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Attentional Biases for Negative Interpersonal Stimuli in Clinical Depression

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An information-processing paradigm was used to examine attentional biases in clinically depressed participants, participants with generalized anxiety disorder (GAD), and nonpsychiatric control participants for faces expressing sadness, anger, and happiness. Faces were presented for 1,000 ms, at which point depressed participants had directed their attention selectively to depression-relevant (i.e., sad) faces. This attentional bias was specific to the emotion of sadness; the depressed participants did not exhibit attentional biases to the angry or happy faces. This bias was also specific to depression; at 1,000 ms, participants with GAD were not attending selectively to sad, happy, or anxiety-relevant (i.e., angry) faces. Implications of these findings for both the cognitive and the interpersonal functioning of depressed individuals are discussed and directions for future research are advanced.

Over the last 2 decades, a great deal of research has been conducted in an effort to identify psychological factors involved in the onset and maintenance of depression. Much of this research has been guided by cognitive theories, which emphasize the role of dysfunctional cognitive structures and biased information processing in placing individuals at elevated risk for experiencing depression. Cognitive models implicating schemas (e.g., Beck, 1976) or associative networks in memory (e.g., Bower, 1981) predict that depressed individuals are characterized by negative biases in virtually all aspects of information processing, including perception, attention, and memory. Empirical support for these theoretical predictions, however, is still far from conclusive. Overall, there is strong evidence for biased retrieval processes in depression (J. M. Williams, Watts, MacLeod, & Mathews, 1997). Moreover, in a number of studies depressed participants have been found to exhibit selective attention to negatively valenced stimuli (e.g., Gotlib & McCann, 1984; Mathews, Ridgeway, & Williamson, 1996; Mogg, Mathews, & Eysenck, 1992). In other studies, however, depressed participants appear to have "lost" the positive attentional bias that characterizes nondepressed persons (e.g., Gotlib, McLachlan, & Katz, 1988; Mogg et al., 1991), and still other investigators have failed to find attentional biases in depression (e.g., MacLeod, Mathews, & Tata, 1986; Mogg, Bradley, Williams, & Mathews, 1993). These and similar results led J. M. Williams, Watts, MacLeod, and Mathews (1988, 1997) to propose an alternative formulation of information processing in which depression and anxiety are characterized by different patterns of biases in attention and memory. Briefly, J. M. Williams et al. (1988, 1997) proposed that in anxiety, automatic activation processes are biased toward enhanced processing of threat cues, leading to biases in early stages of information processing that are evident in selective attention and priming tasks. In contrast, depression is hypothesized to be characterized by a mood-congruent bias in strategic elaboration of information, resulting in biases in recall.

This formulation has not gone unchallenged. As Bradley, Mogg, and Lee (1997) pointed out, investigators have found attentional biases in depression rather consistently using tasks with relatively long stimuli exposure durations of 1 s or more (e.g., Bradley, Mogg, & Lee, 1997; Gotlib & Cane, 1987; Mogg, Bradley, & Williams, 1995); studies in which stimuli have been presented for shorter durations have obtained more variable results (e.g., Mathews et al., 1996). Given this pattern of findings, Bradley, Mogg, and Lee suggested that although depression might not be associated with an initial orienting bias toward negative information, once that information has become the focus of attention, depressed individuals may have greater difficulties in disengaging their attention from it.

In addition to the duration of presentation of stimuli, it is important to note that most studies of attentional biases have used verbal stimuli (i.e., valenced words) to assess biases in depressed and anxious participants. It is interesting to note that results from contemporary research in experimental cognitive psychology suggest that the perception and processing of words is controlled by a different executive system than is the perception and processing of objects and pictures (the semantic system). Valenced pictures should be more strongly related to affective information than words should be because, unlike words, pictures and images have "privileged access" to the system in which affective information is stored (Glaser & Glaser, 1989). Research has provided empirical support for this prediction. For example, De Houwer and Hermans

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(1994, Experiment 1) showed that distracting pictures interfered with affective categorization of words, but distracting words did not interfere with affective categorization of pictures. Moreover, participants were faster to affectively categorize pictures than words. Given the profound difficulties experienced by clinically depressed and anxious persons in their social interactions (e.g., Carter, Turovsky, & Barlow, 1994; Feldman & Gotlib, 1993; McLeod, 1994), human faces expressing different emotions are likely to be a particularly powerful type of pictorial stimuli for these individuals. Thus, the use of emotional faces in studies of attentional biases in depression might yield more consistent results than have been obtained with semantic stimuli.

