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Temperamental Predictors of Attention to Positive and Negative Stimuli

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Abstract

Background and Objectives: There is increasing recognition that reactive and regulatory components of temperament may confer risk for internalizing disorders. One mechanism through which this risk operates may be individual differences in the allocation of attention to and away from emotional stimuli. The aim of the present study was to examine whether trait negative affectivity (NA) and/or effortful control (EC) predicted attentional biases before and in response to an induced stress paradigm among youth. Design: The current study examined both between-subjects (high/low NA and EC) and within-subjects (before and after stress induction) differences in attention biases. Methods: We examined temperament and attentional biases among 114 adolescents aged 10-14 years (M=12.86, SD=0.85; 52.5% female). Youth performed a modified dot probed attentional task. Results: Results indicated that youth with high NA or low EC displayed greater selective attention toward negative stimuli following stress induction relative to low NA or high EC youth. Youth with high NA displayed faster attentional disengagement from positive stimuli following stress induction relative to low NA youth. Conclusions: Results highlight one potential cognitive emotion regulation mechanism through which temperament may confer risk for depression in adolescence.

Keywords: Attention bias; Temperament; Depression; Internalizing disorders; Anxiety; Cognitive emotion regulation

Introduction

A strong body of research now demonstrates the importance of temperament as a risk factor for psychopathology. Temperament-based difficulties in the experience and regulation of negative emotion have in particular been associated with risk for internalizing problems such as depression and anxiety [1-5]. Individuals who experience high levels of trait negative affect (high negative affectivity) and/or who have difficulty engaging executive functions (low effortful control) are at heightened risk for internalizing disorders both cross-sectionally and longitudinally [5-9].

However, the link between temperament and internalizing problems is not well understood. Cognitive emotion regulation theories suggest that individual differences in the experience and regulation of negative emotion may affect subsequent cognitive processing of emotional stimuli, such that the influence of trait temperament on mental health outcomes will be mediated by cognitive processes [10]. One such cognitive process is the allocation of attention to and away from emotional stimuli, particularly in emotion-eliciting situations, which has independently been shown to confer risk for depression and anxiety.

Individuals with or at risk for internalizing disorders may selectively attend to negative stimuli, have difficulty disengaging from negative stimuli, and/or may fail to attend to positive stimuli [11,12]. However, few studies have examined the relationship between trait temperament and attentional biases. The purpose of the current study is to examine two temperament components (trait NA and trait EC) in predicting attention biases before and after an induced stress paradigm among early adolescents.

Background

Temperament as a risk factor for internalizing disorders

Temperament is conceptualized as individual differences in emotional reactivity and self-regulation that are present early in development and remain relatively stable across time. Extensive research demonstrates that temperamental traits confer risk for later psychopathology [3,13,14]. Trait negative affectivity (NA) is characterized by heightened sensitivity to negative cues and an elevated frequency and intensity of negative emotional reactions. High NA is one of the strongest risk factors for developing anxiety disorders, and trait NA has been shown to prospectively predict the onset of depressive symptoms and diagnosis [4,10]. Trait effortful control (EC) refers to the ability to effort fully inhibit dominant behavior, activate non-dominant responses, and shift attention. Low EC may be associated with deficits in the ability to regulate mood and behavior and has been shown to independently predict internalizing disorders as well as exacerbate the effects of high NA on negative outcomes in children, adolescents, and adults [15-17].

