the CS+ during the later portion of extinction may be referred to as fear inhibition. During later extinction, individuals should have learned that the CS+ is no longer dangerous as it is not paired with the US. Learning that the CS+ during late extinction is no longer dangerous (i.e., the process of fear inhibition) should elicit lowered FPS response. Since enhanced fear load (early extinction FPS response) and decreased fear inhibition (late extinction FPS response) have been demonstrated among individuals with PTSD, panic, and phobia, fear load and fear inhibition represent important targets of study in understanding potential mechanisms for treatment efficacy. The ability to reduce fear load and increase fear inhibition may have implications for treatment and symptom reduction (Jovanovic et al., 2009b, 2010a; Larsen et al., 2002; Lissek et al., 2009; Norrholm et al., 2011). Through the use of mindfulness meditation, the current study examined RSA as a potential mechanism through which fear load and fear inhibition may be improved.

Hypotheses

Hypothesis 1 – Manipulation Checks

Hypothesis 1a

Among individuals in the mindfulness condition, it was hypothesized that levels of state mindfulness (as indicated by both subscales of the TMS) would be increased following the mindfulness exercise.

Hypothesis 1b

Among individuals in the relaxation condition, it was hypothesized that levels of tension (as indicated by a one-item tension question) would be decreased following the relaxation exercise.

Hypothesis 1c

Post-exercise, it was hypothesized that individuals in the mindfulness condition would report significantly higher levels of state mindfulness than those in the relaxation condition. Conversely, it was hypothesized that individuals in the relaxation condition would report significantly lower levels of tension than those in the mindfulness condition.

Hypothesis 2 – Fear Load and Fear Inhibition

During extinction, it was hypothesized that individuals who engaged in a mindfulness exercise between fear conditioning and extinction would demonstrate lower fear loads and greater fear inhibition than individuals who engaged in a relaxation exercise.

Hypothesis 2a: It was hypothesized that study condition would significantly predict fear load during extinction, such that membership in the mindfulness condition would predict lower FPS to the CS+ during blocks 1 and 2 of extinction as compared to the relaxation condition.

Hypothesis 2b: It was hypothesized that study condition would significantly predict fear inhibition during extinction, such that membership in the mindfulness condition would predict lower FPS to the CS+ during blocks 5 and 6 of extinction as compared to the relaxation condition.

Hypothesis 3 – RSA

It was hypothesized that engagement in a mindfulness exercise between fear conditioning and extinction would result in greater increases in RSA than engagement in a relaxation exercise. Further, it was hypothesized that increased RSA as a result of participating in a mindfulness exercise would result in lower fear load and greater fear inhibition during extinction (i.e., mediation by RSA).

Hypothesis 3a

It was hypothesized that study condition would significantly predict RSA change, such that membership in the mindfulness condition would predict greater increases in RSA values.

Hypothesis 3b

It was hypothesized that RSA change would significantly predict fear load, such that greater increases in RSA would predict lower FPS response during blocks 1 and 2 of extinction.

Hypothesis 3c

It was hypothesized that RSA change would significantly predict fear inhibition, such that greater increases in RSA would predict lower FPS response during blocks 5 and 6 of extinction.

Hypothesis 3d

It was hypothesized that RSA change would demonstrate a significant indirect effect on the association between study condition and fear load.

Hypothesis 3e

It was hypothesized that RSA change would demonstrate a significant indirect effect on the association between study condition and fear inhibition.

CHAPTER 2

METHOD

Participants

A total of 83 participants were originally scheduled for the FPS session; 26 cancelled or did not show for their session, and 3 were not run due to equipment malfunction, resulting in a final sample size of 54. Participants were female students (*M*age = 20.26, *SD* = 2.61) recruited from psychology courses at Northern Illinois University (NIU). Participants were required to be at least 18 years old and fluent in English. Participants were not selected on the basis of trauma exposure. In terms of race, 32 (59.3%) participants identified as White, 14 (25.9%) as Black, 4 (7.4%) as Asian, and 2 (3.7%) as "Other;" 2 (3.7%) declined to respond. The majority of participants identified as non-Latino/Hispanic (88.9%).

Study Flow

Eligible participants were given a link to first complete an informed consent document (Appendix A) and a battery of online questionnaires, for which they were compensated with two credits for their psychology course. Following completion of the online survey, all students were invited to participate in the experimental portion of the study held at NIU's Center for the Study of Family Violence and Sexual Assault (CSVFSA), for which they received four credits toward their Psychology course. Upon arrival to the session, participants were verbally given informed

consent for the experimental portion of the study; participants and the researcher then signed copies of the informed consent document (Appendix A). All participants were then set up with physiological equipment for the experiment, further described under "Psychophysiological Equipment" and "FPS Paradigm" below. Following set-up, participants underwent the FPS experiment including mindfulness or relaxation exercises. Following the experiment all participants were debriefed and provided with a list of local counseling resources in the event that they became distressed (Appendix B).

Measures

Demographics Questionnaire

A 15-item demographics questionnaire was administered to gather information regarding age, race/ethnicity, education, relationship status, and income. Additionally, the demographics questionnaire assessed for previous experience with yoga and meditation. Demographic items that were significantly related to primary study variables at the bivariate level were included in study analyses as covariates if differences were observed between the mindfulness and relaxation conditions following random assignment (e.g., age, yoga practice).

Five Facet Mindfulness Questionnaire

The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006) is a 39-item self-report measure of trait mindfulness. Using exploratory factor analysis, the FFMQ was originally constructed from five pre-existing measures of mindfulness. These measures were first examined for internal consistency and convergent and discriminant validity. Differential correlations

among mindfulness measures and other constructs were interpreted as evidence for multiple facets of mindfulness. Therefore, exploratory factor analysis (with items from all five measures) was used to determine the factor structure of mindfulness. A five-factor structure emerged that accounted for 33% of the variance. Subsequently, items with the highest loadings were extracted to create the five factors of mindfulness: Observing (8-items), Describing (8-items), Acting with Awareness (8-items), Non-reactivity (7-items), and Non-judging (8-items). Baer et al. (2006) then used confirmatory factor analysis and determined that a five-factor structure of mindfulness demonstrated the best model fit.

Items are rated on a 5-point Likert-type scale from 1 = *never or very rarely true* to 5 = *very often or always true*. Example items include, "I notice the smells and aromas of things" (Observing), "I'm good at finding words to describe my feelings" (Describing), and "I criticize myself for having irrational or inappropriate emotions" (Non-judging). The FFMQ subscales have demonstrated high internal consistency (α's = .87, .72 - .92; Baer et al., 2006, 2008). In addition, the FFMQ subscales have demonstrated good convergent validity with self-compassion (*r's* = .40 - .53) and emotional intelligence (*r's* = .37 - .60; Baer et al., 2006), and modest relations with the TMS (*r's* = .22 - .37; Tanay & Bernstein, 2013). In addition, the FFMQ subscales have demonstrated discriminant validity as evidenced by low correlations with suppression (*r's* = .03 - .14) and reappraisal (*r's* = .04 - .15; Curtiss & Klemanski, 2014). Given that individuals with higher levels of trait mindfulness (as indicated by another mindfulness measure) may exhibit better autonomic functioning (i.e., higher RSA; Mankus et al., 2013), mindfulness as indicated by the FFMQ was to be included as a covariate if significantly related to RSA at the bivariate level and if differences were observed between the mindfulness and

relaxation conditions. Cronbach's alphas in the current sample were .73 (Observing), .94 (Describing), .85 (Acting with Awareness), .89 (Non-reactivity), and .78 (Non-judging).

Pain

A one-item pain question was used to assess the level of pain associated with the US: "Please rate the level of pain that you experienced as a result of the airblast by circling a number on the scale below." The item was rated on a 10-point Likert-type scale from 1 = *absolutely no pain* to 10 = *extreme pain*. The pain item was administered to all participants immediately after the acquisition portion of the study. If associated with any primary outcome variables (and if differences in pain are observed between the mindfulness and relaxation conditions), level of pain was to be included as a covariate.

Tension

As a manipulation check, a one-item tension question was used to assess whether or not the relaxation intervention resulted in decreased physical tension: "Please rate your level of tension/arousal at this moment by circling a number on the scale below" (Vinci et al., 2014). The item is rated on a 10-point Likert-type scale from 1 = *absolutely no tension* to 10 = *extremely tense*. Following the procedures of Vinci et al. (2014), the tension item was administered to all participants before and after the interventions, and it was specifically used as a manipulation check to determine whether or not individuals in the relaxation condition decreased in their levels of tension following the exercise.

State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI; Spielberger, 1983) is a 40-item self-report measure of state and trait anxiety. Only the 20 state anxiety items were used in the current study. Items are rated on a 4-point Likert-type scale from 1 = *not at all* to 4 = *very much so.* Example items include, “I feel tense,” “I am jittery,” and “I am worried.” The STAI has demonstrated high internal consistency α = .86 - .95) and good test-retest reliability (*r* = .65 - .75 over two months; Spielberger, 1983). In addition, the STAI has demonstrated high convergent validity with other measures of anxiety, including the State-Trait Inventory for Cognitive and Somatic Anxiety (*r* = .52), the Beck Anxiety Inventory (*r* = .58), the anxiety subscale of the Depression Anxiety Stress Scale-21 (*r* = .46), and the anxiety subscale of the Symptom Checklist–90–R (*r* = .61; Bados, Gómez-Benito, & Balaguer, 2010; Grös, Antony, Simms, & McCabe, 2007). Given that state anxiety has been associated with FPS in previous research (Grillon et al., 1993), state anxiety as indicated by the STAI was to be included as a covariate if significantly related to FPS at the bivariate level and if differences were observed between the mindfulness and relaxation conditions. This potential covariate was also included in an attempt to control for any anxiety that resulted from being in the presence of the psychophysiology chamber. Cronbach’s alpha in the current sample was .89 for the 20 state items.

Toronto Mindfulness Scale

The Toronto Mindfulness Scale (TMS; Lau et al., 2006) is a 13-item self-report measure of state mindfulness at a given moment in time. Items are rated on a 6-point Likert-type scale from 0 = *not at all* to 5 = *very much*. The TMS contains two subscales: Curiosity (6-items) and

Decentering (7-items). The TMS has demonstrated high internal consistency (Curiosity α = .86 - .93, Decentering α = .87 - .91; Lau et al., 2006). In addition, the TMS has demonstrated modest convergent validity with reflective self-awareness (Curiosity *r* = .23, Decentering *r* = .42) and subscales of the FFMQ (*r's* = .22 - .37; Lau et al., 2006; Tanay & Bernstein, 2013). It should be noted that although these correlations were significant ($p < .05$), some were small in effect. This is a potential limitation to using the TMS; however, the current study did so given an attempt to follow the procedures of Vinci et al. (2014) regarding the mindfulness and relaxation exercises. The modest convergent validity findings suggest that future psychometric research on the TMS is warranted. The TMS has also demonstrated discriminant validity with dissociation (Curiosity *r* = .06, Decentering *r* = -.04) and social desirability (Curiosity *r* = .04, Decentering *r* = .13; Lau et al., 2006). Cronbach's alphas in the current sample were .91(Curiosity) and .67 (Decentering).

Following the procedures of Vinci et al. (2014), the TMS was administered to all participants before and after the interventions, and it was specifically used as a manipulation check to determine whether or not individuals in the mindfulness condition increased in their levels of state mindfulness.

Traumatic Life Events Questionnaire

The Traumatic Life Events Questionnaire (TLEQ; Kubany et al., 2000) is a brief measure of trauma exposure. Respondents indicate the frequency of experiencing 22 potentially traumatic events (e.g., physical abuse, sexual assault, natural disaster). The TLEQ has demonstrated good test-retest reliability (*k's* = .40 - .60 over one week) and convergent validity with other measures of trauma exposure (*r* = -.55 with Life Events Checklist (scored in reverse to TLEQ); *k's* = .36 -

.79, average *k* = .55; Gray, Litz, Hsu, & Lombardo, 2004; Kubany et al., 2000). Participants who endorsed trauma exposure were administered the PTSD Checklist – 5 to assess PTSD symptoms (which were a potential covariate).

