

Integrating Affective and Cognitive Vulnerabilities to Depression: Examining Individual Differences in Cognitive Responses to Induced Stress

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Abstract Cognitive style and rumination are established cognitive vulnerabilities to depression; however, less is known about how these vulnerabilities develop. One hypothesis is that more negative affective responses to stressful events generate depressogenic cognitive responses. We hypothesized that trait negative emotionality (NE-trait) would predict greater state negative emotionality (NE-state) following a laboratory stressor, which would in turn be associated with more depressogenic cognitive responses (i.e. negative event-specific cognitive style and event-specific rumination). In a college sample ($N = 87$, Mean age = 20.58), we found that NE-state mediated the NE-trait—depressogenic cognitive response relationship. Results provide further support for the integration of affective and cognitive vulnerabilities to depression, providing insight into the processes by which cognitive vulnerabilities may develop.

Keywords Cognitive style · Rumination · Negative emotionality · Depression · Stress

Introduction

Depression is a major public health problem among adolescents and young adults, with 20% of individuals experiencing a clinically significant depressive episode by age 21 (Kessler et al. 1993). One of the most empirically supported etiological models of depression is the cognitive vulnerability-stress model, which states that certain

cognitive responses to stressful events, such as making negative cognitive inferences for and ruminatively focusing on the event, put individuals at increased risk for experiencing depressive symptoms (Abramson et al. 1989; Nolen-Hoeksema 1991). Although extensive evidence has indicated that both cognitive factors—negative cognitive style and rumination—confer vulnerability to depression among adolescents and adults, little is known about the processes by which such depressogenic cognitive responses to stressful events are generated.

Recent models of depression have attempted to integrate affective and cognitive vulnerabilities, maintaining that certain affective features may contribute to the initial development and subsequent maintenance of cognitive vulnerabilities over time (Hyde et al. 2008). The trait temperamental feature of Negative Emotionality (NE-trait) may be one contributor to the generation of depressogenic cognitive responses to stressful events. Individuals high in NE-trait may have a lower threshold for identifying negative events as subjectively distressing, and may experience more intense and prolonged negative affect in response to such events. NE-trait subsequently increases attention to negative events, the negative aspects of oneself, and negative expectancies for the future (Derryberry and Reed 1994; Pyszczynski et al. 1987). These conditions may pave the way for depressogenic cognitive responses, or the proximal, event-specific reactions that result immediately following a stressful event or task which, over time, are expected to crystallize into trait cognitive vulnerabilities. While several studies have examined concurrent and prospective relationships between NE-trait and trait cognitive vulnerabilities, few have examined the proximal links between NE-trait, event-specific affective responses, and event-specific cognitive responding. The purpose of this study is to examine whether trait NE-trait predicts greater

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State Negative Emotionality (NE-state) to induced stress, which in turn predicts more negative cognitive style for and rumination about the stressful event in an induced stressor paradigm.

Cognitive Vulnerabilities to Depression

Cognitive vulnerability-stress models of depression identify negative cognitive style and rumination as two salient trait cognitive vulnerabilities to depression. The hopelessness theory of depression (Abramson et al. 1989) defines negative cognitive style as negative inferences about causes, consequences, and self-characteristics of stressful events, and hypothesizes that those who encounter stressful events and exhibit this negative cognitive style are at elevated risk for depression. Strong prospective support for negative cognitive style as a vulnerability factor for depression has been shown in adolescents and adults (e.g., Abramson et al. 1999).

A second cognitive vulnerability factor for depression is a ruminative response style. Nolen-Hoeksema's Ruminative Response Style Theory (1991) describes rumination as the "focusing on depressive symptoms and the possible causes and consequences of those symptoms" (p. 569). The focus of rumination may also be a specific stressful event, such as a breakup with a loved one or failure on an important exam. Those with a tendency to ruminate respond to stressful events and their resultant negative affect with a greater attentional focus on the stressor, their negative affect, and the causes and consequences of the situation. Prospective studies have shown that individuals who engage in ruminative responses following a stressful event are at increased risk for developing depressive disorders (Nolen-Hoeksema 2004).