Temperament may predict attentional biases

The emergence of attentional biases for negative information may mediate the relationship between temperamental vulnerabilities and later risk for internalizing disorders. Cognitive emotion regulation theories suggest that the way in which individuals process emotional information may induce or prolong negative mood states [12]. Of particular interest are biases in the allocation of attention toward and away from emotional stimuli, which have been associated with both depression and anxiety. Fox and colleagues noted that one pathway linking temperament and anxiety-proneness is the link between the temperament-based behavior inhibition system and increased vigilance toward negative cues in the environment [18]. Similarly, Lonigan et al. [4] hypothesized that attentional biases toward negative stimuli may be a key mechanism associating NA and internalizing disorders. Extensive research has demonstrated that children, adolescents, and young adults with high trait NA display greater cognitive vulnerabilities both at a trait and state level. For example, studies have found that children and adolescents with high trait NA displayed greater cognitive reactivity following stress induction [19,20], suggesting that high NA youth may have difficulty exerting cognitive control when experiencing negative mood states. While only a few studies have examined associations between temperament and attention biases specifically, results support the premise that trait emotional reactivity (e.g. trait NA) is associated with attentional bias to negative information [21-23].

The role of low effortful control in attentional biases has received less empirical attention. Some theories suggest that deficits in temperamental regulation, such as low effortful control, may be directly associated with risk for internalizing disorders [12,24]. However, the mechanisms mediating this association remain poorly understood. It has been proposed that one mechanism linking low effortful control with internalizing symptoms is maladaptive information processing, such as attentional biases [12,25]. However, studies on temperamental self-regulation and information processing in youth have been fewer in number and have yielded mixed results [26-28]. Some researchers suggest that EC may not exert a direct effect on information processing and subsequent mental health outcomes, but may moderate the effects of NA. Because EC involves capacity for attentional control, children with high NA may vary in their capacity to use EC to override a bias towards negative or threatening stimuli, with high levels of EC serving as a resiliency factor, and low levels of EC serving as a risk factor [21,29]. The combination of temperamental risk factors, specifically high NA and low EC, may confer a more potent risk for attentional biases. At least two studies have found that it is the combination of high NA and low EC that confers risk for attentional biases toward negative stimuli among youth [21,23].

Attentional biases: Selective attention and attentional disengagement

Attentional biases may occur at one or more of several points of interrelated cognitive components [30], including initial orienting of attention toward stimuli, attentional engagement with stimuli, and disengagement of attention away from stimuli. Several authors have suggested that it is more prolonged elaboration of negative information that characterizes risk for internalizing disorders, especially depression, and have recommended examining attentional biases to negative stimuli at longer stimulus presentations (see, e.g., [31,32]). One common task for examining attentional biases is the exogenous cueing dot probe task, which has been used in several studies of attentional biases and depression, dysphoric mood, and anxiety [32-35]. In this task, the participant views a cue (e.g. emotional or neutral word or picture) on one side of the screen. Following cue offset, a target appears on either the same side as the cue (valid trials) or the opposite side of the cue (invalid trials). Faster reaction times to valid emotional cues compared to valid neutral cues is typically interpreted as a selective attention bias toward the emotional stimuli [21,32]. Several studies with children and adults have identified that high trait or state anxiety is associated with attentional bias toward threat and negatively-valenced cues [23,34,35], with anxious individuals displaying faster identification of targets displayed in the same location as an emotionally-valenced cue word or picture. Data on attentional biases among dysphoric or depressed individuals is more mixed, but there is also evidence for selective attention biases. Individuals with or at risk for depression have demonstrated selective attention biases toward negative word and face stimuli [16,36,37]. Interestingly, the allocation of attention toward positive stimuli might also be associated with internalizing disorders; individuals without depression tend to display selective attention towards positive stimuli, which may serve as a protective factor against negative mood states [12,37].

In addition to attentional biases towards emotional stimuli, difficulty disengaging from emotional stimuli may also confer risk for psychopathology. Prolonged engagement with negative stimuli may represent a failure to use effective emotion regulation strategies and result in lower recovery from negative mood in response to stress [12]. Koster has argued that longer response times to invalid trials of emotional stimuli in exogenous cueing dot probe tasks may represent “impaired attentional disengagement” [32]. In at least two studies, researchers have found no evidence that dysphoric individuals selectively attended to negative stimuli any more quickly than non-dysphoric individuals, but instead that dysphoric individuals displayed difficulty disengaging from negative stimuli [32,38]. Fox and colleagues similarly found that highly anxious individuals took longer to detect invalid negative cues compared to neutral cues [34]. In contrast, healthy (never-depressed) controls tend to take longer to disengage from positive information than do depressed individuals [39], suggesting an adaptive prolonged attention to positive stimuli.

