

DEPRESSIVE RUMINATION AS EXPERIENTIAL AVOIDANCE

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ABSTRACT

Title: Depressive Rumination as Experiential Avoidance

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This study examined an experiential avoidance conceptualization of depressive rumination in 3 ways: 1) associations among questionnaire measures of rumination, experiential avoidance, and fear of emotions; 2) performance on a dichotic listening task that highlights preferences for non-depressive material; and 3) psychophysiological reactivity in an avoidance paradigm modeled after the one used by Borkovec, Lyonfields, Wisner, & Deihl (1993) in their examination of worry. One hundred and thirty eight high (HR) or low (LR) ruminating Temple University undergraduates completed questionnaire measures and participated in a clinical interview to diagnose current and past episodes of depression. Of those, 100 were assigned to the rumination or relaxation induction condition and participated in a dichotic listening task, rumination/relaxation induction, and depression induction, while heart rate and vagal tone were monitored. Questionnaire measures confirmed a relationship between rumination status and avoidance; however, no significant effects were found in the dichotic listening task. Psychophysiological measures indicate that HR individuals show less of an inter-beat interval (IBI) response to a depression induction than LR individuals, regardless of condition assignment. Further, rumination induction, regardless of underlying propensity of rumination, appears to inhibit heart rate variability (HRV) response to a depression induction. Overall, these results support an avoidance conceptualization of depressive rumination. Implications of these findings are discussed.

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CHAPTER 1 INTRODUCTION

Rumination refers to the tendency of some individuals to recursively mull over the symptoms, causes and consequences of their negative affect. Rumination has been linked to longer and more severe depression, delayed recovery from depression, increases in suicidal ideation, and impairments in problem solving, motivation, and concentration (Eshun, 2000; Lyubomirsky & Tkach, 2004; Siegle, Sagrati, & Crawford 1999). Rumination has also prospectively predicted major depression over a 2.5-year follow-up (Nolen-Hoeksema, 2000; Spasojevic & Alloy, 2001). Given that depression affects 1 in every 5 adults (Angst, 1995), it is expected that a greater understanding of the nature of rumination will aid in the design and implementation of intervention strategies that target ruminative response styles and, thus, combat and/or prevent depression.

Major Theories of Depressive Rumination

Several theories about rumination have been presented over the years, the most prolific of which is Nolen-Hoeksema's (1991) Response Styles Theory. Although these differing views of rumination often overlap conceptually, there are important distinctions in their definitions of ruminative thought, their explanations for how rumination is harmful, and in how rumination is integrated with other aspects of cognition and adaptive emotional processing. Therefore, the following section attempts to group the main theories of ruminative thought processes in depression, clarify the way they define the construct of rumination, describe the way in which rumination is theorized to relate to depression or other pathological states, and briefly summarize findings related to each theory.

Rumination in Response to Negative Affect

Response Styles Theory

Definition of the construct. Perhaps the most well known way of defining rumination has been proposed by Nolen-Hoeksema in her Response Styles Theory (RST; Nolen-Hoeksema, 1991). In RST, rumination is defined as repetitively thinking about the causes,

consequences, and symptoms of current negative affect. Rumination is considered to be a stable characteristic, and is employed in response to sad or depressed mood (Nolen-Hoeksema & Davis, 1999). Nolen-Hoeksema's definition also implies that rumination is a predominately harmful thought process, and it is not aimed at problem solving, but instead is a cyclical process in which an individual becomes trapped.

Mechanism of harm. In RST, rumination is harmful in 4 main ways: (1) it exacerbates the effects of negative mood on thinking; (2) it increases the likelihood that people will explain their current circumstances in the context of negative thoughts and memories activated by their depressed mood; (3) it interferes with problem-solving and instrumental behavior; and (4) it alienates social supports (Nolen-Hoeksema & Davis, 1999).

Measurement of rumination. To assess an individual's characteristic level of rumination, Nolen-Hoeksema and Morrow (1991) developed the Response Style Questionnaire (RSQ). The RSQ contains 4 subscales, although the Ruminative Response Scale (RRS) is the most often utilized. The RRS is a 22-item measure that asks individuals to indicate what they "generally do" in response to negative affect. Sample items include, "Think about your feelings of fatigue and achiness," and, "Analyze recent events to try to understand why you are depressed."

Findings related to the construct. There is an extensive literature describing the effects of depressive rumination. Briefly, rumination as defined by RST has been linked to longer and more severe depression, delayed recovery from depression, increases in suicidal ideation, and impairments in problem solving, motivation, and concentration (Eshun, 2000; Lyubomirsky, Kasri, & Zehm, 2003; Siegle, et al., 1999; see Lyubomirsky & Tkach, 2004, for a review). Rumination also prospectively predicts major depression over a 2.5-year follow-up (Nolen-Hoeksema, 2000; Spasojevic & Alloy, 2001). Rumination has been found to mediate the gender differences in depression (Butler & Nolen-Hoeksema, 1994; Nolen-Hoeksema, Larson, & Grayson, 1999), and is related to the development of anxiety as well as

depression (Nolen-Hoeksema, 2000). Further, in 7th graders, the relationship between rumination and depressive symptoms was partially mediated by social support (Abela, Vanderbilt, & Rochon, 2004).

Although there is substantial evidence in support of the RST, aspects of the theory have received limited support. For example, the distraction component of the theory has received mixed support (Butler & Nolen-Hoeksema, 1994; Nolen-Hoeksema & Morrow, 1991). Rumination in this model is also presented without a context in that the theory does not address how rumination fits in with other biological or cognitive processes like attention, metacognitive beliefs, or physiological response to emotion. Further, the model does not account for the relationship between depressive rumination and symptoms of both anxiety and depression. Given these issues, it is useful to consider alternative ways of thinking about ruminative thought processes.

Rumination on Sadness

Definition of the construct. The rumination on sadness (Conway, Csank, Holm & Blake, 2000) construct was developed as an alternative to RST. In this theory, rumination is defined as repetitive thinking regarding, “one’s present distress and the circumstances surrounding the sadness (Conway et al., 2000, pp 404).” Further, “these thoughts (a) relate to the antecedents or nature of one’s negative affect, (b) are not goal directed and do not lead to plans for remedial action, and (c) are not socially shared while the rumination occurs (Conway et al., 2000, pp 404).” Although the authors do not address whether this rumination is characterological or state-dependent, they do report that rumination is related to trait-like qualities, such as neuroticism, self-reflectiveness, and self-concept clarity (Conway et al., 2000). It is also clear that rumination in this model is harmful, and is exclusively negative in content.

Mechanism of harm. According to Conway and colleagues (2000), rumination on sadness is harmful in that it interferes with problem-solving, and thereby, does not lead to

problem resolution, and it can be experienced as intrusive. Similarly to RST, rumination on sadness may exert its negative effects primarily through interfering with more adaptive ways of managing negative affect, specifically sadness.

Measurement of the construct. Conway and colleagues (2000) created a measure to specifically assess their rumination on sadness construct, the Rumination on Sadness Scale. The Rumination on Sadness Scale is a 13-item questionnaire that was developed to capture several aspects of rumination, specifically: (a) the intensity and quality of negative thoughts, (b) the ease with which ruminative thoughts may be stopped, (c) the degree to which thoughts not related to sadness are excluded, (d) attempts at causal analysis of distress, as well as the belief that this analysis is helpful, (e) attempts to understand the nature of the distress, and (f) a lack of focus on instrumental goals. Each item in the scale begins with the phrase, "When I am sad, down, or feel blue..." to highlight the focus on responses to sad mood specifically. The Rumination on Sadness Scale has demonstrated adequate psychometric properties; but as yet, the Rumination on Sadness Scale is not widely utilized in the literature.

Findings related to the construct. In three studies presented by Conway and colleagues (2000), several findings concerning rumination on sadness were presented. The authors confirmed the psychometric utility of their Rumination on Sadness Scale, and compared their measure to other indices of negative thought, rumination, depression, cognitive functions, and emotional expression and self-disclosure. The authors found that rumination on sadness was significantly related to individuals' scores on the Automatic Thoughts Questionnaire (an index of negative self-referential thoughts), likelihood of using imagery, self-disclosure, agreeableness, self-reflectiveness, low self-deception, neuroticism, and femininity (Conway et al., 2000). Rumination on Sadness scores were highly correlated with scores on the RRS and the Beck Depression Inventory (BDI; Beck, Rush, Shaw &

Emery, 1979). In addition, rumination on sadness predicted levels of distress subsequent to a sad mood induction (Conway et al., 2000).

The rumination on sadness model is useful for individuals seeking to address specific questions about sad mood. However, it has less utility for those who are interested in repetitive thought processes to additional or more complex mood states. In addition, the Rumination on Sadness Scale has not been widely used, therefore, it is not clear how well it specifies rumination just in response to sadness, and whether or not it is useful in the prediction of depression or other psychopathology. Further, it is not clear whether or not, as with the RRS, the Rumination on Sadness Scale will fail to demonstrate specificity to depression.

Rumination in Relation to Life Events

Stress Reactive Rumination

Definition of the construct. Another type of repetitive thought has been proposed by Alloy and colleagues (2000). As with Nolen-Hoeksema's RST, Alloy and colleagues propose that rumination is a negative thought process triggered by a stressful life event. Specifically, they suggest that stress reactive rumination, that is, rumination on negative inferences associated with stressful life events, may be more useful in predicting depression than trait self-focus or depressive rumination. The authors do not specifically state whether reactive rumination is a stable characteristic, but clearly purport that it is a harmful thought process.

Mechanism of harm. In Alloy and colleagues' definition of rumination (2000), reactive rumination, in combination with the propensity to make negative inferences about the self in response to stressful events, increases the likelihood of experiencing depression (Robinson & Alloy, 2003). The authors do not specifically state a mechanism of harm for their definition of rumination.

Measurement of the construct. Stress-reactive rumination can be assessed using the Stress Reactive Rumination Scale (SRRS; Alloy et al., 2000). The SRRS was designed to

tap three cognitive tendencies related to life stressors: (1) the tendency to make negative attributions and inferences for life stressors, (2) a focus on hopeless thoughts, or (3) a focus on active coping strategies or problem-solving. Only the scale that assessed tendencies to focus on negative attributions and inferences demonstrated adequate psychometric properties.

Findings related to the construct. Although stress-reactive rumination has not been extensively explored, it moderated the relationship of cognitive vulnerability to depression and the onset, number, and duration of depressive episodes in the Cognitive Vulnerability to Depression (CVD) project (Robinson & Alloy, 2003). Specifically, individuals high in stress-reactive rumination, in combination with negative cognitive styles, were more likely to experience a depressive episode, and had longer and more episodes of depression than those low in stress-reactive rumination. In addition, stress-reactive rumination was a better predictor of depressive episodes than depressive rumination as defined in RST, and private self-consciousness. Further research is needed to more clearly assess the utility of this construct; however, it offers promise as an adjunct to RST.

One advantage to this model is that it is highly similar to RST, but it may capture ruminative phenomena before the presence of negative affect and therefore have added utility. One potential limitation of this model is that it proposes that ruminative content consists of thoughts related to the stressor, and may not capture other important ruminative themes such as memories of other stressors, or self-deprecating thoughts that are not related to the stressor. Although this model offers more in depth hypotheses about the content of depressive rumination, it does not articulate a mechanism of harm for rumination, and it does not explain how depressive rumination may relate to other emotion management strategies.

Rumination as a Function of Goal Progress

Goal Progress Theory

Definition of the construct. According to the Goal Progress Theory of rumination, rumination is initiated by the realization that one has not attained, or is not progressing adequately towards, a wanted goal (Martin, 1999; Martin, Shrira, & Startup, 2004; Martin, Tesser, & McIntosh, 1993). In this model, repetitive thoughts about goal discrepancy constitute ruminative thinking. Martin and colleagues (1993) have proposed that rumination is a conscious and unpleasant process that is brought about by unconscious increases in accessibility of thoughts that are related to goal progress. This theory also proposes that rumination is an adaptive self-regulatory process, designed to aid an individual in identifying more productive strategies for goal attainment, re-evaluating whether or not a goal remains desirable, and/or changing the way an individual thinks about their behavior in relation to their goal (Martin et al., 2004). Martin and colleagues suggest that a goal may potentially be to understand, or make sense of something, which is similar to other conceptualizations of rumination. The goal progress theory proposes that rumination will continue until the goal is either attained or abandoned. Although rumination may not change a person's status in relation to their goal, the function of rumination in this model is to develop goal-related strategies.