Temperament

The relationship between negative cognitive style, rumination, and depression has been well studied; however, little is currently known about the process by which these two response tendencies develop. One hypothesis is that individual differences in affective responding to stress may contribute to subsequent cognitive responses. Mezulis et al. (2006) hypothesized that high NE-trait may increase negative interpretations of stressful events which, when repeated over time, may result in a crystallized negative cognitive style. Similarly, Nolen-Hoeksema (2004) hypothesized that children and young adolescents who are temperamentally prone to distress are more likely to develop a ruminative response style.

Temperament is defined as individual differences in emotional reactivity and the processes that moderate that reactivity (Rothbart and Bates 1998). One component of

temperament is NE-trait, which refers to a constellation of features including negative affect, high intensity of emotional reactions, and low adaptability; "Negative affectivity represents the extent to which a person is feeling upset or unpleasantly engaged rather than peaceful and encompasses various aversive states including *upset, angry, guilty, afraid, sad, scornful, disgusted, and worried*" (Clark and Watson 1991, p. 321). Individuals high in NE-trait dislike novel situations, become upset, fearful, sad, or tearful easily, and appear highly sensitive to negative stimuli (Buss and Plomin 1986). Evidence suggests that high NE-trait is associated with vulnerability to multiple psychopathologies, including depression (e.g., Eisenberg et al. 2005).

When individuals high in NE-trait encounter stressful events, they tend to experience high levels of immediate negative affect or NE-state. NE-state, the state correlate of NE-trait, is often referred to as "subjective distress" or simply "distress." NE-state includes such feelings as upset, fear, and shame (Watson et al. 1988). A body of literature has found that these types of state negative emotions precede and affect resulting cognitions associated with the event (e.g., Weiner 1985). It is therefore hypothesized that NE-trait conveys risk for cognitive vulnerabilities (negative cognitive style and rumination) through NE-state and resulting event-specific cognitive responses that occur when an individual encounters stress.

Temperamental Bases of Cognitive Vulnerabilities

Researchers have hypothesized that temperament may contribute to the development of cognitive vulnerabilities to depression over time (Hyde et al. 2008; Nolen-Hoeksema 2004). Mezulis et al. (2006) proposed a model of the development of cognitive vulnerability to depression in which individuals with greater NE-trait may experience greater NE-state when faced with stressful events, and subsequently make more negative interpretations of the event, as well as attend to it for a longer duration. This pattern of event-specific affective and cognitive responding may in turn produce trait negative cognitive style and rumination over time.

Concurrent and prospective relations between NE-trait and rumination have been established (Chang 2004; Mezulis et al. 2011; Verstraeten et al. 2009). Only one study, however, has examined the links between NE-trait and trait cognitive style, finding that infant NE-trait predicted more negative cognitive style at age 11 (Mezulis et al. 2006). Despite extensive literature linking NE-trait with cognitive vulnerabilities, the proximal processes linking NE-trait with event-specific affective and cognitive responses remain unexamined.

Evidence suggests that the link between NE-trait and cognitive vulnerabilities may be partially mediated by NE-state. NE-state is directly linked to depressogenic

cognitive responses to stressful events. It has been associated with greater attention to negative events (Derryberry and Reed 1994), increased negative expectancies for the future (Pyszczynski et al. 1987), and more focus on negative aspects of the self, others, and the world. Costa et al. (1996) reported that elevated NE-state was associated with increased subjective appraisal of ambiguous or novel events as stressful. In addition, NE-state leads to greater self-focus, which may result in momentary rumination (Salovey 1992). Therefore, when examining the relationships between NE-trait and cognitive vulnerabilities, NE-state is an important factor directly linked to depressogenic cognitions and a product of the NE-stress interaction.