Several studies have examined the attentional responses of anxious persons to emotional faces. Although in some of these investigations dysphoric students were included as controls, investigations explicitly examining clinically depressed individuals' processing of emotional faces are rare. In one of the first studies to use emotional faces as stimuli, Bradley, Mogg, Millar, et al. (1997) developed a pictorial version of the dot-probe task. These researchers presented high and low socially anxious female participants with two faces of differing emotional valence (e.g., one neutral and one angry) simultaneously side by side. Immediately following the 500-ms presentation of the pictures, a dot probe appeared in the location of either the left or the right face, and participants were required to press a response button to indicate the position of the probe; their response latency was used as an index of their deployment of attention. Contrary to predictions, in Experiment 1, Bradley, Mogg, Millar, et al. (1997) found level of social anxiety to be unrelated to attention to threatening (i.e., angry) faces. It is interesting to note that when participants were reallocated to groups based on their scores on a depression inventory, near significant group differences emerged. These differences, however, were not due to dysphoric participants showing a bias toward angry faces, but rather to nondysphoric participants demonstrating an attentional bias away from angry faces, whereas dysphoric participants showed "even-handed" allocation of attention. In Experiment 2, Bradley, Mogg, Millar, et al. (1997) replicated this finding at a conventional significance level with a group of dysphoric and nondysphoric male students.

Bradley, Mogg, Falla, and Hamilton (1998) also used a pictorial version of the dot-probe task with pictures portraying neutral, happy, or threatening faces presented for either 500 or 1,250 ms. Whereas high trait-anxious participants were found to demonstrate an attentional bias toward threatening facial expressions (see also Bradley, Mogg, White, Groom, & de Bono, 1999; Mogg & Bradley, 1999), dysphoria was associated with a tendency to avoid happy faces, regardless of stimulus exposure duration. This pattern of findings is consistent with the results of Bradley, Mogg, and Millar (2000), who found that dysphoria was associated with a reduced attentiveness to happy faces presented for 500 ms, but not with an attentional bias for sad faces.

These studies represent a significant first step in examining attentional biases for pictorial stimuli in depression and anxiety. It is important to note, however, that their conclusions are limited, particularly with respect to depression, because of their exclusive use of nonclinical samples. In addition, it is critical to test explicitly issues concerning both the diagnostic and the stimulus specificity of depression-associated attentional biases. For example, according to Beck's (1976) content-specificity hypothesis, depressed and anxious individuals should demonstrate attentional biases only for stimuli that are consistent with the cognitive schemata that underlie these disorders. Therefore, it is imperative that responses to both sad and threatening (i.e., angry) faces be assessed, and that the response latencies of carefully diagnosed depressed individuals be compared with those of an appropriate group of psychiatric control participants. In fact, only one study to date has examined attentional biases for sad stimuli in a sample of diagnosed depressed individuals. Mogg, Millar, and Bradley (2000) assessed depressed participants and participants with generalized anxiety disorder (GAD) on the dot-probe task using sad, happy, angry, and neutral faces. They assessed the direction and latency of the initial eye movement during the presentation of the faces, and reaction times to detect the dot probe after a 1,000-ms presentation of the faces. Consistent with J. M. Williams et al.'s (1997) formulation, the eye-movement data indicated that the GAD participants shifted their gaze more quickly toward threat faces than toward neutral faces; no significant eye-movement results were obtained for the depressed participants, nor did the response-time data indicate an attentional bias for either the GAD or the depressed participants to the threat or the sad faces. It is important to note, however, that of the 15 depressed participants in this study, 13 had a comorbid diagnosis of GAD, making it impossible to determine whether the absence of an attentional bias for sad faces is a feature of depression or of the co-occurring GAD.

In the current study, we assessed attentional biases to sad and threatening (i.e., angry) faces presented for 1,000 ms in clinically depressed individuals, persons diagnosed with major depressive disorder (MDD). To address the issue of the comorbidity of MDD and GAD raised by the results of Mogg et al.'s (2000) study, we both selected MDD participants who did not have comorbid diagnosis of GAD, and included a group of GAD participants as psychiatric controls. We tested the content-specificity hypothesis that a carefully diagnosed sample of depressed individuals (without comorbid GAD) would show heightened sensitivity to depression-relevant stimuli connoting sadness, selectively allocating and maintaining their attention to sad faces; we predicted further that this bias would not be exhibited by individuals with GAD (without comorbid depression). We also included a third category of emotional faces, happy faces, which allowed us to examine whether a group of nonpsychiatric control participants would demonstrate a positive attentional bias (cf. Gotlib et al., 1988). This inclusion of happy emotional faces also permitted a test of two alternatives to the content-specificity hypothesis: the valence hypothesis and the emotionality hypothesis. Whereas the valence hypothesis predicts that MDD and GAD individuals should show cognitive biases for both types of negatively valenced faces (sad and angry) but not for positive (happy) faces (cf. Mogg et al., 1995), the emotionality hypothesis predicts that MDD and GAD participants should show cognitive biases for all types of emotional faces (sad, angry, and happy), relative to matched neutral faces (cf. Mansell, Clark, Ehlers, & Chen, 1999; Martin, Williams, & Clark, 1991). To provide strong tests of these three competing hypotheses, we took great care to ensure that the two psychiatric samples did not have comorbid diagnoses of MDD and GAD and that all three types of emotional faces were equally emotional (i.e., that the intensity of happiness in the happy faces was equivalent to the intensity of sadness in the sad faces and anger in the angry faces).