In this model, rumination has also been divided into various, dimensional, subtypes. For example, Martin and Tesser (1996) suggest that rumination may be classified along emotional valence (positive or negative), focus of the thoughts (attainment of the goal, or discrepancy from the goal), and time period (past, present, or future) dimensions. Thus, rumination does not necessarily occur in relation to negative affect or depression, unless positive affect is seen as a higher order goal. Similarly, rumination may lead to depression if a person continues to perceive failure to progress towards wanted goals.

Mechanism of harm. In the Goal Progress theory of rumination, rumination is not inherently harmful, and, in fact, it can be adaptive in setting individuals on a course for goal attainment. Martin and colleagues concede however, that rumination can become harmful under certain conditions, specifically: if it restricts the range of acceptable solutions, if it is perceived as a sign of inadequacy, or if an individual holds the belief that they must continue ruminating until they feel better (Martin et al., 2004). In this view of rumination, it is not necessarily the ruminative process that contributes directly to negative affect and depression, but instead, it is suggested that consistent failure to achieve goals is the proximal cause of both rumination and negative affect (Martin et al., 1993).

According to the Goal Progress theory, rumination may be harmful in that it mediates the relationship between linking and unhappiness. Specifically, if an individual endorses the belief that attaining goals is highly linked to feelings of happiness, failure to attain those goals, through rumination, may lead to greater feelings of unhappiness. In this way, rumination may contribute to the development of negative affect. Again, however, it is the failure to achieve desired goals that initiates the process.

Measurement of the construct. To index this type of rumination, Scott and McIntosh (1999) developed a 9-item measure designed to assess the various subtypes of rumination put forth by Martin and Tesser (1996). The Scott McIntosh Rumination Inventory (SMRI; Scott & McIntosh, 1999) measures 3 dimensions of rumination related to goal attainment: emotionality, distraction, and motivation. The SMRI demonstrated somewhat poor internal consistency of the full-scale measure, and the emotionality and motivation subscales demonstrate the highest internal consistencies (Scott & McIntosh, 1999). The SMRI has also demonstrated significant correlations with similar constructs, such as fear of sadness, cognitive interference, worry, neuroticism, depressive symptoms as indexed by the BDI, and trait anxiety (Scott & McIntosh, 1999). Finally, the SMRI has also demonstrated predictive validity; scores on the SMRI predicted the amount of time it took individuals to complete a

mentally challenging task, suggesting that individuals who score high on rumination are consuming their cognitive resources and, thereby, perform more poorly on tasks requiring mental exertion (Scott & McIntosh, 1999).

Martin et al., (1993) developed a measure to examine the linking hypothesis in the Goal progress theory of rumination (that linking of attainment of a goal and happiness will lead to greater rumination about non-attainment of the goal). This measure, labeled the Rumination Scale by Segerstrom, Stanton, Alden, and Shortridge (2003) is a 10-item questionnaire that is rated on a 7 point scale ranging from, “does not describe me well,” to, “describes me well (Martin et al., 1993).” Although no psychometric properties were reported for this measure in the original study, in a meta-analysis of rumination measures, an adequate internal consistency was reported for this measure (Segerstrom et al., 2003). It should be noted that this scale has only been used to examine the linking hypothesis of the Goal Progress Theory; thus, its usefulness in relation to other outcome measures has yet to be determined.

Findings related to the construct. The Goal Progress theory makes several predictions regarding ruminative processes, many of which have been supported by the literature (for reviews see Martin et al., 1993; Martin et al., 2004). One such prediction is that perceived failure to progress toward a desired goal will increase the accessibility of thoughts related to that goal. In a demonstration of this, Martin and colleagues (1993) reported that participants who received success feedback regarding task performance responded less quickly to task related information, thereby suggesting that the accessibility of task related information had decreased following perceived attainment of a goal. Support has also been garnered for the increased focus on higher order, vs. lower order goals in ruminative content (Martin et al., 1993). The theory also predicts that goal related rumination will be associated with increased right hemisphere activation, specifically that the right hemisphere will be utilized in the search for alternative paths to goal attainment. In line with this, rumination has

been related to relatively more right hemispheric activity (Martin & Shrira, 2002; Martin et al., 2004). Finally, evidence for the mediation of rumination in the linking between goal attainment and happiness has also been obtained (Martin et al., 1993; McIntosh, Harlow, & Martin, 1995).

The Goal Progress Theory offers a unique way of viewing rumination, not as a reaction to a mood state per se, but as a response to failure to progress satisfactorily towards a goal. Although the theory proposes that rumination and depression are both driven by the failure experience, studies have demonstrated the stable presence of rumination in the absence of current or perceived failure, and that rumination later predicted depression after the experience of a stressor (Nolen-Hoeksema & Morrow, 1991; Spasojevic & Alloy, 2001). This would call into question Martin and Tesser's assertion that rumination occurs in response to failure to progress towards a goal. Rumination in this model does not demonstrate specificity to depression, and it is not clear how rumination is expected to relate to similar constructs, such as worry. However, this theory is compelling in that it makes predictions about physiological correlates of rumination.

Rumination in Relation to Target Status

Self-Regulatory Executive Function Model

Definition of the construct. Another theory of rumination has been advanced by Wells and Matthews (1994, 1996) in the context of their Self-Regulatory Executive Function model (S-REF). In this theory, rumination is defined as a generic process that is intrinsically harmful and is related to various emotional disorders. In other words, rumination is not specific to negative affect or symptoms of depression, as it is in the RST, but is a common underlying mechanism in many psychopathologies (Matthews & Wells, 2004). One critical difference between the S-REF and the Goal Progress theory is that rumination in the S-REF model is focused on processing self-referent information more generally, as opposed to just identifying goal-related information. It also is not focused on problem-solving per se, but

more on understanding and coping with the current situation. Similarly, it differs from RST in that it is not solely focused on emotional or affect-related content. In this model, rumination is both automatic and controlled, and rumination is seen as a subset of worry (Matthews & Wells, 2004). Rumination in this model is also related to other constructs like emotion-focused coping, thought control, self-criticism, and negative self-appraisal. The content of rumination, therefore, is broad, but predominately negative.

According to the S-REF model, the ruminative cycle is initiated by the detection of a discrepancy between a current status and a desired or target status. After the detection of a discrepancy, the S-REF model predicts that a search for coping options will be initiated by the supervisory executive. The strategy that is selected is influenced by metacognitive beliefs regarding the efficacy of some coping strategies over others; for example, an individual may select ruminative thinking to cope with the discrepancy. It is these metacognitive beliefs about the utility of rumination that is the basis for the Meta-Cognitive Theory advanced by Papageorgiou and Wells (2001b). The Meta-Cognitive Theory proposes that positive beliefs about rumination drive its use in relation to negative affect and that negative beliefs about rumination once it is initiated exacerbate negative affect.

Mechanism of harm. In the S-REF model, rumination is harmful in several ways that are related to the overemphasis of beliefs that thought control strategies are the most useful in regulating emotions. More specifically, rumination is harmful in that it may actually increase attention given to the identified discrepancy, it may block the use of other more adaptive strategies, it may be associated with negative metacognitive beliefs once rumination is initiated, and ruminators may have beliefs about stop-rules that perpetuate the use of continued rumination (Matthews & Wells, 2004). The essential problem with rumination in this model is that it may interfere with using and learning more effective methods of coping and it may exacerbate negative metacognitive beliefs about the use of rumination that may also be distressing to the individual. Rumination may also increase the

accessibility of negative self-referent information, and perpetuate a focus on negative aspects of the self.

Measurement of the construct. Although no direct measure of rumination as described in the S-REF model exists, Matthews and Wells (2004) suggest that the metaworry scale from the Anxious Thoughts Inventory (Wells, 1994) is the best index of the construct. They emphasize, however, that rumination in their model is multi-faceted, and requires measurement of several related aspects of rumination, for example, self-knowledge (and beliefs about coping strategies), situational processes, and outcome variables. They suggest that self-knowledge may be captured by measures such as the Metacognitions Questionnaire (Cartwright-Hatton & Wells, 1997), and the Thought Control Questionnaire (Wells & Davies, 1994). A scale developed by Papageorgiou and Wells (2001b), the Positive and Negative Beliefs About Rumination Scale, may also be an accurate index of metacognitive processes in the S-REF model. They suggest that outcome variables might best be indexed by measures of mood or anxiety.

Findings related to the construct. The S-REF view of rumination makes three main predictions: (1) that maladaptive metacognitions about coping strategies lead to the implementation of maladaptive coping strategies, (2) that maladaptive coping strategies can lead to dysfunction, and (3) that rumination itself can produce harmful effects such as blocking adaptive cognitive restructuring and increasing emotional upset and accessibility of negative self-referent information (Matthews & Wells, 2004). Evidence for each of these predictions has been detailed in Matthews and Wells (2004); however, specific to the hypotheses regarding rumination, the authors cite evidence that worry (of which rumination is a subtype in this model) increases negative thinking after a stressful event, and that rumination is related to negative biases in recollection of negative information about the self. Evidence has also been found for the link between metacognitions and ruminative strategies, for example, individuals with depression reported higher levels of positive beliefs about

rumination's utility as a means of coping, and the relationship between positive beliefs about rumination and depression (both state and trait) was mediated by rumination (Papageorgiou & Wells, 2001b). In other words, those who believed that rumination would help them deal with their distress, through rumination, exhibited more depression. In addition, Papageorgiou and Wells (2001a) reported that individuals also tend to hold negative beliefs about rumination, mainly focused on the controllability and harmful consequences of rumination. This supports the role of metacognitive beliefs in the selection, use, and appraisal of coping strategies as detailed in the S-REF model.

The S-REF theory of rumination offers a broader view of rumination, embedded in a larger context of the S-REF model of emotional disorder, which includes attention, cognition regulation, beliefs about emotion regulation strategies, and interactions between various levels of cognitive processing. In addition, the model integrates metacognitive beliefs into its conceptualization of rumination, which may play a large role in the development of rumination as a stable response style. One potential flaw of this model is that it overlaps with many other constructs (such as worry, intrusive thoughts, coping, etc.) and, therefore, it may be difficult to determine which effects may be attributed to depressive rumination specifically, independent of these other cognitive processes. Further, it proposes that rumination is a subset of worry; however, differences between worry and rumination in content, time period focus, and imagery content have been documented (Beck, Brown, Steer, Eidelson, & Riskind, 1987; Fresco, Frankel, Mennin, Turk, & Heimberg, 2002; Papageorgiou & Wells, 1999, 2004). This suggests that differentiation of these constructs is indicated.

Summary of Major Theories of Rumination

Thus far, several major theories of rumination have been proposed. The theories differ in the degree to which they articulate and have tested a mechanism of harm of depressive rumination, with some demonstrating support for decrements in problem-solving, instrumental behavior, social support, links between metacognitive beliefs and rumination,

and differences in hemispheric activation that support their theories. The theories also differ in the degree to which they attempt to explain rumination in the context of larger theories of emotion regulation. For example, the S-REF and Goal Progress models conceptualize rumination as a self-regulatory process, whereas the Rumination on Sadness Model does not address how rumination may relate to other constructs. The theories also differ in the extent to which they differentiate depressive rumination from other repetitive thought processes, such as worry.

Although the measures and models of rumination presented here differ in some critical ways, one important theme arises across the theories' proposed mechanism of harm for rumination. Specifically, many propose that rumination impacts an individual's ability to employ more adaptive emotion regulation strategies, such as problem solving, in response to a trigger. Given that support for a relationship between rumination and impediments in problem solving has been garnered in the literature, this is likely an important link between theories of rumination (Lyubomirsky & Nolen-Hoeksema, 1995; Lyubomirsky, Tucker, Caldwell, & Berg, 1999). However, it may also be that rumination is a manifestation of a more fundamental process that ultimately inhibits problem-solving. An alternative model suggests that depressive rumination may exert its effects through experiential avoidance.

