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Affective Reactivity Predicts Cognitive Reactivity to Induced Stress in Adolescence

Sarah Ingrid Crystal*, Jordan Simonson, Amy Mezulis and Kara Pegram

Department of Clinical Psychology, Seattle Pacific University, USA

Abstract

The cognitive vulnerability-stress model of depression suggests that maladaptive cognitive responses to stress place individuals at risk for developing depression. Less is understood about the process by which these maladaptive responses are generated. One hypothesis is that affective reactivity elicits depressogenic cognitive responses in the context of stress exposure. We hypothesized that the immediate experience of negative affect following induced stress (state-NA) would precede and influence subsequent depressogenic cognitive responses. We also predicted that trait cognitive style would moderate the relationship between state affective and cognitive reactivity. In two college samples (N1 = 84, M1 = 20.23 years; N2 = 67, M2 = 20.02 years) we found that state-NA predicted cognitive reactivity. This relationship was moderated by pre-existing cognitive style for some, but not all, depressogenic cognitive responses to induced stress. Our findings provide insight into the process by which maladaptive cognitive responses to stress may be elicited, and lend support to the link between affective and cognitive vulnerabilities to depression.

Keywords: Adolescence; Affective and cognitive reactivity; Stress; Depression; Vulnerability

Introduction

The cognitive vulnerability-stress model is one of the most empirically supported etiological models of depression [1] suggesting that certain cognitive responses to stress place individuals at risk for developing depression. The process of generating these maladaptive cognitive responses is often described as cognitive reactivity. Cognitive reactivity can include maladaptive responses to stress such as making negative inferences about the causes, consequences, and self-characteristics of stressful events [1], ruminatively focusing on the possible causes and consequences of the event [2], and/or selectively attending to negative information post-stress. Although cognitive reactivity to stress has been linked to the development of depressive symptoms, less is known about the mechanisms by which depressogenic cognitive responses are elicited in the context of stress exposure.

Recent research suggests that affective reactivity may be related to the generation of maladaptive cognitive responses in the context of stress exposure. Some individuals show more marked increases in negative affect following stress, such as increased distress, fear, and/or sadness. This affective reactivity may represent an affective vulnerability to depression, which is in turn associated with cognitive reactivity through the elicitation of maladaptive cognitive responses [3,4]. However, these studies have relied exclusively on explicit self-report measures of cognitive reactivity.

The goal of our studies was to expand on previous research by examining predictors of cognitive reactivity to induced stress using novel content analysis techniques to assess cognitive reactivity. We first hypothesized that affectivity reactivity would predict cognitive reactivity, and specifically that individuals with high negative affectivity following induced stress would generate more negative cognitive responses. We further hypothesized, that individual differences in trait cognitive vulnerability, specifically trait cognitive style, would moderate this relationship such that individuals with high negative affectivity and high trait cognitive style would display the most cognitive reactivity to induced stress.

Affective Reactivity Predicts Cognitive Reactivity to Stress

Cognitive reactivity describes the process by which established negative patterns of thinking are activated. This can include trait tendencies to make negative inferences about the causes, consequences, and self-implications of negative events (e.g. negative cognitive style; [1]) or perseveratively focusing on the negative aspects of a given situation (e.g. rumination; [2]). Thus, the hallmark of cognitive reactivity is the generation of negative emotionally valenced thoughts in the face of stress. Some researchers suggest that cognitive vulnerability may remain relatively dormant until activated by stress-related changes in mood. For example, negative shifts in mood may activate cognitive vulnerabilities to generate event-specific negative cognitive responses. Through this process, affective and cognitive factors converge and may jointly contribute to the onset and subsequent maintenance of depression over time [5,6].

Affective reactivity is often conceptualized in terms of trait and state reactivity. Trait affective reactivity is frequently assessed via temperament, a construct that represents long-time stable individual difference characteristics in emotional reactivity and the processes that moderate that reactivity [7]. Negative trait affectivity (trait-NA) specifically, which is comprised of high negative effect, intense emotional reactivity, low adaptability and low approach to novelty, is one affective vulnerability individual difference factor that may contribute to the development of cognitive reactivity [8,9].

