

DO HIGHLY MINDFUL INDIVIDUALS EXPERIENCE LESS INTERFERENCE AS A  
RESULT OF BETTER ATTENTION CONTROL AND EMOTION REGULATION?

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Tharaki Javendra Siyaguna

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**Title**

Do Highly Mindful Individuals Experience Less Interference As A Result  
Of Better Attention Control And Emotion Regulation?

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**By**

Tharaki Siyaguna

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The Supervisory Committee certifies that this *disquisition* complies with  
North Dakota State University's regulations and meets the accepted  
standards for the degree of

**MASTER OF SCIENCE**

SUPERVISORY COMMITTEE:

Dr. Paul D. Rokke  
Chair

---

Dr. Kathryn H. Gordon

---

Dr. Clayton J. Hilmert

---

Dr. Gina A. Kelly

---

Dr. Keith F. Donohue

---

Approved:

02/17/2016  
Date

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Dr. James R. Council  
Department Chair

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## ABSTRACT

Mindfulness has been found to be beneficial to psychological health. Furthermore, research suggests that mindfulness is associated with better attention control and fewer difficulties in emotion regulation. The purpose of the current study was twofold. First I investigated whether attention control and emotion regulation are mechanisms of mindfulness that aid performance on two cognitive tasks. Second, I investigated whether mindfulness moderates the relationship between rumination, a risk factor for mental health, and cognitive interference. In this study, participants completed two cognitive tasks that measure interference from emotional stimuli. They also completed self-report questionnaires that measure levels of mindfulness, attention control, difficulties in emotion regulation, and rumination. The results indicated that mindfulness was related to attention control, difficulties in emotion regulation and rumination. However, mindfulness did not predict attentional performance as measured by cognitive interference. It was also found that mindfulness did not moderate the impact of rumination on cognitive performance.

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## LIST OF ABBREVIATIONS

MBSR.....	Mindfulness Based Stress Reduction
MBCT.....	Mindfulness Based Cognitive Therapy
MAAS.....	Mindful Attention Awareness Scale
ACS.....	Attention Control Scale
DERS.....	Difficulties in Emotion Regulation Scale
RRS.....	Ruminative Response Scale
RT.....	Reaction Time
SD.....	Standard Deviation
ANEW.....	Affective Norms of English Words
IAPS.....	International Affective Picture System
FFMQ.....	Five Facet Mindfulness Questionnaire

## INTRODUCTION

Mindfulness, described as paying attention to the present moment on purpose while being nonjudgmental of the experience (Kabat-Zinn, 1990), is a construct rooted in ancient Buddhism. Meditation in Buddhism is a way of training a person to be aware of one's constantly flowing experiences paying more attention to thoughts and sensations in an objective manner (Gunaratana, 2011), in other words being mindful.

Trait mindfulness by comparison is a naturally occurring characteristic defined as an individual's ability and need to be aware and pay attention to the present moment without any formal experience of practicing mindfulness (Brown & Ryan, 2003). Therefore, this ability can be thought of as an individual difference. There are advantages to being naturally mindful. It has been found that trait mindfulness predicts lower anxiety in response to induced stress (Arch & Craske, 2010), acts as a buffer against stress on perceived health and depression (Bränström, Duncan, & Moskowitz, 2011), predicts lower anxiety levels and higher self-esteem in healthy individuals (Rasmussen & Pidgeon, 2011), predicts less variation in experiencing positive and negative mood and less reactivity to emotional experiences (Hill & Updegraff, 2012). Moreover, one facet of trait mindfulness, mindful awareness is associated with greater persistence on a distress tolerance task (Feldman, Dunn, Stemke, Bell, & Greeson, 2014). These findings suggest that higher levels of mindfulness are beneficial to psychological health.

Despite these findings, it does not necessarily follow that low levels of mindfulness are harmful to psychological health. However, there are several individual differences that are known to be associated with psychopathology, that have overlapping characteristics with low levels of mindfulness. Where mindful individuals accept negative emotions and are able to distance themselves from troubling thoughts, those who ruminate are caught up in the repetitive

thinking of negative thoughts or events (Nolen-Hoeksema, 1991). Rumination has been found to predict susceptibility to mood disorders (Joormann & Gotlib, 2008), the duration (Nolen-Hoeksema, 1991) and severity of depressive symptoms (Just & Alloy, 1997). Similarly, studies have indicated that dysfunctional strategies of emotion regulation (Ehring, Tuschen-Caffier, Schnulle, Fischer, & Gross, 2010) and suppression of emotions (Campbell-Sills, Barlow, Brown, & Hofmann, 2006) are predictive of mood and anxiety disorders.

Another individual difference associated with psychological disorders that has been extensively studied is that of attentional bias. Individuals who are biased in their attention to negative information, to the exclusion of positive or neutral information are subject to anxiety and mood disorders (Koster, Raedt, Verschuere, Tibboel, & De Jong, 2009; Yiend & Mathews, 2001). Though it is not known whether those who are low in mindfulness would be biased in their attention to emotional events, it would be expected that those who are lower in trait mindfulness would be more susceptible to the biasing influence of negative emotions. These findings highlight a few individual differences that overlap with characteristics of low levels of mindfulness, which make an individual vulnerable to psychological disorders.

Training individuals in mindfulness has been shown to reduce or control some vulnerabilities to psychological disorders and improve psychological health. Mindfulness Based Stress Reduction (MBSR) and Mindfulness Based Cognitive Therapy (MBCT) are two such interventions that have incorporated the concept of training individuals in mindfulness over several weeks. MBSR has been associated with psychological symptom reduction and improved wellbeing (Carmody & Baer, 2008; Shapiro, Schwartz, & Bonner, 1998) as well as decreasing the tendency to ruminate (Ramel, Goldin, Carmona, & McQuaid, 2004). MBCT has been shown

to prevent relapse in depressed patients (Kuyken et al., 2008; Ma & Teasdale, 2004; Teasdale et al., 2000).

Training individuals in mindfulness has also been shown to enhance the ability to regulate emotions and decrease emotional reactivity to negative self-beliefs in patients with social anxiety disorder (Goldin & Gross, 2010). It is suggested that individuals who are more experienced with mindfulness show less emotional interference as a result of allocating fewer resources to emotional material and being able to disengage from emotional stimuli faster (Ortner, Kilner, & Zelazo, 2007). This indicates that individuals high in mindfulness have better attentional control and as a result, are able to focus on the current task in hand and avoid interference by emotion, when faced with emotional situations.

My interest lies in investigating the relationship between trait mindfulness and the convergence of emotional reactivity and attentional control. Several studies have shown an association between mood disorders and deficits in inhibiting negative material that is no longer relevant (Goeleven, De Raedt, Baert, & Koster, 2006; Joormann, 2004). I will be focusing specifically on whether higher trait mindfulness reduces attentional interference as a result of better attention control and fewer difficulties in emotion regulation. Two computerized cognitive tasks will be used, in which the participants will be required to overcome emotional distractions to respond as quickly as they can. Self-report measures of trait mindfulness, attention control, difficulties in emotion regulation and rumination will be obtained from college students in order to determine the relationships between individual differences and performance on the cognitive tasks.

In this study, I will be focusing on two sets of hypotheses. First, I hypothesize that highly mindful individuals will be less influenced by emotional distractors and display less interference

on the cognitive tasks. I further hypothesize that highly mindful individuals will perform better as a result of higher levels of attention control and fewer difficulties in emotion regulation. These hypotheses will be tested in mediation models using the respective self-report questionnaires.

