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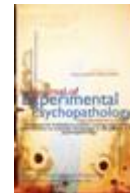


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Maladaptive Processing of Maladaptive Content: Rumination as a Mechanism Linking Cognitive Biases to Depressive Symptoms

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Abstract

Cognitive theories propose that negatively biased thinking is an important factor in the development and maintenance of depression. The mechanisms by which cognitive biases lead to depression, however, have not been thoroughly researched. One potential mechanism is that negatively biased thoughts trigger rumination, or the process of focusing passively and repetitively on the causes and consequences of one's mood, a well-established risk factor for depression. In a series of three studies, we examined rumination and other cognitive emotion regulatory strategies as mechanisms of the relationship between cognitive biases and depressive symptoms. We found consistent evidence that rumination mediates the relationship between interpretation and memory biases and depressive symptoms. The indirect effects through rumination were stronger than indirect effects through other cognitive emotion regulation strategies (dampening and worry). These findings indicate that negatively biased thinking may increase risk for depression by increasing rumination, supporting the notion that rumination is a useful target for intervention with depressed clients.

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Keywords: Rumination, depression, cognitive bias, interpretation bias, memory bias

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Introduction

Among the many innovative contributions of Susan Nolen-Hoeksema's work on rumination ([Nolen-Hoeksema, 1991](#); [Nolen-Hoeksema & Morrow, 1991](#); [Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008](#)), perhaps the foremost was the idea that depression is driven not by dysphoric mood per se, and not just by depressive thoughts themselves, but rather by differences in how individuals cognitively *process* their mood. Rumination is characterized by passive, repetitive processing of the causes and consequences of one's mood ([Nolen-Hoeksema, 1991](#)), and it is implicated in the onset, severity, and duration of major depressive episodes (for a review, see [Nolen-Hoeksema et al., 2008](#)). Although individuals who tend to ruminate believe they are solving problems or gaining insight about themselves (Lyubomirsky, Tucker, Caldwell, & Berg, 1999; Papageourgiou & Wells, 2003), in fact, rumination is associated with cognitive inflexibility ([Davis & Nolen-Hoeksema, 2000](#)), poorer problem solving

(e.g., Lyubomirsky et al., 1999), and reductions in social support (Nolen-Hoeksema & Davis, 1999), leading to a vicious cycle in which distress feeds on itself.

Although much is known about the maladaptive effects of rumination, questions remain regarding how and why people ruminate, what triggers rumination at any particular moment, and how rumination fits into the broader context of depressive cognition. In depression, cognitive content is decidedly biased toward the negative, consistent with Beck's (1967) proposition that depressed individuals hold bleak views of the self, the world, and the future. Depressed individuals display cognitive biases in attention, memory, and interpretation, such that they orient away from positive and toward negative emotional stimuli (e.g., Gotlib, Krasnoperova, Yue, & Joormann, 2004), selectively recall negative autobiographical memories (e.g., Hertel & Gerstle, 2003), and produce negatively biased interpretations for ambiguous events (e.g., Lawson, MacLeod, & Hammond, 2002; Wisco & Nolen-Hoeksema, 2010a).

Content and Process: The Interplay of Cognitive Biases and Rumination

Although rumination typically focuses on negatively valenced content, it is distinguishable theoretically and empirically from such content by its recursive, self-focused, and abstract nature (Ciesla & Roberts, 2007; Nolen-Hoeksema et al., 2008; Watkins, 2008). The psychopathology of depression, then, simultaneously includes both biased cognitive *content* (i.e., over-representation of negative information in attention, memory, and interpretation) and maladaptive cognitive *processing* (i.e., rumination). Surprisingly, the relation between such depressive thought content and ruminative processing – and how they together affect depressive symptoms – remains uncertain.

We propose a theoretical model in which negatively biased content does not lead to depression directly, but rather increases risk for maladaptive forms of cognitive processing, such as rumination, which increase depression risk. We suggest that a negative interpretation of a situation, or recalling a negative memory from one's past, is unlikely to lead to long-lasting depression by itself. Rather, such negative cognitive content likely requires some processing to have a meaningful effect on symptoms. This negative cognitive content is expected to trigger rumination, which subsequently increases depression risk.

Why would negative cognitive content trigger rumination? Rumination requires a prompting "command" to initiate the process. Rumination is typically thought to be triggered by emotional cues signaling discrepancy between current and desired states (Pyszczynski, Holt & Greenberg, 1987). We propose that negatively biased attention, memory, and interpretation also signal such discrepancies by highlighting undesirable aspects of one's present or past circumstances. Therefore, the negative cognitive content in depression (biases in attention, memory, and interpretation) is likely to promote ruminative processing, an effect that maintains focus on that negative content and increases depressive symptoms.

For example, consider a weekend day when you are expecting a friend to call to set up plans for dinner, but by late afternoon, she hasn't called, and your calls go straight to her voice mail. If your interpretation of this situation is, "Well, she's pretty flaky; maybe I'll see her tomorrow," you are unlikely to ruminate, because the content and associated affect is insufficiently negative to trigger abstract, self-focused perseveration. By contrast, if your immediate interpretation of the situation is, "She hates me; I bet she found someone better to spend time with," such negative content is much more likely to trigger ruminative processing, and it may be that ruminating on this material partly accounts for how biased thinking contributes to depressive symptoms.

Indeed, prior work has shown that rumination mediates the effects of certain types of cognitive vulnerabilities on depression. In a 2.5-year longitudinal study, Spasojevic and Alloy (2001) found that rumination accounted for the prospective influence of cognitive content (i.e., dysfunctional attitudes and negative attributional style) on depressive episodes, suggesting that ruminative processing acts as a proximal mechanism through which other cognitive vulnerabilities contribute to depression. Others have similarly found that rumination accounts for the relationship between attributional style and depressive symptoms (Lo, Ho, & Hollon, 2008) and between neuroticism and dysphoria (Roberts, Gilboa & Gotlib, 1998). Experimental studies also demonstrate that rumination exacerbates the effects of negative cognitive styles on negative mood (Ciesla & Roberts, 2007).

The Present Studies

In the present studies, we suggest that rumination (as a process) and cognitive biases (as content) are closely linked, and the effects of cognitive biases on depression are partly mediated through their prompting of rumination. We sought to extend existing research consistent with this hypothesis in two ways. First, past investigations examining the mediating role of rumination have been limited to specific types of self-reported cognitive vulnerability (i.e., dysfunctional attitudes, attributional style, and neuroticism; [Lo et al., 2008](#); [Roberts et al., 1998](#); [Spasojevic & Alloy, 2001](#)). Recent research has increasingly implicated negative biases in interpretation and memory as important cognitive risk factors for depression ([Gotlib & Joormann, 2010](#); [Mathews & MacLeod, 2005](#); [Wisco, 2009](#)), but the role of rumination in relation to these types of cognitive vulnerability and depression has yet to be examined. We sought to examine the indirect effects of biases in interpretation (Studies 1 and 2) and memory (Study 3) on depressive symptoms through rumination. Second, we sought to examine whether individuals' use of rumination played a relatively unique role in mediating influences of cognitive biases, when compared to two closely related forms of cognitive emotion regulation: dampening (i.e., purposeful negative thought in response to positive emotion; Study 2) and worry (i.e., repetitive negative thought about the future; Study 3).

General Method

In a series of three studies, rumination was examined as a potential mediator of the relationship between cognitive biases and depressive symptoms. We included data from three previously collected datasets examining two types of cognitive biases shown to be related to depressive symptoms: negative biases in interpretation and autobiographical memory ([Wisco & Nolen-Hoeksema, 2010a, 2010b, 2011](#)). We also examined reverse mediational models for each of the studies, to examine the possibility that the effects were not in the proposed direction.

Study 1

The data for Study 1 were previously collected to examine interpretation biases associated with depressive symptoms ([Wisco & Nolen-Hoeksema, 2010a](#)).¹ Interpretation of an ambiguous situation involves two related processes: generation of possible interpretations and selection of the most likely interpretation for that situation. For example, when faced with an ambiguous situation, like waving to a friend but not getting any response, one has to generate interpretations for her behavior (e.g., "Maybe she didn't see me" vs. "Maybe she's angry at me") and select one of the possibilities generated as a likely explanation for the event ("She must not have seen me"). Prior research demonstrates that dysphoric individuals both generate and select interpretations that are rated as more negative than those generated and selected by nondysphoric individuals ([Wisco & Nolen-Hoeksema, 2010a; 2011](#)). With the current analyses, we sought to examine whether these negative biases in interpretation generation and selection are associated with depressive symptoms directly, or indirectly through rumination. We predicted that biases in interpretation generation and selection would both have significant indirect effects on depressive symptoms through rumination.

Methods

Participants

Eighty-nine participants were included in these analyses, including 43 (48.3%) dysphoric and 46 (51.7%) nondysphoric participants. Participants' ages ranged from 18 to 31, with a mean age of 20.91 (SD = 3.02). Thirty-six (40.4%) men and 53 (59.6%) women participated. Seventeen (19.1%) participants described their ethnicity as

¹ As part of the aims of this prior research, participants were randomly assigned to complete different measures of interpretation bias, either interpretations made while considering oneself or while considering others ([Wisco & Nolen-Hoeksema, 2010a](#)). Because self-relevant interpretations are most pertinent to cognitive theories of depression (e.g., [Wisco, 2009](#)) and most applicable to our hypotheses concerning the role of self-focused rumination in the development of depression, we restricted our sample to participants randomly assigned to make self-relevant interpretations for all analyses ([Wisco & Nolen-Hoeksema, 2010a](#); Studies 1 and 2).

Hispanic and 66 (74.2%) as non-Hispanic (six participants declined to answer). Forty-seven (52.8%) participants identified their race as Caucasian or White, 22 (24.7%) as Asian-American, eight (9.0%) as African-American or Black, six (6.8%) as multiracial, one (1.1%) as American Indian, and five (5.6%) participants declined to answer.

Measures

Interpretation Bias Questionnaire – Self Version (IBQ).

The IBQ is a measure of interpretation bias in which participants are presented with written descriptions of ten hypothetical situations that could have multiple possible interpretations (e.g., “Your significant other leaves you a voicemail saying ‘Hi it’s me. Give me a call.’ What does he/she want to talk to you about?”; Wisco & Nolen-Hoeksema, 2010a). In the self version of the measure, written instructions are provided that ask participants to imagine the situation happening to them, and to write down all the interpretations for the scenarios that come to mind (generation) and then to circle the one interpretation they view as most likely (selection).