State affective reactivity (state-NA) describes the immediate

***Corresponding author:** Sarah Ingrid Crystal, Department of Clinical Psychology, Seattle Pacific University, 3307 3rd Avenue, Suite 107, Seattle, WA, 98119, USA
Email: scrystal@spu.edu

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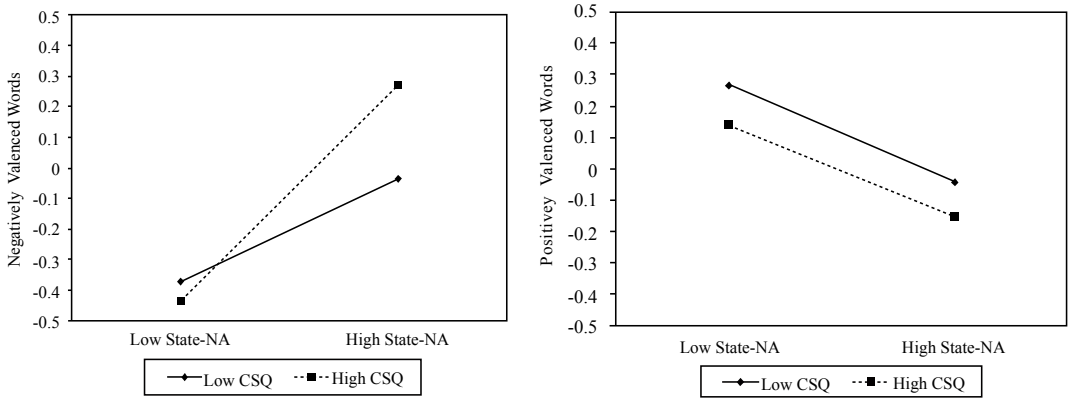

Figure 1: Affective Reactivity (state-NA) x Trait Cognitive Style (CSQ) interaction predicting Cognitive Reactivity for Valenced Word Use.

experience of negative affect following a stressful event. This in-the-moment experience of negative affect or "distress" has been shown to precede and influence subsequent cognitive responses to the stressful event [10]. State-NA has also been directly linked to various Depressogenic cognitive responses to stressful events including paying greater attention to negative events [11], having increased negative expectancies for the future [12], and focusing on negative aspects of the self, others, and world [13]. Thus, the link between trait- and state-NA, cognitive reactivity and psychological outcomes is likely the result of individuals high in trait-NA responding to stressful situations with increased state-NA, and generating maladaptive cognitive responses.

Many studies have used priming techniques and/or mood inductions to examine whether shifts in mood and resultant negative affect induce negative thinking. Findings consistently demonstrate that increases in negative mood following a prime/negative mood induction are associated with depressogenic patterns of thinking [14-18].

Other studies have examined the proximal process of cognitive reactivity by looking at how affective and cognitive vulnerabilities are linked in the context of mood changes. Recently, Mezulis and colleagues demonstrated that over time, trait negative affectivity is related to the development of both trait negative cognitive style and trait rumination [9,19,20]. Additionally, Simonson et al., [4] demonstrated that experiencing negative effect in immediate response to a stressful event mediated the relationship between trait negative affectivity and event-specific cognitive reactivity. Collectively, these studies indicate that individual differences in affective reactivity may contribute to subsequent cognitive reactivity (Figure 1).

Trait Negative Cognitive Style as a Moderator

While state affective reactivity is hypothesized to be a proximal predictor of cognitive reactivity in the context of induced stress, it is likely that individuals' cognitive responses to stress are also influenced by their pre-existing trait cognitive styles. The hopelessness theory of depression [1,21] suggests that depression vulnerable individuals have a stable, trait tendency to make negative inferences about the causes, consequences and self-characteristics of stressful events. This triad of negative inferences is termed negative cognitive style, and it has been extensively linked to depression in children and adults (see [22]; for a review [23,24]). Individuals with high trait cognitive style are more likely to generate negative cognitions about specific events in the context of stress exposure [25]. Trait cognitive style may therefore strengthen the association between affective and cognitive reactivity such that those with high affective reactivity and high trait cognitive style will demonstrate the most cognitive reactivity in the face of stress.

Content Analysis of Cognitive Reactivity

To date, most research examining cognitive reactivity and more generally, cognitive vulnerabilities for depression, have assessed cognitive responses via traditional, stimulus-bound self-report measures. However, over the past decade, depression research has taken an increasing interest in content analytic procedures to elucidate the cognitive processes implicated in the development of depressive disorders. Increasingly researchers interested in cognitive processes are performing linguistic analysis on thought samples or using less structured self-report measures to elicit more authentic individual responses about depressogenic thinking patterns.

