

THE EFFECTS OF MINDFULNESS, FEAR-INDUCING STIMULI, AND FEAR OF
EMOTION ON AVOIDANCE BEHAVIOR

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DEDICATION

To Jeannine and Bill Brown for their unconditional support, and for their models of perseverance through traumatic events and frustrating tasks which inspired this research.

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ABSTRACT

Previous research has shown that those with PTSD may fear their emotions, which in turn may increase avoidance behavior and help to maintain PTSD symptoms. The current study used an analogue laboratory design to investigate whether engaging in a brief mindfulness induction may result in decreased avoidance behavior following a fear-inducing stimulus. Undergraduate students were randomly assigned to listen to a brief mindfulness induction (or control) and were then shown a fear-inducing or neutral film clip. Avoidance behavior was measured by likelihood of quitting and persistence length on a frustrating math task. Of those participants watching the fear-inducing film clip, those in the mindfulness group persisted longer and were less likely to quit the frustrating task than those in the control audio group. Contrary to predictions, there was no significant effect of reported fear of emotion on avoidance behavior. Limitations, implications, and future research directions are discussed.

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CHAPTER 1

INTRODUCTION

Experiencing a trauma is unfortunately not a rare event. One review of the literature estimates that over half of adults in the United States, and 70 to 90% of those in nations experiencing war, have been exposed to what classifies as a “traumatic event” according to the DSM-IV (Friedman, Resick, & Keane, 2007). After a trauma, some individuals develop post-traumatic stress disorder (PTSD), which is characterized by a persistent re-experiencing of the event, avoidance of traumatic stimuli, numbing of responsiveness, and increased arousal (DSM-IV TR). However, most people who experience such an event do not develop PTSD. In the United States, lifetime prevalence of PTSD has been found to be around 8%, though that percentage differs depending on the nature of the trauma (i.e., crime related, combat related, natural disaster, etc.) as well as the length of the traumatic situation (Friedman et al., 2007). There has been a wide variety of research into risk factors influencing the development of PTSD, covering factors from psychosocial, genetic, and biological areas (for a review, see Vogt, King, & King, 2007). However, even when risk factors are identified, many of the mediating pathways connecting them with PTSD development are only beginning to be investigated (Vogt et al., 2007).

Recently, there has been some specific research investigating the hypothesis that those who develop PTSD may have different reactions to and thoughts about their

emotions (Follette, Palm, & Pearson, 2006). Support for the relationship between PTSD and avoidance has begun to expand the understanding of potential risk factors present in individuals who are diagnosed with PTSD (Batten, Orsillo, & Walser, 2005; Follette, Palm, & Hall, 2004; Tull et al., 2007a). Avoidance of trauma-related cues is not only a major part of one of three clusters of PTSD symptoms according to the DSM-IV, but it is an integral part of most major theories attempting to explain the development and maintenance of PTSD, including conditioning theory, emotional processing theory, and cognitive theory (Cahill & Foa, 2007). Therefore, the relationships that have been demonstrated between one's relationship with their emotions and PTSD serve to further underscore the importance of avoidance in the exacerbation of PTSD symptoms. Theoretically, as one's tolerance for extreme emotion decreases and fear of extreme emotion increases, one's avoidance behavior will also increase.

One aspect of avoidance, dealing with one's internal experience, has been conceptualized as experiential avoidance. Experiential avoidance refers to one's unwillingness to tolerate internal experiences (such as emotions, thoughts, or bodily sensations), resulting in avoidance behavior to relieve distress (Hayes et al., 1996). PTSD has even been argued to be "understood as a disorder of experiential avoidance," and recent literature has provided preliminary support for a relationship between PTSD and experiential avoidance (for a review, see Batten et al., 2005).

Mindfulness has been defined generally as bringing one's attention to internal and external experiences in the present moment (Baer, 2003). Trait mindfulness, particularly self-reports of non-judgment (one facet of mindfulness), has been shown to be associated

with fewer avoidance symptoms of PTSD, even after controlling for self-reported experiential avoidance (Thompson & Waltz, 2010). This may indicate that treatments incorporating acceptance (defined as a willingness to experience events in a nonjudgmental way, without changing or avoiding them) as well as mindfulness techniques may be beneficial for PTSD, especially for patients who have not responded to traditional exposure therapies (Batten et al., 2005).

A similar argument has been made regarding the relationship between PTSD and emotion dysregulation, a multi-faceted construct conceptualized as a lack of acceptance of emotional experiences, lack of emotional clarity, decreased access to emotion-regulation strategies, and difficulty with goal-directed behavior while restraining oneself from impulsive behavior (Gratz & Roemer, 2004). A recent study found PTSD symptom severity to be associated with emotion dysregulation, indicating that targeting these deficits may also be beneficial to those with PTSD (Tull et al., 2007a). In a population of women with a history of child abuse, there was also a relationship between emotion dysregulation and functional impairment when PTSD symptoms were controlled for, again indicating that interventions targeting one's ability to appropriately regulate emotion, in addition to standard PTSD treatment, could garner more success in terms of reducing one's impairment (Cloitre, Miranda, Stovall-McClough, & Han, 2005).

One's fear of intense emotion has also been implicated as a potential influencing factor in the development and exacerbation of PTSD. Those who are "prone to fear strong emotion," including fear of "loss of control over emotion," may be "characteristic" of those having problems with anxiety (Williams, Chambless, & Ahrens, 1997). There is

also some support for a specific connection between fear of emotion and PTSD. An investigation of the relationship between emotion dysregulation, fear of emotion (affective control), and PTSD found that both emotion dysregulation and fear of emotion were related to specific PTSD symptom clusters, and that fear of losing affective control was the best predictor of total PTSD symptoms (Price, Monson, Callahan, & Rodriguez, 2006). This finding suggests the possibility that interventions that are “geared toward improving affect management” may be beneficial to those with PTSD (Price et al., 2006). Fear of emotion was also found to be a significant predictor of PTSD symptom severity in a population of adults who were victims of interpersonal violence as children (Tull, Jakupcak, McFadden, & Roemer, 2007b). In this study, fear of emotion was found to be a better predictor than having a tendency to experience heightened negative affect (NA), and NA was only associated with PTSD symptom severity through its relationship with fear of emotion (Tull et al., 2007b). In addition, a different study found that fear of anger specifically was found to partially mediate the relationship between pre-treatment levels of anger and treatment outcome in military veterans with PTSD (Forbes, Parslow, Creamer, Allen, McHugh, & Hopwood, 2008).

However, the literature investigating the relationship of PTSD to fear of emotion has to this point been cross-sectional and after a trauma has occurred. In other words, participants have already experienced their trauma, and their thoughts about and reactions to emotions are being measured at some point after this exposure to a traumatic event. It therefore leaves unknown if avoiding internal experience, engaging in poor emotion regulation, and/or having an increased fear of emotion *prior* to experiencing a trauma

increases one's susceptibility to developing PTSD, or if these characteristics emerge after one has already developed the disorder.