PTSD Checklist – 5

The PTSD Checklist – 5 (PCL-5; Weathers et al., 2013) is a 20-item self-report measure of PTSD symptoms that corresponds to the four DSM-5 symptom clusters. These clusters include: Intrusion (Criterion B; 5 items), Avoidance (Criterion C; 2 items), Negative Alterations in Cognition and Mood (Criterion D; 7 items), and Alterations in Arousal and Reactivity (Criterion E; 6 items). Example items include, "Feeling very upset when something reminded you of the stressful experience?" (Criterion B), "Avoiding memories, thoughts, or feelings related to the stressful experience?" (Criterion C), "Having strong negative feelings such as fear, horror, anger, guilt, or shame?" (Criterion D), and "Taking too many risks or doing things that could cause you harm?" (Criterion E). Items are rated on a 5-point Likert-type scale from 0 = *not at all* to 4 = *extremely*, with higher scores indicating worse PTSD symptoms. Psychometric analyses suggest that the PCL-5 has strong internal consistency (α = .94 - .95) and good test-retest reliability (*r* = .82 over one week; Blevins, Weathers, Davis, Witte, & Domino, 2015). In addition, the PCL-5 has demonstrated good convergent validity with other measures of PTSD (*r's* = .84 - .85), as well as discriminant validity with mania (*r* = .03 - .31) and random response style (*r* = -.09; Blevins et al., 2012, 2015). Cronbach's alphas in the current sample were .81 (Intrusion), .86 (Avoidance), .90 (Negative Alterations in Cognition and Mood), and .89 (Alterations in Arousal and Reactivity).

A number of studies have reported differences in FPS among individuals with PTSD as compared to those without PTSD (Grillon & Morgan, 1999; Jovanovic et al., 2009b, 2010a; Norrholm et al., 2011). Therefore, it is possible that PTSD levels in the current study influenced fear load and fear inhibition. To control for this effect, PTSD as indicated by the PCL-5 was to be included as a covariate if significantly related to FPS scores at the bivariate level and if differences were observed between the mindfulness and relaxation conditions.

Psychophysiological Equipment

Biopac MP150 for Windows (Biopac Systems, Inc.) was used to collect psychophysiological data. Experimental stimuli were presented using SuperLab 4.0 for Windows (Cedrus, Inc.) and synchronized with psychophysiological data acquisition using a DIO card (Measurements Computing, Inc). The FPS response was measured via electromyography (EMG) of the right orbicularis oculi muscle and was identified as the maximum amplitude of the eyeblink muscle contraction 20 to 200 ms after the startle probe was presented. Two 5 mm Ag/AgCl pre-gelled disposable electrodes were positioned approximately 1 cm under the pupil and 1 cm below the lateral canthus. All resistances were less than 6kΩ. EMG activity was acquired at a sampling rate of 1 kHz, amplified and digitized using the EMG module of the Biopac system. Heart rate was measured using the ECG module of the Biopac system at a sampling rate of 1 kHz. One 5-mm Ag/AgCl electrode was placed on the chest over the right clavicle; another electrode was placed on the left forearm. Respiration was measured with a Biopac respiratory belt. The startle probe (noise burst) was a 108-dBA 40-ms burst of broadband noise with near instantaneous rise, delivered through headphones. The startle response was

recorded during the entire FPS paradigm. Participants then underwent a brief auditory screening to ensure that their hearing was within normal limits.

FPS Paradigm

The FPS paradigm has previously been validated and replicated in various clinical and nonclinical samples (Glover et al., 2011; Jovanovic et al., 2011; Norrholm et al., 2011). Prior to beginning the FPS portion of the study, participants completed the TMS and relaxation item to determine baseline levels of state mindfulness and physical tension, respectively. Participants were then seated in a psychophysiology chamber and prepared for the FPS paradigm.

The FPS session included two phases: acquisition (20 minutes) and extinction (25 minutes). The aversive US was a 250-ms airblast with an intensity of 140psi directed at the larynx. The conditioned stimuli (CS) consisted of different colored shapes presented on a computer monitor (programmed with SuperLab; Appendix J). The startle probe was presented after 6 seconds and was followed by the US 0.5 seconds later. The CS+ (a blue square) was paired with the airblast, while the CS- (a purple triangle) was not. The acquisition session consisted of a habituation phase (where no airblasts were delivered) and a conditioning phase with three blocks of four trials of each type [noise alone (NA), CS+, CS-] in each block. Following acquisition, participants were guided in either a mindfulness or relaxation intervention, described below. The fear extinction session occurred after the intervention and involved presentation of the CS+ and the CS- in the absence of the US. The extinction session consisted of six blocks of four trials of each type [NA, CS+ (unreinforced), and CS-] in each block. See Figure 1 for a depiction of the FPS paradigm.

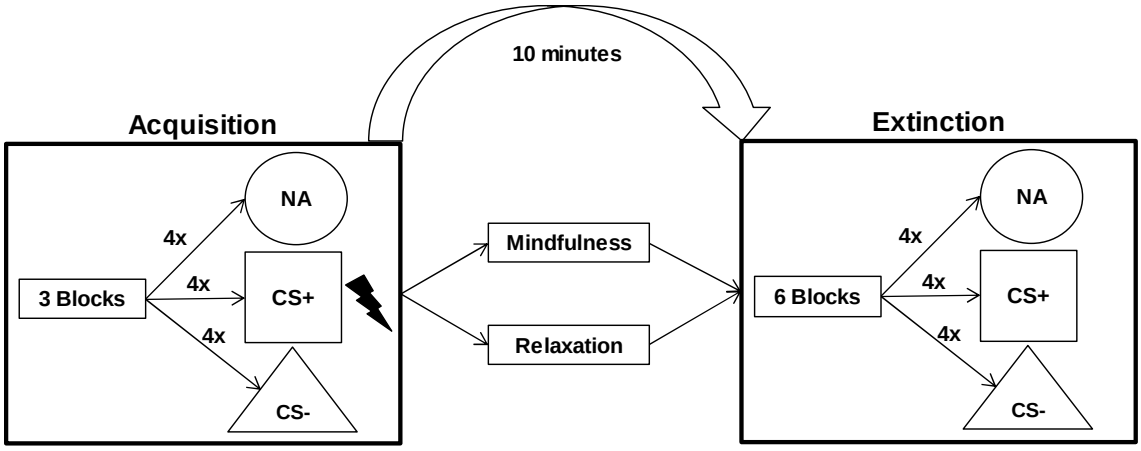

Figure 1: Depiction of FPS paradigm (adapted from Norrholm et al., 2013).

For both phases, participants were instructed to use a keypad to indicate whether or not they thought the US would follow each stimulus (the "+" button was pressed if they expected a CS to be followed by the US, the "-" button was pressed if they did not expect a CS to be followed by the US, and the "0" button was pressed if they were not sure). Trials for all phases were on a fixed schedule. The inter-trial interval was between 18 and 25 seconds.

Conditions

Mindfulness condition: Participants in the mindfulness condition listened to a 10-minute guided meditation utilized by Vinci et al. (2014; adapted from Adams et al., 2013). The instructions asked participants to focus on the present moment while paying attention to their breath and other sensations (e.g., sounds, sights, smells; Appendix K). Participants were asked to do this in a nonjudgmental and accepting manner.

Relaxation condition: Participants in the relaxation condition listened to a 10-minute guided relaxation instructing them to physically relax their muscles (Appendix L). The relaxation

intervention was also utilized by Vinci et al. (2014; adapted from Antoni, 2003 and Bernstein & Borkovec, 1973) and is considered to be a passive form of progressive muscle relaxation (Feldman et al., 2010). For example, participants were not asked to initially tense their muscles prior to relaxing them. The tape began by asking participants to take several deep breaths. Participants were then guided through a physical relaxation of each muscle group.

All participants were randomly assigned to either the mindfulness or relaxation condition upon being scheduled for the FPS session. The TMS and tension item were administered a second time following both exercises to determine levels of state mindfulness and physical tension, respectively.

CHAPTER 3

Data Analysis Plan

G*Power 3.1 software was used to determine the appropriate sample size for the current study (Faul, Erdfelder, Buchner, & Lang, 2009). Based on average effect sizes from previous research, a desired effect size of $f^2 = .16$ was chosen to detect the magnitude of direct and indirect effects. The sample size estimate for 80% power with an alpha level of .05 and an effect size of .16 was 52 participants total (i.e., 26 participants in each group; conducted a-priori). Therefore, the current study was expected to be adequately powered with a final sample size of 54.

Physiological Data Cleaning and Calculation

FPS and RSA were obtained from the raw Biopac recordings (EMG, respiration, ECG) using MindWare EMG and HRV software (MindWare Technologies, Inc). EMG and ECG signals were amplified by a gain of 1000. Screening of eyeblinks involved visually inspecting EMG data for double blinks and other artifacts. When necessary, segments of EMG data without an identifiable eyeblink were set to "0." Startle magnitude values were obtained from MindWare for each stimulus (e.g., amplitude of eyeblinks in response to each CS).

FPS was calculated using a difference score ([startle magnitude in the presence of a CS in each conditioning block] – [startle magnitude to the noise probe alone (NA)]; Jovanovic et al., 2005). For Hypotheses 2 and 3, baseline FPS (FPS to the NA stimulus) was subtracted from FPS

to the CS+ during blocks 1 and 2 of extinction (fear load) and during blocks 5 and 6 of extinction (fear inhibition; each block was approximately four minutes long).

To obtain RSA, MindWare identifies ECG R-waves and R-R intervals (the time between heart-beats), and detects improbable R-waves, which can then be manually inspected and corrected. Settings for high and low frequency bands were based upon standard recommendations for RSA data, which includes a respiratory band of .15-.40 Hz (Task Force, 1996). For Hypothesis 3, change in RSA was obtained by subtracting the RSA value for minute one of acquisition (i.e., baseline – no stimuli present) from the RSA value from minute 10 during the mindfulness and relaxation exercises.

None of the EMG or ECG segments contained more than 25% of unusable data, and therefore all data were used in analyses. Following screening in MindWare, physiological data were exported to SPSS for further analysis.

For the independent variable of study condition, a grouping variable was created with 0 = relaxation and 1 = mindfulness.

Data Screening

Descriptive statistics were used to screen for self-report and physiological responses that were out of range, as well as to identify potential outliers in the data (defined as three or more standard deviations from the mean). One outlier was identified on the fear load variable (score on fear load was greater than three standard deviations above the sample mean), and this case was excluded from analyses. Normality of the data was assessed by examining skewness and kurtosis, and log transformations were performed if these values divided by their respective

standard errors were greater than 2.58 (Field, 2009); transformations were conducted on the following variables: fear load, change in RSA, PCL-5 Negative Alterations in Cognitions and Mood, PCL-5 Hyperarousal, the second tension item, and the pain item. Data were also inspected for the presence and influence of missing data points, and no significant patterns of missing data were observed.

CHAPTER 4

Results

All statistical analyses were performed in SPSS 21.0 for Windows, with $\alpha = 0.05$. Descriptive statistics and bivariate correlations were obtained for all study variables (Table 1). See Tables 2 and 3 for descriptives and correlations by study condition. For all FPS extinction blocks by condition, see Figure 2.

Table 1.

Descriptive Statistics and Bivariate Correlations in Full Sample

	1	2	3	4	5	6	7	8	9	10	11	12
1. Fear load LN	--											
2. Fear inhibition	.42**	--										
3. RSA change LN	-.26	-.17	--									
4. Study condition	.12	.05	-.34*	--								
5. TMS-D - 1	.03	.11	.02	.03	--							
6. TMS-C - 1	.00	.02	.13	-.03	.55†	--						
7. Tension - 1	.02	.15	-.37**	.17	-.03	-.18	--					
8. Pain LN	.06	.06	-.37**	.01	-.22	-.25	.37**	--				
9. TMS-D - 2	-.08	.05	.00	.12	.63†	.62†	-.08	-.24	--			
10. TMS-C - 2	-.05	.06	.10	-.02	.34*	.65†	-.15	-.40**	.65†	--		
11. Tension - 2 LN	-.03	.13	-.38**	.17	-.01	-.19	.97†	.44**	-.04	-.17	--	
12. PCL-5 Intrusions	.16	-.01	-.36*	.05	.02	.11	.13	.13	.01	.06	.06	--
13. FFMQ-Nonreactive	.27*	.26	-.16	.19	.10	.04	.05	-.02	-.08	-.04	-.01	.17
14. Relationship status	-.32*	-.11	.02	.04	.07	.08	-.14	.13	-.07	.03	-.09	.05
15. Race	-.13	.40**	-.07	-.20	.32*	.05	.10	.10	.05	-.03	.13	.08
Mean	4.03	16.88	.17	--	11.13	14.98	3.78	.59	15.26	15.63	.55	9.47
SD	.34	19.82	1.24	--	4.18	5.17	1.83	.62	5.81	6.46	.58	3.97
Minimum	3.35	-14.24	-3.46	--	.00	3.00	1.00	.00	1.00	.00	.00	5.00
Maximum	4.92	73.13	2.42	--	20.00	24.00	7.00	1.95	28.00	24.00	1.79	17.00

Note. Fear load excludes outlier; LN = log transformed; RSA = respiratory sinus arrhythmia; study condition coded 1 = mindfulness and 0 = relaxation; TMS = Toronto Mindfulness Scale (1 refers to baseline, 2 refers to post-exercise); PCL-5 = PTSD Checklist for DSM-5 (Intrusions scale); FFMQ = Five Facet Mindfulness Questionnaire (Nonreactivity scale); relationship status coded 1 = coupled and 0 = not coupled; race coded 1 = White and 0 = non-White; for brevity, only significant covariates included.