Thought-sampling techniques are less structured than other measures that ask participants to endorse prototypical responses and fit their cognitions to an established form. Thus, they have the advantage of obtaining more valid samples of an individual's cognitive processing style and content. Subsequently, the content individuals generate is analyzed for specific patterns of thinking and/or language usage that characterizes depressive patterns of thinking [26,27].

Linguistic analysis has recently been used to support the existence of internal processes that have long been identified by alternative methods. For example, a recent study by Rude and colleagues [27] used linguistic analysis to demonstrate that depressed college students used more negatively valenced and self-focused words compared to healthy controls. Additionally, Stirman and Pennebaker [26] used linguistic analysis to determine if distinctive linguistic features could be identified in the poetry of poets who had committed suicide. They found that the poetry of suicidal poets was in fact distinct from that of nonsuicidal poets - suicidal poets used more first person singular words and less social collective words – and concluded that perhaps individuals who commit suicide are more self-focused and socially isolated than their nonsuicidal peers.

Based on the ability of these studies to detect depressogenic patterns of thinking from linguistic analysis, the current studies assessed cognitive reactivity via thought sampling and linguistic analysis. Because we were interested in cognitive reactivity to stress (i.e. negative cognitive content following a stressor) we chose to specifically focus on

emotionally-valenced negative and positive words, as well as patterns of thinking that typically characterize depression-prone individuals, such as negative focus on aspects of the self as well as on other facets of an individual's life. Thus, we predicted that cognitive reactivity in individual's responses would be characterized by more negatively valenced words, as well as by generally negative thoughts. Furthermore research has also shown that depressogenic thinking is characterized by less positivity, and therefore we also predicted that individual cognitive reactivity would include less positively valenced words. In both studies trait cognitive style and state-NA following an induced stress paradigm are also assessed and analyzed as predictors of cognitive reactivity.

Study 1

In Study 1 we examined cognitive reactivity via linguistic analysis of thought samples. Following a laboratory stressor, participants engaged in a 5-minute thought-sampling procedure during which they were able to write about a topic of their choice. The Linguistic Inquiry and Word Count (LIWC; [28]) was used to interpret participants' thought samples for the presence of negative and positive content. The LIWC identifies, counts, and categorizes negative emotion words such as nervous, hate, sad, and positive words such as happy, good, love etc. We predicted that following the induced-stress procedure participants with high state-NA would use more negative and less positive words in their writing. Furthermore, we predicted that the relationship between state-NA and valenced word-use would be moderated by negative cognitive style.

Method

Participants

The Study 1 sample was comprised of 84 undergraduate students (71% female) at a small liberal arts university in the Pacific Northwest. Participants' ages ranged from 18.37 to 25.37 years (M = 20.23; SD = 1.35). The sample was predominantly Caucasian (79%), with smaller numbers of Asian (12%), African American (3%), Latino (3%), Native American (2%), and Other (1%) participants.

Procedure

Participants were recruited through in-class presentations and flyers posted throughout campus. In Part 1, participants completed a consent form and baseline questionnaire assessing trait cognitive style on-line via Survey Monkey. After completing the questionnaire, participants were contacted via email to complete Part 2 of the study, which occurred within 7 to 10 days after completing Part 1.

Participants completed state and event-specific measures during Part 2, which was conducted in an on-campus laboratory by psychology graduate students. Participants were told that they would be performing a test measuring general cognitive ability, which is predictive of overall success in college. The test was the Paced Auditory Serial Addition Task (PASAT), which we used as a stress-induction paradigm [29].

Immediately following the PASAT 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, placing them in the 18th percentile of college students. Participants were told that their scores indicated that 18% of college students performed worse than they did, and 82% performed better than they did. Following this negative feedback, participant completed a measure of state-NA.

Next, participants were asked to engage in a 5-minute free-write session. The purpose of this period was to allow sufficient time for a cognitively reactive response (if any) to develop. Participants were told to write about anything on their mind, but to write continuously for a full five minutes. Finally, participants were debriefed through a standardized debriefing process. During debriefing, the experimenter explained that the PASAT was used to induce a common stressful event in the study.

Measures

Depressive symptoms (CES-D)

Depressive symptoms were assessed at baseline using the Center for Epidemiological Studies Depression Scale (CES-D; [30]). Study participants completed the 20-item CES-D by rating the frequency with which they experienced each symptom listed, during the week prior to completing the measure, using a 4-point Likert-type scale ranging from rarely or none of the time (0) to most or all of the time (3).

