Research Article

MAKING SOMETHING OUT OF NOTHING: NEUTRAL CONTENT MODULATES ATTENTION IN GENERALIZED ANXIETY DISORDER

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Background: *Although an attentional bias for threat has been implicated in generalized anxiety disorder (GAD), evidence supporting such a bias has been inconsistent. This study examines whether exposure to different emotional content modulates attention disengagement and impairs the perception of subsequently presented nonemotional targets in GAD.* **Methods:** *Patients with GAD (n = 30) and controls (n = 30) searched for a target embedded within a series of rapidly presented images. Critically, an erotic, fear, disgust, or neutral distracter image appeared 200 msec or 800 msec before the target.* **Results:** *Impaired target detection was observed among GAD patients relative to controls following only fear and neutral distractors. However, this effect did not significantly vary as a function of distractor stimulus duration before the target. Furthermore, group differences in target detection after fear distractors were no longer significant when controlling target detection after neutral distractors. Subsequent analysis also revealed that the impaired target detection among those with GAD relative to controls following neutral (but not fear) distractors was mediated by deficits in attentional control.* **Conclusions:** *The implications of these findings for further delineating the function of attentional biases in GAD are discussed. Depression and Anxiety 28:427–434, 2011.*

Key words: *GAD; emotion; attention; attentional control*

The *Diagnostic and Statistical Manual of Mental Disorders* currently characterizes the defining features of generalized anxiety disorder (GAD) as excessive, uncontrollable worry across a variety of domains.[1] Although significant advances have been made in the description of GAD,[2] much remains unknown about the underlying etiological mechanisms of the disorder. An attentional bias favoring threatening information is one mechanism that has been implicated in the development of anxiety disorders,[3–5] including GAD. According to cognitive models,[6,7] anxiety is characterized by a hypervigilant mode of information processing. Anxiety prioritizes the initial automatic encoding of threat, leading to increased orienting toward and rapid detection of threat in the environment. Indeed, the modal finding in such research is increased allocation of attention to threatening stimuli, through biases in the orienting of attention (vigilance)[8] or in the continued engagement of attention (maintenance).[9] This attentional bias in GAD may operate to maintain excessive worry and anxiety because such patients are more likely to identify minor threat cues in the environment.

Attentional bias for threat in GAD may reinforce dysfunctional beliefs that the world is unsafe. This bias may reflect deficits in attention control, an individual

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difference trait that reflects the ability to regulate attention allocation.[5] This can be conceptualized as a "top-down" regulatory ability,[10] such that it inhibits the "bottom up" influence of emotional distractors.[11] Deficits in attentional control in GAD may be observed in two dimensions,[12] corresponding to the components of attention that may be brought under voluntary control. Attentional focus consists of one's ability to maintain attentional engagement in the face of distraction, whereas attentional shifting consists of one's ability to execute attentional disengagement, in order to shift attention away from a distraction or toward a new task. The inability to regulate the focus or shifting of attention in GAD may moderate the degree to which attention can be disengaged from threatening stimuli. Accordingly, attentional control may be construed as a higher-order regulatory mechanism controlling the characteristics of attention biases toward threat in GAD.

Several studies have provided support for the notion that an attentional bias for threat operates as a risk factor for the development of GAD.[13] For example, Mogg et al.[14] found that individuals with GAD were more likely to look first toward threat faces rather than neutral faces compared with controls and those with depression. A Stroop interference effect for negative emotional words among those with GAD compared to controls has also been found, suggesting that negative words interfere with attentional processes more in GAD.[15] However, findings from this body of research have been far from consistent. In one study,[16] participants viewed angry/neutral face pairs. Following the presentation of each face pair, subjects pressed a button to indicate whether a subsequent asterisk appeared on the same (congruent) or opposite (incongruent) side as the angry face. Reaction time differences between congruent and incongruent face trials provided a measure of attention bias to angry faces. This study found that those with GAD demonstrate an attentional bias *away* from angry faces. In contrast, other studies have found an attentional bias *toward* both angry and happy faces.[17,18] Moreover, several studies have failed to find any attentional bias for threat in GAD.[19–21]