In addition to examining both selective attention and disengagement biases, it may also be important to examine the role of stress induction on activation of such information processing biases. Some studies have found that attention biases are sensitive to affective states and as such may not be detectable among nonclinical samples not subjected to mood or stress induction (e.g. [32,40]). Laboratory stressors may be an effective strategy for eliciting attention biases in nonclinical samples [33], although some studies have found attention biases among individuals at risk because of temperamental traits or disorder history [21,23,37].

The Current Study

This study tested a predicted association between high NA, low EC, and attentional biases toward negative stimuli among a sample of nonclinical early adolescents. Youth completed self-report measures of trait temperament and then an exogenous cueing dot probe task comparing selective attention toward and disengagement of attention from negative, positive, and neutral word stimuli. Given prior mixed findings with regards to whether attention biases may only be detected in mood-congruent conditions, the attention task was administered before and after a stress induction. We hypothesized that youth with high NA and/or low EC would display more selective attention toward negative stimuli and more difficulty disengaging attention from negative stimuli, and that this effect would be stronger following stress induction.

Materials and Methods

Participants

Participants were 114 youth, ages 10 to 14 years (M=12.88, SD=0.84, 52.5% female). The majority were Caucasian (79.1%), with smaller percentages identifying as Asian-American (8.2%), African-American (1%), Native American (1%), and biracial or multiracial (10.9%).

Procedures

The study involved school-based screening followed by a laboratory visit. Youth were invited to participate in screening if they were (1) aged 10 to 14 at the time of screening; (2) in 5th to 8th grades; and (3) if they and one parent were sufficiently fluent in English to complete study questionnaires. Parents provided consent and youth assent for screening. At screening youth completed measures of trait temperament and depressive symptoms. To maintain a nonclinical sample, youth and a parent were invited to the laboratory visit only if youths' self-reported depressive symptoms at the screening visit were below the clinical cut-off (see Method below). Approximately 88% of screened youth were eligible for the laboratory visit, which took place approximately two months following screening.

Laboratory visits were conducted by a team of two trained experimenters and lasted approximately 2.5 hours. Only procedures related to the current report are summarized. Youth participated in a 4 minute resting baseline period seated at the computer while viewing relaxing nature scenes. Following this acclimation period, youth completed the dot probe task. Then youth completed a 5 minute anagram stressor task[#]. Following the stressor task, youth completed the modified dot probe task again.

Youth were paid $30 and received a small gift for participation; parents were paid $50. In all, 125 youth participated in the laboratory visit. Data from 11 children were excluded from analyses because of missing self-report data (N=2) or missing attention task data (N=9), yielding the final sample N of 114.

Measures

Adolescent temperament: NA and EC were assessed using the Adolescent Temperament Questionnaire- Revised (EATQ-R; [41]). This self-report measure includes 60 items intended to assess a range of temperamental traits in youth ages 9 to 15. Individual items were scored on a 5 point Likert scale, ranging from 1 (almost always untrue of me) to 5 (almost always true), with higher scores indicating greater trait NA or EC.

The NA subscale was used to measure trait level negative affectivity. The NA subscale is composed of 21 items reflecting three temperamental constructs comprising NA: frustration (e.g. "It bothers me when people are slow at getting ready for things"), shyness (e.g. "I am very shy"), and fear (e.g. "I feel scared when I enter a dark room at home."). Scores were computed as a weighted average across items. Cronbach's alphas range between 0.65 and 0.82 [42]. Cronbach's alpha for our study was 0.82.

