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A Latent Profile Analysis of Rumination: An Examination of Trait Affect and Socio- Emotional Associations

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A LATENT PROFILE ANALYSIS OF RUMINATION:
AN EXAMINATION OF TRAIT AFFECT AND
SOCIO-EMOTIONAL ASSOCIATIONS

By

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ABSTRACT

This study examined the generality of rumination and its associations with multiple indices of trait level affect and socio-emotional functioning using both variable-centered and person-centered approaches to data analysis. Participants were 310 college-age students (81% female) who completed self-report measures of sadness and anger rumination, trait sadness and anger, depressive symptoms, and aggressive behavior. Confirmatory factor analysis found that a two-factor model of rumination, comprised of separate but highly correlated sadness and anger rumination factors, best fit the data. Latent profile analysis concluded that a three-class solution characterized by high, average, and low rumination provided the optimal categorization of participants. The three classes differed on trait sadness, trait anger, depression, and aggression such that as rumination class moved from low to high, so did the severity of trait mood and socio-emotional variables. Hierarchical regression analyses showed that sadness rumination, but not anger rumination, was related to depression, while anger rumination, but not sadness rumination was related to aggression. This study replicated past research that demonstrated both anger rumination and trait anger are uniquely related to aggression and was the first to show that both sadness rumination and trait sadness were uniquely related to depression. Sex differences were found for one measure of sadness rumination, depression, trait sadness, and aggression, with women endorsing more sadness-related variables and men endorsing more aggression. Sex was considered as a covariate and was not shown to moderate any of the relationships between rumination and its correlates. Taken together, these analyses suggest rumination may be considered a general cognitive tendency that is comprised of highly related sub-factors of sadness and anger rumination. Implications for clinical intervention are discussed.

CHAPTER 1

INTRODUCTION

The high rates of comorbidity among mental disorders (Kessler et al., 2005; Watson, 2009) suggest that different forms of psychopathology share some similar underlying developmental processes. This has led to an increased interest in the identification of transdiagnostic cognitive, affective, and neurobiological processes that may lead to the development of psychopathology (e.g., Aldao, 2012; Ehring & Watkins, 2008; Nolen-Hoeksema & Watkins, 2011). The identification of these transdiagnostic factors has in turn led to the development of novel psychosocial interventions (Barlow, Allen, & Choate, 2004; Dear et al., 2011). Factor analyses have demonstrated that the structure of associations between mental disorders is best characterized by a model reflecting two broad, related categories of internalizing and externalizing psychopathology (Krueger, 1999; Krueger & Markon, 2006). The importance of identifying transdiagnostic vulnerability factors has gained considerable support with respect to disorders that fall in the internalizing category (McLaughlin & Nolen-Hoeksema, 2011; Egan, Wade, & Shafran, 2011) but has received less attention with respect to disorders that belong to distinct categories (i.e., internalizing and externalizing). The present study sought to fill this gap by examining the cognitive process of rumination as a transdiagnostic vulnerability factor for the internalizing symptoms of depression and the externalizing enactment of aggression.

Understanding factors involved in the development of depressive symptoms and aggressive behaviors is important given their associations with immediate and long-term negative outcomes. Research has shown that depressive symptoms increase the risk of major depressive disorder, suicide, and substance use during adolescence (Klein, Kujawa, Black, & Pennock, 2013) and are associated with poor social functioning, risk of physical health problems, and suicide in adulthood (Prigerson, Desai, Lui-Mares, & Roseheck, 2003; Wells, Steward, Hays, Burnam, Rogers, Daniels, et al., 1989). Aggression has been shown to increase risk of truancy and delinquency during adolescence (Waldman & Lahey, 2013) and is associated with poor social functioning, risk of physical health problems, antisocial behavior, and suicide attempts in adulthood (Booth-Kewley & Friedman, 1987; Maiuro, O'Sullivan, Michael, & Vitaliano, 1989; Werner & Crick, 1999). While it is difficult to estimate the prevalence of

comorbid depression and aggression in adulthood, evidence suggests the co-occurrence of these symptoms is problematic. For example, research has shown that depressed individuals who also display aggressive behavior are more likely to attempt and complete suicide than their non-aggressive peers (Dumais et al., 2005; Weissman, Fox, & Klerman, 1973). Given the psychosocial difficulties experienced by individuals who display either depression or aggression alone, it is reasonable to expect that outcomes for individuals who display their comorbidity will be even more serious. As such, there is a need to better understand and intervene on factors that put individuals at risk for developing depression, aggression, and their co-occurrence.

The cognitive process of rumination has generated considerable theoretical and empirical interest as a vulnerability factor for multiple maladaptive outcomes. Rumination is generally defined as repetitive thinking about negative personal concerns and/or about the implications, causes, and meanings of a negative mood. It has been suggested that rumination occurs when there is a discrepancy between events and the individual's schema (Clark, 1996). Thus, rumination serves the function of incorporating the events into the schema and making sense of them. Although rumination usually occurs automatically in response to internal cues (Hertel, 2004) individuals who tend to ruminate often do not consider rumination to be intrusive or unwanted. In fact, they often believe that rumination will lead to understanding about their negative mood; consequently, they engage in rumination (Simpson & Papageorgiou, 2004). Once individuals begin to ruminate, however, it is likely to be self-perpetuating and continue even when it is not wanted (Papageorgiou & Wells, 2003).

Sadness Rumination and Depression

A large body of literature has found support for the association between rumination to the negative affect of sadness (herein referred to as "sadness rumination") and depressive outcomes (see Thomsen, 2006 for review). Nolen-Hoeksema (1987, 1991) proposed the Response Styles Theory to explain the relationship between sadness rumination and depressed mood. According to this theory, the way individuals respond to feelings of sadness (e.g., by rumination, distraction, problem-solving, etc.) affects the incidence, duration, and intensity of depressive outcomes. Individuals who engage in sadness rumination display a pattern of behavior and thinking that focus attention to their emotional states and inhibits any actions that might improve their moods (e.g., problem-solving), thus increasing the risk for depressive outcomes.

In support of the Response Styles Theory, a multitude of correlational and cross-sectional studies have found evidence of an association between sadness rumination and depressive symptoms (Abela, Vanderbilt, & Rochon, 2004; Cheung, Gilbert, & Irons, 2004; Ciarrochi, Scott, Deane, & Heaven, 2003). For example, research has shown that participants categorized as “high sadness ruminators” display greater depressive symptoms than “low sadness ruminators” (Watkins & Mason, 2002). In addition, many experimental paradigms have found an association between sadness rumination and depressive symptoms. In some studies participants are recruited as already sad/depressed and then compared to a non-sad group. Sad participants who were instructed to ruminate on their sad feelings were found to have increased depressive symptoms at reassessment compared to sad participants who were instructed to distract themselves and non-sad participants in either condition (Joorman & Simer, 2004; Lavender & Watkins, 2004; Lyubomirsky & Nolen-Hoeksema, 1993). In other experimental studies, rumination is measured as a trait and then participants are exposed to a sadness induction task, in reaction to which highly ruminating participants ruminated more and experienced increased sadness (Conway, Csank, Holm, & Blake, 2000; Young & Nolen-Hoeksema, 2001).

Anger Rumination and Aggression

A quite separate body of literature has found support for the association between rumination to the negative affect of anger (herein referred to as “anger rumination”) and aggression (see Denson, 2009 for review). Denson (2013) proposed the Multiple Systems Model to explain the relationship between anger rumination and aggression. According to this model people must first encounter or remember a situation that induces anger. The extent to which they engage in subsequent aggressive behavior depends in part on the type of ruminative thoughts entertained at the cognitive level. For example, provocation-focused (rather than self-focused) rumination heightens the cognitive accessibility of aggressive actions and increases anger directed at others (Pedersen et al., 2011). The Multiple Systems Model also posits that anger rumination temporarily reduces an individual’s self-control capacity, thereby increasing the likelihood that the individual will be unable to inhibit aggressive behavior.

In support of the Multiple Systems Model, many studies have demonstrated the link between anger rumination and aggression (Anestis, Anestis, Selby, & Joiner, 2009; Vasquez, Bartsch, Pedersen, & Miller, 2007). In a seminal experiment, participants were insulted by a

fictitious participant and then asked to hit a punching bag. While hitting the punching bag, participants were induced to either ruminate by thinking of the insulting person or asked to engage in distraction by thinking about becoming physically fit (Bushman, 2002). Following the rumination manipulation, participants were given the opportunity to deliver loud blasts of white noise to the fictitious participant. Relative to distraction, rumination increased aggression. Additionally, in a series of three studies, Bushman and colleagues (2005) showed that experimental manipulations of rumination augmented aggression toward those who had nothing to do with the initial provocation.

Rumination as a General Tendency

Until recently, rumination has been studied in an affect/outcome specific manner with separate models and theories used to explain why ruminating to certain negative moods are associated with specific outcomes. This divide in the literature suggests that people who engage in sadness rumination and experience its depression intensifying effects are distinct from people who experience anger rumination and subsequently engage in aggressive behavior. But in 2013, Whitmer and Gotlib proposed a model of rumination that suggests rumination is not specific to any one type of negative affect. In fact, the authors stated, “Because there is little evidence indicating that different types of control functioning are specific to a particular form of rumination... We generally use the term ‘trait rumination’ in this review” (page 1037) and they later make a call for more research examining the similarities between sadness rumination and other forms of negative repetitive thought (e.g., anger rumination). Their Attentional Scope Model of rumination posits that a negative mood state leads to a processing bias for mood-congruent information. Therefore, the type/valence of information that becomes established in the working memory or retrieved from the long-term memory becomes more limited and is aligned with the negative mood. This narrowed attentional scope increases the likelihood that thoughts will continue to focus on the same topic over time. It is thought that the narrowed attentional scope mediates the relationship between negative mood and rumination.