Secondly, I will be focusing on the influence of mindfulness on rumination and performance on the cognitive task. Rumination and mindfulness can both be thought of as ways to manage emotions but may impact attention control and emotion regulation differently. Rumination is a maladaptive strategy of emotion regulation that involves paying attention and repeatedly thinking about why one is so miserable, which only serves to exacerbate those emotions (Nolen-Hoeksema, 1991). An adaptive way to pay attention to negative events is by being mindful of the negative event, that is, with an attitude of acceptance and nonreactivity towards the experience (Bishop et al., 2004). Factor analyses have suggested that the Rumination Styles Questionnaire is made of maladaptive and relatively less maladaptive components (Schoofs, Hermans, & Raes, 2010). In this way, mindfulness and rumination styles are not necessarily antithetical constructs. Those higher in trait mindfulness may focus attention on negative events in order to improve them or avoid them in the future. The key, of course, would be to be able to examine those negative events without getting caught up in the negative emotion and being able to examine the events from multiple perspectives. I hypothesize that mindfulness and rumination levels will interact in predicting performance on the cognitive tasks. I expect mindfulness levels to moderate the influence of rumination such that if an individual has a low level of rumination, the level of mindfulness will not have an influence on rumination and performance. However, if an individual has a high level of rumination, a high level of mindfulness will attenuate the influence of rumination, resulting in better performance on the cognitive tasks, i.e., showing less emotional interference. This is based on the premise that when

negative events are attended to in a nonjudgmental, non-reactive and accepting manner, that is, in a mindful manner, the negative impact of rumination on the performance of the cognitive tasks will be reduced.

## PRIMARY STUDY

This study was conducted in two parts. In the primary study, participants were invited to the laboratory, based on prescreen data, to complete two cognitive tasks and two self-report questionnaires. In the secondary follow-up survey, participants who completed the first part were invited to complete one additional self-report measure online.

### **Method**

#### **Participants**

Most students in foundational undergraduate psychology courses complete a survey at the beginning of the semester to place themselves in a participant pool. Once in the pool they are eligible to be recruited for studies that are looking for individuals with particular characteristics. A measure of mindfulness (the Mindful Attention Awareness Scale) and a measure of rumination (the Ruminative Responses Scale) were included in this survey.

There were seven hundred respondents to the participant pool survey. Potential participants were randomly drawn from this participant pool, based on their responses to the two critical questionnaires. Participants were invited if their responses to either of these questionnaires resulted in scores that fell within the bottom, middle, or top third of the distribution of scores on either questionnaire. There were no specific exclusion criteria. The aim was to recruit 90 participants whose scores approximated a full range of scores in this sample.

One hundred and six individuals accepted the invitation to participate. Eight of them were not used in the analyses due to missing data. The final sample consisted of 98 participants (female = 75). The average age of the sample was 18.63 ( $SD = 1.10$ ). All the participants were reportedly not married and 91.8% were white, 1% were Hispanic, 6.1% were Asian/Pacific Islander and 1% were American Indian/Alaska Native. Table 1. lists the number of participants

representing each combination of level of mindfulness and rumination. In this sample, scores of mindfulness ranged between 29 and 90. Scores between 29 and 48 were categorized as low, scores between 49 and 68 as medium and scores between 69 and 90 as high levels of mindfulness. The scores of rumination ranged from 23 to 85. Scores between 23 and 43 were categorized as low, scores between 44 and 63 as medium and scores between 64 and 85 as high levels of rumination. The numbers indicate an overlap between the two constructs with most individuals scoring in the low and medium levels on both constructs. Not many individuals indicated high levels of rumination or mindfulness with no individuals indicating high levels of both mindfulness and rumination.

Table 1

*Number of participants representing each combination of level of mindfulness and rumination*

		Level of Mindfulness		
		Low	Medium	High
Level of Rumination	Low	12	30	16
	Medium	12	15	04
	High	04	05	00

**Measures: Cognitive Tasks**

*Sternberg Task.* A modified Sternberg task modeled after Joormann and Gotlib (2008) was used. This task involves the presentation of two short lists of words, one of which was cued to be remembered and the other to be forgotten. The words were taken from the Affective Norms of English Words (ANEW; Bradley & Lang, 1999). The ANEW list consists of over three thousand words, each rated for its emotional nature in terms of arousal, pleasure, and dominance

on a scale ranging from 1 to 9. There were 95 words each of neutrally and negatively valenced words used in the task. Out of those words, 15 words of each valence were used in the practice trials and the remaining words were used in the experimental trials. The neutral words used in the experimental trials were of moderate valence and arousal levels. That is, the words ranged between 3.21 and 6.96 in pleasure and 4.00 and 6.50 in arousal. The list of neutral words is presented in Appendix A. The negative words used in the experimental trials were of low pleasure and moderate arousal. That is, the words ranged between 1.20 and 4.00 in pleasure and 2.64 and 6.96 in arousal. The list of negative words is presented in Appendix B.

The task was presented as follows. First, a fixation cross was presented for 500ms, followed by the simultaneous, presentation of two rows of words on the upper half and the bottom half of the screen. Each row consisted of three words. One row of words was presented in red and the other in blue. This is the learning display. The lists was on the screen for 7.8s, 1.3 seconds to learn each word on the lists. Participants were instructed to read and memorize the words. Next, a blank screen was presented for 800 ms. Following this, a cue in the form of a colored frame was presented to the participant for 1s, to indicate which of the lists should be remembered for the following recognition task. The cue was either a red frame indicating the word list in red is relevant or a blue frame indicating the word list in blue is relevant. In the final probe display, a single word in black appeared inside the red or blue frame. The participant was required to press the key “no” with the left hand to indicate that the probe was not on the cued list or “yes” with the right hand to indicate that the probe was on the cued list, as quickly as possible. The probe was on the screen until the participant responded.

The task included 8 different conditions. During the critical trials, there were two list conditions (negatively valenced and neutrally valenced) and four probe conditions (relevant,

irrelevant, new negative and new neutral). When the lists were presented, there was always one list that consisted of emotionally neutral words and the other list consisted of negatively valenced words. Each probe came from either the relevant, irrelevant, new negative or new neutral list. Each condition was presented four times in a single block and three blocks in total were presented. In addition to the critical trials, there were 8 trials presented in each block, in which the lists consisted of words of mixed valence. This was to keep participants from using the valence as a cue to recognize the probe. Five practice trials were presented prior to the total of 120 test trials. Following Joorman and Gotlib (2008), a measurement of interference, the intrusion effect, was calculated for both negative and neutral probes. The intrusion effect is the difference between the RTs of an irrelevant probe and a new probe (the average RT of irrelevant probes minus the average RT of new probes of the same valence). The intrusion effect indicates the influence of the information in working memory that is no longer relevant on the cognitive task. That is, when the negative list is cued to be forgotten, that material is required to be inhibited. If it takes longer to reject the irrelevant probe than it does to reject a probe that was not presented (a new probe), this would indicate that the irrelevant probe is still somewhat present in the working memory and has not been completely inhibited. Therefore, the irrelevant probe is interfering with performance on that trial. The entire task took about 30 minutes.

*Emotional Interference Task.* An emotional interference task used by Ortner, Kilner and Zelazo (2007) was used. In this task, participants were randomly presented with neutral and negative pictures from the International Affective Picture System (IAPS; Lang, Bradley, Cuthbert, & others, 1999)). The IAPS consists of over 900 pictures that have been rated for their emotional nature. There were 22 neutral and 22 negative pictures used in this task. Two pictures each of neutral and negative pictures were used in the practice trials. The remaining 40 pictures

were used in the experimental trials. The pictures have been rated in terms of arousal and pleasure levels on a scale of 1 to 9. The neutral pictures used in the experimental trials ranged between 4.63 and 5.50 on pleasure and between 1.72 and 4.20 on arousal. The descriptions, levels of arousal and pleasure of the neutral pictures are presented in Appendix C. The negative pictures used in the experimental trials were unpleasant pictures with a valence ranging between 1.78 and 3.90 and an arousal level ranging between 3.52 and 5.49. The descriptions, levels of arousal and pleasure of the negative pictures are presented in Appendix D.