* = $p < .05$; ** = $p < .01$; †$p < .001$.

Table 2.

Descriptive Statistics and Bivariate Correlations in Mindfulness Condition

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Fear load LN	--												
2. Fear inhibition	.21	--											
3. RSA change LN	-.26	-.05	--										
4. TMS-D - 1	-.19	-.01	.04	--									
5. TMS-C - 1	-.14	-.16	.04	.57**	--								
6. Tension - 1	-.02	.04	-.22	.36	.26	--							
7. Pain LN	.21	-.03	-.39*	-.16	-.21	.16	--						
8. TMS-D - 2	-.31	-.10	.06	.75†	.68†	.34	-.15	--					
9. TMS-C - 2	-.18	-.05	-.01	.60**	.73†	.03	-.37	.75†	--				
10. Tension - 2 LN	.15	.19	-.30	.08	-.15	.40*	.42*	-.03	-.13	--			
11. PCL-5 Intrusions	.17	.10	-.46*	.02	.15	.22	.30	-.04	.16	.08	--		
12. FFMQ-Nonreactive	.26	.26	-.24	.00	.07	.03	.03	.02	.25	.05	.26	--	
13. Relationship status	-.43*	.14	-.15	.43*	.33	-.09	.01	.26	.24	-.10	.26	-.02	--
14. Race	-.40	.41*	-.10	.34	.00	-.04	.09	.08	.09	.21	.00	-.02	.66†
Mean	4.23	17.76	-.24	11.26	14.85	3.93	.59	15.93	15.51	.65	9.70	21.70	--
SD	.34	18.98	1.27	4.49	5.76	1.69	.64	6.52	6.19	.60	4.48	2.46	--
Minimum	3.68	-14.24	-3.46	2.00	3.00	2.00	.00	1.00	.00	.00	5.00	17.00	--
Maximum	4.96	55.77	2.30	19.00	24.00	7.00	1.79	28.00	24.00	1.79	17.00	27.00	--

Note. Fear load excludes outlier; LN = log transformed; RSA = respiratory sinus arrhythmia; TMS = Toronto Mindfulness Scale (1 refers to baseline, 2 refers to post-exercise); PCL-5 = PTSD Checklist for DSM-5 (Intrusions scale); FFMQ = Five Facet Mindfulness Questionnaire (Nonreactivity scale); relationship status coded 1 = coupled and 0 = not coupled; race coded 1 = White and 0 = non-White; for brevity, only significant covariates included.
* = $p < .05$; ** = $p < .01$; †$p < .001$.

Table 3.

Descriptive Statistics and Bivariate Correlations in Relaxation Condition

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Fear load LN	--												
2. Fear inhibition	.55**	--											
3. RSA change LN	-.22	-.29	--										
4. TMS-D - 1	.20	.22	.00	--									
5. TMS-C - 1	.14	.22	.27	.54**	--								
6. Tension - 1	-.13	-.13	-.23	-.26	-.07	--							
7. Pain LN	-.06	.15	-.35	-.29	-.31	.25	--						
8. TMS-D - 2	.12	.21	.01	.45*	.52**	-.13	-.38*	--					
9. TMS-C - 2	.04	.16	.22	.08	.59**	.12	-.43*	.56**	--				
10. Tension - 2 LN	-.21	.05	-.41	-.14	-.24	.64†	.48*	-.10	-.21	--			
11. PCL-5 Intrusions	.14	-.13	-.26	.01	.07	.16	-.07	.07	-.03	.03	--		
12. FFMQ-Nonreactive	.26	.27	-.05	.16	.04	-.02	-.04	-.19	-.16	-.09	.14	--	
13. Relationship status	-.27	-.34	.28	-.33	-.22	.08	.26	-.50**	-.15	-.09	-.19	-.25	--
14. Race	.11	.41*	-.21	.30	.11	-.01	.13	.06	-.15	.13	.19	.24	-.56**
Mean	4.13	16.00	.60	11.00	15.11	3.63	.59	14.59	15.74	.45	9.27	20.19	--
SD	.44	20.95	1.06	3.94	4.62	1.98	.62	5.04	6.84	.56	3.55	5.11	--
Minimum	2.50	-8.55	-2.14	.00	5.00	1.00	.00	4.00	1.00	.00	5.00	11.00	--
Maximum	5.14	73.13	2.42	20.00	24.00	7.00	1.95	27.00	24.00	1.61	17.00	30.00	--

Note. Fear load excludes outlier; LN = log transformed; RSA = respiratory sinus arrhythmia; TMS = Toronto Mindfulness Scale (1 refers to baseline, 2 refers to post-exercise); PCL-5 = PTSD Checklist for DSM-5 (Intrusions scale); FFMQ = Five Facet Mindfulness Questionnaire (Nonreactivity scale); relationship status coded 1 = coupled and 0 = not coupled; race coded 1 = White and 0 = non-White; for brevity, only significant covariates included.

* = $p < .05$; ** = $p < .01$; †$p < .001$.

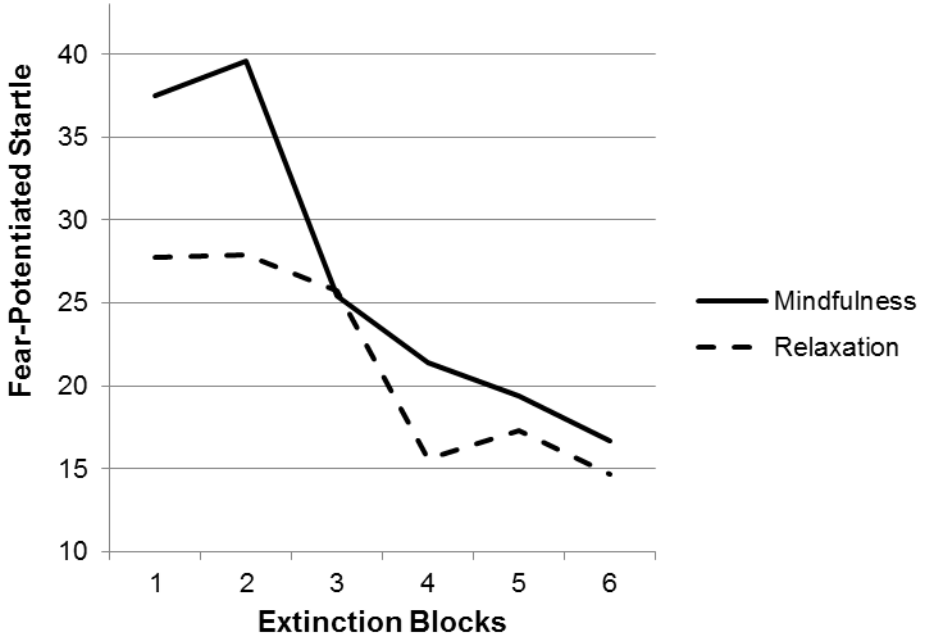

Figure 2: Mean FPS extinction scores by condition.

Scores on the pain item and the PCL-5 Intrusions scale were significantly negatively related to change in RSA (r = -.35, p = .01; -.35, p = .02, respectively), suggesting that lower levels of RSA are associated with higher levels of perceived pain from the airblast and increased symptoms of posttraumatic intrusions (e.g., nightmares, flashbacks). Scores on the FFMQ-Non-reactivity scale were significantly positively related to fear load (r = .27, p = .05), suggesting that higher levels of non-reactivity are associated with higher FPS during blocks 1 and 2 of extinction. Relationship status (coded as 1 = coupled, 0 = not coupled) was significantly negatively related to fear load (r = -.32, p = .02), suggesting that individuals who were in relationships demonstrated lower fear load (i.e., lower FPS during blocks 1 and 2 of extinction). Race (coded as 1 = White, 0 = Black or African American/Asian or South-Asian /American Indian or Alaskan Native/Native Hawaiian or Pacific Islander) was significantly positively related to fear inhibition (r = .40, p < .01), suggesting that individuals who identified as White

had poorer fear inhibition (i.e., higher FPS during blocks 5 and 6 of extinction). Given the aforementioned findings, these variables were included as covariates in main analyses. A series of one-way analyses of variance (ANOVAs) and chi-square tests were used to compare all potential covariates (e.g., PCL-5 and FFMQ scores, demographic variables) in the mindfulness and relaxation groups; no significant differences were observed (see Table 4).

Table 4.

Demographics and Potential Covariates by Condition

	Mindfulness *M* (SD)	Relaxation *M* (SD)	F/χ^2	df	*p*
Age	20.19 (2.19)	20.35 (3.03)	$F = 0.049$	1,51	.825
Education (in years)	12.25 (4.76)	12.76 (3.99)	$F = 0.166$	1,47	.686
Race	13 White, 11 other	19 White, 7 other	$\chi^2 = 1.937$	1	.164
Relationship status	15 coupled, 12 not	14 coupled, 13 not	$\chi^2 = 0.074$	1	.785
Yoga per week	17a, 7b, 3d	14a, 8b, 3c, 1d	$\chi^2 = 4.34$	3	.227
Yoga total experience	17a, 7b, 2e, 1f	14a, 8b, 2e, 2f	$\chi^2 = 0.672$	3	.880
Meditation per week	18a, 3b, 5c, 1d	18a, 5b, 3c	$\chi^2 = 1.982$	3	.576
Meditation total experience	18a, 4b, 4e, 1f	19a, 4b, 2e, 1g	$\chi^2 = 2.676$	4	.613
FFMQ-Observe	26.04 (4.64)	25.26 (4.16)	$F = 0.421$	1,52	.519
FFMQ-Describe	25.81 (5.65)	25.56 (7.01)	$F = 0.022$	1,52	.882
FFMQ-Act with awareness	24.37 (4.85)	24.48 (5.39)	$F = 0.006$	1,52	.937
FFMQ-Nonjudgment	28.26 (5.50)	26.07 (7.12)	$F = 1.592$	1,52	.213
FFMQ-Nonreactive	21.70 (2.46)	20.19 (5.11)	$F = 1.937$	1,52	.170
PCL-5 Intrusions	9.70 (4.48)	9.27 (3.55)	$F = 0.138$	1,47	.712
PCL-5 Avoidance	5.17 (2.67)	4.42 (2.37)	$F = 1.086$	1,47	.303
PCL-5 Negative alterations*	1.46 (1.08)	1.49 (1.04)	$F = 0.008$	1,47	.929
PCL-5 Alterations in arousal*	1.26 (1.07)	1.11 (1.05)	$F = 0.238$	1,47	.628
STAI	36.56 (9.03)	34.07 (8.32)	$F = 1.103$	1,52	.298
Pain*	.59 (.64)	.59 (.62)	$F = 0.002$	1,52	.966

Note. Race coded 1 = White and 0 = non-White; relationship status coded 1 = coupled and 0 = not coupled; a = I have never practiced yoga/meditation; b = I previously practiced yoga/meditation, but have not in the last 3 months; c = I currently practice yoga/meditation less than 4 hours per week; d = I

currently practice yoga/meditation 4-8 hours per week; e = I have been practicing yoga/meditation for less than 1 year; f = I have been practicing yoga/meditation for 1-3 years; g = I have been practicing yoga/meditation for more than 3 years; FFMQ = Five Facet Mindfulness Questionnaire; PCL-5 = PTSD Checklist for DSM-5.
* = log transformed variable.

Hypotheses 1a and 1b: Paired samples *t*-tests were conducted in order to determine if individuals in the mindfulness condition experienced increases in state mindfulness and if individuals in the relaxation condition experienced increases in relaxation following their respective exercises. Hypothesis 1a was partially supported: there was a significant increase in scores on the Decentering subscale of the TMS among those who engaged in mindfulness ($t(26) = -5.60$, $p < .001$), but not on the Curiosity subscale ($t(26) = -.79$, $p = .44$). Hypothesis 1b was supported: there was a significant decrease on the tension item among those who engaged in relaxation ($t(26) = 9.80$, $p < .001$).

Hypothesis 1c: One-way ANOVAs were used to compare levels of state mindfulness and tension among individuals in both conditions. No significant differences were observed: individuals in the mindfulness condition did not experience significantly greater levels of state mindfulness ($F(1,53) = .02$, $p = .90$ for TMS-Curiosity; ($F(1,53) = .71$, $p = .40$) for TMS-Decentering) compared to individuals in the relaxation condition, and individuals in the relaxation condition did not experience significantly lower levels of tension ($F(1,53) = 1.54$, $p = .22$) compared to individuals in the mindfulness condition following the respective exercises. See Figures 3 and 4 for graphs of mean TMS-D, TMS-C, and Tension scores among both conditions.

