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Attentional Bias in Older Adults: Effects of Generalized Anxiety Disorder and Cognitive Behavior Therapy

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Abstract

Attentional biases are known to play a contributing, and perhaps even causal role in the etiology of anxiety and other negative affective states. The prevalence of anxiety disorders in the older cohort is growing, and there are both theoretical and empirical reasons to suspect that age-related factors could moderate attentional bias effects in the context of late-life anxiety. The current study included one of the most widely-used measures of attentional bias, the dot-probe task (Mathews & MacLeod, 1985). Participants were older adults who were either nonanxious or diagnosed with generalized anxiety disorder. The patient subsample also completed cognitive behavior therapy (CBT) or an equivalent wait list condition, after which the dot probe was administered a second time. Results showed that clinical anxiety had no particular importance for the deployment of attention, casting doubt on the universality of biased attention in older anxiety patients. Although there were no maladaptive biases detected toward either threat or depression words at pretreatment, there was nevertheless a marginally significant differential reduction in bias towards threat words following CBT. This reduction did not occur among those in the wait list condition. Implications are discussed.

Keywords

attentional bias; dot probe; generalized anxiety disorder; aging; older adults

Attentional biases are known to play a contributing, and perhaps even causal role in the etiology of anxiety and other negative affective states (MacLeod, Mathews, & Tata, 1986; Mogg et al., 1992). The prevalence of anxiety disorders in the older cohort is growing (Blazer, 2003; Schutzer & Graves, 2004), thus investigations of attentional biases from a lifespan perspective are sorely needed. Selective attention toward negative information (or 'attentional bias') was first described decades ago as a critical maintaining factor in Beck's cognitive models of anxiety and depression (e.g., Beck, Emery, & Greenberg, 1985).

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Contemporary cognitive behavioral models of anxiety and depression propose that attentional bias is not merely a by-product of emotional distress, but actively contributes to the development and maintenance of disorders by promoting hyperawareness of negative information and reinforcing maladaptive beliefs, such as the belief that the world is full of dangers. Research employing methodologies drawn from the field of cognitive science (e.g., reaction time and eyetracking measures of attention) has confirmed that theorized attentional biases are observable in both pediatric and adult samples (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). Yet in older adults, a group with a significant and growing prevalence of anxiety disorders, attentional bias has been little studied, leaving questions pertaining to the nature and clinical significance of attentional bias in this age group largely unanswered.

There are both theoretical and empirical reasons to suspect that age-related factors could moderate attentional bias effects in the context of late-life anxiety. Aging is broadly characterized by changes in attentional control and related neural networks (e.g., changes to prefrontal cortex [PFC]), as well as changes in emotional information processing (Braver & West, 2008; Raz, 2000; West, 1996). In cognitive aging studies where anxiety is not specifically assessed, a substantial literature shows that older adults tend to favor positive stimuli across a range of experimental paradigms, a phenomenon known as the positivity bias (e.g., Mather & Carstensen, 2003). Older adults may also preferentially attend to neutral stimuli over negative, the mirror opposite of the attentional biases seen in anxious younger adults (Mather & Carstensen, 2003). However, another study found that older adults' ability to detect a discrepant threat face in an array (Mather & Knight, 2006), an evolutionarily relevant skill, did not differ from that of younger adults.

These findings suggest that the positivity effect is not the result of a loss of evolutionarily preserved, bottom-up attentional features such as orienting towards threat, but may instead be driven by top-down cognitive factors such as preferences and goals. Socioemotional Selectivity Theory (Carstensen, Isaacowitz, & Charles, 1999) provides a parsimonious explanation for this set of findings. The theory proposes that as individuals age and time left in life is perceived as limited, goals shift from a focus on long-term outcomes to a focus on short-term outcomes, such as maintaining a pleasant mood in the here-and-now. The positivity effect literature provides empirical evidence consistent with the predictions of this theory.

