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Testing the cognitive catalyst model of depression: Does rumination amplify the impact of cognitive diatheses in response to stress?

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Recent studies have found that rumination functions as a catalyst of cognitive vulnerability to depression. Specifically, these studies have reported synergistic effects between rumination and negative cognitive content (beliefs and attitudes), such that rumination amplifies the association between negative cognitive content and depression (Ciesla & Roberts, 2002, 2007; Robinson & Alloy, 2003). The current study extended this work by testing whether cognitive vulnerability involving the combination of negative cognitive content and rumination increases the impact of stress on the course of depressive symptoms. One hundred ninety-one college students with elevated depressive symptoms participated in a two-wave longitudinal study. Results indicate that the maintenance of depressive symptoms was predicted by the three-way interaction of negative cognitive content, rumination, and stressful life events. More specifically, students who endorsed both maladaptive cognitive content and a tendency to ruminate were particularly vulnerable to the deleterious impact of life stress.

Keywords: Depression; Rumination; Negative cognition; Stress.

Multiple cognitive-behavioural theories have been proposed in an attempt to explain the onset, maintenance, and recurrence of depression. For example, Beck (1967) posited that negative and rigid beliefs about the self, world, and future confer vulnerability to disorder. Abramson, Seligman, and Teasdale (1978) suggested that the tendency to attribute stressful events to internal, stable, and global causes leads to depression. In contrast, the response styles theory (Nolen-Hoeksema, 1991) focused less on the *content* of thought, and more on maladaptive *processes*. Specifically, rumination, or the tendency to dwell on feelings of sadness as well as their causes and implications, was proposed to exacerbate and maintain dysphoria, ultimately leading to the onset of a depressive episode. In the most general sense, ruminative thought involves passive, repetitive, or even obsessive thinking, but is not restricted to or defined by any specific content. Despite the differences among these theories, each involves a diathesis that exacerbates the negative effects of life stress.

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Recent evidence suggests that rumination works together with negative cognitive content in creating risk for depression (Ciesla & Roberts, 2002, 2007; Robinson & Alloy, 2003). These investigations found that the effects of rumination were stronger among individuals who reported high levels of negative cognitive content (and vice versa). We have previously likened rumination to a catalyst in the relation between negative beliefs and depression, which have reciprocal effects on each other (Ciesla & Roberts, 2007). Thus, the power of negative beliefs to influence depression is increased by rumination on such beliefs. Further, the degree to which depression may in turn reinforce and exacerbate such negative beliefs is also increased as an individual ruminates. We refer to this as the "cognitive catalyst model of depressive vulnerability". The model posits that negative cognitive content is depressogenic when it is persistently kept in mind through rumination, but has little impact on depression in the absence of rumination. Likewise, the model posits that ruminative thinking is depressogenic in the context of pre-existing negative cognitive content, but is benign without these negative beliefs.

When faced with life stressors, there are individual differences in coping. Some individuals respond with active problem solving, distraction using pleasant activities, or with avoidance via substance use, whereas others engage in rumination. Although the central thesis of the response styles theory suggests that this kind of repetitive thought worsens dysphoria, repetitive focus on an event or its emotional consequences is not universally maladaptive (see Watkins, 2008, for a review), and can even be quite adaptive. Clearly, some moderator is influencing whether focus on stressors is beneficial or harmful.