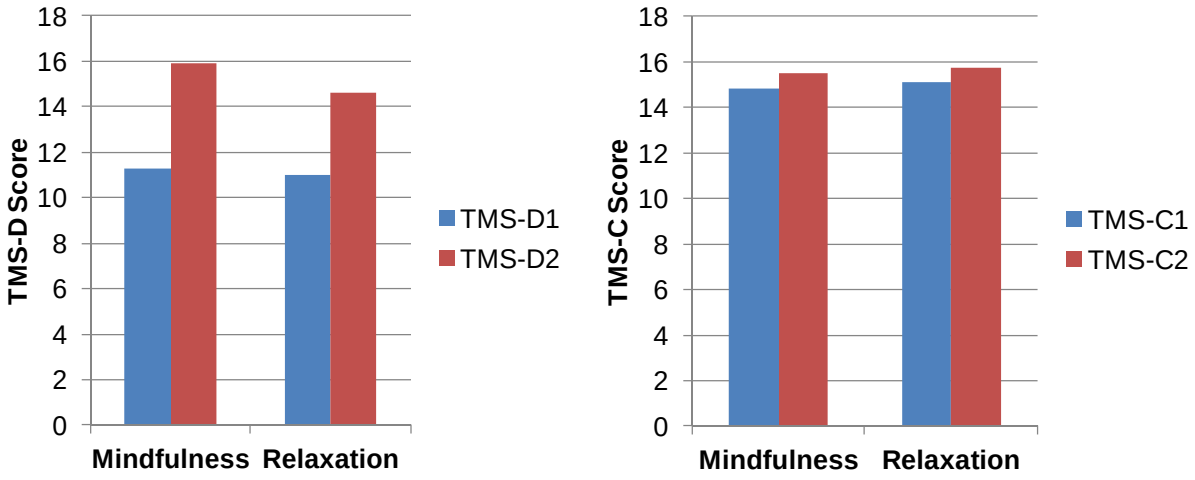

Figure 3: Mean TMS scores by condition.
Note. TMS = Toronto Mindfulness Scale (1 refers to baseline, 2 refers to post-exercise); D = Decentering subscale; C = Curiosity subscale.

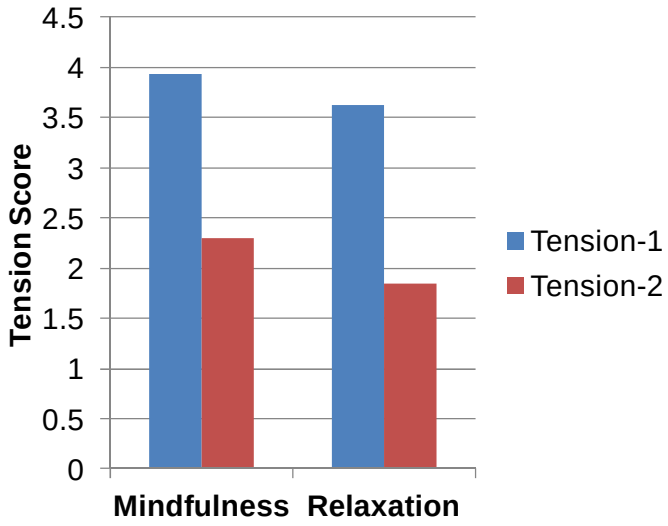

Figure 4: Mean Tension scores by condition.
Note. 1 refers to baseline, 2 refers to post-exercise.

Hypotheses 2a to 3e: Two mediation models were examined. For both models, a nonparametric re-sampling approach (bootstrapping; Preacher & Hayes, 2004) was used to assist

in determining total and indirect effects. The Preacher and Hayes (2004) mediation macro for SPSS was used with 5,000 bootstrap re-samples and a confidence interval (CI) of 95%. This procedure is preferable because it accounts for small sample size and potential abnormality in variable distribution, and because it provides a CI for the point estimates. Variables that were significantly related to main study outcomes were included as covariates, such that their effects were controlled for in the mediation models. In Model 1, covariates included relationship status, FFMQ-Non-reactivity (both related to fear load), PCL-5 Intrusions, and the pain item (both related to RSA). In Model 2, covariates included race (related to fear inhibition), PCL-5 Intrusions, and the pain item (both related to RSA).

Hypothesis 2a was not supported: the study condition variable did not demonstrate a significant effect on fear load (B = .14, t[41] = 1.28, p = .21). Hypothesis 2b was not supported: the study condition variable did not demonstrate a significant effect on fear inhibition (B = 5.10, t[39] = .87, p = .39). Hypothesis 3a was not supported: while study condition demonstrated a significant effect on RSA, membership in the relaxation condition (rather than mindfulness) predicted greater increase in RSA in both the fear load (B = -.84, t[41] = -2.97, p = .01) and fear inhibition (B = -.77, t[39] = -2.44, p = .02) models. Among individuals in the mindfulness condition, average RSA during the last minute of the exercise was 6.10 (SD = 1.35), while it was 7.16 (SD = 1.27) among individuals in the relaxation condition (average baseline RSA was 6.34 and 6.60, respectively). Hypothesis 3b was not supported: change in RSA did not demonstrate a significant effect on fear load (B = -.06, t[40] = -.92, p = .36). Hypothesis 3c was not supported: change in RSA did not demonstrate a significant effect on fear inhibition (B = -4.57, t[38] = -1.57, p = .12).

Hypothesis 3d was not supported: the CI for the indirect effect of RSA in Model 1 included zero (CI = -.04 - .18), suggesting that RSA did not mediate the relation between study condition and fear load (F[6,40] = 2.48, p = .04). Hypothesis 3e was not supported: while the CI for the indirect effect of RSA in Model 2 did not include zero (CI = .19 – 10.08; i.e., RSA mediated the relation between study condition and fear inhibition), the effect was not in the expected direction (F[5,38] = 2.45, p = .05). See Figures 5 and 6 for depictions of the mediation models.

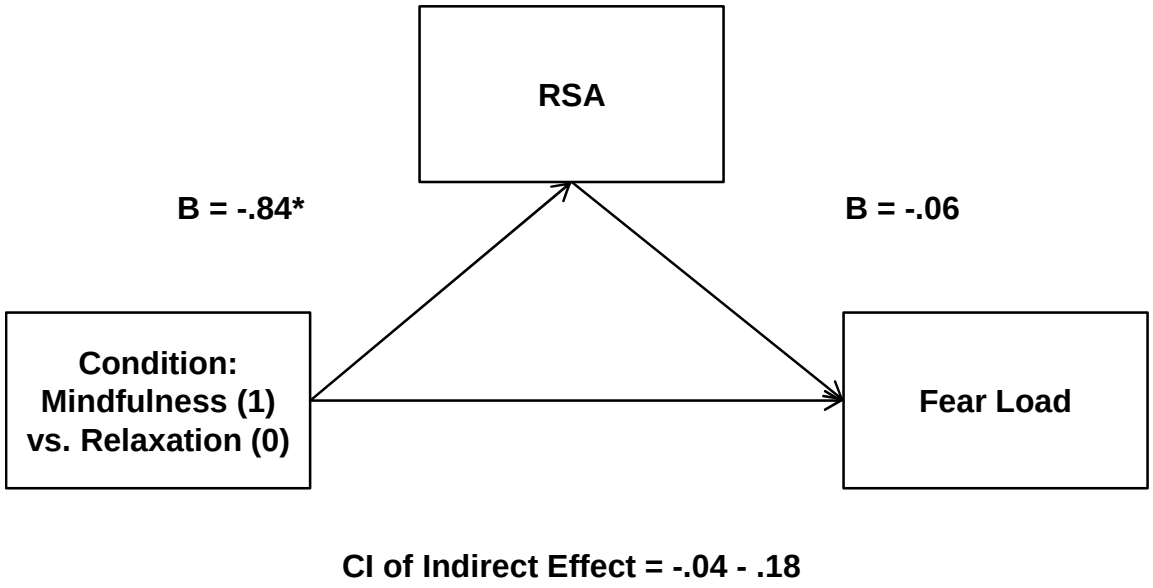

Figure 5: Mediation model predicting fear load.
Note. *p < .05; RSA = respiratory sinus arrhythmia; CI = Confidence interval; covariates included: relationship status, Five Facet Mindfulness Questionnaire-Non-reactivity subscale, PTSD Checklist for DSM-5 – Intrusions subscale, and pain item.

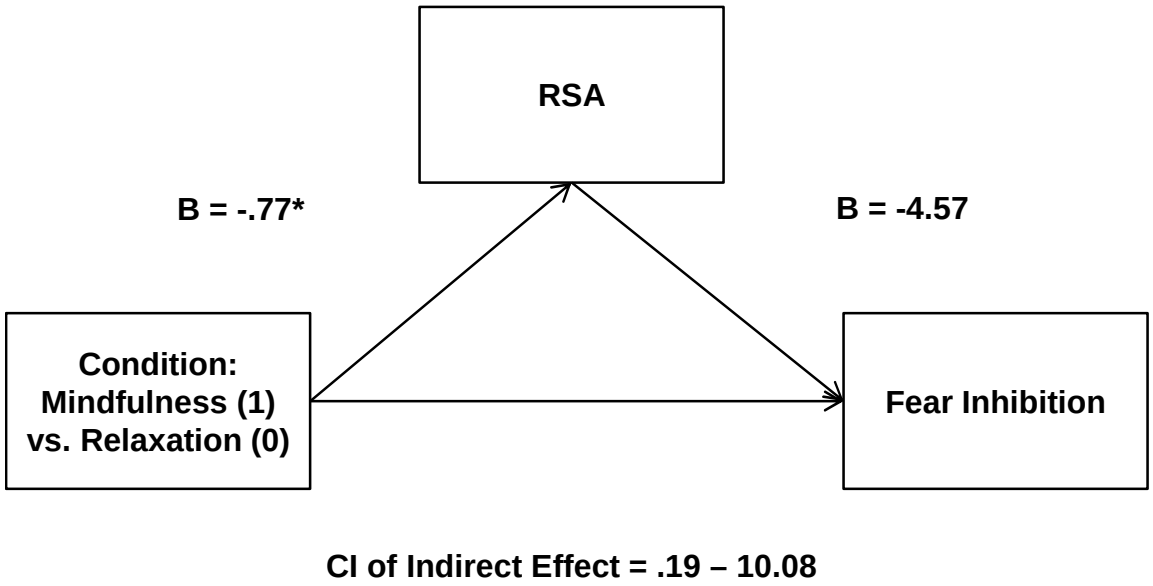

Figure 6: Mediation model predicting fear inhibition.
Note. *$p < .05$; RSA = respiratory sinus arrhythmia; CI = Confidence interval; covariates included: race, PTSD Checklist for DSM-5 – Intrusions subscale, and pain item.

CHAPTER 5

Discussion

The current study explored the impact of a mindfulness meditation (as compared to relaxation) on fear load and fear inhibition in the context of a fear-potentiated startle (FPS) paradigm. Using mediation models, respiratory sinus arrhythmia (RSA) was examined as a potential underlying mechanism of these relations. In addition, several self-report variables (e.g., trait and state mindfulness, PTSD symptoms, race) were included in analyses as covariates.

Hypotheses 1a – 1c (regarding manipulation checks) were partially supported. While individuals in the mindfulness condition experienced a significant increase in one of the state mindfulness scales (TMS-Decentering), they did not experience a greater increase than those in the relaxation condition (i.e., both groups saw an increase in scores on this measure). Similarly, while individuals in the relaxation condition experienced a significant decrease on the tension item, this decrease was not greater than that of individuals in the mindfulness condition. These findings suggest that overall, both mindfulness and relaxation exercises led to an increase in self-reported state mindfulness and a decrease in self-reported tension. As will be discussed further, these findings are not necessarily consistent with the physiological data (i.e., RSA).

Hypotheses 2a – 3c were not supported. While it was expected that membership in the mindfulness condition would predict lower fear load and greater fear inhibition, no significant effects were observed. With Hypothesis 3a it was expected that membership in the mindfulness

condition would predict greater increase in RSA; however, greater RSA was observed in the relaxation condition. Hypotheses 3b and 3c were also not supported, such that change in RSA did not significantly predict fear load or fear inhibition.

Hypothesis 3d was not supported: RSA did not mediate the relation between study condition and fear load. Similar to the reverse findings of Hypothesis 3a, results from the second mediation model suggest that RSA mediated the relation between study condition and fear inhibition, but that greater increases in RSA were observed for the relaxation group as opposed to the mindfulness group.

