Thesis written by
Shannon McCreary

Approved by

____________________________________________, Advisor

____________________________________________, Chair, Department of Psychology

Accepted by

____________________________________________, Dean, Honors College
TABLE OF CONTENTS

LIST OF TABLES..............................................................................................................iv

ACKNOWLEDGMENTS.............................................................................................................v

CHAPTER

I. ABSTRACT.........................................................................................................................1

II. INTRODUCTION...............................................................................................................2

III. METHOD.........................................................................................................................17

Participants.......................................................................................................................17

Measures..........................................................................................................................17

Procedure..........................................................................................................................19

Statistical Analysis..............................................................................................................21

IV. RESULTS.........................................................................................................................23

V. DISCUSSION......................................................................................................................31

Limitations and Future Directions..................................................................................37

REFERENCES.......................................................................................................................39
LIST OF TABLES

Table 1. Mean, range, and standard deviation of self-report measures.................................................................24

Table 2. Correlations between measures and implicit task performance.............................................................26

Table 3. Correlations between measures and explicit task performance...............................................................27

Table 4. Correlations between measures and interoceptive awareness.................................................................28
ACKNOWLEDGEMENTS

I would like to thank several people who have made my thesis possible. First, I would like to express my gratitude to my thesis advisor, Dr. David Fresco, for his guidance and assistance throughout this process. I would especially like to thank Kathrine Shepherd, a graduate student in Dr. Fresco’s lab, both for allowing me to use her study as the basis of my thesis and for her extensive help with the completion of my thesis. I cannot thank her enough! I would also like to thank the members of my defense committee: Dr. Karin Coifman, Dr. William Kalkhoff, and Dr. Don-John Dugas, for taking the time to help me with the final portion of my thesis project. Finally, I would like to thank my family for their support both in this project and everything that I do.
CHAPTER 1

ABSTRACT

The current investigation seeks to elucidate the relationship of interoceptive awareness (i.e., the adaptive capacity to attend to and interpret potentially meaningful physiological signals), decentering (i.e., the ability to create healthy distance from emotional stimuli), depression symptoms, and emotion regulation capacities. We assessed interoceptive awareness using a well-established heartbeat perception task, which measures an individual’s accuracy in counting their heartbeats over variable periods of time, and includes a time perception accuracy control task. In a small analogue sample (N = 19), we examined the relationship between interoceptive awareness, time perception, self-reported depression symptoms and emotion regulation capacities (i.e., trait cognitive reappraisal and expressive suppression), trait mindfulness, and an objective measure of implicit emotion regulation (i.e., assessing the capacity to automatically create psychological distance, or “decenter,” from distressing stimuli). We expected interoceptive awareness to be positively associated with adaptive emotion regulation and decentering. We also expected depression symptoms to be negatively associated with decentering and interoceptive awareness. Results revealed that interoceptive awareness was not associated with adaptive emotion regulation or decentering, while depression was not significantly correlated with decentering and was negatively associated with interoceptive awareness, suggesting a nuanced relationship.
CHAPTER 2
INTRODUCTION

Major depressive disorder (MDD) is a serious public health problem that affects many people every year. It is one of the most prevalent mental disorders in the United States, affecting 7% of the country’s population every year and 17% of the population over the course of a lifetime (Kessler et al., 2005). MDD is defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association [APA], 2000) as an excessive negative affect (i.e. sadness) and a deficient positive affect (i.e. anhedonia) that causes significant impairment to daily functioning. MDD is characterized most notably as a disorder of emotion; patients suffer from a sad and dejected mood, a negative self-concept with tendencies toward self-blame and self-reproach, and self-punitive wishes, such as a desire to escape or die (Beck & Alford, 2009). Individuals suffering from MDD also experience physical symptoms such as insomnia, loss of libido, and either increases or decreases in their activity level (Beck & Alford, 2009). MDD is associated with many negative outcomes including an increased risk of suicide. To better treat this issue, understanding and identifying the factors that make people vulnerable to depression is important. An important step towards successful treatment of depression is understanding the emotional and cognitive factors associated with the disorder.
Emotions are natural part of life and are critical to our survival because they serve as valuable indicators regarding what is the best way to act in a situation (Ekman, 1999). Emotion generation begins when either an external or internal event indicates to the individual that there is something important to which to attend (Gross, Richards, & John, 2006). Once these cues are attended to, a coordinated physiological response is triggered involving experiential, behavioral, and central and peripheral physiological systems (Gross, Richards, & John, 2006). These response tendencies can be modulated and regulated in various ways, thus influencing both the experience of emotion and how it is expressed.

Emotion regulation is the process by which a person influences what emotions they experience, when they have them, and how those emotions are experienced and expressed (Gross, 1998). The process of emotion regulation primarily refers to processes intended to amplify or diminish negative or positive emotions (Gross & Thompson, 2007). Emotion regulation is most commonly employed to lessen the impact of negative emotions (e.g. anger, anxiety, and sadness) and to control the experiential and behavioral aspects of emotion (Gross, Richards, & John, 2006). Commonly studied emotion regulation strategies include situation modification, in which the individual takes steps to directly modify the situation prompting the emotional response; attentional deployment, which involves changing the focus of attention (for example, distracting yourself from the emotional aspects of a situation); and cognitive change, in which the cognitive steps effecting how the individual evaluates the situation are modified (Gross, 1998).
People employ various strategies to regulate their emotions, some of which are more effective and healthier than others. Successful emotion regulation has been associated with good health, interpersonal relationships, and academic or work success (Aldao, Nolen-Hoeksema, & Schweizer, 2010). One important aspect of healthy emotion regulation is the ability to use a range of different strategies and the ability to use those strategies in the appropriate context. Adaptive emotion regulation strategies include reappraisal (which involves creating a positive interpretation of a potentially stressful situation) and problem solving (in which the individual takes direct action to solve the problem causing their stress) (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Maladaptive emotion regulation strategies include avoidance, suppression, and rumination (Aldao, Nolen-Hoeksema, & Schweizer, 2010). Whether a particular strategy is considered adaptive or maladaptive can be dependent on the context in which the strategy is employed. For example, suppression of emotions can be adaptive in certain situations (e.g., suppressing anger to avoid lashing out at someone) or maladaptive (e.g., suppressing sadness following the death of a loved one).