Each picture was presented for 6 s. An interstimulus interval of 1 s was present between picture presentations. Either a high pitched tone of 2000 HZ or a low pitched tone of 200 Hz, was presented at either 1 s or 4 s following the onset of the picture. Participants were instructed to press the key “high” with the left hand and the key “low” with the right hand as quickly as possible, to indicate whether the tone was high pitched or low pitched respectively. Forty trials with randomized picture and tone presentations were presented in 2 blocks for a total of 80 trials. Four practice trials were presented prior to the experimental trials. Following Ortner, Kilner and Zelazo (2007), a score for emotional interference was calculated by subtracting the averaged RT to the tones following neutral pictures at 1s and 4s from the averaged RT to the tones following negative pictures at 1s and 4s. RTs following the negative pictures were expected to be longer as the capacity allocated to the emotional content of the material is expected to be greater. The entire task lasted about 15 minutes.

RTs following accurate responses for the critical trials were used in the analyses. Also, data within  $\pm 2$  SDs from the mean for each condition were used in the analyses. All data were within  $\pm 2$  SDs from the mean and therefore, no data were excluded from the analyses.

## **Measures: Self-Report**

*Mindful Attention Awareness scale* (MAAS; Brown & Ryan, 2003). The MAAS is a 15-item, self-report measure of mindfulness. Participants rate how often the statements apply to them on a 6-point scale ranging from 1 (almost always) to 6 (almost never). A higher total score indicates greater levels of mindfulness. The authors reported a high internal consistency (alpha) 0.82 (Brown & Ryan, 2003).

*Attentional Control Scale* (ACS; (Derryberry & Reed, 2002). The ACS is a 20-item, self-report scale that measures one's ability to control attention. Participants rate each item on a 4-point scale ranging from 1 (Almost never) to 4 (Almost always). A higher total score indicates better attention control. The internal consistency (alpha) of the total score has been reported as 0.84 (Ólafsson et al., 2011).

*Difficulties in Emotion Regulation Scale* (DERS; (Gratz & Roemer, 2004). The DERS is a 36-item, self-report measure of different dimensions of difficulties in managing emotions. The scale consists of the six subscales nonacceptance, goals, impulse, awareness, strategies and clarity. Participants rate their responses on 5-point scale ranging from 1 as almost never (0-10%) to 5 as almost always (91-100%). The responses to all items are summed to form a total score and higher total scores indicate greater difficulty in regulating emotions. DERS has demonstrated an internal consistency (alpha) of 0.93 for all items (Gratz & Roemer, 2004).

*Ruminative Response Scale* (RRS; (Nolen-Hoeksema & Morrow, 1991). The RRS of the response style questionnaire, is a 22-item, self-report questionnaire measuring one's tendency to ruminate following negative emotions. Participants rate their responses on a scale ranging from 1 (almost never) to 4 (almost always). Higher total scores indicate a greater tendency to ruminate.

The internal consistency of this scale has been reported to be 0.89 (Nolen-Hoeksema & Morrow, 1991).

## **Procedure**

Potential participants were invited to the study via email, based on their responses to the online pre-screen survey. Participants completed an informed consent form upon entering the lab. The informed consent form is presented in Appendix E. Next, the participants completed the two cognitive tasks and the order of the tasks were counterbalanced across participants. Finally, the participants completed the RRS, ACS and DERS in random order. The entire study lasted for about 60 minutes.

## **Results**

Two cognitive tasks were used to measure attentional performance and the results for each task will be reported separately. The primary purpose of the study was to determine whether attention control and emotion regulation are mediating factors between mindfulness and attentional performance. A second purpose of the study was to study whether mindfulness moderates the relationship between rumination and attentional performance. Linear regression analyses were planned to test these hypotheses.

## **Descriptive Statistics**

The descriptive statistics of the self-report measures and cognitive measures are reported below in Table 2. The scores of the self-report measures were normally distributed and represented a broad range. However, the breadth of the range in the cognitive measures was less clear.

Table 2

*Descriptive statistics*

	Mean	SD	Range
1. MAAS	56.54	13.93	29 - 90
2. RRS	43.41	13.44	23 - 85
3. ACS	49.77	8.32	32 - 74
4. DERS	81.29	21.44	42 - 149
5. Negative intrusions	286.14 ms	191.00 ms	914.88 ms
5.a. Irrelevant negative probes	1129.89 ms	304.18 ms	1166.68 ms
5.b. New negative probes	1416.03 ms	352.45 ms	1582.79 ms
6. Interference	12.53 ms	56.68 ms	396.65 ms
6.a. RT for negative trials	860.55 ms	200.67 ms	976.18 ms
6.b. RT for neutral trials	848.02 ms	195.92 ms	898.77 ms

*Note.* MAAS = Mindful Attention Awareness Scale, RRS = Ruminative Response Scale, ACS = Attentional Control Scale, DERS = Difficulties in Emotion Regulation Scale, Negative intrusions the dependent variable from the Sternberg task and Interference the dependent variable from the Emotional Interference Task.

**Correlations**

Pearson correlation coefficients among the four individual differences measures and the cognitive measures are reported in Table 3. The correlations indicated that MAAS was

positively associated with ACS and negatively associated with RRS and DERS. The correlations also indicated that the self-report measures were not associated with the cognitive measures.

Table 3

*Pearson correlations*

	1	2	3	4
1. MAAS	-			
2. RRS	-.353**	-		
3. ACS	.372**	-.309*	-	
4. DERS	-.455**	.722**	-.518**	-
5. Intrusions	.084	.074	-.030	-.129
6. Interference	-.053	-.069	-.083	-.044

*Note.* MAAS = Mindful Attention Awareness Scale, RRS = Ruminative Response Scale, ACS = Attentional Control Scale, DERS = Difficulties in Emotion Regulation Scale, Intrusions the dependent variable from the Sternberg task and Interference the dependent variable from the Emotional Interference Task.

\*\*  $p < 0.01$

**Sternberg Task**

In order to test the prediction that higher levels of mindfulness predict fewer intrusions a linear regression was performed in which the intrusions by negative probes were predicted from the MAAS scores. All predictor variables were centered. MAAS did not predict intrusion effects for negative probes ( $R^2=0.007$ ,  $F(1, 96) = 0.684$ ,  $p=0.410$ ). MAAS predicted intrusion effects for neutral probes ( $R^2=0.047$ ,  $F(1, 96) = 4.750$ ,  $p=0.032$ ) indicating that individuals with higher levels of mindfulness took significantly longer to reject an irrelevant neutral probe than a new neutral probe. Since mindfulness did not predict performance on the Sternberg task the mediating

effects of attention control and emotion regulation in the relationship between mindfulness and intrusion performance were not tested.

In order to test the prediction that mindfulness and rumination interact to predict intrusions, a regression analysis was conducted in which these two variables and their interaction was entered simultaneously to predict intrusions. The overall model was not significant ( $R^2=0.034$ ,  $F(3, 94) = 1.117$ ,  $p=0.346$ ). MAAS did not predict intrusion effects for negative probes ( $\beta=0.104$ ,  $t(94) = 0.951$ ,  $p=0.344$ ). RRS did not predict intrusion effects for negative probes ( $\beta=0.108$ ,  $t(94) = 0.997$ ,  $p=0.321$ ). The interaction between MAAS and RRS did not predict intrusion effects for negative probes ( $\beta=-0.131$ ,  $t(94) = -0.125$ ,  $p=0.227$ ).

### **Emotional Interference Task**

In order to test the hypothesis that higher levels of mindfulness predict less interference, a linear regression was performed in which interference was predicted from centered MAAS scores. MAAS did not predict interference ( $R^2=0.003$ ,  $F(1, 96) = 0.268$ ,  $p=0.606$ ). Since MAAS did not predict interference, the mediating effects of attention control and emotion regulation in the relationship between mindfulness and interference were not tested.