Coders unaware of participants’ dysphoria status rated the positivity and negativity of each interpretation on 5-point Likert scales. Following the scoring described by Wisco & Nolen-Hoeksema (2010a), the negativity ratings were subtracted from the positivity ratings to create composite valence ratings, with higher numbers reflecting more positive interpretations. The index of interpretation generation was the mean valence rating of all interpretations generated across all 10 vignettes, and the index of interpretation selection was the mean valence rating of the interpretations selected as the most likely explanation across the vignettes. The coders demonstrated adequate inter-rater agreement on these scales (κ s from .78 to .82; [Wisco & Nolen-Hoeksema, 2010a](#)), and discrepancies were resolved by consensus.

Ruminative Responses Scale (RRS).

The Ruminative Responses Scale of the Response Styles Questionnaire is a commonly used self-report measure of depressive rumination ([Nolen-Hoeksema & Morrow, 1991](#)). Participants’ rate the degree to which they engage in ruminative responses to depressed mood on 4-point scales (from “*almost never*” to “*almost always*”). The measure includes 22 summed items, such that higher scores reflect a greater tendency to ruminate.² The RRS has demonstrated convergent and predictive validity and good psychometric properties, including internal consistency and test-retest reliability (Nolen-Hoeksema, Larson, & Grayson, 1999). In this study, internal consistency of the RRS was high (Cronbach’s $\alpha = .93$).

Beck Depression Inventory-II (BDI-II).

The BDI-II is a well-validated self-report measure of depressive symptoms (Beck, Steer, & Brown, 1996). The questionnaire consists of 21 items, summed to provide a measure of depressive symptom severity. In all three studies reported here, we classified participants as nondysphoric if their total BDI-II score was less than nine, and as dysphoric if their total score was 16 or greater ([Wisco & Nolen-Hoeksema, 2010a](#)).

Procedure

Participants were recruited from flyers posted on a university campus and the surrounding community, and from an undergraduate psychology subject pool. Nondysphoric and dysphoric participants were identified by a prescreening questionnaire, which was a modified version of the Beck Depression Inventory-II (BDI-II), excluding one item assessing suicidal ideation. Individuals meeting criteria were invited to participate in the studies, and the full BDI-II was administered at the time of testing. Only participants whose scores met criteria at both prescreen and the time

² Some have criticized certain items in the total RRS score for construct overlap with depression symptoms (e.g., Roberts et al., 1998). We ran additional analyses using a modified rumination score excluding items identified as “symptom-focused” in a prior factor analysis (items 1, 2, 3, 4, 6, 8, and 19; [Roberts et al., 1998](#)). Excluding these items did not change any results across the three studies with one exception. The sole exception was that a small but significant indirect effect was found for the reverse mediational model for interpretation selection in Study 2 ($ab = 0.03$, 95% CI [0.005, 0.07]).

of testing were included in the final analyses. All participants met individually with the experimenter to complete all study procedures. Participants first provided informed consent and then completed a practice IBQ item to ensure adequate comprehension of the instructions. If the participant only wrote down one response, the experimenter said “Did you write down all explanations that came to mind?” If the participant failed to circle any responses, the experimenter said “Please circle the response you view as the most likely explanation”. Participants then completed the IBQ followed by a packet of self-report questionnaires including the RRS, BDI-II, and demographic information. Participants were compensated for their time with a payment of 15 US dollars or research participation credit.

Data Analytic Plan

We planned simple mediational models for this study, with interpretation bias entered as the independent variable, rumination entered as a mediator, and dysphoria status (nondysphoric or dysphoric) entered as the dependent variable. We planned separate models for the two indices of interpretation bias (generation and selection). For all mediational models presented in this paper (Studies 1-3), we used the bootstrapping approach described by Preacher and Hayes (2008), which is appropriate for use with relatively small samples (MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002). Estimates of indirect effects were based on 5000 resamples; we report unstandardized coefficients and bias-corrected confidence intervals for all indirect effects (95% confidence intervals not including zero are statistically significant). Logistic regression was used for all models with dysphoria status as the outcome; linear regression was used for all analyses with continuous outcomes. We planned the same analytic approach for the reverse mediational models, except that rumination was entered as a predictor and interpretation bias was entered as a mediator. Separate models were again planned for the two indices of interpretation bias.

Results

Dysphoric participants reported BDI-II scores ranging from 16 to 43, with a mean of 22.7 (SD = 6.2), placing them in the moderately depressed range (Beck et al., 1996). Nondysphoric participants reported scores ranging from zero to eight, with a mean of 3.1 (SD = 2.4), indicating that they had no to minimal symptoms of depression. The correlations between rumination and the two interpretation bias variables are presented in Table 1.

Table 1: Zero-order correlations between cognitive bias variables and rumination, dampening, and worry.

Cognitive Bias	Rumination	Dampening	Worry
Interpretation Generation (Study 1)	-.35**	--	--
Interpretation Selection (Study 1)	-.43***	--	--
Interpretation Generation (Study 2)	-.43***	-.22*	--
Interpretation Selection (Study 2)	-.49***	-.23*	--
Memory Negativity (Study 3)	.22*	--	.18

* $p < .05$, ** $p < .01$, *** $p < .001$

Note. Interpretation bias measures are coded such that higher numbers reflect more positive interpretations; memory negativity is coded such that higher numbers reflect more negative memories.

Mediational Models

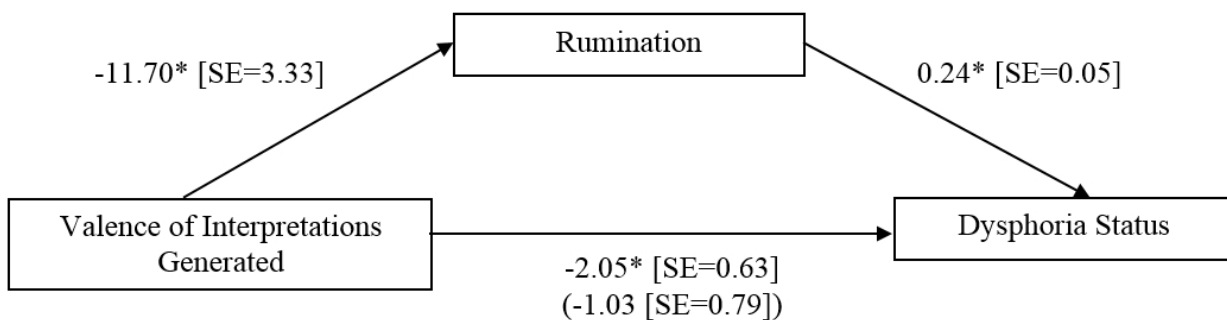
Interpretation Generation Bias.

Results of the mediation analyses are presented in Figure 1. The valence of interpretations generated was significantly associated with dysphoria status ($Z = -3.25$, $p = .001$), and with the proposed mediator, rumination ($t = -3.51$, $p < .001$; see Figure 1a for coefficients). The relationship between rumination and dysphoria status, controlling for interpretation generation bias, was also significant ($Z = 4.49$, $p < .001$). The effect of interpretation generation bias on dysphoria status was no longer significant after including rumination in the model ($Z = -1.32$, $p = .19$), and the indirect effect of interpretation bias on dysphoria status through rumination was statistically significant ($ab = -2.81$, 95% CI [-5.42, -1.09]).

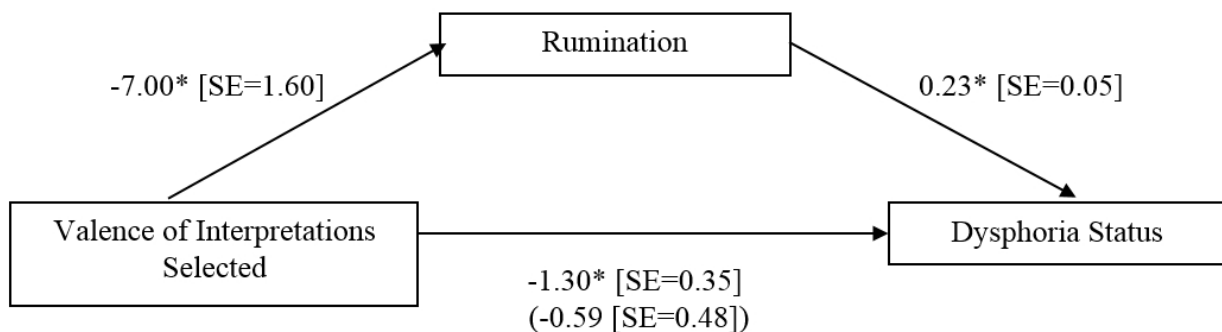
Interpretation Selection Bias.

The valence of interpretations selected as most likely was significantly associated with dysphoria status, $Z = -3.68$, $p < .001$, and with rumination, $t = -4.36$, $p < .001$ (see Figure 1b). Rumination was significantly associated with dysphoria status after statistically controlling for interpretation selection bias, $Z = 4.40$, $p < .001$. The effect of interpretation selection bias on dysphoria status was no longer significant after controlling for rumination ($Z = -1.24$, $p = .22$), and the indirect effect of interpretation selection bias on dysphoria status through rumination was statistically significant ($ab = -1.61$, 95% CI [-2.84, -0.81]). In sum, results indicated that rumination mediated the associations of both biased generation and biased selection with depressive symptoms.

a. Mediation Model for Interpretation Generation



b. Mediation Model for Interpretation Selection



Note. $*p < .05$. Unstandardized coefficients are presented, with standard errors presented in brackets. The total effect is given for the path from interpretation valence to dysphoria status, with the direct effect controlling for the mediator given in parentheses. Higher scores on interpretations generated and selected reflect more positive interpretations.

Figure 1: Rumination as a Mechanism Linking Interpretation Biases to Depressive Symptoms (Study 1).