Healthy emotion regulation is also characterized by the ability to employ both implicit and explicit types of regulatory strategies (Gyurak, Gross, & Etkin, 2011). Gyurak, Gross, & Etkin (2011) define conscious, or explicit, emotion regulation as a process that requires deliberate effort to begin, requires monitoring during regulation, and is associated with some level of insight and awareness. For example, cognitive reappraisal, which involves creating a positive interpretation of a potentially stressful situation, is an explicit emotion regulation strategy (Gyurak, Gross, and Etkin, 2011).
Conversely, unconscious, or implicit, regulation is automatically initiated by the stimulus and works without monitoring, any special awareness, or insight on the part of the individual (Gyurak, Gross, & Etkin, 2011). An example of implicit emotion regulation is affect labeling, in which an individual verbally expresses negative thoughts or emotions in order to diminish their effect (Gyurak, Gross, & Etkin, 2011). These two categories are not completely separate from each other; processes can vary in explicitness or implicitness based on the particular situation (Gyurak, Gross, & Etkin, 2011). Some have proposed to think of this classification as more of a continuum from conscious to unconscious rather than two sets of separate categories (Gross, Richards, & John, 2006).

Employing efficient implicit emotion regulation processes is critical in order to maintain a sense of well being due to the high demand for moment-to-moment regulation in daily life (Gyurak, Gross, & Etkin, 2011).

Optimal emotion regulation also encompasses the natural ability to adopt a “decentered” perspective in response to stress. Decentering is a metacognitive process that allows a person to observe mental processes such as thoughts or feelings with psychological distance, perspective taking, and greater self-awareness. This capacity allows the person to disassociate himself or herself from negative thoughts or feelings, allowing them to regulate his or her emotions at a healthy level. It encourages a present-focused, nonjudgmental stance towards thoughts and feelings, allowing acceptance of these thoughts and feelings (Fresco et al., 2007). This capacity to adopt a psychologically distanced perspective in response to stress is essential for healthy emotion regulation. Higher levels of depression are associated with a lower ability to
decenter, and a lack of this ability indicates vulnerability for developing depression (Fresco et al., 2007).

In one approach to studying the salutary effects of psychological distance, researchers showed that the perceived, if not actual, physical distance from an emotional stimulus influences one’s emotional response to it (Davis, Gross, & Ochsner, 2011). In this study, participants viewed emotional or neutral scenes on a computer screen, which then appear to either recede into the distance or move toward participants, by shrinking or growing on the screen (Muhlberger, Neumann, Wieser, & Pauli, 2008). Negative scenes moving towards the participant in this study resulted in stronger and more negative emotional arousal than those that did not move or moved away from the participant. Similar results have been observed in many other studies, including one by De Cesarei and Codispoti (2008), which found that a larger depiction of a scene caused a stronger emotional response than the same scene depicted on a smaller scale, and another by Williams and Bargh (2008), which showed that even priming the idea of greater distance prompted weaker negative emotional experience in response to a negative story.

Psychological distancing has also been studied though the use of distressing autobiographical memories. Some have suggested that an individual’s attempt to analyze his or her emotions involved with a negative experience can lead to a positive or negative result (Ayduk & Kross, 2010). Ayduk and Kross (2010) state that when the individual has a low psychological distance from the self (referred to as self-immersion), this kind of focus can lead to maladaptive rumination, as mentioned previously. When an
individual has a high psychological distance from the self (referred to as self-distancing), it creates adaptive self-reflection. One way to create this desirable self-distance is to have the individual recall personal experiences from the perspective of an observer (a self-distanced perspective) rather than from their own perspective (a self-immersed perspective) (Ayduk & Kross, 2010).

Decentering is associated with reductions in levels of depressive rumination and represents a more adaptive way to relate to one’s thoughts (Fresco et al., 2007). Attempts to analyze the emotions involved with a negative experience can lead to rumination when the individual is self-immersed, meaning his or her psychological distance from the self is low (Ayduk & Kross, 2010). However, taking a self-distanced perspective while reflecting on their emotions allows individuals to focus on understanding their feelings and the meaning of their experiences in a way that protects them from the negative effects of rumination (Ayduk & Kross, 2010). Consistent with this idea, depressed individuals also exhibit poor decentering capabilities. High decentering capabilities have even been found to reduce the risk of relapse in patients treated for MDD (Fresco et al., 2007).

Healthy emotion regulation requires the ability to flexibly employ different types of strategies, and also necessitates the ability to recognize the best strategy to use based on the context of the situation and choose accordingly. For this reason, the individual must know and understand what he or she is feeling so they can make the appropriate choices in regards to what strategy to employ (Barrett et al., 2001). Because emotions are valuable signals as to how to act, differentiating emotions in this way allows the
individual to correctly employ emotion regulation appropriate to the situation (Barrett et al., 2001).

Accordingly, the capacity to identify physiological changes associated with emotion generation also thought to underlie healthy emotion regulation. Awareness of one’s own bodily sensations is termed interoception, or “interoceptive awareness.” Interception includes the sensation of the body’s physiological condition (Craig, 2002) and the representation of the internal state in the context of current activities (Craig, 2009). It includes many sensations, such as pain (LaMotte et al., 1982), temperature (Craig & Bushnell, 1994), itch (Schmelz et al. 1997), tickle (Lahuerta et al., 1990), sensual touch (Olausson et al., 2002), muscle tension (Light & Perl, 2003), air hunger (Banzett et al., 2000), and discomfort in the stomach (Feinle, 1998). This ability has been linked to the experience of emotions and is said to shape how people perceive them. Healthy interoceptive awareness is also an important component in mediating the emotional experience (Füstös et al., 2012). This awareness serves to help the body maintain a homeostatically regulated internal state within the context of current activities (Craig, 2008). Craig defines homeostasis as the ongoing, hierarchically organized neurobiological process that maintains an optimal balance in the physiological condition of the body (2008), and states that interoception helps the individual maintain this state and provides the individual with an integrated sense of the body’s physiological condition (2002). Interceptive awareness is considered a protective factor: the greater sensitivity to bodily states that it offers allows changes to be detected more accurately, which in turn allows better discernment and appropriate regulation of different emotional states (Füstös
et al., 2012). Because of this, interoceptive awareness is associated with the use of beneficial emotion regulation strategies such as reappraisal (Füstös et al., 2012).

Interoceptive awareness abilities are typically studied using the Schandry (1981) heartbeat perception task. In this task, the participant counts their heartbeats over a period of time while hooked up to an electrocardiogram (ECG), which monitors their heartbeat electronically. The participant’s count is compared to the ECG reading for accuracy. The participant also completes a control task in which they estimate how much time has passed over a certain interval in order to ensure that participants are unlikely to be merely estimating their heart rate based on the passage of time. This task has been used in several studies (Ehlers & Breuer, 1992, Pollatos, Kirsch, & Schandry, 2005, Dunn et al., 2007, etc.).