The EC subscale was used to measure trait level effortful control. The EC subscale is composed of 26 items which reflect three temperamental constructs comprising EC: activation control (e.g. "If I have a hard assignment to do, I get started right away"), attention (e.g. "It is really easy for me to really concentrate on homework problems"), and inhibitory control (e.g. "I can stick with my plans and goals"). Scores were computed as a weighted average across subscale items. Internal consistency for the self-report scale has been found to be adequate [41]. Internal consistency for our study was 0.87.

High and low trait NA and EC were identified using median splits on the scale scores.

Depressive symptoms: Depressive symptoms were assessed using the Children's Depression Inventory (CDI-2; [43], a 28-item self-report measure designed to assess current symptoms among youth ages 8 to 17. Questions are composed of sets of three responses representing a range of symptoms; for example, youth choose between *I am sad once in a while, I am sad many times,* and *I am sad all the time.* Responses representing low symptomatology are assigned a score of 0, items representing borderline symptomatology are assigned a 1, and symptom level items are assigned a 2. Depression symptom scores were calculated by summing responses for all items, with total scores ranging from 0 to 56, with higher scores indicating more symptomatology. A clinical cut-off score of 14 is recommended for community samples; only youth with CDI scores of less than 14 at screening were invited to the laboratory visit. Youth with scores at screening of 14 or higher were referred to their school counselor for further assessment. The CDI-2 has demonstrated alphas ranging from 0.80 to 0.87 [43]. The internal consistency for the full CDI-2 for our sample was .88.

Attention biases: Attention biases were assessed through the use of a modified dot probe task [43]. Stimuli were presented on a 17 inch computer screen approximately 30cm from the participant, using Media Lab Direct RT software to program task administration.

Administration began with a set of instructions presented automatically, followed by the task trials. Each trial contained a white fixation cross which remained positioned between two white rectangular frames, set against a black background. These stimuli alone were presented at the beginning of each trial for 500 ms. We then introduced single word cues in one of the two frames for 1500 ms, following a paradigm used in emotional processing studies among youth and young adults

[32-34]. Word cues then offset and a 50 ms period elapsed. A white asterisk probe then appeared in one frame. Participants were instructed to indicate the location of the asterisk in the left or right frame, with the "Z" key indicating location in the left frame and the "M" key indicating location in the right. The asterisk remained on the screen until a response was detected. After a response, the next trial commenced immediately. The response latency for each trial was recorded.

Within the modified dot probe task, each trial is labelled either valid or invalid, with valid trials occurring when the word cue and the asterisk probe appear in the same frame, and invalid trials occurring when the cue and probe appear in different frames. To examine selective attention toward and disengagement from emotional stimuli, neutral, positive, and negative words used in previous studies were selected as cues and matched for word length [45,46]. Sample positive words include *eager, laugh* and *calm*; sample neutral words include *green, lock* and *carpet*; and sample negative words include *fail, guilty* and *stress*. For both blocks of 90 trials, participants were randomly presented 30 positive, 30 negative, and 30 neutral words. Each word valence included of 15 valid and 15 invalid trials. Each block takes approximately 4.5 minutes to complete.

An index of selective attention toward stimuli was computed as difference scores for response latency between valid trials for neutral stimuli and valid trials for positive or negative stimuli respectively (Neutral – Emotional). Scores were computed such that higher values indicate faster response latencies toward the emotional stimuli, e.g. a selective attention bias.

An index of disengagement of attention away from stimuli was computed as difference scores for response latency between invalid trials for neutral stimuli and invalid trials for positive or negative stimuli respectively (Emotional - Neutral). Scores were computed such that higher values indicate slower response latencies when the invalid target was emotional, e.g. difficulty disengaging attention.

Outlying latencies (under 50ms or over 1200ms) and incorrect responses were excluded from analysis.

Results and Discussion

Results

Variable means, standard deviations, and bivariate correlations for study variables are provided in Table 1.