In their review, Whitmer and Gotlib (2013) examined studies from both the sadness and anger rumination literature to make the point that individuals who tend to ruminate share similar cognitive deficits, such as difficulty inhibiting no-longer-relevant information and learning from punishment. Thus, based on the Attentional Scope Model some rumination should occur in

response to all types of negative affect, but rumination should occur to a greater degree in individuals who have cognitive deficits related to control. Based on Whitmer and Gotlib's (2013) review, it is plausible that some people have a strong, general tendency to ruminate regardless of the type of negative affect experienced while others' tendencies to ruminate are weaker and will only occur in response to a severe negative mood state, such as when very sad or angry. Following this logic, it is possible that those high in general rumination may be at increased risk of negative outcomes that include both depression and aggression. More research is needed in order to clarify whether a group of high-risk, general ruminators exists or whether rumination is simply a mediator in the relationship between a specific negative affect and its logical correlate (e.g., sadness leads to sadness rumination which strengthens depressive symptoms).

Sadness and Anger Rumination Examined Together

Although sadness and anger rumination are the most widely researched forms of rumination, only a few studies have examined both forms in the same sample. The first study to do so only focused on depression as an outcome variable and found that sadness rumination, but not anger rumination, predicted depression when the two forms of rumination were covaried (Gilbert, Cheung, Irons, & McEwan, 2005). Peled and Moretti (2007, 2010) created analogous measures of sadness and anger rumination in order to examine relations between each form of rumination and depression and aggression. The researchers used a variable-centered data analytic approach (i.e., exploratory factor analysis) to find support for two factors of anger and sadness rumination in a sample of clinic-referred adolescents (Peled & Moretti, 2007) and a normal sample of young adults (Peled & Moretti, 2010). As such, they supported the conceptualization of sadness and anger rumination as distinct constructs. In both samples they found that anger rumination, but not sadness rumination, was uniquely related to feelings of anger and two forms of aggression (overt and relational). Both anger rumination and anger were independent predictors of aggression. Similarly, sadness rumination, but not anger rumination, was related to depressed mood. Unlike the anger rumination model, no trait level covariate was considered in the examination of the relationship between sadness rumination and depressed mood.

While unique socio-emotional correlates were demonstrated for sadness and anger rumination, the two forms of rumination were highly related at $r = .72$ and $.74$, respectively (Peled & Moretti, 2007; 2010). Moderate correlations ($r = .56$ and $.57$, respectively) have been reported in other studies using a variety of measures of sadness and anger rumination (Baer & Sauer, 2010; Gilbert, Cheung, Irons, & McEwan, 2005). Taken together, these correlations suggest that there may be different patterns of rumination with some individuals exhibiting a generalized tendency to ruminate to negative affect and others specifically ruminating to either sadness or anger. If there are, in fact, different rumination profiles among young adults it raises some interesting questions about the correlates of these rumination profiles. Specifically, are individuals who display a general rumination tendency at increased risk for comorbid depression and aggression?

To address this question and replicate the work done by Peled and Moretti (2007, 2010), Harmon, Stephens, Repper, Driscoll, and Kistner (2016) examined sadness and anger rumination in a sample of children. Results of regression analyses demonstrated that anger rumination was uniquely and positively associated with both aggression and depression above and beyond the effect of sadness rumination. The results also supported a positive relationship between sadness rumination and depression but when anger rumination was controlled in the regression model the association decreased to non-significance. Interestingly, sadness rumination was negatively related to aggression above and beyond the effects of anger rumination.

Harmon et al. (2016) also used an exploratory cluster analysis to classify rumination response patterns in their sample of children. Four groups were specified and the cluster analysis identified the following groups: 1) “general” ruminators that were high on both forms of rumination; 2) a group that was high on anger rumination but low on sadness rumination; 3) a group that was high on sadness rumination but low on anger rumination; and 4) a group that was low on both forms of rumination. An examination of the group correlates showed that general ruminators and high anger ruminators reported significantly higher levels of depressive symptoms than the other two clusters. With respect to aggression, the high anger ruminators were more aggressive than the other three clusters, which did not differ from each other.

These results suggested that anger rumination may be particularly pernicious with respect to both depressive and aggressive outcomes. This finding replicated unpublished work that showed anger rumination, but not sadness rumination, was uniquely associated with depressive

symptoms in a sample of young adults (Law & Chapman, 2012). Also, interesting was the finding that sadness rumination may mitigate some of the risk for aggressive behavior. More research on patterns of rumination and their associations with depressive and aggressive outcomes are needed to clarify whether generalized rumination exists in an adult population and if so, whether it puts individuals at risk for more severe outcomes than sadness or anger rumination alone.

When examining the correlates of sadness and anger rumination in the same sample it should be of paramount concern that these relationships are measured using the same methodology. In the anger rumination literature, trait anger is typically used as a control variable when examining the relationship between anger rumination and aggression. Doing so makes sense based on the Attentional Scope Model (Whitmer & Gotlib, 2013) because a person who has a dispositional fiery temper is going to be more likely to experience anger, and in turn, ruminate to that anger than someone who is not a temperamentally hostile person. However, an analogous negative affect trait is never used as a control variable in studies examining the association between sadness rumination and depression. By ignoring a temperamental trait that may explain some of the variance in depressive outcomes, researchers may be artificially strengthening the relationship between sadness rumination and depression. Why is it deemed important to control for trait anger in the anger rumination literature but it not necessary to control for trait sadness in the sadness rumination literature? An examination of the associations between trait sadness, sadness rumination, and depressive outcomes is needed in order to determine whether the strength of the estimated relationship between sadness rumination and depression is truly as strong as past research has demonstrated.

The Present Study

The present study sought to replicate and extend the work done by Peled and Moretti (2010) and Harmon et al. (2016) using methods that help clarify patterns of rumination and their correlates in an adult population. First, a confirmatory factor analysis (CFA) was conducted to confirm that the same underlying structure of rumination variables exist in the present study sample as was found by Peled and Moretti (2007, 2010). Second, the data was examined using latent profile analysis (LPA) to determine the number of response profiles of rumination that existed in the present study sample. Participants were then assigned to their response profile

class of most probable membership and the depressive, aggressive, and trait affect correlates of those classes were examined. Finally, hierarchical regression analyses using latent rumination factor scores from the CFA were conducted to replicate and extend findings about the relationships between the forms of rumination and their correlates from Harmon et al. (2016) to an adult sample. In these analyses, both trait anger and trait sadness were included as control variables in their respective models in order to better understand how temperamental characteristics influence the relationships between the forms of rumination and their correlates.

Hypotheses

The following hypotheses were proposed:

- 1) CFA will confirm the results from Peled and Moretti (2007, 2010) and show that two latent factors of sadness and anger rumination best fit the data.
- 2) With respect to rumination, four response profiles of participants will emerge from the LPA:
 - a. Those who have low/average sadness and anger rumination (i.e., low ruminators)
 - b. Those who have high sadness rumination and low/average anger rumination (i.e., high sadness)
 - c. Those who have high anger rumination and low/average sadness rumination (i.e., high anger)
 - d. Those who have high sadness and anger rumination (i.e., general ruminators)
- 3) With respect to the correlates of these classes:
 - a. The general ruminators class will display the highest levels of depressive symptoms, aggressive behavior, trait sadness, and trait anger.
 - b. The high sadness class will display higher levels of depressive symptoms and trait sadness than the high anger and low ruminators classes.
 - c. The high anger class will display higher rates of aggression and trait anger than the sadness and low ruminators classes.
- 4) Including trait sadness as a control variable will decrease the strength of the relationship between sadness rumination and depressive symptoms.

CHAPTER 2

METHODS

Participants

Participants were 313 college students at Florida State University. Students younger than age 18 ($n = 0$) and older than 25 ($n = 2$) were excluded from the study to ensure the sample was representative of a typical college-age population. One participant elected to withdraw from the study and was dropped from the sample. The final study sample consisted of 310 participants (81.6% female). Key characteristics of the sample are presented in Table 1.

Procedure

This study was advertised on the university's psychology research study portal. Students participated in this study in exchange for one credit or extra credit for select courses within the psychology department. During the study visit, participants went through the informed consent process and those who consented to take part in the study were asked to complete a packet of forms that included demographic information and self-report questionnaires assessing rumination, aggressive behavior, depressive symptoms, and trait level affect. The questionnaires were randomized within each packet to prevent the order of administration from affecting the study results. Once participants completed their packets they were debriefed and given referral information for mental health resources on the university campus. Up to eight participants completed the study at one time in a group administration format. The study visit took participants approximately 35-45 minutes to complete.

Measures

Sadness and Anger Rumination

Four measures of rumination were used in the present study. The two most commonly used self-report measures of sadness rumination and the single most widely used self-report measure of anger rumination were used as indicators of rumination in this study. In addition, the anger rumination form of the self-report measure created by Peled and Moretti (2007) was also used as an indicator of anger rumination in this study.

Ruminative Response Scale (RRS). The RRS of the Response Styles Questionnaire (Nolen-Hoeksema & Morrow, 1991) includes 22 items describing sadness rumination responses that are self-focused (e.g., "I think, 'Why do I react this way?'"), symptom focused (e.g., "I think about how hard it is to concentrate"), and focused on the possible consequences and causes of their mood (e.g., "I think, 'I won't be able to do my job if I don't snap out of this'"), which respondents rate on a 4-point scale from 1 (almost never) to 4 (almost always). Previous studies reported acceptable convergent and predictive validity for the Ruminative Responses Scale (Butler & Nolen-Hoeksema, 1994; Nolen-Hoeksema & Morrow, 1991; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). The RRS demonstrated excellent internal consistency reliability in the present study sample ($\alpha = .95$).

Rumination on Sadness Scale (RSS; Conway et. al., 2000). The RSS includes 13 items describing sadness rumination responses that are repetitive (e.g., "I repeatedly analyze and keep thinking about reasons for my sadness"), aimed at understanding causes (e.g., "I search my mind to try and figure out if there is anything about my personality that may have led me to feel this way"), and potential benefits of rumination (e.g., "I get the feeling that if I think long enough about my sadness I will... be able to understand myself better because of it"). Items are preceded by the stem, "When I am sad, down, or feel blue... ." Respondents indicate the extent to which each item reflects their responses to sadness on a 5-point scale ranging from 1 (not at all) to 5 (very much). Previous studies reported good internal consistency reliability ($\alpha = .91$) as well as high concurrent validity with the RRS ($r = .81$; Conway et al., 2000; Luminet, 2004). The RSS also demonstrated excellent internal consistency reliability in the present study sample ($\alpha = .93$).