Experiential Avoidance Conceptualization of Depressive Rumination

Definition of the construct. In this model, rumination is defined as one of many potential experiential avoidance strategies. The content of depressive rumination is similar to Nolen-Hoeksema's (1991) definition of rumination in that it is expected to focus on the causes and consequences of negative affect. It is expected to be a stable characteristic that is driven by metacognitive beliefs about the harmfulness and negative consequences of negative emotional experiences. Further, in this model, rumination occurs in response to the experience of negative affect.

Mechanism of harm. Hayes, Wilson, Gifford, Follette, and Strosahl (1996) argued for an experiential avoidance conceptualization of many forms of psychopathology, citing evidence from the substance abuse, obsessive-compulsive disorder, panic disorder, and borderline personality disorder literatures. They suggest that the avoidance of private negative experiences is detrimental because it prevents individuals from responding to aversive stimuli and often has the paradoxical effect of increasing avoided material (Hayes et al., 2004; Wenzlaff & Wegner, 2000). Applied to rumination, high ruminators may avoid the private experience of negative affect through their repetitive thought, and in so doing, may actually worsen their negative mood.

Similarly, in his conceptualization of worry in individuals with generalized anxiety disorder (GAD), Borkovec (1994) postulates that worry serves to distract individuals from deeper, more emotional, topics and thus serves an avoidance function. This avoidance of emotionally arousing material then provides a false, and reinforcing, sense of control over emotions. Unfortunately, this sense of control is illusory, and instead prevents the individual from effectively processing their negative emotion. It may be that rumination in response to negative affect serves a similar function, such that ruminators avoid the experience of sadness through recursive cognition. In support of this, many researchers have noted the high comorbidity of GAD and depression; over 60% of clients who present with symptoms of GAD also qualify for a diagnosis of major depressive disorder (Brown, Campbell, Lehman, Grisham, & Mancill, 2001). Measures of rumination and worry have also demonstrated high correlations, above and beyond that of symptom measures of anxiety and depression ($r = .66$; Beck & Perkins, 2001). Given that there is evidence that worry may function as experiential avoidance, it follows that rumination may also exert its influence through avoidance of negative affect. Therefore, this study may help elucidate a common underlying construct that contributes to the development of both depression and anxiety and, thus, would provide some insight into the overlap between the two disorders.

Measurement of avoidance. Experiential avoidance has been examined in several ways. Hayes and colleagues (2004) have developed a measure that aims to tap self-reported experiential avoidance: the Acceptance and Action Questionnaire (AAQ). Preliminary studies have pointed to an association between self-reported rumination and high scores on the AAQ (Smith, Hughes, & Alloy, 2005). In addition, Roemer, Salters, Raffa, and Orsillo (2005) examined individuals with and without GAD and determined that worry was associated with higher scores on the AAQ. Roemer and colleagues (2005) also used a measure of fear of emotional responses (the Affective Control Scale, ACS; Williams, Chambless, & Ahrens, 1997) and found that worry was related to higher reported fear of emotional responding. It may be that the ACS, in quantifying “fear of fear,” also taps avoidant tendencies, as well as metacognitive beliefs that drive rumination.

In a unique approach to capturing avoidance in worriers, Laguna, Ham, Hope, and Bell (2004) designed a dichotic listening task that aims to assess individuals' preferential attending to non-threatening material. Typical dichotic listening tasks ask participants to shadow a story presented in one ear, while ignoring information presented in the other ear. At the end of the task, a surprise word recognition task is presented. Differences on task performance have been reported between control participants and individuals with GAD and obsessive compulsive disorder when threatening information was presented in the unattended ear, such that anxious participants remembered significantly more threat words than non-anxious participants (Foa & McNally, 1986; Mathews & MacLeod, 1986). These studies indicate an attention shift towards threat stimuli. A modified dichotic listening paradigm was developed by Laguna et al. (2004) to assess cognitive avoidance in high vs. low worry individuals. In this study, participants were presented with a neutral or worry story in the shadowed ear, while neutral words were presented in the unattended ear. Laguna et al. (2004) reported that high worriers recalled more of the neutral words from the unattended ear during the worry story than low worry individuals, indicating a shift in attention away from

worry. In this study, it was expected that HR individuals would also exhibit a shift away from sad material and recall more neutral words from the unattended ear.

A final indication of avoidance lies in physiological response to aversive stimuli. Specifically, experiential avoidance has been linked to a discordance between self-reported mood and arousal and physiological indices of arousal. For example, in a classic study of worry in GAD, Borkovec, et al. (1993) pre-selected individuals who were afraid of public speaking and had them worry or relax prior to imagining giving a public speech (an exposure to a feared stimulus). He found that individuals in the worry condition showed less heart rate response to this exposure, whereas individuals who relaxed showed greater heart rate response. Similarly, Feldner, Zvolensky, Eifert, and Spira (2003) found that participants who were instructed to inhibit their emotional state during a carbon dioxide inhalation task reported more anxiety and affective distress than those who were instructed to observe their experience. Again, however, measures of physiological arousal indicated less reactivity in the inhibition group. This suggests that inhibition of emotion, or avoidance, contributes to greater self-reported arousal, but less physiological arousal. Finally, in a sample of individuals identified as high or low in experiential avoidance, high experiential avoiders reported greater emotional reactions to emotion-eliciting film clips than the low experiential avoider group; however, they displayed less physiological arousal (Sloan, 2004). As a whole, these studies indicate that worry, avoidance of emotional state, and overall tendency to avoid experiences are related to a specific pattern of response to emotional stimuli, specifically, higher levels of self-reported negative mood and arousal and lower levels of physiological arousal. It is expected that rumination will also produce this pattern of high self-reported negative affect and attenuated physiological arousal during a sad mood induction.

Findings related to the construct. Although no research to date has directly examined rumination as an avoidance strategy, some findings do support an avoidance conceptualization of rumination. For example, Fresco et al. (2002), in a comparison of worry

and rumination, concluded that rumination was harmful because of its passive focus on negative mood. Further, they suggested that rumination may be best characterized as avoidance. Along the same lines, rumination has been linked to lower levels of emotional intelligence (defined as the ability to monitor, identify, and regulate feelings), ineffective problem orientation, as well as difficulty identifying and expressing emotions (Ciarrochi, Scott, Deane, & Heaven, 2003; Salovey, Mayer, Goldman, Turvey, & Palfai, 1995). Although these studies did not test experiential avoidance directly, they all suggest that rumination inhibits an individual's ability to recognize, manage, and process negative mood over time. This inability to identify and regulate emotions may be indicative of avoidance of these emotions.

In a more direct test, Watkins (2004) reported greater negative affect among high ruminating individuals who were instructed to ruminate in response to a negative event, compared to those who were instructed to focus on their feelings. This suggests that purposeful experiencing of an event (the opposite of avoidance) is associated with better outcomes than mulling over the causes and consequences of that event. Extrapolating from these findings, it may be that rumination impedes more adaptive experiencing of negative affect, and in so doing, perpetuates depression. Similarly, in a comparison of mindfulness meditation, rumination, and distraction in response to a negative mood induction, Broderick (2005) reported that the meditation condition produced the least negative mood in response to the induction than the rumination or distraction conditions. Similarly, Jain and colleagues (2007) reported that a mindfulness meditation intervention significantly reduced use of ruminative thinking, and decreased self-reported distress. This also suggests that a focus on experiencing negative emotion may be adaptive.

Other studies have demonstrated a link between rumination and avoidant behaviors. For example, Lyubomirsky, Kasri, Chang, and Chung (2006) reported that, among women who had previously received a diagnosis of breast cancer, ruminating women waited 2

months longer than non-ruminators to report their initial symptoms to their health care professionals. The authors concluded that rumination contributed to a delayed response to symptoms, which supports the hypothesis that high ruminating individuals may avoid dealing with emotionally threatening material. Similarly, Nolen-Hoeksema (2007) and Smith and colleagues (2007) reported that high ruminating individuals reported significantly more cutting behavior, which has been construed as a way for individuals to obtain relief from aversive emotional experiences (Linehan, 1993). High ruminating individuals also reported using substance use as a coping strategy significantly more than low ruminators, which also suggests a preference for escape from negative emotions (Smith, et al., 2007). These studies all point to a link between rumination and purposeful avoidance of negative emotions.

An experiential avoidance conceptualization of depressive rumination offers several advantages over other major theories of rumination. For example, it places rumination in the context of a larger theory of emotion management, experiential avoidance. Further, given that experiential avoidance has been demonstrated in other disorders that are often comorbid with depression, such as GAD, it points to an underlying mechanism that may account for some of the overlap in symptomatology. In addition, the experiential avoidance conceptualization lends itself to methodology that moves beyond associations between self-report questionnaire measures. Specifically, the model makes predictions for how high ruminating individuals are expected to behave in the presence of negative emotional material, and how they will physiologically respond to negative affect. This allows for more sophisticated examination of the mechanism of harm in depressive rumination.

Examination of Avoidance in This Study

Adaptation of Borkovec et al.'s (1993) Paradigm

This study is based on the idea that a sad mood induction may mimic the public speaking exposure task in Borkovec et al.'s (1993) test of avoidance. More specifically, sadness may be the “avoided stimulus” for ruminating individuals. Borkovec and colleagues

used an imaginal exposure to a feared stimulus, specifically, they asked participants to imagine giving a speech. Given that this study aims to examine avoidance of sad mood, a depression inducing image was used. In a review of mood induction procedures, imagination-based mood induction procedures were among the most effective and have been reported to effectively induce depressed mood in up to 100% of participants (Gerrards-Hesse, Spies, & Hesse, 1994; Martin, 1990). The procedure used in this study is one that has been used in other investigations of rumination and depressive mood (Blackhart & Kline, 2005; Morrow & Nolen-Hoeksema, 1990) and effectively produces changes in participants' self-reported mood. In a study that compared several classes of stimuli and physiological response in individuals with GAD, the authors concluded that stimulus type (actual, imagined, or abstract) differentially affects heart rate, vagal tone, and skin conductance responses (Castaneda & Segerstrom, 2004). The authors concluded that the physiological blunting effects of worry are most often observed with imagined stimuli; therefore, an imagined stimulus was also used in this study.

Changes in physiology in response to imagination based mood induction techniques have been reported. For example, when instructed to imagine script-based negative or positive emotions, participants exhibited greater potentiation of the startle response and greater mean heart rate during exposure to negative affect materials (Cook, Hawk, Davis, & Stevenson, 1991). They also displayed less skin conductance reactivity to low-arousal imagery (sadness and relaxation vs. joy, fear and anger; Cook et al., 1991). In another imagery paradigm, corrugator muscle activity was greater during sad imagery than happy imagery (Gehricke & Shapiro, 2000). Finally, one study has examined vagal tone in response to imagined mood; Ritz, Steptoe, DeWilde, and Costa (2001) reported increased respiratory resistance after both happy and depressed mood inductions in asthmatic individuals. Imagery-based mood inductions have produced reliable changes in physiological response,

thus, an imaginal mood induction was used in this study to differentiate high and low ruminating individuals in line with an avoidance conceptualization of rumination.

Physiological Measures of Avoidance

In order to identify avoidance, this study examined heart rate and vagal tone during rumination. Only one study to date has examined the psychophysiological correlates of rumination. Dysphoric and non-dysphoric students participated in a rumination or distraction induction. Higher self-reported negative mood was observed among dysphoric ruminators, but no differences in heart rate, skin conductance, or diastolic blood pressure between dysphoric ruminators and non-ruminators were found (Vickers & Vogeltanz-Holm, 2003). This pattern of arousal is characteristic of avoidance. Trait rumination has also been linked to higher levels of systolic blood pressure and slower cardiac output recovery rates (Bermudez & Perez-Garcia, 1996; Nuemman, Waldstein, Sollers, Thayer, & Sorkin, 2001). This study was the second examination of the physiology of rumination and elaborated on the previous study by including heart rate variability (HRV), which has been linked to emotional responding and emotion regulation.