In sum, we tested three distinct hypotheses in this study that together addressed the issues of diagnostic and stimulus content specificity, valence, and emotionality:

1. Depressed participants, compared with nonpsychiatric controls, will demonstrate an attentional bias for sad faces presented for 1,000 ms.

2. The depression-related attentional bias will be content-specific. Thus, depressed participants, compared with nonpsychiatric controls, will demonstrate an attentional bias for sad faces but not for happy or angry faces.

3. The depression-related bias will be diagnosis specific. Thus, the attentional bias for sad faces exhibited by MDD participants will not be exhibited by individuals diagnosed with GAD.

Method

Participants

Three groups of participants took part in the study: MDD, GAD, and nonpsychiatric controls (NC). Nineteen MDD and 18 GAD participants were recruited from local newspaper advertisements (more than 90% of the participants) and from outpatient services at the Behavioral Medicine Clinic at the Stanford University School of Medicine. Sixteen NC participants were recruited through newspaper advertisements and flyers posted in community colleges and libraries.

Selection criteria. For two reasons, we limited our sample to women. First, both MDD and GAD are more prevalent among women than among men (Kessler et al., 1994). Second, because we know little about possible gender differences in cognitive biases in emotional disorders, we decided to reduce the heterogeneity of our sample by including only female participants. In addition, all participants in this study were between the ages of 18 and 55, native speakers of English, had normal or corrected-to-normal vision, no history of alcohol or drug abuse for at least the past 2 years, no history of epilepsy or head trauma, and no current or past bipolar, psychotic, or panic disorder.[1] All of the participants in the depressed group had a primary diagnosis of MDD in the absence of GAD, according to the *Diagnositic and Statistical Manual of Mental Disorders* (4th ed.; *DSM–IV*; American Psychiatric Association, 1994) criteria. Similarly, all of the participants in the anxious group had a primary diagnosis of GAD in the absence of MDD or dysthymia. Participants in the nonpsychiatric control group had no current or past Axis I psychiatric disorder. The three groups of participants were matched for ethnicity, age, marital status, and level of education, and all participants were paid $25 per hour for their involvement in the study.

Diagnostic assessment. The Structured Clinical Interview for *DSM–IV* (SCID; First, Spitzer, Gibbon, & Williams, 1995) was used to determine psychiatric diagnoses. This interview schedule assesses *DSM–IV* current and lifetime diagnoses for anxiety, mood, psychotic, alcohol and substance use, somatoform, and eating disorders. The SCID has demonstrated good reliability for the majority of the disorders covered in the interview (Skre, Onstad, Torgersen, & Kringlen, 1991; J. B. Williams et al., 1992). To improve our reliability of the diagnosis of GAD (which typically has lower reliability than other disorders), we added rating scales of the frequency, intensity, and controllability of worry from the Anxiety Disorders Interview Schedule—Revised (Di Nardo & Barlow, 1988).

Approximately 250 potential participants were screened over the telephone using a short version of the SCID. Only those sections of the SCID that were relevant to exclusion or inclusion criteria were administered at that time (i.e., bipolar, psychotic, and panic disorders, alcohol and substance abuse, MDD, dysthymia, and GAD). Those individuals who successfully passed the phone screen[2] were invited to participate in the experimental session, which lasted approximately 3 hr (including the administration of the SCID at the end of the session). Interviewers had undergone intensive training in the use of the SCID and all had experience in the use of structured interviews with psychiatric patients prior to beginning the current study. All SCID interviews conducted for this study were audiotaped. To assess and monitor interrater reliability, half of the interviews were randomly selected and independently rerated by one of two trained research assistants. Diagnostic agreement was evaluated using the κ coefficient. The κ coefficients were 1.00 for the MDD diagnosis, .92 for the GAD diagnosis, and .92 for the nonpsychiatric control diagnosis (i.e., the absence of current or lifetime psychiatric diagnoses, according to the *DSM–IV* criteria). This indicates excellent interrater reliability, although we should note that the interviewers used the "skip out" strategy of the SCID, which may have reduced the opportunities for the independent raters to disagree with the diagnoses.