Anger Rumination Scale (ARS; Sukhodolsky, Golub, & Cromwell, 2001). The ARS includes 19 items describing anger rumination responses that fall in to four subcategories: angry afterthoughts (e.g., "I re-enact the anger episode in my mind after it has happened"), thoughts of revenge (e.g., "I have long-living fantasies of revenge after the conflict is over"), angry memories (e.g., "I think about certain events from a long time ago and they still make me angry") and understanding of causes (e.g., "I think about the reasons people treat me badly"). Participants rate how well these items describe them and their responses to anger on a 4-point scale from 1 (almost never) to 4 (almost always). The ARS has been shown to have excellent

reliability and validity ($\alpha = .93$; Barber, Maltby, & Macaskill, 2005). The ARS also demonstrated excellent internal consistency reliability in the present study sample ($\alpha = .93$).

Sadness and Anger Rumination Inventory (SARI; Peled & Moretti, 2007). The SARI was created by identifying key items on existing rumination scales that could be modified to create two parallel scales for rumination on sadness and anger. Although the wording of some items was modified, their meaning remained the same. Five items from Conway et al.'s (2000) RSS and four items from Sukhodolsky et al.'s (2001) ARS were included. One intensification item from Caprara's (1986) Dissipation-Rumination scale was used (i.e., "When I am angry [sad], the more I think about it the angrier [sadder] I feel") and a new intensification item was created (i.e., "When I think about my anger [sadness], I become more upset"). The final version of the SARI consists of 11 items for each type of rumination. The items are analogous, with the words "anger" and "angry" in the anger rumination measure (SARI-A) replaced with "sadness" and "sad" in the sadness rumination measure (SARI-S). Only the SARI-A was used in the present study. Participants rated on a 5-point scale from 1 (never) to 5 (always) how often they "do the following things when they are angry." The SARI-A demonstrated excellent internal consistency reliability in the present study sample ($\alpha = .95$).

Trait Level Affect

Trait sadness. The Positive and Negative Affect Schedule – Expanded Form (PANAS-X; Watson & Clark, 1999) assesses activated positive and negative affect (using items from Watson, Clark, & Tellegen, 1988), as well as 11 more specific affects (fear, hostility, guilt, sadness, joviality, self-assurance, attentiveness, shyness, fatigue, serenity, and surprise). In total, the PANAS-X has 60 items. Instructions asked participants to indicate to what extent they feel the listed emotions "in general, that is, on the average." Extent was measured using a five point scale from 1 (very slightly or not at all) to 5 (extremely). The sadness subscale (SAD) of the PANAS-X, which is measured using the words sad, alone, blue, lonely, and downhearted, was used to assess trait sadness in the present study. The SAD has been shown to have good reliability in a sample of undergraduate students ($\alpha = .83$; Watson & Clark, 1999). The SAD also demonstrated good internal consistency reliability in the present study sample ($\alpha = .85$).

Trait anger. The trait anger subscale (TAS) of the State-Trait Anger Expression Inventory – 2 (STAXI-2; Spielberger, 1999) is composed of 10 items assessing a temperamental disposition toward anger (e.g., “I am a hotheaded person”). Participants rated how they generally feel and react on a 4-point scale from 1 (almost never) to 4 (almost always). The STAXI-2 has been found to demonstrate good reliability and validity (Spielberger, 1999). In a college sample, it correlated highly with the Buss–Durkee Hostility Inventory (males = .71 and females = .66) and (Minnesota Multiphasic Personality Inventory) MMPI hostility (H0, males = .59 and females = .43, see Spielberger, 1999). The TAS demonstrated good internal consistency reliability in the present study sample ($\alpha = .87$).

Socio-emotional Correlates of Rumination

Depression. The Beck Depression Inventory – Second Edition (BDI-II; Beck, Steer, & Brown, 1996) is a widely used self-report measure of depressive symptoms experienced during the past week. The 21-item self-report inventory lends total scores that range from 0 to 63, with higher scores reflecting greater levels of depressive symptoms. Item number nine of the BDI-II assesses suicidal thoughts or wishes and was removed from the measure in the present study. The exclusion of this item should not compromise the integrity of the associations examined because much of the extant research on rumination does not assess suicidality with their measures of depressive symptoms (e.g., Flett, Madorsky, Hewitt, & Heisel, 2002; Nolen-Hoeksema, 2000; Peled & Moretti, 2010). The BDI-II has shown good internal consistency ($\alpha = .90$) and high convergent validity with the State-Trait Anxiety Inventory-Trait Version ($r = .76$; Spielberger, 1983) in a sample of undergraduate students (Storch, Roberti, & Roth, 2004). The BDI-II also demonstrated excellent internal consistency reliability in the present study sample ($\alpha = .92$).

Aggression. The Form-Function Aggression Measure (FFAM; Little, Jones, Henrich, & Hawley, 2003) consists of 36 items that index the forms (i.e., relational and overt) as well as the functions (i.e., reactive and proactive) of aggression. In line with the methods employed by Peled and Moretti (2007, 2010) and other research (Dane & Marini, 2014), the 25 items with the highest factor loadings will be retained for use in this study. Participants rated on a 4-point scale ranging from 1 (not at all true) to 4 (completely true) how well each prompt describes them. There are four items indexing reactive–overt aggression (e.g., If others have angered me, I often hit, kick or punch them), and four items tapping reactive–relational aggression (e.g., If others

upset or hurt me, I often tell my friends to stop liking them). In addition, proactive-overt aggression was tapped by five self-report items (e.g., I often threaten others to get what I want) whereas proactive-relational aggression was measured with four self-report items (e.g., I often tell my friends to stop liking someone to get what I want). Finally, the scales for pure overt (e.g., I am the kind of person who fights with others) and pure relational aggression (e.g., I am the kind of person who gossips or spreads rumors) included items that contained no reference to function. Only the total aggression scale, comprised of all 25 items, was used to assess aggression in the present study. The FFAM and its subscales have shown good internal consistency in a sample of adolescents and young adults (Dane & Marini, 2014; Peled & Moretti, 2010). The FFAM total scale demonstrated good internal consistency reliability in the present study sample ($\alpha = .88$).

Statistical Methods

Confirmatory Factor Analysis

To replicate and extend past work by Peled & Moretti (2010), a CFA of the four rumination indicators was conducted. CFA was used to evaluate different models for the organization of rumination that were specified a priori. Two models were compared (see Figure 1 for diagrams):

Model 1: A one-factor model in which the total scores on the two sadness rumination measures and the total scores on the two anger rumination measures were specified to load on a single latent factor (conceptualized as “general rumination”). This model is identified with two degrees of freedom.

Model 2: A two-factor model in which the two sadness rumination measures were specified to load on a “sadness rumination” latent factor and the two anger rumination measures were specified to load on an “anger rumination” latent factor. The sadness and anger rumination latent factors were allowed to covary. This model is identified with one degree of freedom.

CFA models are evaluated using chi-square goodness-of-fit tests, with a small chi-square value indicating that a model adequately fits the observed data. Besides the chi-square, three fit indices are used to determine model fit and compare models: the Tucker-Lewis index (TLI; Tucker & Lewis, 1973), the comparative fit index (CFI; Bentler, 1990), and the root mean square error of approximation (RMSEA; Browne, Cudeck, & Bollen, 1993). For each of the first two indices, values close to 1 indicate that the model adequately explains the original correlations

obtained between the items. TLI and CFI values of .95 or greater generally indicate that a model fits the data well. With respect to the RMSEA, values between 0 and .05 indicate that the model accounts for the data extremely well, and values between .05 and .08 indicate that the model provides an adequate fit to the data. RMSEA values greater than 1.0 generally indicate that the model fits poorly. When two models fit the data equally well, the more parsimonious model is typically described as the best fitting model.

Latent Profile Analysis

To expand upon Peled and Moretti's (2007, 2010) work, the proposed study used latent profile analysis (LPA), a person-centered latent variable approach, to classify participants into optimal grouping categories based on common rumination presentations (Nylund, Asparaouhov, & Muthen, 2007). Rather than grouping similar items and variables as in factor analysis, person-centered analyses provide a way of grouping individuals into categories based on shared characteristics that distinguish members of one group from another group. Although cluster analysis has been the most commonly used person-centered method, it has several shortcomings including the lack of clear benchmarks or statistics for determining how well the solution fits the data. As such, the number of classes in cluster analysis is somewhat arbitrary.

LPA, on the other hand, enables researchers to identify discrete latent variables that best group individuals based on their scores from two or more discrete observed variables (McCutcheon, 1987). Traditional latent class approaches use categorical observed variables as indicator variables whereas the technique used in this study uses continuous observed variables. LPA is model based, that is, the model can be replicated with an independent sample (Nylund, Asparaouhov, & Muthen, 2007). In LPA, class assignment is determined through fit statistics and tests of significance. LPA assigns membership based on probabilities and thus is able to take uncertainty of membership, or error, into account; cluster analysis cannot. LPA is also more robust with regard to scaling differences on observed variables.

The present study estimated five LPA models (one- through five-class models). As in CFA, with LPA there are multiple statistical indicators of model fit. The Akaike Information Criterion (AIC; Akaike, 1973), Bayesian Information Criterion (BIC; Schwarz, 1978), and sample-size adjusted BIC (Sclove, 1987) are all indicators of model fit, with lower numbers indicating better model fit. In the present study, more weight was given to the BIC and the

sample-size adjusted BIC because recent simulation studies suggest that the BIC provides the most reliable indicators of true model fit (Nylund, Asparaouhov, & Muthen, 2007). A likelihood difference test, the Vuong-Lo-Mendell-Rubin (VLMR; Lo, Mendell, & Rubin, 2001), assesses the fit between two nested models that differ by one class and provides a p-value that indicates which model fits best. For example, a non-significant VLMR p value for a four-class model indicates that the three-class model fits better than the four-class model. Finally, entropy is an indicator of how well the model classifies people, where values closer to or exactly 1 indicate better classification.