Reverse Mediation Models

To address the reverse direction of effects, we also tested whether interpretation biases mediated the association between rumination and dysphoria status. Each reverse mediational model included rumination as the independent variable, interpretation bias (generation or selection) as the mediator, and dysphoria status as the dependent variable. Rumination was significantly associated with dysphoria status ($B = 0.25$, $SE = 0.05$, $Z = 4.63$, $p < .001$) and with both interpretation bias variables (generation, $B = -0.01$, $SE = 0.003$, $t = -3.51$, $p < .001$; selection, $B = -0.03$, $SE = 0.01$, $t = -4.36$, $p < .001$). However, the valence of interpretations generated ($B = -1.04$, $SE = 0.79$, $Z = -1.32$, $p = .19$) or selected ($B = -0.59$, $SE = 0.48$, $Z = -1.24$, $p = .22$) was not significantly related to dysphoria status after statistically controlling for rumination. The indirect effects of rumination on dysphoria status through

interpretation biases were not significant (generation, $ab = 0.01$, 95% CI = [-0.007, 0.04]; selection, $ab = 0.02$, 95% CI = [-0.01, 0.05]).

Discussion

Results indicated that rumination mediated the association between interpretation biases and dysphoria status. These findings are consistent with our hypothesis that rumination is a mechanism explaining the association between negative cognitive biases and depressive symptoms. These data are cross-sectional; therefore, we cannot draw causal conclusions. However, there was no evidence for the reverse mediation model: the indirect effect of rumination through interpretation biases on depressive symptoms was not statistically significant. This finding strengthens support for the proposed direction of effects, such that negatively biased interpretations may prompt rumination, which may serve as the emotion regulatory process by which these cognitions lead to depressive symptoms. Yet, rumination is only one of several maladaptive emotion regulation processes associated with depression that might be initiated by such content. We examined rumination in the context of other responses to affect in Study 2.

Study 2

The purpose of Study 2 was threefold: 1) to replicate the finding that rumination mediates the association between interpretation bias and depressive symptoms; 2) to examine whether interpretation biases are associated with maladaptive responses to positive affect, as well as rumination in response to negative affect; and 3) to examine whether both types of response styles explain the association between interpretation biases and depressive symptoms.

The original response styles theory (Nolen-Hoeksema, 1991) focused on responses to sad mood, however, recent research has also examined dysregulated responding to positive mood as another potential risk factor for depression (see Bylsma, Morris, & Rottenberg, 2008; Carl, Soskins, Kerns, & Barlow, 2013). Some individuals with mood disorders appear to respond to positive affect with a maladaptive response style termed “dampening” (Johnson, McKenzie, & McMurrich, 2008). Dampening is defined as “the tendency to respond to positive mood states with mental strategies to reduce the intensity and duration of the positive mood state” (Feldman, Joormann, & Johnson, 2008, p. 509). In effect, dampening is parallel to negative rumination—it is a negative reflection, but on one’s current positive emotional state (e.g., when in a positive emotional state, think “I don’t deserve this”). Dampening positive affect has been associated with concurrent and prospective depressive symptoms in non-clinical samples, above and beyond the influence of ruminating on negative affect (Raes, Smets, Nelis, & Schoofs, 2012).

However, research has not examined what leads to the use of dampening as a response style, nor whether the negative cognitive biases characteristic of depression might also be associated with the tendency to dampen one’s positive affect. Negative interpretation biases might be expected to lead to use of this maladaptive response style. According to self-verification theory, individuals are motivated to maintain their self-image, even if that self-image is negative (Swann, 1990). Indeed, people preferentially solicit and recall feedback that confirms their self-image (Giesler, Josephs, & Swann, 1996; Swann, Griffin, Predmore, & Gaines, 1987; Swann & Read, 1981) and depressed individuals solicit criticism consistent with their negative self-views (Joiner, 2002; Swann, Wenzlaff, Douglas, & Pelham, 1992; Swann, Wenzlaff, & Tafarodi, 1992). Therefore, habitually interpreting situations in a negatively biased fashion may lead one to repetitively dampen positive affect when it occurs in response to a positive event, in order to make the uncharacteristic positive affect more consistent with one’s self-perception. Thus, in Study 2, we predicted that a tendency to interpret ambiguous situations negatively would lead to dampening one’s positive affect. In turn, we hypothesized that dampening would mediate the relationship between interpretation bias and depressive symptoms, consistent with prior research indicating that dampening prospectively predicts development of depressive symptoms (Raes et al., 2012). We tested this hypothesis while also assessing the independent influence of rumination in response to negative affect. Lastly, we predicted that together, rumination in response to negative affect and dampening in response to positive affect would explain the association between interpretation biases and depressive symptoms.

Methods

Participants

These data were originally collected as part of a larger study examining interpretation biases associated with depressive symptoms (Wisco & Nolen-Hoeksema, 2011).³ There were 110 participants in this study, including 59 (53.6%) nondysphoric individuals and 51 (46.4%) dysphoric individuals. Participants' ages ranged from 18 to 30, with a mean age of 21.9 (SD = 3.5); 43 (39.1%) participants were male and 67 (60.9%) were female. Fifty-three (48.2%) participants identified their race/ethnicity as Caucasian, 25 (22.7%) as Asian, 18 (16.4%) as African American, 9 (8.2%) as Hispanic, 4 (3.6%) as "Other," and one participant (0.9%) declined to provide information about race/ethnicity.

Measures

The measures of rumination (Ruminative Responses Scale; RRS) and dysphoria status (Beck Depression Inventory-II; BDI-II) were identical to those used in Study 1. The nondysphoric and dysphoric groups were again classified by the cut-off scores of less than nine or greater than or equal to 16, respectively.

Interpretation Bias Imagery (IBI).

The Interpretation Bias Imagery (IBI) measure is a modified version of the IBQ (Wisco & Nolen-Hoeksema, 2010a). In this version of the measure, participants listen to digital audio recordings describing eight hypothetical ambiguous situations (e.g., seeing a friend walking down the street, waving to this friend, and seeing that the friend does not respond). Participants are asked to visualize each of the situations as it is being described, write down all interpretations for the situation that come to mind (generation), and then circle the one viewed as the most likely explanation for that situation (selection). Coders unaware of participants' dysphoria status rated the positivity and negativity of each interpretation on 5 point Likert scales. Like the IBQ, negativity ratings were subtracted from positivity ratings to create valence ratings with higher numbers reflecting more positive interpretations and mean valence ratings are used to create indices of interpretation generation and selection bias. The coders demonstrated adequate inter-rater agreement ($\kappa_s = .80$; Wisco & Nolen-Hoeksema, 2011) and discrepancies were resolved by consensus.

Responses to Positive Affect (RPA).

We measured dampening of positive emotion using the dampening subscale of the Responses to Positive Affect (RPA) scale (Feldman et al., 2008). The RPA is a self-report measure that assesses how individuals respond to positive emotion on a 1 ("almost never respond in this way") to 4 ("almost always respond in this way") scale. The RPA has three factor-derived subscales, including emotion- and self-focused positive rumination and dampening. In the current study, we only included the 8-item dampening subscale, which assesses ways individuals diminish positive emotion (e.g., "Think about things that could go wrong"). Dampening has been associated with depressive symptoms in clinical and non-clinical samples (Feldman et al., 2008; Johnson et al., 2008) and good internal consistency was obtained for dampening in the current sample (Cronbach's $\alpha = .83$).

Procedure

Participants were recruited using the same recruitment and prescreening procedure described in Study 1. All participants met individually with the experimenter to complete the study protocol. Participants provided informed

³ In the original study (Wisco & Nolen-Hoeksema, 2011), participants were randomly assigned to imagine themselves in hypothetical, ambiguous situations from one of two visual perspectives, either an immersed condition in which they viewed the situation from their own perspective, or a distanced condition in which they viewed themselves from the perspective of an outside observer. Condition was not related to the valence of interpretations generated or selected (Wisco & Nolen-Hoeksema, 2011), or to rumination, dampening, or dysphoria status, $p_s \geq .20$, so we collapsed across condition for these analyses. One participant from the larger study neglected to complete one self-report questionnaire and could not be included.

consent, listened to the audiorecording of the Interpretation Bias Imagery instructions, and completed a practice IBI item. The experimenter used the same standardized prompts described in Study 1 to ensure that participants understood the instructions. Participants then listened to the eight IBI audio recordings using headsets connected to a computer, wrote down their interpretations immediately following each recording, and then completed all other study measures including the questionnaires described above and demographics questions. Participants were compensated with a payment of 15 US dollars or research participation credit.

Data Analytic Plan

We planned multiple mediational models for this study, using the approach described in Study 1. We entered interpretation bias as the independent variable, rumination and dampening as mediators, and dysphoria status (nondysphoric or dysphoric) as the dependent variable. We again planned separate models for the two indices of interpretation bias (generation and selection). We planned separate reverse mediational analyses examining interpretation biases as mediators of the association between rumination and dysphoria status and of the association between dampening and dysphoria status. We examined each potential mediator (interpretation generation bias or selection bias) in separate models.

Results

Dysphoric participants' BDI-II scores ranged from 16 to 45, with a mean of 24.7 (SD = 7.3), in the moderately depressed range (Beck et al., 1996). Nondysphoric participants reported scores ranging from zero to nine, with a mean of 3.2 (SD = 2.8). The two proposed mediators, rumination and dampening, were correlated at $r = 0.40$, $p < .001$. Correlations between the two types of interpretation bias and rumination and dampening are presented in Table 1.

Mediational Models

Interpretation Generation Bias.

Results of mediation analyses are presented in Figure 2. The valence of interpretations generated was significantly associated with dysphoria status ($Z = -2.89$, $p = .004$) and with the two proposed mediators, rumination, ($t = -4.80$, $p < .001$) and dampening ($t = -2.38$, $p = .02$; see Figure 2a). Both rumination ($Z = 4.61$, $p < .001$) and dampening ($Z = 2.19$, $p = .03$) were related to dysphoria status after controlling for interpretation bias. The association between interpretation generation bias and dysphoria status was no longer significant after controlling for rumination and dampening ($Z = -0.54$, $p = .59$), and the overall indirect effect through both mediators was significant ($ab = -1.87$, 95% CI [-3.21, -0.96]). Significant indirect effects emerged through both rumination ($a_1b_1 = -1.59$, 95% CI [-2.81, -0.78]) and dampening ($a_2b_2 = -0.283$, 95% CI [-0.80, -0.02]), and the indirect effect through rumination was significantly greater than the indirect effect through dampening (contrast $ab = -1.31$, 95% CI [-2.58, -0.42]).