There is some evidence that those who possess an increased ability to tolerate psychological distress may also have an increased ability to endure a distressing situation. One study measured both psychological and physical distress tolerance in a population of individuals entering a residential substance abuse treatment center (Daughters, Lejuez, Bornovalova, Kahler, Strong, & Brown, 2005). Persistence on the psychological tasks (a distressing math task and a mirror tracing task) was a significant predictor of which participants were able to complete 30 days of treatment at the center, as opposed to those who dropped out or were asked to leave the center due to substance use. The measures of physical distress tolerance (breath holding and holding one's arm in very cold water) were not predictive of a 30-day completion of treatment (Daughters et al., 2005).

Recent research has found support for the propensity of mindfulness to decrease avoidance and increase attention, which may help improve the effectiveness of current treatments (Follette et al., 2006). Mindfulness and acceptance-based therapies have seen preliminary support in the literature for treating a range of pathology (for a review, see Baer, 2003) and for anxiety and mood disorders in particular (for a review, see Hofmann, Sawyer, Witt, & Oh, 2010). There is also some preliminary research that suggests such approaches may be beneficial to those diagnosed with PTSD as well (Follette et al., 2004; Batten et al., 2005).

A few studies have shown some preliminary support for newly developed treatments for PTSD which include teaching and practicing mindfulness. One study of a

PTSD treatment described as “affect management,” which included instruction in mindfulness as well as “crisis planning and challenging distorted thinking,” found that compared to a wait-list control group, those in the treatment program experienced significant reduction in PTSD symptoms (Zlotnick et al., 1997). Also, a case study examining the effect of Acceptance and Commitment Therapy (ACT), which includes instruction in mindfulness and acceptance, was found to successfully treat an individual with PTSD comorbid with substance abuse (Batten & Hayes, 2005). Though these studies indicate that mindfulness and acceptance-based therapies may be beneficial to those with PTSD, more research is needed on the mechanisms behind such interventions, particularly because the interventions cited above involve multiple components, resulting in lack of clarity as to how influential the mindfulness instruction in particular was in their effectiveness.

There has been some recent support shown in brief laboratory tasks that mindfulness techniques increase distress tolerance and willingness to experience negative emotions. College students who engaged in 15 minutes of “recorded focused breathing induction,” compared to those being given 15 minutes of instruction in unfocused attention or worrying, recorded lower negative affect in response to negative images, and were also more likely to report a willingness to view the negative slides again as an option at the end of their experiment (Arch & Craske 2006). This supports the argument that mindfulness-based interventions may increase one’s tolerance for distress and willingness to experience emotions, even if they are distressing, and may therefore decrease avoidance behaviors.

Similarly, smokers engaging in a brief mindfulness-based body scan reported a decreased desire to smoke while abstaining from tobacco at the time of the study as compared to a control group, also of abstaining smokers (Cropley, Ussher, & Charitou, 2007). The group which performed the body scan reported less of a desire to smoke five minutes after the induction, as well as reduced self-reported levels of irritability, restlessness, and tension (Cropley et al., 2007). These results may indicate that practicing mindfulness techniques may help one tolerate what is usually seen as a difficult situation, in this case abstaining from smoking.

This preliminary evidence provides some promising examples of how mindfulness techniques may be targeting one's thoughts about and reactions to intense emotions that in turn may affect one's avoidance behavior. As previously stated, most major theories of PTSD include avoidance of trauma-related stimuli and emotion as a major contributor to the development and exacerbation of the disorder (Cahill & Foa, 2007). Decreasing one's tendency to avoid aversive stimuli after a traumatic experience may in turn theoretically decrease one's likelihood of developing PTSD.

The current study sought to contribute to research being done on the mechanisms of mindfulness, such as those cited above by Arch and Craske (2006) and Cropley and colleagues (2007), and the potential application of that research to the etiology of PTSD. The goal of this study was therefore to create an analogue laboratory situation to examine how engaging in mindfulness techniques prior to a fear-inducing stimulus may affect one's tendency to engage in avoidance behavior.

It was hypothesized that those who watched a fear-inducing film would engage in increased avoidance behavior and a decreased willingness to persist on frustrating tasks, as measured by time spent attempting to solve difficult math problems. However, those who engaged in a mindfulness exercise prior to the film were expected to be protected against such reactions, thereby not avoiding the task and demonstrating a willingness to persist on the task that is similar to those who were not exposed to the fear-inducing film. These results would indicate that mindfulness techniques could aid in the prevention of PTSD by decreasing one's avoidance and increasing one's willingness to experience negative stimuli and emotions, thereby decreasing the likelihood of developing PTSD symptoms.

In addition, those participants who reported having greater fear of emotion were expected to be more distressed by the fear-inducing film and therefore exhibit increased avoidance behavior by quitting the persistence task sooner than those with less fear of emotion. In a study investigating the relationship between fear of emotion and reactance to negative stimuli, researchers found that after watching a distressing film of a woman being raped, participants who reported more fear of emotion prior to watching the film also reported increased subjective distress and negative affect and exhibited increased skin conductance after the film (Salters-Pedneault, Gentes, & Roemer 2007). In addition, these participants exhibited a greater delay at naming the colors of words that were related to film content on a modified emotional Stroop task (Salters-Pedneault et al., 2007). This study implies that those exhibiting increased levels of fear of emotion may

show a greater reactivity in the presence of a distressing stimulus, such as a fear-inducing film.

The current study manipulated whether participants were assigned to a brief mindfulness induction or to a control, after which participants from both groups were randomly assigned to watch either a fear-inducing film or a neutral film. The avoidance behavior of all participants was measured by the time they spent attempting to solve frustrating math problems. Participants from the group who did not receive the mindfulness induction and who watched the fear-inducing film were expected to quit the math problem persistence task sooner than those from the same group watching the neutral film. However, those receiving the mindfulness induction as well as watching the fear-inducing film were expected to persist on the math task as long as the group watching the neutral film. Similarly, those exhibiting a higher amount of trait mindfulness, as measured by the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) were also expected to persist longer than those low in trait mindfulness. In addition, participants were asked to complete a measure of fear of emotion at the beginning of the study. Those endorsing a higher fear of emotion were expected to be particularly vulnerable to the fear-inducing film, which was expected to be exhibited by quitting the persistence task sooner than those with a lower fear of emotion.

CHAPTER 2

METHOD

Participants

In order to have an 80% likelihood of detecting an interaction of small to medium magnitude between exercise (mindfulness or control) and film type (fear or control) in predicting persistence on the math task, a power analysis of a regression determined the number of participants needed to be 96, or 24 per condition (Cohen, 1988).

One hundred American University (AU) students participated in this study, recruited from introductory psychology classes and Today@AU e-mails (e-mails sent notifying the AU community of various events, including opportunities to participate in research). Seventy-nine were female and twenty were male (one participant did not report gender). Seventy-three reported identifying as White or Caucasian, seven identified as Hispanic, Latino or Latina, five as African American or Black, five as Asian, and three as “other” race (seven participants did not report race/ethnicity). The median age of participants was nineteen years old (mean=19.6, SD=1.5), with an age range of 18 through 25. Ninety participants reported that English was their first language, while nine reported a different first language and one participant’s first language is unknown. Out of all of the participants, eighteen reported having had some past exposure to mindfulness

and/or meditation, while nine participants reported currently practicing mindfulness and/or meditation.