Trait cognitive style

Inferential style for negative events was measured with the Cognitive Style Questionnaire (CSQ; [31]). Participants rated items on a 7- point Likert scale of the likely causes (e.g., 1 = will only cause problems with my academics to 7 = will cause problems in all areas of my life), consequences (e.g., 1 = nothing bad will happen to 7 = Very bad things will happen), and the implications of each event for oneself (1 = doesn't mean anything is wrong with me to 7 = definitely means something is wrong with me). Alloy and Abramson's [32] Cognitive Vulnerability to Depression (CVD) Project reported reliability of α = .88 in a large screening sample (n = 5,378) for negative event composite scores.

State negative affectivity

We measured state-NA before and after our stress-inducing task with the Negative Affect (NA) subscale of the Positive Affect Negative Affect Schedule (PANAS; [33]). The NA scale is a self-report instrument that consists of 10 items that describe different negative emotions and feelings (e.g., distressed). Participants rate these 10 items on a 5-point Likert scale, where 1 = slightly or not at all, and 5 = very much. Previous reports of reliability for the NA scale range from .84 to .87.

Cognitive reactivity

Cognitive reactivity was assessed following the stressor task via linguistic analysis of a four minute free-write sample. The directions for the free-write task were as follows: "For the next four minutes I would like you to write about anything on your mind. Please write continuously for the full four minutes". All free-write samples were analyzed using The Linguistic Inquiry and Word Count [28]. This computer-based text analysis program classifies words into lexical categories, and for the purpose of this study we examined emotionally valenced words, both positive and negative. The proportion of total words that were negatively and positively valenced were included as dependent variables in our analyses. Examples of negatively valenced words include nervous, angry, hate, sad or worthless. Positively valenced words include happy, love, joy or excited (Figure 2).

Results

Descriptive analysis

Means, standard deviations, and correlations of the variables are presented in Table 1.

Study 1 Variables	M	SD	α	1	2	3	4	5	6	7			
1. Sex	-	-											
2. Age	20.23	1.35	-	-									
3. CESD	13.39	8.29	-	.12	.08	-							
4. CSQ	3.35	.79	.95	-.11	-.10	.43**	-						
5. Pre-PANAS	1.27	.21	.77	.12	.05	.13	.02	-					
6. Post-PANAS	1.52	.38	.82	.10	.07	.21	.16	.58**	-				
7. Positive Emotions	4.43	2.10	-	.06	.16	-.03	-.14	-.03	-.23*	-			
8. Negative Emotions	2.50	1.91	-	.16	.03	.00	.16	.26*	.51**	-.21*			
Note. N = 84. *p< .05, ** p < .01, two-tailed.													
Study 2 Variables	**M**	**SD**	**α**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
1. Sex	-	-	-	-									
2. Age	20.55	3.46	-	-	-	-							
3. CESD	14.40	9.08	.64	.22	-.02	-							
4. CSQ	3.58	.99	.97	.28*	-.04	.52*	-						
5. Pre-PANAS	1.31	.32	.76	.15	.02	.29*	.24*	-					
6. Post-PANAS	1.64	.50	.85	.25*	-.14	.15	.46**	.58**	-				
7. Self-Blaming	4.03	3.85	-	.20	.13	.28*	.35*	.17	.28*	-			
8. Negative View of Self	7.21	3.60	-	.08	.32**	.33**	.40**	.26*	.35**	.54**	-		
9. Negative View of World	4.57	3.59	-	.03	-.02	.13	.24	.12	.24	.34**	.49**	-	
10. Negative View of Future	1.79	1.14	-	-.00	.14	-.03	.20	.12	.32**	.30*	.37**	.44**	-
11. Negative Self-directed Affect	8.07	5.85	-	.24*	.14	.19	.29**	.17	.30*	.77**	.65**	.57**	.38**
Note. N= 67. *p< .05, ** p < .01, two-tailed.													

Table 1: Means, Standard Deviations, and Correlation Matrix of Research Variables in Studies 1 and 2

Does affective reactivity predict cognitive reactivity?

We used hierarchical linear regression to test our main effects hypotheses that greater affective reactivity in response to stress would predict more use of negative words and less use of positive words. Age, sex, depressive symptoms, and pre-stressor NA were entered in Step 1. Post-stressor NA was entered in Step 2.