Self-report measures of depression and anxiety. Prior to the administration of the SCID, participants completed the Beck Depression Inventory (BDI; Beck, Rush, Shaw, & Emery, 1979) and the Beck Anxiety Inventory (BAI; Beck, Epstein, Brown, & Steer, 1988), two widely used self-report measures of intensity of depression and anxiety, with documented reliability and validity (Beck, Steer, & Garbin, 1988; Fydrich, Dowdall, & Chambless, 1992; Hewitt & Norton, 1993). Each questionnaire consists of 21 items that assess cognitive, affective, behavioral, and physiological symptoms of depression or anxiety respectively, with the total score representing a combination of the number of symptoms endorsed and the severity of the particular symptoms.

Materials

A set of over 1,600 photographs of faces of people posing different emotions was assembled from a number of sources, including photograph

[1] We excluded participants with panic disorder because of evidence indicating that they may be characterized by a different pattern of cognitive biases than are individuals with other anxiety disorders (e.g., Becker, Rinck, & Margraf, 1994; McNally, Foa, & Donnell, 1989). Moreover, the extent to which a concurrent diagnosis of panic disorder would affect cognitive biases in individuals with a primary diagnosis of MDD or GAD cannot be established from previous research.

[2] Although it may seem that an unusually large pool ($N = 250$) was required to select the final sample of participants ($N = 53$) in this study, it is important to note that a large majority of participants were responding to newspaper advertisements that were written deliberately to be general, and that did not mention any exclusionary criteria except gender and age. It is not surprising, therefore, that most respondents did not meet formal *DSM–IV* criteria for MDD or GAD on a diagnostic interview. It is also important to emphasize that we used stringent exclusionary criteria to ensure the homogeneity and diagnostic purity of our sample. Thus, a substantial proportion of the prospective pool was eliminated because of history of bipolar, psychotic, or panic disorder, or because of a recent history of alcohol or drug abuse. Finally, approximately 20 participants were screened out from the study because they met diagnostic criteria for both concurrent MDD and GAD—we included only those participants who exhibited only one of these disorders. We offered every respondent who contacted us and who expressed psychological distress (regardless of whether they participated in the study) a free package of information consisting of educational booklets about different psychological disturbances and treatment options available for each (published by the American Psychiatric Association) and lists of local hotlines, therapists, and support groups. More than 80% of prospective participants took advantage of this offer.

collections of other researchers (Laura Carstensen, Ruben Gur, Paula Niedenthal, Stephen Nowicki, and Robert Zajonc), standardized sets of emotional faces developed by Ekman and his colleagues (Ekman & Friesen, 1976; Matsumoto & Ekman, 1988), and sets of photographs developed by Lang and his colleagues (Lang, Bradley, & Cuthbert, 1997). In addition, photographs were taken of 27 undergraduate, graduate, and postdoctoral student volunteers posing different emotions. All of the images were digitized and edited to be monochromatic and of approximately the same size (260 × 300 pixels, or approximately 9 × 10 cm).

The entire set of faces was rated independently by four graduate student raters on happiness, sadness, and anger on scales ranging from 1 (*no emotion*) to 7 (*extreme emotion*). Faces were categorized as *sad* if they received an average rating of greater than 4 (with 4 representing moderate intensity) on the sadness scale, less than 4 on the anger scale, and less than 2 on the happiness scale. Faces were categorized as *angry* if they received an average rating of greater than 4 on the anger scale, less than 4 on the sadness scale, and less than 2 on the happiness scale. Faces were categorized as *happy* if they received an average rating of greater than 4 on the happiness scale and less than 2 on both sadness and anger scales. Finally, faces were categorized as *neutral* if they received an average rating of less than 2 on all three emotion scales (happiness, sadness, and anger). These selection criteria resulted in the selection of a set of 120 relatively pure faces, with the average rating of nondominant emotions (e.g., sad emotion expressed in faces categorized as angry) never exceeding 1.68 on the 7-point scale.

Following Bradley, Mogg, Millar, et al. (1997), pairs of one emotional and one neutral photograph of the same poser were used as stimuli. Using the same poser ensured that the pictures in each pair were matched exactly with respect to age, gender, race, physical appearance, attractiveness, and so forth, and that the only difference between the two pictures was the emotional expression. In contrast to Bradley, Mogg, Millar et al. (1997), however, who used only two types of picture pairs (angry–neutral and happy–neutral), three types of picture pairs were used in this study: angry–neutral, sad–neutral, and happy–neutral. There were 20 picture pairs of each type, for a total of 60 pairs. Within each emotion face category, half of the pictures were of men and half were of women. The pictures were carefully matched with respect to the intensity of the dominant emotion displayed in the picture, both across the gender of the poser and across the different types of emotional expression. Average intensity ratings of the faces were 5.67 ($SD = .70$) for angry faces, 5.49 ($SD = .79$) for the sad faces, and 5.53 ($SD = .43$) for the happy faces. A 2 (face gender: male, female) × 3 (emotion: happy, sad, angry) analysis of variance (ANOVA) conducted on the intensity of the emotion displayed in the face yielded no significant main effects or interactions, all Fs < 1. An additional 12 neutral–neutral face pairs of the same poser (i.e., two identical copies of a neutral face) were used for practice trials.