The inconsistency in demonstrating an attentional bias for threat in GAD may be partially due to the frequent use of reaction times as an index of attentional bias, which is problematic because threatening stimuli slow reaction times regardless of attention processes.[22] Thus, previous inconsistencies in identifying the specific components of attentional dysfunction in GAD may be due to nonspecific effects of emotional stimuli in reaction time-based tasks. The inconsistency in demonstrating an attentional bias in GAD may also be partially attributed to the diffuse nature of worry concerns, as well as their idiosyncratic nature. Indeed, one of the most consistent findings differentiating patients with GAD from nonanxious controls is the degree of worry over seemingly idiosyncratic topics, such as being late for appointments or having car problems.[23,24]

Inconsistencies in demonstrating an attentional bias in GAD may also be partially due to the use of lexical stimuli in many studies; as such, stimuli often lack ecological validity and are confounded by differential frequency of use by GAD patients compared to controls.[17] GAD is increasingly being conceptualized in terms of deficits in affective regulation.[25,26] Valenced images may be more strongly related to affective information in GAD than words because, unlike words, images have privileged access to the system in which affective information is stored.[20,27] Recent investigations have addressed this limitation by employing pictorial images of threat.[28] However, such research is often limited by the unitary assessment of threat to include only fear stimuli. This is a concern as recent research suggests that different types of threat, for example, fear and disgust, are associated with a differential pattern of attentional processing.[29]

A more precise understanding of the components underlying attentional biases in GAD may also be informed by the use of novel experimental paradigms. The emotional attentional blink (AB) paradigm, a behavioral measure that probes attention at different time intervals through the rapid serial visual presentation (RSVP) of stimuli may be a good method for probing the emotional modulation of attention in GAD. The earliest RSVP tasks used nonemotional text stimuli which revealed diminished reports of the second target when attending to the first target, an effect termed the AB.[30] Most et al.[31] adopted this paradigm for use with emotional stimuli in order to determine the extent to which task-irrelevant emotional distractors induce an AB. On each trial of the task, participants attempt to accurately detect a rotated target image among a set of rapidly presented distractors. Critically, the target image appears 200 msec (Lag 2) or 800 msec (Lag 8) after the onset of an emotional distractor. The shorter lag time is specifically sensitive to attentional capture by emotional stimuli, typically causing large deficits in target detection. In contrast, at longer delay times, individuals are typically able to reengage their attention despite the earlier capturing of their attention. The findings revealed that attentional biases to emotional information induced a temporary inability to process stimuli that people actively sought. In this study, we employed this emotional AB paradigm in order to test the hypothesis that patients with GAD are excessively disrupted by emotional stimuli and to examine the extent to which these biases reflect initial capture or problems with disengagement. The AB paradigm may also be more ideal for addressing this hypothesis, given that it is not limited by reaction time as the dependent variable. This study also advances the current literature by testing performance following neutral, erotic, fear, and disgust stimuli, in order to test the level of effective specificity of observed effects.

METHOD

PARTICIPANTS

Participants consisted of 30 community adults who meet diagnostic criteria for GAD and 30 nonclinical controls (NCC). The *Structured Clinical Interview for the DSM–IV* (SCID-IV)[32] was administered by trained personnel that was supervised by a trained clinical psychologist to confirm diagnosis for all participants, with exclusionary criteria for the GAD group including a diagnosis of bipolar disorder, substance abuse, attention-deficit hyperactivity disorder, pervasive developmental disorders, mental retardation, or current or past neurological diseases. Many GAD patients had additional current Axis I diagnoses (47%), including 20% with major depressive disorder.

DIAGNOSTIC AND SYMPTOM ASSESSMENT

The SCID-IV[32] is a semi-structured interview for making the major DSM-IV diagnoses.

The *Penn State Worry Questionnaire* (PSWQ)[33] is a commonly used trait measure of anxiety intended to assess a person's overall tendency to experience worry. Participants respond to items using a five-point Likert scale anchored by "not at all typical" and "very typical." The PSWQ had good internal consistency in this study ($\alpha = .95$).

The *State-Trait Anxiety Inventory - Trait* (STAI-T)[34] is a 20-item measure of proneness toward experiencing distress and anxiety (trait anxiety). Each item is rated on a four-point Likert scale that ranges from "1 = never" to "4 = almost always." The STAI-T had good internal consistency in this study ($\alpha = .95$).