Participants were randomly assigned to one of four conditions: mindfulness induction/fear film; neutral audio/fear film; mindfulness induction/neutral film; neutral audio/neutral film. Participants received research participation credit for participating psychology classes and also received chances in a cash lottery for \$100.

Materials

Mindfulness induction. The mindfulness induction was the same as that used by Arch and Craske (2006). They used a “focused-breathing induction” which was adapted from a mindfulness meditation exercise used by Jon Kabat-Zinn. The focused-breathing induction directs the participants’ focus to attention and awareness of their bodily sensations and the “experience of breathing” (Arch & Craske, 2006). These directions to focus on their breath and bodily experience are repeated approximately every two to three minutes during the induction. They found that college students engaging in 15 minutes of “recorded focused breathing induction,” compared to students engaging in 15 minutes of instruction in either unfocused attention or worrying, recorded less negative affect in response to negative images. The focused-breathing group was also more likely to report a willingness to view negative images again as an option at the end of their experiment (Arch & Craske, 2006).

The neutral audio played for the control group was also the same as that played for one of the control groups from the Arch and Craske (2006) study. Participants in this group were asked to let their mind wander (also for 15 minutes) and not focus on

anything in particular. The audio reminded the participants of this request for "non-focus" every 30 to 60 seconds. This control was chosen so that instead of instructions requesting one's attention to breathing, thoughts, or one's body, the participant was exposed to a similar environment but ideally was not focused on paying attention to anything in particular.

Films. A film eliciting fear and a neutral film were chosen from a list of films that have been validated based on both "intensity and discreteness" in eliciting a specific emotion (Rottenberg, Ray, & Gross, 2007). This validation study builds on a previous list of validated films by cross-validating that list, as well as adding and replacing some films with those that elicited higher intensity or higher discreteness of the target emotion (Rottenberg et al., 2007; Gross & Levenson, 1995). Participants rated the film clips on 9-point Likert scales to report how much of each of 18 emotions they felt during the film. Those films for which participants rated the highest intensity of the target emotion (higher means on that emotion compared to other films) as well as higher discreteness (target emotion was felt "more intensely than all nontargeted emotions") were chosen to appear on this list of validated films (Rottenberg et al., 2007).

Based on the findings of the film validation studies, the fear-inducing film chosen for the current study was a three and a half minute clip from *Silence of the Lambs*, and the neutral film, also approximately three and a half minutes, was from *Alaska's Wild Denali*. In previous research, the fear-inducing film had a mean fear rating on the 0-8 scale of 3.87 for male participants (N=31) and 4.45 for female participants (N=40). The neutral film was described as a "pleasant neutral film," which was recommended by the authors of the validation study as it "is well tolerated by participants" and "it fully

engages participants' attention," as compared to neutral stimuli such as screen savers (Rottenberg et al., 2007). In previous research, the fear rating of this neutral film was 0.25 for male participants (N=12) and 0.00 for female participants (N=12; Rottenberg et al., 2007).

Measures. *The Affective Control Scale (ACS)*. The ACS is a 42-item scale measuring one's fear of intense emotions, namely anger, depression, anxiety, and positive affect (Williams et al., 1997). Previous research has found the scale to be normally distributed and had satisfactory internal consistency for the total score (Cronbach's $\alpha = .94$) as well as subscale scores for each emotion, and showed acceptable retest reliability after a period of two weeks ($r = .78$). The current study found a Cronbach α of .93 for total ACS score. ACS scores have been found to correlate with anxiety symptoms, including PTSD symptom severity (Tull et al., 2007; Price et al., 2006) as well as the severity of generalized anxiety disorder (GAD) and self-reports of worry (Roemer, Salters, Raffa, & Orsillo, 2005).

***Five Facet Mindfulness Questionnaire (FFMQ)*.** The FFMQ is a questionnaire that was developed using both exploratory factor analyses and confirmatory factor analyses of items from existing self-report measures of trait mindfulness (Baer et al., 2006). The FFMQ measures trait mindfulness along five factors: nonreactivity to inner experience, observing, acting with awareness, describing, and nonjudging of experience. Each factor was shown to be internally consistent and distinct from each other, showing only "modest" correlations between the factors (Baer et al., 2006). The mindfulness facets have been found to correlate with similar constructs, such as the "describe facet" with alexithymia ($r = -.68$) and "act with awareness facet" with dissociation ($r = -.62$; Baer

et al., 2006). The current study found Cronbach alphas for the subscales ranging from .70 to .93.

Positive Affect/Negative Affect Schedule (PANAS). The PANAS is a brief questionnaire used to measure positive and negative affect (Watson, Clark, & Tellegen, 1998). The PANAS has been shown to have high internal consistency (Cronbach's alpha for PA=.88 and NA=.87; alpha's for current study, PA=.86 and NA=.61) and was "appropriately stable" in retest reliability after a period of two weeks, $r=.68$ for PA and $r=.71$ for NA. The participants were asked the degree to which they are feeling the emotions listed, on a scale of 1 to 5, at the present moment in order to assess for affect at baseline.

Manipulation check for film. Participants completed a brief post-film questionnaire inquiring about how intensely each of nine emotions was felt by the participants during the film. This questionnaire was derived from that used during the film validation studies from which the films for the current study were chosen (Rottenberg et al., 2007). The questionnaire served as a manipulation check of the film by measuring the intensity and discreteness of the target emotion of fear.

Avoidance measure. Participants were asked to engage in a distressing task of solving very difficult math problems (Smith & Kirby, 2009). These problems were used along with others of varying difficulty to investigate problem-focused versus emotion-focused coping (Smith & Kirby, 2009). The problems chosen for the current study were based on the performance of participants from a pilot study and were shown to be frustrating and distressing to complete. Participants in the pilot study rated how frustrating and distressing they found the math problems both on average and with the

hardest problem. Ratings were on a scale of 1-7. The mean response for the participants ($n=15$) for how frustrating they found the problems on average was 4.2 ($SD=1.32$), and the mean response for how frustrating they found the hardest problem was 5.2 ($SD=1.70$). The mean response for how distressing the participants found the problems on average was 3.1 ($SD=1.44$), and for the hardest was 4.5 ($SD=1.84$). The math problems given in the current study began with three problems that were quite easy to solve, followed by the problems that were assessed as frustrating in the pilot study (see Table 1 for response percentages and means for the math problems in the current study).

Avoidance behavior was measured by the number of minutes participants persisted on the problem-completion task until they quit. The problems were chosen to be difficult enough so that most participants would find it impossible to complete all of them in 20 minutes. Most participants (66%) in the pilot study quit the task before 20 minutes elapsed, and the mean number of minutes until quitting for all participants was 13.95, with a standard deviation of 6.4 minutes. The range of minutes until quitting was 1.17 minutes to 20 minutes, as participants were stopped if they continued to work after 20 minutes had elapsed.

Willingness Measure. Participants were asked immediately after the problem-completion task how willing they were (on a scale of 1-7) to participate in another study that used the same type of problems. This question is similar to that used by Arch and Craske (2006) when assessing willingness to view additional distressing material.