Healthy emotion regulation and decentering abilities can be enhanced by the practice of mindful meditation. Mindful meditation can produce beneficial effects in a number of psychological disorders, including depression, and has therefore been incorporated into treatment strategies for such disorders (Hölzel et al., 2011). Meditation practitioners report greater perceptual clarity of interoception, resulting in improvements in emotion regulation (Hölzel et al., 2011). Meditation cultivates the tendency to practice mindfulness in daily life (Baer et al., 2008). Mindfulness is an enhanced, open attention to and awareness of current experience or present reality (Brown & Ryan, 2003). Mindfulness is a quality of consciousness characterized by clarity and vividness in current experience and functioning (Brown & Ryan, 2003). Mindfulness plays an important role in behavioral regulation, as well as in disengaging individuals from
automatic thoughts, habits, and unhealthy behavior patterns (Brown & Ryan, 2003). It has also been associated with positive psychological outcomes (Kabat-Zinn, 1990) and better moment-to-moment experiences (Brown & Ryan, 2003). Self-report measures are generally used to assess mindfulness, such as the *Five Facet Mindfulness Questionnaire* (FFMQ; Baer et al., 2008). The FFMQ is comprised of five component skills represented by distinct subscales: observing, describing, acting with awareness, non-judging of internal experience, and non-reactivity to inner experience. Trait mindfulness can also exist naturally independent of meditation practice, but meditation has been found to cultivate several mindfulness skills, including those measured by the FFMQ, which in turn support better psychological functioning (Baer et al., 2008).

MDD is a disorder of emotion generation and regulation (Fresco et al., 2013) characterized by an elevated negative affect and reduced positive affect (APA, 2000). Deficits in emotion generation may include exhibiting strong emotional responses to all situations as well as insensitivity to both positive and negative emotional cues (Mennin et al., 2007; Rottenberg, 2005). Depressed individuals also exhibit poor performance in many areas involved with healthy emotion regulation. For example, depression has been associated with an inability to successfully employ cognitive reappraisal to down-regulate negative emotions (Johnstone et al., 2007) as well as with an inflexible reliance on other strategies that are associated with maladaptive outcomes. For example, depressed individuals tend to use maladaptive forms of emotion regulation, such as rumination or suppression, as a means of regulating emotional experiences (Joormann & Gotlib, 2010). Rumination involves thinking repetitively and passively about the negative emotions the
individual is experiencing with a focus on their symptoms of distress (“I feel so lousy”) and worrying about the meaning of this distress (“Will I ever get over this?”) (Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Nolen-Hoeksema, 1991). Studies have shown that individuals who more often engage in a ruminative response style when they are feeling sad or depressed exhibit higher levels of depressive symptoms over time (ex: Nolen-Hoeksema & Davis, 1999; Nolen-Hoeksema & Morrow, 1991). An unhealthy emotional regulator may, for example, use rumination as his or her sole form of emotion regulation, or use suppression in inappropriate contexts instead of when it can be adaptive (Joormann & Gotlib, 2010).

Another form of disordered emotion regulation that has been associated with psychopathology, including MDD, is alexithymia. Alexithymia refers to the inability to recognize the emotions being experienced and verbalize them (Sifneos, 1972). Healthy emotion regulation requires the ability to recognize what emotions one is experiencing in order to respond to them appropriately. Thus, individuals with alexithymia are less aware of their emotions and bodily signals, and are therefore less likely to benefit from valuable emotional signals (Krystal, 1982). Honkalampi et al. (1999) state that alexithymia symptoms include a deficit in imagination, difficulty communicating with other people, a lack of feelings, and an affect similar to that found in MDD patients (a high prevalence of negative emotions and a low prevalence of positive emotions). Prevalence rates vary from 13% (Salminen et al., 1999) to 19% (Parker, Taylor, & Bagby, 1989). Individuals with alexithymia are more likely to suffer from depression. As well, the presence of
alexithymia correlates with more severe depression symptoms in both men and women (Honkalampi et al., 1999).

Although alexithymia has been associated with deficits in emotion regulation and different forms of psychopathology, the relationship between interoceptive awareness and psychopathology appears to be more nuanced. For example, some have theorized that those people who are high in interoceptive awareness experience their emotions more intensely than people with low interoceptive awareness (Paulus & Stein, 2006). Higher interoceptive abilities have sometimes been associated with higher anxiety symptoms (Paulus & Stein, 2006). This finding is interpreted in light of evidence that anxious individuals exhibit hyper-arousal, which means that they have a greater physiological response to an emotional stimulus (Clark & Watson, 1991). In addition, anxious individuals report greater emotional experience in self-report measures (Turk et al., 2005). Hyper-arousal in anxious individuals is thought to result from an increased tendency to judge stimuli (including physiological signals) as threatening with more frequency than a healthy individual (Wilson et al., 2006). Hyper-arousal is thought to result from this heightened threat sensitivity (Paulus & Stein, 2010). Additionally, hyper-arousal is thought to increase the likelihood that the individual will have difficulties in emotion regulation (Carthy et al., 2010). One possible explanation for the association between high anxiety symptoms and greater interoceptive awareness abilities is that anxiety is associated with greater activation of the medial pre-frontal cortex (mPFC), which in turn results in great activation in the insula, which is associated with interoceptive awareness (Paulus & Stein, 2010). The increased activation of the insula
results in greater interoceptive awareness correlates with the higher anxiety resulting from the greater activation of the mPFC. Furthermore, major depression has been associated with alexithymia and deficits in motivation that are common MDD symptoms (e.g., fatigue, apathy) (Bylsma, Morris, & Rottenberg, 2008). Therefore, MDD should theoretically be associated with poor interoceptive abilities, possibly due to reduced reactivity to emotional stimuli (Bylsma, Morris, & Rottenberg, 2008). However, the literature is mixed on the relationship between interoceptive awareness and depression symptoms. Some studies show a non-significant correlation between depression and interoceptive awareness abilities (e.g., Ehlers & Breuer, 1992), while others found normal levels of interoceptive accuracy in a more severely depressed clinical sample (Dunn et al., 2007).

Taken together, research suggests that depression is associated with difficulties in emotion regulation, including decentering. However, no previous studies have examined the interrelationships between all these things, and current approaches to the study of decentering and interoceptive awareness have been limited in number and methodology. We also know that depression is associated with deficits in decentering, but currently we have an incomplete understanding of the relationship between depression and interoceptive awareness. Thus, the current study aims to explore how these concepts are interrelated.

