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ANGER AND SADNESS RUMINATION AND THEIR IMPACT ON MOMENTARY
CHANGES IN IMPULSIVITY AND PAIN TOLERANCE: IMPLICATIONS
FOR THE DEVELOPMENT OF SUICIDE RISK

by

Keyne Catherine Law

A Thesis
Submitted to the Graduate School
and the Department of Psychology
at The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Master of Arts

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May 2016
ABSTRACT

ANGER AND SADNESS RUMINATION AND THEIR IMPACT ON MOMENTARY CHANGES IN IMPULSIVITY AND PAIN TOLERANCE: IMPLICATIONS FOR THE DEVELOPMENT OF SUICIDE RISK

by Keyne Catherine Law

May 2016

Recent research in suicide has called for an increased focus on factors that facilitate an individual’s transition from suicidal ideation to action (Klonsky & May, 2015). Rumination, the repetitive fixation on negative emotional material, has been associated with not only increased suicidal ideation but also a history of self-injury and suicide attempts (Morrison & O’Connor, 2008), suggesting that it may contribute to the ability to inflict lethal and non-lethal self-harm. Given that past research has found physiological differences between low (ex. sadness) and high (ex. anger) arousal negative affective states, the present thesis project sought to compare the effects of anger and sadness ruminati on state pain tolerance and impulsivity to examine the mechanisms that underlie non-suicidal self-injury (NSSI) and suicidal behaviors. The moderating effect of suicide risk on the aforementioned relationships was also examined. A sample of 120 undergraduate students was randomly assigned into one of four conditions: control, anger, sadness, or anger with sadness and underwent an idiographic emotion (Pitman, Orr, Forgue, & de Jong, 1987) and rumination induction (Nolen-Hoeksema & Morrow, 1993). They also completed subjective and behavioral measures assessing emotion, impulsivity, and pain tolerance. Results were not supportive of the hypothesis that individuals who engage in anger (vs. sadness) rumination will experience greater levels
of state impulsivity and pain tolerance. Furthermore, suicide risk did not appear to impact the aforementioned relationships.
ACKNOWLEDGMENTS

This thesis project would not have been successful without the hard work and support of many individuals. First and foremost, I would like to express my deepest gratitude to my committee chair and major professor, Dr. Michael Anestis, for providing me with the opportunity to pursue this project, helping me refine my ideas, and easing my constant self-doubt and imposter syndrome. I would also like to thank my committee members, Dr. Bradley Green and Dr. Joye Anestis, for their suggestions, support, and encouragement.

I would also like to extend a deep and sincere gratitude to my team of research assistants: Ashleigh Woodmansee, Tyler Surber, Elizabeth Adams, Jennifer Adah, Abigail Hill, and Christina Jacobs for their time, hard work, initiative, positivity, and dedication throughout this project. The complexity and demands of this project required an effective and self-managing team, and I was very lucky to have one.
DEDICATION

In addition to those individuals who made my thesis project possible, I would also like thank to my undergraduate supervisors at Simon Fraser University, Dr. Alexander Chapman and Dr. Kathleen Slaney, and mentors, Dr. Katherine Dixon-Gordon and Dr. Brianna Turner, who believed in me and helped me get into graduate school. Finally, I am grateful for the past and present members of the Personality and Emotion Research Lab, my friends, my family, and my partner for their feedback, understanding, patience, unwavering emotional support, and frequent reminders to keep practicing self-care even during my worst moments.
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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td><em>ITS</em></td>
<td>The Interpersonal Theory of Suicide</td>
</tr>
<tr>
<td><em>3ST</em></td>
<td>The Three-Step Theory of Suicide</td>
</tr>
<tr>
<td><em>NSSI</em></td>
<td>Non-Suicidal Self-Injury</td>
</tr>
<tr>
<td><em>ARS</em></td>
<td>Anger Rumination Scale</td>
</tr>
<tr>
<td><em>RSS</em></td>
<td>Rumination on Sadness Scale</td>
</tr>
<tr>
<td><em>UPPS-P</em></td>
<td>Urgency, Premeditation, Perseverance, Sensation seeking, and Positive urgency</td>
</tr>
<tr>
<td><em>SITBI</em></td>
<td>Self-Injurious Thoughts and Behaviors Interview</td>
</tr>
<tr>
<td><em>PANAS</em></td>
<td>Positive and Negative Affect Schedule</td>
</tr>
<tr>
<td><em>IMT</em></td>
<td>Immediate Memory Task</td>
</tr>
<tr>
<td><em>DMT</em></td>
<td>Delayed Memory Task</td>
</tr>
<tr>
<td><em>CPT</em></td>
<td>Cold Pressor Task</td>
</tr>
<tr>
<td><em>ANOVA</em></td>
<td>Analysis of Variance</td>
</tr>
<tr>
<td><em>RM-ANOVA</em></td>
<td>Repeated Measures – Analysis of Variance</td>
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<tr>
<td><em>ANCOVA</em></td>
<td>Analysis of Covariance</td>
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CHAPTER I - INTRODUCTION

This thesis project sought to examine the differential effects of anger and sadness rumination on state fluctuations in pain tolerance and state expressions of impulsivity, respectively. Additionally, this project examined the moderating effect of level of suicide risk on the relationship between types of rumination and these outcomes. Gaining an understanding of the relationship between rumination, the emotional context of rumination, and state changes in impulsivity and pain tolerance provided an opportunity to further our understanding towards the cognitive and behavioral mechanisms that facilitate the transition from suicidal ideation to suicidal behaviors.

Suicide behaviors and Non-Suicidal Self-Injury (NSSI)

Suicide is the deliberate infliction of acute physical self-harm or intended physical harm with some intention to cause death (Centers for Disease Control and Prevention [CDC], 2011). In 2013, the Centers for Disease Control and Prevention (CDC, 2015) reported suicide to be the 10th leading cause of death in the U.S. across all ages, with an average of 112 deaths by suicide each day. Moreover, approximately 3.9% of U.S. adults reported having thoughts of suicide, 1.1% reported having made plans for suicide, and 0.6% reported a suicide attempt in the past year (CDC, 2015). The CDC estimates a societal cost of approximately $51 billion per year in combined medical bills and lost work due to suicide. Additionally, in 2013, the CDC (2015) found that 494,169 people were treated in the emergency room for non-fatal self-inflicted injuries and estimated a societal cost of approximately $10.4 billion in medical bills and lost work for non-fatal self-inflicted injuries.
While there are many individuals who have thought of suicide, only a minority of these individuals will make a suicide attempt; of those who attempt, only a small minority will die by suicide (e.g., CDC, 2012; Kessler, Berglund, Nock, & Wang, 2005; Nock, Borges, Bromet, Cha, Kessler, & Lee, 2008). Two prominent theories of suicide: the interpersonal-psychological theory (ITS; Joiner, 2005) and three step theory (3ST; Klonsky & May, 2015), emphasize that in addition to suicidal desire, an individual must possess the capability to progress from suicidal ideation to the act of making a lethal suicide attempt (Joiner, 2005; Klonsky & May, 2015). Within these models, it is assumed that most individuals with suicidal ideation or urges will never attempt or die by suicide because they lack the capability to overcome the highly distressing and physically painful nature of suicidal behaviors. Moreover, these models both suggest that the capability to engage in suicidal behaviors is not entirely innate but largely acquired through repeated exposure to painful, provocative, and potentially self-damaging behaviors involving physical pain. This repeated exposure would then lead to higher tolerance for pain and increased fearlessness of death/bodily harm (the two components of acquired capability for suicide) through habituation.