Controlling for age, sex, depressive symptoms and pre-stressor NA, we found that greater NA following the stressor task (as measured by Post-PANAS), predicted less positively (B = -1.50, t = -2.17, p = .03) and more negatively valenced words (B= 2.46, t = 4.24, p < .001). These findings support study hypotheses that individual differences in affective reactivity predict cognitive reactivity to stress.

Does trait cognitive style moderate the effect of affective reactivity on cognitive reactivity?

We used the Preacher and Hayes MODPROBE script for SPSS 18.0 to test the moderating effect of cognitive style on the relationship between affective reactivity and word use. The MODPROBE script tests the significance of the main effect relationship at different values of moderating variable (typically -1 SD, M, and +1 SD). Moderation was tested separately for positively and negatively valenced words. We first tested moderation for relationship between affective reactivity and positive words; cognitive style was not a significant moderator of the relationship (B = .07, t = .10, p = .92; ΔR^2= .00). Next we tested the moderating effect of cognitive style on the affective reactivity-negative word use relationship. Cognitive style interacted with affective reactivity to predict negative words such that individuals with high negative cognitive style and high post-stressor state-NA generated the most negative words during the thought-sampling task (Figure 1). The interaction term was significant (B = 1.26, t = 2.04, p = .05) and significantly contributed to the model (ΔR^2 = .04, p < .05).

Discussion 1

The present study examined affective and cognitive components of cognitive reactivity in an adolescent sample. Consistent with our main hypothesis, we demonstrated that experiencing negative affect following an induced stress is in fact associated with increased negative thought content immediately following a stressor. These findings are consistent with previous research [9,4], which has found state-NA to predict engagement in negative cognitive processes following exposure to stress. Our finding also provides further support for previous research that has demonstrated the generation of negative thought content following shifts in mood in depressed individuals [18].

The proposed model of the relationship between negative cognitive style, state-NA and depressogenic cognitive responses to stress is further strengthened by our findings. We hypothesized that those with greater negative cognitive style would respond more affectively negative to stress, which would result in more depressogenic thinking. Indeed, negative cognitive style exacerbated the relationship such that those with high state-NA and high negative cognitive style demonstrated the most negative thougt content. Thus, the results from our moderation analyses supported this hypothesized model.

Study 2

In Study 2, we examined the relationship between affective and cognitive reactivity using the Rotter Incomplete Sentences Blanks (Rotter) as a method of thought sampling. The Rotter includes 39 incomplete sentence stems that participants complete to generate self-referent statements. Given that the Rotter includes specific prompts, it is a more structured technique than was used in Study 1; however, an unlimited variety of responses can be generated. Thus, it enables participants to respond genuinely rather than attempt to fit their thoughts to standardized response options. Following a similar procedure to Study 1, in Study 2 participants completed the Rotter following a laboratory stressor. The Rotter was analyzed using the Cognition Rating Form (CRF; [34]), which assesses for the presence of particular cognitive domains within each sentence.