Currently, there are gaps in the extant literature regarding these concepts. One important limitation is that both decentering and interoceptive awareness are often studied through self-report measures. Decentering is typically measured using the
decentering subscale of the Experiences Questionnaire (Fresco et al., 2007). This is an 11-item questionnaire that includes items such as “I am better able to accept myself as I am” and “I can observe unpleasant feelings without being drawn into them.” Findings from this model indicate that high levels of decentering is correlated with a more durable depressive treatment response and low levels of decentering is correlated with a greater chance of MDD relapse (Fresco et al., 2007).

Interoceptive awareness has also been studied using self-report measures. For example, Ehlers and Breuer (1992) asked participants to complete two Likert scales measuring on a scale of 1 (not very aware) to 7 (extremely aware) how generally aware they were of their cardiac and gastrointestinal (e.g., bloating or abdominal cramps) symptoms, respectively. However, comparisons between the self-report and heartbeat perception groups in the Ehlers and Breuer (1992) study did not result in significant correlations. Ehlers and Breuer (1992) speculated that self-reported cardiac awareness might be based on participant measures of cardiac activity other than heartbeat, such as heart palpitations, making it less accurate than the Schandry task. This misinterpretation on the part of the participants could cause the discrepancy between the self-report measure and the objective heartbeat perception task. This discrepancy and the greater accuracy in experimental measures make examining interoceptive awareness solely through the Schandry task preferable.

Despite their prevalence in research on decentering and interoceptive awareness, there are important drawbacks to the use of self-report measures. Self-report measures are limited and do not always provide reliable and valid results because people do not always
have good insight into their emotional experiences and how they regulate those experiences. Experimental approaches more accurately capture emotion regulation processes and can provide more insight into the mechanisms involved in those processes. However, no experimental measures of decentering currently exist. Several experimental studies, however, have demonstrated that increasing psychological distance from distressing internal and external stimuli can reduce the impact of negative emotions. Critically, the capacity to create psychological distance in response to stress is a key facet of decentering.

In summary, healthy emotion regulation is an important factor in the treatment and prevention of major depression. Healthy emotion regulation encompasses a range of concepts and skills, including successful employment of adaptive emotion regulation strategies (i.e., cognitive reappraisal), the ability to flexibly employ various types of emotion regulation strategies depending on the context of the particular situation, and avoiding reliance on maladaptive emotion regulation strategies (i.e., suppression). Decentering and interoceptive awareness are concepts associated with healthy emotion regulation that are often studied through self-report measures. However, self-report measures are not as reliable as experimental measures and do not always provide as valid results. The current study aims to examine the relationship between interoceptive awareness abilities, time perception, emotion regulation tendencies, depression symptoms, mindfulness, and decentering abilities through experimental measures.

In a small sample of college-aged participants (N=19), we manipulated implicit and explicit psychological distance from distressing visual stimuli in two separate tasks
and examined emotional reactivity as a function of increasing distance. We also measured interoceptive awareness objectively using the commonly used Schandry task. These objective measures of distancing and interoceptive awareness were in relation to self-report measures of depression, trait mindfulness, and emotion regulation.

We hypothesized that:

1. Implicit and explicit psychological distancing from negative, but not neutral, stimuli will be positively associated with heart rate perception accuracy (i.e., interoceptive awareness), but not with time estimation accuracy;

2. Implicit and explicit psychological distancing from negative, but not neutral, stimuli will be positively associated with self-reported use of adaptive emotion regulation (i.e., cognitive reappraisal and mindfulness) and negatively associated with use of maladaptive strategies (i.e., expressive suppression);

3. Implicit and explicit psychological distancing from negative, but not neutral, stimuli will be negatively associated with self-reported depression;

4. Interoceptive awareness (i.e., heartbeat perception accuracy controlling for time perception accuracy) will be positively associated with adaptive emotion regulation strategies (i.e., cognitive reappraisal and mindfulness) and negatively associated with maladaptive strategies (i.e., expressive suppression); and

5. Interoceptive awareness (i.e., heartbeat perception accuracy controlling for time perception accuracy) will be negatively associated with self-reported depression.
CHAPTER 3

METHOD

Participants

Students from a large Midwestern university completed a Mass Testing screening. Based on their scores, 20 participants were recruited to participate in the study. Five participants were excluded because of technological failures with the computer equipment. 16 participants (84%) were female. The mean age of all participants was 19.05 years (SD=1.43). Caucasian was the largest ethnicity represented (83%).

Measures

Prospective participants completed a Mass Testing screening, which included the Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977), which asks participants to rate how often they have experienced feelings and behaviors associated with depression symptoms over the course of the past week on a self-report rating scale from “not at all” to “most or all of the time.” Participants with high (CES-D ≥ 16) and low (CES-D ≤ 3) scores were invited to participate in the study. Some participants were also recruited for a healthy control group and did not complete the CES-D questions. The *Quick Inventory of Depressive Symptomology* self-report measure (QIDS-SR; Rush et al., 2003) is a 16-item measure of depressive symptom severity. It includes all DSM-IV diagnostic criteria for Major Depressive Disorder (MDD) over nine domains:
sad mood, concentration, self-criticism, suicidal ideation, interest, energy/fatigue, sleep disturbance, changes in appetite/weight, and psychomotor agitation/retardation. This measure served as index of current depression severity in the analyses that follow.

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) is a 10-item self-report measure assessing trait Cognitive Reappraisal (e.g., “I control my emotions by changing the way I think about the situation I’m in”) and Expressive Suppression (e.g., “I control my emotions by not expressing them”). Participants answered using a rating scale ranging from 1 (strongly disagree) to 7 (strongly agree).

The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2008) is a 39-item measure of five self-reported component skills of mindfulness. These five subscales are observing (e.g., “I noticed the smells and aromas of things”), describing (e.g., “I’m good at finding words to describe my feelings”), acting with awareness (e.g., “I find myself doing things without paying attention”), non-judging of internal experience (e.g., “I think some of my emotions are bad or inappropriate and I should not feel them”), and non-reactivity to inner experience (e.g., “I perceive my feelings and emotions without having to react to them”). Participants rate their agreement with each statement on a 5-point Likert-type scale including responses ranging from 1 (never or very rarely true) to 5 (very often or always true). These questions were analyzed to determine participants’ approximate score for mindfulness abilities.
Procedure

The study took place in a quiet room with participants seated in an armchair facing the computer screen. Informed consent was acquired from each participant after explaining experimental procedures. All participants completed a set of questionnaires at the beginning of the first experiment session. Participants completed a battery of questionnaires, including questions on mindfulness and expressive suppression, as well as questions about the participant’s background.