Non-suicidal self-injury (NSSI) is the direct and deliberate destruction of one's own body tissue in the absence of the intent to cause death (Gratz, 2003; Nock, Joiner, Gordon, Lloyd-Richardson, & Prinstein, 2006). It is a prevalent behavior, occurring in 4% of adults (Briere & Gil, 1998), 21-79% of psychiatric patients (Briere & Gil, 1998; Zanarini, Gunderson, Frankenburg & Chauncey, 1989), and 13-23% of adolescents (Muehlenkamp & Gutierrez, 2004, 2007; Walsh, 2006). Past research examining suicidal behaviors has consistently demonstrated that NSSI is associated with both thoughts of
suicide (Laye-Gindhu & Schonert-Reichl, 2005; Lloyd-Richardson, Perrine, Dierker & Kelley, 2007) and future suicide attempts, particularly when it is engaged in repeatedly (Cooper et al., 2005; Nock et al., 2006; Whitlock & Knox, 2007).

Behavioral Factors and the Capability for Lethal Self-Injury

One factor that has been found to be associated with the capability for suicide is increased levels of impulsivity (Bresin, Carter, & Gordon, 2013; Chapman, Gratz, & Brown, 2006; Glenn & Klonsky, 2010). Specifically, negative urgency, the tendency to respond impulsively to negative moods has been found to be greater in individuals with one or more prior suicide attempts compared to individuals with no attempts (Anestis & Joiner, 2011). It is important to note, however, that the relationship between impulsivity and suicidal behaviors is mediated by the acquired capability for suicide, likely due to the increased exposure to painful and provocative events like NSSI (Anestis et al., 2012; Bender, Gordon, Bresin, & Joiner, 2011). While impulsivity is often conceptualized as a trait that is expressed under particular circumstances, little research has examined potential factors that increase vulnerability to state expressions of impulsivity.

Examining the processes that lead to elevated levels of state impulsivity would allow us to understand how cognitions and emotions can increase the likelihood to engage in behaviors associated with impulsivity, such as NSSI. Through this understanding, we can deepen our knowledge towards potential cognitive and emotional mechanisms that contribute to the transition from suicidal ideation to the capability to tolerate pain and engage in suicidal behaviors.

Another factor that is associated with NSSI is one of the two components of acquired capability for suicide: pain tolerance. Pain tolerance can be understood as a
combination of the threshold for pain detection and ability to persist through pain. Pain tolerance has been found to mediate the relationship between painful and provocative behaviors (e.g., NSSI) and the acquired capability for suicide (Franklin, Hessel, & Prinstein, 2011). Indeed, past research comparing individuals who have engaged in NSSI and those with no history of NSSI has found that individuals with a history of NSSI possess a lower sensitivity and higher tolerance for pain (Bresin & Gordon, 2013; Hooley, Ho, Slater & Lockshin, 2010; McCoy, Fremouw, & McNeil, 2010; Russ et al., 1992; Russ, Campbell, Kakuma, Harrison, & Zanine, 1999). Furthermore, lack of physical pain during NSSI has been demonstrated to increase an individual’s risk of dying by suicide (Nock et al., 2006; Turner, Layden, Butler, & Chapman, 2013), thereby emphasizing the role of heightened pain tolerance in the acquired capability for suicide. The majority of research on pain tolerance, however, has focused on differences in baseline levels of pain tolerance between individuals with varying levels of acquired capability, with few considering changes in momentary fluctuations in pain tolerance. Ludäscher and colleagues (2009) found that pain perception returns to baseline following NSSI episodes. This suggests that, in addition to stable, trait-like differences, the processes associated with pain tolerance may also be associated with acute changes. Thus, it would be important to examine factors associated with momentary changes in pain tolerance because, in moments of heightened pain tolerance, individuals may be more inclined to engage in behaviors associated to self-injury and suicide. Moreover, engaging in self-injury and suicidal behaviors during a state of elevated pain tolerance may contribute to the development of greater baseline levels of pain tolerance and thus capability for lethal self-injury.
Cognitive and Emotional Factors and the Capability for Lethal Self-Injury

Taken together, the aforementioned research provided support for the notion that impulsivity is a factor influencing NSSI, through which baseline levels of pain tolerance and acquired capability for suicide are increased. Moreover, there seems to be evidence suggesting the presence of state changes in pain tolerance involved in NSSI episodes, potentially influencing subsequent baseline levels of pain tolerance and acquired capability for suicide.

A potential mechanism that may play a significant role in changing momentary levels of impulsivity and pain tolerance is rumination. Rumination is a cognitive process involving a negative, repetitive fixation on the causes and consequences of past events (Nolen-Hoeksema, 1991). Although often perceived by the individual as an effective coping strategy (Nolen-Hoeksema, Wisco & Lyubomirsky, 2008; Liverant, Kamholz, Solan, & Brown, 2011; Watkins & Baracaia, 2001), it has been found to consistently predict, maintain, and exacerbate negative mood and increase vulnerability to depressive affect (Nolen-Hoeksema, 1991; Nolen-Hoeksema et al., 2008). Rumination sustains the processing of negative emotion (McLaughlin, Borkovec, & Sibrava, 2007) which obstructs the ability to disengage from negative emotional material (LeMoult, Joormann, & Arditte, 2011). More specifically, rumination has been found to be associated not only with suicidal ideation but also with self-injury and suicide attempts (Morrison & O’Connor, 2008). As such, rumination may contribute to the ability to inflict lethal and non-lethal self-harm. In the emotional cascade model (Selby & Joiner, 2013), it is posited that rumination confers vulnerability to the use of painful and provocative means to cope with negative emotions. In this model, rumination intensifies emotions making it difficult
for the individual to disengage from rumination which creates a positive feedback loop amplifying negative affect. At the height of this emotional cascade, individuals are then at an elevated risk of using painful and provocative behaviors, such as NSSI, to distract or escape from the experience of the negative affect (Selby & Joiner, 2013). Additionally, Indeed, previous research has found that a large majority of individuals report the function of releasing emotional pressure as the central reason for engaging in NSSI (Klonsky, 2011). Moreover, it has been suggested that the presence of a negative affective state is a moderator between negative urgency and NSSI (Bresin et al., 2013) and is associated with pain perception regardless of whether or not the individual has a previous history of NSSI (Franklin, Aaron, Arthur, Shorkey, & Prinstein, 2012). Given the impact rumination has on generating intense levels of negative affect, it would then be important to understand how rumination contributes to impulsivity and pain perception and how they are associated with NSSI and suicide behaviors. Extant research has found psychiatric symptoms to be associated with risky behaviors only when the individual has moderate to high levels of rumination (Borders, McAndrew, Quigley, & Chandler, 2012). Furthermore, rumination has been found to be negatively associated with self-control (a potential proxy for impulsivity; Denson, Pedersen, Friese, Hahm, & Roberts, 2011) and positively associated with pain tolerance (Stimmel, Crayton, Rice, & Raffeld, 2006).