Procedure

The task was presented on an IBM-compatible computer and a Dell 14-in color monitor. Micro Experimental Laboratory software (MEL 2.0; Schneider, 1995) was used to control stimulus presentation and record response accuracy and latency. When projected on the screen, the size of each picture was approximately 9 × 10 cm. The pictures in each pair were approximately 13 cm apart (measured from their centers). Participants sat approximately 50 cm from the screen, giving a visual angle of approximately 4.6° between the inner edges of the pictures.

Each of the 60 picture pairs was presented four times, for a total of 240 trials, which were presented in a new, fully randomized order for each subject. Each trial started with a display of a white fixation cross in the middle of the screen for 500 ms. A face pair was then displayed on the screen for 1,000 ms. Following the offset of the pictures, a small gray dot appeared in the center of the screen location where one of the pictures had been and remained on the screen until the participant pressed one of two response keys on the keyboard to indicate the position of the dot—left or right side of the screen. The computer recorded the accuracy and latency of each response and gave auditory feedback, a 500-ms beep, to incorrect responses. The intertrial interval was 1,000 ms. The emotional stimulus faces (angry, sad, or happy) appeared in the right and the left positions with equal probability, with the matched neutral face of each pair appearing in the other position. The dot probe was also presented in both positions with equal probability.

Participants were told that their goal was to detect a small dot as quickly as possible. They were told that the dot could appear in the left or right position on the screen and that their job was to respond as quickly as possible when they saw the dot by pressing the button labeled *left* on the keyboard in front of them if the dot appeared on the left side of the screen and by pressing the button labeled *right* if the dot appeared on the right side. Participants were instructed to keep the index finger of their right hand on the button labeled left and the middle finger of their right hand on the button labeled right. Participants first completed four practice trials of the simplified dot-detection task, in which the dot followed the fixation cross in the absence of the intervening face stimuli. Participants were then given further instructions informing them that the task would now be made more difficult and more interesting by briefly presenting a pair of photographs of a person's face between the presentations of the cross and the dot. They were told that, as before, their task was to detect the dot as quickly and as accurately as possible. Participants completed 12 practice trials of the face-dot task (with neutral–neutral face pairs) with the experimenter present in the room. When the participant felt comfortable with the procedure, the experimenter left the room and the participant completed the 240 test trials of the task on her own. The entire task took approximately 20 min.

Results

Participant Characteristics

Demographic and clinical characteristics of the three participant groups are presented in Table 1. Participants in all three groups were predominantly Caucasian, with no significant ethnic differences among the groups, $\chi^2(2, N = 53) < 1$. The three groups also did not differ significantly with respect to age, $F(2, 50) = 2.08$, level of education, $F(2, 50) < 1$, marital status, $\chi^2(2, N = 53) = 3.03$, or number of children, $F(2, 50) < 1$, all ps $> .05$. MDD participants were less likely to be employed outside of the home than were both the GAD and the NC participants, $\chi^2(2, N = 53) = 11.19$, $p < .01$.

The three groups of participants differed in their history of psychiatric treatment. As is shown in Table 1, a greater proportion of the MDD than the GAD participants, and none of the control participants, were currently taking psychotropic medication, $\chi^2(2, N = 53) = 8.79$, $p < .05$; moreover, the three groups also differed in their history of having taken psychotropic medication at some point in their lives, $\chi^2(2, N = 53) = 15.47$, $p < .001$. Two MDD participants (11%), 1 GAD participant (6%), and none of the NC participants reported having been hospitalized for psychiatric problems, $\chi^2(2, N = 53) = 1.80$, $p > .05$. Finally, as expected, a greater proportion of MDD and GAD than control participants reported receiving psychotherapy or psychological counseling at some point in their lives, $\chi^2(2, N = 53) = 12.06$, $p < .01$. We should emphasize that although a small percentage of the NC participants had a history of taking psychotropic medication or receiving psychotherapy or counseling, they did so only for a short period of time after the occurrence of a specific stressor (e.g., bereavement or divorce), and none met *DSM–IV* lifetime diagnostic criteria for any Axis I disorder.