Procedures

Participants were recruited by posting flyers, an announcement in Today@AU,

and from introductory level psychology classes with professor's approval. Participants were told that the study would be investigating how different activities affect problem-solving to further the understanding of emotion, cognition, and behavior. Students were asked to either sign up for the study or contact the experimenter directly. Potential participants were then contacted by the experimenter to schedule an individual appointment to come in to the lab to complete the study. Two experimenters were used to conduct the study in order to keep each blind to one of the study conditions. The first part of the study (during which the participant completed the informed consent, self-report measures, and listened to the audio recording) was conducted by one of two research assistants (one psychology graduate student and one undergraduate psychology major). The second part of the study (during which the participant viewed the video clip, did the math problem task, and completed the post-study questionnaires) was conducted by the thesis author. All of the experimenters were Caucasian females.

Upon arriving at the lab, the participant was welcomed by an experimenter (Experimenter 1) and given a consent form. Experimenter 1 verbally explained the form to the participant. The consent form included the information that the participants may be asked to watch a short film they may find distressing, and that all participants will be asked to complete a task that may be frustrating or distressing to them. They were also informed that the study required random assignment to conditions, and that to limit bias in the study they would be introduced to a different experimenter after the initial activity who would continue the experiment at that time.

After consenting, participants were given the Affective Control Scale (ACS), the Five Facet Mindfulness Questionnaire (FFMQ) and the Positive and Negative Affect

Schedule (PANAS) to complete. Participants were given the measures in a random order. Participants were then told the experiment would continue with the first activity, which would involve listening to a recording. Participants in the mindfulness condition were asked to follow instructions on the recording that asked them to focus their attention on their breathing. Participants in the control condition were asked to follow instructions on the recording asking them to let their minds wander and to not focus on anything in particular. Both groups were informed that this activity would last approximately 15 minutes. The recording was played through the RealPlayer program on a Dell Dimension 4500 computer, and the participants heard it via headphones. Lights in the room were dimmed during the audio recording.

After listening to the recording, the participants were introduced to the second experimenter (Experimenter 2) who administered the next activity, watching a film clip. The participants were asked to watch the film carefully, an instruction that is advised from those doing research on emotion elicitation through film to reduce experimenter demand (Rottenberg et al., 2007). Experimenter 2 then started the film, *Silence of the Lambs* or *Alaska's Wild Denali*, depending on the condition to which the participants were randomly assigned. The film was viewed on the same Dell computer, also using the RealPlayer program. Lights remained dimmed through the viewing of the film clip. The film lasted approximately three and a half minutes. After the film, participants were asked to fill out the post-film questionnaire which served as a manipulation check.

Experimenter 2 then explained that the final activity would involve solving math problems on the computer. The participants were told that the better they did on this task (i.e., the more problems they solve), the more chances they would receive in a lottery for

\$100. The task began with two practice problems to ensure that the participants understood the type of problems that were on the problem-completion task. The participants were then given one problem at a time to solve. The participants had to provide a correct answer in order to continue to the next question. The participants were told that they could not pass a problem to continue, and that if they wished to stop working on the problem in front of them, that would end the task. The computer program, DirectRT, timed each participant to measure how long the participants persisted at attempting to solve the very difficult problems. Participants were asked to stop working on the problems if they persisted for 20 minutes.

After the problem-completion task, the participants were asked how willing they would be (on a scale of 1-7) to participate in an experiment that would require them to attempt similar problems. They were also asked to complete the same emotion questionnaire that they completed after viewing the film, as well as a short demographics questionnaire.

Experimenter 2 then conducted a post-experimental interview with each participant, during which time the experimenter probed for suspicion from the participants and revealed the deception involved, that the problem-completion task was conducted to measure persistence time, not how many problems the participant was able to complete. None of the participants indicated that they had guessed at the true purpose of the experiment; when asked what they thought the experiment was about, most participants indicated that they did not know. When participants did respond, they gave answers such as “to see how well we would do at math” or “to see if being scared would affect how well we did the math problems.” Experimenter 2 also described the full nature

of the study and the hypothesis that the condition they were assigned to (mindfulness or control recording, fearful or neutral film) was expected to influence how long they persisted on the problems. They were also informed that their performance on the problems was not due to their abilities to solve math problems in general, but that the problems were specifically selected because they were difficult and frustrating to solve.

All of the participants were able to solve two or more of the problems, which was expected as the first three puzzles were extremely easy. They therefore all received two chances in the lottery. (If they were not able to solve two problems, they would have only received one chance at the lottery.) Participants were not told the specific criteria to determine the number of chances to prevent other potential participants from knowing these criteria prior to participating in the experiment. Participants were able to sign a sheet indicating that they would like information about the results of the study after its completion. All eligible participants received one hour of research participation credit for their psychology class.

CHAPTER 3

RESULTS

Descriptive Statistics

Across all conditions, 53% of participants quit the task prior to twenty minutes. The high rate of persistence led to a ceiling effect on persistence length on the math problem task, and so this variable was not normally distributed. Table 1 reports a summary of math problem responses. Means and standard deviations for the main variables are reported in Table 2, and Table 3 reports the Pearson correlations between the main variables.

Effects of Demographic Variables

Preliminary analyses were done to determine if demographic variables were significantly related to total ACS score, total FFMQ score, positive and negative affect, persistence length, and quitting. Male and female participants did not differ on any of these variables. Given that few participants belonged to any given minority group, it was not feasible to compare specific racial/ethnic groups. However, comparison of scores of white participants to those of non-white participants found no differences. The mean scores for those participants whose first language was English also did not differ from the mean scores of participants whose first language was not English. Participants' age was also not significantly correlated with any of these same variables.

Table 1

Summary of Math Problem Responses

Problem	Number attempting problem	Percent correct ^a	Mean time until correct ^b	Percent quit ^a	Mean time until quit ^c	Percent stopped ^a	Mean time until stopped ^d
1	100	100	1.46	0	N/A	0	N/A
2	100	100	.34	0	N/A	0	N/A
3	100	97	.88	3	1.38	0	N/A
4	97	48	9.49	35	8.03	16	16.42
5	46	22	4.71	24	4.31	52	6.16
6	10	0	N/A	40	2.90	60	3.80

^a Percents are out of those attempting the problem (not total *N*).

^b Mean time (in minutes) participants who gave correct answer worked on the problem.

^c Mean time (in minutes) participants who quit the problem worked until quitting.

^d Mean time (in minutes) participants asked to stop working on the problem (because they had reached twenty minute total time) worked on the problem until stopped.