Implications of Negative Evidence

There are several potential explanations for the lack of significant/predicted findings. Consistent with recommendations by Cronbach and Meehl (1955), three interpretations of null findings will be discussed: 1) the test does not measure the construct variable, 2) the theoretical framework from which the hypothesis was generated is incorrect, and 3) the experiment failed to test the hypothesis properly. Considering the first interpretation, it is possible that RSA is not an accurate measure of autonomic regulation. This would suggest that even if individuals experienced improved regulatory capacity via either exercise, RSA was not a valid indicator of this phenomenon. While no physiological measure may be considered a true and definite indicator of a psychological change, ample research with various study designs and populations suggests that this is not the most likely explanation for null findings (i.e., RSA has strong support for its proxy of self-regulatory abilities; e.g., Beauchaine, 2001; Demaree et al., 2004; Rash & Prkachin, 2013). Similarly, it is possible that the FPS variables are not reliable indicators of fear

load and fear inhibition; however, there is a consistent line of research demonstrating its usefulness and application to fear learning (e.g., Grillon, 2002; Jovanovic et al., 2005; Myers & Davis, 2004; Norrholm et al., 2006; Rothbaum et al., 2014), suggesting that failure of the FPS paradigm to obtain these variables is not a likely explanation for null findings. Another possible explanation in terms of construct measurement failure is the use of the TMS and tension item. Items on the TMS may not be accurately measuring the complicated construct of state mindfulness (e.g., "I experienced myself as separate from my changing thoughts and feelings" and "I was curious to see what my mind was up to from moment to moment"). As with any self-report measure, these questions can be interpreted differently by each participant, leading to potentially inaccurate or inconsistent responses. These challenges aside, the TMS has demonstrated utility in previous research as an indicator of state mindfulness (Khoury et al., 2013; Lau et al., 2006) and thus its limitations may not have been most influential in the current study. Alternatively, the use of only one item to assess tension could certainly limit the degree of confidence in its measurement. This item was first used in the study by Vinci et al. (2014) and the current study was the first to use it subsequently. Although it demonstrated efficacy in that study, the tension item remains new and mostly untested. Thus, future studies may benefit from the inclusion of a more broad measure of physical tension/relaxation.

In terms of Cronbach and Meehl's (1955) second interpretation, it is possible that the theoretical framework regarding mindfulness and parasympathetic activation is faulty. This would suggest that mindfulness meditation may not (or may not consistently) improve measures such as RSA, and/or that other factors have accounted for this relation in previous research. Although this is a possibility given that research on mindfulness and parasympathetic activation

is still relatively new, the aforementioned studies have indeed found significant relations between these phenomena (e.g., Ditto et al., 2006; Libby et al., 2012). It is therefore more likely that other factors may help to explain null findings in the current study. Previous studies using FPS and other startle paradigms have suggested that greater parasympathetic activation (e.g., higher RSA) is associated with lower startle responding (e.g., Gorka et al., 2012; Pappens et al., 2014). Therefore, it would seem that hypotheses regarding mindfulness, RSA, and FPS were developed from a relatively sound theoretical network.

Cronbach and Meehl's (1955) third explanation (the experiment failed to test the hypothesis properly) may be the most likely reason for null findings in the current study. In terms of the manipulation checks, it is possible that the mindfulness and relaxation exercises were too similar for individuals to have significantly different experiences of mindfulness and tension. These measures were self-report only, and while physiological differences may have been observed, self-reports may not be sensitive-enough indicators of these changes. It is possible that the TMS is measuring a more general feeling of relaxation than a specific feeling of mindfulness. For example, items such as "I experienced myself as separate from my changing thoughts and feelings" and "I was more invested in just watching my experiences as they arose, than in figuring out what they could mean" may be endorsed when an individual feels physically relaxed, and not just when they are mindful. Given the strong history of mindfulness as an intervention for pain (see Veehof, Trompetter, Bohlmeijer, & Schreurs, 2016 for a review), it may be inferred that decreases in general physical tension are likely to be observed following mindfulness meditation. The tension item may therefore not be a specific-enough indicator of relaxation. In terms of the lack of a significant increase on TMS-Curiosity (for both groups), it is

possible that the 10-minute exercise was not long enough to encourage this more advanced facet of mindfulness. As suggested by Linehan (1993), basic mindfulness skills such as observing and describing emotions may be necessary "first steps" toward emotion regulation. The TMS-Decentering scale may arguably be similar to the construct of observing emotions (i.e., the ability to separate yourself from your thoughts and emotions, and thus observe them more objectively), thus explaining why this aspect of mindfulness may have been achievable for participants in the current study. Individuals may therefore need to practice mindfulness for longer periods of time before being able to achieve a more advanced skill such as curiosity. This appears especially relevant to the current study given that most participants reported never having practiced meditation or yoga (67.9% and 58.5%, respectively). These percentages rise to 83% and 86.8%, respectively, if including individuals who previously practiced but had not done so in the past three months. While previous experience does not appear necessary to observe the beneficial effects of mindfulness (e.g., Ditto et al., 2006; Libby et al., 2012), it is possible that this lack of experience in combination with low dosage accounted for some of the non-significant findings in the current study.

In terms of findings regarding study condition, RSA, and fear load, the fear load variable may be measured too early in extinction for differences to be observed (it is obtained by calculating the FPS response during the first two segments of extinction). This may not be sufficient time for participants to have learned that the UCS is no longer paired with the CS+, regardless of self-regulatory capabilities. It may therefore be too early to observe any real differences between groups (i.e., the fear load variable is really a measure of carryover fear from acquisition [Norrholm et al., 2011, 2014], and since both groups underwent the same procedures

for acquisition, there may not be differences). The lack of a significant effect of RSA on fear load may also suggest that RSA is not a reliable predictor of one's fear response. While condition did predict change in RSA, perhaps this change was not a sufficient mechanism through which fear was reduced. Specifically, individuals in the relaxation condition experienced an increase in RSA (suggestive of improved self-regulation; "rest and digest"), but this may not have been enough to engender less fear during early extinction (i.e., fear load).

The lack of a significant effect of study condition on fear inhibition may partially be explained by the aforementioned limitations of the exercises. Specifically, the exercises may not have been potent enough to affect the inhibition of fear. Further, results from the manipulation checks suggest that while individuals experienced increases in TMS-Decentering and decreases in tension, there was a lack of difference between groups. If the exercises didn't result in meaningful differences on the self-report variables, this may be why there was no relation between condition and fear inhibition. The lack of a significant effect of RSA on fear inhibition may suggest that RSA is not a reliable indicator of inhibition (as suggested above), or that RSA did not increase significantly enough to produce change in fear inhibition. This relates to previous explanations of the impact of the exercises, such that they may not have been potent enough to improve fear inhibition. In essence, while individuals in the relaxation condition experienced increased RSA, this increase may not have been strong enough to affect fear inhibition. Alternatively, the lack of significant relations between fear inhibition and both study condition and RSA may be explained by suppressor variables, as described below.

While the effects of study condition and RSA on fear inhibition were not significant, the indirect effect of RSA on the relation between condition and fear inhibition was significant. One

potential explanation for this finding is the presence of suppressor variables (Rucker, Preacher, Tormala, & Petty, 2011). A suppressor variable is one that decreases the relation between an independent and dependent variable when it is *omitted* (Tabachnick & Fidell, 2007). Tabachnick and Fidell (2007) suggest that one of two criteria be met in order to assert that a suppressor variable is present: 1) the absolute value of the correlation between independent and dependent variables is substantially smaller than the beta weight for the independent variable, or 2) the correlation and beta weight have opposite signs. In addition, Rucker et al. (2011) have stated that suppression is present when the sign of the indirect effect is opposite to that of the total effect. Since none of these criteria were met, suppressor variables do not appear to explain this finding in the current study.

Clinical Implications

Given the current study's mixed findings, clinical implications are limited. Results generally suggest that relaxation exercises may lead to increased RSA, supporting previous literature regarding its beneficial effects on parasympathetic activation (Lewis et al., 2015; Pal, Ganesh, Karthik, Nanda, & Pal, 2014). However, the history of support for mindfulness interventions and their improved efficacy over relaxation (as well their positive impact on parasympathetic activation; e.g., Ditto et al., 2006; Jain et al., 2007; Khoury et al., 2013) suggests that they remain highly relevant treatment options for a range of psychopathology. The current study's finding regarding higher RSA among the relaxation condition is noteworthy nonetheless. Perhaps physical relaxation is more palatable (especially to novice participants), at least in a short-term exercise. While it is possible that mindfulness would be superior given

additional/longer sessions, these results at least suggest that relaxation may be a beneficial intervention among those with fear-based disorders.

The current study adds to the literature by suggesting that dosage of mindfulness may be a key factor in its usefulness, as with any psychological intervention or exercise. Future research examining the number, timing (e.g., daily, weekly), and length of mindfulness sessions, as well as other factors that may predict its usefulness (e.g., previous meditation experience) is warranted. In addition, studies demonstrating that RSA may be increased via mindfulness are limited in their estimation of long-term effects, such that the longest period of follow-up has been one month (Ditto et al., 2006). This limits conclusions about the potential long-terms benefits of mindfulness on parasympathetic activation and warrants additional longitudinal research with longer follow-up periods. According to a review of biofeedback as a tool for improving parasympathetic activation, indices such as RSA may be improved long-term, though there is currently insufficient research to make such an assertion (Wheat & Larkin, 2010).

Limitations and Future Directions

One important limitation of the current study is that it utilized only one 10-minute session of mindfulness meditation. As mentioned above, this small dosage may explain some of the non-significant findings and warrants future research that examines whether more sessions are needed in order for an effect to be observed with the FPS paradigm. This limitation may have interacted with the lack of meditation/yoga experience among participants. While lack of experience itself does not dictate the efficacy of an exercise, its combination with such a brief dosage could have limited its efficacy. In effect, the 10-minute exercise may have been particularly challenging

because most participants were inexperienced meditators (whereas longer/more sessions may be able to induce mindfulness in a novice sample, and alternatively, where experienced meditators may have been able to achieve higher levels of mindfulness in only 10 minutes). Future research examining the impact of longer/more frequent mindfulness sessions and/or comparisons among experienced and inexperienced meditators is therefore warranted.

Another limitation is that the current sample was composed of female undergraduates. Therefore, there is less generalizability due to factors such as gender, racial and ethnic diversity, and level of psychopathology. Previous research has demonstrated that there appear to be sex differences in terms of fear conditioning and inhibition. For example, Ressler et al. (2011) reported that pituitary adenylate cyclase-activating polypeptide (PACAP 38; a protein involved in regulation of the stress response) blood levels in females, but not males, were associated with PTSD symptoms and increased startle responses to both CS+ and CS- using the same FPS paradigm. Glover et al. (2012, 2013) reported that low levels of estrogen were associated with deficits in extinction and fear inhibition during FPS, and the authors suggested that sex differences in psychopathology may be partially explained by low levels of estrogen. Future studies would therefore benefit from the examination of sex differences and estrogen cycle effects in the current paradigm. In particular, it would be noteworthy if males and females differ in their ability to achieve state mindfulness, and how their levels of state mindfulness relate to FPS variables such as fear load and fear inhibition.

It is noteworthy that race was significantly associated with fear inhibition in the current study, such that individuals identifying as White demonstrated worse fear inhibition (i.e., higher startle to the CS+ in late extinction) than non-White individuals. Future studies with greater

racial diversity are needed to explore these relations in more detail, such as examining groups within the non-White category separately instead of collapsing them together (an analysis that the current study was not sufficiently powered to conduct).

Testing the current paradigm in a clinical sample is also warranted given that the FPS response differs among those with high levels of psychopathology (in particular, symptoms related to PTSD and panic; e.g., Jovanovic et al., 2009b, 2010a; Lissek et al., 2009). It is possible that relatively low levels of psychopathology and therefore lower FPS magnitudes made it difficult to observe significant findings in the current study. Future research should therefore examine whether a brief mindfulness exercise has benefits in a clinical sample. Similarly, levels of resting/baseline parasympathetic activation are likely to be lower among individuals with clinical levels of psychopathology (see Chalmers, Quintana, Abbott, & Kemp, 2014 for a review) and thus the impact of mindfulness meditation on RSA/other measures of parasympathetic activation is likely to be different in such a sample.

Although comparison of a mindfulness condition to a relaxation condition may be considered a strength (i.e., relaxation is a conservative and active control), the current study is limited in its lack of an additional control group. For example, a third condition whereby participants engaged in a task such as listening to a neutral story (e.g., someone describing a mundane day that they had) would have served as a more inert control. In such a study, the effects of mindfulness and relaxation could be compared to the effects of a neutral control task to determine if either exercise has benefits over the lack of an exercise.

Using change scores for RSA is another noteworthy limitation. While this strategy may capture RSA increase or decrease regardless of baseline, it may also overlook important

information. For example, two individuals – one with low and one with high baseline RSA – may have the same change score (perhaps they both had a minor increase), but this score is not necessarily reflective of success or failure of an exercise. The individual who started with high RSA arguably has greater regulatory ability than the individual with low RSA, but their change scores are the same. This would suggest that both individuals experienced the same shift in RSA, but if one person had higher RSA to begin with, the interpretation is different (e.g., perhaps the individual with high RSA had less to gain).

