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Cognitive Style Moderates Attention to Attribution-Relevant Stimuli

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Abstract

Individuals with negative cognitive style are at high risk for depressive disorders; however, the mechanisms linking cognitive vulnerability to depression are not fully understood. Here, we use an attentional blink task to test whether stimuli associated with negative attributions are especially salient to individuals with high negative cognitive style. We found that individuals high in negative cognitive style were able to attend to negative attribution words during a period of time when attentional resources would ordinarily be depleted. These individuals were not more likely than those with low or moderate negative cognitive style to detect neutral and negative non-self-relevant words during this period. These data suggest that cognitive style modulates the saliency of material that is relevant to negative attributions, and these alterations in information processing may link cognitive style to development of depression.

Keywords

Cognitive style; Cognitive vulnerability; Attentional blink; Depression; Emotion regulation

Introduction

Negative cognitive style represents a vulnerability factor for depression. Individuals with negative cognitive style tend to make inferences that negative life events have stable and global causes, believe these events have significant negative consequences for the future, and believe these events reflect negative self-characteristics (Abramson et al. 1989). This cognitive style precedes and predicts depressive illness, but little is understood about the relationship between the process of making stable and global inferences about negative life events and maladaptive emotion regulatory strategies observed in depression.

This experiment attempts to bridge the research that has focused on trait-like vulnerability factors for depression, such as negative cognitive style, with research on dynamic automatic attentional processes that have been linked to emotional regulation. Despite considerable evidence that negative cognitive style confers risk for depression (see Abramson et al. 2002 for review) and that on-line automatic attentional processes play a critical role in emotion regulation (e.g., Rothbart et al. 2006), it remains unclear if individuals high in negative cognitive style show alterations in automatic attention to emotional information. Our reasoning is that individuals with frequent activation of thought content related to negative attributions may learn to automatically attend to environmental cues that are consistent with negative interpretations, which may in turn disrupt emotion regulation.

Information Processing Anomalies as Risk Mechanisms

Individuals high in negative cognitive style exhibit a trait-like pattern of interpreting negative life events as unsolvable and catastrophic, and this style is highly stable once developed (Romens et al. 2009). Yet cognitive style theory differentiates between distal and proximal influences on risk processes (Abramson et al. 1989). Distal influences of cognitive style are the trait-like factors that confer general risk, while proximal influences are the specific thoughts and interpretations triggered by a discrete negative life event. Because individuals with negative cognitive style engage in frequent activation of negative attribution-relevant thought content, they may automatically attend to attribution-relevant stimuli in the environment because it is salient and consistent with typical thought processes; this would reflect a stable, distal influence of negative cognitive style on attention. These individuals may have a highly trained information-processing network for attribution-relevant thoughts and stimuli, and this network could influence attention processes for negative attribution-relevant stimuli even in the absence of a triggering negative event. Alternatively, individuals high in negative cognitive style may automatically attend to attribution-relevant stimuli only after a triggering negative event, because that is the only time these stimuli are salient; this would reflect a proximal influence of cognitive style on automatic attention.

Attentional processes play a critical role in the regulation of emotion. As one example, focusing visual attention on positive and negative social cues leads to protection from or exacerbation of negative affect in response to a negative event, respectively (Isaacowitz et al. 2009; Gross and Thompson 2007). Furthermore, attention to emotional stimuli is altered in disorders related to emotion regulation, such as depression (Eizenman et al. 2003; Gotlib et al. 2004). Although much research has focused on attentional processes as a top-down regulator of emotion, automatic attention processes may also influence emotion regulation (Rothbart et al. 2006). For example, differences in automatic attention may affect what environmental stimuli are subject to more elaborative processing and influence subsequent behavior. Therefore, we reasoned that attentional processes may serve as a mechanism linking negative cognitive style with the types of disrupted emotion regulation observed in individuals with depressive disorders.