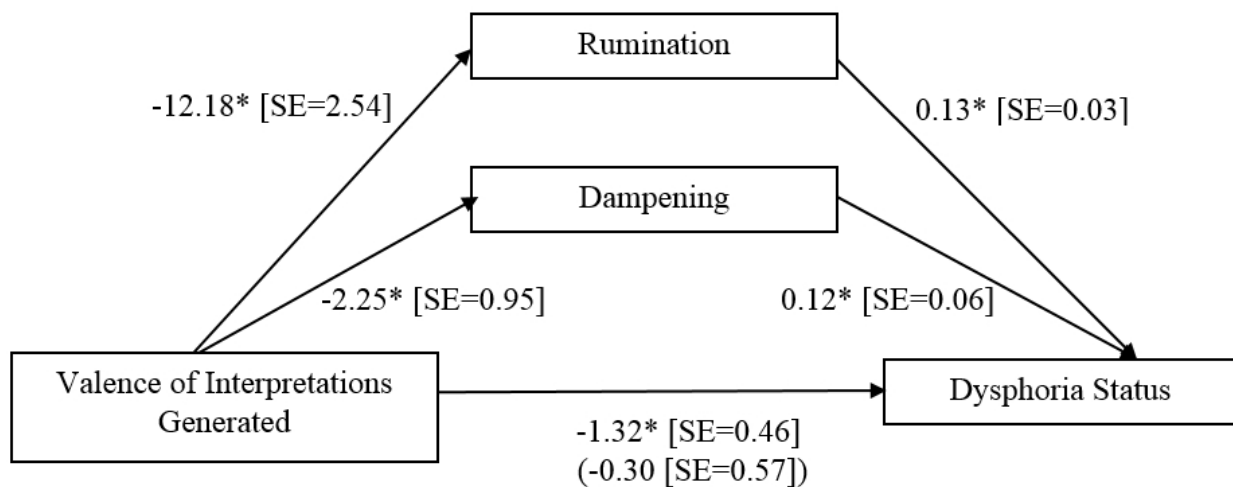
Interpretation Selection Bias.

The valence of interpretations selected was significantly associated with dysphoria status ($Z = -4.10$, $p < .001$) and with two of the proposed mediators, rumination ($t = -5.68$, $p < .001$) and dampening ($t = -2.48$, $p = .01$). Both rumination ($Z = 4.13$, $p < .001$) and dampening ($Z = 2.18$, $p = .03$) were significantly associated with dysphoria status after controlling for interpretation selection bias. The effect of interpretation selection bias on dysphoria status was marginally significant after controlling for both mediators ($Z = -1.85$, $p = .06$), and the overall indirect effect of both mediators was significant ($ab = -1.17$, 95% CI [-2.03, -0.60]). The indirect effects through rumination ($a_1b_1 = -0.99$, 95% CI [-1.74, -0.48]) and dampening ($a_2b_2 = -0.18$, 95% CI [-0.53, -0.006]) were each significant, and the indirect effect through rumination was significantly greater than the indirect effect through dampening (contrast $ab = -0.81$, 95% CI [-1.58, -0.25]).

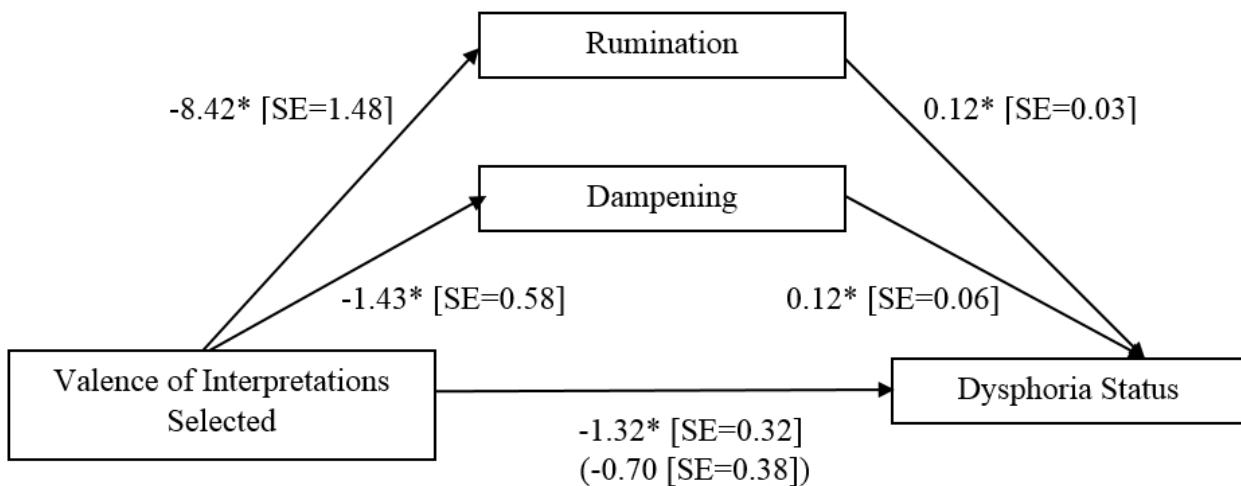
Reverse Mediation Models

Neither of the reverse mediational models indicated an indirect effect of rumination on dysphoria status through interpretation bias. Rumination was significantly associated with dysphoria status ($B = 0.15$, $SE = 0.03$, $Z = 5.27$, $p < .001$) and with interpretation generation ($B = -0.01$, $t = -4.80$, $p < .001$) and selection bias ($B = -0.03$, $SE = 0.005$, $t = -5.68$, $p < .001$). After statistically controlling for rumination, interpretation generation bias was not significantly associated with dysphoria status ($B = -0.38$, $SE = 0.56$, $Z = -0.68$, $p = 0.50$), but interpretation selection bias was marginally associated with dysphoria status ($B = -0.70$, $SE = 0.36$, $Z = -1.93$, $p = .05$). The association between rumination and dysphoria status was still significant after controlling for interpretation generation ($B = 0.14$, $SE = 0.03$, $Z = 5.02$, $p < .001$) and selection ($B = 0.13$, $SE = 0.03$, $Z = 4.60$, $p < .001$). The indirect effects of rumination on dysphoria status through interpretation generation ($ab = 0.006$, 95% CI $[-0.01, 0.03]$) or selection ($ab = 0.02$, 95% CI $[-.0002, .04]$) were not significant.

a. Mediation Model for Interpretation Generation



b. Mediation Model for Interpretation Selection



Note. $*p < .05$. Unstandardized coefficients are presented with standard errors in brackets. The total effect is given for the path from interpretation valence to dysphoria status, with the direct effect controlling for the mediators given in parentheses. The measure of interpretation valence is scored such that higher numbers reflect more positive interpretations.

Figure 2: Rumination and Dampening as Mechanisms Linking Interpretation Biases to Depressive Symptoms (Study 2).

The reverse mediational models for dampening, however, did indicate an indirect effect of dampening through interpretation bias on dysphoria status. Dampening was significantly associated with dysphoria status ($B = 0.19$, $SE = 0.05$, $Z = 4.04$, $p < .001$) and with valence of interpretations generated ($B = -0.02$, $SE = 0.009$, $t = -2.38$, $p = .02$) and selected ($B = -0.04$, $SE = 0.02$, $t = -2.48$, $p = .01$). Interpretation generation ($B = -1.05$, $SE = 0.47$, $Z = -2.21$, $p = .03$) and selection ($B = -1.24$, $SE = 0.34$, $Z = -3.60$, $p < .001$) biases were significantly associated with dysphoria status after controlling for dampening. The association between dampening and dysphoria status was still significant after controlling for interpretation generation ($B = 0.17$, $SE = 0.05$, $Z = 3.65$, $p < .001$) and selection ($B = 0.17$, $SE = 0.05$, $Z = 3.47$, $p < .001$). The indirect effects of dampening on dysphoria status through interpretation generation bias ($ab = 0.02$, 95% CI [0.002, 0.07]), and through interpretation selection bias ($ab = 0.05$, 95% CI [0.008, 0.12]), were both statistically significant.

Discussion

In this study, two emotion regulation strategies involving negative reflection on one's current emotional state mediated the association between negative interpretation biases and depressive symptoms. Specifically, a tendency to interpret situations negatively was associated with greater use of both rumination and dampening, and the two regulatory processes together accounted for the association between interpretation biases and depressive symptoms. The specific indirect effects indicated that rumination and dampening each independently explained some of the association between interpretation biases and dysphoria status. This replicates Study 1's findings on rumination and builds upon previous research suggesting that dampening positive emotion is an independent emotion regulation strategy that contributes to depressive symptoms above and beyond ruminating on negative moods (Raes et al., 2012).

Additionally, a significant contrast effect emerged such that the indirect effect of interpretation bias through rumination was stronger than the indirect effect through dampening. This contrast indicates that rumination accounts for more of the association between interpretation biases and depressive symptoms than dampening does. This finding is consistent with prior research indicating that, in comparison to other forms of self-focused attention, rumination is more strongly associated with depression (Hughes, Alloy, & Cogswell, 2008; Mor & Winquist, 2002). The relative size of the indirect effects through rumination and dampening may also be due to the nature of the interpretation bias task. Because the interpretations were mostly negative, one would expect more negative affect than positive affect to be associated with making interpretations. Indeed, participants reported an increase in negative mood while completing this interpretation bias task (Wisco & Nolen-Hoeksema, 2011). Therefore, the indirect effect of interpretation biases would be expected to be stronger through regulatory processes focused on negative emotion (rumination) than processes focused on positive emotion (dampening).

The reverse mediational models offered further evidence for rumination as a mechanism linking interpretation biases to depressive symptoms as there was no evidence for an indirect effect of rumination on dysphoria status through interpretation biases. Similar to Study 1, these findings are consistent with a theoretical model in which negatively valenced cognitions provide a prompting command for the regulatory process of rumination, which then increases risk for depression. However, the reverse mediational models did support an indirect effect of dampening on dysphoria status through interpretation biases. Therefore, the direction of effects between interpretation biases and dampening is unclear. Given that the process of dampening is a devaluing or dismissing of positive emotion via negative reflection, this process may lead to dismissing of positive interpretations, such that dampening leads to more negatively biased interpretations. It may be that interpretation biases and dampening have reciprocal effects on each other, such that habitually interpreting situations negatively leads to dampening in the rare instances that positive affect occurs, and dampening one's initial affective response to an ambiguous situation influences one's interpretation of that situation. Future research, particularly longitudinal research, is warranted to better understand the association between negatively biased interpretations and dampening in response to positive affect.