Table 2

Means and Standard Deviations of Main Variables

Measure	Mean	Standard Deviation
ACS ^a : Total	134.97	29.88
ACS ^a : Anxiety	44.61	12.10

Measure	Mean	Standard Deviation
FFMQ ^b : Total	129.35	15.22
FFMQ ^b : Observe	26.45	4.62
FFMQ ^b : Describe	28.02	6.20
FFMQ ^b : Act with Awareness	25.75	5.81
FFMQ ^b : NonJudge	27.24	6.63
FFMQ ^b : NonReact	21.89	3.70
PA ^c	26.17	7.11
NA ^d	13.45	3.11
Persistence length (in minutes)	14.97	6.13
Willingness	5.31	1.38

^a Affective Control Scale (ACS)

^b Five Facet Mindfulness Questionnaire (FFMQ)

^c Positive Affect (PA); from Positive Affect Negative Affect Schedule (PANAS)

^d Negative Affect (NA); from PANAS

Table 3

Pearson Correlations Between the Main Variables

	ACS	ACS: Anx	FFMQ	Obs	Desc	AA	NJ	NR	PA	NA
ACS	-									
ACS: Anx	.797*	-								
FFMQ	-.515**	-.402**	-							

	ACS	ACS: Anx	FFMQ	Obs	Desc	AA	NJ	NR	PA	NA
Obs	.002	-.029	.483**	-						
Desc	-.158	-.206*	.636**	.389**	-					
AA	-.366**	-.260**	.671**	.078	.228*	-				
NJ	-.510**	-.300**	.468**	-.130	-.090	.234*	-			
NR	-.369**	-.324**	.555**	.195	.261**	.295**	.079	-		
PA	-.323**	-.160	.369**	.109	.253*	.353**	.167	.103	-	
NA	.249*	.230*	-.173	-.035	-.083	-.062	-.175	-.177	-.053	-

Note. Main variables are as follows: Affective Control Scale (ACS), ACS fear of anxiety subscale (ACS: Anx), Five Facet Mindfulness Questionnaire (FFMQ), FFMQ observe subscale (Obs), FFMQ describe subscale (Desc), FFMQ act with awareness subscale (AA), FFMQ non-judge subscale (NJ), FFMQ non-react subscale (NR), positive affect from PANAS (PA), negative affect from PANAS (NA).

* $p < .05$ ** $p < .01$

Participants with and without past experience in mindfulness differed significantly on the FFMQ-Observe subscale ($t(98)=-2.24, p=.028$). Participants with mindfulness experience scored higher on this scale. Their differences neared significance on the ACS-Anxiety subscale ($t(98)=-1.96, p=.052$) and FFMQ-Non-React ($t(98)=1.86, p=.066$), but both differences were not in the expected direction; those with mindfulness experience scored higher on the fear of anxiety subscale and lower on the non-react subscale. The two groups did not differ in mean score of the ACS, FFMQ, PA, and NA. The average NA score was significantly lower for those who reported some type of current mindfulness practice ($n=9$) compared to those who did not ($n=91; H(1)=7.079, p=.008$). Those practicing mindfulness also reported lower scores on the ACS anger subscale ($t(98)=2.45, p=.016$). Neither past mindfulness experience nor current

mindfulness experience was predictive of quitting or of length of time persisting on the task.

As the analysis of the demographic variables did not reveal any variables that would have confounded the results, none of these variables were controlled for in the following analyses. The four experimental groups did not differ in ACS, FFMQ, PA, or NA (for ACS and FFMQ, all $F(1, 98) < .49, p > .49$; for PA and NA all $H(1) < 2.33, p > .13$).

Manipulation Check

Participants responded to a measure of affect immediately following the film. Their ratings for anxiety and fear had a Cronbach's alpha of 0.87, indicating that the two items can be combined and used together as a measure of fear, hereafter referred to as post-film fear. A two-way ANOVA showed that film condition, but not audio condition or the film-audio interaction, was a significant predictor of the variation in post-film fear ($F(1,96)=140.10, p<0.001$). Those in the *Silence of the Lambs* condition reported significantly higher post-film fear than did those viewing *Alaska's Wild Denali* (control film). Those in the fear-inducing film group reported a mean post-film fear score of 8.9 ($SD=4.45$), compared to the control group reporting a mean score of 0.76 ($SD=1.86$). This indicates that the fear manipulation was successful in that those viewing the fear-inducing film reported being significantly more afraid than those viewing the neutral film. However, though film group did predict self-reported anxiety and fear, as expected, it also predicted significant differences in most of the other self-reported emotions. As the negatively valenced emotions (anxiety, fear, anger, disgust, and sadness) had a combined alpha of .80, they were combined into a single variable, post-film negative affect

(PFNA). Film group predicted PFNA ($F(1,98)=150.33, p<.001$), with those in the SOTL group reporting higher negative affect than the control film group, as expected.

Main Analyses

The first hypothesis was that the fear-inducing film would have a differential effect on those in the mindfulness condition compared to those in the control-audio condition (i.e., those instructed to let their minds wander). In other words, the fear-inducing film was expected to affect persistence time for those in the control condition (by reducing persistence) more than for those in the mindfulness condition. Two dependent variables were used: whether participants quit and how long they persisted. First, a logistic regression was used to test for the effects of audio condition (mindfulness or control), film condition (fear-inducing film or control) and the interaction of audio and film on the categorical variable of whether participants quit the math problem task or not. Neither of the odds ratios for the main effects of audio condition (*odds ratio*, 1.76, $p=.16$) or film condition (*odds ratio*, .786, $p=.55$) was significant. However, the odds ratio (4.527) of the interaction was marginally significant ($p=.068$). A post-hoc analysis indicated that for participants in the fear-inducing film condition, hearing the mindfulness audio resulted in these participants being almost twice as likely to persist the full twenty minutes than those hearing the control audio (*odds ratio*, 3.857, $p=.025$); however, audio condition made no difference on whether the participant persisted for those in the control film group (*odds ratio*, .85, $p=.78$). Figure 1 displays the percentage of participants persisting for the full twenty minutes on the math task for each experimental group.

A second analysis examined the interaction between audio and film condition on

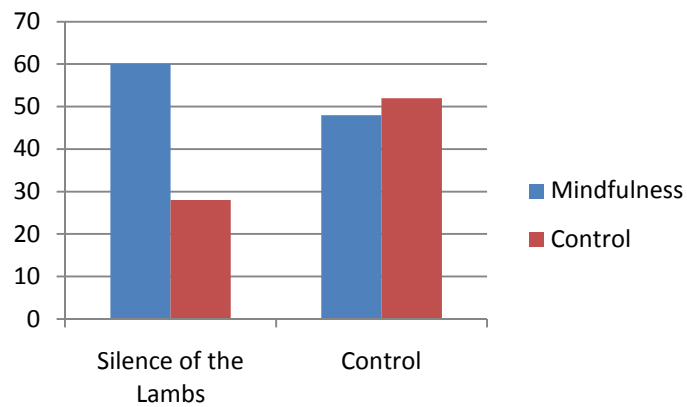


Figure 1: Percent of participants persisting on the math problems task.

length of time persisting. As participants were stopped if they persisted for twenty minutes, the data reflect a ceiling effect and are not normally distributed. Therefore, a nonparametric test (Kruskal-Wallis) was used to examine the interaction of the audio and video conditions in predicting how long participants would persist. These results indicate that neither the main effects of audio ($H(1)=1.70$, $p=.192$) or film group ($H(1)=.002$, $p=.97$) nor the interaction of the two on length of persistence was significant ($H(1)=.75$, $p>.15$). Table 4 provides information on persistence times and mean ranks for the four experimental groups. A post-hoc analysis looking at just participants in the fear-inducing film condition found a marginally significant effect of audio condition on persistence length ($H(1)=2.903$, $p=.088$), with the mindfulness group persisting longer than the control group (mean rank control = 22.14; mean rank mindfulness = 28.86).