Present Study

Although an abundance of research has explored the role of rumination in a large variety of processes and behaviors, there has been dearth of experimental research comparing the differential effects of anger and sadness rumination. It has been
demonstrated that physiological differences exist between negative low arousal affective states (ex. sadness) and negative high arousal affective states (ex. anger; Marci, Glick, Loh, & Dougherty, 2007), which may contribute to differences in pain tolerance (Carter et al., 2002). Sadness rumination is characterized as the fixation on sad experiences and their implications (Nolen-Hoeksema, 1991), while anger rumination is defined as the recurrent processing of anger experiences and their implications such as recalling memories of the experience, trying to understand the causes of one’s experience, angry afterthoughts, and thoughts of revenge (Sukhodolsky, Golub, & Cromwell, 2001).

Existing evidence indicates that there may be differences in how sadness rumination and anger rumination influence negative affect (Baer & Sauer, 2011; Gilbert, Cheung, Irons, & McEwan, 2005; Peters, Geiger, Smart, & Baer, 2013). Furthermore, considering the differences in arousal states between anger and sadness (Marci et al., 2007), anger rumination and sadness rumination may have different effects on state expressions of impulsivity and momentary fluctuations in pain tolerance, which are associated with a variety of maladaptive behavioral outcomes (e.g., NSSI and suicidal behavior). Although no existing research studies have directly compared anger and sadness rumination on impulsivity, past studies have found that anger is often associated with high levels of energy, whereas sadness is often associated with slower cognitive and motor abilities (Ekman, 2003; Izard et al., 2000). These findings suggest that the speed of cognitive and physiological responses may differ in the context of anger and sadness. Furthermore, previous studies have linked anger rumination, specifically, to reduced self-control (Denson et al., 2011). There are also no studies directly comparing the effect of sadness and anger rumination on pain tolerance. In separate studies, however, the
induction of sadness has been found to result in significantly lower pain tolerance (Tang, Salkovskis, Hodges, Wright, Hanna, & Hester, 2008), whereas anger rumination has been linked to elevated levels of pain tolerance (Stimmel et al., 2006). Additionally, two recent studies found anger rumination to be more strongly related to depressive symptoms (Besharat, Nia, & Farahani, 2013) and borderline personality features (Baer & Sauer, 2011) than sadness rumination. Notably, both depressive symptoms (Davidson, Wingate, Grant, Judah, & Mills, 2011; Holma et al., 2010; Hawton, Comabella, Haw, & Saunders, 2013) and borderline personality features (Stringer et al., 2013) are often considered risks for suicide. These aforementioned findings suggest that the effects of anger rumination and sadness rumination may differ in their effects on suicidal behaviors and suicide risk.

Research in this area has also been limited by the use of descriptive or correlational research designs. As previously mentioned, few studies had directly compared the effects of anger rumination and sadness rumination, and even fewer studies have experimentally tested the effect of rumination and type of rumination on impulsivity and pain tolerance. As such, it is unclear how the two types of rumination would impact the variables of interest. This study was designed to compare the differential effects of laboratory-induced anger versus sadness rumination on state level changes in impulsivity and pain tolerance. Findings for this study could inform future studies examining the stability of impulsivity and pain tolerance and how it may relate to the capability to engage in lethal self-injury.

While type of rumination may be a significant factor in influencing state expressions of impulsivity and fluctuations in pain tolerance, individuals who are high in suicide risk may not respond in a manner similar to their counterparts who are low in
suicide risk. Past research has demonstrated that high levels of impulsivity, specifically the tendency to respond impulsively in the context of negative affect, is associated with suicide risk (Anestis & Joiner, 2011). Moreover, based on the ITS and 3ST models, individuals who are high in suicide risk already have increased levels of baseline pain tolerance (Franklin et al., 2011). Thus, it is likely that individuals who are elevated in suicide risk would have higher levels of state impulsivity and pain tolerance regardless of the emotion upon which they ruminate. In sum, this thesis project sought to test three hypotheses:

1. Anger rumination would lead to greater levels of state impulsivity compared to sadness rumination.
2. Anger rumination would lead to greater levels of pain tolerance compared to sadness rumination.
3. Suicide risk, determined by the presence of suicide ideation, plans, and preparation, will have an effect on the relationships being tested in Hypothesis 1 and 2. Specifically individuals who are high on suicide risk will have elevated levels of pain tolerance and impulsivity that are comparable across all types of rumination. This would indicate that type of rumination is not as salient amongst individuals already at elevated risk for suicidal behavior due to their already heightened levels of pain tolerance.
CHAPTER II - METHODS

Participants

Participants were 124 undergraduates (M<sub>age</sub>=21.03, SD=6.25; 83.9% female; 62.1% White) enrolled in psychology courses and recruited through the psychology research participation system. Of the participants, 32.3% (n=40) had thought about suicide in their lifetime, 10.5% (n=13) had thought about suicide in the past year, 9.7% (n=12) had previously made a plan for suicide, and 7.3% (n=9) had a history of at least one previous suicide attempt (M=2.33, SD=1.66, Range=1-6). Furthermore, 16.1% (n=20) of participants reported a history of NSSI. All demographic information is presented in Table 1.

Table 1

*Demographics for Overall Sample and Each Condition*

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Experimental Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>124</td>
<td>30</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range</td>
<td>18-57</td>
<td>18 - 46</td>
</tr>
<tr>
<td>Mean</td>
<td>21.03</td>
<td>20.93</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>6.25</td>
<td>5.56</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%Female</td>
<td>83.9</td>
<td>76.7</td>
</tr>
<tr>
<td>%Male</td>
<td>16.1</td>
<td>23.3</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%European American</td>
<td>62.1</td>
<td>60.0</td>
</tr>
<tr>
<td>%African American</td>
<td>31.5</td>
<td>33.3</td>
</tr>
<tr>
<td>%Hispanic American</td>
<td>3.2</td>
<td>3.3</td>
</tr>
<tr>
<td>%Native American</td>
<td>0.8</td>
<td>0</td>
</tr>
<tr>
<td>%Other</td>
<td>2.4</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>Suicidality</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>%Ideation</td>
<td>32.3</td>
<td>23.3</td>
</tr>
<tr>
<td>%Plans/Preparations</td>
<td>9.7</td>
<td>13.3</td>
</tr>
<tr>
<td>%Past Attempt</td>
<td>7.3</td>
<td>6.7</td>
</tr>
<tr>
<td>%NSSI</td>
<td>16.1</td>
<td>16.7</td>
</tr>
</tbody>
</table>

Note: NSSI = Non-suicidal self-injury
Participants completed the online portion of the study through a secure link and were subsequently invited to the Suicide and Emotion Dysregulation Lab at The University of Southern Mississippi to complete the laboratory portion of the study. In order to minimize potential of third variable effects on pain tolerance variables, participants were asked to refrain from taking analgesics (e.g., aspirin, acetaminophen) and other pain suppressants for at least eight hours (Bender, Anestis, Anestis, Gordon, & Joiner, 2012), and ingesting sugared foods and alcoholic beverages for at least one hour prior to their scheduled appointment (Mercer & Holder, 1997). Following the laboratory session, participants were debriefed and compensated with course credit.