Lastly, it should be noted that the current study attempted to measure mindfulness and relaxation within the context of an arguably stressful situation (i.e., the FPS paradigm). Participants had fairly extensive physiological equipment attached to them and were seated in a soundproof chamber with large and heavy metal doors. Although participants were told that the doors would not lock, the nature of the room itself along with the physiological equipment likely hindered their ability to achieve a fully relaxed or mindful state. This limitation should be considered when interpreting findings from the current study as it may have reduced the effects of both exercises.

Conclusion

The current study examined the impact of a mindfulness meditation on fear load and fear inhibition using an FPS paradigm. A potential underlying mechanism of this relation, RSA, was also explored along with several covariates. Results indicated that individuals who underwent the mindfulness meditation did not experience significantly different levels of state mindfulness or physical tension compared to those who underwent a relaxation exercise. Individuals in the

relaxation group demonstrated greater increases in RSA than those in the mindfulness group, calling into question the benefits of this short exercise and suggesting that more mindfulness training may be needed in order for positive parasympathetic effects to be observed. Similarly, the lack of significant effects of study condition and RSA on fear load/fear inhibition suggests that the mindfulness exercise may not have been long enough, and/or that RSA is not a reliable indicator of FPS phenomena. Future research is needed to determine whether longer/more frequent mindfulness sessions would be beneficial to parasympathetic activity and fear load/fear inhibition.

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APPENDIX A

CONSENT FORMS

Informed Consent for Online Survey

I agree to participate in the research project entitled "Emotions and Stressful Experiences" being conducted by Antonia Seligowski, a graduate student at Northern Illinois University. I understand that the purpose of the study is to investigate emotions, mental health, and stressful or traumatic life events.

I understand that if I agree to participate in this study, I will be asked to complete a number of questionnaires related to my current mental health and traumatic life events. The study will last approximately 30 minutes and my participation will provide further insight into the relations between trauma and mental health symptoms. For my participation, I understand that I will be granted one credit towards my Psychology 102 course.

All information gathered during this experiment will be kept confidential in password-protected, encrypted electronic files that will only be available to the research team. I know that if I have any additional questions concerning this study, I may contact Antonia Seligowski at (815) 753-7241 or Dr. Holly Orcutt, Graduate Advisor, Department of Psychology, Northern Illinois University, at (815) 753-5920 during standard business hours.

I am aware that potential risks include experiencing upsetting thoughts or feelings during or after this study in response to material related to emotions and/or mental health. If I become distressed, I know that I can contact the 24-hour Crisis Line at (815) 758-6655 at any time. I also understand that my participation is voluntary and I may withdraw at any time without penalty or prejudice.

I realize that my consent to participate in this project does not constitute a waiver of any legal actions or redress I might have as a result of my participation. If I wish to have further information regarding my rights as a research subject, I may contact the Office of Research and Compliance (ORC) at Northern Illinois University at (815) 753-8588 or visit their website at www.orc.niu.edu.

By clicking the appropriate buttons below, I am acknowledging that I have read this consent form in its entirety and understand the purpose and conditions of this study.

[ ] I agree to participate in the present study
[ ] I do not wish to participate in the present study

Informed Consent for FPS Session

You are being asked to take part in the study entitled, "Meditation and Startle Responding." The purpose of this study is to understand conditioned responses that are associated with psychological stress symptoms, such as symptoms of Posttraumatic Stress Disorder. Findings from this study will be used to help refine treatments and interventions for Posttraumatic Stress Disorder.

We anticipate that the study will take approximately 90 minutes. Upon completion of the study, you will earn 3 points toward the partial course credit option in your Psychology 102 course.

During this study, you will be seated in a quiet room and will have non-invasive electrodes attached to two of your fingers, your right collar bone, your lower left forearm, your right cheek under your eye, and your earlobe. These electrodes measure your heart rate, facial muscles, and skin reactivity. We will also put a belt around your chest to measure your breathing. Putting these things on your body will not cause you any discomfort.

You will participate in an acoustic startle test, where you will hear loud tones that may make you startle. You will listen to some clicks and tones for about 40 minutes, in two sections with a 10 minute break in the middle. During the 10 minute break, you will participate in a guided meditation exercise. You will stay seated in the chair and hear a recording that will ask you to close your eyes and pay attention to your breathing.

You will be able to communicate with the experimenter using microphones and cameras. The sounds will be presented through earphones. We expect that some of the sounds will startle you a little, and you will blink your eyes. We will measure your reaction by recording your eye blink using the electrodes under your right eye. The startling sounds will be about as loud as a train. They will last a fraction of a second. As part of the startle procedure, you will sit comfortably in a sound-attenuated booth with a computer screen. During the task you will see shapes on a computer screen that will sometimes be paired with a mild airblast that might make you feel afraid or anxious, but typically is not experienced as painful. From time to time, a participant experiences the sensation of the mild airblast as mild pain or discomfort.

The total time for the experimental session will be up to 75 minutes.

Potential Risks:

- During the startle measurement, scrubbing your skin with cleanser or application of skin tape may cause skin irritation.
-

- The noise level you will hear during the startle test session is about what you hear on a train. For most people, this sound level is not uncomfortable. If the sounds or airblasts cause you any pain or discomfort, you can stop the test session at any time.

All the information that you provide as part of this study will be confidential to the full extent of the law, and accessible only to research project staff for research purposes. All data will be password protected and stored in a private office. Once analyzed, your data will be encrypted. Though results from this study may be published, you will not be personally identified in any reports or publications that may result from this study.
If you feel upset during or after the study, please ask to speak with the experimenter. At the end of the study, you will be provided with other phone numbers of agencies in the DeKalb area that provide counseling. You will be provided with Antonia Seligowski's, the experimenter, phone number and she can be reached during standard business hours.

Any further information about the experiment may be obtained by contacting Antonia Seligowski or Dr. Holly Orcutt, Department of Psychology, Northern Illinois University, at (815) 753-5920. If you have questions about your rights as a research participant, please contact the NIU Office of Research Compliance, (815) 753-8588.

You realize that Northern Illinois University policy does not provide for compensation for, nor does the University carry insurance to cover injury or illness incurred as a result of participation in University sponsored research projects.

You understand that your consent to participate in this project does not constitute a waiver of any legal rights or redress you might have as a result of your participation, and you acknowledge that you have received a copy of this consent form.

I have read the above statements. I understand the purpose of the study and have been given the chance to ask questions and express concerns about the research project. I understand that I can withdraw from the study at any time for any reason. I understand that Northern Illinois University does not provide compensation for treatment of injuries that may occur as a result of participation in this research. I give my informed consent to be a participant in this study. I have been given a copy of the consent form.

_____	_____
Participant (signature) and Date	Witness (signature) and Date
_____	_____
Name (please print)	Name (please print)

Video and audio taping: As described above, experiment will take place in a quiet room equipped with cameras and microphones, which allows you to communicate with the experimenter. Also, as described above, all of your data, including recordings will be confidential. Only research staff will have access to your recordings. All recordings will be kept for a maximum of two weeks on the computer (which is not connected to the internet) in a locked research room in this building. After two weeks, all recorded data will be erased.

I have read the above statements. I have been given the chance to ask questions and express concerns about the taping. All my questions about taping have been answered. I understand that I take part in this study of my own free will. I understand that I can stop at any time for any reason and that I have a choice not to take part in the taping.

_____	_____
Participant (signature) and Date	Witness (signature) and Date
_____	_____
Name (please print)	Name (please print)

APPENDIX B

DEBRIEFING FORM

Thank you for participating in the present study. The information you provided, once combined with information from other participants, will provide a better understanding of how individuals respond to different stimuli and how this may be related to mental health.

It is possible that the material you dealt with today may have elicited some distressing thoughts, feelings, or memories for you. If you need immediate assistance, please call the 24-hour Crisis Line (815) 758-6655. The experimenter, Antonia Seligowski, is also available during standard business hours to address any concerns. If you wish, she can arrange for you to have a "fast track" appointment at the Psychological Services Center at NIU within 24 hours of contacting her by telephone during standard business hours. Attached is a list of agencies in the area that offer individual and group counseling for students and community members.

If you have any questions concerning the experiment or would like to speak with the experimenters about the topics addressed in the present study, please contact Antonia Seligowski (aseligowski@niu.edu), Department of Psychology, Northern Illinois University, at (815) 753-7251, or Dr. Holly Orcutt, Department of Psychology, Northern Illinois University, at (815) 753-5920 during standard business hours.

Thank you again for your participation!

Confirmation of participation in the study "*Meditation and Startle Responding.*"

This experiment is worth 3 research credits in Introductory Psychology (PSYC 102)

The date of the session was_____and the time was_____.

Participant Name_____

Experimenter Signature_____

Counseling Resources in DeKalb

Dekalb and Northern Illinois University are fortunate in having several free or low-cost services available to the community.

Student health insurance will cover 80% of eligible charges (after the deductible has been met) up to a maximum benefit of $2,500 per plan year for outpatient treatment. The counselor must be licensed in the State of Illinois to provide mental health services (e.g. psychologist, psychiatrist, licensed clinical social worker, licensed clinical professional counselor, marriage and family therapist, etc.) This list is intended to help you find timely and appropriate assistance. Sometimes one agency will have a high demand for services that necessitates a waiting period for new clients, or you may have personal reasons for choosing one agency over another. Counselors at any of these agencies will gladly assist you in making a final decision about where to seek help.

Campus Services

Counseling and Student Development Center, NIU (STUDENTS ONLY*)*
Phone: 815/753-1206
Address: Campus Life Building-200
Fees: None for counseling.
Hours: 8:00 a.m. – 4:30 p.m. Monday-Friday
Open whenever NIU is open, including breaks.
After Hours: Assistance after hours available by calling—(815) 753-1212
Description of Services: This service provides students with short-term, individual and group counseling for a broad range of personal concerns. Career counseling services include interest assessment, workshops, and use of computerized career counseling programs. Educational counseling services include assistance with test anxiety and study skills. Assessments of drug and alcohol abuse are also provided. First appointment scheduled with 3-7 days. (Handicapped accessible).

Counseling Laboratory, NIU
Phone: 815/753-9312
Address: 416 Graham Hall
Fees: None for students, faculty, or staff.
Hours: Call for available counseling hours.
Description of Services: A wide range of services are offered by the counselors including both personal and vocational counseling. In general, the approach used is one that promotes growth and focuses on increasing emotional well-being and self-awareness. All counselors are doctoral or masters level students who are being supervised by members of the counseling faculty. First appointments scheduled within 3-5 days.

Family Center, NIU
Phone: 815/753-1684
Address: 429 Garden, Rd
Fees: $5.00 per session fee for students. Faculty, staff, and community members charged on a sliding scale. No one will be denied services due to inability to pay.
Hours: Wednesday – 2:00 p.m. – 10:00 p.m. Thursday – 10:00 a.m. – 10:00 p.m. By appointment Monday through Friday. Open whenever NIU is open, including breaks.
Description of Services: Individual, couple, and family counseling. Services provided by graduate students under supervision of Marriage and Family Therapy faculty. First appointment scheduled within 4 days.

Psychological Services Center, NIU
Phone: 815/753-0591
Address: Normal Rd and Lincoln Hwy.
Fees: No fee for students. Faculty, staff, and community members charged on a sliding scale
Hours: Monday – 12:00 noon – 8:00 p.m.
Tuesday – 11:00 a.m. – 7:00 p.m.
Wednesday-Friday- 9:00 a.m. to 5:00 p.m. Open whenever NIU is open, including breaks.
Description of Services: Individual, couples, family, and group psychotherapy, Intellectual, personality, and academic assessments. Clients are generally seen by advanced level graduate student staff under faculty supervision. Services tailored to meet a client's specific needs. First appointment scheduled with 7 days. (Handicapped accessible).

Community Resources

Ben Gordon Community Mental Health Center
Phone: (815) 756-4875
Address: 12 Health Services Dr.-DeKalb
Hours: Monday-Thursday- 8:00 a.m. – 8:30 p.m.
Friday-8:00 a.m.-5:00 p.m.
After Hours: (815) 758-6655 Crisis Line
Description of Services: Comprehensive counseling services to all residents of DeKalb County. Services to all persons affected by mental health problems, substance abuse, and family/child welfare concerns. 24-hour sexual assault/abuse services can be accessed through the Crisis Line. First appointment scheduled within 30 days. (Handicapped accessible and on Campus Bus Route).

Family Service Agency, Center for Counseling
Phone: 815/758-8636
Address: 14 Health Services Dr.-DeKalb
Fees: $75.00 per visit. Insurance accepted, including NIU Student Insurance. Payment plans and scholarship funds available.
Hours: Monday-Wednesday-9:00 a.m. – 8:00 p.m.
Thursday – Friday – 8:00 a.m. – 4:00 p.m. Additional hours available by appointment.
Description of Services: Individual, couple, group counseling for children, adults, senior citizens, and families. First appointment scheduled within 1-7 days. (Handicapped accessible and on Campus Bus Route).