Why is it that some individuals can ruminate without experiencing negative outcomes, but other individuals cycle into depression? The cognitive catalyst model proposes that the answer concerns maladaptive beliefs relevant to depression. Consider an individual with high self-esteem, who makes self-protective attributions for stressors, and sees the world positively and optimistically. Inevitably, such a person will experience stress, rumination, and sadness. However, given their positive attributions and beliefs about themselves, ruminating may even bring to mind their feelings of self-efficacy and thoughts that the current situation is only temporary. In contrast, consider an individual who has low self-esteem, a tendency toward negative attributions, and pessimistic thoughts about the future. This person will also experience stress, sadness, and rumination. Yet, when this individual ruminates, pre-existing negative schemas will be brought to mind and continually activated. Consistent with multiple perspectives on how cognition influences depression (e.g., Teasdale, 1988), activation of these negative beliefs further deepens feelings of sadness and distress, leading to depression. Not only would rumination activate and amplify negative cognitive content, but such negative beliefs would make it much harder to disengage from maladaptive rumination. We do not propose that rumination causes negative beliefs or that core negative beliefs cause rumination. In fact, we propose that an individual can be ruminative in the general sense (i.e., being very reflective, prone to reanalysing events, and emotionally focused) without holding negative beliefs. Similarly, one may hold many negative beliefs, but tend not to ruminate on them.

In earlier work (Ciesla & Roberts, 2002), we examined rumination, negative cognitions, and their interaction as predictors of outcome in cognitive-behavioural treatment for depression. Pre-treatment rumination interacted with two measures of negative content to predict change in depressive symptoms. Among individuals reporting high levels of negative content, rumination was associated with greater depression at the end of treatment. In contrast, among individuals reporting low levels of negative content, rumination was associated with less symptomatology. Further evidence for an interaction between rumination and negative content was reported by Robinson and Alloy (2003). In this study, 148 college students were followed for two and a half years. Participants were recruited on the basis of their levels of dysfunctional attitudes and negative attributional styles.

Individuals in the most dysfunctional quartile on both constructs made up a "high-risk" group and those in the last dysfunctional quartiles made up a "low-risk" group. Rumination was measured with the commonly used Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991), and a measure of "stress-reactive rumination", or the tendency to ruminate in response to stressful life events. Their results revealed significant risk status × rumination interactions in predicting episodes of depression. Rumination had a greater impact among individuals in the high-cognitive-risk group compared to the low-risk group.

We recently investigated the relationship between rumination and negative cognition in two laboratory studies (Ciesla & Roberts, 2007). In the first, participants were randomly assigned to either a rumination or distraction task following a sad mood induction. Analyses revealed that rumination had a stronger effect on dysphoric affect among participants who reported lower self-esteem and higher dysfunctional attitudes prior to the experimental tasks. In the second study trait rumination was measured prior to a mood induction followed by a no-task period. Thus, participants were provided the opportunity to ruminate naturally with the expectation that trait ruminators would be more likely to spontaneously ruminate during this period. Results indicated that rumination was more strongly predictive of changes in dysphoric affect across the no-task period among individuals with lower self-esteem and greater dysfunctional attitudes.

Although the results of four previous studies have provided support for the cognitive catalyst model, additional questions remain. Importantly, the role of life stress has yet to be investigated. As previously noted, a diathesis–stress relationship has been posited for both rumination (Nolen-Hoeksema & Morrow, 1991) and negative cognitive content (Clark , Beck, & Alford, 1999). Thus, if the Rumination × Negative cognition interaction is itself a form of cognitive vulnerability, a three-way interaction would be anticipated: Stress × Rumination × Negative cognitive content. In addition, we sought to investigate the influence of different forms of rumination (see Watkins, 2008). In particular, an important distinction has been made between brooding versus reflective pondering (Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Brooding is a type of rumination that is gloomy or moody, and appears to be a stronger predictor of depression than reflective pondering. Reflective pondering is more neutral, contemplative, or introspective. Research on the influence of reflective pondering has been mixed in terms of whether it is adaptive, neutral, or maladaptive.