Yet, in spite of these age-related changes in emotional information processing, findings to date suggest that the positivity effect may not apply equally to all older adults, but can be moderated, and perhaps entirely eradicated, by individual differences in emotion-related variables such as anxiety. The small number of studies to date suggest that anxious older adults, like anxious younger adults and children, show an attentional bias *toward* negative or threatening information. However, a wide range of procedural variables appears to impact whether or not the phenomenon is observed. For instance, Fox and Knight (2005) reported that both elevated trait anxiety and experimentally manipulated state anxiety increased attentional bias towards threatening words in older adults, but the effects were different depending on the specific paradigm used to assess attention to threat. In a more recent study (Lee & Knight, 2009), older adults high on trait anxiety showed a bias towards negative words presented for 1500ms (allowing for conscious awareness of stimuli), while older adults with moderate trait anxiety showed a bias towards sad faces presented for 50ms, followed immediately by a masking stimulus to preclude conscious awareness of the stimulus. Additional stimulus and presentation formats (e.g., masked and unmasked emotional pictures, masked negative words) did not elicit a threat bias in anxious older adults. Brown and colleagues reported that older adults with self-reported fear of falling

exhibited a specific difficulty disengaging attention from fall-related words (Brown, White, Doan, & de Bruin, 2011).

Price and colleagues reported a bias towards general threat-related words in older adults with high levels of self-reported worry (Price, Siegle, & Mohlman, 2012) that was present in a more difficult task but not in a simpler task version. In the only study to assess attentional bias in a clinically anxious late-life sample, attentional bias towards threat- and depression-related words was found in late-life GAD patients, in conjunction with neural activation differences (prefrontal cortex decreases and amygdalar increases) assessed by functional Magnetic Resonance Imaging (fMRI; Price, Eldreth, & Mohlman, 2011). Collectively, these studies suggest that, in opposition to the positivity effect found in unselected older adult samples, anxious older adults may exhibit biases towards negative stimuli, but findings are easily influenced by experimental parameters including stimulus duration, stimulus modality, specific stimulus content, and attentional task paradigm.

If attentional bias towards negative information does indeed characterize late-life anxiety, a clinically relevant question is whether such biases are resolved following treatment. In younger adults, a number of studies suggest that cognitive behavior therapy (CBT) for anxiety, which explicitly targets cognitive biases including exaggerated attention towards threat, can remediate attentional bias, producing decreases in observed attentional bias from pre- to post-treatment (Tobon, Ouimet, & Dozois, 2011). A recent study found that such changes in attentional bias occur rapidly and may mediate downstream improvements in anxiety (Reinecke, Waldenmaier, Cooper, & Harmer, 2013). In a sample of panic disorder patients, a single session of exposure therapy was sufficient to decrease attentional bias towards fearful faces one-day post-treatment. Attentional biases at this early post-treatment time-point predicted subsequent decreases in agoraphic avoidance four weeks later. Interestingly, anxiolytic medication has also been shown to exert acute effects on attentional bias which appear after just seven days of administration in healthy volunteers (Murphy, Yiend, Lester, Cowen, & Harmer, 2009), preceding the typical timecourse of symptom improvement in clinical samples.

Finally, a direct approach to attentional bias modification—computerized attention retraining, in which attention is trained away from threat and towards neutral stimuli through repeated practice—has recently been tested as a treatment for anxiety, and shows initial promise in reducing anxiety symptoms in clinically anxious samples of younger adults (Hakamata et al., 2010). Collectively, these findings suggest that change in attentional bias may represent a final common pathway to symptom relief across multiple treatments. However, in contrast to these findings, a study in anxious youth found that attentional bias towards threat was not fully remediated by CBT (Waters, Wharton, Zimmer-Gembeck, & Craske, 2008), suggesting age effects may be important to consider. No previous study has examined the effects of any treatment for late-life anxiety on attentional bias, leaving numerous questions regarding whether this mechanism of symptom relief is applicable to an older age group characterized by age-normative deficits in attentional control.

The current study employed one of the most widely-used measures of attentional bias, the dot-probe task (Mathews & MacLeod, 1985). In this task, emotional and neutral stimulus pairs are presented, followed by a probe replacing one of the two stimuli. Increased response latencies to dots in the previous location of the neutral stimulus (termed ‘incongruent trials’) are frequently interpreted as an index of selective attention towards the emotional stimulus, suggesting that visual attention was oriented towards the emotional stimulus location at the time the dot appeared. The dot-probe task has previously elicited both positivity effect findings in unselected older adults (Mather & Carstensen, 2003) and biases towards threat-related stimuli in anxious older adults (Fox & Knight, 2005; Lee & Knight, 2009). We

expanded on this literature by testing biases toward threat (e.g., ‘accident,’ ‘incurable’), depression (e.g., ‘misery,’ ‘sadness’), and positive words (e.g., ‘celebration,’ ‘smile’) in older GAD patients compared to age-matched nonanxious controls. We also assessed effects of psychotherapy on biases by comparing late-life GAD participants before and after either an 8-week course of CBT or an equivalent wait period.