Overall, there is prospective support for an association between NE-trait and trait cognitive vulnerabilities, yet the proximal processes involved in this association remain unexamined. We therefore examined the relationships between NE-trait, NE-state, and depressogenic cognitive responses to a specific stressful task in order to shed light on this proximal process. Our study is the first to test the relationship between NE-trait, NE-state, and event-specific cognitive responses in an induced stressor paradigm. We expect that:

1. NE-trait will be associated with trait and event-specific cognitive style and rumination.
2. NE-state will have a direct effect on both event-specific cognitive style and rumination, even when controlling for their respective trait cognitive measures.
3. NE-state will mediate the NE-trait and event-specific cognitive responses relationship.

Method

Participants

Participants were 87 undergraduates (71% female) at a small liberal arts university in the Pacific Northwest. The age of the participants ranged from 18.37 to 25.37 years ($M = 20.58$, $SD = 1.35$). The sample was predominantly Caucasian (82%), with small numbers of Asian (10%), African American (2%), Latino (3%), Native American (2%), and “Other” (1%) participants.

Instrumentation

Trait Negative Emotionality

We assessed NE-trait with the NE superscale of the Adult Temperament Questionnaire (ATQ; Evans and Rothbart 2007). NE-trait consisted of 26 items based on 4

(sub-construct) scales: Fear (e.g., I become easily frightened), Sadness (e.g., I seldom become sad when I hear of an unhappy event [reverse scored]), Discomfort (e.g., Colorful flashing lights bother me), and Frustration (e.g., I am rarely a patient person). Participants self-rated items on a 7-point, Likert scale from 1, *extremely untrue of you* to 7, *extremely true of you*.

Trait Cognitive Style

Inferential style for negative events was measured with the Cognitive Style Questionnaire (CSQ; Abramson et al. 2000). The CSQ assesses attributions for 12 negative events (6 achievement [e.g., “Do you think there is something wrong with you because you got a bad report card?”] and 6 interpersonally oriented [e.g., “Did you get in a fight with your parents because of something about you or because of something else?”]) in terms of internality, stability, and globality. Participants rated items on a 7-point Likert scale of the likely causes, consequences, and the implications of each event for oneself.

Trait Rumination

Rumination was measured with the Perseverative Attention to Negative Events (PANE; Mezulis et al. 2002). The PANE assesses rumination about achievement and interpersonal events by asking participants to imagine how they would think and feel in a given situation. An example scenario is “Image that you fail an important exam at school.” Each scenario contains five items describing typical ruminative responses to negative events. Participants were asked to rate how much each of the responses described them on 5-point Likert scale (1 = *very unlike me*, to 5 = *very like me*). An example item is “I’d replay the event over and over in my mind.”

State Negative Emotionality

We measured NE-state before and after our stress-inducing task with the Negative Affect (NA) subscale of the Positive Affect Negative Affect Schedule (PANAS; Watson et al. 1988). The NA scale consists of 10 items that describe different negative emotions and feelings (e.g., “distressed”). Participants rate each item on a 5-point Likert scale, where 1 = *slightly or not at all*, and 5 = *very much*. We used the post-PANAS scores in our analyses involving NE-state, while controlling for pre-PANAS scores.

Event-Specific Cognitive Responses to Stress

Cognitive responses to the stressor task were measured with event-anchored adaptations of the CSQ and PANE.

Since both the CSQ and the PANE are scenario-based measures, the initial prompts were modified to reflect participant's performance on the stress-inducing task (e.g., "Regarding your performance on the PASAT cognitive processing test:"). All other aspects of the original measures were maintained. Participants rated 5 items on the event-anchored CSQ on a 7-point Likert scale (e.g., 1 = *totally caused by something else*, 7 = *totally caused by something about me*). On the event-anchored PANE, participants rated 5 items on a 5-point Likert scale (1 = *very unlike me*, 5 = *very like me*).