The *Beck Depression Inventory* (BDI)[35] is a 21-item self-report measure of depressive symptoms or dysphoria. Each item is rated on a four-point Likert scale that ranges from 0 to 3. The BDI had good internal consistency in this study ($\alpha = .91$).

The *Attentional Control Scale* (ACS)[12] is a 20-item measure of control of attention across two domains; *focusing*, the ability to maintain attention on a given task, and *shifting*, the ability to reallocate attention to a new task or to engage attention on multiple tasks. Each item is rated on a four-point Likert scale from "1" (almost never) to "4" (always), with higher scores indicative of better attentional control. The ACS had adequate internal consistency ($\alpha = .87$).

RAPID SERIAL VISUAL PRESENTATION TASK

The visual stimuli were images consisting of 168 distractor images drawn from four categories of emotional images (42 disgusting, 42 erotic, 42 fear evoking, 42 neutral), 252 upright landscapes/architectural filler images (appearing before the distractor, between the distractor and the target, and after the target), and 80 target images consisting of landscape/architectural photos where 40 rotated 90° to the left and 40 rotated 90° to the right. One trial consisted of 17 images, including one distractor image and one target image that was rotated 90° to the left or right (see Fig. 1). Each image was presented for 100 msec. Each trial consisted of a disgust (contaminated or diseased items, including roaches, feces, and maggot-ridden food products), fear (animals bearing teeth in a threatening manner, humans brandishing weapons, and explosions), erotic (nude male–female couples engaging in sexual scenarios),[1] or neutral (scenic in style, including both animals and humans) distractor image that appeared 200 msec (Lag 2) or 800 msec (Lag 8) before the rotated image.[2]

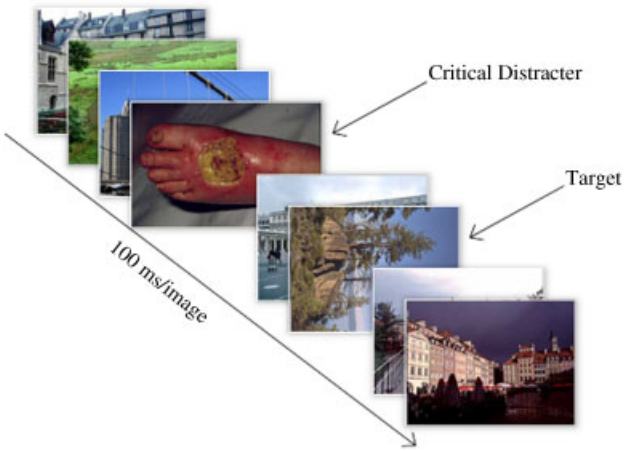

Figure 1. The trial procedure for the emotional attentional blink paradigm. Note that the distracter consisted of four distinct categories (disgust, erotic, fear, and neutral) presented at 200 and 800 msec time lags.

Fear, disgust, and neutral pictures were partially drawn from the International Affective Picture System (IAPS)[39] and were supplemented with similar images drawn from publicly available sources. These stimuli were selected based on fit for the given emotional category (face validity) as indicated by the IAPS. Erotic images were mainly obtained from publicly available sources and have been employed in previous research.[36] Participants completed six blocks with 28 trials per block. Of the total 168 trials, there were 42 trials for each distractor type with 2 trials per distractor type containing no target; the two lags were equally distributed for the 40 trials with targets present per distractor type. The position of the distractors was equally distributed by emotion category and lag positions in the RSVP stream. Participants were instructed to indicate if they saw a rotated (yes, no; *detection*) image and which direction it was rotated (right, left; *accuracy*). Participants received 16 practice trials to ensure mastery of the task, with 4 trials containing no rotated target image, 6 trials with the target image rotated to the right, and 6 trials with the target mage rotated to the left.

[1]Emerging research suggests that the arousal value of a stimulus, and not its valence (negative versus positive versus neutral), is more important for modulating attention.[36,37] Erotic (i.e., sexually explicit) stimuli in particular, which have high arousal value but minimal valence, have been found to affect attention to a greater degree than stimuli with negative valence.[38] Thus, erotic stimuli may be excellent stimuli to employ in attentional bias research among anxious populations to control arousal levels when examining the effects of valenced stimuli on attention.