We examined multiple domains of negative thinking using the CRF,

	Study 1 Variables		Study 2 Variables			
	Negatively Valenced Words	Positively Valenced Words	Self-Blaming	Negative View of Self	Negative View of Future	Negative Self-Directed Affect
Predictors	Slope (S.E.)	Slope (S.E.)	Slope (S.E.)	Slope (S.E.)	Slope (S.E.)	Slope (S.E.)
Step 1:						
Age	-.02 (.07)	.09 (.07)	.26 (.14)+	.42 (.13)	.05 (.04)	.44 (.21)*
Sex	.47 (.50)	.37 (.53)	3.06 (1.38)*	2.30 (1.24)	.17 (.42)	5.50 (2.05)**
Step 2:						
Age	-.02 (.07)	.09 (.07)	.24 (.14)	.39 (.12)**	.05 (.04)	.41 (.22)+
Sex	.43 (.51)	.39 (.55)	2.36 (1.40)+	1.36 (1.22)	.16 (.44)	4.81 (2.13)**
Depressive Symptoms (CESD)	-.01 (.03)	-.00 (.03)	.09 (.05)+	.10 (.05)*	-.01 (.02)	.07 (.08)
Pre-PANAS	1.60 (1.05)	-.06 (1.14)	.85 (1.50)	1.82 (1.30	.46 (.47)	1.52 (2.27)
Step 3:						
Age	-.02 (.06)	.09 (.07)	.26 (.14)+	.42 (.12)**	.06 (.04)	.44 (.21)**
Sex	.66 (.47)	.26 (.55)	1.77 (1.40)	.67 (1.17)	-.07 (.42)	3.69 (2.08)+
Depressive Symptoms (CESD)	-.04 (.03)	.01 (.03)	.06 (.06)	.08 (.05)	-.02 (.02)	-.00 (.09)
Pre-PANAS	-.14 (1.07)	.91 (1.25)	-.78 (1.81)	-.29 (1.51)	-.32 (.55)	-.79 (2.69)
Post-PANAS	2.24 (.60)***	-1.24 (.71)+	1.62 (1.25)	2.15 (1.05)*	.82 (.38)*	2.10 (1.86)
Trait Cognitive Style (CSQ)	.35 (.28)	-.22 (.32)	.62 (.60)	.60 (.51)	.15 (.18)	1.58 (.90)+
Step 4:						
Age	-.02 (.06)	.09 (.07)	.23 (.14)	.35 (.12)**	.07 (.04)	.41 (.22)+
Sex	.59 (.46)	.25 (.55)	1.70 (1.40)	.56 (1.13)	-.06 (.43)	3.63 (2.09)+
Depressive Symptoms (CESD)	-.04 (.03)	.01 (.03)	.07 (.06)	.09 (.05)	-.02 (.02)	.00 (.09)
Pre-PANAS	.23 (1.06)	.93 (1.28)	-.47 (1.86)	.46 (1.50)	-.37 (.57)	-.48 (2.77)
Post-PANAS	-2.04 (2.19)	-1.49 (2.64)	.17 (2.24)	-1.35 (1.80)	1.02 (.69)	.63 (3.34)
Trait Cognitive Style (CSQ)	-1.61 (1.00)	-.33 (1.21)	.42 (.66)	.12 (.53)	.18 (.20)	1.37 (.98)
CSQ x Post-PANAS	1.26 (.62)*	.07 (.75)	.23 (.30)	.56 (.24)	-.03 (.09)	.24 (.45)

Note: Study 1 N = 84, Study 2 N=67. Unstandardized coefficients are shown, standard error in parentheses. + p<.10, * p < .05, ** p < .01, *** p < .001, two-tailed.

Table 2: State Negative Affect and Cognitive Style Predicting Cognitive Reactivity to Stress in Studies 1 and 2.

including *self-blaming, negative view of the self, negative self-directed affect, negative view of the future, and negative view of the world*, as measures of cognitive reactivity. We predicted that greater state-NA in response to stress would be related to each of these domains of cognitive reactivity. We further examined whether trait cognitive style moderated the relationship between affective and cognitive reactivity.

Method

Participants

Study 2 utilized a sample of 67 separate adolescents (85% female) at a small liberal arts university in the Pacific Northwest. Participants' ages ranged from to 18.21 to 28.65 (M = 20.02, SD = 1.65). The sample was predominantly Caucasian (92%), but also included small numbers of Latino (4%), Asian, Native American and "Other" (1.3%) participants.

Procedure

Psychology graduate students recruited participants through in-class presentations. At baseline (Part 1), participants were consented and self-reported depressive symptoms were assessed on-line via Survey Monkey. After completing theses questionnaires, participants were contacted via email to complete Part 2 of the study.

During Part 2, participants completed state and event-specific measures in-person, in an on-campus laboratory. Participants were told that they would be performing a test measuring general cognitive ability, which is predictive of overall success in college. The test consisted of 25 anagrams, 8 solvable versus 17 unsolvable, which we used as a stress induction. Immediately following the stressor-task, participants received standardized negative feedback on their performance. Regardless of actual performance, participants were informed that they scored 87 out of a possible 180 points, placing them in the 18th percentile of college students. Participants were told that their scores indicated that 18% of college students performed words than they did, and 82% performed better than they did. Following this negative feedback, participant completed a post-stressor measure of state-NA.

Next, participants completed a thought-sampling technique to assess cognitive reactivity using the Rotter. Using the Rotter, participants responded to sentence stems by forming a complete sentence. Participants' responses were then coded for the presence of depressogenic thinking. Lastly, participants were debriefed through a standardized debriefing process that was identical to the debriefing procedure described in Study 1.

Measures

Depressive Symptoms: Depressive symptoms were assessed using the 20-item Center for Epidemiological Studies Depression Scale (CES-D; [30]. A full description of the scale is included in the description of Study 1 above).