Eight electrodes were then placed on the participant: one on the right collarbone, one on the left hip, one on the middle section of both the pointer and middle fingers on the non-dominant hand, two on the left cheek, and two above the left eyebrow. The participant was instructed to stay still throughout the task in order to avoid detaching or disrupting the electrodes. A five-minute baseline was then recorded.

The participant then completed the interoceptive awareness task. This task design was based on the task used by Dunn et al. (2007). The participant was instructed not to look at any watches or clocks, hold their breath, take their pulse, or do anything that could influence their heart rate for the duration of the task. The participant completed six trials in which they were asked to count their own heartbeats. There were two trials each of 45, 35, and 25 seconds, and they were presented in a random order. The participant was then instructed to estimate the length in seconds for three trials, which lasted 23, 56, 40 seconds respectively.

The study design was a 2x2 blocked factorial design. The participant was shown four groups of 36 color images on the computer screen of various objects that were for
negative (e.g., spider) or neutral (e.g., battery) emotional valence. Two blocks had negative emotional valence and two blocks had neutral emotional valence. For one of each of the negative and neutral blocks, the participants was asked to decide whether the object would fit inside the palm of their own hand. For the other block of both the negative and neutral pictures, the participants were asked whether the object would fit inside of a standard size shoebox. Participants could answer “Yes”, “No”, or “I don’t know.” The images were grouped based on their emotional valence (negative/neutral) and instruction (hand/shoebox). At baseline and after each group of images, participants were asked to rate the extent to which they felt specific emotions (upset, guilty, hostile, irritable, jittery, scared) on a sliding scale from 1 to 5.

The participant was then shown 48 color photographs selected from the International Affective Picture System (IAPS) database. These were standardized for emotional valence and arousal: 24 negative (e.g., mutilated body) and 24 neutral (e.g., ironing board). Each picture was shown to the participant with an instruction stating either AWAY or NO CHANGE. Each condition included half negative and half neutral pictures. After the instruction was presented, both the instruction and the picture disappeared from the screen. For the AWAY condition, participants were instructed to imagine the picture receding until it was the size of a postage stamp. For the NO CHANGE condition, participants were instructed to imagine the picture remaining at the same size they had seen it. Following each picture, the participant was asked to rate his or her emotional reaction to the imagination exercise using the nine-point Self Assessment Manikin (SAM) for arousal and valence.
Statistical Analysis

All participants’ heart rates were recorded using an electrocardiogram (ECG). The number of heartbeats in each experimental trial were automatically quantified by AcqKnowledge software and then hand-counted by a research assistant to ensure accuracy. The recorded number of heartbeats was compared to the participant’s self reported number of heartbeats for accuracy. Time and heartbeat perception inaccuracy was calculated using the method described by Dunn et al. (2007): taking the modulus of the actual value minus the estimated value, dividing this by the actual value, and then multiplying by 100 to express the inaccuracy as a percentage (\(\frac{|\text{actual} - \text{estimated}|}{\text{actual}} \times 100\)).

These difference scores in the dependent variables were calculated by subtracting the emotional reactivity score as measured by self-reported negative affect and reaction time in the near conditions (e.g., the hand or “NO CHANGE” conditions) from the emotional reactivity score in the far conditions (e.g., the shoebox or “AWAY” conditions). A negative difference score indicates greater emotional reactivity in the far conditions in comparison with the far conditions, demonstrating a greater decentering capacity. Scores approaching zero signifies no difference between the conditions, indicating a poorer decentering capacity. A positive difference score shows greater emotional reactivity in the far conditions in comparison to the near conditions. This result was termed “reverse-distancing.”

Pearson correlations were then run to compare the dependent variable difference scores, the heart rate and time estimation accuracy scores, and the self-report measures
from the emotion regulation questionnaires. For significant correlations, we conducted additional regression analyses to examine the effect of heart rate and self-report measures controlling for time accuracy.

One participant was excluded from statistical analysis because their time accuracy deviation score was more than two standard deviations above the group mean (N=19, 16 females).
CHAPTER 4
RESULTS

Fifteen participants were submitted for analysis in the heart rate accuracy task. One participant was removed as an outlier because his or her time estimation accuracy score was more than two standard deviations above the mean. Nineteen participants were submitted for analysis in the time estimation task. This task had more subjects because the data from four participants had to be excluded from the heart rate task due to malfunctioning computer equipment. The mean, range, and standard deviation of self-report measure are reported on Table 1.
Table 1.

Mean, range, and standard deviation of self-report measures

<table>
<thead>
<tr>
<th>Measure</th>
<th>Subscale</th>
<th>Range</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>18</td>
<td>7.84</td>
<td>4.39</td>
<td></td>
</tr>
<tr>
<td>Mindfulness</td>
<td>62</td>
<td>114.05</td>
<td>17.27</td>
<td></td>
</tr>
<tr>
<td>Observe</td>
<td>19</td>
<td>25.63</td>
<td>5.35</td>
<td></td>
</tr>
<tr>
<td>Describe</td>
<td>24</td>
<td>21.89</td>
<td>6.46</td>
<td></td>
</tr>
<tr>
<td>Act aware</td>
<td>20</td>
<td>24.16</td>
<td>5.15</td>
<td></td>
</tr>
<tr>
<td>Nonjudge</td>
<td>18</td>
<td>23.68</td>
<td>5.93</td>
<td></td>
</tr>
<tr>
<td>Nonreact</td>
<td>17</td>
<td>18.68</td>
<td>4.58</td>
<td></td>
</tr>
<tr>
<td>Emotion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reappraise</td>
<td>16</td>
<td>26.00</td>
<td>4.01</td>
<td></td>
</tr>
<tr>
<td>Suppress</td>
<td>16</td>
<td>14.53</td>
<td>5.41</td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 19 for all measures

Manipulation Check. Heart rate and time were not correlated, indicating that participants were unlikely to have estimated their heart rates based on how much time had passed.