[2]An independent sample of participants ($n = 23$; 65.2% female; 65.2% Caucasian, mean age = 20.35, $SD = 2.57$) rated each Disgust (valence = −24.69, $SD = 7.29$; arousal = 46.26, $SD = 14.65$), Erotic (valence = 4.45, $SD = 15.59$; arousal = 41.77, $SD = 20.42$), Fear (valence = −15.83, $SD = 7.17$; arousal = 31.98, $SD = 10.36$), and Neutral (valence = 4.87, $SD = 3.66$; arousal = 6.18, $SD = 5.05$) image for valence (−50 = extremely negative; +50 = extremely positive; 0 = being no positive or negative valence/neutral) and arousal (0 = none to 100 = extremely/most imaginable). A significant difference for valence ratings between disgust images and all other categories was found, such that disgust images were rated the most negative ($Ps < .001$). Fear images were rated as significantly more negative than erotic and neutral images ($Ps < .001$). However, the valence of erotic and neutral images did not significantly differ from each other ($P > .90$). Neutral images were rated significantly less arousing than all other images ($Ps < .001$). Fear images were significantly less arousing than disgust images ($P < .001$), but not erotic images ($P > .05$). Last, arousal ratings for disgust and erotic images did not significantly differ from each other ($P > .05$).

PROCEDURE

Participants were seated at a computer where they first completed the self-report questionnaires listed above and then the RSVP task.

RESULTS

PARTICIPANT CHARACTERISTICS

As shown in Table 1, GAD participants and NCCs were well-matched on gender, age, ethnicity, and education with no significant differences between the two groups (Ps > .05). However, a chi-square analysis for socioeconomic status was significant ($\chi^2 = 8.99$, $P < .05$), indicating generally lower income among those in the control group. A chi-square analysis for marital status was also significant ($\chi^2 = 7.68$, $P < .05$), indicating a higher portion of married participants in the GAD group. As expected, Table 2 shows that GAD participants reported significantly more severe symptoms of worry, trait anxiety, depression, and difficulty with attention control than NCCs (Ps < .001).

RSVP TASK ACCURACY

Means and standard deviations of percent accuracy on the RSVP by emotion, lag, and group are presented in Table 3. A 2 (Group: GAD, NCC) × 2 (Lag; 2, 8) × 4 (Emotion: disgust, fear, erotic, neutral) mixed model Analysis of Variance (ANOVA) on percent accuracy[3] revealed a significant main effect of Group [$F(1, 58) = 6.29$, $P < .02$, partial $\eta^2 = .10$], reflecting higher accuracy for NCCs relative to those with GAD, Lag [$F(1, 58) = 311.21$, $P < .001$, partial $\eta^2 = .84$], reflecting higher accuracy at Lag 8 than Lag 2, and Emotion [$F(3, 174) = 58.80$, $P < .001$, partial $\eta^2 = .50$], reflecting differential performance across stimulus categories. These main effects were qualified by significant Group × Emotion [$F(3, 174) = 2.88$, $P < .04$, partial $\eta^2 = .05$] and Lag × Emotion [$F(3, 174) = 61.60$, $P < .001$, partial $\eta^2 = .52$] interactions. The Group × Lag interaction [$F(1, 174) = 2.22$, $P = .14$, partial $\eta^2 = .04$] and the Group × Lag × Emotion interaction were not significant [$F(3, 174) = 1.53$, $P = .20$, partial $\eta^2 = .03$].[4]

Group differences as a function of emotion. To examine the Group × Emotion interaction, we performed *t*-tests for Group differences for each emotion (collapsed across two lags). As depicted in Figure 2, the extent to which NCCs outperformed GAD patients varied with emotion. NCCs showed greater accuracy than GAD patients after presentation of fear [$t(58) = 2.54$, $P < .02$] and neutral [$t(58) = 3.26$, $P < .01$] distractors.