Studies 1 and 2 offer evidence that rumination mediates the association between interpretation biases and depressive symptoms. However, it is unclear whether these effects are specific to interpretation biases, or might extend to other cognitive biases that are known risk factors for depression. This possibility is considered in a third study.

Study 3

The purpose of Study 3 was two-fold: 1) to examine whether rumination is a mechanism linking another type of cognitive bias, negative memory bias, to depressive symptoms, and 2) whether the mediating effect is specific to rumination or extends to another self-focused emotion regulatory process, namely, worry. Like interpretation biases, negative biases in autobiographical memory are consistently associated with depression (Wisco, 2009). When asked to recall autobiographical memories in response to single-word cues, depressed individuals describe more negative memories than nondepressed individuals (Fogarty & Hemsley, 1983; Lyubomirsky, Caldwell, & Nolen-Hoeksema, 1998; Watson, Berntsen, Kuyken, & Watkins, 2012; Wisco & Nolen-Hoeksema, 2010b). Sad autobiographical memories are retrieved with less difficulty than happy memories among depressed, but not nondepressed individuals (Rottenberg, Hildner, & Gotlib, 2006), indicating heightened accessibility of negative memories. Intrusive or involuntary and spontaneous autobiographical memories of negative events are common among depressed individuals (Brewin, Reynolds, & Tata, 1999; Patel et al., 2007) and depressive symptoms are associated with higher levels of intrusions, more negative reactions to intrusive memories, and greater intrusion-related distress (Kuyken & Brewin, 1994; Starr & Moulds, 2006; Watson et al., 2012; Williams & Moulds, 2007).

If negatively biased content encourages ruminative processing as we propose, a biased tendency to recall more negative autobiographical memories might be expected to lead to rumination on those negative events and increase risk for depression. Prior work has shown that asking dysphoric individuals to ruminate, rather than distract themselves, following description of an intrusive memory leads to greater levels of intrusion-related distress and more negative views of the memory, offering support for the notion that ruminating in response to negative memories is maladaptive (Williams & Moulds, 2010). In the current study, we propose that rumination may explain the well-established association between negative memory biases and depression.

The second aim of this study was to examine whether rumination is a specific mechanism linking negative autobiographical memory bias to depressive symptoms, and whether another self-focused form of emotion regulation, worry, would exhibit a similar effect. Worry is defined as a “chain of thoughts and images, negatively affect-laden and relatively uncontrollable; it represents an attempt to engage in mental problem-solving on an issue whose outcome is uncertain but contains the possibility of one or more negative outcomes” (Borkovec, Robinson, Pruzinsky, & Depree, 1983, p. 10). Worry and rumination have overlapping features: both are forms of self-focused repetitive thought that are considered relatively maladaptive (Nolen-Hoeksema et al., 2008; Watkins, 2008). Negatively biased memories might be expected to fuel not only ruminative processing, but other kinds of repetitive thinking focused on self-relevant negative content, such as worry. Although worry is a defining characteristic of generalized anxiety disorder (American Psychiatric Association, 2013), more recent research has indicated that worry is also related to depression (e.g., Starcevic, 1995; Zimmerman & Chelminski, 2003). Because rumination and worry are independently associated with depressive symptoms (Hughes et al., 2008; Muris, Roelofs, Rassin, Franken, & Mayer, 2005), the two types of repetitive thought together might account for more of the association between cognitive bias and depressive symptoms than either process alone. In this study, we examined the specific and combined indirect effects of memory bias on depressive symptoms through rumination and worry.

Method

Participants

These data were collected as part of a larger study examining valence of autobiographical memories associated with depressive symptoms (Wisco & Nolen-Hoeksema, 2010b). Eighty-one participants were included in these analyses, including 40 (49.4%) dysphoric participants and 41 (50.6%) nondysphoric participants. Participants' ages ranged from 18 to 57, with a mean age of 23.30 (SD = 7.11). Thirty (37.0%) men and 51 (63.0%) women participated in this study; 74 (91.4%) participants identified their ethnicity as non-Hispanic, three (3.7%) identified their ethnicity as Hispanic, and four (4.9%) participants did not answer the question about ethnicity. Forty-seven (58%) participants identified their race as White, 16 (19.8%) as Asian, nine (11.1%) as multiracial, six (7.4%) as Black, and three (3.7%) did not provide information about race.

Measures

The RRS and BDI-II were again used as our measures of rumination and depressive symptoms, with the same cut-off criteria used to determine dysphoric and nondysphoric status.

Penn State Worry Questionnaire (PSWQ).

The PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990) served as our measure of worry. The PSWQ is a 16-item self-report questionnaire of the tendency to worry. Each item is rated on a 5-point Likert-type scale (from “not at all typical of me” to “very typical of me”). The PSWQ has demonstrated convergent and divergent validity and possesses strong psychometric qualities, including good internal consistency and test-retest reliability (Meyer et al., 1990). In this study, the PSWQ had excellent internal consistency (Cronbach’s $\alpha = .94$).

Autobiographical Memory Valence.

In our test of autobiographical memory valence, the experimenter read a script with instructions for participants to recall and describe out loud autobiographical memories in response to single word cues. Eighteen cues developed in prior research (Jones et al., 1999) were provided by the experimenter in a standardized order. In order to encourage a variety of memories, equal numbers of positive, neutral, and negative cues were provided. Participants’ responses were recorded on a digital audiorecorder for later coding. The negativity of the autobiographical memories were rated by coders unaware of the dysphoria status of the participants, on a Likert-type scale from 1 (“not at all”) to 7 (“extremely”). The coders demonstrated adequate inter-rater reliability ($r = .84$, $p < .001$; Wisco & Nolen-Hoeksema, 2010b). Coder discrepancies of one point were averaged together and discrepancies of more than one point were resolved by consensus. Because the results of the prior study indicated that dysphoric participants recalled more negative memories than nondysphoric participants in response to all three cue types (positive, neutral, or negative), and no cue type by dysphoria status interaction emerged (Wisco & Nolen-Hoeksema, 2010b), we collapsed across cue type.

Procedure

Potential participants were recruited using the same recruitment and prescreening procedures described in Studies 1 and 2. All participants met individually with the experimenter. After providing informed consent, participants completed the questionnaires including the BDI-II, RRS, PSWQ and demographics questions and then completed the autobiographical memory measure. Participants were compensated for their time with either a payment of 20 US dollars or research participation credit.

Data Analytic Plan

We planned a multiple mediational model using the approach described in Studies 1 and 2. We entered memory negativity as the independent variable, rumination and worry as mediators, and dysphoria status (nondysphoric or dysphoric) as the dependent variable. We planned two separate reverse mediational analyses examining memory negativity as a mediator of the association between rumination and dysphoria status and of the association between worry and dysphoria status.

Results

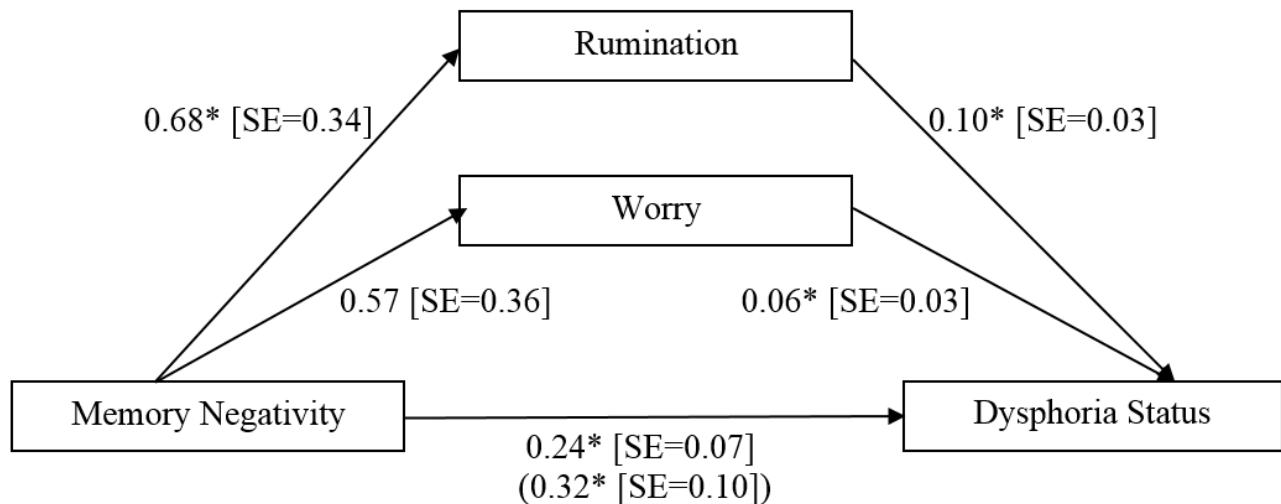
Dysphoric participants’ BDI-II scores ranged from 16 to 38, with a mean of 23.6 ($SD = 6.3$), in the moderately depressed range. Nondysphoric participants’ scores ranged from 0 to 9, with a mean of 2.5 ($SD = 2.3$). Rumination and worry were significantly correlated at $r = .54$, $p < .001$. Correlations between memory negativity and rumination and worry are presented in Table 1.

Mediational Model

Memory negativity was associated with dysphoria status ($Z = 3.61$, $p < .001$) and rumination ($t = 2.02$, $p = .047$; see Figure 3). Memory negativity was not significantly associated with worry ($t = 1.58$, $p = .12$). Both rumination ($Z =$

3.37, $p < .001$) and worry ($Z = 2.13$, $p = .03$) were significantly associated with dysphoria status, controlling for memory negativity. The association between memory negativity and dysphoria status remained significant after controlling for both mediators ($Z = 3.24$, $p = .001$), and neither the overall indirect effect of the model ($ab = 0.10$, 95% CI [-0.003, 0.25]) nor the specific indirect effect through worry were significant ($a_2b_2 = 0.03$, 95% CI [-0.01, 0.13]). However, the specific indirect effect through rumination was significant ($a_1b_1 = 0.07$, 95% CI [0.006, 0.18]).