To test this theory, we employed an attentional blink (AB) paradigm. In this procedure, individuals are directed to detect two target words or pictures from a stream of rapidly presented distracter stimuli. A critical feature of this experimental paradigm is that the first target stimulus draws an individual's attentional resources. Because of this attentional draw, individuals usually cannot attend to a second target stimulus if it is presented within 500 ms after the first target. This "blink" in attention thus reflects a limitation of attentional resources—during those 500 ms it is believed that attentional resources are sufficiently encumbered by the first stimulus that the second stimulus is not processed (Chun and Potter 1995). This limitation in attentional resources is hypothesized to be due to a two-stage visual processing system that involves initial shallow processing followed by in-depth processing

for each attended visual stimulus. If a first stimulus is occupying resources for in-depth processing, a second stimulus cannot be processed at a deep enough level for identification (see Shapiro et al. 1997 for review).

However, one compelling feature of the AB phenomenon is that highly arousing or personal stimuli can “break through” the blink period. When this occurs, stimuli presented within the 500 ms blink period that would otherwise go unnoticed are indeed detected (Anderson 2005; Keil and Ihssen 2004). For example, when individuals high in trait anxiety are presented with threatening words, they are able to detect the threat words within the blink period (Fox et al. 2005). This suggests that some stimuli have special attentional status for some individuals and are more easily attended. Thus, individual differences in personal saliency of stimuli have been shown to modulate the AB, suggesting that this procedure is useful for measuring individual differences in stimulus salience.

The Current Study

We predicted that individuals high in negative cognitive style would better attend to negative attribution-relevant words. In this manner, negative attribution words, because they are salient and congruent with the participants’ ongoing thought processes, would break through the AB period and be detected. In contrast, individuals low in negative cognitive style should not attend to these same words if they occur during the attentional blink period. Additionally, cognitive style theory suggests that attributional biases could be due to either distal or proximal influences of cognitive style. Therefore, we also conducted an exploratory manipulation to test whether a mild negative event would alter AB performance. To do so, we exposed half of the participants to a mildly negative experience just prior to testing.

Method

Participants

We began by screening a large sample of 535 undergraduate college students using the Cognitive Style Questionnaire (CSQ; Alloy et al. 2000). The CSQ assesses the internality, stability and globality of causal attributions, inferred consequences, and implications about self-worth and has been validated in numerous other studies (see Haeffel et al. 2008 for review). The shortened version administered in the current study consisted of 12 hypothetical negative events and 3 hypothetical positive events (α for negative events = .96, $n = 95$), and only negative event items were used to calculate CSQ scores (positive events were included to provide a more neutral questionnaire to participants). Individuals were recruited to participate in this experiment if their cognitive style score was in the highest or lowest 15th percentile of scores (based on data from Alloy et al. 2000), to create high- and low-risk groups, respectively. We chose to select high- and low-risk groups based on cutoffs used in previous studies to ensure that our sample represented individuals with previously established estimates of prospective risk for depression (Alloy et al. 2000). We subsequently recruited and tested a group of individuals who scored within .75 standard deviations of the mean on the CSQ as a moderate-risk group to better interpret the performance of the very high and very low risk individuals.

The final sample included 96 participants (31 males, 65 females), with 36 low-risk, 25 moderate-risk, and 35 high-risk participants. All individuals who scored in the predetermined ranges on the CSQ were contacted to participate ($n = 152$), and the final sample represents those who subsequently completed the full study and who were included in final analyses. Seven low-risk, 5 moderate-risk, and 9 high-risk participants were excluded from final analyses because they reported recognizing the experimental manipulation involved in exposure to the negative event.

The majority of participants were ages 18–19 (70.8%, $n = 68$), and other participants were ages 20–22 (26%, $n = 25$), 23–25 (1%; $n = 1$), and older than 26 (1%, $n = 1$). The majority of participants self-identified as Caucasian/non-Hispanic (84.4%, $n = 81$), and other participants self-identified as Asian (7.3%, $n = 7$), Hispanic (4.2%, $n = 4$), or Other/Prefer not to respond (4%, $n = 4$). Participants were undergraduate students either enrolled in an introductory psychology course who signed up to participate in order to receive extra credit in their course or who agreed to be contacted for paid research studies as part of a university database.