Procedure

Participants were recruited from the undergraduate population with in-class presentations and flyers posted in various campus locations. Individuals were directed to an online questionnaire to complete the first of two parts to the study. In Part 1, participants completed a consent form and all trait questionnaires including the ATQ, PANE, and CSQ. Participants were then contacted via email to arrange a time to complete Part 2 of the study within 7–10 days of Part 1. Of the 117 participants who completed Part 1, 87 (74%) completed Part 2. There were no differences between Part 1 and Part 2 participants in terms of NE-trait ($t [115] = .44$, $P = .66$), rumination ($t [115] = .66$, $P = .51$), or cognitive style ($t [115] = -.01$, $P = .99$).

Participants completed state and event-specific measures during Part 2, which took place in an on-campus laboratory by one of five graduate students in psychology. Participants completed the pre-PANAS, followed by what they were told was a test of general cognitive ability that was predictive of overall success in college. The test was the Paced Auditory Serial Addition Task (PASAT), which we used as a stress-inducer. Though developed for the assessment of persons with brain injuries, several have used the PASAT in a stressor paradigm to induce generalized negative affect. We used the PASAT as our stress-inducing task because it is effective in producing negative affect in college students (Holdwick and Wingefeld 1999).

The PASAT requires participants to attend to numbers presented by an audio recording and respond verbally, while continuing to attend to the on-going aurally presented numbers. Single-digit (1–9) numbers are presented. Participants are asked to sum each pair of numbers and say the summed number out loud, while inhibiting the encoding of that response in order to continue summing only the presented numbers (e.g., "If the first two numbers are 5 and 7, you would say 12. If the next number was 3, you would say 10"). The PASAT consists of 3 sessions of 60 numbers each with varying number presentation latency. In the first session, numbers are presented every 3 s. This speed increases in subsequent sessions such that the latency is

1.5 s in the second session, and 1 s in the final session. Presentation rate acceleration is used to increase task difficulty by increasing processing demands. The experimenter appeared to score the answers while sitting in a chair facing the participant.

Following task completion, participants were given standardized negative feedback on their performance. Regardless of actual performance, participants were informed that they scored 87 out of a possible 180 points, which placed them at the 18th percentile of college students. The researcher explained that this meant that 18% of college students did worse than they did, and that 82% did better than they did. Following this negative feedback, the researcher re-opened the on-line questionnaire and asked the participant to follow the directions on the screen to complete the post-PANAS and event-anchored CSQ. Next, participants were asked to engage in a 4-min free-writing session. The purpose of this period was to allow sufficient time for a ruminative response (if any) to develop. Participants were told to write about anything on their mind, but to write continuously for a full 4 min. After, the participant was again redirected to the on-line questionnaire to complete an event-anchored version of the PANE.

Finally, participants were debriefed regarding their task performance through a standardized debriefing process. Debriefing consisted of explaining that the PASAT was used to induce a common stressful event in the study. Participants were informed that the feedback given to them did not reflect their actual performance on the task, but was in fact standardized feedback given to all participants. No differences existed between graduate student researchers in terms of participant-reported NE-state ($F [4, 82] = .48$, $P = .75$), event-specific cognitive style ($F [4, 82] = 1.46$, $P = .22$), or event-specific rumination ($F [4, 81] = .53$, $P = .72$). Participants received \$5 compensation for their participation and were entered into a raffle for an iPod.

Planned Analyses

First, we used a paired-samples t test to determine if the PASAT resulted in a significant increase in distress as measured by the pre- and post-PANAS scores. To test our first hypothesis, that NE-trait would predict trait and event-specific measures of cognitive vulnerability, we separately regressed trait cognitive style, trait rumination, and both event-specific cognitive measures on NE. Next, to determine if NE-state was associated with depressogenic cognitive responses to stress, we used regression to examine the relationship between NE-state and each of our event-anchored measures separately, controlling for their respective trait measures. Finally, to test whether NE-state mediates the relationship between NE-trait and each of our event-anchored measures of cognitive responses, we used

the Preacher and Hayes (2004) macro for SPSS through the joint-significance method. The macro was used to generate 5,000 bootstrap resamples with replacement from the original sample data in order to avoid the violation of assumption of normality related to the multiplication of path coefficients. A 95% confidence interval was used to assess the significance of the indirect (mediated) pathway.