Hypothesis 1. Our first hypothesis predicted that both implicit and explicit psychological distancing from negative, but not neutral, stimuli would be positively associated with heart rate perception accuracy (i.e., interoceptive awareness), but not
with time estimation accuracy. Contrary to predictions, no correlations were found between heart rate accuracy and either implicit ($r(14)=.31$ in neutral objects; $r(14)=-.05$ in negative objects) or explicit ($r(14)=-.22$ in neutral stimuli; $r(14)=.33$ in negative stimuli) psychological distancing. Surprisingly, in the implicit distancing task, time estimation accuracy was found to predict the degree to which participants reported reduced negative affect in the far (i.e., “hand” condition) versus the near (i.e., “shoebox”) condition in negative, $r(17)=-.40$, $p<.1$ (i.e., trend level) and neutral conditions, $r(17)=-.49$, $p<.05$. Furthermore, in the implicit distancing task, time estimation accuracy was positively associated with reduced reaction times in the far (i.e., “hand” condition) versus the near (i.e., “shoebox”) conditions in negative, $r(17)=-.40$, $p<.1$ (i.e., trend level). This finding suggests that time estimation accuracy, not heart rate perception, is associated with whether individuals experience salutary effects of implicit (but not explicit) distancing.
Table 2.

Correlations between measures and implicit task performance

<table>
<thead>
<tr>
<th>Measure</th>
<th>Subscale</th>
<th>Neutral Subscale</th>
<th>Negative Subscale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Negative Affect</td>
<td>Reaction Time</td>
</tr>
<tr>
<td>Depression</td>
<td></td>
<td>.28</td>
<td>-.24</td>
</tr>
<tr>
<td>Mindfulness</td>
<td>-.41†</td>
<td>-.08</td>
<td>-.09</td>
</tr>
<tr>
<td>Observe</td>
<td>-.001</td>
<td>.14</td>
<td>.31</td>
</tr>
<tr>
<td>Describe</td>
<td>-.55*</td>
<td>-.53*</td>
<td>-.18</td>
</tr>
<tr>
<td>Act aware</td>
<td>-.19</td>
<td>.04</td>
<td>-.18</td>
</tr>
<tr>
<td>Nonjudge</td>
<td>.02</td>
<td>.39</td>
<td>-.12</td>
</tr>
<tr>
<td>Nonreact</td>
<td>.59**</td>
<td>-.27</td>
<td>-.07</td>
</tr>
<tr>
<td>Emotion Regulation</td>
<td></td>
<td>Reappraise</td>
<td>Suppress</td>
</tr>
<tr>
<td>Reappraise</td>
<td>-.08</td>
<td>.05</td>
<td>-.22</td>
</tr>
<tr>
<td>Suppress</td>
<td>-.16</td>
<td>.01</td>
<td>-.07</td>
</tr>
</tbody>
</table>

Note. $N = 19$ † $p < .10$ * $p < .05$, ** $p < .01$, *** $p < .001$.

Hypothesis 2. Our second hypothesis stated that implicit and explicit psychological distancing from negative, but not neutral stimuli, would be positively associated with self-reported use of adaptive emotion regulation strategies (i.e., cognitive reappraisal and mindfulness) and negatively associated with maladaptive strategies (i.e., expressive suppression). Contrary to predictions, results revealed that correlations of neither implicit nor explicit distancing (from negative or neutral
stimuli) to self-reported emotion regulation (i.e., cognitive reappraisal, expressive suppression, or mindfulness) were significantly different from zero.

Table 3.

Correlations between measures and explicit task performance

<table>
<thead>
<tr>
<th>Measure</th>
<th>Subscale</th>
<th>Neutral</th>
<th>Negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td></td>
<td>.09</td>
<td>-.22</td>
</tr>
<tr>
<td>Mindfulness</td>
<td></td>
<td>-.15</td>
<td>.29</td>
</tr>
<tr>
<td>Observe</td>
<td></td>
<td>-.21</td>
<td>.09</td>
</tr>
<tr>
<td>Describe</td>
<td></td>
<td>-.18</td>
<td>.27</td>
</tr>
<tr>
<td>Act aware</td>
<td></td>
<td>-.07</td>
<td>-.09</td>
</tr>
<tr>
<td>Nonjudge</td>
<td></td>
<td>.06</td>
<td>.14</td>
</tr>
<tr>
<td>Nonreact</td>
<td></td>
<td>-.05</td>
<td>.35</td>
</tr>
<tr>
<td>Emotion Regulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reappraise</td>
<td></td>
<td>.19</td>
<td>-.21</td>
</tr>
<tr>
<td>Suppress</td>
<td></td>
<td>-.17</td>
<td>.38</td>
</tr>
</tbody>
</table>

*Note. N = 19. † p < .10 * p < .05, ** p < .01, *** p < .001.*

_Hypothesis 3._ Our third hypothesis predicted that implicit and explicit psychological distancing from negative, but not neutral, stimuli would be negatively associated with self-reported depression. Contrary to our hypothesis, as depicted in
Table 2, results revealed that neither implicit nor explicit distancing (from negative or neutral stimuli) was associated with self-reported depression symptoms.

Table 4.

*Correlations between measures and interoceptive awareness*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Subscale</th>
<th>Heartbeat perception accuracy</th>
<th>Time perception accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td></td>
<td>-.45*</td>
<td>-.22</td>
</tr>
<tr>
<td>Mindfulness</td>
<td></td>
<td>.03</td>
<td>.08</td>
</tr>
<tr>
<td>Observe</td>
<td></td>
<td>-.60*</td>
<td>-.11</td>
</tr>
<tr>
<td>Describe</td>
<td></td>
<td>.14</td>
<td>.19</td>
</tr>
<tr>
<td>Act aware</td>
<td></td>
<td>.54*</td>
<td>.17</td>
</tr>
<tr>
<td>Nonjudge</td>
<td></td>
<td>.04</td>
<td>-.05</td>
</tr>
<tr>
<td>Nonreact</td>
<td></td>
<td>-.06</td>
<td>.04</td>
</tr>
<tr>
<td>Emotion Regulation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reappraise</td>
<td></td>
<td>.33</td>
<td>-.26</td>
</tr>
<tr>
<td>Suppress</td>
<td></td>
<td>.61*</td>
<td>.20</td>
</tr>
</tbody>
</table>

Note. N = 90 for all measures except heartbeat perception accuracy (N = 14). † p < .10 * p < .05, ** p < .01, *** p < .001.