To determine whether the null finding for an indirect effect through worry could be accounted for by collinearity between worry and rumination, we also ran a simple mediational model with worry entered as the sole mediator. The indirect effect of memory negativity on dysphoria status through worry was not significant ($ab = 0.04$, 95% CI [-0.02, 0.13]).



Note. * $p < .05$. Unstandardized coefficients are presented with standard errors in brackets. Memory negativity is scored such that higher numbers reflect more negative memories. The total effect is given for the path from memory negativity to dysphoria status, with the direct effect controlling for the mediators given in parentheses.

Figure 3: Rumination and Worry as Mechanisms Linking Memory Biases to Depressive Symptoms (Study 3).

Reverse Mediational Model

Rumination was significantly associated with dysphoria status ($B = 0.11$, $SE = 0.03$, $Z = 4.262$, $p < .001$) and with memory bias ($B = .07$, $SE = 0.04$, $t = 2.02$, $p = .047$). The effect of memory negativity on dysphoria status was significant after controlling for rumination ($B = 0.27$, $SE = 0.09$, $Z = 3.14$, $p = .002$). The association between rumination and dysphoria status remained significant after controlling for the mediating effect of memory negativity ($B = 0.12$, $SE = 0.03$, $Z = 3.94$, $p < .001$). The indirect effect of rumination on dysphoria status through memory negativity was significant ($ab = 0.02$, 95% CI [.001, .05]).

In contrast, no indirect effect emerged of worry on dysphoria status through memory negativity. Worry was significantly associated with dysphoria status ($B = 0.07$, $SE = 0.02$, $Z = 3.53$, $p < .001$), but was not significantly associated with memory negativity ($B = 0.05$, $SE = 0.03$, $t = 1.58$, $p = .12$). The indirect effect of worry through memory negativity was also not significant ($ab = .02$, 95% CI [-0.006, 0.05]).

Discussion

Rumination mediated the association between autobiographical memory bias and depressive symptoms, thus extending the findings of the first two studies from biases in interpretation to another type of cognition. This finding indicates that rumination explains, at least partially, the association between negatively biased autobiographical memories and depressive symptoms. However, the reverse mediational model also provided evidence for an indirect effect of rumination on depressive symptoms through memory bias, rendering the direction of effects unclear. The reverse mediational model offers support for a theoretical model in which a tendency to ruminate

leads to negatively biased memory, which leads to depressive symptoms. Consistent with the reverse direction of effects, experimentally inducing rumination leads to more negative autobiographical memories ([Lyubomirsky et al., 1998](#)) and enhanced memory for negative, self-referent words ([Moulds, Kandris, & Williams, 2007](#)). Therefore, the direction of mediation is more ambiguous for memory biases than for interpretation biases.

In contrast to the findings for rumination, there was no indirect effect of memory bias on dysphoria status through worry. Consistent with prior research ([Fresco, Frankel, Mennin, Turk, & Heimberg, 2002](#); [Hughes et al., 2008](#); [Muris et al., 2005](#); [Segerstrom, Tsao, Alden, & Craske, 2000](#)), worry was significantly associated with dysphoria status, but it was not associated with memory bias. The finding that memory biases were associated with rumination but not worry is consistent with a literature indicating that explicit and autobiographical memory biases are more strongly associated with depression than with anxiety ([Dalgleish & Watts, 1990](#); [Morgan, 2010](#); [Rinck & Becker, 2005](#); [Williams, Watts, MacLeod, & Mathews, 1997](#); [Wisco, 2009](#)). Although rumination and worry are each related to both depression and anxiety, the content of ruminative thought (loss and self-worth) is more relevant to depression, whereas the content of worry (potential threat) is more closely related to anxiety ([Nolen-Hoeksema et al., 2008](#)). Therefore, as suggested here, autobiographical memory biases in dysphoric individuals might be more likely to encourage rumination on depression-relevant content than worry about anxiety-relevant concerns. The time-orientation of rumination (past-focused) versus worry (future-oriented) is another important consideration ([Alloy, Kelly, Mineka, & Clements, 1990](#); [McLaughlin, Borkovec, & Sibrava, 2007](#); [Mineka, Watson, & Clark, 1998](#); [Nolen-Hoeksema et al., 2008](#); [Watkins, Moulds, & Mackintosh, 2005](#)). Selective recall of negative memories may be more likely to encourage rumination about the past rather than worry about the future. Future research contrasting memory biases with biases in future-oriented thought (e.g., pessimistic predictions about the likelihood of future life events) could examine this possibility.

Overall Discussion

The current studies demonstrated that rumination mediates the association between negative interpretation and memory biases and depressive symptoms. This finding was consistent across three different samples and two types of cognitive biases. The mediating role of rumination held even when controlling for other emotion regulatory processes (dampening and worry). Of the three possible mediators examined, we found the strongest evidence for rumination as a mechanism linking negative cognitive biases to depressive symptoms. The current studies are the first to examine rumination as a mechanism while measuring cognitive biases with objectively and independently coded interpretations and memories, as opposed to more attitude-based self-report measures. Our findings support theoretical perspectives that emphasize rumination as a process that exacerbates negative content to lead to depressive symptoms ([Ciesla & Roberts, 2007](#); [Selby, Anestis, & Joiner, 2008](#)).

We found no evidence to support the reverse models that interpretation bias explains the association between rumination and depression (Studies 1 & 2). Thus, our findings are consistent with a theoretical model in which negative interpretations first provide the fuel that triggers the process of rumination, which then leads to depressive symptoms. Interestingly, we did find evidence for the reverse model that memory bias explains the association between rumination and depressive symptoms (Study 3). Therefore, the direction of mediation is less clear for memory than for interpretation biases. Rumination on the past may be more likely to encourage negative autobiographical memories than negative interpretations of present or hypothetical events. Specifically, because a tendency to ruminate on the past involves rehearsal of past negative events, those negative memories may become more accessible. Indeed, memory and rumination may be cyclically intertwined, such that ruminating filters memories to be more negative and these negative memories lead to more ruminative thinking, ultimately leading to depression (see [Ciesla & Roberts, 2007](#)). Future longitudinal and experimental research is indicated to examine the directional effects of memory biases and rumination on depressive symptoms.

Although weaker than the indirect effect through rumination, the process of dampening positive affect also partially explained the association between negative interpretation biases and depressive symptoms. This effect was significant even when statistically controlling for rumination, indicating that dampening offers additional explanatory power when examining mechanisms between interpretation biases and depressive symptoms. However, the reverse model was also significant, such that negative interpretation biases mediated the relationship between dampening and depressive symptoms, rendering the direction of mediation unclear. Given the increasing evidence

for the importance of dampening and dysregulation of positive emotion in the onset of depressive symptoms (e.g., [Carl et al., 2013](#); [Gilbert, Nolen-Hoeksema, & Gruber, 2013](#); [Raes et al., 2012](#)), it is imperative to gain a better understanding of how dampening interacts with other factors to increase risk for depression.

Finally, worry did not explain the association between memory biases and depressive symptoms, demonstrating the specificity of rumination as a mechanism of this association. Although worry is also characteristic of depression ([Fresco et al., 2002](#); [Hughes et al., 2008](#); [Muris et al., 2005](#); [Segerstrom et al., 2000](#)), the past-focused quality of memory may be less likely to activate worry about the future. Increasingly, emotion regulation research has focused on contextual features when examining whether particular strategies increase risk for psychopathology ([Aldao, 2013](#); [Marroquín, Fontes, Scilletta, & Miranda, 2010](#)). Our findings indicate that the specific cognitive content fueling different emotion regulatory efforts may be an important contextual feature to consider.

Findings from the current studies highlight the pervasiveness of rumination as a process to target in cognitive treatments. In addition to challenging the content of negative cognitions, reducing rumination on that content may be an important aim of treatment. Treatments targeting rumination have already been developed, including Rumination-Focused Cognitive Behavioral Therapy (RFCBT; [Watkins et al., 2007](#)) and mindfulness-based treatment approaches (e.g., [Teasdale et al., 2000](#)). RFCBT helps individuals identify ruminative tendencies and in turn develop more effective strategies ([Watkins et al., 2007](#)). Mindfulness techniques provide tools to help individuals become more aware of and less judgmental of thoughts and ruminations ([Teasdale et al., 2000](#)). Both of these techniques target the *process* of ruminating (rather than the negative content itself) as a way to attenuate depressive symptoms. By targeting rumination, these treatments may break the link between negatively biased thinking and depression. At the same time, our findings suggest that countering cognitive biases may aid in interrupting rumination.

Our dampening findings also highlight the importance of targeting processes that depressed individuals use to regulate positive emotion in treatment. Recent work has demonstrated the benefits of savoring positive emotion on decreasing depressive symptoms ([McMakin, Siegle, & Shirk, 2010](#)). Increasing the use of savoring (as compared with dampening) may be beneficial for depressed individuals prone to negative thinking. Lastly, our work highlights that although different forms of maladaptive cognitive processing may be characteristic of depression, it is important to take note of contextual issues, such as the type of cognitive content being processed, when targeting emotion regulation in treatment. Although depression is associated with rumination, dampening, and worry, each individual regulatory process might be employed in response to different external contexts and internal cues (e.g., memories). Knowing when each strategy is most commonly employed, and most directly associated with clinical symptoms, will help to inform targeted treatment for depression.

Limitations of the current studies should be noted. First, all three studies were cross-sectional and thus the direction of the mediation effects should be interpreted with caution. Future research would benefit from longitudinal or experimental designs to confirm findings on interpretation biases and rumination and to tease apart the bidirectional effects of interpretation biases on dampening and memory biases on rumination. Future research would also benefit from contrasting the mediational models tested here with other theoretical models of the interrelationships between cognitive biases, rumination, and depression. Other theorists have proposed that rumination may moderate, rather than mediate, the association between cognitive biases and depression (e.g., [Ciesla & Roberts, 2007](#)). Experimental and longitudinal work, then, can help examine whether cognitive biases confer vulnerability because they interact with ruminative processing, because they actually engender such processing, or both.