Table 1
Characteristics of Participants

Variable	Group: Depressed	GAD	Control
N	19	18	16
% Caucasian	89%	83%	88%
Age	38.58_a (8.05)	32.33_a (9.01)	34.31_a (11.49)
Level of education[a]	4.00_a (1.11)	3.83_a (0.79)	3.75_a (1.06)
% married	53%	39%	69%
No. of children	0.68_a (0.95)	0.61_a (1.09)	1.00_a (1.21)
% employed outside of home	63%	100%	94%
% currently on psychotropic medication	42%	22%	0%
% with history of psychotropic medication	79%	44%	13%
% with history of psychotherapy	74%	78%	25%
Beck Depression Inventory	25.53_a (9.00)	12.94_b (6.22)	5.25_c (3.97)
Beck Anxiety Inventory	11.58_a (10.34)	14.17_a (7.03)	4.50_b (3.71)

Note. Standard deviations are shown in parentheses. Means having the same subscript are not significantly different at $p < .05$ in the Tukey's honestly significant difference comparison. GAD = generalized anxiety disorder.
[a] Levels of education were coded as follows: 1 = did not finish high school, 2 = high school or equivalent, 3 = two-year college, 4 = four-year college, 5 = master's degree, 6 = advanced degree (PhD, MD, JD, etc.).

Participants' scores on the BDI and BAI, completed at the end of the experimental session, are also presented in Table 1. One-way ANOVAs yielded significant differences among the three groups on both the BDI, $F(2, 50) = 39.37$, $p < .001$, and the BAI, $F(2, 50) = 7.06$, $p < .01$. Follow-up *t* tests indicated that the MDD participants had higher scores on the BDI than did both the GAD, $t(35) = 4.97$, $p < .01$, and the NC participants, $t(33) = 8.34$, $p < .01$, and that the GAD participants, in turn, had higher BDI scores than did the NC participants $t(32) = 4.34$, $p < .01$. Both the MDD, $t(33) = 2.59$, $p < .01$, and the GAD participants, $t(32) = 4.92$, $p < .01$, had higher scores on the BAI than did the NC participants, but did not differ significantly from each other, $t(35) < 1$. Thus, whereas the BDI reliably differentiated all three groups of participants, the BAI only distinguished the MDD and GAD participants from the NC participants.

Dot-Probe Task

Data reduction procedures. Only response times from correct responses were analyzed. Error rates were extremely low (depressed: 0.48%, anxious: 0.51%, control: 0.42%) and did not differ among the groups, $F(2, 50) < 1$. Average overall reaction times also did not differ among groups, $F(2, 50) < 1$. To minimize the influence of outliers, reaction times that were less than 100 ms were considered anticipation errors and were excluded from analyses. Similarly, reaction times that were greater than 1,000 ms were excluded because they were extremely infrequent and likely reflected lapses of concentration. Overall, the exclusion of these extreme reaction times resulted in the deletion of 0.83% of the data for the depressed group, 1.02% of the data for the anxious group, and 0.60% of the data for the nonpsychiatric control group, $F(2, 50) < 1$. Analyses were then conducted on both the remaining untransformed reaction time data, and on all of the data after an inverse transformation (cf. Ratcliff, 1993). The two sets of analyses produced the same pattern of results, and untransformed data are presented here for ease of comprehension.

Average reaction times were computed for each group of participants separately for each emotion type in the different conditions (same [probe is in the same location as the emotional face] vs. different [probe is in the other location from the emotional face]). These data are presented in Table 2. To test specific hypotheses, attentional bias scores were computed separately for each facial expression (sad, angry, happy), using the following equation (cf. Mogg et al., 1995):

$$\text{Attentional bias score} = 1/2[(\text{RpLe} - \text{RpRe}) + (\text{LpRe} - \text{LpLe})],$$

where R = right position, L = left position, p = probe, and e = emotional face. In this equation, RpLe corresponds to the mean latency when the probe is in the right position and the emotional face is in the left position, and so on. This equation calculates the

Table 2
Mean Probe Detection Latencies (in Milliseconds) in the Attention Deployment Task

Emotion and emotional face/probe location	Group: Depressed	Anxious	Control
Angry			
Same	460 (75)	442 (94)	425 (77)
Different	457 (71)	438 (89)	427 (83)
Sad			
Same	454 (72)	436 (87)	426 (83)
Different	465 (71)	438 (95)	425 (72)
Happy			
Same	458 (64)	440 (88)	428 (72)
Different	457 (70)	436 (86)	426 (82)

Note. Standard deviations are shown in parentheses. Same = probe in same location as emotional face; different = probe in different location than emotional face.