In order to test the prediction that mindfulness and rumination interact to predict intrusions, a regression analysis in which mindfulness, rumination, and their interaction were entered simultaneously to predict interference was conducted. The overall model was not significant ( $R^2=0.012$ ,  $F(3, 94) = 0.376$ ,  $p=0.770$ ). The MAAS did not predict interference ( $\beta=-0.085$ ,  $t(94) = -0.763$ ,  $p=0.447$ ). RRS did not predict interference ( $\beta=-0.098$ ,  $t(94) = -0.895$ ,  $p=0.373$ ). The interaction between MAAS and RRS did not predict interference ( $\beta=0.019$ ,  $t(94) = 0.182$ ,  $p=0.856$ ).

## **Discussion**

Even though research shows that higher levels of trait mindfulness is beneficial to psychological well-being (Arch & Craske, 2010; Bränström et al., 2011; Hill & Updegraff, 2012; Rasmussen & Pidgeon, 2011), not much of the research has been focused on the mechanisms of mindfulness. One purpose of the current study was to determine whether attention control and emotion regulation are potential mechanisms of mindfulness. A second purpose of the study was to determine the ability of mindfulness to buffer the negative impact of rumination on attentional performance.

The results indicated that mindfulness did not predict attentional performance and therefore, the mediating effects of attention control and emotion regulation on the relationship between trait mindfulness and attentional performance were not able to be tested. However, the correlations indicated that MAAS was significantly and positively correlated with the ACS. This shows that participants reporting higher levels of mindfulness also reported higher levels of attention control. MAAS was significantly and negatively correlated with DERS indicating that participants reporting higher levels of mindfulness also reported lower levels of difficulties in emotion regulation. This demonstrates that mindfulness is related to self-reported attentional control and emotion regulation in the expected directions. It is possible that the cognitive tasks were not suited to measure attentional performance.

It was hoped that the MAAS, which is specifically focused on attention and awareness, would be most relevantly related to performance on the attention tasks. This turned out not to be true. It is possible that the lack of observed relationships between mindfulness and performance was due to a narrow definition and measure of mindfulness. In order to check on this possibility

a follow-up study was conducted using a measure with a broader conceptualization of mindfulness.

## SECONDARY FOLLOW-UP SURVEY

In part 2, participants who had completed the primary study were invited to complete the Five Facet Mindfulness Questionnaire (FFMQ) as an additional measure of trait mindfulness. The FFMQ was used to collect data from a broader range of components associated with mindfulness such as one's ability to observe, describe, be non-judgmental, and be emotionally non-reactive in addition to being attentive and aware. This was conducted 4-6 weeks following the completion of the laboratory tasks. The details of the self-report questionnaire are described below in the Measures section.

### **Method**

#### **Participants**

The final sample consisted of 56 participants (female = 44). The average age of the sample was 18.64 ( $SD = 1.17$ ). All the participants were reportedly not married and 92.9% were White, 5.4% were Asian/Pacific Islander and 1.8% were American Indian/Alaska Native. Table 4. lists the number of participants representing each combination of level of mindfulness and rumination. In this sample, scores of mindfulness ranged between 85 and 165. Scores between 85 and 111 were categorized as low, scores between 112 and 127 as medium and scores between 130 and 165 as high levels of mindfulness. The scores of rumination ranged from 24 to 85. Scores between 24 and 44 were categorized as low, scores between 46 and 61 as medium and scores between 65 and 85 as high levels of rumination. The numbers indicated an overlap between the two constructs with most individuals scoring in the low and medium levels on both constructs. Not many individuals indicated high levels of rumination or mindfulness with no individuals indicating high levels of both mindfulness and rumination.

Table 4

*Number of participants representing each combination of level of mindfulness and rumination*

		Level of Mindfulness		
		Low	Medium	High
Level of Rumination	Low	04	15	12
	Medium	07	08	04
	High	05	01	00

**Measures**

*Five Facet Mindfulness Questionnaire* (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006). The FFMQ is a 39-item, self-report questionnaire measuring trait mindfulness. It consists of the five factors, observing, describing, acting with awareness, non-judging of inner experiences and non-reactivity to inner experiences. Participants rate their responses on a five point scale ranging from never or very rarely true to very often or always true. A higher score indicates higher levels of trait mindfulness. The internal consistency for the facets of the FFMQ has been reported ranging from 0.67 to 0.92 (Baer et al., 2008).

**Procedure**

The FFMQ data were collected 4-6 weeks following the laboratory study. Potential participants who completed the laboratory portion of the study, were invited to complete the FFMQ measure online. The informed consent form is presented in Appendix F.

## **Results**

### **Descriptive Statistics**

The descriptive statistics of the self-report measures and cognitive measures are reported below in Table 5. The scores of the self-report measures were normally distributed and represented a broad range. However, the range in the cognitive measures was narrow.

### **Correlations**

Pearson correlation coefficients among the four individual differences measures and the cognitive measures are reported in Table 6. The correlations indicated that FFMQ was positively associated with ACS and MAAS and negatively associated with RRS and DERS. The correlations also indicated that the self-report measures were not associated with the cognitive measures.

The primary purpose of the follow-up study was to determine whether attention control and emotion regulation are mediating factors between mindfulness and attentional performance, by using an additional mindfulness measure. Similarly, a second purpose of the study was to study whether mindfulness moderates the relationship between rumination and attentional performance by using an additional mindfulness measure. The same two cognitive tasks were used as measures of attentional performance and the results for each task will be reported separately.

Table 5

*Descriptive statistics*

	Mean	SD	Range
1. FFMQ	120.39	17.42	85 - 165
2. RRS	44.79	14.07	24 - 85
3. ACS	49.23	7.63	35 - 69
4. DERS	82.16	21.06	42 - 138
5. Negative intrusions	304.80 ms	196.64 ms	881.45 ms
5.a. Irrelevant negative probes	1447.49 ms	328.60 ms	1390.34 ms
5.b. New negative probes	1142.69 ms	288.32 ms	1166.68 ms
6. Interference	11.49 ms	46.83 ms	261.76 ms
6.a. RT for negative trials	867.88 ms	196.60 ms	857.73 ms
6.b. RT for neutral trials	856.39 ms	189.29 ms	801.41 ms

*Note.* FFMQ = Five Facet Mindfulness Questionnaire, RRS = Ruminative Response Scale, ACS = Attentional Control Scale, DERS = Difficulties in Emotion Regulation Scale, Negative intrusions the dependent variable from the Sternberg task and Interference the dependent variable from the Emotional Interference Task.

Table 6

*Pearson correlations*

	1	2	3	4	5
1. FFMQ	-				
2. RRS	-.427**	-			
3. ACS	.386**	-.204	-		
4. DERS	-.593**	.706**	-.343**	-	
5. MAAS	.489**	-.369**	.389**	-.478**	-
6. Intrusions	-.052	-.002	.043	.041	0.126
7. Interference	.095	-.158	.106	-.218	0.101

*Note.* FFMQ = Five Facet Mindfulness Questionnaire, RRS = Ruminative Response Scale, ACS = Attentional Control Scale, DERS = Difficulties in Emotion Regulation Scale, Intrusions the dependent variable from the Sternberg task and Interference the dependent variable from the Emotional Interference Task.

\*\*  $p < 0.01$

**Sternberg Task**

In order to test whether higher levels of mindfulness predict fewer intrusions, a linear regression was performed in which the intrusions by negative probes were predicted from the FFMQ scores. All predictor variables were centered. FFMQ did not predict intrusion effects for negative probes ( $R^2=0.003$ ,  $F(1, 54) = 0.147$ ,  $p=0.703$ ). FFMQ did not predict intrusion effects for neutral probes ( $R^2=0.010$ ,  $F(1, 54) = 0.539$ ,  $p=0.461$ ). Since the above prediction was not supported, the mediating role of attention control and emotion regulation in the relationship between mindfulness and intrusions were not investigated.