TABLE 1. Demographic information by diagnostic group

	GAD	NCC
N	30	30
% female	50	50
Age	38.63 (11.26)	39.50 (10.29)
% Caucasian	86.7	73.3
% SES		
<$39,999	37.9	66.7
$40,000–$69,999	31.0	30.0
>$70,000	31.0	3.3
Marital status		
% married	65.5	30.0
% single	27.6	50.0
% divorced	6.9	20.0
Highest education level		
% high school	27.5	26.7
% college degree	37.9	46.6
% masters/doctorate	34.6	26.7

GAD, generalized anxiety disorder; NCC, nonclinical control.

TABLE 2. Means and standard deviation by group on symptom measures

Symptom measures	GAD *M* (*SD*)	NCC *M* (*SD*)	*t*	*d*
PSWQ	62.00 (10.34)	35.43 (8.67)	10.70	1.62
STAI–T	53.34 (10.24)	35.50 (8.73)	7.20	1.37
BDI	15.45 (8.55)	4.76 (4.69)	5.97	1.23
ACS	47.21 (8.46)	58.52 (6.72)	5.63	1.19

All *t*-values were significant at $P < .001$. GAD, generalized anxiety disorder; NCC, nonclinical control; PSWQ, Penn State Worry Questionnaire; STAI–T, State Trait Anxiety Inventory–Trait Subscale; BDI, Beck Depression Inventory; ACS, Attention Control Scale. Cohen's *d* was calculated as the difference between the mean scores in each group divided by the pooled standard deviation.

By contrast, group differences in percent accuracy failed to reach statistical significance for targets following disgust [$t(58) = 1.66$, $P = .10$] and erotic distractors [$t(58) = 0.64$, $P = .52$]. Given that GAD participants showed poorer accuracy following neutral stimuli, the extent to which a general deficit (as reflected by poor performance in the neutral condition) could explain poorer accuracy following fear stimuli was examined. These results revealed that the group differences in percent accuracy after presentation of fear distractors were no longer significant after controlling for group differences in percent accuracy following neutral distractors ($P = .84$).

The significant Group × Emotion interaction was also tested by examining percent accuracy after the emotional distractors for each group separately. A main effect of Emotion was found for GAD patients [$F(3, 87) = 49.91$, $P < .001$, partial $\eta^2 = .63$] and NCCs [$F(3, 87) = 16.02$, $P < .001$, partial $\eta^2 = .36$]. Subsequent pairwise comparisons revealed that percent

[3]Analyses for accuracy rather than detection are presented, as they reflect more precise performance on the RSVP. Furthermore, the pattern of findings did not differ when detection is employed as the dependent variable.

[4]The pattern of findings from the 2 (Group: GAD, NCC) × 2 (Lag; 2, 8) × 4 (Emotion: disgust, fear, erotic, neutral) mixed model ANOVA on percent accuracy was unchanged when controlling for the group differences in SES and marital status.

TABLE 3. Rapid serial visual presentation task means and standard deviations of accuracy percentage by emotion, lag, and group

	GAD				NCC			
Lag	Disgust *M* (*SD*)	Erotic *M* (*SD*)	Fear *M* (*SD*)	Neutral *M* (*SD*)	Disgust *M* (*SD*)	Erotic *M* (*SD*)	Fear *M* (*SD*)	Neutral *M* (*SD*)
2	56.81 (17.59)	41.25 (18.09)	66.81 (11.81)	67.22 (14.30)	60.42 (12.61)	38.75 (13.05)	71.25 (12.05)	78.05 (13.58)
8	69.86 (11.97)	75.83 (10.80)	71.11 (11.78)	73.89 (12.47)	75.28 (11.52)	81.80 (11.50)	79.58 (11.34)	81.25 (8.17)

GAD, generalized anxiety disorder; NCC, nonclinical control.