	1	2	3	4	5	6	7	8	9	10	11	12	M	SD	Range
1. Sex	-	-0.166	0.161	0.111	-0.064	0.090	-0.100	-0.022	0.051	-0.006	0.066	0.107	52.5% female		
2. CDI		--	0.221*	-0.293**	-0.109	-0.144	0.050	-0.001	-0.174	0.019	-0.125	-0.127	4.525	4.135	0.00 – 19.00
3. Trait NA			--	-0.484**	0.005	0.138	0.159	0.143	-0.104	-0.035	-0.120	-0.301**	2.681	0.481	1.36 – 3.88
4. Trait EC				--	-0.124	-0.081	-0.111	-0.045	0.243**	0.147	-0.013	0.101	3.594	0.420	2.77 – 4.59
5. Pre-Stress SA-Neg					--	0.395**	-0.075	-0.018	0.087	0.069	0.131	0.120	-0.655	27.209	-69.33-66.73
6. Pre-Stress SA-Pos						--	0.016	-0.062	0.030	-0.020	-0.093	0.106	0.545	27.256	-95.40-68.89
7. Pre-Stress DIS-Neg							--	0.637**	0.066	-0.004	-0.049	-0.282**	-2.094	29.873	-151.62-100.53
8. Pre-Stress DIS-Pos								--	0.052	0.000	-0.043	-0.515**	0.125	29.822	-131.50-65.07
9. Post-Stress SA-Neg									--	0.585**	-0.018	0.043	0.522	37.119	-92.78 – 236.31
10.Post-Stress SA-Pos										--	-0.087	-0.027	0.896	45.682	-127.49-201.97
11. Post-Stress DIS-Neg											--	0.431**	-1.699	28.115	-72.28-86.26
12. Post-Stress DIS-Pos												--	3.516	31.168	-79.04-96.45

Note: SA=Selective Attention; DIS=Disengagement of Attention; Neg=Negative Stimuli; Pos=Positive Stimuli. *$p < 0.05$, **$p < 0.01$.

Table 1: Descriptive statistics and bivariate correlations among study variables.

To examine if attention biases varied as a function of condition and temperament, repeated measures ANCOVAs were conducted on each dependent attention variable. Condition (pre-stress and post-stress) was the within subjects variable; temperament (high and low NA and EC) were the between subjects variables; and sex and depressive symptoms were the covariates. Significant condition by temperament interactions were then examined using post-hoc pairwise comparisons using least significant difference tests to clarify simple effects adjusting for multiple comparisons.

Attention biases for negative stimuli: For valid trials indexing selective attention to negative stimuli relative to neutral stimuli, the repeated measures ANCOVA indicated a significant Condition x NA interaction, F (1,109)=5.894, p=0.014, and a significant Condition × EC interaction, F (1,109)=4.144, p=0.045. The Condition × NA × EC interaction was not significant, F (1,109)=1.792, p=0.184.

Examination of the simple slopes indicated that the high NA youth displayed a non-significant increase in selective attention for negative stimuli from pre- to post-stress (mean difference=7.694, SE=6.338, p=0.228), while the low NA youth displayed a significant decrease in selective attention for negative stimuli from pre- to post-stress (mean difference=-14.321, SE=6.478, p=0.029). Similarly, pairwise comparisons indicated that the group difference between high and low NA youth on selective attention for negative stimuli was significant only post-stress (mean difference=13.934, SE=6.345, p=0.031) but not pre-stress (mean difference=-8.081, SE=6.089, p=0.188). Figure 1 (top).

Similarly, examination of the simple slopes indicated that the low EC youth displayed a significant increase in selective attention for negative stimuli from pre- to post-stress (mean difference=12.674, SE=6.528, p=0.050), while the high EC youth displayed a nonsignificant decrease in selective attention for negative stimuli from pre- to post-stress (mean difference=-6.048, SE=6.380, p=0.346). Pairwise comparisons, however, indicated that the difference between high and low EC youth on selective attention for negative stimuli did not reach significance at either pre-stress (mean difference=-8.770, SE=6.175, p=0.159) or post-stress (mean difference=9.951, SE=6.435, p= 0.125). Figure 1 (middle).