Associations between Rumination, Trait Affect, and Socio-emotional Correlates

Analysis of variance tests were conducted to determine if latent profile class was related to aggression, depressive symptoms, trait anger, and trait sadness. Hierarchical regression analyses were used to examine the relationships between forms of rumination (i.e., sadness and anger) and their correlates (i.e., aggression or depression) while controlling for the effects of trait level affect (i.e., trait anger or trait sadness).

CHAPTER 3

RESULTS

Preliminary Analyses

IBM SPSS version 19 was used to conduct all preliminary analyses.

Missing Data

Twelve participants (3.9% of the study sample) had incomplete data profiles. Each of the 12 participants was missing only one data point, resulting in missing data for only 0.32% of all possible data. Little's MCAR test was used to examine whether the missing values were missing completely at random. The test resulted in a significant chi-square = 102.75 ($df = 63$; $p < .001$), indicating that the values were not missing completely at random. When data is not missing completely at random, the default method for identifying variables that are related to the missingness is to run t-tests. But, t-tests are not recommended for any variable that has less than 5% missing data. In the present study, the variable with the most missing data was the BDI-II, and it only had 1.3% missing data. This made identifying factors related to missing data patterns in the present study quite difficult. Schafer (1999) asserted that a missing data rate of less than 5% is inconsequential while Bennett (2001) claimed that statistical analysis is not likely to be biased when less than 10% of data are missing. Tabachnick and Fidell (2012) asserted that deletion of cases is a reasonable choice for handling missing data if only a few cases have missing data and those cases are missing data on different variables. The two primary concerns for the use of listwise deletion of missing data are that this method may yield biased parameter estimates (Wothke, 2000) and it will result in loss of statistical power because of the unused partial data. However, if the loss of cases due to missing data is less than 5%, biases and loss of power are both likely to be negligible (Graham, 2009). As such, listwise deletion was used to handle missing data in the present study.¹

¹ All analyses were also conducted using pairwise deletion of missing data. None of the results reported in the present study differed with the use of pairwise deletion.

Tests for Normality, Outliers, and Curvilinear Associations

Inspection of histograms, Q-Q plots, skewness and kurtosis values, and the Shapiro-Wilk test of normality were used to evaluate the distributions of all study variables for violations of the assumption of normality. Skewness and kurtosis values were in the acceptable range (-1 to +1) for all variables except depression (skewness = 1.33; kurtosis = 2.46) and aggression (skewness = 1.62; kurtosis = 3.45). Statistically significant Shapiro-Wilk test confirmed that depression (statistic = .91, $df = 306$, $p < .001$) and aggression (statistic = .87, $df = 309$, $p < .001$) violated the assumption of normality. A square root transformation was conducted for depression, resulting in acceptable skewness and kurtosis values of .06 and .19 respectively and a non-significant Shapiro-Wilk test (statistic = .99, $df = 306$, $p = .18$). A logarithmic transformation was conducted for aggression, resulting in acceptable skewness and kurtosis values of .95 and .96 respectively. However, the Shapiro-Wilk test remained statistically significant (statistic = .94, $df = 309$, $p < .001$). The transformed depression and aggression variables were used in all further analyses.²

An examination of boxplots and histograms was conducted to search for outliers within each study variable. Two outliers at the high end of depression and three outliers at the high end of aggression were identified and inspected for validity. The two participants with outlying depression scores also scored exceptionally high on trait sadness and had higher than average levels of sadness rumination. As such, these two depression scores were determined to be valid and were left unaltered. The three participants with outlying aggression scores also scored especially high on trait anger and had higher than average levels of anger rumination. Again, these three aggression scores were determined to be valid and were left unaltered.

Scatterplots for associations between rumination measures and their respective clinical correlates were examined for potential curvilinear relationships. To be certain no curvilinear relationship between sadness rumination and depression existed, two separate polynomial regression analyses were run with squared terms for RRS, then RSS as the independent variable and depression as the dependent variable. Additionally, to be certain no curvilinear relationship between anger rumination and aggressive behavior existed, two separate curvilinear regression analyses were run with squared terms for ARS, then SARI-A as the independent variable and

² All analyses were also conducted using the original depression and aggression variables. None of the results reported in the present study differed with the use of the non-transformed variables.

aggression as the dependent variable. No significant curvilinear associations were found for any of the four regression analyses.

Correlations and Sex Differences

Correlations between demographic characteristics, rumination measures, trait anger, trait sadness, depression, and aggression, as well as means and standard deviations for all continuous study variables, are presented in Table 2. A binary variable was created for ethnicity such that Caucasian was coded “1” ($n = 177$) and all other ethnicities were categorized as an “ethnic minority” group and coded “2” ($n = 133$). Ethnicity and age were not correlated with any measures of rumination, trait affect, depression, or aggression and therefore were not included in any further study analyses. Sex differences on key study variables are reported in Table 3. Compared to men, women endorsed more depressive symptoms and less aggressive behavior. Additionally, women endorsed greater trait sadness and higher levels of sadness rumination according to one measure (i.e., RRS). The magnitudes and directions of all other correlations were as expected based on past research. The measures of sadness rumination correlated more strongly with one another than they did with either of the two anger rumination measures and the anger rumination measures correlated strongly with each other. Depression correlated more strongly with trait sadness than with trait anger and more strongly with the measures of sadness rumination than with the measures of anger rumination. Aggression, on the other hand, correlated more strongly with trait anger than with trait sadness and more strongly with measures of anger rumination than with measures of sadness rumination.

CFA of Competing Rumination Models

The CFA was conducted using MPlus version 7 (Muthen & Muthen, 2010). One- and two-factor models were evaluated using CFA³ as summarized in Table 4. The one-factor model demonstrated overall poor model fit. The two-factor model demonstrated excellent model fit and significantly better model fit than the one-factor model according to a chi-square difference test

³ As suggested at the dissertation prospectus meeting, a bi-factor model was specified as a competing model for the one- and two-factor models. Several methods for identifying the scale of the factors were attempted but despite these efforts, the bi-factor model did not converge. The specified bi-factor model was “just identified” with zero degrees of freedom. This means the chi-square goodness of fit test, CFI, TLI, and RMSEA would not have been computed for this model and therefore, the fit of the bi-factor model could not have been easily compared to the one- and two-factor models. As such, the bi-factor model was dropped from this dissertation.

($\chi^2 = 150.55$, $df = 1$, $p < .001$). As such, the two-factor model was selected as the best fitting CFA model of rumination. The correlation between the sadness and anger rumination latent factors was $r = .74$, $p < .001$. Standardized factor loadings for the two-factor model are displayed in Table 5. All factor loadings were significant at $p < .001$. The scores for the latent factors of sadness and anger rumination were saved for each participant and were used in the hierarchical regression analyses for this study (described below).

LPA of Rumination Response Patterns

The LPA was conducted using MPlus version 7 (Muthen & Muthen, 2010). Four indicators were included in these analyses: RRS, RSS, ARS, and SARI-A. LPA fit indices for one- through five-class solutions are summarized in Table 6. The three-class solution was determined to best fit the sample because it provided the best combination of low BIC and sample-size adjusted BIC values and high entropy compared to the other class solutions. The non-significant VLMR likelihood difference test for the four-class model confirmed that the three-class model fit the data better than the four-class model. Figure 2 shows the mean rumination levels of the three identified latent classes. Rumination levels for each class differed significantly from the other two classes for every measure of rumination. Class labels were assigned based on these rumination levels. Class 1 ($n = 161$) was best characterized as a low rumination class, with average scores on all four rumination measures falling at least one half standard deviation below the sample mean. Class 2 ($n = 109$) was best characterized as an average rumination class, with mean scores on all four rumination measures located just above the sample mean. Class 3 ($n = 40$) was best characterized as a high rumination class, with average scores on all four measures placed more than one standard deviation above the sample mean.

Associations with Class Membership

Participants were assigned to their latent class of most probable membership. Table 7 describes class differences in demographic characteristics. With respect to ethnicity, the average rumination class was comprised of a higher proportion of minority participants compared to the low and high rumination classes. The high rumination class was comprised of a higher

proportion of women compared to the low and average rumination classes. Notably, only one man was categorized as a high ruminator. The three classes did not differ on age.

Analyses of variance tests were conducted using IBM SPSS version 19 to examine class differences in depression, aggression, trait anger, and trait sadness. Results of the omnibus tests and post hoc pairwise comparisons are presented in Table 8. Tukey HSD post hoc testing was used to compare the classes on depression. Levene's test for homogeneity of variance was significant for aggression (Levene's statistic = 6.38; $df = 2, 306, p < .01$), trait anger (Levene's statistic = 3.88; $df = 2, 306, p = .02$), and trait sadness (Levene's statistic = 9.60; $df = 2, 306, p < .001$). As such, the Welch statistic was used to interpret the omnibus tests and Dunnett's T3 post hoc tests were used to evaluate the pairwise comparisons for these dependent variables. Mean depression and trait sadness levels significantly increased in a stepwise fashion as class moved from low rumination to average rumination to high rumination. With respect to aggression and trait anger, the average and high rumination classes displayed significantly higher mean levels than the low rumination class but did not differ from each other.

A similar pattern of results emerged when analysis of covariance tests were used to examine class differences in depression, aggression, trait sadness, and trait anger while controlling for the effect of sex (see Table 9). Sex was significantly related to aggression and trait anger above and beyond the effect of class membership. When controlling for the effect of sex, differences between the high and average rumination groups became significant for aggression and trait anger. However, these results must be interpreted with caution because the variances of the high and average rumination classes were unequal.