Although this has not been directly tested in rumination, reduced HRV has been linked to worry and GAD, and may be implicated in rumination. In particular, individuals with GAD, when instructed to worry, show less HRV than non-anxious individuals (Lyonfields, Borkovec, & Thayer, 1995; Thayer et al., 1996). Further, they show reduced baseline vagal tone (Lyonfields et al., 1995). Vagally mediated HRV is a measure of parasympathetic activation and has been linked to cognitive factors such as poor attentional control, behavioral inflexibility, and unsuccessful emotion regulation (Friedman & Thayer, 1998a, 1998b). It is believed that HRV is linked to self-regulation; thus, lower HRV is indicative of deficits in self-regulation. Individuals with depression also exhibit reduced tonic HRV (Thayer, Smith, Rossy, Sollers, & Friedman, 1998). Given its links to worry, attention, emotion regulation, and depression, it is likely that individuals who chronically ruminate will

display reduced HRV. To date, no study has examined this construct in relation to rumination, although rumination has been related to slower recovery of blood pressure in response to an emotional task (Gerin, 2000). This study examined HRV in high and low ruminating individuals. A baseline period was used to ascertain whether ruminators, like worriers, exhibit tonic deficits in HRV similar to those seen in worry and depression. In addition, this study monitored vagal response through changes in HRV during a rumination or relaxation induction, and during a depression induction to identify differences in parasympathetic activation in response to negative mood.

The Blunting Hypothesis

One criticism of Borkovec et al.'s (1993) study is that it did not control for baseline levels of physiological activation in worriers; therefore, the blunted physiological response observed in worriers may have been due to increased physiological response to worry itself (Peasley-Miklus & Vrana, 2000). In a study that measured baseline physiology in worriers, it was determined that high worrying individuals did show a significant physiological response to the worry induction and did not exhibit an additional response to the fear induction (Peasley-Miklus & Vrana, 2000). In addition, worrying was associated with marginally greater heart rate than relaxation. The authors concluded that although the heart rate suppression effect from Borkovec et al.'s (1993) study was replicated, it may be due to physiological activation during worry. To control for this possibility, this study obtained baseline measures of heart rate and vagal tone prior to the rumination induction in order to control for physiological response from baseline to rumination.

Summary

In sum, this study examined an experiential avoidance conceptualization of depressive rumination in HR vs. LR university students in three ways: 1) self-report questionnaire measures of avoidance, 2) a behavioral index of avoidance (shift in attention away from depressive content during a dichotic listening task), and 3) a discrepancy between

self-reported emotional response and physiological response to a negative mood induction. It is the first study to directly test this conceptualization of rumination, and it expands on findings from the current major theories of depressive rumination by identifying an underlying mechanism of harm in rumination. Further, this study adds to the current literature by examining multiple indices of avoidance (self-report, behavioral, and physiological). In addition, it examined an alternative explanation to experiential avoidance: the blunting hypothesis.

CHAPTER 2 METHODS

Participants

Description of Participants

Phase 1

One hundred and thirty-eight Temple University undergraduates participated in Phase 1 of the study. The mean age of the sample was 19.51 and 84% of the participants were female. The ethnic breakdown of the sample was 63% Caucasian ($n = 85$), 18% African American ($n = 25$), 2% Hispanic American ($n = 3$), 7% Asian American ($n = 10$), 3% Not American (Foreign, $n = 4$), and 7% Other ($n = 9$).

Phase 2

Of the 138 participants who completed Phase 1, 100 participated in Phase 2 of the study. The mean age of the Phase 2 sample was 19.65 and 88% of the participants were female. The ethnic breakdown of the sample was 62% Caucasian ($n = 58$), 18% African American ($n = 17$), 2% Hispanic American ($n = 2$), 8% Asian American ($n = 7$), 3% Not American (Foreign, $n = 3$), and 7% Other ($n = 6$). The high rumination group consisted of 46 participants and 54 participants were classified as low ruminators. Forty-eight participants were randomly assigned to the rumination induction condition and 49 were assigned to the relaxation induction condition.

Inclusion/Exclusion Criteria.

Participants were excluded from the study if they: were under 18 years of age, and thereby required parental permission to participate; if they had received a diagnosis of high blood pressure; if they had a pacemaker device; if they took cardiac dysfunction, anxiolytic, or stimulant medications; or if they reported undergoing anesthesia or using alcohol, marijuana, morphine or cocaine within 24 hours prior to their Phase 2 appointment. Participants were asked to refrain from ingesting caffeine or nicotine for 4 hours prior to their Phase 2 appointment.

In addition, individuals were excluded from Phase 2 if they were believed to be too vulnerable to complete the depression induction. Specifically, 14% of participants ($n=19$) who completed Phase 1 were excluded from Phase 2 because they met criteria for current depression, were believed to be at risk for suicide, or were potentially entering a depressive episode at Phase 1, but did not yet meet full criteria (i.e., met symptom criteria, but not duration criteria for a major depressive episode). Significantly more HR individuals were excluded than LR individuals based on these criteria ($\chi^2(1) = 5.6, p = .02, \varphi = .21$).

Procedure

Screening

Participants were recruited from undergraduate psychology courses via completion of the Response Style Questionnaire (RSQ) as part of a packet of measures that students may use to fulfill their research requirements. In addition, flyers posted around campus advertised a website where students could complete the rumination measure and be entered to win a monetary prize. Participants who scored 1 standard deviation above the mean (high-ruminating; HR) on the Rumination scale of the RSQ, or scored at or below the mean (low-ruminating; LR) were invited to participate in Phase 1. Chi-square analyses indicated that an equal number of HR and LR participants were recruited from each source ($\chi^2(1) = .35, p = .56, \varphi = .06$). There were no differences between participants recruited from each source on age, ethnicity, or sex (age, $t(93) = .66, p = .51, d = .14$; ethnicity, $\chi^2(5) = 5.28, p = .38, \varphi = .24$; sex, $\chi^2(1) = .19, p = .67, \varphi = .04$).

Phase 1

Phase 1 consisted of completion of a diagnostic interview, followed by completion of the questionnaire measures administered in random order. Individuals were informed that the study could potentially consist of 2 sessions, and only a subset of individuals would be asked to participate in the second session. Those who qualified for the study were given a thorough explanation of the study and were invited to participate in Phase 2. Individuals who

verbally consented were scheduled for Phase 2 and received a sheet reminding them to refrain from recreational drug or alcohol use 24 hours prior to the study and to refrain from ingesting caffeine or nicotine 4 hours prior to the study. Individuals who met criteria for current depression, who were believed to be at risk for suicide, or who may have been entering a depressive episode at Phase 1, were not invited to participate in Phase 2 and were given appropriate referrals if indicated.

Phase 2

Participants who consented to participation were randomly assigned to the rumination or relaxation condition. Initially participants completed a measure of drug and alcohol use in the past 24 hours and completed the BDI. Individuals who reported recent drug, alcohol, nicotine, or caffeine use were rescheduled for a later time. Physiological recording devices were then attached to participants' chests and they completed the following sequence of tasks:

- 1) 5-minute baseline recording period (baseline 1)
- 2) dichotic listening task, followed by surprise word recognition task
- 3) another 5-minute baseline recording period (baseline 2)
- 4) 8-minute rumination or relaxation induction (rumination/relaxation induction)
- 5) 8-minute imagery script mood induction (depression induction)
- 6) second 8-minute rumination or relaxation induction; the data from this recording were not used for the current study
- 7) 5-minute final baseline period (rest)
- 8) 2-minute amusing film clip to increase positive mood (film)

Physiological indices were monitored continuously throughout the baselines, rumination/relaxation induction, depression induction, and rest periods. After each task, participants completed questionnaires about self-reported mood and thought content. At the end of the session, participants viewed a film clip that has been shown to lift mood (Gross &

Levenson, 1995). For this sample, participants reported a significant increase in mood valence from the rest to film task ($t(98) = 8.2, p < .001, d = 1.15$), suggesting that this film was successful in lifting mood.

Dichotic Listening Task

For the dichotic listening task, participants were instructed to attend to the information being played in their dominant ear (as determined by the handedness questionnaire) and ignore the information from the other channel. Participants heard 2 stories, a neutral script and a failure script, presented in counterbalanced order. As each script was playing, 180 of the 270 non-threatening words used in Laguna et al.'s (2004) paradigm were presented in the non-dominant ear, 90 during each script, at a rate of 1 word every 2 seconds. This was followed by a surprise word recognition test that consisted of all 270 words from Laguna et al.'s (2004) word list.

Instructions

Rumination and relaxation induction instructions. To induce rumination, participants read 28 items from Nolen-Hoeksema and Morrow's (1991) commonly used rumination induction. The task asks participants to focus on symptoms such as, "the physical sensations in your body," which are presented in a series. Participants received these instructions, "As you read the items, use your imagination and concentration to think about the causes, meanings, and consequences of the items. Spend a few moments visualizing and concentrating on each item, attempting to make sense of and understand the issues raised by each item." As in Borkovec et al.'s (1993) paradigm, participants in the relaxation condition were instructed to relax and focus on their breathing.

In this sample, analytical thinking, which is believed to be a crucial characteristic of ruminative thinking, increased among participants who completed the rumination induction ($t(49) = -3.78, p < .001, d = .78$); and, individuals who were assigned to the relaxation induction condition also showed a significant decrease in analytical thinking ($t(49) = 2.44, p =$

.02, $d = .50$) after the relaxation induction. Thus suggests that the rumination and relaxation inductions were successful.

Depression induction instructions. Mood was induced using an imagery script developed by Morrow and Nolen-Hoeksema (1990) in their examination of rumination. It asks participants to vividly imagine the death of their mother and has been shown to increase self-reported negative mood (Blackhart & Kline, 2005; Morrow & Nolen-Hoeksema, 1990). For this study, the instructions were modified so that participants were instructed to imagine the death of a “loved one” instead of their mother. Given that rumination differs from worry in its focus on themes of loss, it is expected that this script is an appropriate corollary to the imagined stimulus in Borkovec’s paradigm (Beck, et al., 1987; Papageorgiou & Wells, 1999). Participants reported a significant decrease in mood valence from the rumination induction to depression induction tasks ($t(98) = -9.38, p < .001, d = 1.34$), which suggests that this induction successfully induced negative mood.

Measures

Diagnostic Interview

Past and/or current episodes of depression. The depression section of the Schedule for Affective Disorders and Schizophrenia-Lifetime (SADS-L; Endicott & Spitzer, 1978) diagnostic interview was used to exclude individuals in a depressive episode at the time of the study. The SADS-L used in the study was adapted for use in the Cognitive Vulnerability to Depression (CVD) Project (Alloy et al., 2000). As in the CVD project, interviewers in this project were blind to participants’ rumination status. The inter-rater reliability in the CVD project was excellent ($\kappa > 0.90$); it was expected to be similar for this study.

Questionnaire Measures

Response style. The Response Style Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991; Nolen-Hoeksema, Morrow, & Frederickson, 1993) is a 71-item questionnaire that assesses the way an individual typically responds to negative affect. The RSQ contains

4 subscales designed to assess four coping styles: Rumination, Distraction, Problem-Solving, and Dangerous Activities. Only the 22-item Rumination subscale was included in the analyses for this study. Items in the rumination subscale focus on responses to depressive symptoms and their possible causes and consequences, for example, “think about how hard it is to concentrate” and “go away by yourself and think about why you feel this way.” The Rumination subscale has demonstrated high internal consistency ($\alpha = 0.89$; Nolen-Hoeksema & Morrow, 1991) and its test-retest reliability is moderate ($r = .47$ over 1 year; Just & Alloy, 1997) to high ($r = .80$ over 5 months; Nolen-Hoeksema, Parker, & Larson, 1994). In the current sample the internal consistency was .96. In studies of university students or community samples, the Rumination scale has been found to predict prospective episodes of major depression (Just & Alloy, 1997; Nolen-Hoeksema, 2000; Spasojevic & Alloy, 2001).