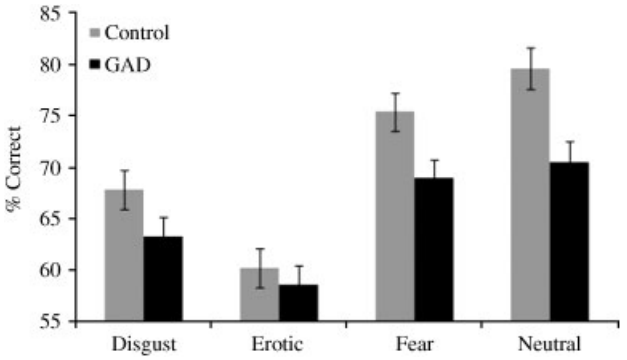

Figure 2. Percent accuracy by emotion and group. Bars represent standard error.

accuracy following neutral distractors did not significantly differ from percent accuracy following fear distractors for those with GAD ($P = .24$). Percent accuracy following disgust distractors was only marginally different from percent accuracy following erotic distractors among those with GAD ($P = .07$). Pairwise comparisons for percent accuracy following the remaining emotional distractors did significantly differ from each other in the GAD sample ($Ps < .01$). Among NCCs, percent accuracy was greatest following neutral distractors followed by fear, disgust, and erotic distractors. Furthermore, percent accuracy following the four emotional distractors differed significantly from each other ($Ps < .01$).

Emotional differences as a function of lag. To examine the Lag × Emotion interaction, a mixed model ANOVA on percent accuracy for the four emotional categories was performed separately at each lag. A main effect of Emotion was found at Lag 2 [$F(3, 177) = 72.74$, $P < .001$, partial $\eta^2 = .55$]. Pairwise comparisons revealed that percent accuracy after erotic distractors was significantly worse compared to disgust, fear, and neutral distractors ($Ps < .001$). Percent accuracy after disgust distractors was also significantly worse compared to fear and neutral distractors ($Ps < .001$). Percent accuracy after fear distractors was marginally worse compared to neutral distractors ($P = .07$). A main effect of Emotion was also observed at Lag 8 [$F(3, 177) = 9.37$, $P < .001$, partial $\eta^2 = .18$]. Pairwise comparisons revealed that percent accuracy after erotic distractors was significantly better compared to disgust and fear distractors ($Ps < .001$) but equal to neutral distractors ($P = .30$). Percent accuracy after disgust distractors was significantly worse compared to neutral distractors ($Ps < .001$) and marginally worse compared to fear distractors ($P = .07$). Percent accuracy after fear distractors was also marginally worse relative to neutral distractors ($P = .06$).

MEDIATION OF ATTENTIONAL CONTROL

Difficulty with attentional control has been implicated as a higher order mechanism that may confer risk for the development of GAD.[11] Using the recommendations of Baron and Kenny,[40] attentional control was examined as a mediator of the relationship between group (GAD versus NCC) and percent accuracy after fear distractors. Evidence of mediation requires the following conditions to be present: (a) a significant relationship between attentional control and group ($r = -.61$, $P < .01$), (b) a significant association between percent accuracy after fear distractors and group ($r = -.32$, $P < .02$), (c) a significant relationship between attentional control and percent accuracy after fear distractors ($r = .29$, $P < .03$), and (d) the statistically significant relationship between percent accuracy after fear distractors and group diminishes or disappears when attentional control is controlled. Pearson correlation coefficients indicated that conditions (a), (b), and (c) were met.

Condition (d), the critical test of mediation, was investigated by examining the magnitude of the relationship between group and percent accuracy, following fear distractors after controlling for attentional control. A two-step regression equation was estimated for percent accuracy after fear distractors by entering, in order, group and attentional control as predictors. The key comparison involved the change in standardized regression coefficients for group from step 1 (total effect) to step 2 (direct effect controlling for attentional control). As depicted in Figure 3A, the significant relationship between group and percent accuracy after fear distractors became nonsignificant after controlling for attentional control. Thus, all a priori conditions were met. However, examination of the Sobel test ($z = 0.98$, $P = .32$) suggests that the effect of group on percent accuracy after fear distractors is not transmitted via group differences in attentional control. A similar meditational analysis was conducted to determine if attention control mediated the relationship between