Hierarchical Regression Analyses

In the first set of analyses, hierarchical regression was used to examine the unique associations of both forms of rumination with depression and aggression. In the first analysis, depression was the dependent variable and sadness and anger rumination, as measured by the latent factor scores, were entered as independent variables in step 1 [$F(2, 303) = 100.08, p < .001$]. Sadness rumination ($beta = .63, t = 8.36, p < .001$), but not anger rumination ($beta = .00, t = .05, p = .96$), was uniquely related to depression. The relationship between sadness rumination and depression remained significant ($beta = .61, t = 8.12, p < .001$) after the addition of sex ($beta = .10, t = 2.32, p = .02$) to the model in step 2. In the second analysis, sadness and anger

rumination were again entered as independent variables in step 1, but this time aggression was the dependent variable [$F(2, 306) = 42.72, p < .001$]. Anger rumination ($beta = .43, t = 4.99, p < .001$), but not sadness rumination ($beta = .05, t = .60, p = .55$), was uniquely related to aggression. The relationship between anger rumination and aggression ($beta = .41, t = 4.87, p < .001$) remained significant after the addition of sex ($beta = -.15, t = -2.95, p < .001$) to the model in step 2.

In the second set of analyses, hierarchical regression was used to assess the unique associations of sadness rumination and trait sadness with depression and to test whether these associations remained significant after controlling for sex and anger rumination. Sadness rumination and trait sadness were entered in step 1, explaining 48.5% of the variance in depression [$F(2, 302) = 142.10, p < .001$]. As described in Table 10, sadness rumination and trait sadness were both uniquely associated with depression. Trait sadness accounted for more of the variance in depression than did sadness rumination. It is especially important to interpret the semi-partial correlation for sadness rumination in step 1 ($sr = .27$) because it represents the relationship between sadness rumination and depression once the variance shared with trait sadness has been removed from sadness rumination, but not depression.

The unique associations between sadness rumination, trait sadness, and depression remained significant after entry of sex and anger rumination at step 2. Sex, but not anger rumination, was uniquely associated with depression and their addition to the model did not significantly improve on the percentage of variance explained for depression (R square change = .01, F change = 2.15, $p = .12$). In order to be comprehensive in the investigation of the relationship between sadness rumination and depression, sex, anger rumination, and trait sadness were examined as moderators of the relationship. Multiple regression analyses showed that the relationship between sadness rumination and depression did not differ based on sex ($beta = .39, t = 1.49, p = .14$), anger rumination ($beta = .03, t = .50, p = .62$), or trait sadness ($beta = .07, t = 1.35, p = .18$).

In a separate analysis, hierarchical regression was used to assess the unique associations of anger rumination and trait anger with aggression and to test whether these associations remained significant after controlling for sex and sadness rumination. Anger rumination and trait anger were entered in step 1, explaining 43.6% of the variance in aggression [$F(2, 302) = 117.79, p < .001$]. As described in Table 11, anger rumination and trait anger were both uniquely

associated with aggression. Trait anger accounted for more of the variance in aggression than did anger rumination. The unique association between trait anger and aggression remained significant once sex and sadness rumination were entered at step 2, but the relationship between anger rumination and aggression was reduced to non-significance. Sex, but not sadness rumination, was also uniquely related to aggression. The addition of sex and sadness rumination significantly improved on the percentage of variance explained for aggression (R square change = .1, F change = 3.40, $p = .04$). Like before, sex, sadness rumination, and trait anger were examined as moderators of the relationship between anger rumination and aggression. Multiple regression analyses showed that the relationship between anger rumination and aggression did not differ based on sex ($beta = .48$, $t = 1.76$, $p = .08$), sadness rumination ($beta = -.01$, $t = -.16$, $p = .88$), or trait anger ($beta = -.02$, $t = -.38$, $p = .70$).

CHAPTER 4

DISCUSSION

Conceptualization of Rumination

The present study extended prior research on the latent factor structure of rumination by using CFA to compare the “generalized tendency” conceptualization of rumination with the “separate constructs” conceptualization of rumination. Consistent with the previous findings of Peled and Moretti (2007, 2010), the two-factor model of rumination was an excellent fit to the data and a better fit than the one-factor model, suggesting that sadness and anger rumination represent separate constructs. Yet, in the present study and in the work done by Peled and Moretti (2007, 2010) the latent factors of sadness and anger rumination were strongly correlated. Similarly, the individual measures of sadness (i.e., RRS, RSS) and anger rumination (i.e., ARS, SARI-A) in the present study demonstrated strong bivariate correlations with each other, meaning that those who endorse high levels of sadness rumination were also likely to endorse high levels of anger rumination. In further contrast to the notion that sadness and anger rumination are separate constructs, the LPA uncovered high, average, and low rumination response patterns based on multiple measures of sadness and anger rumination within the present study sample. The gradation of the LPA classes suggests that rumination can be measured continuously and linearly. These findings are consistent with Whitmer and Gotlib’s (2013) assertion that rumination is one general construct. Taken together, the results of the CFA and LPA suggest that rumination may most accurately be conceptualized as a general cognitive tendency that is comprised of highly related sub-factors of sadness and anger rumination.

Both subtypes of rumination are characterized by repetitive thinking about negative personal concerns and/or about the causes and consequences of a negative mood. This is one reason Whitmer and Gotlib (2013) asserted that these two forms of rumination are actually one cognitive process. However, it may be that the content of the ruminative thoughts differs by subtype because the experiences of sadness and anger are quite different in nature. Whereas, anger is typically episodic and occurs in response to specific anger-provoking events, sadness is typically characterized as chronic and more often occurs in response to feelings of personal dissatisfaction. As such, there are likely differences in the thoughts of those ruminating to anger

versus sadness. With respect to the measurement of rumination in the present study, all four questionnaires used wording that assessed both the repetitive nature of rumination and the need to understand the causes and personal implications of the negative mood. The sadness rumination measures consisted only of items that measured these aspects of rumination (e.g., “I search my mind many times to try and figure out if there is anything about my personality that may have led me to feel this way”). But, one measure of anger rumination (i.e., ARS) also contained items that were truly unique to anger rumination and tapped into feelings related to specific anger-provoking events (e.g., “I have long-living fantasies of revenge after the conflict is over”). These thoughts of revenge differentiate anger rumination from sadness rumination and may be a reason the subtypes of rumination were distinguishable according to the CFA.

The somewhat inconsistent findings from the CFA and LPA concerning the generality of rumination may also be due to the fact that these two methods take quite different approaches to data analysis. CFA is a variable-centered approach in which the focus is on relationships among variables and the goal is to study how constructs influence their indicators. LPA, on the other hand is a person-centered approach in which the focus is on relationships among individuals. The goal of LPA is to group individuals into categories, each one of which contains individuals who are similar to each other and different from individuals in other categories. In the present study, the sadness and anger rumination measures were strongly related with Pearson’s correlations around .60. Given such strong associations, the LPA was unable to identify sufficiently distinct groups of individuals that had high levels of one subtype of rumination, but low or average levels of the other subtype. In contrast, the variable-centered CFA easily determined that two separate factors of sadness and anger rumination best fit the data because the sadness rumination measures were more strongly related to one another ($r = .82$) than they were to the anger rumination measures, which were also very strongly related to each other ($r = .81$).

While the CFA confirmed the latent factor structure of rumination found by Peled and Moretti (2007, 2010), the rumination response classes formed from the LPA in the present study did not match the rumination groups specified in a k-means cluster analysis by Harmon et al. (2016). Importantly, LPA is a methodological improvement upon cluster analysis because with LPA, the number of classes that best fit the data is chosen according to fit indices rather than specified a priori, as in cluster analysis. Harmon et al. (2016) found evidence for groups that endorsed high levels of one rumination subtype but not the other when four groups were forced

to converge. The present study, however, allowed grouping based on the natural rumination response patterns of participants and found that three classes comprised of high, average, and low ruminators best fit the study sample. Importantly, Harmon et al.'s (2016) cluster analysis utilized a child sample, while the present study was conducted with college-aged participants. An LPA should be conducted in a sample of children to best compare their rumination response profiles to those found in this young adult sample.

Correlates of Rumination

The present study extended previous research on the transdiagnostic effects of rumination by examining its associations with trait level affect and socio-emotional outcomes using multiple methods. By one method, participants were assigned to their class of most probable membership according to the LPA and then class differences were examined for the correlates of depression, aggression, and trait sadness and anger. Consistent with the notion that rumination is a transdiagnostic risk factor, the results of these analyses indicated that as classes increased in the severity of rumination, so did the severity of each correlate. But, because sadness and anger rumination levels were similar within each class, it was difficult to determine whether class associations with the correlates were carried by both forms of rumination or only by one of the subtypes.

To help clarify these relationships, the latent factor scores for sadness and anger rumination from the CFA were saved for each participant and used to examine shared and unique associations with depression, aggression, and trait sadness and anger. The results of these analyses indicated that sadness and anger rumination had distinct correlates. In separate analyses, sadness rumination was uniquely related to depression and anger rumination was uniquely related to aggression when the other form of rumination was covaried, and these relationships held true above and beyond the effect of sex. These findings supported the idea that it is important to measure sadness and anger rumination separately.

This study improved upon previous research methodology because it provided parallel examinations of the relationships between sadness rumination and depression, and anger rumination and aggression. It is common to control for trait level anger in anger rumination studies but conversely, trait level sadness is never considered as a covariate in studies examining sadness rumination. The present study found that both trait anger and anger rumination were

uniquely associated with aggression, and that both trait sadness and sadness rumination were uniquely associated with depression. These results indicated that rumination is likely a risk factor for poor socio-emotional functioning above and beyond the general predisposition to experience negative affect.

Sadness is a symptom of depression, and therefore, when trait sadness is partialled from depression, what remains is the non-mood related symptoms of depression. It is possible that this remaining variance is saturated with error, and thus, is not a valid indicator to use for the examination of the relationship between sadness rumination and depression. A better approach may be to partial the effect of trait sadness from sadness rumination, and then examine the relationship between the remaining variance in sadness rumination and depression. As such, it is especially important to interpret the semi-partial correlation between sadness rumination and depression when trait sadness is in the regression model. On the other hand, anger is not as much a symptom of aggression as it is an antecedent to aggression. This means that partialling the effect of anger from aggression should not be problematic and interpretation of the regression coefficients and partial correlation for anger rumination is appropriate.