Demographic questionnaire. A demographic questionnaire was used obtain information about age, sex, ethnicity, and current and permanent contact information.

Handedness questionnaire. The Edinbergh Handedness Inventory (EHI; Oldfield, 1971) was used to assess handedness for the dichotic listening task. The EHI is the most widely used self-report measure of handedness and is comprised of 10-items that ask respondents to indicate which hand they use to perform everyday tasks, such as, “writing” and “using a spoon.” They rate their preference as “strong,” “less strong,” or “indifferent.” Scores range from +100 (totally right handed) to –100 (totally left-handed). The EHI has demonstrated a 14-week test-retest reliability of .75 for right-handed individuals, and .86 for left-handed individuals (McMeekan & Lishman, 1975), and a 4 week test-retest reliability of .91 (McFarland & Anderson, 1980). EHI status has also predicted observed hand preference on actual tasks (Bishop, Ross, Daniels, & Bright, 1996).

Experiential avoidance. The Acceptance and Action Questionnaire (AAQ; Hayes, et al., 2004) is a 9-item self report designed to measure emotional avoidance. Respondents

rate the degree to which each statement applies to them on a Likert scale (1 = never true to 7 = always true). The AAQ includes items such as, "If I could magically remove all the painful experiences I've had in my life, I would do so," and, "Anxiety is bad." Zvolensky and Forsyth (2002) reported an internal consistency of .70 in their non-clinical sample. The internal consistency in our sample was .74. The AAQ shows good concurrent validity in terms of its ability to predict higher levels of anxiety and depression (Hayes, et al., 1996).

Worry. Worry was measured using the Penn State Worry Questionnaire (PSWQ; Meyer, Miller, Metzger, & Borkovec, 1990). The PSWQ is a frequently used 16-item measure that assesses a general tendency to worry excessively. Individuals are asked to rate how typical statements are of them using a 5-point Likert scale (1 = not at all typical of me to 5 = very typical of me). Items include, "I know I should not worry about things, but I just cannot help it." In undergraduates, the PSWQ has demonstrated high internal consistency (Cronbach's $\alpha = .91-.95$; Meyer et al., 1990) and good test-retest reliability over ten weeks ($r = .92$; Meyer et al., 1990). The internal consistency in the current sample was .94. The PSWQ has been highly correlated with other self-report measures of worry, such as the Worry Domains Questionnaire, and the Student Worry Questionnaire, as well as with measures of other repetitive thought constructs like rumination (r 's = .57-.78; Davey, 1993; van Rijsoort, Emmelkamp, & Vervaeke, 1999).

Fear of emotional responses. The Affective Control Scale (ACS; Williams et al., 1997) was used to index individuals' fear of emotional responses. The ACS consists of 42 items that index 4 emotional domains (anger, anxiety, positive emotions, and depression). Items include, "Depression is scary to me – I am afraid that I could get depressed and never recover," and, "I think my judgment suffers when I get really happy." Respondents rate the degree to which each statement applies using a Likert scale ranging from 1, "very strongly disagree" to 7, "very strongly agree." The ACS has demonstrated good internal consistency for both the full scale (Cronbach's $\alpha = .92$) and subscales (α 's range from .72-.91). In an

undergraduate sample, the test-retest reliability was .77 (Williams et al., 1997). The full scale internal consistency in the current sample was .95. The subscale scores were as follows: anger, $\alpha = .80$; positive emotions, $\alpha = .86$; depression, $\alpha = .92$; anxiety, $\alpha = .94$. Each of the ACS subscales have been shown to predict panic symptoms in the laboratory, suggesting that each subscale is a valid indicator of fear of emotion (Williams, et al., 1997).

Depressive symptoms. The Beck Depression Inventory (BDI; Beck, et al., 1979) is a 21-item, self-report measure that assesses the presence and severity of depressive symptoms. It instructs individuals to indicate which statement out of 4 best describes their experience over the past 2 weeks. Items assess cognitive, motivational, affective, and somatic symptoms of depression. This measure has been validated for student samples (Bumberry, Oliver, & McClure, 1978; Hammen, 1980). In addition, in a non-clinical population, the internal reliability is good ($\alpha = 0.81-0.86$) and the test-retest reliability ranges from .48 to .86 (Beck, Steer, & Garbin, 1988). The internal consistency in the current sample was .87.

Subjective mood ratings. Mood ratings were obtained using Lang's (1980) Self-Assessment Manikin (SAM). The SAM rating scale allows participants to indicate their current mood state along 2 dimensions: arousal and valence. The SAM is a non-verbal measure and it requires individuals to select one of nine figures from each dimension (arousal and valence) that best captures their current mood. The SAM has demonstrated high levels of convergent validity with other self-report measures of mood (Bradley & Lang, 1994).

Analytical thinking. Participants were also asked to complete a measure of analytical thinking, a thinking style that is characteristic of rumination (Watkins & Teasdale, 2004). The scale is comprised of 7 items that rate level (0, never – 5, constantly) of concern with understanding and making sense of their emotions. The internal consistency in this sample was .88.

Psychophysiological Measures

Heart rate. Heart rate was recorded continuously using a Contact Precision Instruments bioamplifier. Two Beckman standard electrodes, placed on the participant's chest, were used to assess heart rate. PSYLAB 7 software detected R-waves and recorded the inter-beat interval (IBI) in ms. Mean IBI was assessed as an index of heart period, and 2 indices of HRV were assessed: 1) the mean of the absolute values of successive differences in inter-beat intervals (also known as mean successive differences, MSD) and, 2) respiratory sinus arrhythmia (RSA) as derived using power spectral analysis. MSD is highly correlated with other indices of vagally mediated heart rate variability and is a key measure of parasympathetic vagal tone (Friedman & Thayer, 1998; Lyonfields et al., 1995). RSA has been advocated as a measure of heart rate variability because it isolates the respiratory component of cardiac vagal tone, where the greatest effects of parasympathetic input on heart rate variability have been observed (Mezzacappa, Kindlon, & Earls, 1994).

Data reduction. MSD and RSA were extracted using CMet Software (Allen, 2002). Raw IBI data, visually scanned and corrected for artifacts, was entered into CMet. CMet then converts the IBI series to a time series and the data are filtered using an optimal finite impulse response digital filter. RSA is defined as the natural log of band limited (.12-.40 Hz) variance of the IBI series. RSA estimates derived from CMet have been found to correlate .99 with estimates from other widely used programs, such as Porges' MXEdit program (Allen, 2002).

CHAPTER 3 RESULTS

Preliminary Analyses

Analyses were conducted to determine whether the HR and LR groups, and individuals assigned to the rumination vs. relaxation condition (Phase 2 participants only), differed systematically on demographic variables. Given that the equality of variances assumption was not met for age data, variance corrected results are reported. For participants in Phase 1 ($n = 138$), the HR ($n = 69$) and LR ($n = 68$) groups differed significantly on sex ($\chi^2(1) = 3.47, p = .06$, marginal significance, $\phi = .16$), age ($t(112.91) = -2.53, p = .01, d = .44$), and ethnicity ($\chi^2(5) = 13.06, p = .02, \phi = .31$, see Table 1). In order to control for these differences, sex, age, and ethnicity were entered as covariates in all Phase 1 analyses.

For participants in Phase 2 ($n = 100$), there were no significant differences in sex, age, or ethnicity based on condition assignment (rumination, $n = 48$; relaxation $n = 49$); however, the HR ($n = 46$) and LR ($n = 54$) groups significantly differed on several demographic variables (see Table 1). Specifically, there was a marginally significant difference between the groups on age such that the LR group was slightly younger than the HR group ($t(64.96) = 1.92, p = .06$, marginal significance, $d = .39$). The ethnic composition of the HR and LR groups was also significantly different ($\chi^2(5) = 13.46, p = .02, \phi = .37$). The HR and LR groups did not differ on sex ($\chi^2(1) = 0.15, p = .70, \phi = .004$). In order to control for these differences, age and ethnicity were entered as covariates in all analyses of Phase 2 data.

In addition, it was expected that rumination status would be related to both worry and depression. In support of this, rumination status was significantly correlated with both worry (PSWQ) and current symptoms of depression (BDI; see Table 2). Thus, worry was entered as a covariate in all analyses in order to control for the overlap between worry and

rumination. Likewise, current depressive symptoms were statistically controlled in order to isolate the effects of rumination independent of current mood.

Table 1. Demographic Characteristics of the Sample

	Phase 1 (<i>n</i> = 138)		Phase 2 (<i>n</i> = 100)			
	Rumination Status		Rumination Status		Condition Assignment	
	High	Low	High	Low	Relax	Rumination
Sex (% female)	78%	90%	86%	88%	87%	87%
Mean Age	19.88	19.13	20.07	19.30	19.70	19.57
Ethnicity						
% Caucasian	69%	56%	67%	59%	60%	65%
% African American	7%	29%	7%	28%	23%	13%
% Other	24%	15%	26%	13%	17%	22%

Table 2. Correlation Matrix

	Rumination Status	BDI	PSWQ
Rumination Status			
BDI	.57*		
PSWQ	.55*	.58*	

* $p < .01$

Main Hypotheses

Questionnaire Indices of Avoidance

It was expected that rumination status would differentially relate to the measures of experiential avoidance and current depressive symptoms. Specifically, it was expected that HR individuals would report significantly higher levels of experiential avoidance (AAQ) and fear of emotions (ACS). This was tested using univariate ANCOVAs with age, sex, and ethnicity as covariates. Consistent with predictions, HR individuals reported significantly more experiential avoidance ($F(1, 126) = 38.49, p < .001, \eta^2 = .23$) and greater fear of

emotions ($F(1, 131) = 41.61, p < .001, \eta^2 = .24$) than LR individuals (see Table 3). Further, rumination status was related to fear of all emotions indexed by the subscales of the ACS, including positive emotions (anger, $F(1, 131) = 25.80, p < .001, \eta^2 = .16$; positive, $F(1, 131) = 6.91, p = .01, \eta^2 = .05$; depression, $F(1, 131) = 44.72, p < .001, \eta^2 = .25$; anxiety, $F(1, 131) = 37.28, p < .001, \eta^2 = .22$; see Table 3). In line with other studies, HR individuals also reported greater current depressive symptoms than LR individuals ($F(1, 92) = 42.31, p < .001, \eta^2 = .30$).

Table 3. Mean Scores and Results for Questionnaire Data

	Mean Scores Rumination Status		Df	F-Statistic	p-Value	η^2
	High	Low				
AAQ	39.45	31.19	126	38.49	< .001	0.23
ACS						
Total	3.77	2.93	123	42.52	< .001	0.24
Anger	3.93	3.05	131	25.8	< .001	0.16
Positive Emotion	3.10	2.73	131	6.91	0.01	0.05
Depression	4.07	2.83	131	44.72	< .001	0.25
Anxiety	4.17	3.12	131	37.28	< .001	0.22
BDI	9.38	2.81	92	42.31	<.001	0.30

Behavioral Index of Avoidance: Differences in Dichotic Listening Response

If HR individuals exhibit a tendency to divert their attention away from negative stimuli, HR individuals should remember significantly more neutral words from the unattended ear during the depressive story than during the neutral story. In addition, it was expected that this difference would not be observed in the LR group. This was tested using a repeated measures rumination status by story type ANCOVA, with number of words recalled during each story as the dependent variable. Contrary to predictions, the interaction of rumination status and words recalled during the neutral vs. depressive story was not significant ($F(1, 89) = 2.05, p = .16, \eta_p^2 = .02$, see Figure 1). Further, the main effect of

rumination status was also not significant ($F(1, 89) = .38, p = .53, \eta_p^2 = .004$, see Figure 1). Thus, contrary to predictions, the HR and LR groups did not differ in their recall of neutral words during the dichotic listening task.