Measures

Because previous studies suggest that an individual's current mood can affect attention to emotional information (Eizenman et al. 2003; Gotlib et al. 2004), and because depressive symptoms and negative affect may be related to level of negative cognitive style, we measured depressive symptoms at the initial screen and negative affect on the day of testing to allow us to control for these potential confounds. Participants completed the Beck Depression Inventory (BDI; Beck et al. 1961; $\alpha = .84$) during the initial screening to assess depressive symptoms. At the start of the experimental session, participants completed the Positive and Negative Affect Schedule (PANAS; Watson et al. 1988; $\alpha = .75$) to assess current negative affect.

Procedure

Two to 12 weeks after completing the screening questionnaires, participants returned to the lab to complete the experimental measures. Participants completed the PANAS, and we informed participants that they would “complete two tasks related to intelligence” in order to heighten motivation for the tasks and increase personal relevance of the manipulated positive or negative event. Participants were randomized to either a successful or unsuccessful anagram condition meant to give them the experience of a positive or negative life event, respectively. After the anagram task, participants then took a 10-minute break alone in the experimental room, and then completed the attentional blink (AB) task. After the anagram task, participants were fully debriefed by the experimenter.

Anagram Task—Participants were given one minute to generate new words using letters in each of ten words. After each word, participants received pre-determined feedback that their performance was in the top (for the successful group) or bottom (for the unsuccessful group) 17th–25th percentile of college students. Participants completed ten trials of the anagram task, with consistently negative or positive feedback across trials.

Attentional Blink (AB) Task—Participants viewed a continuous rapid serial visual presentation (RSVP) of 15 words. Each RSVP contained two target words presented in green font and 13 distracter words presented in black font. At the end of each RSVP, participants responded to prompts to identify each green target word by typing those words on a keyboard. Each stimulus was presented for 130 ms. Target words were randomly presented 2–5 positions from each other, with lags of 260, 390, 520, and 650 ms between the first (T1) and second (T2) targets (see Fig. 1 for visual representation of AB task). Words were presented in pseudorandom order to ensure second target type was not the same for more than three consecutive trials. There were three experimental blocks, for a total of 156 trials.

Because the AB occurs for approximately 500 ms, we expected individual differences in attenuation of the AB to emerge at the 260 or 390 ms intervals between T1 and T2 words. (Attenuation of the AB effect is unlikely to be observed at 520 or 650 ms, as most participants should have recovered full attentional resources; Anderson 2005).

T1s were 78 neutral words (e.g., “fabric”) and T2s were 26 neutral, negative and non-self-relevant (e.g., “danger”) or negative attribution words (e.g., “failure”). Distracter words were neutral and longer than target words (see Anderson 2005 for distracter list). Neutral and negative non-self-relevant words were selected from the Affective Norms for English Words (ANEW) database (Bradley and Lang 1999). Distracter words were taken from Anderson (2005) and negative attribution words that were relevant to negative cognitive style were generated by the authors.

Target stimulus word categories were matched on word length, written word frequency, and orthographic neighborhood (see Table 1). When available, arousal and valence ratings were obtained from the ANEW database. For words not in the ANEW database, arousal and valence ratings were obtained from 45 undergraduate students who did not participate in the current AB experiment. To obtain these ratings, negative non-self-relevant, negative attribution, neutral, and happy words were randomly listed in a questionnaire (happy words were included to create a more neutral questionnaire for participants). Participants rated each word for arousal and valence on a 9-point scale, from “not at all arousing” to “very arousing” and from “very negative” to “very positive”, respectively. 24 words (six from each T2 stimulus category) were excluded after pilot testing indicated they were poorly detected in the AB paradigm.