In order to test whether mindfulness and rumination interact to predict intrusions, a linear regression analysis was conducted with all variables entered simultaneously. The overall model

was not significant ( $R^2=0.010$ ,  $F(3, 52) = 0.167$ ,  $p=0.918$ ). FFMQ did not predict intrusion effects for negative probes ( $\beta=-0.079$ ,  $t(52) = -0.513$ ,  $p=0.610$ ). RRS did not predict intrusion effects for negative probes ( $\beta=-0.008$ ,  $t(52) = -0.052$ ,  $p=0.958$ ). The interaction between FFMQ and RRS did not predict intrusion effects for negative probes ( $\beta=0.084$ ,  $t(52) = 0.567$ ,  $p=0.573$ ).

### **Emotional Interference Task**

In order to test whether higher levels of mindfulness predict less interference, a linear regression was performed in which the interference was predicted from the centered FFMQ scores. FFMQ did not predict interference ( $R^2=0.021$ ,  $F(1, 54) = 1.156$ ,  $p=0.287$ ). Since the above prediction was not supported, the mediating effect of attention control and emotion regulation in the relationship between mindfulness and interference were not investigated.

In order to test whether mindfulness and rumination interact to predict emotional interference, a linear regression analysis was conducted. The overall model was not significant ( $R^2=0.043$ ,  $F(1, 52) = 0.350$ ,  $p=0.556$ ). FFMQ did not predict interference ( $\beta=2.094$ ,  $t(52) = 0.631$ ,  $p=0.531$ ). RRS did not predict interference ( $\beta=0.090$ ,  $t(52) = 0.600$ ,  $p=0.551$ ). The interaction between FFMQ and RRS did not predict interference ( $\beta=1.962$ ,  $t(52) = 0.592$ ,  $p=0.556$ ).

### **Discussion**

Similar to the primary study, the purpose of the follow-up survey was two-fold. By using a different mindfulness measure, I wanted to investigate whether attention control and emotion regulation are mechanisms of mindfulness and the impact of mindfulness on the relationship between rumination and attentional performance. Unfortunately, the findings were similar to that of the primary study. Mindfulness did not predict attentional performance and therefore the mediating effect of attention control and emotion regulation on the relationship between trait

mindfulness and attentional performance were not able to be tested. Furthermore, mindfulness did not moderate the impact of rumination on attentional performance.

## GENERAL DISCUSSION

Research has shown that naturally occurring mindfulness (Arch & Craske, 2010; Bränström et al., 2011; Hill & Updegraff, 2012; Rasmussen & Pidgeon, 2011) and training individuals in mindfulness (Carmody & Baer, 2008; Hofmann, Sawyer, Witt, & Oh, 2010; Ortner et al., 2007) has a positive influence on psychological well-being. Despite the use of mindfulness principles in clinical settings, not much is understood about the mechanisms by which mindfulness has its effects.

Emotion regulation, which is often poor in mood and anxiety disorders (Campbell-Sills et al., 2006; Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010) may be a pathway through which mindfulness influences well-being (Desrosiers, Vine, Klemanski, & Nolen-Hoeksema, 2013). Another individual difference that has often been associated with mood and anxiety disorders is attention control (Joormann, Dkane, & Gotlib, 2006; Koster et al., 2009; Yiend & Mathews, 2001). Hence, it is possible that another potential mechanism of mindfulness is attention control. A primary purpose of the present study was to investigate whether emotion regulation and attention control are potential mechanisms of mindfulness, by using two cognitive tasks to measure attentional performance.

Unfortunately, the results did not support the hypotheses that attention control and emotion regulation are mechanisms of mindfulness. In the current study, the MAAS did not predict attentional performance. Therefore, the prediction that attention control is a mediating factor of the relationship between mindfulness and attentional performance was not supported. Similarly, the prediction that emotion regulation is a mediating factor of the relationship between mindfulness and attentional performance under emotional conditions was also not supported. However, the correlations indicated that MAAS was significantly and positively correlated with

ACS indicating that participants reporting higher levels of mindfulness also reported higher levels of attention control. Likewise, MAAS was significantly and negatively correlated with DERS indicating that participants reporting higher levels of mindfulness reported better ability to regulate emotions. There are two potential explanations. One is that the hypothesized relationship is limited to self-report and thus, perhaps is a perceived relationship that does not relate directly to performance or two, that the measures of performance used were not suited to detect the relationship between mindfulness and attentional control and emotion regulation.

In the follow-up study, the FFMQ was used as the measure of mindfulness. This was done to account for the possibility that the MAAS was too narrow in its coverage of the construct of mindfulness. As the FFMQ goes beyond attention and awareness and also includes items related to emotional reactivity and a nonjudgmental perspective it represents a broader and perhaps more complete measure of mindfulness. The reanalysis of the data with the new measure of mindfulness yielded the same results. These two measures were related to all of the other measures in the study in much the same way. This suggests that neither measure of mindfulness was wholly unrepresentative or necessarily the reason for the nonpredictability of attention performance.

A second purpose of the study was to investigate the buffering effect of mindfulness on rumination. Rumination has also been shown to be associated with mood and anxiety disorders (Joormann et al., 2006; Joormann & Gotlib, 2008; Just & Alloy, 1997; Nolen-Hoeksema, 1991). Even though rumination has been thought of as a maladaptive emotion regulation strategy (Nolen-Hoeksema, 1991), research has also indicated that the RRS contains maladaptive and less maladaptive components (Joormann et al., 2006; Schoofs et al., 2010). Therefore, mindfulness and rumination styles may not be opposite constructs but may have some overlapping

characteristics. Trait mindfulness has been shown to moderate the negative impact of rumination on depressive symptoms (Siyaguna, Myhre, Saxton & Rokke, 2015). It is possible that individuals with higher levels of trait mindfulness are able to attend to negative thought and events but not get caught up in the negative emotion. These individuals may be able to identify when they get caught up in rumination and able to end ruminating. However, results did not support the hypothesis that mindfulness moderates the impact of rumination on attentional performance. This was true for analyses using both mindfulness self-report questionnaires.

The results indicated that mindfulness predicted intrusions of neutral probes for the Sternberg task. That is, individuals higher in trait mindfulness had more difficulty ignoring an irrelevant neutral probe than those lower in trait mindfulness. However, this finding was not predicted and is possibly a spurious finding as a result of a third variable.

There are a few possible explanations to my null findings. It is possible that even though it has been speculated that emotion regulation and attentional control are mechanisms of mindfulness, there may be a third variable responsible for the mechanism through which mindfulness promotes well-being. A second more probable possibility is that attention tasks were either not sensitive enough or did not appropriately measure the relevant attentional processes. For example, it is possible that the Sternberg task was difficult for the participants, as evidenced by the longer RTs of 1000 ms to 1500 ms and failed to show significant differences between the conditions of interest. The larger SDs of over 300 ms also indicate that the variability in RT among individuals was large. Therefore, the small differences between the conditions may have been overwhelmed by the larger variance in RTs among individuals, resulting in no differences. In contrast, the EIT was possibly easy, resulting in faster RTs as evidenced by RTs between 848 ms and 868 ms. It is also possible that the emotion manipulation in EIT was not sensitive.

Therefore, the participants may have responded fast to all the stimuli regardless of the emotion manipulation associated with the trials.

In summary, this study found that mindfulness measures are related to attention control, emotion regulation and rumination in the expected directions. Therefore, it is possible that mindfulness is associated with better attention control and emotion regulation and lower levels of rumination. However, my tasks were not associated with mindfulness and it is very likely that the methods used to employ attention was not sensitive to detect differences. Therefore, it is recommended that future studies use different measures of attention performance under more discriminative emotional conditions.