Trait Cognitive Style: Inferential style for negative events was measured with the Cognitive Style Questionnaire (CSQ; [31]. A full description of the scale is included in the description of Study 1 above).

State negative affectivity: We measured state-NA before and after our stress-inducing task with the Negative Affect (NA) subscale of the Positive Affect Negative Affect Schedule (PANAS; [33]. A full description of the scale is included in the description of Study 1 above).

Cognitive Reactivity

Cognitive reactivity was measured using the Rotter Incomplete Sentences Blanks: High School Form [35-37]. Using the Rotter,

participants respond to 39 sentence stems including for example, "The best time is..,", "My parents….", "The future…,", and "I regret…". Participants' were instructed to use the sentence stems to form complete sentences or thoughts, writing down the first impression that came to mind after reading the provided sentence stem. Participant's complete sentence responses were then coded for the presence of depressogenic thinking using the Cognition Rating Form.

The Cognition rating form

The Cognition Rating Form(CRF) was used to rate the presence or absence of 7 types of cognitions in participants' responses to the Rotter. Thirty-nine stems from the Rotter Incomplete Sentences Blanks were scored in our study. The CRF categories were developed to be consistent with the cognitive theory of depression [13] and previous research findings that indicate specific patterns of depressogenic thinking. For example, some CRF categories (such as negative view of self, world and future) are based on the cognitive triad [13]. The CRF categories examined in the current study included: self-blaming, negative view of self, negative view of world, negative view of future, and negative affect towards the self. Scoring the sentence completions entailed rating the presence (1) or absence (0) of each of the 5 types of cognitions for each of the 39 possible sentence completions. Consequently, more than one type of cognition can be scored as present in any given sentence completion. After all sentence completions were rated, the total of each type of cognition was calculated by adding the total number of times a specific type of cognition was present. For example, if 8 sentence stems were scored present (1) for the category of negative view of self, the summary score for that category would be 8. This total present score was used in all data analyses.

Two clinical psychology graduate students, trained to use the detailed CRF manual, scored participants' Rotter Incomplete Sentence Blanks. Twenty percent of all responses were dual-coded to determine interrater reliability. Interrater reliability of the CRF was examined by computing Kappa statistics between raters on all 5 CRF categories. Landis and Koch [38] suggest that Kappa statistics between .40 and .59 indicate moderate agreement and Kappa statistics between .60 and .79 indicate substantial agreement. We found that across raters there was at least substantial agreement at the item level (self-blaming Kappa = .83, negative view of self Kappa = .92, negative view of world Kappa = .86, negative view of future Kappa = .86, negative self-directed affect Kappa = .81).

Results

Descriptive analysis

Means, standard deviations, and correlations of the variables are presented in Table 1.

Does affective reactivity predict cognitive reactivity?

We used hierarchical linear regression to test our main effects hypotheses that greater affective reactivity in response to stress would predict depressogenic thinking. Age, sex, depressive symptoms, and pre-stressor NA were entered in Step 1. Post-stressor NA was entered in Step 2. Controlling for age, sex, depressive symptoms, and pre-stressor NA, we found that greater NA following exposure to the stressful task did not predict negative view of the world (B= 1.90, t = 1.71, p = .09). However, controlling for age, sex, depressive symptoms, and pre-stressor NA, we found that greater NA following exposure to the stressful task did predict self-blaming (B = 2.20, t = 1.98, p = .05), negative views of the self (B = 2.73, t = 2.92, p = .005), negative views of the future (B = .96, t = 2.85, p = .01), and negative self-directed affect (B = 3.60, t = 2.13, p = .037). These findings support study hypotheses that individual differences in affective reactivity predict cognitive reactivity to stress (Table 2).

Does trait cognitive style moderate the effect of affective reactivity on cognitive reactivity?