Measures and Manipulations

*Online self-report questionnaire battery*

*Trait tendencies towards anger rumination.* The Anger Rumination Scale (ARS; Sukhodolsky et al., 2001) was used to account for trait anger rumination tendencies. The ARS is a 19-item self-report questionnaire assessing how often individuals tend to engage in thoughts associated with rumination in the context of anger. Items are rated on a 4-point scale from 0 (almost never) to 4 (almost always), with higher scores representing a higher tendency towards anger rumination. The ARS also contains four subscales measuring aspects of anger ruminative tendencies: angry afterthoughts, thoughts of revenge, angry memories, and understanding of causes. In past studies, the ARS has demonstrated good test-retest reliability and convergent validity in samples of university students (Sukhodolsky et al., 2001). In the current sample, the ARS demonstrated good internal consistency ($\alpha = .95$).
**Trait tendencies towards rumination on sadness.** The Rumination on Sadness Subscale (RSS; Conway, Csank, Holm, & Blake, 2000) was used to account for trait tendencies to ruminate on sadness. The RSS is a 13-item self-report questionnaire assessing how often individuals engaged in thoughts associated with rumination in the context of sadness. Items are rated on a 5-point scale ranging from 1 (not at all) to 5 (very much), with higher scores representing a higher tendency towards rumination on sadness. The RSS has demonstrated good internal consistency and convergent validity in samples of university students (Conway et al., 2000). In the current sample, the RSS demonstrated good internal consistency ($\alpha = .94$).

**Trait tendencies towards impulsivity.** The UPPS-P Impulsive Behavior Scale (UPPS-P; Whiteside & Lynam, 2001) was used to measure trait levels of impulsivity. Items are rated on a 4-point scale from 1 (Agree strongly) to 4 (Disagree strongly) and reverse scored such that higher scores represent more pathological levels of impulsivity. The UPPS-P contains five subscales measuring aspects of impulsivity: negative urgency, (lack of) premeditation, (lack of) perseverance, sensation seeking, and positive urgency. The current study specifically used the negative urgency subscale to measure impulsivity in the context of negative emotions. The UPPS-P has demonstrated good internal consistency and concurrent validity in past studies using university student samples (Magid & Colder, 2007). In the present study, the negative urgency subscale of the UPPS-P demonstrated good internal consistency ($\alpha = .77$).

**Laboratory Suicide Risk Assessment**

**Self-injurious thoughts and behaviors.** Suicide risk was determined at baseline by the number of days experiencing suicide ideation during the participants’ lifetime, using
the Self-Injurious Thoughts and Behaviors Interview (SITBI; Nock, Holmberg, Photos, & Michel, 2007). The SITBI is a structured interview which assesses the presence, age of onset, frequency, and severity of suicide related thoughts and behaviors, such as suicide attempts, gestures, plans, ideation, and NSSI. In past studies, the SITBI has demonstrated strong inter-rater reliability and test-retest reliability, as well as strong concurrent and convergent validity (Nock et al., 2007). We did not measure inter-rater reliability or test-retest reliability in this sample.

Laboratory Measures

Subjective emotional state. The Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) was used to evaluate the subjective emotional state of participants at baseline, after the emotion induction procedure, and after the rumination induction procedure. Participants provided ratings on 10 positive emotion items and 10 negative emotion items, which represented how they were feeling “right now, at the present moment” using a 5-point scale where 1= not at all or very slightly and 5= very much. An additional item (anger) was added to the original 20-item PANAS to allow for the measurement of specific emotions associated with the emotion and rumination induction procedures using an “anger” and “sadness” item. The PANAS has shown good test-retest reliability in past studies using a sample of students (Watson et al., 1988) as well as good convergent validity (MacKinnon et al., 1999). In the current sample, both the positive (a=.89) and the negative (a=.86) affect scales of the PANAS demonstrated good internal consistency.

Baseline and state impulsivity. The Immediate and Delayed Memory Tasks (IMT/DMT; Dougherty, Marsh, & Mathias, 2002) was used as a behavioral measure of
impulsivity. The IMT/DMT is a continuous performance test involving the comparison of numbers and selective responses to target stimuli (i.e. matching number) and avoiding responses to non-target stimuli (i.e. different number) that are rapidly presented consecutively within 0.5 seconds (IMT) or following a filter sequence (e.g. 16375) which delays the presentation of the target stimuli by 3.5 seconds (DMT). The IMT/DMT also includes catch stimuli (which match on all but one digit with the target), which require a longer information processing period to distinguish from the target sequence. Individuals who are high in impulsivity have a tendency to respond incorrectly to catch stimuli more frequently because they tend to respond prior to the completion of information processing, indicating response initiation impulsivity. Impulsivity was determined by the ratio of commission errors (responses to catch stimuli) to correct responses using the formula: (Number of commission errors / number of catch trials) / (Number of correct detections / number of target trials).

*Baseline and state pain tolerance.* The cold pressor test (CPT) was used to examine participants’ pain threshold and ability to tolerate and persist through pain past the pain threshold. The CPT is a frequently used pain induction procedure in studies examining NSSI (e.g., Bohus, Limberger, Ebner, Glock, Schwarz, Wernz, et al., 2000; Russ, Roth, Lerman, Kakuma, Karrison, Shindledecker, Hull et al., 1992; Gratz, Hepworth, Tull, Paulson, Clarke, Remington, et al., 2011). Participants were asked to submerge their hand, up to their wrist, in a cooler containing a mixture of water and crushed ice maintained at 2°C with a water circulator that prevents the water surrounding the participant’s hand from warming. Participants were asked to alternate hands (dominant/non-dominant) between the first trial and the second trial; furthermore, hand
order was counterbalanced across trials. Pain tolerance was operationalized as the time elapsed until the participants pulled their hand out of the water and indicated that they could no longer tolerate the pain. A two-minute time limit was used for the task to reduce outliers as past studies have found that participants seldom continue past two minutes and those that do often continue due to a numbed sensation in their hand (Franklin et al., 2012). Time elapsed was measured and recorded using a timer, which began when the participant’s hand was submerged and stopped at pain tolerance. Participants were asked to indicate their subjective level of pain on a scale of 1 (barely perceptible pain) to 10 (most intense pain imaginable) at the moment they reach pain tolerance. Due to the nature of this task, individuals with Reynaud’s syndrome were excluded from the study.

**Experimental Manipulations.**

*Emotion induction.* An adapted version of the Pitman Protocol (Pitman et al., 1987) was used to induce the emotional contexts, in which participants ruminated, using personalized script driven imagery. In the online stage of the study, participants were asked to write for 10 minutes about a situation where they felt sad or angry (or sad and angry) and to include specific details about the sequence of events, people involved, context, descriptions of thoughts, feelings, and physical reactions that were experienced. They were then asked to indicate bodily sensations and emotions they experienced during the event from two separate lists. Finally, they were asked to list the thoughts they had during the situation they described. The narrative and relevant information acquired from the participants were then combined and written into scripts between 350 and 550 words in length and subsequently recorded into two-minute audio files using simple, direct
language in the active voice and in the second person. The audio file was then played to the participant during the experimental session.