Hypotheses were formulated from the literature demonstrating attentional biases toward negative words in younger GAD patients (e.g., MacLeod, Mathews, & Tata, 1986), the deleterious effects of aging on the attentional system (e.g., West, 1996), and the positivity effect found among healthy older adults (e.g., Mather & Carstensen, 2005) in which positive information is overattended to, and neutral or negative cues are neglected or ignored. It was predicted that GAD patients would show greater attentional bias than controls when responding to cues that followed the threat related word in threat-neutral word pairs. Due to the symptom overlap between GAD and depression (e.g., trouble concentrating, fatigue, insomnia), we expected a secondary bias toward depression words in the GAD group but not in controls.

On the other hand, controls were expected to show greater attentional bias than GAD patients when responding to cues that followed the positive word in positive-neutral word pairs. A bias away from the negative word in negative-neutral word pairs was expected in this group, given that nonanxious older adults have been known to focus away from negative material.

We also predicted that the subset of GAD patients who completed cognitive behavior therapy (CBT) would show attenuated biases to negative words at posttreatment as compared to those who were assigned to a wait list condition, who would show no change.

Method

Participants

Participants were 62 adults age 60 and older (mean age = 69.10, s.d. = 5.24), 34 diagnosed with GAD according to the Structured Clinical Interview Diagnostic for DSM-IV (SCID; First et al., 2001) and 28 age- and sex-matched controls (mean age = 68.91, s.d. = 6.05) free of lifetime psychiatric disorders according to the SCID. All participants scored above 24 on the Mini Mental State Exam (Folstein et al., 1975) and none reported having been diagnosed with dementia, cognitive impairment, or any other progressive brain disease.

Participants were recruited through direct mail advertising and community outreach lectures delivered to senior centers and living communities. Those in the GAD group were recruited for participation in eight 90-minute sessions of outpatient manualized CBT at a university psychology clinic in the Eastern U.S. None were taking medications for anxiety, although other types of medication were allowed (i.e., for medical or physical problems). Thirty-three percent of the GAD group had secondary diagnoses (5% major depressive disorder, 10% dysthymia, 12% social phobia, 24% specific phobia, 3% posttraumatic stress disorder), with 12% having more than one comorbid disorder.

Those in the control group were recruited for a one-session laboratory study of mood, cognition, and aging. Additional details of the sample are shown in Table 1.

Measures

Measures of mood and cognition included the Penn State Worry Questionnaire (PSWQ; Meyer et al., 1991), the Generalized Anxiety Disorder-Questionnaire-IV (GAD-Q; Newman et al., 2002), and the Beck Depression Inventory (BDI; Beck & Steer, 1987). Alpha

coefficients on these measures ranged from .82 to .90 in the current sample. The Mini-Mental Status Exam (Folstein, Folstein, & McHugh, 1975) was administered as a means of assessing broad cognitive abilities. A standard cutoff of 24 was used as a criterion for participation (Lezak, Howieson, & Loring, 2004).

Dot Probe Task

Stimuli used in the dot probe were 20 threat, 20 depression, 20 positive, and 100 neutral words derived from an earlier study of younger adults (Bradley, Mogg, Millar, & White, 1995; see Appendix A). Linguistic stimuli were rated by a subset of those who participated in the study ($n = 19$) after completion of the task. Ratings were made on two dimensions, emotional valence and word familiarity, each on a five-point Likert-type scale ('1' = 'very negative' or 'completely unfamiliar'; '5' = 'very positive' or 'completely familiar'). All ratings were in the expected directions and are displayed in Table 2.