Results

To test our hypotheses, we conducted an omnibus 3 (cognitive style: high, moderate, low) $\times$ 2 (feedback condition: negative, positive) $\times$ 3 (word condition: negative attribution, negative and non-self-relevant, neutral) $\times$ 4 (target lag: 260, 390, 520, 650 ms) mixed ANOVA on percentage of T2s correctly identified (contingent on correct identification of T1) on the attentional blink (AB task). There was a trend for participants to differ in BDI scores based on negative cognitive style, $F(2, 93) = 2.50$, $P = .08$, and there was a significant linear increase in BDI scores with increased negative cognitive style, $F(1, 93) = 4.60$, $P = .03$. Participants differed in PANAS negative scale scores based on negative cognitive style, $F(2, 95) = 6.44$, $P = .002$, such that there was a linear increase in PANAS negative scale scores with increased negative cognitive style, $F(1, 95) = 12.54$, $P = .001$. Because altered attention for emotional stimuli has been previously observed in individuals with depressed mood and affect, both BDI and PANAS scores were included as covariates. Descriptive statistics for all questionnaire measures are included in Table 2.

Before examining our specific hypotheses, we confirmed that our procedure produced the expected AB effect. As expected, participants identified T1s ($M = 92\%$), but their accuracy was lower for T2s ($M = 76\%$). Also consistent with prior studies of AB performance, accuracy for T2s improved as the time between T1 and T2 increased, reflecting attentional recovery, $F(3, 258) = 10.30$, $P < .001$. Data on subjects’ performance is presented in Table 3.

We next tested our prediction that individuals high in negative cognitive style would show an attenuated AB for negative attribution words compared to neutral and negative non-self-relevant words relative to other cognitive styles, even when controlling for the influence of current depressive symptoms and negative affect. There was a trend toward a 3-way interaction among cognitive style, word condition, and target lag, $F(12, 516) = 1.64$, $P = .08$ (see Fig. 2), which was significant when not controlling for current depressive symptoms, $F(12, 534) = 1.79$, $P = .05$. A series of planned follow-up paired sample t -tests confirmed that, as predicted, individuals high in negative cognitive style correctly identified more negative attribution than neutral T2 words ($t [34] = 2.45$, $P = .02$, Cohen’s $d = 0.84$) and more negative attribution than negative non-self-relevant T2 words ($t [34] = 2.32$, $P = .03$,

Cohen's $d = 0.80$) at an interval within the 500 ms AB window (390 ms behind T1 words). T2 identification for each word type was equivalent at all other target lags. Furthermore, a follow-up one-way ANOVA (controlling for BDI and PANAS) revealed a between-group difference for cognitive style on negative attribution T2 identification within the AB window (390 ms behind T1 words), $F(2, 89) = 4.04$, $P = .02$. Individuals high in negative cognitive style correctly identified more negative attribution T2 words at 390 ms than individuals low ($t [69] = 2.82$, $P = .006$; Cohen's $d = 0.68$) or moderate ($t [58] = 2.00$, $P = .05$; Cohen's $d = 0.53$) in negative cognitive style. Thus, the first component of our hypotheses was confirmed: individuals high in negative cognitive style detected more negative attribution words during the AB period than individuals moderate and low in negative cognitive style, even when controlling for the influence of current depressive symptoms and negative affect.

The second component of our hypotheses, that those individuals low in negative cognitive style would show the effects of the blink period and not detect these words, was also confirmed. Individuals low in negative cognitive style identified *fewer* negative attribution ($t [35] = 2.36$, $P = .02$, Cohen's $d = 0.80$) and *fewer* negative non-self-relevant ($t [35] = 2.26$, $P = .03$, Cohen's $d = 0.76$) than neutral T2 words at an interval within the AB window (390 ms behind T1 words). Individuals low in negative cognitive style also identified more negative attribution than negative non-self-relevant T2 words that occurred after a greater lag (520 ms behind T1 words, $t [35] = 2.39$, $P = .02$, Cohen's $d = 0.81$). At the longest lag (650 ms behind T1 words), individuals low in negative cognitive style identified more negative attribution than neutral T2 words ($t [35] = 2.64$, $P = .01$, Cohen's $d = 0.89$) and negative non-self-relevant T2 words ($t [35] = 2.85$, $P = .007$, Cohen's $d = 0.96$). Effects outside the 500 ms AB period are unlikely to be related to AB phenomenon and instead may represent a bias in attention related to response bias or top-down influences on selective attention. In contrast to either extreme group, individuals moderate in negative cognitive style showed no differences in T2 word identification based on word condition at any target lag, suggesting an effect of cognitive style on attention at both ends of the continuum.