**Rumination induction.** To induce rumination, the original rumination induction protocol developed by Nolen-Hoeksema & Morrow (1993) was adapted, in terms of verb tense, to guide participants to think about their emotional state, within the context of the event they heard during the emotion induction. Participants were delivered 45 items (e.g., “think about why people treated you the way they did,” “think about why you reacted the way you did.”) through a series of slides over the course of 8 minutes.

**Procedures**

**Laboratory Procedures**

Prior to being implemented, the current study protocol was approved by The University of Southern Mississippi’s Institutional Review Board. Once participants reviewed the informed consent form and consented to participate in the study, they were asked to complete a battery of online questionnaires. They were then randomly assigned to receive instructions to a control condition where they described the room they were in (n=30) or an experimental condition where they provided a narrative describing an event that made them feel a) angry but not sad (n=39), b) sad but not angry (n=31), or c) angry and sad (n=24) using the Pitman Protocol (Pitman et al., 1987). Participants were then invited to participate in the second stage of the study, which took place in the Suicide and Emotion Dysregulation laboratory at The University of Southern Mississippi. These narratives were written into scripts and recorded into an audio file to increase immersion into the personalized imagery task used for the emotion induction procedure prior to the participant’s scheduled laboratory session. Participants who did not provide enough
detail in their narrative to elicit emotion (e.g. only provided 2-3 sentences) were not invited to the second stage of the study.

In the laboratory session, participants completed an interview assessing suicide risk, a battery of questionnaires measuring baseline emotion (PANAS; Watson et al., 1988), and underwent the IMT/DMT (Dougherty et al., 2002) and CPT to measure baseline levels of impulsivity and pain tolerance. The two behavioral tasks were counterbalanced to control for possible order effects. Participants were then guided through a personalized idiographic emotion induction using the audio file recorded from the narrative they provided in the first stage of the study. They were then asked to complete the PANAS to measure change in emotion following the emotion induction procedure. Subsequently, participants were guided through the rumination induction procedure (Nolen-Hoeksema & Morrow, 1993), which was followed by the PANAS (Watson et al., 1988) to measure change in emotion after the rumination induction procedure. They then completed the IMT/DMT (Dougherty et al., 2002) and CPT a second time to test for changes in state impulsivity and pain tolerance. Again, the two tasks were counterbalanced to account for potential order effects. Finally, the participants completed the PANAS to measure the recovery of emotion. Suicide risk was assessed, again, at the end of the study as a means to ensure the participants’ safety after leaving the laboratory. Participants were also debriefed and provided with coping skills and local/national counseling services. All self-report questionnaires in the laboratory session were completed on laboratory computers. Behavioral measures (IMT/DMT and CPT) were administered by trained research assistants.
Data Analytic Procedures

Subjective emotional state and manipulation check. To determine if the emotion and rumination inductions produced the intended effect on the participants, a 4 (Time: Baseline vs. Post-Emotion vs. Post-Rumination vs. Recovery) X 4 (Neutral vs. Anger Only vs. Sadness Only vs. Anger and Sadness) repeated measure ANOVA (RM-ANOVA) and subsequent Bonferroni-corrected pairwise comparisons were used to test for main and interaction effects of Time and Condition on subjective emotional state (positive affect subscale, negative affect subscale, sad item, anger item). Based on previous studies using similar forms of experimental manipulations (e.g., Ciesla & Roberts, 2007; Rusting & Nolen-Hoeksema, 1998; Wisco & Nolen-Hoeksema, 2009), a significant increase in negative affect and items relevant to the assigned Condition (anger and sadness) between baseline and post-emotion induction was expected. It was also predicted that a significant increase between post-emotion induction and post-rumination induction would be observed. Finally, negative affect and items relevant to the Conditions were expected to decrease and return to baseline between post-rumination induction and at the end of the laboratory session. The opposite effects were anticipated for positive affect.

Primary Analyses. To test the aforementioned hypotheses, a series of hierarchical regression analyses were conducted. The Condition variable (Neutral vs. Anger vs. Sadness vs. Anger/Sadness) was first recoded into dummy variables in preparation for the proposed regression analyses, such that the three experimental conditions would be compared to the neutral condition embedded in the constant. Two separate models were used to test Hypothesis 1 (anger rumination would lead to greater levels of state
impulsivity compared to sadness rumination) and Hypothesis 2 (anger rumination would lead to greater levels of state pain tolerance compared to sadness rumination). In step 1 of the regression analysis for both models, relevant demographic variables, depression, and trait tendencies were entered as covariates. In step 2, the main effect of Condition (anger vs. sadness vs. anger and sadness vs. neutral) was entered into the models. In step 3, Suicide Risk was entered into the models to determine if there was a main effect of suicide risk, and in step 4 the interaction terms between Condition and Suicide Risk were entered into the models to test the moderation effect of suicide risk proposed in Hypothesis 3 (individuals who are high on suicide risk would have elevated levels impulsivity regardless of type of rumination). Changes in state impulsivity and pain tolerance following the emotion and rumination induction, calculated by subtracting post-manipulation scores from baseline scores, served as the outcome variables.
CHAPTER III - RESULTS

Examination of Distributions

Due to the presence of significant skew and kurtosis, suicide risk ($\gamma_1=10.94$, $\gamma_2=120.98$), IMT Ratio ($\gamma_1=-9.47$, $\gamma_2=97.93$), change in pain threshold ($\gamma_1=-2.54$, $\gamma_2=12.24$), and change in pain tolerance ($\gamma_1=-2.36$, $\gamma_2=9.26$) were rank transformed using Blom’s formula. This resulted in acceptable levels of both skew ($\gamma_1<|1.27|$) and kurtosis ($\gamma_2<|.490|$; Kline, 2011). The Huynh-Feldt correction was applied to violations of sphericity.

Selection of Covariates

To determine an appropriate list of covariates, we first examined zero-order correlations amongst continuous demographic variables (age, depressive symptoms), moderator (suicide risk), and dependent variables (impulsivity and pain variables). Results indicated that age did not significantly correlate with any variables (all $p$s>.250) and thus was not included as covariates in the primary analyses.\(^1\)

Next, a series of analyses of variance (ANOVAs) was conducted to determine the influence of categorical demographic variables (race, sex) on the moderator, and

\(^1\)Given that depressive symptoms are often associated with suicide risk (Hawton et al., 2013), we conducted exploratory analyses including depressive symptoms as a covariate to ensure the specificity of our models. The addition of depressive symptoms, however, did not impact the results. As such, depressive symptoms were excluded from the final model to increase parsimony.
dependent variables. Race and sex did not differ on changes in any variables (all $p$s > .074) and thus were not included as covariates in the primary analyses. Lastly, as proposed, trait tendencies for anger rumination, sadness rumination, and impulsivity (negative urgency) were included as covariates in the primary analyses to account for the possibility that trait may impact the effect of the experimental manipulations.