The present study was designed with the goal of creating a prospective parallel to the laboratory studies we previously conducted (Ciesla & Roberts, 2007). In those investigations, we examined the interactive effects of rumination and negative cognition on the maintenance of sad affect following a sad mood induction. We sought to extend this work by examining these interactive influences on depressive symptoms in reaction to stressful life events among dysphoric individuals. A dysphoric sample was utilised for two reasons. First, this provided a naturalistic equivalent to our experiments that utilised induced dysphoria (Ciesla & Roberts, 2007) and clinical depression (Ciesla & Roberts, 2002). Second, laboratory (e.g., Nolen-Hoeksema & Morrow, 1993) and field (e.g., Moberly & Watkins, 2008; Nolan, Roberts, & Gotlib, 1998) research has suggested that rumination has a larger influence in the context of dysphoric affect. Given that our prior research suggested that rumination amplifies the effects of negative beliefs, which in turn amplify the effects of life stress, the resulting model becomes complex. Specifically, the cognitive catalyst model posits a Cognitive Content × Rumination × Life Stress interaction, such that individuals with high levels of rumination and negative cognitive content would be vulnerable to experience depression in the face of life stress. We further hypothesised that these interactive effects would be present in the case of the brooding form of rumination, and examined reflective pondering on an exploratory basis.

METHOD

Participants

Participants were 191 individuals (106 females) recruited from introductory psychology courses at a large state university. Participants were screened using the BDI. In order to qualify for this study, students had to: (a) score a 10 or greater on the BDI, and (b) indicate the presence of at least one symptom related to the presence of sadness or anhedonia.[1] The mean age of the sample was 20.5 ($SD = 4.9$). The majority of participants were Caucasian (57%), followed by Asian (19%) and the remainder identified themselves as African American, Hispanic, Native American, or other.

Measures

Beck Depression Inventory – II (BDI; Beck, Steer, & Brown, 1996). The BDI was used to assess depressive symptoms. Participants respond to 21 items concerning different symptoms of depression on a 4-point scale. This widely used measure has been shown in prior research to have excellent internal consistency and test–retest reliability.

Response Styles Questionnaire (RSQ; Nolen-Hoeksema & Morrow, 1991). The 22-item rumination scale of the RSQ was used to measure aspects of depressive rumination. Participants report how often they engage in differing responses to depressed mood on a 4-point scale. Following the factor-analytic work of Treynor and colleagues (2003), we formed brooding (Brood) and reflective pondering (Ponder) subscales. Coefficient alpha for the Brood scale was .77 and for the Ponder scale was .67.

Dysfunctional Attitudes Scale (DAS; Weissman & Beck, 1978). The DAS is a 40-item scale that assesses rigid and perfectionistic beliefs thought to represent a vulnerability to depression (e.g., "People will probably think less of me if I make a mistake"; "I cannot be happy unless most people I know admire me"). Coefficient alpha in this study was .90.

Attributional Style Questionnaire (ASQ; Peterson et al., 1982). The ASQ asks about explanations for six hypothetical events. Individuals report the likelihood that the hypothetical events were caused by the self (internal), would have lasting negative consequences (stable), and would have negative implications for other domains of life (global). Scores on each subscale were summed to create a composite with higher scores reflecting a negative attributional style. Coefficient alpha in this study was .65.

Rosenberg Self-Esteem Questionnaire (RSE; Rosenberg, 1979). The RSE is a 10-item scale that taps participants' global self-worth. Agreement on 10 statements about their general self-concept is indicated using a 7-point scale (e.g., "On the whole, I am satisfied with myself"). Coefficient alpha in this study was .92.

Life Experiences Survey (LES; Sarason, Johnson, & Siegel, 1978). The LES was used to assess the occurrence of 59 stressful life events between study baseline and follow-up. The instructions for this instrument were modified to ask participants to report events that occurred during the past six weeks in order to provide coverage for the full study interval. This survey asks respondents to indicate whether or not an event occurred, and also to rate how positive or negative the event was. To minimise the potential for confounds with other study variables, the count of events but not severity ratings were summed.

Procedure

Individuals who met the study criteria were contacted and brought into the laboratory to complete questionnaires at Time 1 and were scheduled for a Time 2 appointment six weeks later. Of these, 149 (83 female) returned at Time 2 to complete these same questionnaires again.