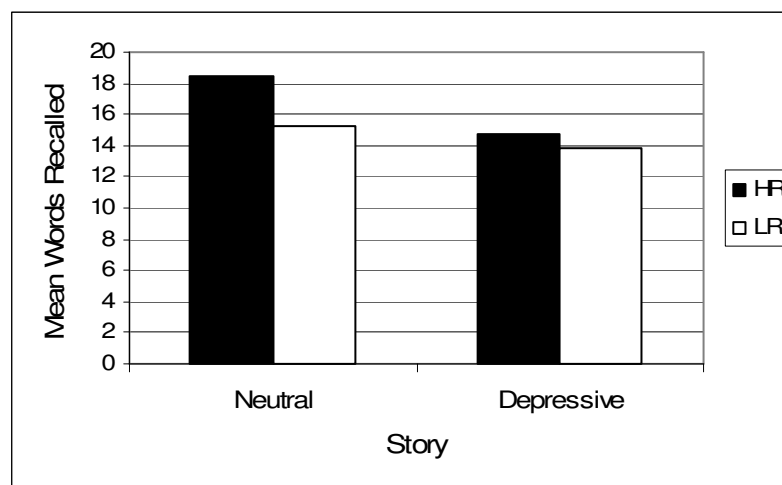


Figure 1. Non-significant interaction of rumination status across story types on mean number of words recalled during dichotic listening task.

Physiological Indices

Baseline Differences in Physiology

It was expected that HR individuals would exhibit higher tonic heart rate than LR individuals, in line with findings from other studies of worry. It was also expected that at baseline, HR individuals would display lower RSA than LR individuals, regardless of condition. This was tested using a MANCOVA with rumination status as the independent variable; age, ethnicity, worry, and depressive symptoms as covariates; and IBI, MSD, and RSA as the dependent variables. Contrary to predictions, there were no differences between HR and LR individuals on indices of baseline heart rate (IBI, $F(1, 73) = .19, p = .66, \eta^2 = .002$; MSD, $F(1, 73) = .64, p = .43, \eta^2 = .01$; RSA, $F(1, 73) = .47, p = .50, \eta^2 = .01$; see Table 4). However, it was noted that worry was significantly related to measures of baseline heart

rate across all measures (IBI, $F(1, 73) = 11.19, p = .001, \eta^2 = .13$; MSD, $F(1, 73) = 8.12, p = .006, \eta^2 = .10$; RSA, $F(1, 73) = 5.99, p = .02, \eta^2 = .07$). Higher worry was associated with lower IBI, MSD, and RSA at baseline 1. This suggests that worry was more closely related to baseline heart rate activity than rumination status.

Table 4. Baseline Indices of Heart Activity

	Rumination Status	
	High	Low
IBI	808.88	792.86
MSD	44.73	38.51
RSA	6.70	6.49

* $p < .05$

Replication of Avoidance Paradigm

Self-reported emotional response. Consistent with the patterning of avoidance, it was also expected that HR individuals in the rumination condition would report the highest levels of self-rated negative mood and arousal throughout the rumination induction, depressive mood induction, and rest periods. This was tested using a rumination status by condition assignment MANCOVA on SAM valence and SAM arousal ratings for each period. The covariates were age, ethnicity, worry, and depressive symptoms. There was a significant interaction of condition assignment and rumination status on ratings of valence during the rumination/relaxation induction period ($F(1, 83) = 4.41, p = .03, \eta_p^2 = .05$, see Figure 2). However, no interaction effects were found for valence or arousal for the depression induction (valence, $F(1, 83) = .10, p = .75, \eta_p^2 = .001$; arousal, $F(1, 83) = 1.36, p = .25, \eta_p^2 = .02$), and rest periods (valence, $F(1, 83) = .30, p = .59, \eta_p^2 = .004$; arousal, $F(1, 83) = .03, p = .86, \eta_p^2 = .000$), or for arousal during the rumination/relaxation induction period ($F(1, 83) = .84, p = .36, \eta_p^2 = .01$). Bonferroni corrected follow-up analyses of this interaction indicated

that there was a trend for HR individuals in the rumination condition to report significantly greater negative mood than LR individuals ($t(45) = 2.41, p = .02$, see Figure 1, $d = .72$). No differences in mood valence were found between LR and HR individuals in the relaxation condition ($t(47) = -.88, p = .39, d = .26$), or for LR participants across conditions ($t(48) = -1.65, p = .11, d = .48$) or for HR participants across conditions ($t(44) = 1.67, p = .10, d = .50$).

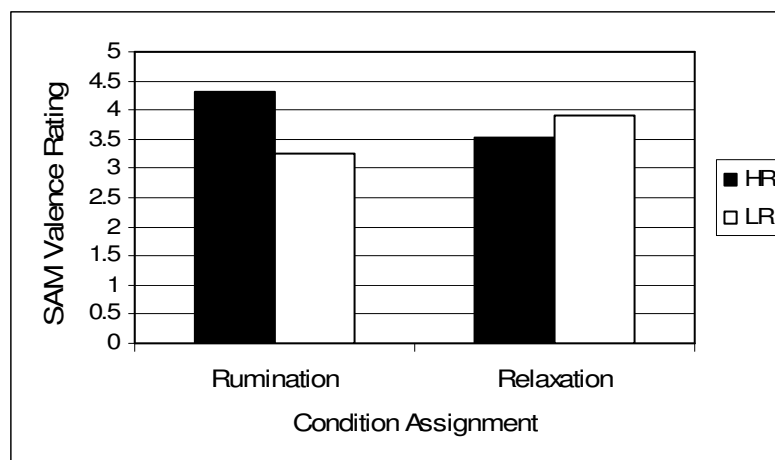


Figure 2. Significant interaction effect of condition assignment and rumination status on SAM valence ratings during the rumination/relaxation induction.

There was also a significant main effect of condition on SAM arousal ratings for the rumination/relaxation induction; individuals in the rumination condition reported greater arousal than individuals in the relaxation condition ($F(1, 83) = 6.97, p = .01, \eta_p^2 = .08$). No other main effects were found for rumination status or condition assignment. It was noted that there was also a main effect of depressive symptoms (BDI) on SAM valence ratings for the rumination/relaxation and depression tasks (rumination/relaxation, $F(1, 83) = 5.08, p = .03, \eta^2 = .05$; depression, $F(1, 83) = 8.24, p = .005, \eta^2 = .08$). Thus, it may be that potential differences in reported mood during the rumination/relaxation and depression tasks between HR and LR individuals is better accounted for by differences in depressive symptoms.

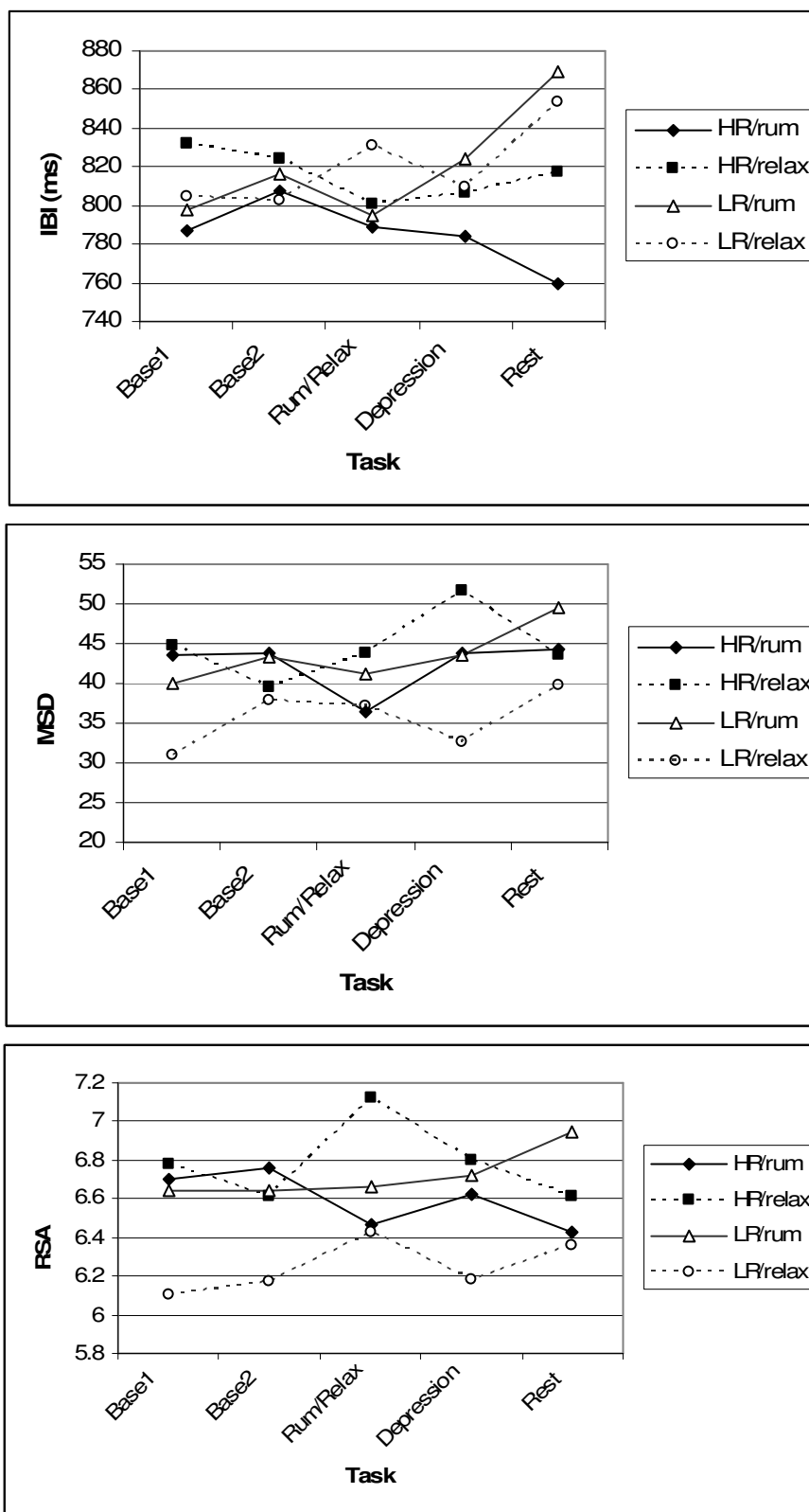


Figure 3. Changes in IBI, MSD, and RSA across tasks.

Physiological response to inductions. Consistent with the patterning of avoidance, it was also expected that HR individuals in the rumination condition would exhibit the lowest levels of physiological response (as measured by heart rate and vagal withdrawal) to the mood induction (see Figure 3 for mean IBI, MSD, and RSA across tasks). This was tested using a rumination status by condition assignment MANCOVA with the change in IBI, MSD, and RSA from the rumination/relaxation induction to the depression induction as dependent variables (see Figure 4).

The interaction of rumination status and condition assignment was marginally significant for changes in IBI ($F(1, 82) = 2.84, p = .10, \eta_p^2 = .03$, see Figure 4), but was not significant for MSD ($F(1, 82) = .29, p = .59, \eta_p^2 = .004$) or RSA ($F(1, 73) = 1.03, p = .31, \eta_p^2 = .01$). Follow-up analyses indicated that LR individuals' IBI response significantly differed in the relaxation condition vs. the rumination condition ($t(49) = 2.80, p = .007, d = .80$). No differences were found in HR individuals' IBI across condition ($t(42) = -.03, p = .97, d = .01$), and HR and LR individuals' IBI did not significantly differ for either condition (rumination, $t(45) = -.95, p = .35, d = .28$; relaxation, $t(46) = .99, p = .33, d = .30$). Overall, this suggests that LR individuals show a differential response to the rumination vs. the relaxation conditions on IBI. Consistent with hypotheses, HR individuals in the rumination condition did not physiologically respond to the depression induction on IBI, MSD, or RSA indices; however, this was not different for HR individuals in the relaxation condition either.