The second hypothesis was that for those participants who score higher in fear of emotion, as measured by the ACS, the fear-inducing film would have more of an effect

Table 4

Persistence per Experimental Group

Conditions	Mean Persistence Time (in minutes)	SD	Mean Rank
Control Audio & Control Film	14.32	6.99	49.56
Mindfulness Audio & Control Film	15.32	5.77	51.68
Control Audio & Fear Film	14.18	5.61	44.28
Mindfulness Audio & Fear Film	16.04	6.23	56.48

on persistence times (shortening persistence). This hypothesis was tested in the same two ways as above. First was a logistic regression, testing for the effects of the interaction of ACS score and film condition on the categorical variable of whether the participant quit or not. Neither the main effect of ACS score (*odds ratio*, .998, $p=.80$) nor the interaction of ACS score and film condition (*odds ratio*, .983, $p=0.212$) was significant. To analyze the possible effects of ACS on length of persistence, ACS scores were dichotomized at the median (134.5) into high ACS and low ACS groups. As reported above, there was no main effect of film on persistence time ($H(1)=.002$, $p=.97$). There was also no main effect of ACS score on persistence time ($H(1)=.166$, $p=.68$), and the interaction between ACS and film condition on persistence time was also not significant ($H(1)=1.36$, $p=.71$). See Table 5 below for information regarding mean persistence time and mean ranks.

In addition, it was predicted that those scoring higher on the FFMQ, indicating that they have higher trait mindfulness, would be affected less by the fear-inducing film

Table 5

Mean Persistence Times and Mean Ranks for ACS and Film Conditions.

Conditions	Mean Persistence Time (in minutes)	SD	Mean Rank
Low ACS & Control Film	14.50	6.44	48.81
High ACS & Control Film	16.64	4.89	54.67
Low ACS & Fear Film	15.18	6.40	52.58
High ACS & Fear Film	13.70	6.54	46.42

than those with lower FFMQ scores. There was no significant main effect of FFMQ (*odds ratio*, 1.01, $p=.34$) or interaction of FFMQ score and film condition (*odds ratio*, 1.03, $p=.37$) on whether a participant persisted for the full twenty minutes. However, post hoc analysis of those just in the fear-inducing film condition found that higher FFMQ scores were predictive of whether participants persisted or not (*odds ratio*=1.03, $p=.02$). FFMQ score was not predictive of persistence to twenty minutes for those in viewing the control film (*odds ratio*=1.00, $p=.83$). To analyze the possible effects of FFMQ score on length of persistence, FFMQ score was dichotomized at the median (129) into high and low FFMQ groups. There was a significant main effect of FFMQ score on length of persistence ($H(1)=5.05$, $p=.025$), with those in the high FFMQ group (mean rank=56.80) persisting significantly longer than those in the low FFMQ group (mean rank=44.45). There was no significant interaction effect of FFMQ score and film condition on length of persistence ($H(1)=.04$, $p>.15$). However, post hoc analysis using a Spearman

correlation indicated that for those in the fear-inducing film condition, higher FFMQ scores were marginally associated with longer persistence on the math problem task ($r=.26, p=.06$). There was no significant association between FFMQ score and persistence time for those viewing the control film ($r=.07, p=.64$).

The final hypothesis predicted that participants who were assigned to the mindfulness audio would report that they were more willing to engage in future studies involving similar frustrating tasks than were those in the control audio condition. Contrary to this prediction, an ANOVA showed that neither audio condition ($F(1,96)=1.165, p=.283$), nor video condition ($F(1,96)=.626, p=.431$), nor their interaction ($F(1,96)=.254, p=.616$) affected participants' rating of willingness to engage in a similar study in the future.

Post Hoc Analysis

Post-hoc analyses were conducted to further explore factors affecting persistence. As there was a marginal interaction of audio and video conditions in predicting whether people would quit, I examined whether this interaction may be true for some participants but not others (i.e., whether there was a three-way interaction with another variable). In addition, the subscales of the FFMQ in this study showed low inter-subscale correlations (all below .40; see Table 6), and therefore the relationships between each subscale and persistence were also examined.

Table 6

Correlations of FFMQ Subscales

	Observe	Describe	Act with Awareness	Non-judge
Observe	---	---	---	---
Describe	.389**	---	---	---
Act with Awareness	.078	.228*	---	---
Non-judge	-.130	-.090	.234*	---
Non-react	.195	.261**	.295**	.079

* $p < .05$ ** $p < .01$

Fear of emotion, film condition, and audio condition. As reported above, there was no significant interaction between fear of emotion (as measured by the ACS) and film condition on persistence. However, further investigation found a significant three-way interaction between fear of emotion, film condition, and audio condition on likelihood of quitting (*odds ratio*, .907, $p=.01$; see Table 7). For those participants low in fear of emotion, there was a significant interaction of audio and film condition on likelihood of quitting (*odds ratio*, 77.00, $p=.004$). After watching the fear-inducing film, the mindfulness audio caused those low in fear of emotion to be less likely to quit than did the control audio (*odds ratio*, 55.00, $p=.002$) but not after watching the control film (*odds ratio*, .714, $p=.67$). There was no such interaction effect of audio and film condition for those high in fear of emotion (*odds ratio*, .75, $p=.80$). There was not a significant three-way interaction between fear of emotion, film condition, and audio condition on persistence length ($H=1.91$, $p=.18$). However, for those low in fear of emotion, there was a marginally significant interaction between audio and film condition

on persistence length ($H=3.57, p=.06$). As above, there was no audio and film condition interaction effect on persistence length for those high in fear of emotion ($H=.03, p>.15$). Again, those low in fear of emotion listening to the mindfulness audio persisted longer

Table 7

Mean Persistence Time and Mean Rank for Fear of Emotion, Audio, and Film Conditions

Conditions	<i>N</i>	Mean Persistence Time (in minutes)	SD	Mean Rank	% Quit
Low fear of emotion, control audio, control film	14	13.89	7.11	47.86	50%
Low fear of emotion, mindfulness audio, control film	12	15.20	5.78	49.92	58%
Low fear of emotion, control audio, fear-inducing film	12	14.60	4.60	40.08	92%
Low fear of emotion, mindfulness audio, fear-inducing film	12	18.72	4.43	69.25	17%
High fear of emotion, control audio, control film	11	14.90	7.15	51.73	45%
High fear of emotion, mindfulness audio, control film	13	15.43	5.98	53.31	46%
High fear of emotion, control audio, fear-inducing film	13	13.82	6.58	48.15	54%
High fear of emotion, mindfulness audio, fear-inducing film	13	13.57	6.77	44.69	62%

than those listening to the control audio after viewing the fear-inducing film ($H=3.28$, $p=.001$) but not after viewing the control film ($H=.19$, $p=.85$).