[1] Specifically, the items from the BDI used to indicate the presence of sadness or anhedonia were items 1 (sadness), 4 (loss of pleasure), 10 (crying), and 12 (loss of interest).

Participants received course credit for their participation.

RESULTS

Preliminary analyses were conducted to examine if any demographic variables were significantly associated with the study variables. Age and ethnicity were not significantly associated with any of the measures. However, women had higher brooding scores, $t(185) = 2.33$, $p < .05$, and showed a marginal trend toward higher Time 1 BDI scores, $t(186) = 1.90$, $p = .058$. Importantly, individuals lost to attrition did not differ from those who completed the study on any variable.

Overall, the mean BDI score decreased from 19.6 ($SD = 11.1$) at Time 1 to 16.0 ($SD = 10.2$) at Time 2, $t(144) = 5.00$, $p < .001$. This change was anticipated given that depression is commonly episodic and some level of regression to the mean should be expected for a sample selected on the basis of having elevated BDI scores. Partial correlation was used to explore possible main effects of the study variables in predicting Time 2 BDI scores controlling for Time 1 BDI. Greater brooding ($pr = .19$, $p < .05$), dysfunctional attitudes ($pr = .26$, $p < .01$), negative attributional style ($pr = .28$, $p < .01$), and life events ($pr = .26$, $p < .05$) were associated with higher depressive symptoms at Time 2, whereas greater self-esteem was associated with lower depressive symptoms ($pr = -.43$, $p < .001$). In contrast, reflective pondering was not a significant predictor ($pr = .03$, $p = .75$).

Multiple regression was used to test the hypothesis that the interaction between rumination, negative cognitive content, and life stress would predict changes in BDI scores from Time 1 to Time 2. In each of the following regression models, Time 2 BDI was the dependent variable. At Step 1 of these models, Time 1 BDI was entered as a covariate. Step 2 then added one measure of rumination, one of negative cognitive content, and the LES. Step 3 then added the three two-way interaction terms. Finally, Step 4 added the three-way interaction between Rumination × Negative cognitive content × Life stress. When a significant three-way interaction was detected, we conducted simple slope tests examining the slope between stress and depression for combinations of individuals high versus low in rumination crossed with individuals high versus low in negative cognitive content. This asks whether individuals with these combinations of vulnerability are at risk for continued depression in the face of stress. Due to the large number of these simple slopes, we adopted a conservative standard ($p < .01$) for considering these results significant.

Separate models for each of the three measures of content (self-esteem, dysfunctional attitudes, attributional style) were run to test the Brood ing × Stressful life events × Cognitive content triple interaction in prospectively predicting change in depressive symptoms. As seen in Table 1, the RSE × Brood × LES interaction was statistically significant ($\beta = -.713$, $pr = -.25$, $p < .01$). Simple slope analyses showed that among individuals with high Brood and low RSE scores, the relation between stress and depression was highly significant ($\beta = .415$, $pr = .35$, $p < .001$), whereas none of the other three combinations of vulnerability were associated with a significant relation between stress and depression ($ps > .02$). In contrast to self-esteem, the triple interactions involving dysfunctional attitudes ($\beta = .368$, $pr = .15$, $p = .08$) and attributional style[2] ($\beta = .371$, $pr = .15$, $p = .07$) were not statistically significant.

Separate models for each of the three measures of content (self-esteem, dysfunctional attitudes, attributional style) were run to test the Reflection × Stressful life events × Cognitive content triple interaction in prospectively predicting change in depressive symptoms. As seen in Table 2, the triple interaction was not statistically significant in the case of either self-esteem ($\beta = -.494$, $pr = -.17$, $p = .05$) or

[2] Though not presented, we explored the three marginally significant interactions from Tables 1 and 2, and in each of these, the same general form of the interaction was observed throughout the study.