*Hypothesis 4.* Our fourth hypothesis predicted that interoceptive awareness (i.e., heartbeat perception accuracy controlling for time perception accuracy) would
be positively associated with adaptive emotion regulation strategies (i.e., cognitive reappraisal and mindfulness) and negatively associated with maladaptive strategies (i.e., expressive suppression). Contrary to predictions, heart rate accuracy was positively associated with the expressive suppression subscale of emotion regulation, \( r(12) = .61, p = .02 \). We further examined the effect of heart rate accuracy on expressive suppression while controlling for time accuracy. This analysis revealed that the association between heart rate accuracy and expressive suppression remained significant, \( B = 1.76, t(11) = 2.21, p = .05 \). Heart rate accuracy also explained a significant proportion of variance in suppression scores, \( R^2 = .38, F(1, 11) = 4.86, p < .05 \). This suggests that the relationship between heart rate accuracy and expressive suppression is independent of time perception accuracy.

Consistent with predictions, heart rate accuracy was positively associated with the FFMQ act with awareness subscale, \( r(12) = .54, p < .05 \), suggesting that better heart rate accuracy predicts greater acting with awareness. Using linear regression to control for time estimation accuracy revealed that heart rate remained significantly correlated with the FFMQ act with awareness subscale, \( B = .65, t(11) = 2.36, p < .05 \). Heart rate accuracy also explained a significant proportion of variance in FFMQ acting with awareness scores, \( R^2 = .34, F(1, 11) = 5.56, p < .05 \).

However, heart rate accuracy was negatively associated with the FFMQ observe experiences subscale, \( r(12) = -.6, p < .05 \). This finding was contrary to our hypothesis and suggests that higher heart rate accuracy predicts lower mindful observance of experiences. We further examined the effect of heart rate accuracy on
the FFMQ observe experiences subscale while controlling for time estimation accuracy. This analysis revealed that heart rate accuracy remained significantly correlated with the FFMQ observe subscale, $B=-.76$, $t(11)=-3.04$, $p<.05$.

_Hypothesis 5_. Our fifth hypothesis stated that interoceptive awareness (i.e., heartbeat perception accuracy controlling for time perception accuracy) would be negatively associated with self-reported depression. As expected, heart rate accuracy was negatively associated with depression symptoms, $r(12)=-.49$, $p<.1$ (trend level). After controlling for time-estimation accuracy, heart rate and depression also remained correlated at a trend level, $B=-.51$, $t(11)=-1.71$, $p=.1$. This finding supported our hypothesis.
CHAPTER 5
DISCUSSION

This study aimed to examine the complex relationship between interoceptive awareness, time estimation, depression symptoms, emotion regulation, and mindfulness. We expected interoceptive awareness abilities to be negatively associated with depression and positively associated with decentering capacity.

Hypothesis 1 predicted that psychological distancing would be positively associated with interoceptive awareness, but not with time perception accuracy. Unexpectedly, time perception accuracy was instead found to be associated with psychological distancing. That is, individuals who exhibited greater ability to distance from emotionally evocative objects were more accurate in perceiving the amount of time in a given interval. We suspect that this association may be moderated by executive functioning abilities. Executive processes serve to order and control all thought and behavior (Struss & Alexander, 2000). Examples of such processes include reasoning, decision-making, memory, and comprehension (Brown, 2006). Because timekeeping is an intentional, conscious process, it can logically be grouped with other executive functions (Brown, 2006). Timekeeping, like other executive processes, is conscious and intentional by nature and requires continuous monitoring and updating, reinforcing its grouping with executive functioning (Brown, 2006). Additionally, coordination and scheduling, which are commonly acknowledged as executive processes, are by nature
related to timekeeping (Brown, 2006); logically, it follows that timekeeping should then also be grouped as an executive function. We suspect that the correlation between decentering and time perception accuracy reflects the relationship between time perception and executive function.

Similar to timekeeping, emotion regulation has previously been related to executive function. For example, Schmeichel (2007) found that emotion regulation behaved similarly to executive functions such as visual attention and memory. This study investigated the idea that efforts at executive control deplete resources needed for later, unrelated attempts at executive control. Participants who completed a memory-updating task (memory is commonly considered an executive function) were less successful at subsequent attempts at emotion regulation (Schmeichel, 2007), indicating that emotion regulation originates from the same region of the brain as executive functions and therefore may also be an executive function. Schmeichel (2007) does note that contrary to the results of this study, previous studies (ex: Rule, Shimamure, & Knight, 2002; Stone, Baron-Cohen, & Knight, 1998) indicate that memory and emotion regulation originate from different parts of the brain, meaning that they draw on different processing resources and therefore performance on one should not influence the other. However, the results of the Schmeichel study in addition to the results from the present study indicate that classifying emotion regulation as an executive function is a viable theory and an appealing area for further study.

Likewise, a functional magnetic resonance imaging (fMRI) study by Ochsner et al. (2002) revealed that the emotion regulation strategy of reappraisal activates the same
regions of the prefrontal cortex as memory and other executive processes. This study revealed that effective reappraisal results in activation of the lateral prefrontal cortex (LPFC) and medial prefrontal cortex (MPFC) regions of the brain (Ochsner et al., 2002). Both of these regions have been previously associated with working memory, cognitive control (Miller & Cohen, 2001) and self-monitoring (Gusnard et al., 2001), all of which are considered executive processes. The Ochsner (2002) study was one of the first to assess the idea that emotion regulation may be related to executive functioning through the use of fMRI. Recently, several other studies (examples include Phan et al., 2005; Beauregard, Levesque, & Bourgouin, 2001; Levesque et al., 2003) have consistently found results similar to Ochsner’s through the use of fMRI. Presumably, this indicates a relationship between these processes. We suspect that the correlation between decentering and time perception accuracy reflects the relationship of time perception and emotion regulation to executive function. Future studies should explore this idea, perhaps by studying at the overlap in neural activity associated with these two tasks in the same participants. If each participant completes all tasks and the experimenter assesses whether each of the tasks activates regions associated with executive function, the relationship between these concepts may become clearer.

Hypothesis 2 predicted that psychological distancing would be positively associated with cognitive reappraisal and mindfulness while being negatively associated with suppression. We instead found no correlations between psychological distancing and any form of emotion regulation. These findings may have been biased by our small sample size, as previous research indicates that distancing should be associated with
adaptive emotion regulation. Distancing has previously been found to be negatively associated with depression symptoms (Fresco et al., 2007), meaning that logically it should positively correlate with other protective factors against depression such as cognitive reappraisal and mindfulness and negatively correlate with risk factors for depression (i.e., suppression).