FFMQ Subscales. The “Non-React” subscale of the FFMQ did not significantly predict quitting behavior on its own. However, it did show a significant three way interaction with audio and video conditions on quitting (*odds ratio*, 1.80, $p=.031$), though not on persistence length ($H(1)=.89$, $p>.15$; see Table 8 for persistence times and mean ranks). These findings indicate that the interaction of audio and video condition on quitting is dependent on score on reported non-reactivity; there was an interaction between audio and film condition on quitting for those high in non-reactivity (*odds ratio*, 14.143, $p=.03$), but not for those low in non-reactivity (i.e., high in reactivity; *odds ratio*, 1.234, $p=.867$). This audio-video interaction is again of the same nature: for those high in nonreactivity, the mindfulness audio causes participants to persist longer and be less likely to quit after watching the fear-inducing film ($H(1)=2.3$, $p=.02$; *odds ratio*, 11.00, $p=.01$), but makes no difference on quitting or persistence time after watching the control film ($H(1)=.29$, $p=.78$; *odds ratio*, .78, $p=.73$). It is noteworthy that though the three-way interactions described above for fear of emotion, film condition, and audio condition and nonreactivity, film condition, and audio condition are similar in nature, the correlation of fear of emotion and nonreactivity was modest ($r=-.37$, $p<.01$).

A logistic regression found that those scoring higher on the Observe subscale of the FFMQ were more likely to persist the full twenty minutes on the math problem task (*odds ratio*, 1.143, $p=.008$). Observe was also significantly related to time persisting on the math problems, with those scoring above the median on observe persisting longer than those scoring below the median ($H=7.033$, $p=.008$). None of the other subscales of

Table 8

Mean Persistence Times and Mean Ranks for Non-reactivity, Audio, and Film Conditions

Conditions	N	Mean Persistence Time (in minutes)	SD	Mean Rank
Low non-reactivity, control audio, control film	11	14.85	6.99	51.55
Low non-reactivity, mindfulness audio, control film	9	15.97	5.98	54.89
Low non-reactivity, control audio, fear-inducing film	13	13.74	6.32	43.46
Low non-reactivity, mindfulness audio, fear-inducing film	11	13.70	7.37	44.09
High non-reactivity, control audio, control film	14	13.91	7.22	48.00
High non-reactivity, mindfulness audio, control film	16	14.95	5.80	49.88
High non-reactivity, control audio, fear-inducing film	12	14.65	4.96	45.17
High non-reactivity, mindfulness audio, fear-inducing film	14	17.86	4.65	66.21

the FFMQ had significant main effects or were part of interaction effects in predicting persistence.

CHAPTER 5

DISCUSSION

The current study sought to explore the mechanisms of change behind mindfulness interventions and the possible application of mindfulness to disorders, such as PTSD, that are influenced by avoidance behavior. An analogue laboratory task was created to test the hypothesis that mindfulness techniques prior to exposure to a fear-inducing stimulus could reduce avoidance behavior after the exposure. This hypothesis was partially supported by the data. The interaction between audio and film condition was a marginally significant predictor of whether the participants quit the frustrating task. For those participants in the fear-inducing film condition, listening to the mindfulness exercise caused participants to be more likely to persist on the task the full twenty minutes as compared to those listening to the control audio; however, this effect was not seen in the control film group. Post-hoc analysis also revealed that for those low in fear of emotion, as well as those high in non-reactivity, there was a significant interaction between audio and film condition on persistence. For these participants, hearing the mindfulness audio predicted persistence on the math problem task only for those who also watched the fear-inducing film. This same interaction was not found in those high in fear of emotion or low in non-reactivity (i.e., high in reactivity). However, as alpha was not corrected for the post-hoc analyses, related implications of these findings are unclear without further research.

This lab situation was developed to be an analogue of one's willingness to persist on a frustrating task, and the conditions in which one would avoid this frustration or not. The above results suggest that for those participants who have viewed the fear-inducing film (and are therefore on average feeling more fear and anxiety), engaging in the mindfulness exercise helped them to not avoid this frustrating task. They were, therefore, "protected" from quitting by engaging in the mindfulness exercise. This persistence behavior could indicate that these participants were more willing to experience the frustration associated with attempting to solve the difficult math problems. Similarly, those who did not engage in the mindfulness exercise were more likely to quit the task, and quit the task sooner; this may indicate that they were more likely to avoid the frustration elicited by the math problem task.

The hypothesis that those participants reporting higher fear of emotion would be more likely to quit the frustrating task after viewing the fear-inducing film did not find support in this study. This hypothesis was based on previous research in which participants high in fear of emotion were more reactive to a distressing film clip than were those low in fear of emotion (Salters-Pedneault et al., 2007). Reactivity was measured in this previous study both physiologically (heart rate and skin conductance level) as well as through self-reported levels of negative affect and distress following a distressing stimulus (fear-inducing film). Consistent with these previous findings, fear of emotion predicted reactivity (as measured in this study by quitting behavior) following a distressing stimulus (fear-inducing film) for those in the mindfulness audio condition. However, this effect was not found for those in the control audio condition. It is unclear why fear of emotion was not predictive of quitting behavior for all participants following

the fear-inducing film. That fear of emotion was predictive of quitting on the math problem task for those in the mindfulness condition may indicate that those high in fear emotion were more reactive to the fear-inducing film clip, as the mindfulness exercise did not help them persist as it did for those low in fear of emotion.

It is worth noting that as the mindfulness intervention was helpful to those already low in fear emotion, and high in non-reactivity, these participants may have been able to use the mindfulness instruction to capitalize on skills or personality traits that they already possessed. Research on strengths-based models of psychotherapy suggest that interventions attending to patients' strengths may increase therapeutic alliance and therapy effectiveness (Fluckiger & Holtforth, 2008). The mindfulness intervention in this study may therefore have affected participants differentially by capitalizing on the strengths already possessed by those not fearful of emotion or high in non-reactivity.

A limitation of this study was that there was no assessment of current psychopathology. Therefore, it cannot be ruled out that higher scores on the fear of emotion measure and lower scores on the non-reactivity scale could be serving as proxies for other psychopathology. It may be that participants' anxiety or other symptoms is what is causing the scores seen on these measures as well as on the avoidance behavior observed. It is also worth noting that, for those high in fear of emotion (or low in non-reactivity), listening to a focused breathing exercise may have the potential to *increase* one's anxiety or discomfort; if one is afraid of their emotions and/or is reactive to emotions, being asked to focus on one's internal experiences may not be a pleasant experience. Therefore, the observed results may be due to an increase in anxiety or discomfort felt by some of the participant population as opposed to an increase in

mindfulness strategies by the others. However, the previous discussion on the observed post-hoc results are offered tentatively as alpha was not corrected.

It is also of interest that mindfulness was not helpful for persistence for those in the control film condition. Mindfulness condition only predicted persistence for those having watched the fear-inducing film; for those watching the neutral film, audio condition was not related to quitting behavior. In addition, total FFMQ scores were only associated with quitting behavior in the fear-inducing film condition. A similar finding was shown for all participants in the neutral film condition; for these participants, both audio condition and total FFMQ score did not predict quitting behavior. The protective asset of the mindfulness exercise, therefore, seemed to only be “activated” by the fear-inducing film. This may indicate that mindfulness is especially helpful (or perhaps only helpful) for persistence on a difficult or frustrating task after an anxious, fearful, or stressful situation. Practicing mindfulness may not make a difference on persistence on a frustrating task on a relaxing, non-stressful day; however, when something triggers one’s anxiety, those with practice in mindful meditation may have the skills and/or resources to respond more constructively by not exhibiting less avoidance behavior than those without these skills.