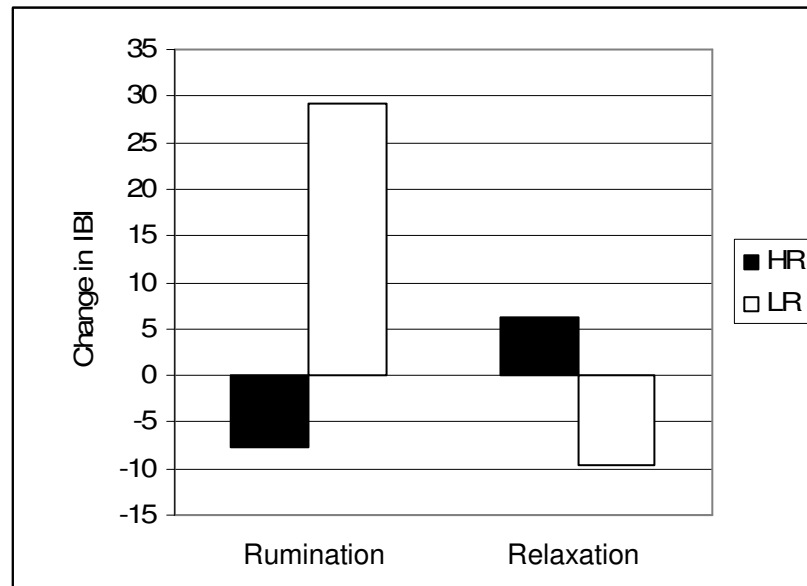


Figure 4. Marginally significant interaction of rumination status and condition on change in IBI from the rumination/relaxation induction to the depression induction.

A significant main effect of condition assignment was also observed for changes in RSA from the rumination/relaxation induction to the depression induction. Specifically, individuals in the relaxation condition, regardless of rumination status, demonstrated greater vagal withdrawal in response to the depression induction ($F(1, 82) = 2.61, p = .001, \eta_p^2 = .12$, see Figure 5). The main effects of condition assignment on IBI and MSD were not significant (IBI, $F(1, 82) = .68, p = .41, \eta_p^2 = .01$; MSD, $F(1, 82) = .53, p = .47, \eta_p^2 = .01$). No significant main effects for rumination status were found for IBI, MSD, or RSA (IBI, $F(1, 82) = .17, p = .61, \eta^2 = .003$; MSD, $F(1, 82) = .27, p = .19, \eta^2 = .02$; RSA, $F(1, 82) = 1.76, p = .69, \eta^2 = .001$). Overall, this suggests that individuals in the rumination condition demonstrated significantly less physiological reactivity (as indexed by RSA) to the depression induction than individuals assigned to the relaxation induction (see Figure 5).

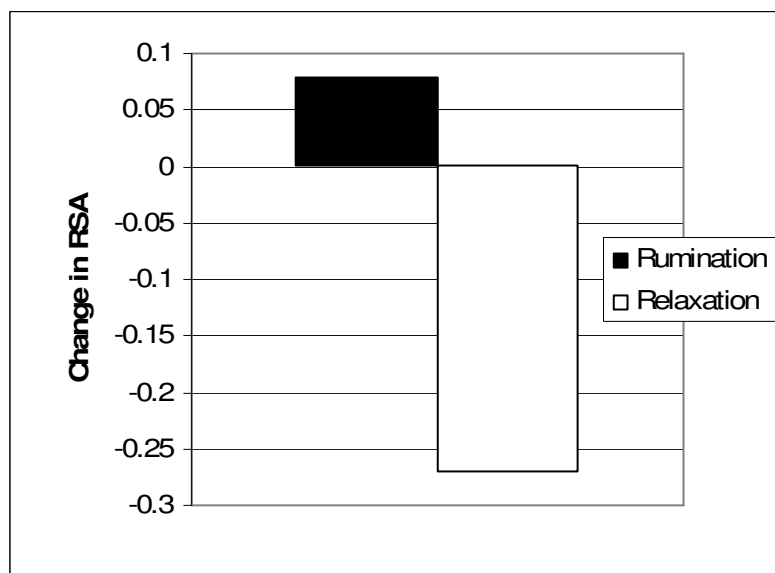


Figure 5. Significant main effect of condition assignment on RSA.

It was also noted that worry was significantly related to changes in MSD ($F(1, 82) = 14.23, p < .001, \eta^2 = .13$) and RSA ($F(1, 82) = 4.23, p = .04, \eta^2 = .04$) such that higher self-reported worry was associated with less change in MSD and less vagal withdrawal. This may help explain why no differences were found for condition assignment or rumination status on MSD. Further, it suggests that the effect of condition assignment on RSA is significant above and beyond the association of worry and RSA.

Examination of Blunting Hypothesis

In order to examine whether the lack of physiological response to the depression induction was due to an initial response to the rumination/relaxation induction, repeated measures MANCOVAs were run on IBI, MSD, and RSA from baseline 1 to baseline 2 and to the rumination/relaxation induction. The sphericity assumption for IBI was not met, thus, Greenhouse-Geisser corrected results are reported for all IBI results. The interaction between rumination status and condition assignment was not significant for any of the physiological indices (IBI, $F(1, 105.48) = 2.02, p = .15, \eta_p^2 = .03$; MSD, $F(1, 132) = 1.53, p =$

.22, $\eta_p^2 = .02$; RSA, $F(1, 132) = 2.33, p = .10, \eta_p^2 = .03$, see Figure 3). Contrary to the blunting hypothesis, these results suggest that HR individuals in the rumination condition did not respond differently to the rumination induction than other groups.

For IBI and MSD, rumination status and condition assignment did not significantly interact with task (baseline 1, baseline 2, or rumination/relaxation; IBI rumination status, $F(1, 105.44) = .83, p = .44, \eta_p^2 = .01$; IBI condition assignment, $F(1, 105.44) = 1.34, p = .27, \eta_p^2 = .02$; MSD rumination status, $F(1, 132) = 1.60, p = .21, \eta_p^2 = .02$; MSD condition assignment, $F(1, 132) = 1.57, p = .21, \eta_p^2 = .02$). It was also noted that worry significantly interacted with task for MSD ($F(1, 132) = 3.91, p = .02, \eta_p^2 = .06$), which again suggests that differences in worry may have exerted a greater effect on MSD response than rumination status or condition assignment. For RSA, condition assignment significantly interacted with task; however, rumination status did not (RSA rumination status $F(1, 132) = .14, p = .87, \eta_p^2 = .002$; RSA condition assignment, $F(1, 132) = 7.34, p = .001, \eta_p^2 = .10$). Follow-up analyses indicated that for participants in the relaxation condition, RSA significantly increased from baseline 2 to the relaxation induction ($t(47) = -4.61, p < .001, d = .95$). No changes in the rumination condition were significant. Again, this does not support the blunting hypothesis in that rumination status, regardless of condition assignment, did not relate to physiological change from baseline to rumination/relaxation induction for IBI, MSD, or RSA.

CHAPTER 4 DISCUSSION

This study examined an experiential avoidance conceptualization of depressive rumination among HR and LR Temple undergraduates using questionnaire, behavioral, and psychophysiological indices of avoidance. In line with other studies, rumination status was significantly related to both worry and current symptoms of depression such that HR individuals reported more worry and symptoms of depression than LR individuals.

Questionnaire Indices of Avoidance

In line with predictions, a relationship between rumination status and avoidance was evident on self-report questionnaire measures of avoidance. HR individuals reported significantly greater experiential avoidance, as measured by the AAQ, and fear of emotions, as measured by the ACS, than LR individuals. Further, HR participants reported greater fear of emotion on each of the emotion subscales (anger, depression, anxiety, positive emotions). This suggests that HR individuals may experience discomfort in response to any intense emotion, regardless of valence. One potential criticism of the AAQ is that it taps into many different constructs; for example, items on the AAQ ask about beliefs about emotions, behaviors related to avoidance, fears about the consequences of negative emotions, metacognitions, and cognitive activities related to avoidance (such as daydreaming). Further, some of these items may conceptually overlap with symptoms of depression (“when I feel depressed or anxious, I am unable to take care of my responsibilities”). In contrast, the ACS is a purer measure of fear of emotions because items on the ACS focus solely on fear of the experience of emotions, and fear of the consequences of those emotions to self and others. The convergence of both of these measures in terms of their relationship to rumination status suggests that rumination is related to a wide range of self-reported avoidant phenomena.

Behavioral Indices of Avoidance: Dichotic Listening Task

Contrary to predictions, there was no evidence of behavioral avoidance in the dichotic listening task. Rumination status did not interact with the neutral vs. depressive story

on number of words recalled. Further, there was no main effect of rumination status, such that HR and LR individuals did not differ in their overall recall of words, regardless of story. This suggests that the HR group did not show overall deficits in word recall. Overall, these findings suggest that HR and LR individuals do not differ in their attention allocation during the presentation of neutral and depressive stories.

Psychophysiological Indices of Avoidance

Baseline Differences in Physiology

This study also aimed to examine physiological differences in HR and LR individuals. Although previous studies have found that rumination is related to higher systolic blood pressure and slower cardiac output recovery (Bermudez & Perez-Garcia, 1996; Neuman et al., 2001), there was no evidence of baseline differences between HR and LR individuals in IBI, MSD, or RSA. Reduced tonic HRV has also been linked to depression (Thayer et al., 1998); however differences in HRV at baseline were not observed in this sample. This may be because individuals who met criteria for a major depressive episode were excluded. In line with this, HR individuals in this sample on average reported minimal symptoms of depression (mean BDI = 9.38). Thus, tonic HRV may be more directly related to current symptoms of depression than rumination.

Alternatively, given that HRV differences have been observed in worriers (Lyonfields et al., 1995), the relationship between worry and baseline IBI, MSD, and RSA was examined. In line with other findings, baseline indices of all physiological measures were significantly related to self-reported worry. This suggests that worry is a more proximal predictor of baseline HRV than rumination status, and thus, may have reduced the effect of rumination status on baseline physiological measures. Thus, our discrepant findings may also be due to the fact that other studies of HRV and depression did not control for worry. Further investigation of the relationship between worry, rumination, and baseline HRV is warranted.

Replication of Avoidance Paradigm

Self-Reported Emotional Response

In addition to baseline differences in physiology, this study aimed to replicate Borkovec et al.'s (1993) avoidance paradigm which reported a discrepancy between reported anxiety and physiological indices of anxiety in worriers. Similarly, it was expected that HR individuals in the rumination condition would report elevated levels of negative mood in response to the depression induction, but would not show a commensurate physiological response on IBI, MSD, or RSA. Contrary to predictions, HR individuals did not report greater negative valence or arousal during the depression induction or rest periods. Instead, there was a trend for HR participants to report significantly greater negative mood during the rumination induction. In addition, individuals in the rumination condition, regardless of rumination status, reported greater arousal during the rumination induction than the relaxation induction, which suggests that it was the rumination induction, not overall tendency to ruminate, that related to self-reported emotional response to the rumination induction.

The expected self-reported mood response of HR individuals to the depression induction was not observed. One potential explanation for this is that symptoms of depression (as indexed by the BDI) were significantly related to valence ratings during the depression and rumination/relaxation inductions, and were marginally related to arousal ratings during the depression induction. Thus, it may be that the greater reported emotional response observed in other studies was due to differences in baseline symptomatology, as opposed to differences based on rumination status. Overall, further examination of the relationship between current depressive symptoms, rumination, and self-reported emotional response to depression induction is indicated. Although the difference in self-reported response to the mood induction among HR vs. LR individuals was not supported in this

study, both HR and LR participants reported a significant, but equal, decrease in mood in response to the depression induction.

Physiological Response to Inductions

The second portion of Borkovec et al.'s (1993) paradigm predicts differential physiological response to an emotion induction. Specifically, we expected that HR individuals in the rumination condition would not exhibit a physiological response to the depression induction. Although results generally supported a lack of physiological response by HR individuals, the various indices of physiological response demonstrated slightly different patterns. For IBI, LR individuals responded differently to the rumination vs. the relaxation induction. Consistent with predictions, there was no evidence of physiological response to the depression induction among HR individuals on IBI. However, this was true regardless of condition assignment and not just in the rumination condition as predicted.