Table 1. *Interactions of negative cognition and brooding predicting Time 2 BDI*

	Dysfunctional attitudes			*Attributional style*			*Self-esteem*		
Predictor	β	*t*	$R^2\Delta$	β	*t*	$R^2\Delta$	β	*t*	$R^2\Delta$
Step 1			.54***			.53***			.58***
T1 BDI	0.47	6.45***		0.50	6.97***		0.35	4.69***	
Brood	0.10	1.43		0.10	1.34		0.03	0.49	
Cognition	0.19	2.77**		0.17	2.66**		−0.39	5.22***	
LES	0.21	3.40**		0.20	3.12**		0.21	3.52**	
Step 2			.02			.00			.01
Brood × Cognition	−0.01	−0.09		0.02	0.28		−0.02	−0.29	
Cognition × LES	0.52	2.14*		0.05	0.18		−0.51	−1.80†	
LES × Brood	−0.29	−1.49		−0.22	−0.95		−0.30	1.47	
Step 3			.01†			.01†			.03**
Brood × Cognition × LES	0.37	1.77†		0.37	1.81†		−0.71	−3.05**	

Notes: †$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$. BDI = Beck Depression Inventory; Brood = Brooding Rumination; LES = Life Events Survey; Cognition = type of cognitive content noted in the header.

dysfunctional attitudes (β = .320, $pr = .10$, $p = .24$), the ASQ × Ponder × LES interaction was statistically significant (β = .550, $pr = .20$, $p < .05$). Simple slope analyses revealed a significant positive relation between stress and depression for individuals who scored high on both the ASQ and Ponder (β = .249, $pr = .24$, $p < .01$). Individuals reporting the other combinations of these vulnerabilities did not evidence a relation between stress and depression (*p*s > .05).

DISCUSSION

The current study investigated the diathesis–stress aspect of the cognitive catalyst model, in the context of predicting the maintenance of depression. While

Table 2. *Interactions of negative cognition and ponder predicting Time 2 BDI*

	Dysfunctional attitudes			*Attributional style*			*Self-esteem*		
Predictor	β	*t*	$R^2\Delta$	β	*t*	$R^2\Delta$	β	*t*	$R^2\Delta$
Step 1			.53***			.52***			.59***
T1 BDI	0.51	7.58***		0.55	8.34***		.036	4.98***	
Ponder	−0.03	−0.52		−0.05	−0.75		−0.02	−0.42	
Cognition	−0.22	3.37**		0.20	3.26**		−0.40	5.80***	
LES	0.21	3.35**		0.19	3.06**		0.20	3.48**	
Step 2			.01			.00			.01
Ponder × Cognition	−0.02	−0.39		0.03	0.41		0.04	0.60	
Cognition × LES	0.41	1.73†		−0.10	−0.41		−0.33	−1.27	
LES × Ponder	0.02	0.11		0.05	0.21		0.09	0.45	
Step 3			.01			02*			.01†
Ponder × Cognition × LES	0.32	1.18		0.55	2.32*		−0.49	−1.95†	

Notes: †$p < .10$; *$p < .05$; **$p < .01$; ***$p < .001$. BDI = Beck Depression Inventory; Ponder = Reflective Pondering; LES = Life Events Survey; Cognition = type of cognitive content noted in the header.

results indicated that the main effect of life stress during the six-week prospective interval was associated with higher depressive symptoms at Time 2 after controlling for Time 1 depression, the impact of stress varied depending on levels of rumination and negative cognitive content. Specifically, the effects of life stress were strongest for individuals who either had the combination of low self-esteem and high brooding or the combination of a more negative attributional style and high reflective pondering. These results suggest that rumination increases the sensitivity to life stress among dysphoric individuals who either have low self-esteem or who tend to attribute negative events to stable and global causes. It appears that this interactive effect of rumination and negative beliefs is robust, being observed in the laboratory (Ciesla & Roberts, 2007), having naturalistic and longitudinal effects (Robinson & Alloy, 2003), and even impacting the course of treatment (Ciesla & Roberts, 2002).