The task consisted of two blocks. The first block included 20 practice trials using only neutral words with feedback provided. The second block consisted of 160 trials, on which 75% of trials featured an emotionally valenced word paired with a neutral word, without performance feedback. Word pairs were presented in the same random order for all participants. Words of each type were equally associated with both positions on the screen and with both response keys. Half were *congruent trials* on which the probe replaced an emotion word; half were *incongruent trials* on which the probe replaced a neutral word. Each trial began with a white fixation cross displayed in the center of a black screen. After 500ms, two words appeared, one above and one below the fixation cross. The words were displayed entirely in capital letters in 19-point Helvetica font, and were approximately 1-inch tall on the screen, with approximately 1 inch of space between them. The trial continued after 500ms, when both words disappeared, and a probe replaced either the top or bottom word. The probe was two white dots, arranged either vertically or horizontally. The participant was instructed to respond as quickly and accurately as possible by pressing the 'A' key with their left hand for vertical dots and the 'L' key with their right hand for horizontal ones. The probe remained on the screen until the participant made a response or 10 seconds elapsed. Reaction times (RTs) were measured on a trial-by-trial basis in milliseconds. Trials with incorrect responses and those with RTs < 300ms or >3000ms were excluded prior to analysis.

The dot-probe task was implemented in E-Prime 1.2 software, administered on a Dell Latitude D600 laptop computer with a 15-inch LCD display set to its native 1024- by 768-pixel resolution at 60Hz.

Procedure

Informed consent was obtained from all participants. Participants attended a session in which they completed the SCID (First et al., 2001), self-report questionnaires, and MMSE (Folstein et al., 1975) in a clinical laboratory setting. After completing these tasks, each participant then completed the 15-min computerized dot probe task. To ensure that all participants could easily read the stimuli, we asked them to read the task instructions aloud, which were in the same font and size as the stimuli.

Participants in the GAD group were then randomly assigned to either the CBT or wait list group. Those in the CBT group attended weekly treatment sessions in individual format, and immediately following the last session, completed a posttreatment assessment identical to the pretreatment assessment in the same clinical laboratory setting. Individuals in the wait list group completed a second assessment at a similar time point to the CBT group (approximately 8-weeks after the initial assessment).

Therapists and assessors were graduate students at the Masters or higher level who participated in weekly individual and group supervision from the first author. Therapy was conducted according to a manualized protocol for treating GAD in older adults (Mohlman & Gorman, 2005), and a random sample of recorded sessions were rated for fidelity by the first author.

Aspects of treatment (described in detail in Mohlman & Gorman, 2005) included psychoeducation on mood and GAD, training in relaxation and diaphragmatic breathing, cognitive restructuring, stimulus control exercises, sleep hygiene education, a perspective-taking exercise, exposure to worrisome situations, and problem solving. Those in the control group were compensated \$25.00 and those in the CBT and waitlist groups were compensated \$100.00 for their participation.

Results

The GAD and control groups did not differ on any demographic variables. All reaction time means ranged from 600–800 ms. Repeated measures analysis of variance (RM ANOVA) was conducted to test hypotheses related to performance on the dot probe task. Bias scores (the dependent variable) were generated for each of the three emotional word types by calculating the difference between the average incongruent trial RT minus the average congruent trial RT, such that a positive score indicated a bias toward, whereas a negative score indicated a bias away from, that emotional word type.

Between-Group Analysis

An RM ANOVA with Group (Control, GAD) as a between-subjects factor and Word Type (anxiety, depression, positive) as a within-subjects factor revealed that there were no significant main effects of Group or Group x Word Type on RT bias scores, indicating that clinical status was not associated with any particular attentional bias (p 's $>.40$) (Table 3). There was, however, a significant effect of Word Type on bias scores across all participants ($F(2,118)=3.85$, $p=.02$). The effect of Word Type was explained by a bias *away* from positive words (towards neutral words in positive-neutral pairs) evident across all subjects (mean positive bias = -21.2 , $SD=55.5$; differs significantly from zero: $t(60)=-2.97$, $p=.004$). The hypothesized bias toward negative words in the patients was not evident, nor did reaction times to negative words differ by group.