For invalid trials indexing disengagement of attention from negative stimuli relative to neutral stimuli, the repeated measures ANCOVA indicated no significant interactions between Condition and NA, EC, or NA × EC (all Fs<1.00, all ps>0.20).

Attention biases for positive stimuli: For valid trials indexing selective attention to positive stimuli relative to neutral stimuli, the repeated measures ANCOVA indicated no significant interactions between Condition and NA, EC, or NA × EC (all Fs<1.00, all ps>0.20).

For invalid trials indexing disengagement of attention from positive stimuli relative to neutral stimuli, the repeated measures ANCOVA indicated a significant Condition × NA interaction, F (1,109) =4.288, p=0.041. Examination of the simple slopes indicated that the high NA youth displayed a nonsignificant decrease in disengagement bias from pre- to post-stress (mean difference =-5.705, SE=5.806 p=0.328), indicating somewhat faster time to disengage from positive stimuli following stress. By contrast, the low NA youth displayed a non-significant increase in disengagement bias from pre- to post-stress (mean difference=6.943, SE=5.934, p=0.245), indicating somewhat slower time to disengage from positive stimuli following stress. Pairwise comparisons indicated that the group difference between high and low NA youth on disengagement of attention from positive stimuli was significant only post-stress (mean difference=14.953, SE=6.104, p=0.016) but not pre-stress (mean difference=2.304, SE=5.654, p=0.685). Figure 1 (bottom).

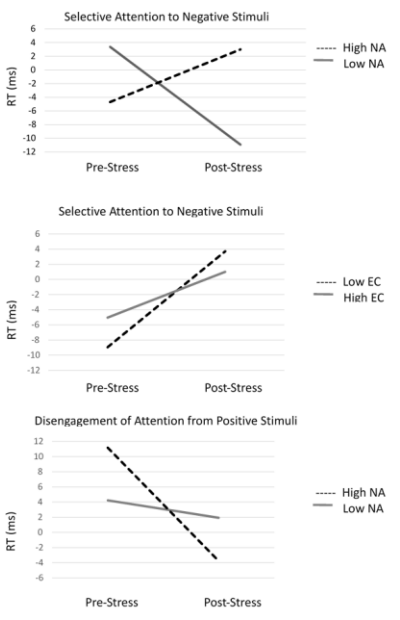

Figure 1: Attentional biases (in ms) as a function of negative affect (NA) and effortful control (EC). High and low temperament groups represent median splits. Higher scores represent more attention bias for the emotional stimuli relative to neutral stimuli in milliseconds; higher scores for Selective Attention represent faster identification of emotional stimuli relative to neutral in valid trials while higher scores for Disengagment of Attention represent slower identification emotional stimuli relative to neutral in invalid trials.

Discussion

The purpose of the current study was to examine whether trait NA and/or trait EC predicted attention biases before and in response to an induced stress paradigm among early adolescents. Our results indicate that, compared to low NA youth, high NA youth were more likely to selectively attend to negative stimuli following stress induction. Similarly, compared to high EC youth, low EC youth were more likely to display a significant increase in selective attention for negative stimuli following stress induction. Finally, high NA youth disengaged attention from positive stimuli significantly faster than low NA youth following stress induction. These results are consistent with the premise that trait temperament may make some youth more vulnerable to maladaptive attentional processes when faced with stressful or emotion-eliciting situations. However, our results show some divergence from prior findings that bears examination as well.

Current literature indicates that high trait NA is associated with internalizing disorders and that low trait EC is associated with deficits in mood regulation [17]. Similarly, extensive research has shown that the effect of temperament on mental health outcomes is partially mediated by cognitive emotion regulation strategies. Individuals with high trait NA and low trait EC are more likely to ruminate, display cognitive appraisal biases, and activate negative cognitive content in response to stress [19,47]. Although extensive research has demonstrated that currently anxious or depressed individuals display attention biases, less research has examined predictors of such biases. We hypothesized that children with temperamentally high levels of negative emotions and poor regulatory capacity might have difficulty regulating their attention, but that this effect might be specific to situations in which negative affect has been elicited. Consistent with our hypotheses, trait NA and EC were not significant predictors of attention biases prior to stress induction.