Results

Descriptive Analysis

The means, standard deviations, and correlations of the variables are presented in Table 1. Prior to testing our main effects hypotheses, a paired-samples *t* test was used to compare pre- and post-PANAS scores to confirm that negative feedback following the PASAT resulted in a significant increase in NE-state. The results of this test were significant ($t[86] = 6.48, P < .001, d = .67, 95\% \text{ CI} [.19, .36]$), indicating that the PASAT and its feedback did indeed induce NE-state. We then began testing our main effect hypotheses.

Analysis of Main Effects

NE Predicts Trait Cognitive Vulnerabilities and Depressogenic Cognitive Responses

We hypothesized that NE-trait would predict trait cognitive style and rumination, as well as more negative cognitive responses to the stress-inducing task. To test the first part of this hypothesis, we regressed trait cognitive style and rumination on NE-trait separately. We found that NE-trait was significantly related to trait cognitive style ($B = .30, P < .05, R^2 = .07$), accounting for 7% of the variance. NE-trait was also significantly related to trait rumination ($B = .45, P < .001, R^2 = .17$), accounting for 17% of the variance in rumination scores. Thus, consistent with previous findings, NE-trait was significantly related to trait cognitive vulnerabilities in our data.

Though no previous studies have tested the relationship between NE-trait and depressogenic cognitive responses to specific stressors, we expected that NE-trait would be positively related to both event-specific negative cognitive style and event-specific rumination. NE-trait was a marginally significant predictor of event-specific cognitive style as measured by the event-anchored adaptation of the CSQ (EA_CSQ; $B = .27, P = .09, R^2 = .03$). NE-trait was a significant predictor of event-specific rumination (EA_PANE; $B = .36, P < .05, R^2 = .07$).

SNE Predicts Depressogenic Cognitive Responses

We hypothesized that individual differences in distress to the stress-inducing task (NE-state) would have a direct effect on both event-specific cognitive style and rumination, controlling for respective trait measures. These analyses examined the role of event-related affect in the generation of depressogenic cognitive responses above and beyond existing cognitive traits. For cognitive style, Pre-PANAS scores and trait cognitive style were entered in the first block as controls, followed by post-PANAS scores in the second block. NE-state was a marginally significant predictor of event-specific cognitive style, controlling for trait cognitive style ($B = .50, P = .05, \Delta R^2 = .04$; see Table 2).

We next tested the relationship for event-specific rumination. Again, pre-PANAS and trait rumination were entered in the first block, followed by post-PANAS in the second block. NE-state was a significant predictor of event-specific rumination when controlling for trait rumination ($B = .73, P < .01, \Delta R^2 = .09$), indicating that the distress related to the PASAT task and its feedback was a significant predictor of event-specific rumination.

Mediation Analyses

Our final hypothesis was that NE-trait would predict NE-state related to the PASAT and its feedback, which would in turn predict depressogenic cognitive responses to that event. We used the Preacher and Hayes (2004) Sobel script

Table 1 Means, standard deviations, and correlation matrix of research variables

Variable	<i>M</i>	<i>SD</i>	α	1	2	3	4	5	6
1. NE	3.72	0.71	.82	–					
2. CSQ	3.38	0.80	.95	.26*	–				
3. PANE	3.33	0.77	.95	.41**	.36**	–			
4. Pre-PANAS	1.31	0.32	.77	.24*	.05	.12	–		
5. Post-PANAS	1.58	0.49	.82	.32**	.19	.31**	.60**	–	
6. CSQ Event-Anchored	3.06	1.06	.74	.16	.52**	.30**	.03	.24*	–
7. PANE Event-Anchored	2.54	0.96	.85	.24*	.32**	.45**	.13	.40**	.36**