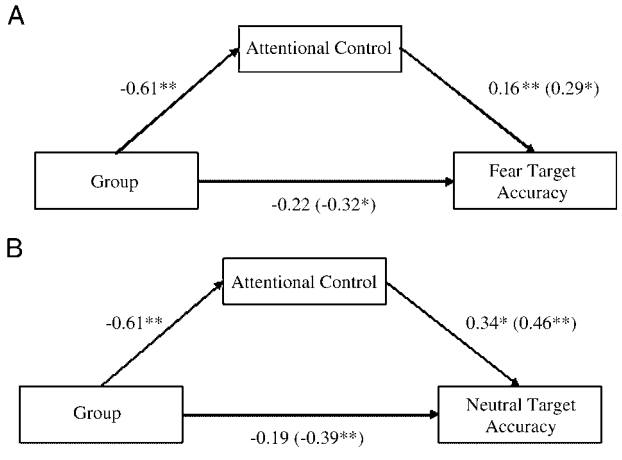

Figure 3. Attentional control as a mediator of the effect of Group (GAD versus NCC) on accuracy after fear (A) and neutral (B) distractors. Parenthetical coefficients represent the direct effects. Asterisks indicate significant relationships ($^{*}P<.05$, $^{**}P<.01$).

group (GAD versus NCC) and percent accuracy after neutral distractors. As shown in Figure 3B, this pattern of findings, along with a significant Sobel test ($z = 2.21$, $P<.03$), confirmed that the group difference in percent accuracy after neutral distractors is transmitted via group differences in attentional control.

DISCUSSION

This investigation examined the extent to which emotional stimuli modulate attention in GAD on an emotional AB paradigm. A main effect was observed such that patients with GAD were generally less accurate than NCCs in target detection accuracy in the RSVP task. The poorer target detection in GAD patients compared to NCCs may reflect a generalized attention control-related deficit that may be observed at multiple stages of information processing.[11] The emotional AB paradigm has the advantage over many attention paradigms in its ability to distinguish between sensitivity to attentional capture at shorter lags and problems with disengagement at later lags. Strikingly, patients with GAD showed worse performance at both lags, perhaps suggesting more generalized deficit in attention control. A significant Lag × Emotion in interaction was also observed, such that percent accuracy after erotic distractors was generally worse compared to other emotional distractors at Lag 2, but significantly better relative to other emotional distractors at Lag 8. This finding is consistent with prior research suggesting that emotional stimuli may impair intentional allocation of attention at early temporal stages, but at later temporal stages, emotional stimuli can have an enhancing effect on directed attention.[41] Such findings highlights the importance of examining emotional influences on attention over a longer timescale as more dynamic and complex processes may be observed.

These findings did reveal that fear and neutral stimuli uniquely induced deficits in visual processing that differentiated GAD patients from NCCs. The difficulty disengaging from fearful images for the purposes of target identification among those with GAD relative to controls is consistent with prior research that has demonstrated an attention bias for threat among those with GAD.[14,28] The absence of an effect for lag duration is also in line with prior research demonstrating an attentional vigilance for threat among GAD patients independent of stimulus duration.[17] In this study, variation in stimulus duration could have revealed biases in different attentional components; for example, if patients with GAD initially oriented attention to threat (deficits in performance at Lag 2), but then subsequently shifted their attention away from threat (enhanced performance at Lag 8). However, these findings are more in line with the view that attention among patients with GAD, relative to controls, is being direct toward fear and neutral distractors and also maintained on these distractors at least up to 800 msec.

The finding of difficulty disengaging attention from neutral content for the purposes of target identification among those with GAD relative to controls was found to be more robust than the group differences in target accuracy after exposure to fear images. Such findings raise the possibility that patients with GAD may appraise neutral distractors as more emotionally salient than controls. A closer examination of the findings did reveal that neutral distractors received comparable processing as fear distractors among GAD patients. In contrast, neutral distractors resulted in significantly higher target detection accuracy than fear distractors among NCC. Thus, attention in NCCs benefits from the presence of neutral distractors relative to threatening distractors, whereas those with GAD do not appear to receive such benefits. This finding raises the possibility that GAD patients may have difficulty inhibiting the threat detection system in the presence of safety cues.