However, as expected, following stress induction youth with high NA or low EC demonstrated the greatest selective attention to negative stimuli, and youth with high NA displayed the fastest disengagement of attention from positive stimuli. However, our results differ from those of Lonigan et al. [21] and Susa et al. [23] in that we found main effects for reactive and regulatory components of temperament independently, but no interaction between NA and EC, and we only found effects following stress induction. Our study methodology differed in that our stimuli were broadly negative word stimuli rather than specific threat [21] or anger [23] stimuli; we also used the entire spectrum of temperamental traits rather than an extreme groups approach. Among a nonclinical sample with a broad representation of temperament traits, we may have had reduced power to detect interaction effects of temperament or effects of temperament in non-emotional situations. However, our sample does lend itself to an increased knowledge of the developmental pathway of nonclinical youth toward biased attention, which suggests that even within a normal range of temperament youth with relatively higher NA or lower EC may be susceptible to attention biases when faced with stressful situations.

Our finding that high NA youth were more rapid to disengage attention from positive stimuli is also consistent with the premise that individuals with or at risk for depression may lack the bias toward positive stimuli that characterizes healthy, non-depressed individuals [39]. Again, this disengagement bias was only significant following stress induction, suggesting that nonclinical high NA youth attend to stimuli in a similar way as low NA youth under non-stressful conditions, but may display more dysregulation in their attention when faced with stress. In particular, our results suggest that high NA youth may lack the ability that low NA youth have to regulate their attention in adaptive ways when faced with stress. For both selective attention to negative stimuli and disengagement of attention to positive stimuli, the significant difference between high NA and low NA youth was attributable primarily to the fact that low NA youth deployed more adaptive attention allocation post-stress – selectively attending away from negative stimuli and sustaining attention longer to positive stimuli.

Limitations and Future Research

Our study extends the current literature by examining the activation of attentional biases in response to an emotion-eliciting stressful situation among a sample of nonclinical adolescents. However, there are several important limitations to this study. First, it is important to note that our screening procedure was specific to identifying a sample nonclinical for depression but not anxiety. Although these symptom dimensions are highly correlated in youth, we did not control for or assess anxiety symptoms specifically. Second, youth self-reported on their temperament and other reporters or observational assessments would strengthen future research. Future studies should also examine attentional biases in response to positive mood induction to further explore temperamental vulnerabilities and selective attention to positive stimuli. Third, although our theory might suggest that the effect of temperament on attention biases might be mediated by state affective reactivity to the stress induction, we did not test this mediation model in the current study. Clasen et al. [11] have suggested that mood-induced attentional biases might be a product of state affect but may also contribute to state affect trends, and testing both of these hypotheses was beyond the scope of this brief report. However, future analyses should examine whether in fact it is dysregulated state affect that links temperament with dysregulated attention following stress or mood induction. Despite these limitations, the findings in the current study contribute to a more comprehensive understanding of temperamental vulnerabilities and attentional biases among youth.

Conclusions

Within a nonclinical sample, youth within a normal range of temperament displayed susceptibility to maladaptive attentional biases after a stress induction. Specifically, high trait NA and low trait EC may make some youth more vulnerable to maladaptive attentional processes, such as selectively attending to negative stimuli and disengaging from positive stimuli, when they encounter stressful or emotion-eliciting situations.

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[#]The anagram task included 5 solvable and 15 unsolvable word anagrams. Following the task, regardless of actual score, all youth were informed they had answered less than 25% of the items correctly. As a manipulation check to ensure that the stressor task was successful in inducing stress, youth completed the Positive and Negative Affect Scale (PANAS) before and after the task. Paired samples t-test indicated that youth reported significantly more negative affect after the task ($t=5.681$, $p<0.001$).

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