N = 87

* $P < .05$, ** $P < .01$, two-tailed

Table 2 State negative emotionality and cognitive vulnerabilities predicting depressogenic cognitive responses to stress

Variable	Slope (SE)	Constant (SE)	R^2	ΔR^2	F	P
<i>Event-specific cognitive style (EA_CSQ)</i>						
Step 1						
Pre-PANAS	-.13 (.33)	.85 (.60)	.27		15.11	<.001
Trait cognitive style (CSQ)	.70 (.13)**					
Step 2						
Pre-PANAS	-.57 (.40)	.81 (.59)	.31	.04	11.69	<.001
Trait cognitive style (CSQ)	.64 (.13)**					
Post-PANAS	.50 (.26) ⁺					
<i>Event-specific rumination (EA_PANE)</i>						
Step 1						
Pre-PANAS	.41 (.31)	.17 (.51)	.22		11.89	<.001
Trait rumination (PANE)	.54 (.12)**					
Step 2						
Pre-PANAS	-.20 (.35)	.18 (.51)	.31	.09	12.13	<.001
Trait rumination (PANE)	.43 (.12)**					
Post-PANAS	.73 (.23)**					

$N = 87$. Unstandardized coefficients are shown, standard error in parentheses

⁺ <.10, * $P < .05$, ** $P < .01$, two-tailed

for SPSS, which tests mediation through the joint significance method. This method has good statistical power for smaller samples, and it is considered a stronger test of mediation when used in conjunction with bootstrapping (MacKinnon et al. 2002). The script generated 5,000 bootstrapped resamples from our data and created an asymmetrical 95% confidence interval for the effect of the indirect path. Confidence intervals that do not include “0” indicate a significant effect of the indirect (mediated) path, whereas those that do are considered nonsignificant.

We first tested the mediation for event-specific cognitive style. Controlling for pre-PANAS scores, we entered NE-trait as the predictor, NE-state (post-PANAS) as the mediator, and the event-anchored CSQ measure as the dependent variable. The resulting confidence interval did not include “0” (.01 to .26), indicating that NE-state is a significant mediator of the NE—event-specific cognitive style relationship (see Fig. 1). Thus, our hypothesized model for the relationship between NE, NE-state, and event-specific cognitive style was supported.

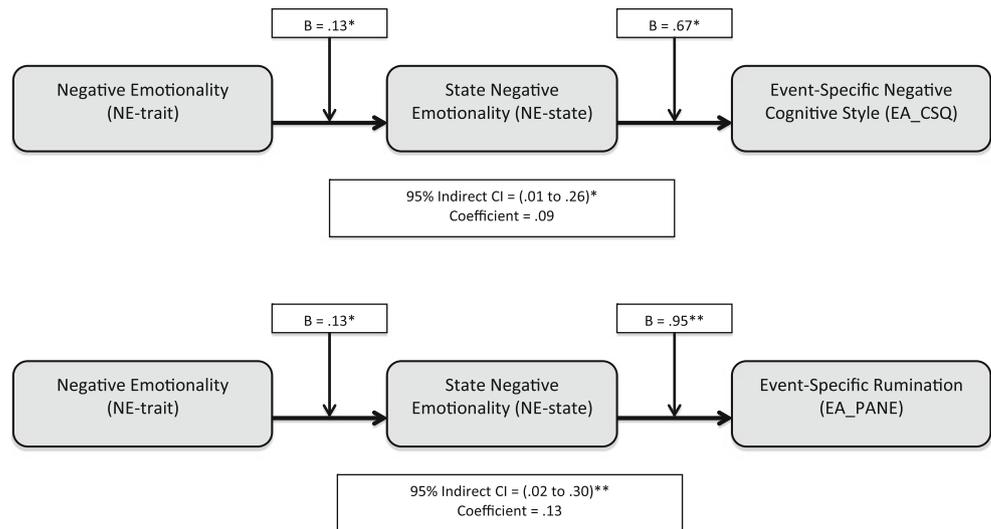
This procedure was repeated to test the model with event-specific rumination as the dependent variable. We again controlled for pre-PANAS, entered NE-trait as the predictor, and NE-state (post-PANAS) as the mediator. The confidence interval for the indirect pathway did not include “0” (.02 to .30), indicating a significant pathway. Thus, our model of the relationship between NE, NE-state, and event-specific rumination was also supported by the data.