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APPENDIX A. STERNBERG TASK- NEUTRAL WORD STIMULI

Word	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
1. STOOL	4.56	1.72	4.00	2.14
2. RADIATOR	4.67	1.05	4.02	1.94
3. GLASS	4.75	1.38	4.27	2.07
4. HAMMER	4.88	1.16	4.58	2.02
5. SCISSORS	4.95	1.28	5.00	1.34
6. STOVE	4.98	1.69	4.51	2.14
7. ICEBOX	5.00	0.88	4.84	1.80
8. HOSPITAL	5.05	1.85	5.00	2.41
9. INDUSTRY	5.06	1.70	4.34	2.48
10. TRUNK	5.09	1.57	4.18	2.19
11. NOISY	5.10	1.92	6.15	1.73
12. JOURNAL	5.14	1.49	4.05	1.96
13. TIME	5.15	1.95	5.36	2.92
14. TANK	5.16	1.87	4.88	1.86
15. CONTEXT	5.19	1.33	4.12	2.52
16. TOOL	5.19	1.27	4.33	1.78
17. HARD	5.22	1.82	5.12	2.19
18. OFFICE	5.28	1.90	4.08	1.82
19. FABRIC	5.30	1.20	4.14	1.98
20. GREEN	5.30	2.00	4.80	2.44
21. ACTIVATE	5.31	0.97	5.00	2.55
22. WAGON	5.32	0.89	4.05	2.35
23. ELBOW	5.32	1.17	4.10	2.19
24. MONTH	5.40	0.84	4.10	1.66
25. THEORY	5.40	1.54	4.80	2.12
26. ELEVATOR	5.44	1.18	4.16	1.99
27. QUART	5.45	1.85	4.10	2.40
28. SPHERE	5.45	1.15	4.10	2.22
29. HAT	5.46	1.36	4.10	2.00
30. TRUCK	5.47	1.88	4.84	2.17
31. AVENUE	5.50	1.37	4.12	2.01
32. WRITER	5.52	1.90	4.33	2.45
33. DETAIL	5.55	1.58	4.10	2.24
34. SHIP	5.55	1.40	4.38	2.29

Word	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
35. BUILDING	5.56	1.23	4.08	2.12
36. ROCK	5.56	1.38	4.52	2.37
37. SALUTE	5.56	1.55	5.12	2.19
38. YELLOW	5.58	2.02	4.77	1.99
39. INVEST	5.64	2.30	5.41	2.09
40. RUNNER	5.67	1.91	4.76	2.40
41. BOOK	5.72	1.54	4.17	2.49
42. CHANCE	5.72	1.86	5.40	2.55
43. SKYSCRAPER	5.73	1.78	5.81	2.37
44. TRUMPET	5.75	1.38	4.97	2.13
45. HIGHWAY	5.80	1.80	5.52	2.26
46. MARKET	5.84	1.01	4.79	1.51
47. GRASS	5.85	1.27	4.85	1.93
48. WHISTLE	5.86	1.25	4.90	2.17
49. COIN	6.02	1.96	4.29	2.48
50. FLAG	6.02	1.66	4.60	2.35
51. WONDER	6.03	1.58	5.00	2.23
52. GARMENT	6.07	1.61	4.49	2.50
53. BOTTLE	6.15	1.49	4.79	2.44
54. BAKE	6.17	1.71	5.10	2.30
55. EVENT	6.21	1.63	5.10	2.40
56. IDENTITY	6.23	2.16	5.09	2.33
57. COMPUTER	6.24	1.61	4.75	1.93
58. BOLD	6.25	1.71	4.75	2.53
59. VEHICLE	6.27	2.34	4.63	2.81
60. OPINION	6.28	1.45	4.89	2.46
61. DIVER	6.31	1.49	5.12	1.68
62. ANSWER	6.32	1.64	5.18	2.63
63. PLANE	6.43	1.98	6.14	2.39
64. SAILBOAT	6.52	1.81	4.76	2.33
65. BOUQUET	6.52	1.99	5.10	2.41
66. GAME	6.52	2.45	5.58	2.53
67. WHITE	6.54	1.70	4.77	2.27
68. IDOL	6.55	1.93	5.15	2.08

Word	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
69. QUICK	6.59	1.65	6.50	1.68
70. TRAVEL	6.64	2.13	6.09	2.47
71. FOAM	6.67	2.20	6.18	2.48
72. TASTE	6.68	1.38	5.37	2.29
73. WORLD	6.69	2.19	5.52	2.37
74. GARDEN	6.71	1.74	4.39	2.35
75. CLOTHING	6.88	1.59	5.12	2.86
76. PEOPLE	6.88	1.69	5.12	1.72
77. MAIL	6.88	1.74	5.63	2.36
78. LETTER	6.91	1.63	4.64	2.54
79. RIVER	6.93	1.73	4.69	2.54
80. SUN	6.96	2.03	4.80	2.40
81. CONFUSE	3.21	1.51	6.03	1.88
82. FRIGID	3.54	2.16	4.85	2.57
83. NEEDLE	4.11	1.57	5.00	2.61
84. FALL	4.32	2.23	4.81	2.32
85. CONTROL	4.53	2.26	5.60	2.13
86. COLD	4.14	2.08	5.00	2.56
87. EMBATTLE	4.15	1.35	5.15	2.43
88. ALLEY	4.19	2.16	5.43	2.66
89. VANITY	4.29	1.79	5.00	2.32
90. RAZOR	4.81	2.16	5.36	2.44
91. PAINT	5.62	1.72	4.10	2.36
92. HISTORY	6.00	1.79	4.12	2.18
93. WATCH	6.04	1.51	4.08	2.53
94. AIR	6.34	1.56	4.12	2.30
95. NATURAL	6.59	1.57	4.09	2.37

APPENDIX B. STERNBERG TASK- NEGATIVE WORD STIMULI

Word	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
1. DISASTER	1.20	0.52	6.60	2.89
2. SUICIDE	1.25	0.69	5.73	3.14
3. DEPRESS	1.27	0.72	4.54	3.35
4. FUNERAL	1.39	0.87	4.94	3.21
5. ABUSE	1.46	1.03	6.88	2.83
6. INFECTION	1.48	0.85	5.22	2.84
7. REJECT	1.50	1.09	6.37	2.56
8. SUFFOCATE	1.52	1.08	6.57	2.97
9. TORTURE	1.55	0.83	5.15	2.85
10. UNHAPPY	1.57	0.96	4.18	2.50
11. LONELY	1.61	1.02	4.56	2.97
12. PARALYSIS	1.64	1.09	4.64	2.90
13. GRIEF	1.69	1.04	4.78	2.84
14. FAILURE	1.70	1.07	4.95	2.81
15. CRISIS	1.72	1.37	6.08	3.09
16. EXECUTE	1.78	1.54	5.83	2.77
17. TRAGEDY	1.78	1.31	6.24	2.64
18. GLOOM	1.79	1.15	3.68	2.20
19. VENOM	1.80	0.89	6.55	2.46
20. MISERY	1.93	1.60	5.17	2.69
21. TERRIBLE	1.93	1.44	6.27	2.44
22. DISTRESS	1.94	1.10	6.40	2.38
23. CRUEL	1.97	1.67	5.68	2.65
24. HATRED	1.98	1.92	6.66	2.56
25. STARVE	2.00	1.23	5.23	2.49
26. UPSET	2.00	1.18	5.86	2.40
27. AFRAID	2.00	1.28	6.67	2.54
28. ACCIDENT	2.05	1.19	6.26	2.87
29. TRAUMA	2.10	1.49	6.33	2.45
30. SICK	2.12	1.20	4.44	2.27
31. ANGUISH	2.12	1.56	5.33	2.69
32. USELESS	2.13	1.42	4.87	2.58
33. PAIN	2.13	1.81	6.50	2.49
34. TROUBLE	2.17	1.21	5.94	2.36