"attention capturing" quality of emotional faces by subtracting the mean probe detection times for probes appearing in the same position as the emotional face from the mean probe detection times for probes appearing in a different position than the emotional face. Positive values of this bias score indicate a shift of attention toward the spatial location of emotional faces relative to matched neutral faces, and negative values indicate a shift of attention away from the spatial location of emotional faces relative to matched neutral faces. Mean bias scores for the three groups of participants are presented in Figure 1.

Consistent with the position articulated by Rosenthal and Rosnow (1985) and by the APA Task Force on Statistical Inference (Wilkinson, 1999) that the appropriate way to test a priori predictions is by planned contrasts rather than by analyses of variance, which include all possible main effects and interactions, we tested our three specific hypotheses using planned comparisons.

> *Hypothesis 1:* Depressed participants, compared with the nonpsychiatric control participants, will demonstrate an attentional bias for sad faces.

To test this hypothesis, we compared MDD and NC participants' attentional bias scores for sad faces. As predicted, MDD participants demonstrated significantly greater vigilance for sad faces than did NC participants, $t(33) = 2.27$, $p < .05$. That is, MDD participants were relatively faster than were NCs to detect dot-probes that appeared in the same location as the sad face.

Group differences on attentional bias measures do not indicate which of the groups is showing a bias (see Gotlib et al., 1988). The difference between the MDD and NC participants could be due to either one of the groups showing a bias, or to both groups showing a bias, but to different degrees. To distinguish among these possibilities, one-sample t tests were conducted comparing attentional bias scores to zero within each participant group. A positive bias score that is significantly different from zero indicates a bias toward sad faces; a negative bias score that is different from zero indicates a bias away from sad faces. A bias score that is not significantly different from zero indicates no bias for sad faces. These analyses revealed that MDD participants' attentional bias for sad faces was positive and significantly different from zero, $t(18) = 3.02$, $p < .01$, whereas NC participants showed no attentional bias for sad faces, $t(15) < 1$. Thus, as predicted, MDD participants exhibited an attentional bias toward sad faces, whereas NC participants showed no systematic attentional bias toward sad faces.

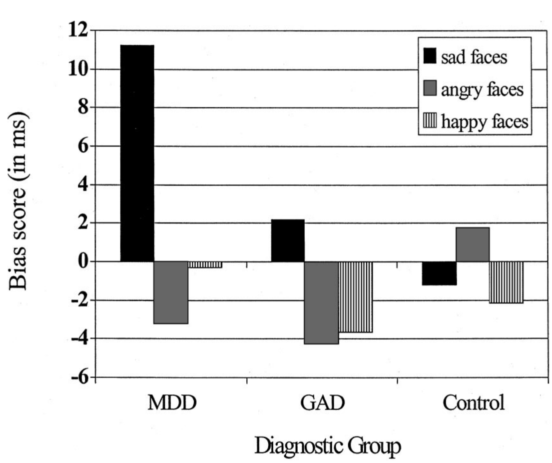

Figure 1. Attentional biases for sad, angry, and happy faces in participants with major depressive disorder (MDD), participants with generalized anxiety disorder (GAD), and nonpsychiatric controls.

> *Hypothesis 2:* The depression-related attentional bias will be content-specific. Thus, depressed participants, compared with nonpsychiatric controls, will demonstrate an attentional bias for sad faces, but not for happy or angry faces.

Two sets of analyses were conducted to test the content-specificity hypothesis. In the first set of analyses, planned contrasts were conducted comparing the MDD and NC participants' attentional bias scores for angry faces and for happy faces. Neither of these tests yielded significant results, both $ts(33) < 1$. These results support the content-specificity hypothesis: Whereas MDD participants were more vigilant than were NC participants to sad faces (see analyses for Hypothesis 1 above), they did not demonstrate similar attentional biases for angry or happy faces.

The second set of analyses consisted of within-groups comparisons. Within the depressed group, paired t tests were conducted comparing participants' attentional bias scores for sad faces with their scores for angry faces, and for happy faces. Again, consistent with the content-specificity hypothesis, these analyses indicated that depressed participants were significantly more vigilant to sad faces than they were to both angry faces, $t(18) = 2.52$, and happy faces, $t(18) = 1.91$, both $ps < .05$. Finally, one-sample t tests were conducted on attentional bias scores for angry and for happy faces within the depressed group to compare both bias scores to zero. Again, consistent with the content-specificity hypothesis, neither bias score was significantly different from zero, both $ts(18) < 1$.

> *Hypothesis 3:* The depression-related bias will be diagnosis-specific. Thus, the attentional bias for sad faces exhibited by MDD participants will not be exhibited by individuals diagnosed with GAD.