Post-Treatment Analysis

There were no differences in baseline characteristics or response times on the dot probe task between the CBT and Wait List groups who participated in the treatment portion of the present study. However as shown in Table 4, those in the treated group were more likely to be free of GAD and showed significant reductions on all self-report measures at posttreatment. An RM ANOVA with Treatment (CBT, Waitlist) as a between-groups factor and Time (pre- vs. post-intervention period) and Word Type (anxiety, depression, positive) as within-groups factors indicated a marginally significant Time x Treatment X Word Type interaction ($F(2,52) = 2.47$, $p = .09$) (Table 5). Following CBT, the GAD group showed reduced bias to threat words while those in the wait list showed an increase in threat bias ($F(1,26) = 4.03$, $p = .055$). There were no significant or marginal Group x Time interaction effects for depression or positive word bias scores (all p 's $> .25$); however, at post-treatment, the waitlist group continued to show a significant bias away from positive words ($t(12) = -3.27$, $p=.007$) while the patient group did not ($t(14) = -.57$, $p=.58$). All participants showed a significant decrease in latency to neutral words regardless of group ($F(1,26)=8.5$, $p=.007$), which is likely to indicate nonspecific improvement on cognitive aspects of performance (e.g., response selection) over the two task administrations regardless of treatment.

Discussion

Hypotheses of the current study were based on previous research in cognitive aging and anxiety in younger adults. Predictions based on clinical status were not supported; no biases were found toward threat, depression, or positive words in either the controls or the patients, a finding that diverges from that of previous studies. Biases toward threat in younger anxiety patients are well documented (e.g., Bar Haim et al., 2007), and have shown relations to other clinical variables of interest, such as visual fixation on threat cues (Armstrong, Sarawgi, & Olatunji, 2012) and neural patterns related to elaborated emotional processing (van den Heuvel et al., 2005). However, as discussed earlier, these biases are known to be fragile and strongly contingent upon task characteristics (e.g., stimulus presentation time).

Furthermore, although we also expected a bias toward positive words in the control group, there was no positivity effect whatsoever. Contrary to predictions based on Socioemotional Selectivity Theory (Carstensen, Isaacowitz, & Charles, 1999), both groups preferentially attended away from positive words as reflected by negative bias scores on neutral-positive word pairings. A secondary hypothesis predicted longer latencies for neutral as compared to negative words, which was also not evident.

Taken together, this set of null findings suggests that clinical anxiety had no particular importance for the deployment of attention in the current older sample, casting doubt on the universality of biased attention in older anxiety patients. This study differed from previous studies that have documented attentional bias effects in older adults in a number of procedural ways. For instance, previous threat bias findings from anxious adults completing the dot-probe task were from studies utilizing state anxiety manipulation (Fox & Knight, 2005) or 1500ms stimulus presentations (Lee & Knight, 2009; in contrast to the 500ms presentations used here). Other studies finding threat bias used a distinct RT measure of attentional bias (the emotional Stroop task; Price et al., 2011; Price et al., 2012), which allows for assessment of the speed of emotional word processing scaled to each participant's processing speed for neutral words.

By contrast, the dot-probe task provides a single 'snapshot' of the direction of attentional allocation at the moment the probe appears (in this case, 500ms after word onset), and may therefore be more vulnerable to the unintended effects of age-normative changes in overall processing speed (Salthouse, 2000). Given that the reliability of dot-probe bias scores has been called into question in younger adults (Schmukle, 2005), variability across studies may also be due to noise in RT measures. To our knowledge, no study of late-life anxiety has utilized technologies allowing for more direct measurement of visual attentional bias, such as eyetracking, and only one study has examined neuroimaging indices of emotional word processing (Price et al., 2011), which may be more proximal to the theoretical phenomenon of interest (biased information processing). These alternative measures of attentional bias may have better psychometric properties compared to RTs (e.g., Britton et al., 2012) and would be useful to include in future late-life anxiety research.

If attentional biases towards threat prove difficult to replicate in additional studies of late life anxiety, there may also be empirical explanations for a less robust bias in this age group. Anxiety is less common and generally less severe in older as compared to younger adults (Jorm, 2000; Lau, Edelstein, & Larkin, 2000), which might impact the emergence of late life attentional biases. Additionally, the right hemisphere is believed to decline at a faster rate than the left in later adulthood (Cherry & Hellige, 1999), which may lead to constrained vigilance abilities (Heilman 1995; Posner & Peterson, 1990). These neural changes have the potential to affect the attentional system, possibly leading to a reduction in the magnitude of attentional biases toward threat that are common among younger anxiety patients (MacLeod,

1999; MacLeod & Hagan, 1992). Because these biases can play a causal role in anxiety, it is possible that older adults are less vulnerable to the acquisition of full-blown disorders through the mechanism of attentional bias, although this hypothesis is speculative.