Discussion

The purpose of this study was to examine the links between trait and state affective and cognitive responses to stress. Our hypothesis that the temperamental feature of NE-trait would predict both trait and event-specific cognitive vulnerabilities to depression was supported. Consistent with previous research (e.g., Mezulis et al. 2006; Verstraeten et al. 2009), NE-trait predicted both trait negative cognitive style and rumination. In addition, we found that NE-trait was a marginally significant predictor of event-specific cognitive style, and a significant predictor of event-specific rumination. This is the first study linking NE-trait to event-specific depressogenic cognitive responses to stress. Our findings are consistent with recent integrated models of affective and cognitive vulnerabilities (e.g., Hyde et al. 2008), and may be helpful in the identification of individuals at particular risk when exposed to stress.

In our second hypothesis, we expected that NE-state (the distress associated with the PASAT task and its feedback) would predict event-specific depressogenic responses to the task even when controlling for trait cognitive vulnerabilities. Our rationale derives from our previous hypothesis about the link between affect and cognition; that is, we believe that affective responses precede and affect resulting cognitive responses. We found that NE-state was a marginally significant predictor of event-specific negative cognitive style after controlling for pre-PANAS scores and trait negative cognitive style. Previous studies have shown

Fig. 1 Mediated relationship between NE, NE-state, and event-specific cognitive responses, controlling for pre-PANAS. Note $N = 87$, $* < .05$, $** < .01$, Unstandardized coefficients reported. 95% bias corrected and accelerated confidence intervals (CI) based on 5,000 bootstrapped resamples. Analyses conducted with post-PANAS as the measure of NE-state, controlling for pre-PANAS



that thought content is relatively stable in never-depressed individuals following exposure to a negative mood-inducing task, which we believe accounted for our marginal significance (Segal et al. 1999). In contrast, NE-state predicted event-specific rumination, even when controlling for pre-PANAS and trait rumination scores. NE-state therefore appears to predict ruminative responses to events above and beyond one's established tendency to ruminate. These findings highlight the link between affective and cognitive responses to specific events.

We found support for our proposed model of the relationship between NE-trait, NE-state, and depressogenic cognitive responses to stressful events. We hypothesized that NE-trait becomes associated with trait cognitive vulnerabilities to depression through the repeated pairings of NE-state and depressogenic cognitive responses to specific stressful events. Individuals high in NE-trait are expected to experience more NE-state when faced with stressful events, which is in turn associated with more negative event-specific thought content (event-specific cognitive style) and repetitive cognitive processing of that event (event-specific rumination). The results from our mediation analyses supported this hypothesized model.

NE-trait predicted greater NE-state after the feedback from the PASAT, which in turn was associated with more negative thought content, and more repetitive focus on the event. This is the first study to support Mezulis' et al. (2006) hypothesis that NE-trait may give rise to crystallized negative cognitive style through the repeated experience of distress and concomitant negative inferences. Our findings link NE-trait with increased attention to negative events and greater self-focus by introducing the mediating variable of NE-state (Pyszczynski et al. 1987). Given the large body of research on emotion-cognition relationships (e.g., Weiner 1985), we believe that the affective factor of

NE-state is a necessary step in the causal chain between trait affectivity, event-specific depressogenic cognitive responses, and trait cognitive vulnerabilities.