With respect to aggression, the partial correlations were stronger for trait anger than for anger rumination. In addition, the relationship between anger rumination and aggression decreased to non-significance once sadness rumination and sex were added to the model, while the relationship between trait anger and aggression was unaffected. With respect to depression, the magnitudes of the semi-partial correlations were similar for trait sadness and sadness rumination. But, once anger rumination and sex were added to the model, the semi-partial correlations for sadness rumination, but not trait sadness, decreased tremendously. These findings suggested that trait level affect may be a more robust predictor of socio-emotional difficulty than rumination. However, it is important to note that sadness and anger rumination were competing for much of the same variance in depression and aggression, and therefore the addition of the second form of rumination to the model would naturally have a greater impact on the strength of the relationship for the original form of rumination in the model than that of the trait level affect.

Sex Differences

The present study found modest support for the notion that women may be particularly likely to engage in rumination. Women endorsed significantly greater levels of sadness rumination than men according to the RRS measure and had higher mean levels of rumination according to the other three measures of rumination (i.e., RSS, ARS, SARI-A), although these differences did not reach statistical significance. In addition, the high rumination class from the LPA was comprised of a disproportionately high number of women, compared to the average and low rumination classes. These results suggest that sex differences in rumination may be comparable to those found for similar clinically-relevant cognitive processes, such as worry (Robichaud, Dugas, & Conway, 2003).

Expected sex differences emerged for the socio-emotional functioning and trait level affect variables. Women endorsed significantly higher levels of depression and lower levels of aggression than men, and these sex differences remained significant after controlling for trait level affect and both forms of rumination. Women also demonstrated significantly higher levels of trait sadness than men. Interestingly, while men endorsed greater average trait anger than women, this difference was not significant. Given these apparent sex differences, one might expect that the relationship between anger rumination and aggression is carried by men and the relationship between sadness rumination and depression is carried by women. But, no support was found for the notion that the relationship between rumination and aggression/depression differed for men and women in the present study.

Clinical Implications

Findings from this study add support to the extant literature that suggests rumination is an important contributor to depression and aggression among young adults. In addition, weight was given to the idea that even low to moderate levels of rumination are harmful, as no curvilinear relationships existed between rumination and depression/aggression. Compelling evidence was found to support the notion that the two forms of rumination have distinct correlates. In addition, some support for the idea that rumination, whether in response to feelings of sadness or anger, is one cognitive process of repetitive thinking. If rumination is, in fact, one cognitive process that can lead to multiple negative outcomes, it can appropriately be considered a transdiagnostic risk factor. That means that rumination should be considered as an indicator for the identification

individuals who are at-risk for depression and aggression. Similarly, rumination should be considered as a point of intervention for individuals who have already developed depression and problematic aggression.

Research studies within the sadness and anger rumination literatures have shown that in non-clinical samples, distraction and problem-solving techniques led to more favorable depressive and aggressive outcomes compared to rumination (Bushman, 2002; Joorman & Simer, 2004; Lavender & Watkins, 2004; Lyubomirsky & Nolen-Hoeksema, 1993). However, it still remains to be determined whether teaching these alternative cognitive techniques would be effective for decreasing depression and aggression levels within clinical samples. In addition, if rumination is a cognitive process similar to worry, it should respond well to cognitive-behavioral therapy techniques, such as cognitive restructuring.

Limitations and Future Directions

The present study had many methodological strengths, including the use of multiple methods to investigate the nature of rumination (i.e., CFA, LPA) and the correlates of rumination (i.e., class differences, latent factor regression analyses). In addition, this study was the first to examine the relationship between sadness rumination and depression in a way that is analogous to much of the anger rumination research. However, it is important to note several methodological limitations to the present study. First, this was a normal college-aged sample that represented a constrained period of young adulthood. The extent to which the results of this study will generalize to normal child/adolescent or older adult populations remains unknown. In addition, replication of this study with clinical samples of depressed and aggressive individuals would help clarify whether the patterns and correlates of rumination found in the present study hold true within a more severe population. The sample in the present study was primarily comprised of women. This means that variability in the severity levels of rumination, trait affect, and socio-emotional functioning was likely more constrained for men than for women and this may have affected the detection of sex differences. Future research on the effects of rumination, especially studies with primary research questions related to sex differences, would benefit from a sample with more equal numbers of men and women.

All of the constructs in the present study were measured via self-report and therefore, shared method variance. This means that the strengths of the relationships among the variables

in this study may be inflated. The study of the effects of rumination would be improved through use of mixed methods for measuring these constructs. Unfortunately, it would be difficult to obtain indices of rumination, trait sadness, and depression by any other method than self-report because these processes and emotions are so internal to the individual in question. However, it would be possible to obtain peer or family member ratings of aggression and trait anger, as these behaviors and feelings are typically external to the individual and can be observed by others. Finally, the data from the present study was collected concurrently so the temporal ordering of rumination and socio-emotional functioning can not be determined. Experimental studies have been conducted to assess the effects of rumination on depression/aggression (and the opposite) within short time periods (e.g., one hour). However, future research may wish measure the stability of rumination over longer periods of time (e.g., one month) and examine whether long-term changes in rumination are related to changes in depression/aggression.

Table 1

Demographic Characteristics of the Study Sample

Characteristics	<i>n</i>	% of sample
Sex		
Male	57	18.4
Female	253	81.6
Ethnicity		
Caucasian	177	57.1
African American	45	14.5
Hispanic	69	22.3
Asian	10	3.2
Indian	3	1.0
Arab	2	0.6
Native American	4	1.3
Grade		
Freshman	152	49.0
Sophomore	54	17.4
Junior	66	21.3
Senior	38	12.3
Age	<i>M</i> = 19.20	<i>SD</i> = 1.35

Note. Age was measured in years.

Table 2

Bivariate Correlations among Study Variables (N = 310)

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Sex	--									
2. Ethnicity	-.08	--								
3. Age	-.13*	.05	--							
4. Depression	.17**	.09	.02	--						
5. Aggression	-.12*	.09	.01	.29**	--					
6. Trait Anger	-.07	.05	-.02	.31**	.65**	--				
7. Trait Sadness	.12*	.01	.03	.64**	.22**	.23**	--			
8. RRS	.15**	.02	.02	.65**	.35**	.40**	.67**	--		
9. RSS	.06	.03	.04	.54**	.34**	.35**	.59**	.82**	--	
10. ARS	.02	.06	.00	.48**	.49**	.56**	.46**	.62**	.61**	--
11. SARI-A	.08	-.04	.00	.40**	.36**	.47**	.38**	.59**	.60**	.81**
<i>MEAN</i>	--	--	19.20	3.17	1.52	18.97	11.05	44.21	30.20	27.68
<i>SD</i>	--	--	1.35	1.32	.08	5.94	4.57	14.91	10.80	10.63

Note. The means and standard deviations presented are for square root transformed depression and logarithmically transformed aggression.

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

Table 3

Sex Differences on Key Study Variables

	Men		Women		<i>t</i>	<i>df</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Age	19.58	1.75	19.11	1.23	1.90	68.88
Depression	2.71	1.16	3.28	1.33	-2.94**	304
Aggression	1.54	0.08	1.52	0.09	2.06*	307
Trait Anger	19.81	5.35	18.79	6.06	1.17	307
Trait Sadness	9.88	3.21	11.31	4.79	-2.75*	119.83
RRS	39.56	11.53	45.27	15.40	-3.15**	106.86
RSS	28.10	10.19	29.81	12.08	-1.00	308
ARS	35.58	11.03	36.20	12.18	-0.36	308
SARI-A	26.02	8.78	28.06	10.98	-1.51	99.85

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

Table 4

Summary of CFA Model Fit

Model	Factors	No. free parameters	χ^2 (df)	<i>p</i>	CFI	TLI	RMSEA
1	One-factor	12	151.971 (2)	< .001	.823	.469	.492
2 ^a	Two-factor	13	1.424 (1)	.233	.999	.997	.037

Note. CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation

^aBest fitting model: Lower χ^2 value, higher CFI and TLI, and lower RMSEA.

Table 5

Standardized Factor Loadings for the Two-factor Model

Indicator	Sadness Rumination	Anger Rumination	Residual Variance
RRS	0.91	--	0.17
RSS	0.90	--	0.20
ARS	--	0.92	0.16
SARI-A	--	0.88	0.22

Note. Standardized coefficients are shown. All factor loadings are statistically significant at $p < .001$.

Table 6

Model Fit Indices for One- to Five-class Solutions of the LPA

	<i>AIC</i>	<i>BIC</i>	<i>Adj. BIC</i>	<i>VLMR p</i>	<i>Adj. VLMR p</i>	<i>Entropy</i>
One-Class Solution	9705.81	9735.71	9710.33	--	--	--
Two-Class Solution	9154.71	9203.29	9162.06	< .001	< .001	.88
Three-Class Solution ^a	8989.51	9056.77	8999.68	< .001	< .001	.90
Four-Class Solution	8948.44	9034.38	8961.43	.58	.59	.84
Five-Class Solution	8858.55	8963.17	8874.37	.25	.25	.86

Note. AIC = Akaike Information Criterion; BIC = Bayesian Information Criterion; VLMR = Vuong-Lo-Mendell-Rubin likelihood difference test.

^aBest fitting model: Low AIC, BIC, and adjusted BIC; significant VLMR test; high Entropy

Table 7

Demographic Differences in LPA Classes

	Low Rumination		Average Rumination		High Rumination	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	19.20	1.37	19.12	1.33	19.40	1.30
	<i>n</i>	% of class	<i>n</i>	% of class	<i>n</i>	% of class
Ethnicity						
Caucasian	99	61.5	51*	46.8	27	67.5
Ethnic Minority	62	38.5	58*	53.2	13	32.5
Sex						
Men	35	21.7	21	19.3	1*	2.5
Women	126	78.3	88	80.7	39*	97.5

*Proportions differ significantly from the other two classes at $p < .05$.