Subjective Emotional State and Manipulation Check

Positive Affect

An interaction effect was found between Time and Condition on positive affect ($F(8.791, 295.965) = 2.303, p = .017, η^2 = .064$). Specifically, individuals in the Neutral, Anger Only, and Anger and Sadness conditions reported a significant decrease in positive affect between Baseline (Neutral: $M=23.167$, $SD=7.087$; Anger: $M=21.667$, $SD=7.979$; Anger and Sadness: $M=21.350$, $SD=7.228$) and Recovery (Neutral: $M=18.833$, $SD=8.575$, $p=.008$; Anger: $M=17.194$, $SD=6.427$, $p<.001$; Anger and Sadness: $M=16.800$, $SD=7.482$, $p = .012$) but not at Post-Emotion and Post-Rumination (all $p$s > .153). Individuals in the Sadness Only condition reported a significant decrease in positive affect following Baseline ($M=27.000$, $SD=9.156$), at Post-Emotion ($M=20.240$, $SD=8.666$, $p<.001$), Post-Rumination ($M=20.160$, $SD=7.526$, $p<.001$), and Recovery ($M=21.000$, $SD=7.509$, $p<.001$).
An interaction effect was found between Time and Condition on negative affect (F(7.149, 221.625) = 3.518, \( p = .001 \), \( \eta^2 = .102 \)). As expected, individuals in the Neutral condition did not report a significant increase in negative affect between all four time points. Individuals in the Anger Only condition reported a significant decrease in negative affect between Post-Emotion (M=16.057, SD=8.629) and Recovery (M=12.914, SD=5.266, \( p = .18 \)). Individuals in the Sadness Only condition reported a significant increase in negative affect between Baseline (M=14.952, SD=7.406) and Post-Emotion (19.095, SD=6.999, \( p = .046 \)). They also reported a significant decrease in negative affect at Recovery (M=13.571, SD=6.368) from Post-Emotion (\( p < .001 \)) and Post-Rumination (M=16.667, SD=7.364, \( p = .001 \)). Finally, individuals in the Anger and Sadness Condition reported significant decreases in negative affect following Post-Emotion (M=19.500, SD=7.710) at Post-Rumination (M=15.444, SD=6.862, \( p = .019 \)) and Recovery.
They also demonstrated a further significant decrease in negative affect between Post-Rumination and Recovery ($p=.025$).

![Figure 2. Changes in Negative Affect](image)

### Figure 2. Changes in Negative Affect

#### Anger

An interaction effect was found between Time and Condition on anger ($F(7.783, 29.575) = 3.384, p=.001, \eta^2=.083$). As expected, when compared to those in the Neutral condition ($M=1.071, SD=.262$) at Post-Emotion, individuals in the Anger Only ($M=1.921, SD=1.323, p=.015$) and Anger and Sadness conditions ($M=2.318, SD=1.460, p=.001$) reported greater levels of anger. These differences were not found at Baseline, Post-Rumination, and Recovery. Furthermore, within the Anger as well as Anger and Sadness conditions, there were significantly greater levels of anger at Post-Emotion when compared to Baseline (Anger: $M=1.237, SD=.675, p<.001$; Anger and Sadness: $M=1.636, SD=1.255, p=.013$), Post-Rumination (Anger: $M=1.447, SD=.891, p=.022$; Anger and Sadness: $M=1.682, SD=1.249, p=.018$), and Recovery (Anger: $M=1.158, SD=1.575, p=.001$, Sadness: $M=1.523, SD=1.554, p=.001$).
SD=.437, $p<.001$; Anger and Sadness: $M=1.500$, SD=.889, $p=.005$). Within the Sadness condition, there was a significant increase in anger only between Baseline ($M=1.179$, SD=.612) and Post-Emotion ($M=1.921$, SD=1.323, $p=.037$).

![Figure 3. Changes in Anger](image)

**Figure 3. Changes in Anger**

**Sadness**

Contrary to our expectations, no significant interaction ($p=.448$) or main ($p=.194$) effect of Condition were found on the “Sad” item of the PANAS. There was, however, a main effect of Time ($F(2.224, 255.797) = 7.543, p<.001, \eta^2=.062$) such that individuals reported a significant increase in sadness between Baseline ($M=1.286$, SD=.715) and Post-Emotion ($M=1.555$, SD=1.133, $p=.001$). There was also a significant decrease in sadness between Post-Emotion and Recovery ($M=1.219$, SD=.715, $p=.001$).
Primary Analyses

Impulsivity

Descriptive data and intercorrelations for the variables utilized in the primary analyses for impulsivity are provided in Table 2. Prior to using the change in IMT and DMT scores in the analyses, we first examined whether or not these scores were significantly different between baseline and the experimental manipulations using a repeated measures ANOVA (RM-ANOVA). We found that there was a significant decrease in IMT scores from baseline (M=.420, SD=.345) to post-manipulation (M=.340, SD=.175, $p=.006$, $\eta^2=.066$). There was, however, no significant change in DMT scores from baseline (M=.400, SD=.290) to post-manipulation (M=.407, SD=.273, $p=.778$).

Immediate Memory Task

No significant main effect of Condition ($R^2=.167$, $F(3, 92) =4.912, p=.272$) was found on changes in IMT scores. Neither Suicide Risk ($\Delta R^2<.001$, $\Delta F(1, 91)=.012$, $p=.912$) nor the interactions between Condition and Suicide Risk ($\Delta R^2=.058$, $\Delta F(3,$
88)=2.198, \( p=.094 \) significantly contributed to changes on IMT scores. See Table 3 for regression coefficients.
Table 2

Descriptive data and intercorrelations for variables used in analyses of impulsivity.

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Change in IMT Ratio</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Baseline IMT Ratio</td>
<td>-0.21**</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Change in DMT Ratio</td>
<td>0.05</td>
<td>-0.02</td>
<td>1.00</td>
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<td>4. Baseline DMT Ratio</td>
<td>-0.10</td>
<td>0.64***</td>
<td>-0.24**</td>
<td>1.00</td>
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<td></td>
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<tr>
<td>5. Suicide Risk</td>
<td>0.02</td>
<td>0.02</td>
<td>-0.31***</td>
<td>0.21*</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Trait Sadness Rumination</td>
<td>0.07</td>
<td>0.06</td>
<td>0.07</td>
<td>0.09</td>
<td>0.32***</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Trait Anger Rumination</td>
<td>0.09</td>
<td>0.03</td>
<td>0.05</td>
<td>0.17**</td>
<td>0.24**</td>
<td>0.54***</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>8. Trait Negative Urgency</td>
<td>0.16</td>
<td>0.04</td>
<td>-0.11</td>
<td>0.07</td>
<td>0.19*</td>
<td>0.23**</td>
<td>0.38***</td>
<td>1.00</td>
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<tr>
<td>Mean</td>
<td>-0.05</td>
<td>0.38</td>
<td>-0.02</td>
<td>0.39</td>
<td>0.08</td>
<td>33.34</td>
<td>36.13</td>
<td>26.95</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>0.09</td>
<td>0.18</td>
<td>0.16</td>
<td>0.27</td>
<td>0.76</td>
<td>12.71</td>
<td>12.23</td>
<td>5.74</td>
</tr>
</tbody>
</table>

Note: *p significant at .05, **p significant at .01, ***p significant at .001.
### Table 3