Word	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
35. VICTIM	2.18	1.48	6.06	2.32
36. DISCOMFORT	2.19	1.23	4.17	2.44
37. HELPLESS	2.20	1.42	5.34	2.52
38. PUNISH	2.22	1.41	5.93	2.40
39. HUMILIATE	2.24	1.34	6.14	2.42
40. ROTTEN	2.26	1.37	4.53	2.38
41. DREADFUL	2.26	1.91	5.84	2.62
42. REGRET	2.28	1.42	5.74	2.32
43. INSULT	2.29	1.33	6.00	2.46
44. CRIME	2.33	1.52	5.75	2.45
45. DIRTY	2.35	1.26	4.58	1.77
46. INSECURE	2.36	1.33	5.56	2.34
47. BURDEN	2.38	1.50	5.72	2.01
48. DISAPPOINT	2.39	1.44	4.92	2.64
49. DESPAIR	2.43	1.47	5.68	2.37
50. AGONY	2.43	2.17	6.06	2.67
51. HARDSHIP	2.45	1.61	4.76	2.55
52. DISGUST	2.45	1.41	5.42	2.59
53. SHAME	2.50	1.34	4.88	2.27
54. CEMETERY	2.63	1.40	4.82	2.66
55. NEGLECT	2.63	1.64	4.83	2.31
56. GUILTY	2.63	1.98	6.04	2.76
57. HOSTILE	2.73	1.50	6.44	2.28
58. OFFEND	2.76	1.50	5.56	2.06
59. FEAR	2.76	2.12	6.96	2.17
60. DISPLEASE	2.79	2.23	5.64	2.48
61. MISTAKE	2.86	1.79	5.18	2.42
62. DECEIT	2.90	1.63	5.68	2.46
63. DISCOURAGE	3.00	2.16	4.53	2.11
64. EMBARRASS	3.03	1.85	5.87	2.55
65. DREARY	3.05	1.58	2.98	2.18
66. DAMAGE	3.05	1.65	5.57	2.26
67. INFERIOR	3.07	1.57	3.83	2.05
68. IMPAIR	3.18	1.86	4.04	2.14

Word	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
69. FATIGUE	3.28	1.43	2.64	2.19
70. PITY	3.37	1.57	3.72	2.02
71. IMMORAL	3.50	2.16	4.98	2.48
72. NASTY	3.58	2.38	4.89	2.50
73. OUTRAGE	3.68	2.23	6.55	2.34
74. NERVOUS	3.74	1.28	5.53	1.95
75. RESENT	3.76	1.90	4.47	2.12
76. WEARY	3.79	2.12	3.81	2.29
77. DETACH	3.86	1.88	4.26	2.57
78. SKULL	3.96	1.54	4.12	1.86
79. TEASE	3.96	2.29	5.68	2.41
80. DESTROY	4.00	2.75	6.30	2.91
81. POVERTY	1.46	0.76	4.84	2.75
82. DEATH	1.69	1.14	4.41	2.87
83. DEFORM	1.85	1.39	4.55	2.46
84. ACHE	2.00	1.11	4.77	2.62
85. SLAVE	2.18	1.24	5.06	2.88
86. MALARIA	2.40	1.38	4.40	2.54
87. CORRUPT	2.52	1.81	4.52	2.20
88. TRASH	2.67	1.45	4.16	2.16
89. ADDICTED	2.75	1.33	4.50	2.24
90. GERMS	2.86	1.39	4.49	2.24
91. COFFIN	3.00	2.11	4.30	2.79
92. SCAR	3.18	1.99	4.91	2.45
93. MOODY	3.20	1.58	4.18	2.38
94. FEEBLE	3.26	1.47	4.10	2.07
95. IMMATURE	3.39	1.70	4.15	1.96

APPENDIX C. EMOTIONAL INTERFERENCE TASK – NEUTRAL PICTURE STIMULI

	Description	IAPS No	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
Practice Trials	1. Hair Dryer	7050	4.93	0.81	2.75	1.80
	2. Fire Hydrant	7100	5.24	1.20	2.89	1.70
Experimental Trials	3. Stool	7025	4.63	1.17	2.71	2.20
	4. Neutral Man	2215	4.63	1.24	3.38	2.00
	5. Iron	7030	4.69	1.04	2.99	2.09
	6. Umbrella	7150	4.72	1.00	2.61	1.76
	7. Cabinet	7705	4.77	1.02	2.65	1.88
	8. Clock	7211	4.81	1.78	4.20	2.40
	9. Lamp	7175	4.87	1.00	1.72	1.26
	10. Chess	2840	4.91	1.52	2.43	1.82
	11. Mug	7009	4.93	1.00	3.01	1.97
	12. Chair	7235	4.96	1.18	2.83	2.00
	13. Fan	7020	4.97	1.04	2.17	1.71
	14. Boy	9070	5.01	1.89	3.63	2.03
	15. Plate	7233	5.09	1.46	2.77	1.92
	16. Mushroom	5510	5.15	1.43	2.82	2.18
	17. Shadow	2880	5.18	1.44	2.96	1.94
	18. Plant	5740	5.21	1.38	2.59	1.99
	19. Tourist	2850	5.22	1.39	3.00	1.94
	20. Flowers	5731	5.39	1.58	2.74	1.95
	21. Bus	7140	5.50	1.42	2.92	2.38
	22. Fruit	7283	5.50	1.84	3.81	2.01

APPENDIX D. EMOTIONAL INTERFERENCE TASK – NEGATIVE PICTURE STIMULI

	Description	IAPS No	Valence (Mean)	Valence (SD)	Arousal (Mean)	Arousal (SD)
Practice Trials	1. Mother	2312	3.71	1.64	4.02	1.66
	2. Elderly Woman	2590	3.26	1.92	3.93	1.94
Experimental Trials	3. Sad Child	2800	1.78	1.14	5.49	2.11
	4. Toddler	2095	1.79	1.18	5.25	2.34
	5. Hospital	2205	1.95	1.58	4.53	2.23
	6. Cemetery	9220	2.06	1.54	4.00	2.09
	7. Crying Boy	2900	2.45	1.42	5.09	2.15
	8. Cemetery	9000	2.55	1.55	4.06	2.25
	9. Bum	2750	2.56	1.32	4.31	1.81
	10. Girl	2276	2.67	1.66	4.63	1.93
	11. Homeless Man	9331	2.87	1.28	3.85	2.00
	12. Garbage	9330	2.89	1.74	4.35	2.07
	13. Sad Girls	2455	2.96	1.79	4.46	2.12
	14. Burnt Building	9471	3.16	1.35	4.48	2.02
	15. Man	2490	3.32	1.82	3.95	2.00
	16. Family	9046	3.32	1.49	4.31	1.99
	17. Jail	2722	3.47	1.65	3.52	2.05
	18. Drug Addict	2718	3.65	1.58	4.46	2.03
	19. Dishes	9390	3.67	1.58	4.14	2.52
	20. Woman	2399	3.69	1.40	3.93	2.01
	21. Jail	6010	3.73	1.98	3.95	1.87
	22. Woman	9190	3.90	1.44	3.91	1.73

## APPENDIX E. CONSENT FORM (LABORATORY)

Department of Psychology

Minard 332Q, Dept 2765

Fargo, ND 58108-6050

701.231.8622

Title of Research Study: “Mindfulness, Attention and Emotion”

This study is being conducted by: Tharaki Siyaguna, Graduate Student, Psychological Clinical Science (Ph.D.), Department of Psychology.

Why am I being asked to take part in this research study? You are eligible to participate in this study because you are enrolled in an undergraduate psychology course that includes research participation as a requirement or offers extra-credit for participating. You must be at least 18 years old and fluent in English to participate.

What is the reason for doing this study? It has been suggested that attention to emotional stimuli varies depending on the way an individual attends to the present experience. Some individuals are able to inhibit their attention to emotional stimuli better than others. However, the mechanisms behind inhibition to emotional stimuli are not clear. This study is being conducted to learn more about the mechanisms that influence an individual’s ability to inhibit attention to emotional experiences.