Table 8

Class Differences on Socio-emotional Variables

DV	LR <i>n</i> = 161		AR <i>n</i> = 109		HR <i>n</i> = 40		One-way ANOVA			
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>F</i> / <i>Welch</i>	<i>df</i>	<i>eta</i> <i>squared</i>	Tukey HSD / Dunnett's T3 post-hoc
Depression	2.54	1.09	3.53	.99	4.77	1.19	78.56*	2, 303	.34	LR < AR, HR; AR < HR
Aggression	1.49	.07	1.54	.08	1.58	.10	24.29*	2, 97.58	.15	LR < AR, HR
Trait anger	16.65	4.84	20.93	6.04	22.95	5.76	32.20*	2, 101.89	.18	LR < AR, HR
Trait sadness	8.89	3.00	11.89	4.07	17.35	4.52	74.14*	2, 95.82	.38	LR < AR, HR; AR < HR

Note. DV = dependent variable; LR = low rumination class; AR = average rumination class; HR = high rumination class. Post-hoc comparisons are all significant at $p < .05$.

* $p < .001$

Table 9

Class Differences on Socio-emotional Variables Controlling for Sex

DV	Effect of class			Effect of sex			Pairwise Comparisons
	<i>F</i>	<i>df</i>	<i>Partial eta squared</i>	<i>F</i>	<i>df</i>	<i>Partial eta squared</i>	
Depression	74.54**	2, 302	.33	3.50	1, 302	.01	LR < AR, HR; AR < HR
Aggression	31.06**	2, 305	.17	10.84**	1, 305	.03	LR < AR, HR; AR < HR
Trait anger	34.98**	2, 305	.19	5.38*	1, 305	.02	LR < AR, HR; AR < HR
Trait sadness	88.21**	2, 305	.37	.39	1, 305	.00	LR < AR, HR; AR < HR

Note. DV = dependent variable; LR = low rumination class; AR = average rumination class; HR = high rumination class.

Pairwise comparisons are all significant at $p < .05$.

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

Table 10

Hierarchical Regression Model for Depression

	<i>B</i>	<i>Std. Error</i>	<i>Beta</i>	<i>t</i>	<i>p</i>	<i>r</i>	<i>pr</i>	<i>sr</i>
Step 1								
Sadness Rum.	.04	.01	.37	6.64	< .001	.63	.36	.27
Trait Sadness	.11	.02	.40	7.18	< .001	.64	.38	.30
Step 2								
Sadness Rum.	.03	.01	.33	4.10	< .001	.63	.23	.17
Trait Sadness	.11	.02	.39	7.08	< .001	.64	.38	.29
Anger Rum.	.01	.01	.04	.60	.55	.51	.04	.03
Sex	.28	.14	.08	2.02	.04	.17	.12	.08

Note. Rum. = rumination; r = zero-order correlation; pr = partial correlation; sr = semi-partial correlation

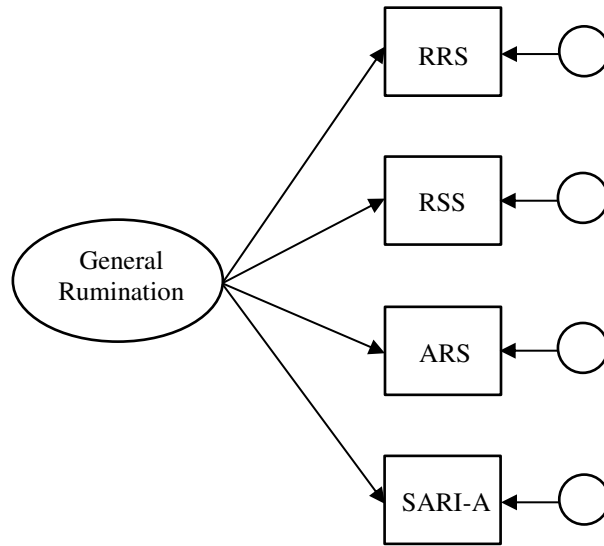
Table 11

Hierarchical Regression Model for Aggression

	<i>B</i>	<i>Std. Error</i>	<i>Beta</i>	<i>t</i>	<i>p</i>	<i>r</i>	<i>pr</i>	<i>sr</i>
Step 1								
Anger Rum.	.00	.00	.15	2.91	< .01	.47	.16	.13
Trait Anger	.01	.00	.56	10.88	< .001	.65	.53	.47
Step 2								
Anger Rum.	.00	.00	.08	1.02	.31	.47	.06	.04
Trait Anger	.01	.00	.55	10.72	< .001	.65	.52	.46
Sadness Rum.	.00	.00	.10	1.40	.16	.39	.08	.06
Sex	-.02	.01	-.10	-2.34	.02	-.12	-.13	-.10

Note. Rum. = rumination; r = zero-order correlation; pr = partial correlation; sr = semi-partial correlation

Model 1



Model 2

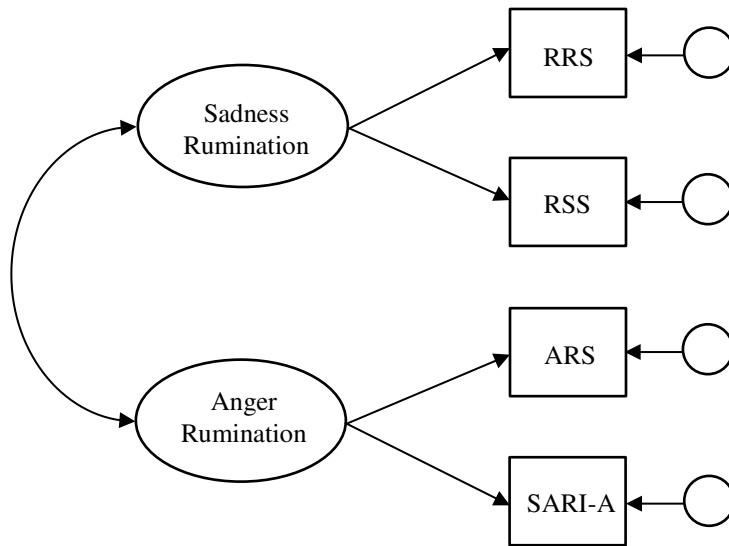


Figure 1. Diagrams of the competing CFA models.

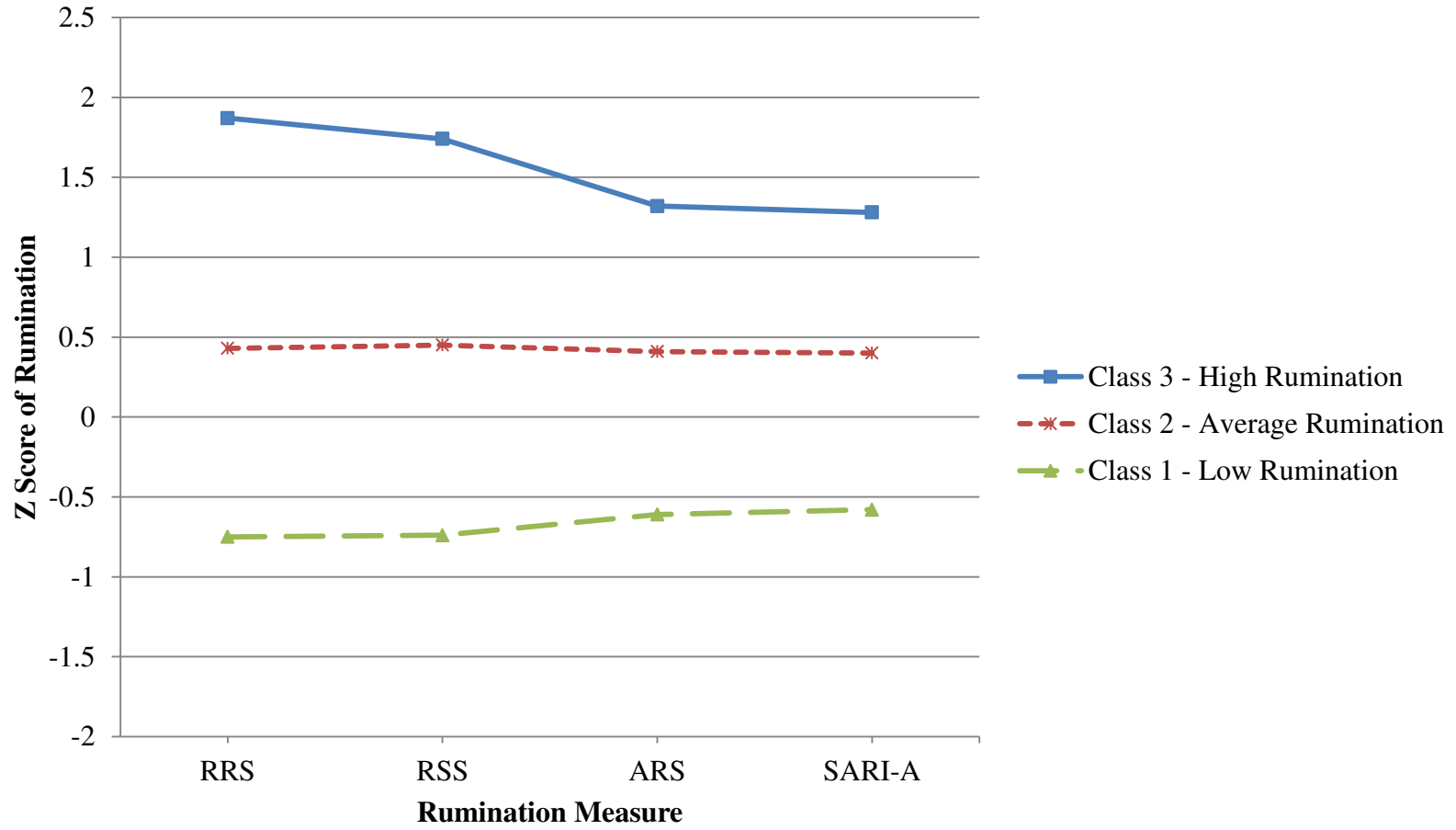


Figure 2. Standardized rumination measure scores for latent classes.