APPENDIX C

DEMOGRAPHICS QUESTIONNAIRE

1. What is your gender?
    a. Male
    b. Female

2. What is your date of birth? _____/_____/_____
    Month Day Year

3. Do you identify as Latino, Hispanic, or being of Spanish origin (please select one)?
    a. Yes
    b. No
    c. Prefer not to respond

4. What is your race (please select one)?
    a. American Indian or Alaskan Native
    b. Asian or South-Asian
    c. Black or African American
    d. Native Hawaiian or Pacific Islander
    e. White
    f. Other (please specify) _____
    g. Prefer not to respond

5. How many years of education have you completed?
    a. _____ Years of education
    b. Prefer not to respond

6. Which year in school are you?
    a. Freshman
    b. Sophomore
    c. Junior
    d. Senior
    e. Graduate
    f. Other (please specify) _____
    g. Prefer not to respond

7. What is your legal marital status?
    a. Single
    b. Married or equivalent (e.g., civil union)
    c. Divorced
    d. Widowed
    e. Prefer not to respond

8. What is your relationship status?
    a. Engaged

b. Living with someone
c. Dating seriously
d. Dating casually
e. Not involved
f. Prefer not to respond

9. What is your best guess of your family's income last year?
    a. Under $10,000
    b. $10,000 - $14,999
    c. $15,000 - $24,999
    d. $25,000 - $34,999
    e. $35,000 - $49,999
    f. $50,000 - $74,999
    g. $75,000 or more
    h. Prefer not to respond

10. Do you practice yoga, either on your own (e.g., CD, DVD, or book) or go to classes?
    a. Yes
    b. No

11. If you answered yes, how many hours per week do you practice yoga? _____

12. If you answered yes, how long have you practiced yoga? _____

13. Do you practice meditation, either on your own (e.g., CD, DVD, or book) or go to classes?
    a. Yes
    b. No

14. If you answered yes, how many hours per week do you practice meditation? _____

15. If you answered yes, how long have you practiced meditation? _____

APPENDIX D

FIVE FACET MINDFULNESS QUESTIONNAIRE

Instructions: Please rate each of the following statements using the scale provided. Write the number in the blank that best describes your own opinion of what is generally true for you.

1	2	3	4	5
never or very rarely true	rarely true	sometimes true	often true	very often or always true

_____ 1. When I'm walking, I deliberately notice the sensations of my body moving.
_____ 2. I'm good at finding words to describe my feelings.
_____ 3. I criticize myself for having irrational or inappropriate emotions.
_____ 4. I perceive my feelings and emotions without having to react to them.
_____ 5. When I do things, my mind wanders off and I'm easily distracted.
_____ 6. When I take a shower or bath, I stay alert to the sensations of water on my body.
_____ 7. I can easily put my beliefs, opinions, and expectations into words.
_____ 8. I don't pay attention to what I'm doing because I'm daydreaming, worrying, or otherwise distracted.
_____ 9. I watch my feelings without getting lost in them.
_____ 10. I tell myself I shouldn't be feeling the way I'm feeling.
_____ 11. I notice how foods and drinks affect my thoughts, bodily sensations, and emotions.
_____ 12. It's hard for me to find the words to describe what I'm thinking.
_____ 13. I am easily distracted.
_____ 14. I believe some of my thoughts are abnormal or bad and I shouldn't think that way.
_____ 15. I pay attention to sensations, such as the wind in my hair or sun on my face.
_____ 16. I have trouble thinking of the right words to express how I feel about things
_____ 17. I make judgments about whether my thoughts are good or bad.
_____ 18. I find it difficult to stay focused on what's happening in the present.
_____ 19. When I have distressing thoughts or images, I "step back" and am aware of the thought or image without getting taken over by it.
_____ 20. I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing.
_____ 21. In difficult situations, I can pause without immediately reacting.
_____ 22. When I have a sensation in my body, it's difficult for me to describe it because I can't find the right words.
_____ 23. It seems I am "running on automatic" without much awareness of what I'm doing.
_____24. When I have distressing thoughts or images, I feel calm soon after.
_____ 25. I tell myself that I shouldn't be thinking the way I'm thinking.
_____ 26. I notice the smells and aromas of things.
_____ 27. Even when I'm feeling terribly upset, I can find a way to put it into words.
_____ 28. I rush through activities without being really attentive to them.

_____ 29. When I have distressing thoughts or images I am able just to notice them without reacting.
_____ 30. I think some of my emotions are bad or inappropriate and I shouldn't feel them.
_____ 31. I notice visual elements in art or nature, such as colors, shapes, textures, or patterns of light and shadow.
_____ 32. My natural tendency is to put my experiences into words.
_____ 33. When I have distressing thoughts or images, I just notice them and let them go.
_____ 34. I do jobs or tasks automatically without being aware of what I'm doing.
_____ 35. When I have distressing thoughts or images, I judge myself as good or bad, depending what the thought/image is about.
_____ 36. I pay attention to how my emotions affect my thoughts and behavior.
_____ 37. I can usually describe how I feel at the moment in considerable detail.
_____ 38. I find myself doing things without paying attention.
_____ 39. I disapprove of myself when I have irrational ideas.

Observe items:
1, 6, 11, 15, 20, 26, 31, 36
Describe items:
2, 7, 12R, 16R, 22R, 27, 32, 37
Act with Awareness items:
5R, 8R, 13R, 18R, 23R, 28R, 34R, 38R
Nonjudge items:
3R, 10R, 14R, 17R, 25R, 30R, 35R, 39R
Nonreact items:
4, 9, 19, 21, 24, 29, 33

APPENDIX E

STATE-TRAIT ANXIETY INVENTORY

Instructions: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment.* There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.	Not at all	Somewhat	Moderately So	Very Much So
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

APPENDIX F

TORONTO MINDFULNESS SCALE

Instructions: We are interested in what you just experienced. Below is a list of things that people sometimes experience. Please read each statement. Next to each statement are five choices: “not at all,” “a little,” “moderately,” “quite a bit,” and “very much.” Please indicate the extent to which you agree with each statement. In other words, how well does the statement describe what you just experienced, just now?	Not at all	A little	Moderately	Quite a bit	Very much
1. I experienced myself as separate from my changing thoughts and feelings.	0	1	2	3	4
2. I was more concerned with being open to my experiences than controlling or changing them.	0	1	2	3	4
3. I was curious about what I might learn about myself by taking notice of how I react to certain thoughts, feelings or sensations.	0	1	2	3	4
4. I experienced my thoughts more as events in my mind than as a necessarily accurate reflection of the way things ‘really’ are.	0	1	2	3	4
5. I was curious to see what my mind was up to from moment to moment.	0	1	2	3	4
6. I was curious about each of the thoughts and feelings that I was having.	0	1	2	3	4
7. I was receptive to observing unpleasant thoughts and feelings without interfering with them.	0	1	2	3	4
8. I was more invested in just watching my experiences as they arose, than in figuring out what they could mean.	0	1	2	3	4
9. I approached each experience by trying to accept it, no matter whether it was pleasant or unpleasant.	0	1	2	3	4
10. I remained curious about the nature of each experience as it arose.	0	1	2	3	4
11. I was aware of my thoughts and feelings without overidentifying with them.	0	1	2	3	4
12. I was curious about my reactions to things.	0	1	2	3	4
13. I was curious about what I might learn about myself by just taking notice of what my attention gets drawn to.	0	1	2	3	4

Curiosity: 3, 5, 6, 10, 12, 13
Decentering: 1, 2, 4, 7, 8, 9, 11

APPENDIX G

TRAUMATIC LIFE EVENTS QUESTIONNAIRE

Instructions: The purpose of this questionnaire is to identify important life experiences that can affect a person's emotional well-being or later quality of life. The events listed below are far more common than many people realize. Please read each question carefully and select the answers that best describe your experiences.

1. Have you ever experienced a natural disaster (e.g., flood, hurricane, earthquake)?
____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond
b) Were you seriously injured?
____Yes _____No _____Prefer not to respond
c) Was someone you cared about or close by seriously injured or killed?
____Yes _____No _____Prefer not to respond
d) Did you think you or a loved one was in danger of being killed by the disaster?
____Yes _____No _____Prefer not to respond

2. Were you involved in a motor vehicle accident for which you received medical attention or that badly injured or killed someone?
____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond
b) Were you seriously injured?
____Yes _____No _____Prefer not to respond

3. Have you been involved in any other kind of accident where you or someone else was badly hurt (e.g., a plane crash, a drowning or near drowning, an electrical or machinery accident, an explosion, home fire, chemical leak, overexposure to radiation or toxic chemicals)?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond
b) Were you seriously injured?
____Yes _____No _____Prefer not to respond

4. Have you lived, worked, or had military service in a war zone?

____Yes _____No _____Prefer not to respond

If yes, were you ever exposed to warfare or combat (e.g., in the vicinity of a rocket attack or people being fired upon; seeing someone get wounded or killed)?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

b) Were you seriously injured or wounded?
____Yes _____No _____Prefer not to respond

5. Have you experienced the sudden and unexpected death of a close friend or loved one?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

Due to accident? **____Yes _____No _____Prefer not to respond**

Due to illness? **____Yes _____No _____Prefer not to respond**

Due to suicide? **____Yes _____No _____Prefer not to respond**

Due to murder? **____Yes _____No _____Prefer not to respond**

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

6. Has a loved one ever survived a life threatening or permanently disabling accident, assault, or illness (e.g., spinal cord injury, rape, cancer, life threatening virus)?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

7. Have you ever had a life threatening illness?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

8. Have you been robbed or been present during a robbery – where the robber(s) used or displayed a weapon?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

b) Were you seriously injured?
____Yes _____No _____Prefer not to respond

9. Have you ever been hit or beaten up and badly hurt by a stranger or by someone you didn't know very well?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

b) Were you seriously injured?
____Yes _____No _____Prefer not to respond

10. Have you seen a stranger (or someone you didn't know very well) attack or beat up someone and seriously injure or kill them?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?

____Yes _____No _____Prefer not to respond

11. Has anyone threatened to kill you or cause you serious physical harm?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

By a stranger?

____Yes _____No _____Prefer not to respond

By a friend or acquaintance?

____Yes _____No _____Prefer not to respond

By a relative?

____Yes _____No _____Prefer not to respond

By an intimate partner?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?

____Yes _____No _____Prefer not to respond

12. While growing up: Were you physically punished in a way that resulted in bruises, burns, cuts, or broken bones?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?

____Yes _____No _____Prefer not to respond

13. While growing up: Did you see or hear family violence (e.g., your father hitting your mother, any family member beating up or inflicting bruises, burns, or cuts on another family member)?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

14. Have you ever been slapped, punched, kicked, beaten up, or otherwise physically hurt by your spouse (or former spouse), a boyfriend/girlfriend, or some other intimate partner?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

b) Were you seriously injured?
____Yes _____No _____Prefer not to respond

c) Has more than one intimate partner physically hurt you?
____Yes _____No _____Prefer not to respond

d) If yes, how many hurt you?
____ (please type in a number) _____Prefer not to respond

15. Before your 13th birthday: Did anyone – who was at least 5 years older than you – touch or fondle your body in a sexual way or make you touch or fondle their body in a sexual way?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

How old were you when this happened?

_____ (Please type in your age at the time)

_____ Prefer not to respond

Was the person a stranger?

____Yes _____No _____Prefer not to respond

Was the person a friend or acquaintance?

____Yes _____No _____Prefer not to respond

Was the person a parent or caregiver?

____Yes _____No _____Prefer not to respond

Was the person an other relative?

____Yes _____No _____Prefer not to respond

Did anyone…

Touch or fondle any of your private or sexual parts?

____Yes _____No _____Prefer not to respond

Have you touch or fondle any of his or her private or sexual parts?

____Yes _____No _____Prefer not to respond

Do sexual things to you with his or her hands or mouth?

____Yes _____No _____Prefer not to respond

Have you do sexual things to them with your hands or mouth?

____Yes _____No _____Prefer not to respond

Sexually penetrate you with a foreign object (e.g., placing a bottle or finger in your anus or vagina)?

____Yes _____No _____Prefer not to respond

Have oral sex with you (someone's mouth or tongue making contact with your genitals or anus or your mouth making contact with someone else's genitals or anus)?

____Yes _____No _____Prefer not to respond

Have sexual intercourse with you, either vaginal (penis in vagina) or anal (penis in butt or rectum)?

____Yes _____No _____Prefer not to respond

Was threat of force used?

____Yes _____No _____Prefer not to respond

Were you seriously injured?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?

____Yes _____No _____Prefer not to respond

16. Before your 13th birthday: Did anyone close to your age touch sexual parts of your body or make you touch sexual parts of their body – against your will or without your consent?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

How old were you when this happened?

_____ (Please type in your age at the time)

_____ Prefer not to respond

Was the person a stranger?

____Yes _____No _____Prefer not to respond

Was the person a friend or acquaintance?