Our experiment was also designed to explore the influence of positive or negative events on AB performance. However, the feedback manipulation did not have a main effect on AB task performance or interact with cognitive style to influence AB task performance (main effect and all interactions involving feedback $P < .05$). Indeed, the trait measure of cognitive style was the robust predictor of attention across both the positive and negative feedback conditions.

Discussion

The current study was designed to examine whether negative cognitive style was related to altered attentional processes that may confer risk for disrupted emotion regulation processes associated with depression. We found that individuals high in negative cognitive style better attended to negative attribution-relevant words during an epoch when attentional resources would ordinarily be depleted. These data suggest that for these individuals at risk for depression, environmental stimuli that are congruent with their negative attributions are salient. These individuals may have a well-learned information-processing network for attribution-relevant thoughts and stimuli, such that these features in the environment are easier for them to detect and require less attentional resource allocation (Keil and Ihssen 2004). This may serve as a step linking trait measures of cognitive style and the development of depressive disorders.

These results are among the most specific in the extant literature on attention in individuals at-risk for depression. Individuals with high negative cognitive style attended more to

negative attribution words than to non-self-relevant negative or neutral words. The attenuated attentional blink (AB) effect for negative attribution words cannot be explained by the heightened salience of emotional words in general because negative non-attribution words did not attenuate the AB for individuals high in negative cognitive style. Second, these results were not explained by participant's depressive symptoms or negative affect because differences based on cognitive style were present even when controlling for symptoms and affect. Third, these findings also show temporal consistency with the experimental literature on cognition, with the attenuation of the AB effect occurring within the 500 ms window after participants engaged attention to a prior stimulus.

These effects were not influenced by the positive or negative feedback given to participants prior to testing, suggesting that the findings may relate more to stable trait-like aspects of cognitive style rather than the transient process following immediate experiences. Of course, such speculation requires further evidence because it is possible that our feedback manipulation was simply not salient enough to influence attentional performance. Alternatively, it is possible that participating in a performance task that involves feedback of any kind is sufficient to activate proximal influences of negative cognitive style on information processing. Future studies should compare attentional patterns at baseline and after a negative event to clarify the role of triggering negative events.

Alterations in automatic attention processes, such as those observed in the present study, may impact emotion regulation processes (Rothbart et al. 2006). Only stimuli that are allocated attentional resources early in processing can be further processed; therefore, those individuals high in negative cognitive style may further process and modify behavior based on negative environmental cues, leading to greater disruption in top-down emotion regulatory processes. Indeed, previous research suggests that individuals high in negative cognitive style also have disruptions in other forms of information processing that are more subject to top-down regulatory processes, such as memory (Alloy et al. 1997). Additionally, the fact that individuals high in negative cognitive style are more likely to become depressed is clear evidence that emotion regulation is impaired. However, further research is required to demonstrate the role that attention plays in the emotion regulation of individuals high in negative cognitive style, and to specify more precisely how emotion regulation is disrupted (e.g., through increased use of rumination as a regulatory strategy).

While negative attribution words broke through the AB period for individuals high in negative cognitive style, it is intriguing that the AB effect for negative attribution words appeared to be even stronger (i.e. identification of these words was even lower) for individuals with extremely low cognitive style. One possible explanation for these results is that low cognitive style individuals represent a unique "invulnerable" group. These individuals may have found negative attributional stimuli to be highly incongruent with current processing and inconsistent with well-learned information processing, and therefore may have exhibited an avoidance of negative information. This observation is consistent with the hypothesis of "normative" positive biases in non-vulnerable populations (Mezulis et al. 2004), as well as previous research showing that individuals with no history of depression direct attention away from negative stimuli (McCabe et al. 2000). Given that participants with low, moderate, and high negative cognitive style showed distinct patterns of attention in the current study, it may be beneficial for future studies to include individuals that represent a full range of cognitive styles.