A second component of the study investigated the effects of psychotherapy on dot probe performance. Following treatment, it was expected that the CBT group would show reduced bias towards negative words. Although there were no maladaptive biases detected toward either threat or depression words at pretreatment, there was nevertheless a marginally significant differential reduction in bias towards threat words following CBT. This reduction did not occur among those in the wait list condition. In addition, in the waitlist group only, there was exploratory *post hoc* evidence for a continuing attentional bias away from positive words, as was observed across all subjects at baseline, while the CBT group no longer showed this bias following treatment. Although this pattern could be consistent with increased attentional engagement with positive words following CBT, omnibus tests did not support an interaction of treatment group and time on positive bias scores even at the trend-level, possibly due to inadequate power. Therefore this exploratory result must be interpreted quite cautiously given the aforementioned unreliability of dot-probe RT bias measures. These changes in attentional bias following treatment (decreased attention towards threat words, increased attention towards positive words) could suggest an increase in the intentional modification of attention, which is also one plausible mechanism of action for CBT in older patients (Mohlman, 2008; Mohlman & Gorman, 2005). These results are the first examining effects of treatment on attentional bias in an older adult sample, and do not fit seamlessly with any previous study that we are aware of.

There were a number of limitations to the current study. Participants were mostly female, white, and well educated. It is possible that results were impacted by self-selection bias (e.g., if only those with sound attentional abilities sought CBT). Attentional biases are known to emerge only under certain task conditions, thus different presentation times and more compelling stimuli (e.g., self relevant, pictorial) might provide a more potent version of the task. The current stimuli were presented for 500 ms, a relatively brief time relative to other studies showing bias. No mood induction was used, meaning that variability in mood state may have reduced power to detect effects. Future studies using the dot probe might also include mood induction procedures. In a study including older participants, the mood congruent bias toward threat was replicated on the dot probe, regardless of trait anxiety levels (low vs. high; Fox & Knight, 2005). It may be that biases are more state-dependent in the elderly due to decreased emotional reactivity or enhanced coping skills (Magai, Consedine, & Krivoshekova, 2006). Future studies would also benefit from concurrent collection of other indices of emotional information processing (e.g., eyetracking, neuroimaging) in order to provide potentially more reliable, sensitive, and direct measurement of the phenomena of interest (i.e., emotional information processing).

Because attentional biases are prone to many factors pertinent to the tasks themselves as well as participant characteristics, it may take years before ample data is amassed and we can state anything definitive about the nature of attentional biases in older anxiety patients. Clinical and cognitive researchers might join forces to accelerate future research in this area.

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Highlights

- Clinical anxiety had no particular importance for the deployment of attention,
- This casts doubt on the universality of biased attention in older anxiety patients.
- There was a marginal reduction in bias towards threat words following CBT.
- This reduction did not occur among those in the wait list condition.
- Attentional biases are fragile and contingent upon task and participant features.

Table 1

Characteristics of the full sample.

	Control (n = 28)	GAD (n = 34)
Age	67.37 (5.53)	66.67 (4.56)
Female	71%	68%
Retired	68%	68%
Education		
High School or Less	18%	21%
College or Above	82%	79%
Marital		
Married	68%	71%
Divorced	14%	18%
Widowed	14%	12%
Medical Problems	3.15 (1.60)	3.66 (1.71)
MMSE	28.85 (1.46)	28.73 (1.31)
PSWQ	30.50 (7.86)	57.06 (8.58) ***
GAD-Q-IV	1.91 (1.46)	9.50 (2.13) ***
BDI	4.04 (2.87)	13.65 (5.67) ***

Note.

*
 $p < .05$;***
 $p < .001$.

MMSE = Mini-mental State Exam (Folstein, Folstein, & McHugh, 1975). PSWQ = Penn State Worry Questionnaire (Meyer et al., 1991). GAD-Q-IV = Generalized Anxiety Disorder Questionnaire for DSM-IV (Newman et al., 2002). BDI – Beck Depression Inventory (Beck & Steer, 1987).