Hypothesis 3 predicted that psychological distancing would be negatively associated with depression. Our findings did not support this hypothesis, as neither explicit nor implicit distancing was significantly correlated with depression symptoms. Like the findings for hypothesis 2, the most likely explanation for this lack of association in our sample is the small sample size. Previous research (i.e., Fresco et al., 2007) indicates that distancing is adaptive and should be negatively correlated with depression symptoms as we predicted. Another possible explanation for the lack of significant correlations is lower engagement in the task on the part of the participants (i.e., less effort). Both the implicit and explicit distancing tasks require the participant to completely engage in the task to be effective, and the results would be negatively affected if the participant were not fully engaged. We did not include any control task to determine if the participant was fully engaged in order to rule out this possibility. This is of special concern in regard to the depressed participants as poor concentration skills are often found in depressed individuals (Beck & Alford, 2009). Our sample size was so small that if even one participant’s answers were a result of poor attention to the task, it would change the entire correlation significantly.
Hypothesis 4 predicted that interoceptive awareness would be positively associated with cognitive reappraisal and mindfulness, while being negatively associated with suppression. The first half of this prediction was partially supported. As expected, higher interoceptive awareness ability, as demonstrated by a more accurate count of heartbeats, was associated with the act with awareness subscale of the FFMQ. Mindfulness has previously been found to be associated with greater bodily awareness because it promotes a nonjudgmental moment-to-moment awareness that breaks down psychological barriers such as negative self judgment and an inability to focus attention on separate sensations (Silverstein et al., 2011). Because of this association, logically mindfulness and interoceptive awareness ability would correlate.

However, contrary to our hypothesis, greater interoceptive awareness ability was also negatively associated with the observe experiences subscale of the FFMQ. Previously, scores on the observe experience subscale of the FFMQ has been found to correlate with psychopathological symptoms, including suppression and dissociation, in a student sample (Baer et al., 2008). The discrepancy in our results between these two subscales of the FFMQ might reflect the fact that the observe experiences subscale is not as good of a measure of mindfulness as the other subscales. Baer and colleagues (2008) performed confirmatory factor analysis (CFA) to examine whether each of the five facets should be viewed as elements of one general mindfulness construct, or if the five facets are better understood as five separate constructs. Four out of the five subscales were found to be valid indicators of an overarching mindfulness construct; the only subscale that did not fit this model was the observe experience subscale, indicating that it may not
be as valid a measure of mindfulness as the other subscales. This was surprising because observing has been generally considered a central element of mindfulness, and should be investigated further in future studies. Nevertheless, this discrepancy between this subscale and the other four may help to explain our findings.

The second part of hypothesis 4 was not supported. Interoceptive awareness was found to be positively associated with the suppression subscale of emotion regulation. Suppression is considered a response-focused form of emotion regulation; suppression happens after an emotional response has already developed. This kind of late-stage engagement of emotional processing tends to be less effective than earlier engagement because the emotional process has already gained force before modulation (Sheppes et al., 2011). In high, trait-like levels suppression is considered a maladaptive emotion regulation strategy, but it can be an adaptive strategy in certain situations.

Because interoceptive awareness was also associated with greater intensity of emotional experiences, the relationship of both suppression and the intensity of emotional experiences to interoceptive awareness may be related. Psychologists as far back as William James have claimed that feelings are derived from the individual’s perception of his or her bodily state (James, 1884). A study by Pollatos, Kirsch, and Schandry (2005) compared self-report scores of emotional arousal from a group of participants with high interoceptive awareness abilities and a group with low interoceptive awareness abilities. Each group’s respective interoceptive awareness abilities were assessed using a heartbeat perception task. Each group was shown unpleasant, pleasant, and neutral slides from the International Affective Picture System as stimuli and asked to rate their emotional
valence and arousal. Though no difference was found in the emotional valence ratings between the groups, the group made up of participants with high interoceptive awareness abilities reported significantly higher arousal ratings than the group with low interoceptive awareness. This result reflects the idea that interoceptive awareness is linked to the experience of emotions. Based on this idea, we think greater interoceptive awareness abilities may create a greater need to control the experience of intense emotions, thus leading to higher levels of suppression. This relationship remains an open question and should be investigated further in the future.

Hypothesis 5 stated that interoceptive awareness would be negatively associated with depression symptoms. The results of this study supported this hypothesis, as heart rate accuracy was found to be negatively associated with depression. These results were only as a trend level, but this was most likely due to our small sample size. We suspect that with a larger sample size this result would become significant. This association between better interoceptive awareness abilities and fewer self-reported depression symptoms reinforces the idea that interoceptive awareness is a protective factor and a component of healthy emotion regulation.

Limitations and Future Directions

The primary limitation of this study is the small sample size. Because of the strong effects found when the results were significant, we believe that with a larger sample size the results with only trend level significance would be significant. The high proportion of females in the sample also limited the study. Of the 19 participants
submitted for analysis, all but three were female. This may have biased the sample in a way that would not have happened with a more diverse sample.

In the future, the relationship between interoceptive awareness and the suppression subscale of emotion regulation should be examined further. The association between these two concepts was unexpected and may be explained by the relationship of interoceptive awareness to an increase in the intensity of emotions, but further study is needed to fully explain the connection. The relationship between interoceptive awareness and mindfulness was expected, but may need to be investigated further due to the discrepancy in the results on the act with awareness and observe experience subscales of the FFMQ. The discrepancy between the two FFMQ subscales may have been a result of the observe experience subscale not accurately measuring mindfulness, but it may also indicate a more nuanced relationship between interoceptive awareness and mindfulness than originally thought.
CHAPTER 6
REFERENCES


James, W. (1884). II.—What is an emotion?. Mind, (34), 188-205.


Rush, A. J., Trivedi, M. H., Ibrahim, H. M., Carmody, T. J., Arnow, B., Klein, D. N.,
Markowitz, J. C., Ninan, P. T., Kornstein, S., Manber, R., Thase, M. E., Kocsis, J.
H., & Keller, M. B. (2003). The 16-Item Quick Inventory of Depressive
Symptomatology (QIDS), clinician rating (QIDS-C), and self-report (QIDS-SR):
a psychometric evaluation in patients with chronic major depression. *Biological
psychiatry, 54*(5), 573-583.

Prevalence of alexithymia and its association with sociodemographic variables in
the general population of Finland. *Journal of psychosomatic research, 46*(1), 75
82.


Schmeichel, B. J. (2007). Attention control, memory updating, and emotion regulation
temporarily reduce the capacity for executive control. *Journal of Experimental
Psychology: General, 136*(2), 241.

Schmelz, M., Schmidt, R., Bickel, A., Handwerker, H. O., & Torebjörk, H. E.
Neuroscience, 17*(20), 8003-8008.


University Press.