This investigation was the first to examine the cognitive catalyst model in terms of different types of ruminative thought. Both reflective pondering and brooding demonstrated interactions with stress and negative content. In contrast to some prior research, reflective pondering was predictive of higher levels of depression over time. Although pondering did not demonstrate a significant direct association with depression, it interacted with stress and negative attributional style. These findings may help explain prior mixed findings on the relative (mal)adaptive effects of reflective pondering. It is possible that these samples differed significantly from each other on levels of stress and/or negative cognitive content.

Earlier work suggested that interactions with rumination are contingent on the type of cognitive content. In three studies (Ciesla & Roberts, 2002, 2007), interactions involving self-esteem and dysfunctional attitudes consistently were significant, whereas those involving attributional style were not. The results of this study were slightly different from our prior research. Evidence for moderation was observed with self-esteem (though effects with dysfunctional attitudes were only marginally significant), similar to our prior findings. However, in this study, attributional style also interacted with the reflective pondering form of rumination. We note that Robinson and Alloy (2003) found evidence for a risk status × rumination interaction, wherein risk status was assessed as a combination of dysfunctional attitudes and attributional style. Unfortunately it is impossible to know whether their findings were predominately driven by attributions or dysfunctional attitudes. Yet with the results of the present study, these findings suggest that attributional style may also interact with a form of rumination involving reflection.

The present investigation suggests that rumination influences the duration of depression. In contrast, Nolen-Hoeksema, Wisco, and Lyubomirsky's (2008) review found mixed support for the hypothesis that rumination predicts the duration of MDEs. They speculated that rumination may simply have less influence on duration of depression, they also suggested that the mixed support may be an artefact resulting from restricted ranges on study variables. Fortunately, the present sample had as much variance on study variables as an unselected sample of undergraduates from the same university (Ciesla & Roberts, 2007) and so the present study did not suffer from this problem.

There are a number of important directions for future research. First, future investigations would benefit from the use of methods of assessment beyond self-reports. Information-processing tasks may be useful in the assessment of cognitive schemas, while physiological measures such as pupil dilation and vagal tone are being explored as potential indices of cognitive processes of rumination and emotion dysregulation. We also note that the present investigation utilised the Attributional Style Questionnaire (Peterson et al., 1982) rather than the more reliable Cognitive Style Questionnaire (see Haeffel et al., 2008). Second, with respect to the assessment of life stress, the present study utilised a count of the number of reported life events rather than subjective severity ratings. Although the latter are potentially confounded with cognitive diatheses and depression, we acknowledge that most diathesis–stress models

are concerned with stress *severity* and thus our approach is conservative. Future research would benefit from contextual assessments of life stress using interviews to provide an objective index of stressor severity. Finally, participants were followed for six weeks and investigations with longer follow-up intervals are warranted. Although other investigations have successfully supported cognitive models of depression over similar intervals (e.g., Abela, Parkinson, Stolow, & Starrs, 2009; Nolan et al., 1998), shorter follow-up intervals could result in less within-subject change in depression, reducing statistical power. However, two recent findings suggest that relatively brief follow-up intervals may be optimal. Prior research found a mean depressive episode duration of 2–3 weeks in university students (Iacoviello, Alloy, Abramson, Whitehouse, & Hogan, 2006). Further, Morris, Ciesla, and Garber (2010) empirically tested the effect of different time lags and found that the prediction of depression from stress was strongest using a two-week interval.

This study extends earlier investigations of the cognitive catalyst model by providing evidence that the combination of rumination and negative cognitive content is associated with persistent depressive symptoms when individuals are faced with life stress. Studies are needed to test whether the cognitive catalyst model performs well in the prediction of new onsets depression, while others are needed to contrast the cognitive catalyst model with alternative models of rumination and negative cognition (e.g., Spasojevic & Alloy, 2001).

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