What will I be asked to do? You will be asked to complete four self-report questionnaires and two computerized attention tasks. In one of the tasks, you will be shown two lists of words to memorize and then asked to remember one of the lists and forget the other list. You will then be asked to identify a word from the list-to-be-remembered. In the other task, you will be shown a

series of emotionally charged slides followed by tones. You will then be asked to identify the tones.

Where is the study going to take place and how long will it take? The study will be conducted in the Department of Psychology Laboratories located in Minard Hall on the NDSU campus. It will take approximately an hour to complete the study.

What are the risks and discomforts? This study involves minimal risks to the participant. There are certain slides that some people find disturbing. Some slides include depictions of death and mutilation, as well as disease. If you believe that you are particularly sensitive to any of these themes, you may choose not to participate. If you have any questions about the slides before deciding whether or not to participate, please ask the experimenter at this time.

We warn you about the graphic nature of some slides only because we believe that some people could have strongly negative reactions. Many people, however, will not have such strong reactions, some may find most the slides mildly interesting, if not unsettling. You will have the opportunity to ask questions at any time during the study, decline to answer any questionnaire items, and withdrawal your participation at any time during the study. Any potential distress experienced from the graphic nature of the pictures is anticipated to be short-lived. The computerized task that you will be engaged in may also tax your concentration abilities, but any negative experience that may be caused by this task should not persist beyond the experimental task.

What are the benefits to me? You may learn something about research methods in psychology by participating in this study. You are not expected to benefit directly in any other way as a result of participating in this study.

What are the benefits to other people? We are conducting this study so that we may learn about fundamental processes in psychology. It is hoped that the knowledge gained will contribute to our understanding of emotions and may someday benefit people with emotional problems.

Do I have to take part in the study? Your participation in this research is your choice. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

What are the alternatives to being in this research study? There are other studies to participate in besides this one. In addition, every psychology instructor will have specified alternative means for satisfying course requirements. Please see your course syllabus or visit with your instructor to learn about these options.

Who will see the information that I give? All information collected in this study will remain completely confidential. All forms and data will be marked with a unique code. Names and identifying information will not be stored with the data. Only authorized research personnel will have access to the data. When reporting on the results of this study the data will be reported only in summary form, combining the information collected from all participants.

Will I receive any compensation for taking part in this study? All participants in this study will receive credit towards course requirements or extra-credit towards course grades. The typical credit given is 1 point for every 15 minutes of participation. This study involves an hour of participation.

What if I have questions? Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, you can contact the researcher, Tharaki Siyaguna at [tharaki.siyaguna@ndsu.edu](mailto:tharaki.siyaguna@ndsu.edu).

What are my rights as a research participant? You have rights as a participant in research. If you have questions about your rights, or complaints about this research, you may talk to the researcher or contact the NDSU Human Research Protection Program by:

Telephone: 701.231.8908

Email: [ndsu.irb@ndsu.edu](mailto:ndsu.irb@ndsu.edu)

Mail: NDSU HRPP Office, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050

The role of the Human Research Protection Program is to see that your rights are protected in this research; more information about your rights can be found at: [www.ndsu.edu/research/irb](http://www.ndsu.edu/research/irb).

Documentation of Informed Consent You are freely making a decision whether to be in this research study. Signing this form means that

1. You have read and understood this consent form
2. You have had your questions answered, and
3. You have decided to be in the study.

You will be given a copy of this consent form to keep.

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Your signature

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Date

---

Your printed name

---

Signature of researcher explaining study

---

Date

---

Printed name of researcher explaining study

## APPENDIX F. CONSENT FORM (FOLLOW-UP)

Department of Psychology

Minard 332Q, Dept 2765

Fargo, ND 58108-6050

701.231.8622

Title of Research Study: “Mindfulness, Attention and Emotion Survey”

This study is being conducted by: Tharaki Siyaguna, B.S., North Dakota State University, Graduate Student, Department of Psychology, [tharaki.siyaguna@ndsu.edu](mailto:tharaki.siyaguna@ndsu.edu).

Why am I being asked to take part in this research study? You are eligible to participate in this study because you are enrolled in an undergraduate psychology course that includes research participation as a requirement or offers extra-credit for participating and because you have already participated in the study “Mindfulness, Attention and Emotion” in Fall 2015. You must be at least 18 years old and fluent in English to participate.

What is the reason for doing the study? Individuals indicate differences in the way they respond to emotional situations and events. The way we respond can tell us something about how we cope with emotions and events as well as process and regulate the emotions involved. This survey will be used to collect responses on a self-report measure on responding styles in a sample of undergraduate students.

What will I be asked to do? You will be asked to complete two self-report measures.

Where is the study going to take place, and how long will it take? The study will be conducted via the online Psychology Sign-Up Website (Sona) at participants’ convenience. It will take

approximately 15 minutes to complete the survey and the survey must be completed in one sitting.

What are the risks and discomforts? It is not possible to identify all potential risks in research procedures, but we have taken reasonable safeguards to minimize any known risks. One foreseeable risk is that there may be questions which you do not feel comfortable answering.

What are the benefits to me? By participating in this research study, you may learn something about research methods in Psychology. You are not expected to benefit directly in any other way as a result of participating in this study.

What are the benefits to other people? We are conducting this study so that we may learn about how individuals, in particular college students, respond to and cope with negative emotions. It is hoped that the knowledge gained will contribute to our understanding of emotions and may someday benefit people with emotional problems.

Do I have to take part in the study? Your participation in this research is your choice. If you decide to participate in the study, you may change your mind and stop participating at any time without penalty or loss of benefits to which you are already entitled.

What are the alternatives to being in this research study? There are other studies to participate in besides this one. In addition, every psychology instructor will have specified alternative means for satisfying course requirements or earning extra credit. Please see your course syllabus or visit with your instructor to learn about these options.

Who will see the information that I give? All information collected in this study will remain completely confidential. All forms and data will be marked with a unique code. Names and identifying information will not be stored with the data. Only authorized research personnel will

have access to the data. When reporting on the results of this study the data will be reported only in summary form, combining the information collected from all participants.

Will I receive any compensation for taking part in this study? All participants in this study will receive credit of one point towards course requirements or extra-credit towards course grades.

What if I have questions?

Before you decide whether to accept this invitation to take part in the research study, please ask any questions that might come to mind now. Later, if you have any questions about the study, you can contact the researcher, Tharaki Siyaguna, at [tharaki.siyaguna@ndsu.edu](mailto:tharaki.siyaguna@ndsu.edu) or the principal investigator, Paul D. Rokke, at [Paul.Rokke@ndsu.edu](mailto:Paul.Rokke@ndsu.edu), or 701.231-8626.

What are my rights as a research participant?

You have rights as a participant in research. If you have questions about your rights, or complaints about this research [may add, “or to report a research-related injury” if applicable], you may talk to the researcher or contact the NDSU Human Research Protection Program by:

Telephone: 701.231.8995 or toll-free 1.855.800.6717

Email: [ndsu.irb@ndsu.edu](mailto:ndsu.irb@ndsu.edu)

Mail: NDSU HRPP Office, NDSU Dept. 4000, PO Box 6050, Fargo, ND 58108-6050.

The role of the Human Research Protection Program is to see that your rights are protected in this research; more information about your rights can be found at: [www.ndsu.edu/irb](http://www.ndsu.edu/irb).

This study consists of an online survey, which you may now participate in. You will receive credit immediately upon completion of the survey. The survey consists of a number of multiple-choice questions. You must complete all items in one sitting, as you are not allowed to resume at another time from where you left off. While you are participating, your responses will be stored

in a temporary holding area as you move through the items, but they will not be permanently saved until you complete all items and you are given a chance to review your responses.

You are freely making a decision whether to be in this research study. By clicking "YES, Start Survey" you mean that you have read and understood this consent form and you have decided to be in the study.