Implications

Our study is the first to test a model of the development and maintenance of cognitive vulnerabilities to depression from trait and event-specific affectivity. In analyses from our first hypothesis, we found NE-trait was a significant predictor of trait cognitive vulnerabilities as well as the specific depressogenic cognitions following our stressful event. An implication of this is that negative emotionality may be a useful target for the prevention of cognitive vulnerabilities to depression as well as intervention in those with already established cognitive vulnerabilities.

In our second hypothesis, we expected NE-state to predict event-specific depressogenic cognitive responses above and beyond their associated trait cognitive vulnerabilities. This hypothesis was marginally supported for event-specific cognitive style, a measure of cognitive content, and significant for event-specific rumination, a cognitive process. A major implication of this finding is that the process, or way of thinking about an event, appears to be more affectively and situationally variable than is thought content. Treatment aimed at altering thought process might therefore yield faster results than those targeting content. One likely reason for this is that the latter may be closely linked to an individual's "core beliefs" about themselves and their world (Beck 1976). These core beliefs develop in response to experiences over time, and are therefore often difficult to alter. Thus, immediate intervention for distress and depressogenic cognitions should focus on the distress itself or the way the stressful event is

thought about. Interventions such as mindfulness training may be particularly useful in teaching individuals to respond to negative events in a reflective, as opposed to ruminative, manner. Mindfulness meditation is effective in reducing both subjective distress and rumination among young adults (Jain et al. 2007). In contrast, targeting core beliefs may prevent the immediate negative thought generation in response to stress, but may require longer periods of intervention.

Results from our third and final hypothesis provide some support for our proposed model of the development and maintenance of cognitive vulnerabilities. Findings indicate that NE-state and resulting depressogenic cognitions may be the proximal contributors to the development of cognitive vulnerabilities. This additional step adds a target for prevention and intervention efforts. For example, distress tolerance skills may prove useful in the inhibition of event-specific ruminative responses as well as the development of trait ruminative tendencies if implemented early in life. Once established, cognitive vulnerabilities may be strengthened by exposure to stress, the experience of distress, and resulting depressogenic cognitions. Future research, should investigate ways in which emotional vulnerabilities may be best targeted both to prevent the initial development of cognitive vulnerabilities, and decrease their strength once established.

Limitations

Our study has several limitations worth noting. First, the study was conducted in a relatively small, predominantly female community sample. Results, therefore, need replication in a diverse setting. In particular, we speculate that there may be stronger links between NE-state and event-specific cognitive style among clinical samples as hypothesized by Segal et al. (1999). Second, we relied exclusively on participants' self-reported questionnaires to assess temperament, cognitive style, rumination, and depressive symptoms. Third, replication among younger individuals would be beneficial to better test the developmental aspects of our model. Cognitive vulnerabilities tend to be somewhat stable by college. Our results, therefore, provide evidence of the strengthening of these vulnerabilities rather than their initial development. In a younger sample, we would be able to provide better evidence of the initial development of these vulnerabilities that we assume to occur through the same process. Finally, the short time gap between measurement of NE-state and event-specific cognitive measures potentially allows for reversed models where NE-trait gives rise to event-specific cognitive content and processes, which in turn contribute to NE-state. While our review of the literature appears to lean toward the sequence proposed in this study (e.g., Salovey 1992;

Weiner 1985), future studies should attempt to rule out alternative models more conclusively.

Conclusion

The results from this study extend previous findings on the associations between temperament, cognitive vulnerabilities, and depression. Our results indicate that temperament influences emotional responses to stress, which then predicts cognitive content and process following the stressor. This provides further support for the hypothesis that individuals' emotional responses produce cognitive responses that, through repeated experience, then crystallize into cognitive vulnerabilities and maintain them over time. Targeting emotional vulnerabilities may therefore facilitate the prevention and early intervention in depression.

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