____Yes _____No _____Prefer not to respond

Was the person an other relative?

____Yes _____No _____Prefer not to respond

Was threat of force used?

____Yes _____No _____Prefer not to respond

Were you seriously injured?

____Yes _____No _____Prefer not to respond

Was there oral, anal, or vaginal penetration?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

17. After your 13th birthday and before your 18th birthday: Did anyone touch sexual parts of your body or make you touch sexual parts of their body – against your will or without your consent?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

How old were you when this happened?

_____ (Please type in your age at the time)

_____ Prefer not to respond

Was the person a stranger?

____Yes _____No _____Prefer not to respond

Was the person a friend or acquaintance?

____Yes _____No _____Prefer not to respond

Was the person a relative?

____Yes _____No _____Prefer not to respond

Was the person an intimate partner?

____Yes _____No _____Prefer not to respond

Was threat of force used?

____Yes _____No _____Prefer not to respond

Were you seriously injured?

____Yes _____No _____Prefer not to respond

Was there oral, anal, or vaginal penetration?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

18. After your 18th birthday: Did anyone touch sexual parts of your body or make you touch sexual parts of his or her body against your will or without your consent?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

Was the person a stranger?

____Yes _____No _____Prefer not to respond

Was the person a friend or acquaintance?

____Yes _____No _____Prefer not to respond

Was the person a relative?

____Yes _____No _____Prefer not to respond

Was the person an intimate partner?

____Yes _____No _____Prefer not to respond

Was threat of force used?

____Yes _____No _____Prefer not to respond

Were you seriously injured?

____Yes _____No _____Prefer not to respond

Was there oral, anal, or vaginal penetration?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?

____Yes _____No _____Prefer not to respond

19. Were you ever subject to uninvited or unwanted sexual attention? (other than sexual contact covered by Items 15, 16, 17, and 18) (e.g., touching, cornering, pressure for sexual favors, verbal remarks)

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

Was the person a stranger?

____Yes _____No _____Prefer not to respond

Was the person a friend or acquaintance?

____Yes _____No _____Prefer not to respond

Was the person a relative?

____Yes _____No _____Prefer not to respond

Was the person a supervisor or coworker?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

20. Has anyone stalked you – in other words – followed you or kept track of your activities causing you to feel intimidated or concerned for your safety?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

Was the person a stranger?

____Yes _____No _____Prefer not to respond

Was the person a friend or acquaintance?

____Yes _____No _____Prefer not to respond

Was the person a relative?

____Yes _____No _____Prefer not to respond

Was the person an intimate partner?

____Yes _____No _____Prefer not to respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

21. Have you or a romantic partner ever had a miscarriage?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

b) Did it (ever) happen after you were physically injured?
____Yes _____No _____Prefer not to respond

22. Have you or a romantic partner ever had an abortion?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

21. Have you experienced (or seen) any other events that were life threatening, caused serious injury, or were highly disturbing or distressing (e.g., lost in the wilderness, a serious animal bite, violent death of a pet, being kidnapped or held hostage, seeing a mutilated body or body parts)?

____Never ____Once ____Twice ____3 Times ____4 Times ____5 Times
____More than 5 Times ____Prefer not to Respond

Please describe:
_____

If this happened:

a) Did you experience intense fear, helplessness or horror when it happened?
____Yes _____No _____Prefer not to respond

b) Were you seriously injured?
____Yes _____No _____Prefer not to respond

23. The events listed below correspond to items #1 to #22 on this questionnaire. If any of these events happened to you, CHOOSE the number of the *ONE* event (only 1) that CAUSES YOU THE MOST DISTRESS?

1. Natural disaster
2. Motor vehicle accident
3. "Other" kind of accident
4. Combat or warfare
5. Sudden death friend/loved one
6. Life threatening/disabling event to loved one
7. Life threatening illness
8. Robbery/weapon used
9. Assaulted by acquaintance or stranger
10. Witnessed severe assault to acquaintance/stranger
11. Threatened with death/serious harm
12. Growing up: physically punished

13. Growing up: witnessed family violence
14. Physically hurt by intimate partner
15. Before 13: Sexual contact – someone 5 years older
16. Before 13: Unwanted sexual contact
17. As a teen: Unwanted sexual contact
18. As an adult: Unwanted sexual contact
19. Sexual harassment
20. Stalked
21. Miscarriage
22. Abortion
23. Some “other” traumatic event
24. None of these events happened to me

a) When did this event (first) occur? (your age): _____
b) When did this event last occur? (try to be precise, e.g., year, month, day): _____
c) **How much distress** (anxiety, worry, sadness, frustration, or grief) **does this event cause you?** *(Select the best answer)*

- None happened to me
- No Distress
- Slight Distress
- Moderate Distress
- Considerable Distress

Extreme Distress

APPENDIX H

PTSD CHECKLIST-5

Instructions: Below is a list of problems that people sometimes have in response to a very stressful experience. Please read each problem carefully and then circle one of the numbers to the right to indicate how much you have been bothered by that problem in the past month. Make sure to base your answers on problems that started or got worse after the event.

The event you experienced was _____ in _____.
(event) (month/year)

In the past month, how much were you bothered by:	*Not at all*	*A little bit*	*Moderately*	*Quite a bit*	*Extremely*
1. Repeated, disturbing, and unwanted memories of the stressful experience?	0	1	2	3	4
2. Repeated, disturbing dreams of the stressful experience?	0	1	2	3	4
3. Suddenly feeling or acting as if the stressful experience were actually happening again *(as if you were actually back there reliving it)*?	0	1	2	3	4
4. Feeling very upset when something reminded you of the stressful experience?	0	1	2	3	4
5. Having strong physical reactions when something reminded you of the stressful experience *(for example, heart pounding, trouble breathing, sweating)*?	0	1	2	3	4
6. Avoiding memories, thoughts, or feelings related to the stressful experience?	0	1	2	3	4
7. Avoiding external reminders of the stressful experience *(for example, people, places, conversations, activities, objects, or situations)*?	0	1	2	3	4
8. Trouble remembering important parts of the stressful experience *(for some reason besides a head injury or alcohol or drug use)*?	0	1	2	3	4

9. Having strong negative beliefs about yourself, other people, or the world *(for example, having thoughts such as: I am bad, there is something seriously wrong with me, no one can be trusted, the world is completely dangerous)*?	0	1	2	3	4
10. Blaming yourself or someone else *(who didn't directly cause the event or actually harm you)* for the stressful experience or what happened after it?	0	1	2	3	4
11. Having strong negative feelings such as fear, horror, anger, guilt, or shame?	0	1	2	3	4
12. Loss of interest in activities that you used to enjoy?	0	1	2	3	4
13. Feeling distant or cut off from other people?	0	1	2	3	4
14. Having trouble experiencing positive feelings *(for example, being unable to feel happiness or have loving feelings for people close to you)*?	0	1	2	3	4
15. Feeling irritable or angry or acting aggressively?	0	1	2	3	4
16. Taking too many risks or doing things that could cause you harm?	0	1	2	3	4
17. Being "superalert" or watchful or on guard?	0	1	2	3	4
18. Feeling jumpy or easily startled?	0	1	2	3	4
19. Having difficulty concentrating?	0	1	2	3	4
20. Trouble falling or staying asleep?	0	1	2	3	4

APPENDIX I

PERMISSION FOR PCL-5

Gmail by Google

Antonia Seligowski <avic858@gmail.com>

PTSD Assessments

1 message

Mott, Juliette M. <Juliette.Mott@va.gov> Mon, Dec 29, 2014 at 8:40 AM
To: "avic858@gmail.com" <avic858@gmail.com>

Greetings, and thank you for your assessment instrument request.

You may access National Center for PTSD assessment measures by following the link below:

http://www.ptsd.va.gov/professional/assessment/documents/ptsd_trauma_assessments.asp

These assessment tools were created by government employees and therefore are not copyrighted. In accordance with the American Psychological Association's ethical guidelines, these instruments are intended for use by qualified health professionals with advanced graduate training in psychodiagnostic assessment.

Please let us know if you have any difficulties downloading these instruments. Also, no thank you email is necessary.

Sincerely,

National Center for PTSD Staff

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Juliette Mott, PhD

Psychologist/Education Specialist

National Center for PTSD, Executive Division

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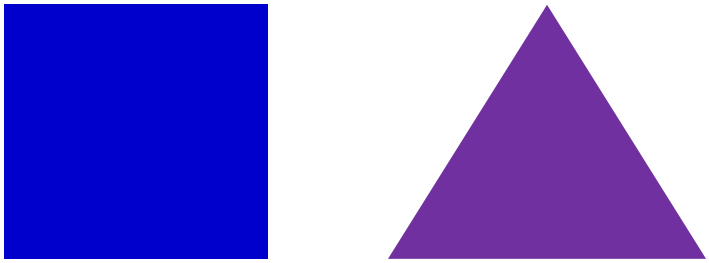
APPENDIX J

CONDITIONED STIMULI



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APPENDIX K

MINDFULNESS INSTRUCTIONS

“While sitting down in your chair, place your feet flat on the floor. Sit up straight. Relax your shoulders, relax your neck, and place your hands in your lap or on your knees. As you settle into a comfortable position, commit yourself to simply being fully awake, fully present for these next few moments. If you feel comfortable with it, gently close your eyes. Otherwise, just look toward the floor.

Focus on tuning into the feeling of the breath moving in and out of your body. Focus on the sensation of the breath moving through your nose on each inbreath and each outbreath. Allow yourself to just be here in this moment, following the breath as it comes in and as it goes out. Just breathe and let go. Breathe and let be.

Naturally your mind may wander off into thoughts of one kind or another. Take note of any thoughts as they come up. Note what's on your mind and how your body is feeling. Acknowledge these thoughts, whatever they are, without judging or evaluating them. And then just gently let them go. Bring your attention back to the breath, focusing on the feeling of the breath coming in and out of your nostrils.

And each time you notice that your mind has gone off somewhere else, wherever that may be, just bring your attention back to the feeling of the breath. And if the mind wanders off a thousand times, you simply bring it back a thousand times, intentionally cultivating an attitude of patience and gentleness towards yourself. This means choosing as best you can not to react to or judge any of your thoughts or feelings, impulses or perceptions, reminding yourself instead that absolutely anything that comes into the field of awareness is ok. We simply sit with it and breathe with it and observe it, staying open and awake in the present moment, right here, right now, a continual process of seeing and letting be, seeing and letting go, rejecting nothing, pursuing nothing, dwelling in stillness and in calmness as the breath moves in and out.

If you'd like, commit yourself to bringing this attitude of attention and acceptance with you throughout your day, being fully aware in the present moment, noticing any thoughts or feelings that may arise, without judging them - just being right here and right now, accepting the present moment, and accepting yourself, no matter what happens. Remember that you can always bring your focus back to your breath, back to the sensations of the present moment, to cultivate this sense of attention and acceptance.”

APPENDIX L

RELAXATION INSTRUCTIONS

“While sitting down in your chair, place your feet flat on the floor. Sit up straight. Relax your shoulders, relax your neck, and place your hands in your lap or on your knees. If you feel comfortable with it, gently close your eyes. Otherwise, just look toward the floor.

For the next several minutes, I would like you to try and relax your body. Start by taking a few deep breaths to relax. As you do so, your body may physically begin to feel more relaxed. Continue to take a few more deep breaths, and let go of any tension you may feel. Just allow yourself to relax.

Draw your attention to the muscles in your right hand and relax them. Release any tension in your hand. You may begin to feel more heavy. Now, relax your left hand. Just let the muscles go. Relax your entire right arm in a similar way. Allow your muscles to feel more and more relaxed. Shift your attention to your left arm and relax it as well. Continue to release any tension in your hands and arms feel.

Relax the muscles in your face and neck. Slowly notice how your body is feeling more and more heavy with relaxation. Continue to allow all the muscles in your face and neck to relax. Your upper body may feel more relaxed now than it did when you first started to relax your muscles.

Draw you attention to your chest and shoulders. Allow your chest and shoulders to relax. Recognize how your body may feel warm and heavy as you continue to relax more deeply. Just let the muscles go. Relax the muscles in your abdomen and back. Again, just allow all of these muscles to relax. Continue to relax. You may feel less tense and more relaxed.

Attend to the muscles in your upper leg and tell these muscles to relax as well. Notice the relaxation you are experiencing. Continue to relax by relaxing your calves. Your body may be becoming more heavy and relaxed. Let your body relax and release any tension. You may feel more relaxed not than you did initially. Shift your attention to your feet. Again, allow all the muscles around your feet to relax.

While continuing to relax your body, take a few more deep breaths. Your hands, arms, face, and neck may feel more relaxed. Also your chest, shoulders, abdomen and back maybe less tense. Finally, the muscles in your legs and feet may also be more relaxed. Take one more deep breath in and out and slowly open your eyes.”