Table 2

Stimulus word ratings made by Controls (n=12) and GADs (n=7).

	Threat	Depression	Positive	Neutral
<i>Valence Ratings</i>				
Control	1.75 (0.42) ^a	1.67 (0.48) ^a	4.50 (0.35) ^a	3.25 (0.34)
GAD	1.51 (0.36) ^a	1.76 (0.67) ^a	4.78 (0.64) ^a	3.09 (0.55)
<i>Familiarity Ratings</i>				
Control	3.63 (0.91)	3.23 (0.73)	4.13 (0.65) ^a	4.00 (0.61)
GAD	3.48 (0.99)	3.34 (0.81)	4.13 (0.65) ^a	3.71 (0.75)

Note.

^a = significantly different from neutral word rating, $p < .05$. All valence ratings were in the expected directions. All words were familiar to participants. Positive familiarity ratings were significantly different from depression familiarity ratings.

Table 3

Baseline reaction times to each word type.

	Control (n = 28)			GAD (n = 34)		
	Congruent	Incongruent	Bias	Congruent	Incongruent	Bias
Threat	714.19 (98.91)	717.25 (88.91)	3.06	729.39 (129.46)	730.55 (119.25)	1.16
Depression	714.70 (102.39)	712.70 (100.39)	-2.00	732.27 (144.37)	738.68 (148.49)	6.41
Positive	722.10 (88.85)	694.55 (95.69)	-27.55	733.20 (146.72)	717.56 (126.32)	-15.64
Neutral	706.84 (92.77)			731.96 (136.70)		

Note. No significant differences between groups or word types. Reaction times shown in milliseconds, collapsed across probe type, probe location, and word location.

Table 4

Characteristics of CBT and Wait List groups.

	Wait List (n = 13)	CBT (n = 15)
Age	67.13 (4.96)	66.84 (4.54)
Female	69%	63%
Working	54%	38%
Ethnic		
Caucasian	76%	94%
African American	8%	0
Asian American	8%	0
Hispanic/Latino	8%	6%
Education		
High School or Less	15%	6%
College or Above	85%	94%
Marital		
Married	68%	71%
Divorced	14%	18%
Widowed	14%	12%
Free of GAD at Post-Tx	0	75% ***

Note.

 $p < .001$.

Table 5

Clinical measures and dot probe results at pre- and posttreatment.

	Wait List (n = 13)		CBT (n = 15)	
	Pre	Post	Pre	Post
PSWQ	56.92 (6.10)	61.46 (5.62)	57.37 (8.90)	44.56 (9.12) **
GAD-Q	9.23 (1.89)	9.09 (1.95)	8.39 (2.12)	4.06 (3.17) *
BDI	13.90 (7.30)	12.77 (5.92)	14.38 (5.45)	6.63 (5.86) *
Threat				
Congruent	763.59 (137.07)	691.17 (78.32)	722.78 (116.45)	654.91 (93.74)
Incongruent	753.98 (136.15)	703.68 (59.75)	729.91 (97.09)	644.68 (70.81)
Bias	-9.61	12.51	7.13	-10.23
Bias Change	22.12 *		-17.36 *	
Depression				
Congruent	762.56 (165.81)	701.74 (72.97)	732.25 (122.82)	636.24 (86.83)
Incongruent	753.21 (170.76)	699.90 (66.65)	754.88 (129.37)	651.52 (79.59)
Bias	-9.35	-1.84	22.63	15.28
Bias Change	7.51		-7.35	
Positive				
Congruent	764.31 (181.03)	720.09 (68.61)	734.66 (115.00)	657.15 (96.62)
Incongruent	737.61 (138.09)	671.24 (63.69)	717.80 (114.82)	650.77 (85.78)
Bias	-26.70	-48.85	-16.86	-6.38
Bias Change	-22.15		10.48	
Neutral	759.08 (161.70)	712.71 (59.64)	733.77 (108.54)	657.41 (95.32)

Note.

* Group x time interaction: $p = .055$.

PSWQ = Penn State Worry Questionnaire (Meyer et al., 1991). GAD-Q-IV = Generalized Anxiety Disorder Questionnaire for DSM-IV (Newman et al., 2002). BDI – Beck Depression Inventory (Beck & Steer, 1987).