**Regression coefficients for changes in Immediate Memory Task (IMT)**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>.131**</td>
<td>.036</td>
<td>&lt;.001</td>
<td>.058</td>
</tr>
<tr>
<td>Covariates</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trait Sadness Rumination</td>
<td>0.025</td>
<td>-0.002</td>
<td>0.002</td>
<td>0.005</td>
</tr>
<tr>
<td>Trait Anger Rumination</td>
<td>0.028</td>
<td>0.045</td>
<td>0.046</td>
<td>0.032</td>
</tr>
<tr>
<td>Trait Negative Urgency</td>
<td>0.146</td>
<td>0.137</td>
<td>0.139</td>
<td>0.197</td>
</tr>
<tr>
<td>Baseline IMT Ratio</td>
<td>-0.343***</td>
<td>-0.346***</td>
<td>-0.347***</td>
<td>-0.388***</td>
</tr>
<tr>
<td>Conditions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger Only</td>
<td>-0.231</td>
<td>-0.23</td>
<td>-0.213</td>
<td></td>
</tr>
<tr>
<td>Sadness Only</td>
<td>-0.146</td>
<td>-0.144</td>
<td>-0.103</td>
<td></td>
</tr>
<tr>
<td>Anger and Sadness</td>
<td>-0.069</td>
<td>-0.069</td>
<td>-0.055</td>
<td></td>
</tr>
<tr>
<td>Suicide Risk</td>
<td>-0.012</td>
<td>-0.304</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger x Suicide Risk</td>
<td>0.348**</td>
<td></td>
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</tr>
<tr>
<td>Sadness x Suicide Risk</td>
<td>0.063</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger Sadness x Suicide Risk</td>
<td>0.122</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *p significant at .05, **p significant at .01, ***p significant at .001.

**Delayed Memory Task**

In terms of changes in DMT scores, no significant main effect of Condition was found (R²=.101, F(3, 90) =2.680, p=.715). The addition of Suicide Risk, however, significantly predicted changes in DMT scores above and beyond Condition (ΔR²=.081, ΔF(1, 89)=8.828, β=-.310, p=.004) such that increases in Suicide Risk led to greater decreases in DMT scores. The interactions between Condition and Suicide Risk (ΔR²=.031, ΔF(3, 86)=1.134, p=.340) did not significantly contribute to changes on DMT scores. See Table 4 for regression coefficients.
Table 4

**Regression coefficients for changes in Delayed Memory Task (DMT)**

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>R^2</strong></td>
<td>0.087</td>
<td>0.014</td>
<td>.081**</td>
<td>0.031</td>
</tr>
<tr>
<td><strong>Covariates</strong></td>
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<tr>
<td>Trait Sadness Rumin</td>
<td>0.041</td>
<td>0.06</td>
<td>0.141</td>
<td>0.152</td>
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<tr>
<td>Trait Anger Rumin</td>
<td>0.114</td>
<td>0.109</td>
<td>0.123</td>
<td>0.136</td>
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<tr>
<td>Trait Negative Urgency</td>
<td>-0.157</td>
<td>-0.161</td>
<td>-0.121</td>
<td>-0.118</td>
</tr>
<tr>
<td>Baseline DMT Ratio</td>
<td>-0.253*</td>
<td>-0.254*</td>
<td>-0.209*</td>
<td>-0.216*</td>
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<tr>
<td><strong>Conditions</strong></td>
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<tr>
<td>Anger Only</td>
<td>0.085</td>
<td>0.129</td>
<td>0.135</td>
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<tr>
<td>Sadness Only</td>
<td>-0.029</td>
<td>0.035</td>
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<tr>
<td>Anger and Sadness</td>
<td>-0.045</td>
<td>-0.02</td>
<td>-0.017</td>
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<tr>
<td>Suicide Risk</td>
<td></td>
<td>-0.31**</td>
<td>-0.371</td>
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<tr>
<td><strong>Interactions</strong></td>
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<tr>
<td>Anger x Suicide Risk</td>
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<td>0.008</td>
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<tr>
<td>Sadness x Suicide Risk</td>
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<td>0.169</td>
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<tr>
<td>Anger Sadness x Suicide Risk</td>
<td></td>
<td>-0.081</td>
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<td></td>
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</tbody>
</table>

Note: *p significant at .05, **p significant at .01, ***p significant at .001.

**Pain Tolerance**

Descriptive data and intercorrelations for the variables utilized in the primary analyses for pain tolerance variables are provided in Table 5.
Table 5

Descriptive data and intercorrelations for variables used in analyses of pain tolerance

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
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<th>4</th>
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<tbody>
<tr>
<td>1. Change in Pain Tolerance</td>
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<tr>
<td>2. Baseline Pain Tolerance</td>
<td>-0.50***</td>
<td>1.00</td>
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<tr>
<td>3. Suicide Risk</td>
<td>0.10</td>
<td>-0.22**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Trait Sadness Rumination</td>
<td>-0.07</td>
<td>0.09</td>
<td>0.24**</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>5. Trait Anger Rumination</td>
<td>-0.03</td>
<td>-0.03</td>
<td>0.27**</td>
<td>0.55***</td>
<td>1.00</td>
</tr>
<tr>
<td>Mean</td>
<td>-9.84</td>
<td>41.13</td>
<td>0.06</td>
<td>32.72</td>
<td>36.39</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>19.06</td>
<td>31.55</td>
<td>0.73</td>
<td>12.79</td>
<td>12.96</td>
</tr>
</tbody>
</table>

Note: *p significant at .05, **p significant at .01, ***p significant at .001.

Prior to using the changes in each pain variable in the analyses, we first examined whether or not these scores were significantly different between baseline and the experimental manipulations using an RM-ANOVA. There were significant decreases in pain tolerance from baseline (M=40.93, SD=31.067) following the experimental manipulations (M=31.260, SD=27.118; p<.001, \( \eta^2 = .214 \)).

No significant main effect of Condition (\( R^2 = .160, F(3, 105) = 6.739, p = .653 \)) was found on changes in Pain Tolerance. Neither Suicide Risk (\( \Delta R^2 < .001, \Delta F(1, 104) = .028, p = .868 \)) nor the interactions between Condition and Suicide Risk (\( \Delta R^2 = .015, \Delta F(3, 101) = .593, p = .621 \)) significantly contributed to changes on Pain Tolerance. See Table 6 for regression coefficients.
### Table 6

Regression coefficients for changes in pain tolerance

<table>
<thead>
<tr>
<th></th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>$R^2$</strong></td>
<td>.147***</td>
<td>0.013</td>
<td>&lt;.001</td>
<td>.015</td>
</tr>
<tr>
<td><strong>Covariates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trait Sadness Ruminat</td>
<td>-0.019</td>
<td>-0.015</td>
<td>-0.012</td>
<td>-0.01</td>
</tr>
<tr>
<td>Trait Anger Ruminat</td>
<td>-0.063</td>
<td>-0.063</td>
<td>-0.06</td>
<td>-0.079</td>
</tr>
<tr>
<td>Baseline Pain Tolerance</td>
<td>-0.376***</td>
<td>-0.380***</td>
<td>-0.384***</td>
<td>-0.373***</td>
</tr>
<tr>
<td><strong>Conditions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger Only</td>
<td>0.037</td>
<td>0.039</td>
<td>0.027</td>
<td></td>
</tr>
<tr>
<td>Sadness Only</td>
<td>-0.091</td>
<td>-0.089</td>
<td>-0.096</td>
<td></td>
</tr>
<tr>
<td>Anger and Sadness</td>
<td>-0.046</td>
<td>-0.045</td>
<td>-0.056</td>
<td></td>
</tr>
<tr>
<td>Suicide Risk</td>
<td>-0.016</td>
<td>0.086</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Interactions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger x Suicide Risk</td>
<td>-0.117</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sadness x Suicide Risk</td>
<td>-0.092</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger Sadness x Suicide Risk</td>
<td>0.041</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *$p$* significant at .05, **$p$** significant at .01, ***$p$** significant at .001.
CHAPTER IV - DISCUSSION