Although the majority of the effects of negative cognitive style on attention were observed while controlling for depressive symptoms, the range in depressive symptoms in the current study was low. Participants were undergraduate students, and the group of individuals high in negative cognitive style in the current study may represent a select group of high-

functioning individuals. However, the high-functioning status of participants in the current study works against our hypotheses, and we observed different patterns of attention based on cognitive risk even among individuals who were low in depressive symptoms. Of course, future research is needed to determine if the current results hold for a broader population of at-risk individuals.

In sum, individuals high in negative cognitive style show heightened attention to negative attribution-relevant stimuli, regardless of mood, affect, and the presence or absence of a negative event. The attentional salience of stimuli that are congruent with negative attributions appears to reflect trait-like information processing of individuals at risk for depression, perhaps reflecting a well-trained information processing network. This pattern of attention may highlight a mechanism linking cognitive vulnerability to development of depression.

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Fig. 1.
Schematic of part of one trial of the rapid serial visual presentation attentional blink task. Target words (*bold*) were shown in *green*. T1 was always a neutral word, while T2 varied between neutral and negative attribution words. T1s and T2s varied in position on each trial

Fig. 2.

Mean percentage correct scores for T2 identification as a function of word condition (neutral, negative non-self-relevant, negative attribution), T1–T2 lag (260, 390, 520, 650), and negative cognitive style (low, moderate, high). AB performance for low, moderate, and high negative cognitive style groups are shown in panel A, B, and C, respectively

Table 1

Descriptive statistics (mean, standard deviation) of negative attribution and neutral words

	Neutral words	Negative words	Negative attribution words
Valence *	5.11 (0.47)	3.67 (0.66)	3.54 (0.85)
Arousal **	4.91 (0.57)	5.27 (0.55)	4.82 (0.39)
Length	5.35 (1.23)	5.04 (1.04)	5.08 (1.09)
Word frequency	23.96 (26.03)	17.23 (22.47)	22.00 (33.65)
Orthographic Neighborhood	4.15 (5.55)	3.81 (3.84)	4.19 (5.11)

Valence was rated on 9-point scale, with 1 as very negative and 9 as very positive. Arousal was rated on 9-point scale, with 1 as not at all arousing and 9 as highly arousing

* Difference between neutral compared to negative and negative attributional each significant at $P < .05$

** Difference between negative compared to negative attributional and neutral each significant at $P < .05$

Table 2

Mean Scores (and Standard Deviations) for Questionnaire Measures of Depressive Symptoms (BDI), Current Mood (PANAS Negative Scale), Negative Cognitive Style (CSQ Negative Scale), and Trait Rumination (RSQ Rumination Scale) for Low, Moderate, and High Negative Cognitive Style Groups

	Cognitive style					
	Low		Moderate		High	
	M	SD	M	SD	M	SD
BDI (sum)	5.50 (<i>n</i> = 36)	4.66	7.68 (<i>n</i> = 25)	6.24	8.36 (<i>n</i> = 33)	5.86
PANAS negative (mean item)	1.26 (<i>n</i> = 36)	0.26	1.38 (<i>n</i> = 25)	0.39	1.60 (<i>n</i> = 35)	0.52 *
CSQ (mean item)	2.75 (<i>n</i> = 36)	0.47	3.80 (<i>n</i> = 25)	0.29	4.57 (<i>n</i> = 36)	1.51 ***

* Difference between low and high negative cognitive style groups, *P* < .01

** Difference between low and moderate and low and high negative cognitive style groups, *P* < .01

*** Difference among all negative cognitive style groups, *P* < .01

Table 3

Mean Performance on the T1 Task and T2 Task (Contingent on T1 Success) for Low ($n = 36$), Moderate ($n = 25$), and High ($n = 35$) Negative Cognitive Style Participants

	Cognitive style					
	Low		Moderate		High	
	M	SD	M	SD	M	SD
T1% Correct	91.4	5.2	89.9	8.9	93.9	4.7
T2% Correct						
260 ms	58.7	18.6	59.9	19.5	65.8	18.5
390 ms	76.0	14.9	76.9	15.9	80.0	11.7
530 ms	79.6	13.6	81.6	13.2	82.2	10.4
650 ms	82.3	11.7	81.3	13.5	86.6	9.9