These findings support a lack of specificity for threat stimuli in attentional biases observed in GAD. This is consistent with recent work in other anxiety disorders demonstrating a deficit in inhibiting the reflexive orienting to neutral as well as to emotional facial expressions.[42] Although GAD patients did not differ from NCCs in accuracy after presentation of erotic images in this study, an attentional bias for positive information has been found for happy faces in GAD.[17] This lack of content specificity for threat stimuli suggests that the specific context and the strategic processes employed may be a more important determinant of attentional biases in GAD. This view is consistent with cognitive models of anxiety which posit that the stimulus evaluation process determines the threat value of external stimuli, and is also responsible for triggering attentional biases through the activation of goal engagement processes.[8] In the absence of clear

danger signals, the stimulus evaluation process in GAD may appraise relatively innocuous content as threatening, which may interfere with goal-directed behavior.

These findings suggest that emotionally negative stimuli may not be exclusive in their ability to capture and hold attention in GAD. This may reflect the fact that worry content in GAD are rather diverse.[13] However, patients with GAD did not differ from NCCs in percent accuracy after the presentation of disgust distractors. Disgust stimuli may be more representative of concerns observed in anxiety disorders (e.g., obsessive–compulsive disorder)[43] other than GAD. The chronic worry that is characteristic of GAD may function to heighten difficulty disengaging attention from threatening and ambiguous cues in the environment that are specifically associated with uncertainty. This view is consistent with the present finding that percent accuracy after fear and neutral distractors correlated with worry symptoms, indicating that those with greater worry symptoms showed a weakened ability to disengage their attention. Excessive worry in GAD may hinder successful attempts to suppress distractors that may impair processing of other information.

The difficulty disengaging attention from fear and neutral content among patients with GAD may be accounted for by impairment in higher order cognitive processes. According to the attentional control theory of anxiety, impairment in the volitional control of attention is a prominent feature in the anxiety disorders.[11] Attentional control may account for the likelihood that distractors will intrude into consciousness and interfere with target detection in GAD. Consistent with this notion, Peers and Lawrence[44] found that participants with good attentional control were less affected by both neutral and emotional distractors than participants with poorer attentional control and more pronounced distraction deficits were seen for emotional relative to neutral distractors in individuals with poor attentional control. Although the effect of diagnostic group on accuracy after fear distractors was not found to be mediated by attentional control, the effect of diagnostic group on accuracy after neutral distractors was found to be transmitted via attentional control. Although definitive causal inferences cannot be made based on these cross-sectional data,[45] these meditational findings suggest that deficits in attentional control account for instances when neutral stimuli interfere with attention in GAD.

Given that GAD participants performed poorly across conditions, it is possible that their apparent difficulty with the task is not specifically an attentional problem but reflects a more perceptual processing problem. Specifically, the RSVP task requires rapid processing of images, as images only last for 100 msec each. A modest impairment in processing speed could produce the general pattern of less accurate performance in the GAD group. However, existing evidence does not suggest a general impairment in processing speed in this population.[46] Moreover, participants showed similar differences in accuracy across conditions, making it clear that the GAD performance was sensitive to both stimulus type and lag effects, indicating that the results were not due to a fundamental inability to perform the task. The meditational findings also suggest that attentional control may be a stronger determinant of poorer target detection on the RSVP among those with GAD than perhaps perceptual processing deficits.

Recent research has shown that attention modification designed to decrease attentional biases toward threat reduces symptoms of GAD.[47] However, these findings suggest that cognitive tasks that train flexibility in attentional control per se, not necessarily to avoid threat, may be therapeutic for GAD. Although this is the first investigation, to our knowledge, demonstrating that neutral content differentiates attention disengagement difficulty in GAD relative to controls, other studies have found that trait anxiety, a vulnerability factor for GAD, is associated with difficulty inhibiting neutral, nonthreatening distractors,[48] due to decreased recruitment of prefrontal regions associated with attentional control.[49] However, inferences based on these findings must be considered within the context of the study's limitations. Implications for the importance of assessing the extent to which attention in GAD fails to benefit from the presence of safety (or the absence of danger) cues, in addition to the extent to which the presence of danger cues hinders attention, are limited by the absence of an idiographic assessment of worry themes which may reveal a more robust effect for negative relative to neutral stimuli among GAD patients. Inclusion of a psychiatric control group (that does not overlap with GAD in symptom phenomenology) in future research may also clarify the extent to which difficulty disengaging attention from neutral stimuli is unique to GAD. Research along these lines may further elucidate causal attentional mechanisms specific to GAD that can be directly targeted during treatment.

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