Similarly to Study 1, we used the Preacher and Hayes MODPROBE

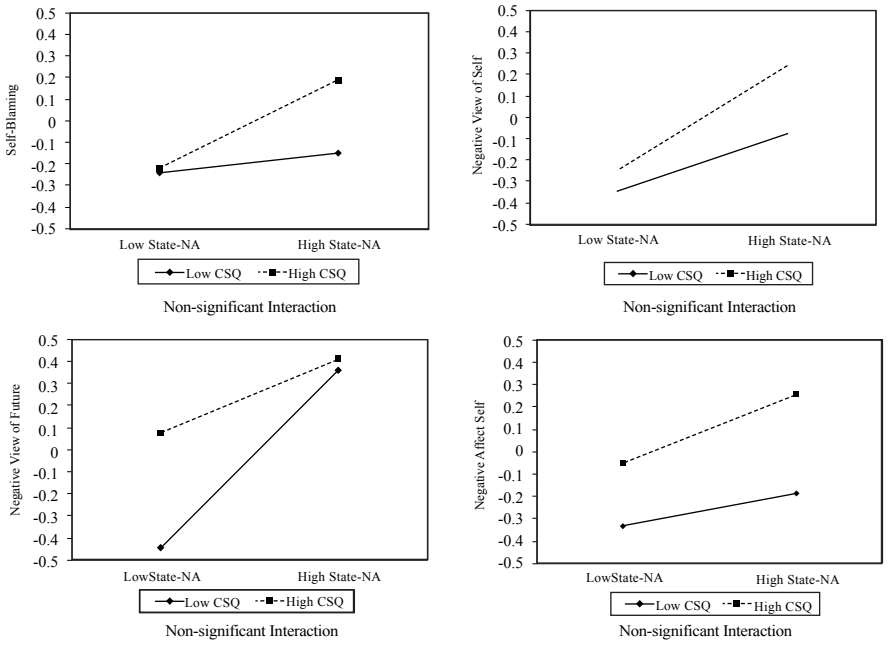

Figure 2: Affective Reactivity (state-NA) x Trait Cognitive Style (CSQ) interaction predicting Cognitive Reactivity for Self-Referent statements.

script for SPSS 18.0 to test the moderating effect of cognitive style on the relationship between affective reactivity and negative cognitions (this technique is described in greater detail in Study 1). Moderation was tested separately for each category of negative thinking that was significant. Cognitive style was not a significant moderator for any the relationship between affective reactivity and depressogenic thinking (self-blaming[B = 1.17, t = 1.20, p = .23; ΔR^2= .02, p = .23], negative view of self [B = .81, t = 1.00, p = .32; ΔR^2 = .11, p = .32],negative view of the future[B = -.52, t = -1.80, p = .07; ΔR^2 = .04, p = .07], negative self-directed affect[B = .92, t = .63, p = .53; ΔR^2 = .00]).

General Discussion

The relationship between affect and cognition has been widely established in depression literature, and the current studies provides further support for the notion that affective and cognitive processes are linked and may jointly contribute to maladaptive processes in the development of depression. Both studies were among the first to examine proximal affective and cognitive components of cognitive reactivity, linking state-NA to event-specific depressogenic cognitive responses to stress. Using a novel, linguistic analysis technique, Study 1 demonstrated that affective reactivity following stress is associated with cognitive reactivity. Adolescents who reported greater negative affect (state-NA) in response to stress spontaneously generated more negatively valenced words. Moreover, negative cognitive style placed adolescents at greater risk for experiencing heightened cognitive reactivity in response to stress.

Study 2 similarly revealed that affective reactivity (increased negative affect) in response to stress predicts depressogenic patterns of thinking, (i.e., cognitive reactivity), using another content-analysis technique. Here we did not find that trait cognitive style moderated the effects of state-NA on subsequent depressogenic though content. However, we speculate that we had insufficient power to detect moderation. Figure 2 suggests a trend for cognitive style to exacerbate the effect of state-NA in eliciting several types of negative cognitions.

Overall, our findings suggest that affective and cognitive reactivity are indeed linked, and that affective reactivity may be an important contributor to depressogenic responses to stress. These findings are also consistent with previous research yoking maladaptive affective and cognitive responses to stress, and highlight the importance of assessing both affective and cognitive domains of stress reactivity when examining risk for depression.

Limitations

Both studies were conducted in a small, predominantly female community sample. Not only do results, therefore, need replication in a diverse setting, we also believe that with increased sample size it may be easier to detect hypothesized links between state NA and trait cognitive style in predicting cognitive reactivity. Additionally, although our measures of cognitive reactivity were more implicit than traditional assessment techniques, we relied exclusively on participants' self-reports to assess state-NA, cognitive style, cognitive reactivity and depressive symptoms.

Conclusion

Our results extend previous findings demonstrating that affective and cognitive reactivity are linked in the context of stress. And, over time, patterns of heightened negative affective and cognitive responding to stress may lead to depressive outcomes. Therefore, it is important to target both affective and cognitive vulnerabilities in adolescents at risk for depression, in order to prevent and intervene before depressive outcomes occur.

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