One possible explanation for this is that HR individuals were ruminating during the relaxation condition despite being instructed to relax. However, HR individuals in the relaxation condition reported significantly less analytical thinking than HR individuals in the rumination condition ($t(44) = 5.12, p < .001, d = 1.54$), and HR and LR individuals in the relaxation condition did not differ in their level of analytic thinking ($t(47) = 1.04, p = .30, d = .03$). This suggests that HR individuals in the relaxation condition engaged in thinking styles that characterize rumination significantly less than HR individuals in the rumination condition. Overall, this suggests that HR individuals, regardless of whether they ruminated before the depression induction or not, did not display a significant change in IBI in response to the depression induction. Thus, although ruminators exhibited less analytical thinking during the relaxation induction, it may be that an active change in cognitive style, such as that produced by mindfulness meditation interventions, is needed to counteract the physiological blunting seen in HR individuals in response to negative mood. This is in line with Broderick's (2005) findings which suggested that mindfulness meditation produced significantly less negative

mood than rumination or distraction. It may be that purposeful focusing on emotion may be required to elicit physiological response in HR individuals. Another explanation for this finding is that HR individuals, despite lower levels of analytical thought during the relaxation induction, began ruminating in earnest during the depression induction and this may have blunted their IBI response. Consistent with this, HR individuals reported significantly more analytical thinking during the depression induction than LR individuals ($t(97) = 4.39, p < .001, d = .89$).

A different pattern of reactivity was observed on one index of HRV (RSA). Specifically, individuals in the relaxation condition, regardless of rumination status, demonstrated greater vagal withdrawal to the depression induction than individuals assigned to the rumination condition. This suggests that rumination before the depression induction, regardless of trait propensity for rumination, suppresses vagal response to a negative mood induction. Given that LR individuals in the rumination condition reported significantly higher levels of analytic thinking than LR individuals in the relaxation condition ($t(49) = 2.14, p = .04, d = .61$), it may be that the rumination induction was successful in inducing rumination in LR individuals and, thereby, inhibited vagal response in both HR and LR individuals.

Overall, the response of HR individuals in the rumination condition to the depression induction does not directly replicate the findings of Borkovec and colleagues (1993) with high worrying individuals. However, the findings do suggest that HR individuals show reduced IBI response to a depression induction in general, regardless of condition assignment, and that a rumination induction can inhibit vagal withdrawal in response to a depression induction even among individuals who are not prone to ruminating. These findings provide partial support for an avoidance conceptualization of depressive rumination and suggest that rumination may inhibit emotional processing in general. Further, these data suggest that direct experiencing of emotions may be necessary to elicit IBI response in HR individuals. This is an area for future study.

Blunting Hypothesis

An additional goal of this study was to examine whether the blunting effect described by Peasley-Miklus and Vrana (2000) in worry was also operating in rumination. Specifically, I examined whether or not the blunted physiological response observed in HR individuals could be better accounted for by an initial physiological response to the rumination induction. As expected, no evidence of the blunting effect was observed in these data; HR individuals did not show a differentially high physiological response to the rumination or relaxation induction.

Implications for Avoidance Conceptualization of Depressive Rumination

The major aim of this study was to determine whether or not depressive rumination was best characterized as an experiential avoidance strategy using paradigms that had been established as indicators of avoidance in worry. Other theories of rumination propose that rumination is harmful in a variety of ways; however, most theories converge on the hypothesis that rumination interferes with problem-solving and/or other adaptive responses to negative affect. Consistent with this, an avoidance conceptualization of rumination proposes that rumination blocks adaptive processing of negative affect by interfering with certain aspects of emotional experience, such as physiological response, which may be necessary for effective processing (Foa & Kozak, 1986) and effective problem solving.

Although previous studies of worry in GAD have reported a discrepancy between self-reported changes in mood and physiological changes in mood, suggesting incomplete activation of the emotion, this pattern was not replicated in the current sample of HR individuals. Instead, HR individuals reported the same degree of emotional response to the depression induction as LR individuals. Further, in studies of worry, high worrying individuals in the worry condition showed less physiological reactivity to a feared stimulus than those in the relaxation condition. In our study of rumination, HR individuals showed less physiological response (change in IBI) regardless of condition assignment. This suggests that there may

be a fundamental difference between worry and rumination, such that rumination may not need to be activated in advance of a negative emotion to affect physiological response. Given that HR individuals reported significantly greater levels of analytical thought during the depression induction than LR individuals, it may be that the condition assignment did not affect rumination behavior during the emotion induction. Although this does not mimic the pattern of findings in studies of worry, it does support an avoidance conceptualization of rumination in that HR individuals in general did not demonstrate an IBI response to negative mood. Further, given the trend in LR individuals in the relaxation condition to exhibit the greatest IBI response to negative mood, it may be that LR individuals who were "trained" to ruminate via the rumination induction also showed less IBI reactivity to the depression induction.

This is consistent with the finding that the rumination induction was successful in inhibiting vagal response to a depression induction in both HR and LR individuals. Although this has not been reported in studies of worry, it is compatible with an avoidance conceptualization of rumination in that rumination prior to the depression induction was associated with decreased physiological response. Further, it suggests that the effect of rumination on suppressing physiological response occurs with little "practice" of rumination. Theories of anxiety have suggested that the decrease in physiological response associated with removing oneself from an anxiety provoking stimulus may negatively reinforce avoidance of such stimuli in the future (Mower, 1960). Similarly, this may help explain why rumination becomes so ubiquitous in individuals with depression given that the negative reinforcement properties of rumination (the reduction in physiological response) that may maintain its use appear to occur immediately.

Although the physiological findings across measures (IBI, MSD, and RSA) were not identical, the IBI and RSA data converge in a meaningful pattern. Specifically, they both suggest that HR individuals do not physiologically respond to a depression induction,

regardless of condition assignment. Further, there is evidence that LR individuals in the relaxation condition physiologically respond differently than all other groups. Overall, this suggests that the physiological blunting that was expected among HR individuals in the rumination condition may have been operating for HR individuals regardless of condition, and that rumination in LR individuals can also impact physiological response to depressed mood. It is unclear why this pattern of response was not evident in the MSD data; however, that measure appeared to be consistently more affected by the influence of level of self-reported worry than the other indices, which may explain the null findings.

The current study supports several aspects of an experiential avoidance conceptualization of rumination and adds to the current literature by introducing a new model of depressive rumination that addresses a few of the limitations of the major theories of rumination. For example, an avoidance model of rumination places depressive rumination in the context of experiential avoidance theories more generally, and provides an explanation for the overlap between rumination and worry without assuming that they are the same construct. Similarly, it provides an explanation for the common co-occurrence of depression and anxiety, specifically, that they both arise from maladaptive attempts to avoid emotional experience. In addition, the model makes predictions about HR individuals' behavioral and physiological responses to negative affect, which allows for more varied research methodologies.

One theme that arises across various theories of rumination is that rumination is likely harmful in its disruption of adaptive problem-solving. An experiential avoidance conceptualization of rumination is compatible with this view in that it may be that rumination's interference with adaptive processing of negative emotion limits problem-solving ability in high-ruminating individuals. For example, it may be that activation of the full emotion structure is necessary to generate appropriate solutions for coping with negative affect. Future studies are needed to determine whether or not the relationship between depressive

rumination and poor problem-solving is mediated by experiential avoidance, in line with other theories of rumination.

Summary and Limitations

Although many of these findings support an avoidance conceptualization of rumination, a few limitations of the current study should be acknowledged. In particular, there were some anomalies in the current sample that should be considered. For example, the sex difference in rumination has been widely reported; however, our Phase 2 HR and LR groups did not differ in their sex composition. It should be noted that there was a trend for a sex difference in the Phase 1 sample, but it is unclear why the sex difference in rumination was not duplicated in the Phase 2 sample, and this may limit the generalizability of the findings. However, this also suggests that the findings from this study apply to both male and female ruminators. In addition, the HR and LR groups differed on their ethnic composition. To my knowledge, no other studies of rumination have reported differences in ethnicity for rumination. Given that this sample was particularly diverse, it may have been able to discern true differences among ethnic groups in propensity towards rumination. Conversely, it may just be an anomaly of this sample. Regardless, ethnic differences in rumination and its experiential avoidance function is an area that warrants further inquiry.

Another limitation of the sample is that individuals who were deemed to be at risk for experiencing adverse effects due to the depression induction were excluded from the study. This included individuals who currently met criteria for a major depressive episode, but also individuals who were believed to be at risk for suicide, or potentially entering a depressive episode, despite not meeting duration criteria (i.e., experiencing symptoms for 1 week). Thus, HR individuals in our sample reported a minimal level of depressive symptoms on average, although the range of depressive symptoms reported (0-25) suggests that some individuals were experiencing moderate symptoms of depression at the time of the study. Given that 14% of the Phase 1 sample, the majority of which were high ruminators, was

excluded because of elevated levels of depression, these findings may not generalize to the full range of high ruminating individuals. Related to this, this study only included individuals who reported high or low levels of rumination; thus, it does not capture the full range of ruminating individuals and cannot confirm that the same mechanisms of avoidance are operating in mid-range ruminators. Future studies should examine the avoidance hypothesis with a full range of ruminating individuals.

A further limitation of the current study is the placement of the rumination or relaxation induction in the experimental procedure. Although the goal of this study was to replicate the findings of Borkovec et al. (1993) in worriers, important differences in the time period focus of worry and rumination may have impacted the generalizability of the findings. Specifically, worry has been related to a greater focus on future, whereas rumination is often focused more highly on past events (Papageorgiou & Wells, 1999; Watkins, Moulds, & Mackintosh, 2005). Given rumination's increased focus on past events, a rumination induction prior to a depression induction may not fully capture the impact of rumination on emotional experience. For example, a rumination induction following a negative mood induction may best capture the nature of rumination, such as in Watkins' (2000) and Broderick's (2005) studies. Future studies should examine whether the placement of the rumination induction indeed has a differential effect on physiological response to a negative mood induction. However, given that HR individuals reported significantly more analytical thinking during the depression induction, and exhibited a corresponding lack of physiological response, and that LR individuals increased in their level of ruminative thinking after the rumination induction, it is likely that the experiential avoidance function of rumination was observed in this sample during the depression induction.

Debate has also emerged over the nature of the construct of depressive rumination. Specifically, it has been suggested that depressive rumination, as measured by the RSQ, may actually be a multi-faceted construct that captures both negative and potentially

positive forms of self-focus (Roberts, Gilboa, & Gotlib, 2003; Treynor, Gonzales, & Nolen-Hoeksema, 2003). Factor analytic studies of the RSQ confirm that a certain subtype of rumination, characterized by brooding, may account for the harmful effects of rumination, whereas more reflective forms of self-focus do not relate to depressive symptoms. In the current study, rumination status was determined based on the entire rumination subscale of the RSQ, therefore, the multi-factored nature of rumination was not considered. Future research should examine how an experiential avoidance conceptualization of rumination applies to all factors of the RSQ.

In sum, some support for an avoidance conceptualization of rumination was garnered. Rumination status was significantly related to questionnaire measures of avoidance. In addition, consistent with the patterning of avoidance observed in high worrying individuals, HR individuals in both conditions did not demonstrate a significant physiological response to the depression induction as measured by IBI, MSD, and RSA, despite a reported decrease in mood. Further, it appears that the rumination induction inhibited vagal response to the depression induction regardless of trait propensity for rumination.

These findings have important implications for the treatment of HR individuals. Although this study excluded individuals with current depression, these findings suggest that HR individuals who present for treatment of depression, despite reported negative mood, may actually have difficulty activating the full spectrum of experience associated with negative emotions. Further, it may be that treatment for depression that incorporates active experiencing of emotions may be more successful in activating effective problem-solving and ameliorating depressive symptoms. In line with this, therapies that have included a mindfulness meditation component (Jain et al., 2007; Kenny & Williams, 2007; Ramel, Goldin, Carmona, & McQuaid, 2004) have demonstrated efficacy in reducing both rumination and symptoms of depression, and reduced risk of relapse in previously depressed individuals (Teasdale et al., 2000). Further, Ramel et al. (2004) reported that the decrease in

depressive symptoms was accounted for by the decrease in rumination. Thus, rumination may indeed be an important point of intervention for individuals with depression, and "exposure" to negative mood may be an important part of treatment for rumination.

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