The previous research on the effects of brief mindfulness interventions has investigated how the intervention affects participants’ reactions to a distressing stimulus, such as smokers abstaining from smoking or participants viewing aversive pictures (Cropley et al., 2007; Arch & Craske, 2006). Other research has found a relationship between non-reactivity (as measured by the FFMQ) and persistence on difficult anagrams (Evans, Baer, & Segerstrom, 2009). The current study found similar support for

mindfulness inductions affecting one's response to negative stimuli. The difference in this study was that it also found no support for mindfulness affecting participants quitting following a neutral stimulus.

One explanation for this interaction between audio and film condition may be that after viewing the control film, participants did not need "extra" coping resources in order to persist on the difficult math problems. Though there was a natural variability between participants in solving the math problems, since these participants viewing the control film were not "challenged" by having their fear and anxiety manipulation, they were able to use the resources they already possessed to persist however long they were going to persist on the frustrating task. However, those participants who watched the fear-inducing film (and were therefore more anxious and fearful) were less able to persist unless they had gone through the previous exercise of focused breathing meditation (mindfulness audio). The brief mindfulness intervention may have provided them with additional resources than the control audio group, allowing them to persist longer than the control group on the frustrating task.

A recent study investigated the possibility that the benefits seen from mindfulness interventions may be mediated by an increase in one's abilities to regulate emotions following mindfulness practice (Erisman & Roemer, 2010). The researchers found mixed results for this hypothesis. Participants in the mindfulness intervention group reported more adaptive emotion regulation and less negative affect after viewing an affectively mixed film clip; however, no differences were found in self-reported affect, affect recovery, or emotion regulation between the mindfulness and control groups following a distressing film clip. As the current study did not assess for changes in

emotion regulation strategies, the results found cannot speak to whether emotion regulation mediated the effect of mindfulness on quitting behavior. Future research combining both self-reported emotion regulation measures as well as behavioral measures may be able to further elucidate emotion regulation strategies as a possible mediator of the effects of mindfulness.

An alternative explanation for the current study's findings may be that participants viewing the fear-inducing film were reminded of their own mortality, as the content of the film clip surrounds the protagonist running for her life and ends with this same character stumbling upon a rotting corpse. Terror Management Theory (TMT) proposes that when responding to a "mortality salient" (MS) cue, participants are likely to respond defensively, which may include repressing thoughts of death, defending one's worldview, or enhancing self-esteem (Burke, Martens, & Faucher, 2010; Niemiec et al., 2010). Some recent research suggests that those higher in trait mindfulness are less likely to respond defensively to MS cues (Niemiec et al., 2010). Though this research does not address persistence behavior specifically and relies on self-report measures of trait mindfulness instead of experimentally manipulated mindfulness inductions, it suggests that mindfulness may play a role in avoidance behavior when thoughts of one's mortality have been made salient.

Participants' willingness to engage in a similar study was not related to audio or film condition, and was also not related to total FFMQ scores and ACS scores. This was in contrast to the finding of previous research that participants who first engaged in a mindfulness exercise were more willing to view additional distressing images at the end of the study than were those in the control group (Arch & Craske, 2006). The willingness

question in this study was both vaguer and less immediate than the one used in the Arch and Craske study, asking participants how willing they would be to participate in a future study using similar math problems; the previous study asked about willingness to view additional distressing images right at that moment. There is a possibility that by asking about willingness for a future date, other variables could have affected the students' answers, such as whether they would need additional study participation for an academic course, how much free time they had, at what point in the semester it was, etc. Future studies should focus on willingness questions that are more specific and more immediate.

A limitation of this study is that it involves an analogue lab task that is meant to represent more intense and severe real-world situations. However, it remains possible that what was created in the lab was not a sufficient model of the "real-world," and therefore the external validity may be questioned. Participants were recruited from an undergraduate college-student population and may not be representative of more diverse populations. The fear-inducing film was a relatively short and minor model of a "traumatic" stressor, and therefore the effects seen in this study may not be representative of the effects that would be seen following a real-world traumatic or fear-inducing event. In addition, it is worth noting that the fear-inducing film induced other emotions beyond fear and anxiety, so the necessity of fear and anxiety being induced (as opposed to general negative affect) is unclear. Similarly, the frustrating task was also relatively benign, with no real consequences to quitting. Previous research using films to induce fear and anxiety, as well as pilot-testing on the frustrating task, led to the decisions to use these methods, particularly as manipulating a more realistic traumatic event would have posed ethical challenges.

In addition, the current study had only one control group, in which the participants were asked to let their minds wander instead of practicing a focused breathing meditation. Arch and Craske's study (2006), for example, used two control groups: one was asked to let their minds wander as in the current study, and the other was asked to worry about their concerns in a variety of different domains. It may be that what was manipulated in this study was not "mindfulness" but rather something else, as there were other differences between the audio conditions besides the fact that one was a mindfulness intervention and one was not. For example, the audio instructions were repeated a different number of times and were of different lengths. In addition, the mindfulness intervention was not compared to another intervention, such as progressive muscle relaxation, to give more specific evidence that it is mindfulness specifically that is causing the effects seen here. Therefore, though the intervention attempted to manipulate mindfulness, the differences in the audio conditions are such that other variables may have been affected, such as engaging in an activity or not, or level of annoyance due to differences in the repetitiveness of the instructions.

Similarly, it may be that a confounding variable was also manipulated that influenced the results. For example, optimism has been shown to be associated with persistence on a similar frustrating task (insoluble anagrams) when combined with high self-awareness (Nes, Segerstrom, & Sephton, 2005). There is therefore a possibility that optimism or another such variable was manipulated by the mindfulness intervention, and it is this confounding variable that influenced the results rather than mindfulness. In addition, recent research has implicated that letting one's mind wander may be associated with lower happiness ratings (Killingsworth & Gilbert, 2010). Though this data is

preliminary, it is worth noting that there may be reason to hypothesize that mind wandering may have negatively affected participant's ability to persist on the math problem task (as opposed to the mindfulness exercise helping them persist). Future research might address these limitations by using a second control group of another type of brief intervention, as well as administer a post-intervention measure of mindfulness and/or assessments of potential third variables such as optimism.

Though the fear-inducing film clearly cannot truly represent a trauma, and the math problems are a relatively minor source of frustration compared with frustrating tasks in daily life that have real consequences, it is notable that a brief, fifteen-minute mindfulness induction was able to significantly affect avoidance behavior for those who were also made to feel anxious. This supports a possible causal relationship between mindfulness interventions and avoidance behavior in response to a fear-inducing stimulus. Possible applications of these results include use of mindfulness interventions as a prevention tool. There is preliminary evidence that mindfulness practice may prevent deficits in working memory during a stressful situation (pre-deployment military training; Jha, Stanley, Kiyonaga, Wong, & Gelfand, 2010). The current study supports the theory that mindfulness interventions may be effective in preventing avoidance behavior that could lead to psychological symptoms commonly seen in those with PTSD.

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