This study sought to experimentally test the differential effects of laboratory induced anger versus sadness rumination on state level changes in impulsivity and pain tolerance. Furthermore, suicide risk was examined as a potential factor moderating the aforementioned relationships. Impulsivity (when the response was immediate) and pain tolerance were found to be malleable at the state level. The results from the primary analyses of this study, however, were largely inconsistent with the hypotheses that anger rumination and not sadness rumination would lead to greater increases of both state impulsivity and pain tolerance between baseline and after rumination. Consistent with existing research, individuals with increasing levels of suicide risk exhibited greater increases in impulsivity (Dougherty et al., 2009). This effect, however, was only found when participants were required to wait before responding to the stimulus and not when they were asked to immediately respond to the stimulus. It may be possible that the emotional distress generated by the experimental manipulation in combination with the delay in response may have exacerbated negative urgency in participants with elevated levels of suicide risk. Impulsivity, when there is a delay between the stimulus and the response, however, appears to be a relatively stable, as it did not exhibit significant changes following the experimental manipulations.

While the results of this study provide us with novel information regarding the malleability of pain tolerance and impulsivity and how they may be impacted by emotion and rumination, there are several limitations that warrant caution in the interpretation and generalization of these findings. Given that our results did not support our hypotheses, the models that were specified may not have been correct. The specific act of ruminating
on an emotion may not be a factor that meaningfully contributes to changes in impulsivity and pain tolerance. Rather, it may be the emotional experience, and its intensity, that drives the mechanisms leading to changes in the ability to tolerate pain (Carter et al., 2002) and manage impulsivity (Muhlert & Lawrence, 2015). Rumination is also a coping method often used as a means to avoid the direct experience of emotions (Nolen-Hoeksema et al., 2008). Thus, the rumination induction may have provided participants with the opportunity to avoid experiencing the emotion generated in the emotion induction. Alternatively, perhaps the secondary emotions and behaviors born out of rumination such as self-blame, shame, agitation (Law & Chapman, 2013; Tucker et al., n.d.) are more salient than rumination at influencing changes in pain tolerance and impulsivity.

The methodology of this study may also have obstructed our ability to effectively test our hypotheses. Firstly, the experimental manipulation procedures did not yield the intended effects. Although the manipulations were effective in decreasing positive affect in all conditions and increasing negative affect in the experimental conditions, the two conditions involving sadness did not yield greater reports of sadness following the emotion induction procedures when compared to the other two conditions. This suggests that the sadness emotion induction may have failed at eliciting sufficient sadness to impact impulsivity and pain tolerance. Moreover, the experience of negative emotions may be characterized by mixed emotions. Asking participants to ruminate upon anger without sadness and sadness without anger may have resulted in a less ecologically valid representation of rumination in negative emotional experiences.
Both the emotion induction and rumination induction procedures were selected due to their ability in past studies to elicit the expected emotional effects when compared to control and alternative conditions (Pitman et al., 1987; Rusting & Nolen-Hoeksema, 1998). Furthermore, based on current theories and past studies, it was expected that rumination would increase the intensity of the emotion generated by the emotion induction procedures. The greatest level of negative affect, however, was found after the emotion induction and its intensity decreased following the rumination induction procedure. Past studies using this combination of emotion and rumination induction procedures did not assess for changes in emotion between the two induction procedures (Law & Chapman, 2014). The addition of a measure of subjective emotional state between the two tasks may have decreased the effect of the combined emotion and rumination inductions. As such the anger and sadness rumination induced in our laboratory did not mimic past studies that have demonstrated success in using the combination of the emotion and rumination induction protocols and may not be the same as anger and sadness rumination as it occurs in a natural setting.

Other potential factors that may have contributed to this decrease in negative emotions in between the two experimental manipulations may be the presentation of the emotion and rumination induction procedures. The emotion induction was personalized and presented with audio instructions while the rumination induction was generic and only presented as a series of slides that participants were asked to read. This difference may have impacted the participants’ level of immersion in the task. It may be beneficial for future studies to consider presenting both emotion and rumination inductions using an
audio format or combining the emotion and rumination induction tasks by injecting prompts for ruminative thinking into the participant’s personalized scripts.

Given the low base rate of suicide risk in undergraduate populations, the ability to detect the potential moderating role of suicide on rumination, impulsivity, and pain tolerance may have been obstructed. Thus, future research on community and clinical samples is needed to further explore the role of suicide risk in the relationship between types of ruminative tendencies and state changes in impulsivity and pain tolerance.

Suicide risk in this study was also determined solely on the presence of suicidal ideation and did not take into account other known indicators of elevated suicide risk such as tendency to cope using painful and provocative behaviors such as NSSI, the quality of an individual’s suicidal ideation, the availability of a plan and means for suicide, and past history of suicide attempts (Chu et al., 2015). Furthermore, the suicide risk assessment procedures may not have been homogeneous as we did not assess for inter-rater reliability. As such, future studies would benefit from using a more systematic assessment of suicide risk that takes into account other empirically determined factors contributing to an elevated risk for suicide.

Overall, this study represents a novel contribution to existing research on rumination and suicide risk by examining potential mechanisms by which rumination can facilitate the transition of suicidal ideation to the act of making a suicide attempt. Although the hypotheses of this study were largely unsupported, these findings offer an alternate way of conceptualizing impulsivity and pain tolerance as being malleable and not simply stable traits. Ultimately, these findings serve as a springboard for suicide research to examine other possible factors that may contribute to state changes in
impulsivity and pain tolerance, which theoretically could lead to a momentary increase in an individual’s capability to make a lethal suicide attempt. A great number of treatments have been developed to address cognitive and emotional difficulties but not the capability needed to die by suicide. By understanding how cognitive and emotional factors interface with the capability for suicide, we may be able to generate the information and knowledge required to develop or refine existing interventions that can effectively reduce suicide risk by decreasing an individual’s ability to make a lethal suicide attempt.
APPENDIX A – IRB Approval Letter

NOTICE OF COMMITTEE ACTION

The project has been reviewed by The University of Southern Mississippi Institutional Review Board in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the “Adverse Effect Report Form”.
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: CH2-14061901
PROJECT TITLE: Cognition, Impulsivity, and Pain Processing
PROJECT TYPE: Change to a Previously Approved Project
RESEARCHER(S): Keyne Law
COLLEGE/DIVISION: College of Education and Psychology
DEPARTMENT: Clinical Psychology
FUNDING AGENCY/SPONSOR: N/A
IRB COMMITTEE ACTION: Expedited Review Approval
PERIOD OF APPROVAL: 7/28/2014 to 07/27/2015

Lawrence A. Hosman, Ph.D.
Institutional Review Board
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