Second, we utilized measures of interpretation and memory biases which required participants to report their cognitions. These kinds of measures can be influenced by response biases and self-presentation concerns. Participants' responses were scored by independent coders unaware of dysphoria status, offering a more objective measure of negativity than participant ratings. However, future research would benefit from inclusion of performance-based measures of interpretation and memory biases and corresponding physiological indices of reactivity. Third, we did not experimentally manipulate interpretation or memory bias, and did not examine the effects of negatively biased interpretations or memories on state levels of rumination, dampening, or worry. Examining whether negatively biased interpretations and memories lead to immediate increases in rumination

would offer important corroborating evidence for the proposed theoretical model. Finally, our determination of dysphoria status was based on a self-report measure of depressive symptoms rather than a structured clinical interview. Although participants in the dysphoric group reported symptoms in the moderate severity range, the extent to which these findings generalize to clinically depressed individuals is unclear.

Taken together, these findings support the theory that rumination is an important mechanism of the association between negatively biased cognition and depressive symptoms. Moreover, rumination appears to have a stronger influence on this relationship than dampening or worry—two other emotion regulatory processes implicated in depression. These findings suggest that rumination may be a particularly important process to target in treatment, and that reducing rumination has the potential to break the link between negatively biased thinking and depression. The current studies add to a rapidly growing literature on rumination that was originated by Susan Nolen-Hoeksema, our mentor. Her scientific and personal legacy will influence the field's understanding of depressive cognition, inform clinical practice, and inspire novel research for years to come.

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References

- Aldao, A. (2013). The future of emotion regulation research: Capturing context. *Perspectives on Psychological Science*, 8(2), 155-172. <http://dx.doi.org/10.1177/1745691612459518>
- Alloy, L. B., Kelly, K. A., Mineka, S., & Clements, C. M. (1990). Comorbidity of anxiety and depressive disorders: A helplessness-hopelessness perspective. In J. D. Maser & C. R. Cloninger (Eds.), *Comorbidity of mood and anxiety disorders*.
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Association.
- Beck, A.T. (1967). *Depression: Clinical, experimental and theoretical aspects*. New York: Harper & Row.
- Beck, A., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory-II*. San Antonio, TX: Psychological Corporation.
- Borkovec, T. D., Robinson, E., Pruzinsky, T., & DePree, J. A. (1983). Preliminary exploration of worry: Some characteristics and processes. *Behaviour Research and Therapy*, 21(1), 9-16. [http://dx.doi.org/10.1016/0005-7967\(83\)90121-3](http://dx.doi.org/10.1016/0005-7967(83)90121-3)
- Brewin, C., Reynolds, M., & Tata, P. (1999). Autobiographical memory processes and the course of depression. *Journal of Abnormal Psychology*, 108(3), 511-517. <http://dx.doi.org/10.1037/0021-843X.108.3.511>
- Bylsma, L., Morris, B., & Rottenberg, J. (2008). A meta-analysis of emotional reactivity in major depressive disorder. *Clinical Psychology Review*, 28(4), 676-691. <http://dx.doi.org/10.1016/j.cpr.2007.10.001>
- Carl, J. R., Soskin, D. P., Kerns, C., & Barlow, D. H. (2013). Positive emotion regulation in emotional disorders: A theoretical review. *Clinical Psychology Review*, 33(3), 343-360. <http://dx.doi.org/10.1016/j.cpr.2013.01.003>

- Ciesla, J. A., & Roberts, J. E. (2007). Rumination, negative cognition, and their interactive effects on depressed mood. *Emotion*, 7(3), 555-565. <http://dx.doi.org/10.1037/1528-3542.7.3.555>
- Dalgleish, T. & Watts, F. N. (1990). Biases of attention and memory in disorders of anxiety and depression. *Clinical Psychology Review*, 10(5), 589-604. [http://dx.doi.org/10.1016/0272-7358\(90\)90098-U](http://dx.doi.org/10.1016/0272-7358(90)90098-U)
- Davis, R.N., & Nolen-Hoeksema, S. (2000). Cognitive inflexibility among ruminators and nonruminators. *Cognitive Therapy & Research*, 24, 699–711. <http://dx.doi.org/10.1023/A:1005591412406>
- Feldman, G. C., Joormann, J., & Johnson, S. L. (2008). Responses to positive affect: A self-report measure of rumination and dampening. *Cognitive Therapy and Research*, 32(4), 507-525. <http://dx.doi.org/10.1007/s10608-006-9083-0>
- Fogarty, S. J., & Hemsley, D. R. (1983). Depression and the accessibility of memories: A longitudinal study. *The British Journal of Psychiatry*, 142(3), 232-237. <http://dx.doi.org/10.1192/bjp.142.3.232>
- Fresco, D., Frankel, A., Mennin, D., Turk, C., & Heimberg, R. (2002). Distinct and overlapping features of rumination and worry: The relationship of cognitive production to negative affective states. *Cognitive Therapy and Research*, 26(2), 179-188. <http://dx.doi.org/10.1023/A:1014517718949>
- Giesler, R. B., Josephs, R. A., & Swann, W. B. (1996). Self-verification in clinical depression: The desire for negative evaluation. *Journal of Abnormal Psychology*, 105(3), 358-368. <http://dx.doi.org/10.1037/0021-843X.105.3.358>
- Gilbert, K. E., Nolen-Hoeksema, S., & Gruber, J. (2013). Positive emotion dysregulation across mood disorders: How amplifying versus dampening predicts emotional reactivity and illness course. *Behavior Research and Therapy*, 51(11), 736-741. <http://dx.doi.org/10.1016/j.brat.2013.08.004>
- Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology*, 6(1), 285-312. <http://dx.doi.org/10.1146/annurev.clinpsy.121208.131305>
- Gotlib, I. H., Krasnoperova, E., Yue, D. N., & Joormann, J. (2004). Attentional biases for negative interpersonal stimuli in clinical depression. *Journal of Abnormal Psychology*, 113(1), 127-135. doi: 10.1037/0021-843X.113.1.127
- Hertel, P. T., & Gerstle, M. (2003). Depressive deficits in forgetting. *Psychological Science*, 14(6), 573-578. <http://dx.doi.org/10.1046/j.0956-7976.2003.psci.1467.x>
- Hughes, M. E., Alloy, L. B., & Cogswell, A. (2008). Repetitive thought in psychopathology: The relation of rumination and worry to depression and anxiety symptoms. *Journal of Cognitive Psychotherapy*, 22(3), 271-288. <http://dx.doi.org/10.1891/0889-8391.22.3.271>
- Johnson, S. L., McKenzie, G., & McMurrich, S. (2008). Ruminative responses to negative and positive affect among students diagnosed with bipolar disorder and major depressive disorder. *Cognitive Therapy and Research*, 32(5), 702-713. <http://dx.doi.org/10.1007/s10608-007-9158-6>
- Joiner, T.E., Jr. (2002). Depression in its interpersonal context. In I.H.Gotlib & C.L. Hammen (Eds.), *Handbook of depression* (pp. 295–313). New York: Guilford Press.
- Jones, B., Heard, H., Startup, M., Swales, M., Williams, J. M. G., & Jones, R. S. P. (1999). Autobiographical memory and dissociation in borderline personality disorder. *Psychological Medicine*, 29(6), 1397–1404. <http://dx.doi.org/10.1017/S0033291799001208>
- Kuyken, W., & Brewin, C. R. (1994). Intrusive memories of childhood abuse during depressive episodes. *Behaviour Research and Therapy*, 32(5), 525-528. [http://dx.doi.org/10.1016/0005-7967\(94\)90140-6](http://dx.doi.org/10.1016/0005-7967(94)90140-6)
- Lawson, C., MacLeod, C., & Hammond, G. (2002). Interpretation revealed in the blink of an eye: Depressive bias in the resolution of ambiguity. *Journal of Abnormal Psychology*, 111(2), 321-328. <http://dx.doi.org/10.1037/0021-843X.111.2.321>
- Lo, C. S. L., Ho, S. M. Y., & Hollon, S. D. (2008). The effects of rumination and negative cognitive styles on depression: A mediation analysis. *Behaviour Research and Therapy*, 46(4), 487-495. <http://dx.doi.org/10.1016/j.brat.2008.01.013>
- Lyubomirsky, S., Caldwell, N.D., & Nolen-Hoeksema, S. (1998). Effects of ruminative and distracting responses to depressed mood on retrieval of autobiographical memories. *Journal of Personality and Social Psychology*, 75(1), 166–177. <http://dx.doi.org/10.1037/0022-3514.75.1.166>
- Lyubomirsky, S., Tucker, K. L., Caldwell, N., D., & Berg, K. (1999). Why ruminators are poor problem solvers: Clues from the phenomenology of dysphoric rumination. *Journal of Personality and Social Psychology*, 77(5), 1041-1060. <http://dx.doi.org/10.1037/0022-3514.77.5.1041>

- MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods*, 7(1), 83-104. <http://dx.doi.org/10.1037/1082-989X.7.1.83>
- Marroquín, B. M., Fontes, M., Scilletta, A., & Miranda, R. (2010). Ruminative subtypes and coping responses: Active and passive pathways to depressive symptoms. *Cognition & Emotion*, 24(8), 1446-1455. <http://dx.doi.org/10.1080/02699930903510212>
- Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology*, 1(1), 167-195. <http://dx.doi.org/10.1146/annurev.clinpsy.1.102803.143916>
- McLaughlin, K. A., Borkovec, T. D., & Sibrava, N. J. (2007). The effects of worry and rumination on affect states and cognitive activity. *Behavior Therapy*, 38(1), 23-38. <http://dx.doi.org/10.1016/j.beth.2006.03.003>
- McMakin, D. L., Siegle, G. J., & Shirk, S. R. (2010). Positive affect stimulation and sustainment (PASS) module for depressed mood: A preliminary investigation of treatment-related effects. *Cognitive Therapy and Research*, 35(3), 217-226. <http://dx.doi.org/10.1007/s10608-010-9311-5>
- Meyer, T. J., Miller, M. L., Metzger, R. L., & Borkovec, T. D. (1990). Development and validation of the Penn State Worry Questionnaire. *Behaviour Research and Therapy*, 28(6), 487-495. [http://dx.doi.org/10.1016/0005-7967\(90\)90135-6](http://dx.doi.org/10.1016/0005-7967(90)90135-6)
- Mineka, S., Watson, D., & Clark, L. A. (1998). Comorbidity of anxiety and unipolar mood disorders. *Annual Review of Psychology*, 49(1), 377-412. <http://dx.doi.org/10.1146/annurev.psych.49.1.377>
- Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, 128(4), 638-662. <http://dx.doi.org/10.1037/0033-2909.128.4.638>
- Morgan, J. (2010). Autobiographical memory biases in social anxiety. *Clinical Psychology Review*, 30(3), 288-297. <http://dx.doi.org/10.1016/j.cpr.2009.12.003>
- Moulds, M. L., Kandris, E., & Williams, A. D. (2007). The impact of rumination on memory for self-referent material. *Memory*, 15(8), 814-821. <http://dx.doi.org/10.1080/09658210701725831>
- Muris, P., Roelofs, J., Rassin, E., Franken, I., & Mayer, B. (2005). Mediating effects of rumination and worry on the links between neuroticism, anxiety and depression. *Personality and Individual Differences*, 39(6), 1105-1111. <http://dx.doi.org/10.1016/j.paid.2005.04.005>
- Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, 100(4), 569-582. <http://dx.doi.org/10.1037/0021-843X.100.4.569>
- Nolen-Hoeksema, S., & Davis, C. G. (1999). "Thanks for sharing that": Ruminators and their social support networks. *Journal of Personality and Social Psychology*, 77(4), 801-814. <http://dx.doi.org/10.1037/0022-3514.77.4.801>
- Nolen-Hoeksema, S., Larson, J. T., & Grayson, C. (1999). Explaining the gender difference in depressive symptoms. *Journal of Personality and Social Psychology*, 77(5), 1061-1072. <http://dx.doi.org/10.1037/0022-3514.77.5.1061>
- Nolen-Hoeksema, S., & Morrow, J. (1991). A prospective study of depression and distress following a natural disaster: The 1989 Loma Prieta earthquake. *Journal of Personality and Social Psychology*, 61(1), 105-121. <http://dx.doi.org/10.1037/0022-3514.61.1.115>
- Nolen-Hoeksema, S., Wisco, B., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science*, 3(5), 400-424. <http://dx.doi.org/10.1111/j.1745-6924.2008.00088.x>
- Patel, R., Brewin, C. R., Wheatley, J., Wells, A., Fisher, P., & Myers, S. (2007). Intrusive images and memories in major depression. *Behaviour Research and Therapy*, 45(11), 2573-2580. <http://dx.doi.org/10.1016/j.brat.2007.06.004>
- Papageorgiou, C., & Wells, A. (2003). An empirical test of a clinical metacognitive model of rumination and depression. *Cognitive Therapy and Research*, 27(3), 261-273. <http://dx.doi.org/10.1023/A:1023962332399>
- Preacher, K., & Hayes, A. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40(3), 879-891. <http://dx.doi.org/10.3758/BRM.40.3.879>
- Pyszczynski, T., Holt, K., & Greenberg, J. (1987). Depression, self-focused attention, and expectancies for positive and negative future life events for self and others. *Journal of Personality and Social Psychology*, 52, 994-1001. <http://dx.doi.org/10.1037/0022-3514.52.5.994>

- Raes, F., Smets, J., Nelis, S., & Schoofs, H. (2012). Dampening of positive affect prospectively predicts depressive symptoms in non-clinical samples. *Cognition & Emotion*, 26(1), 75-82. <http://dx.doi.org/10.1080/02699931.2011.555474>
- Rinck, M., & Becker, E. S. (2005). A comparison of attentional biases and memory biases in women with social phobia and major depression. *Journal of Abnormal Psychology*, 114(1), 62-74. <http://dx.doi.org/10.1037/0021-843X.114.1.62>
- Roberts, J.E., Gilboa, E., & Gotlib, I.H. (1998). Ruminative response style and vulnerability to episodes of dysphoria: Gender, neuroticism, and episode duration. *Cognitive Therapy and Research*, 22(4), 401-423. <http://dx.doi.org/10.1023/A:1018713313894>
- Rottenberg, J., Hildner, J., & Gotlib, I.H. (2006). Idiographic autobiographical memories in major depressive disorder. *Cognition & Emotion*, 20(1), 114-128. <http://dx.doi.org/10.1080/02699930500286299>
- Segerstrom, S., Tsao, J. I., Alden, L., & Craske, M. (2000). Worry and rumination: Repetitive thought as a concomitant and predictor of negative mood. *Cognitive Therapy and Research*, 24(6), 671-688. <http://dx.doi.org/10.1023/A:1005587311498>
- Selby, E. A., Anestis, M. D., & Joiner, T. E. (2008). Understanding the relationship between emotional and behavioral dysregulation: Emotional cascades. *Behaviour Research and Therapy*, 46(5), 593-611. <http://dx.doi.org/10.1016/j.brat.2008.02.002>
- Spasojevic, J., & Alloy, L. B. (2001). Rumination as a common mechanism relating depressive risk factors to depression. *Emotion*, 1(1), 25-37. <http://dx.doi.org/10.1037//1528-3542.1.1.25>
- Starcevic, V. (1995). Pathological worry in major depression: A preliminary report. *Behaviour Research and Therapy*, 33(1), 55-56. [http://dx.doi.org/10.1016/0005-7967\(93\)E0028-4](http://dx.doi.org/10.1016/0005-7967(93)E0028-4)
- Starr, S., & Moulds, M. L. (2006). The role of negative interpretations of intrusive memories in depression. *Journal of Affective Disorders*, 93(1-3), 125-132. <http://dx.doi.org/10.1016/j.jad.2006.03.001>
- Swann, W.B., Jr. (1990). To be known or to be adored: The interplay of self-enhancement and self-verification. In E.T. Higgins & R.M. Sorrentino (Eds.), *Handbook of motivation and cognition* (Vol. 2, 408-444). New York: Guilford Press.
- Swann, W. B., Griffin, J. J. J., Predmore, S. C., & Gaines, B. (1987). The cognitive-affective crossfire: When self-consistency confronts self-enhancement. *Journal of Personality and Social Psychology*, 52(5), 881-889. <http://dx.doi.org/10.1037/0022-3514.52.5.881>
- Swann, W. B., & Read, S. J. (1981). Self-verification processes: How we sustain our self-conceptions. *Journal of Experimental Social Psychology*, 17(4), 351-372. [http://dx.doi.org/10.1016/0022-1031\(81\)90043-3](http://dx.doi.org/10.1016/0022-1031(81)90043-3)
- Swann, W. B., Wenzlaff, R. M., Douglas, K. S., & Pelham, B. W. (1992). Allure of negative feedback: Self-verification strivings among depressed persons. *Journal of Abnormal Psychology*, 101(2), 293-306. <http://dx.doi.org/10.1037/0021-843X.101.2.293>
- Swann Jr, W. B., Wenzlaff, R. M., & Tafarodi, R. (1992). Depression and the search for negative evaluations: More evidence of the role of self-verification strivings. *Journal of Abnormal Psychology*, 101(2), 314-317. <http://dx.doi.org/10.1037/0021-843X.101.2.314>
- Teasdale, J. D., Segal, Z. V., Williams, J. M. G., Ridgeway, V. A., Soulsby, J. M., & Lau, M. A. (2000). Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *Journal of Consulting and Clinical Psychology*, 68(4), 615-623. <http://dx.doi.org/10.1037/0022-006X.68.4.615>
- Watkins, E. R. (2008). Constructive and unconstructive repetitive thought. *Psychological Bulletin*, 134(2), 163-206. <http://dx.doi.org/10.1037/0033-2909.134.2.163>
- Watkins, E. R., Scott, J., Wingrove, J., Rimes, K., Bathurst, N., Steiner, H., . . . Malliaris, Y. (2007). Rumination-focused cognitive behaviour therapy for residual depression: A case series. *Behaviour Research and Therapy*, 45(9), 2144-2154. <http://dx.doi.org/10.1016/j.brat.2006.09.018>
- Watkins, E. R., Moulds, M., & Mackintosh, B. (2005). Comparisons between rumination and worry in a non-clinical population. *Behaviour Research and Therapy*, 43(12), 1577-1585. <http://dx.doi.org/10.1016/j.brat.2004.11.008>
- Watson, L. A., Berntsen, D., Kuyken, W., & Watkins, E. R. (2012). The characteristics of involuntary and voluntary autobiographical memories in depressed and never depressed individuals. *Consciousness and Cognition*, 21(3), 1382-1392. <http://dx.doi.org/10.1016/j.concog.2012.06.016>
- Williams, J. M., Watts, F. N., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and emotional disorder*. Chichester, England: Wiley.

- Williams, A. D., & Moulds, M. L. (2007). Cognitive avoidance of intrusive memories: Recall vantage perspective and associations with depression. *Behaviour Research and Therapy*, 45(6), 1141-1153.
<http://dx.doi.org/10.1016/j.brat.2006.09.005>
- Williams, A. D., & Moulds, M. L. (2010). The impact of ruminative processing on the experience of self-referent intrusive memories in dysphoria. *Behavior Therapy*, 41(1), 38-45. <http://dx.doi.org/10.1016/j.beth.2008.12.003>
- Wisco, B. E. (2009). Depressive cognition: Self-reference and depth of processing. *Clinical Psychology Review*, 29(4), 382-392. <http://dx.doi.org/10.1016/j.cpr.2009.03.003>
- Wisco, B. E., & Nolen-Hoeksema, S. (2010a). Interpretation bias and depressive symptoms: The role of self-relevance. *Behaviour Research and Therapy*, 48(11), 1113-1122. <http://dx.doi.org/10.1016/j.brat.2010.08.004>
- Wisco, B. E., & Nolen-Hoeksema, S. (2010b). Valence of autobiographical memories: The role of mood, cognitive reappraisal, and suppression. *Behaviour Research and Therapy*, 48(4), 335-340.
<http://dx.doi.org/10.1016/j.brat.2009.11.009>
- Wisco, B. E., & Nolen-Hoeksema, S. (2011). Effect of visual perspective on memory and interpretation in dysphoria. *Behaviour Research and Therapy*, 49(6–7), 406-412. <http://dx.doi.org/10.1016/j.brat.2011.03.012>
- Zimmerman, M. & Chelminski, I. (2003). Generalized anxiety disorder in patients with major depression: Is DSM-IV's hierarchy correct? *American Journal of Psychiatry*, 160(3), 504-512.
<http://dx.doi.org/10.1176/appi.ajp.160.3.504>