APPENDIX A

INSTITUTIONAL REVIEW BOARD PROJECT APPROVAL MEMORANDUM

Office of the Vice President for Research
Human Subjects Committee
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

APPROVAL MEMORANDUM

Date: 01/05/2015

To: Haley Stephens

Address: *PI's home address

Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Use of Human Subjects in Research
A Latent Profile Analysis of Rumination

The application that you submitted to this office in regard to the use of human subjects in the proposal referenced above have been reviewed by the Secretary, the Chair, and two members of the Human Subjects Committee. Your project is determined to be Expedited per 45 CFR § 46.110(7) and has been approved by an expedited review process.

The Human Subjects Committee has not evaluated your proposal for scientific merit, except to weigh the risk to the human participants and the aspects of the proposal related to potential risk and benefit. This approval does not replace any departmental or other approvals, which may be required.

If you submitted a proposed consent form with your application, the approved stamped consent form is attached to this approval notice. Only the stamped version of the consent form may be used in recruiting research subjects.

If the project has not been completed by 01/04/2016 you must request a renewal of approval for continuation of the project. As a courtesy, a renewal notice will be sent to you prior to your expiration date; however, it is your responsibility as the Principal Investigator to timely request renewal of your approval from the Committee.

You are advised that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report, in writing any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the chairman of your department and/or your major professor is reminded that he/she is responsible for being informed concerning research projects involving human subjects in the department, and should review protocols as often as needed to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

This institution has an Assurance on file with the Office for Human Research Protection. The Assurance Number is IRB00000446.

Cc: Janet Kistner
HSC No. 2014.14145

APPENDIX B

INSTITUTIONAL REVIEW BOARD PROJECT RENEWAL MEMORANDUM

Office of the Vice President For Research
Human Subjects Committee
P. O. Box 3062742
Tallahassee, Florida 32306-2742
(850) 644-8673 · FAX (850) 644-4392

RE-APPROVAL MEMORANDUM

Date: 10/26/2015

To: Haley Stephens

Address: *PI's home address

Dept.: PSYCHOLOGY DEPARTMENT

From: Thomas L. Jacobson, Chair

Re: Re-approval of Use of Human subjects in Research:
A Latent Profile Analysis of Rumination

Your request to continue the research project listed above involving human subjects has been approved by the Human Subjects Committee. If your project has not been completed by 10/24/2016, you are must request renewed approval by the Committee.

If you submitted a proposed consent form with your renewal request, the approved stamped consent form is attached to this re-approval notice. Only the stamped version of the consent form may be used in recruiting of research subjects. You are reminded that any change in protocol for this project must be reviewed and approved by the Committee prior to implementation of the proposed change in the protocol. A protocol change/amendment form is required to be submitted for approval by the Committee. In addition, federal regulations require that the Principal Investigator promptly report in writing, any unanticipated problems or adverse events involving risks to research subjects or others.

By copy of this memorandum, the Chairman of your department and/or your major professor are reminded of their responsibility for being informed concerning research projects involving human subjects in their department. They are advised to review the protocols as often as necessary to insure that the project is being conducted in compliance with our institution and with DHHS regulations.

Cc:
HSC No. 2015.16807

APPENDIX C

INFORMED CONSENT FORM

Project Title: A Latent Profile Analysis of Rumination

You are invited to participate in a research study that examines how humans think about and process negative events and emotions. We ask that you read this form and ask any questions you may have before agreeing to participate in the study.

This study is being conducted by Haley Stephens, M.S. and Janet Kistner, Ph.D. from the Department of Psychology at Florida State University.

Background information:

Rumination refers to conscious, repetitive thinking that revolves around a common theme. The main purpose of this study is to determine under what emotional circumstances people engage in ruminative thinking. It is possible that some people only ruminate about feelings of sadness while others only ruminate about feelings of anger. Another possibility is that some people are prone to rumination in general (i.e., they ruminate about feelings of sadness and anger) and other people do not tend to ruminate at all. This study seeks to determine the emotion specificity or generality with which people tend to ruminate. A second aim of the present study is to examine what clinical outcomes (i.e., sadness, aggression, and anger) are associated with each or both types of rumination.

Procedures:

If you agree to participate, we will ask you to complete questionnaires describing how you think and feel about negative events. First, you will be asked to provide information about your age, gender, race, and ethnicity. Next, you will be asked to complete ten questionnaires about your styles of thinking and your feelings of sadness and anger, and aggressive behavior. It is expected that your completion of this study will take no more than 30 minutes, though you may have as much time as you need.

Risks and benefits of being in the study:

As part of your participation in this study you will be asked to complete questionnaires that inquire about your feelings of sadness, anger, and your aggressive behavior. As such, one risk of participating in the present study is that you may feel distress as a result of thinking about your feelings. To mitigate this risk the researcher will provide you with referrals to mental health clinics at Florida State University.

Your participation may result in the following benefits: The information that we gather will be used to evaluate the effects of rumination on feelings of sadness, anger, and aggressive behaviors. It will also help us understand whether people tend to ruminate to only one type of emotion or both types of emotions.

Compensation:

Upon consenting to participate in this study you will be awarded one course credit. You will receive this course credit even if you choose to withdraw from this study before answering all the questionnaires.

Voluntary nature of the study:

Your participation in this project is completely voluntary. You do not have to participate if you do not want to. Your decision whether or not to participate will not influence your education at Florida State University. You may change your mind and withdraw from this study at any time without penalty. There are no risks associated with withdrawal from this study.

Confidentiality:

The records of this study will be kept private and confidential to the extent permitted by law. Specifically, confidentiality will be ensured in the following ways. In public reports on the results of this project, results will only be reported that have been averaged across participants. No individual participant will ever be identified publically. Your name will not be listed on any questionnaire you complete. All information gathered from you will be kept in a locked file storage area.

Contacts and questions:

The researchers conducting this study are Haley Stephens, a Florida State University graduate student, and Janet Kistner, a faculty advisor at the Department of Psychology at Florida State University. You may ask any questions you have now; if you have a question later, you are encouraged to contact Haley Stephens at (xxx) xxx-xxx, or *email address.

If you have any questions or concerns regarding this study and would like to talk to someone other than the researchers, you are encouraged to contact the FSU IRB at humansubjects@fsu.edu, or call 850-644-7900.

Statement of consent:

If you agree to participate in this research project, please sign and print your name below. Your signature indicates that you have read and understood the information provided above and that you have decided to participate.

Participant Signature

Printed Name of Participant

Today's Date

FSU Human Subjects Committee approved on 10/26/2015. Void after 10/24/2016.
HSC # 2015.16807

APPENDIX D

PERMISSION TO USE THE BECK DEPRESSION INVENTORY



Clinical Assessment—Legal
19500 Blanding Road, Bldg. 7
San Antonio, TX 78249
Telephone: 210-339-8343
Fax: 210-339-8029
www.pearson.com

April 15, 2016

Florida State University
C/o Haley E. Stephens, M.S., Graduate Student

Re: *Beck Depression Inventory[®]-II (BDI[®]-II)* (the "Product");

Dear Ms Stephens:

Thank you for your request for permission to administer the BDI II test forms you purchased in your dissertation study (the "Purpose").

We have no objection to the use of this material for the purpose as stated above subject to the following Terms and Conditions:

1. You have permission to use the BDI II test forms in your dissertation study entitled "A Latent Profile Analysis of Rumination" and to include this permission letter in the appendix of your written study results.
2. This permission expires April 30, 2018.
3. Because of test security and validity concerns, permission is not granted for appending tests to theses, dissertations, or reports of any kind. You may not include any actual assessment test items, discussion of any actual test items or inclusion of the actual assessment product in the body or appendix of your dissertation or thesis. You are only permitted to describe the test, its function and how it is administered and discuss the fact that you used the test(s), your analysis, summary statistics, and the results.
4. Please ensure the following copyright and trademark notice(s) are present:

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Sincerely,

William H. Schryver

William H. Schryver
Senior Legal Licensing Specialist

ALWAYS LEARNING

APPENDIX E

PERMISSION TO USE THE TRAIT ANGER SCALE



Creating Connections. Changing Lives.

16204 N. FLORIDA AVENUE • LUTZ, FLORIDA 33549
Telephone: 813.968.2003 • Fax: 813.968.2585 • Web: www.parinc.com

Sent Via Email:

April 12, 2016

Haley Stephens
Florida State University

Dear Ms. Stephens:

In response to your recent request, permission is hereby granted to you to reproduce up to a total of 315 (paper) copies of the 10 items from the Trait Anger (T-Ang) Scale of the State-Trait Anger Expression Inventory-2 (STAXI-2) for use in your research titled, *A Latent Profile Analysis of Rumination*. If additional copies are needed, it will be necessary to write to PAR for further permission. Permission is also granted for you to include up to a total of three (3) sample items from the STAXI-2 in your dissertation; any further publication in a Journal (or otherwise) will require additional permission.

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Sincerely,

Vicki M. McFadden
Permissions Specialist

ACCEPTED AND AGREED:

ACCEPTED AND AGREED:

BY: HALEY STEPHENS

BY: VICKI M. MCFADDEN

DATE: 4/12/16

DATE: April 13, 2016

PAYMENT RECEIVED: _____
PAR CUSTOMER NO.: _____

SIGNATURE OF PROFESSOR REQUIRED:

I hereby agree to supervise this student's use of these materials. I also certify that I am qualified to use and interpret the results of these tests as recommended in the *Standards for Educational and Psychological Testing*, and I assume full responsibility for the proper use of all materials used per this Agreement.

BY: _____

Printed Name: Janet Kistner

©2007 Stephens-Kistner Test Agency (SKTA) 4-12-2016

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BIOGRAPHICAL SKETCH

Haley Stephens attended the University of Virginia where she graduated with a Bachelor of Arts degree in Psychology *with distinction* in 2008. After graduating, she worked as a research coordinator for one year in the Peer Relations and ADHD laboratory at the University of Virginia. Haley received a Master of Science degree in Psychology from Florida State University in 2012. She will begin her pre-doctoral clinical psychology internship at Oregon Health & Science University in Portland, Oregon in August 2016 and will graduate with her Ph.D. in Clinical Psychology from Florida State University in August 2017.