To test this hypothesis, a planned comparison was conducted on GAD and MDD participants' attentional bias scores for sad faces. As predicted, MDD participants demonstrated greater vigilance for sad faces than did GAD participants, but this difference was only a trend, $t(35) = 1.69$, $p < .10$. MDD participants were faster than their GAD counterparts to detect dot-probes that appeared in the same location as the sad face. Although the group difference was a trend, it is important to note that the bias score for sad faces in the GAD group did not differ from zero, $t(17) < 1$. To relate our findings to those reported by Mogg et al. (2000), we also examined attentional bias scores of GAD participants to angry faces. We found that GAD participants did not differ from NC participants in their attentional deployment to angry faces, $t(32) < 1$, nor did the bias score for angry faces in the GAD group differ from zero, $p > .7$. Thus, we found no evidence of an attentional bias for angry faces in participants diagnosed with GAD.

Discussion

The current study was designed to assess attentional biases to sad faces in clinically depressed participants. In addition, we also addressed issues concerning both the diagnostic and the stimulus specificity of depression-associated attentional biases. The results of this study indicate that, when confronted with a sad face and a matched neutral face presented for a duration of 1 s, participants diagnosed with MDD selectively attend to the sad face. In contrast to the depressed participants, nonpsychiatric controls did not show such a bias, but instead allocated their attention evenly to sad and to neutral faces. It is important to note that participants diagnosed with a different emotional disorder, GAD, also did not show an attentional bias for depression-relevant (sad) faces. Thus, with the caveat that the statistical comparison of the MDD and GAD participants on bias for sad faces reached a trend level of significance, the attentional bias for sad faces appears to be specific to depression.

This is the first study to report an attentional bias for sad faces in a sample of carefully diagnosed depressed patients. This finding of a depression-associated bias for sad faces contradicts the null results reported by Mogg et al. (2000) for depressed participants. As we noted earlier, 13 of the 15 depressed participants in that study had a concurrent diagnosis of GAD, making it impossible for Mogg et al. to examine the issue of diagnostic specificity. Taken together, the findings from these investigations suggest that depressed individuals who do not have comorbid GAD exhibit an attentional bias for sad faces that are presented for 1 s.

We did replicate Mogg et al.'s (2000) results for GAD, demonstrating no attentional bias as operationalized by the reaction times of GAD patients responding to threatening (i.e., angry) faces presented for 1 s. It is noteworthy, however, that Mogg et al.'s eye movement data indicated that GAD participants exhibited an initial orienting response for threat faces. In a different study, these investigators found increased vigilance among GAD participants for angry faces, evident in reaction time data (Bradley et al., 1999). In attempting to reconcile these findings, it may be helpful to focus on the different stimulus presentation durations. In our study, as in Mogg et al.'s study, faces were presented for 1,000 ms. It is possible that reaction times recorded 1,000 ms after the onset of the faces on this task do not reflect the direction of an initial orienting response. Rather, the 1-s exposure may allow for more than one shift of attention during the face display and may more simply reflect the focus of attention when the dot-probe appears at the end of the face presentation. It is likely that different stimulus durations capture different components of attention and might distinguish between shifting and maintenance of attention (e.g., LaBerge, 1995). Consistent with this formulation, the attentional bias for GAD patients in the Bradley et al. (1999) study was most prominent at shorter stimulus durations (i.e., 500 ms instead of 1,250 ms). According to Mogg et al., this pattern suggests that although GAD patients may automatically orient their attention toward threatening stimuli, this attentional focus is not maintained.

This explanation of the results is further corroborated by Mogg et al.'s (2000) analysis of eye movement data on the dot-probe task, which indicated an attentional bias in initial orientation toward angry faces in GAD patients but not in depressed patients responding to either sad or angry faces. Thus, this finding and the results for the depressed participants in the current study suggest that the attentional bias is different for depressed and for anxious individuals. Specifically, whereas anxious individuals may immediately attend to, and then disattend from, threatening stimuli, depressed individuals may not attend immediately to sad stimuli; however, by the end of 1,000 ms, the stimuli seem to have captured their attention. This formulation is consistent both with findings from the standard dot-probe task, in which attentional biases for depression have also been found with prolonged stimuli exposures (Bradley, Mogg, & Lee, 1997), and with findings suggesting that dysphoric participants show inhibitory dysfunctions in the immediate processing of negative material in a selective attention task (Joormann, 2004). Matthews and Antes (1992) examined the eye movements of dysphoric and nondysphoric students in response to complex pictures with both happy and sad regions. Although both groups of participants fixated on the happy regions more often, longer, and sooner than they did on the sad regions, the dysphoric students fixated on the sad regions more often than did the nondysphoric students. Considered collectively, these results suggest that depressed participants have difficulty disengaging their attention from negative stimuli. To test this hypothesis more systematically, it will be important to compare the duration periods of different stimuli, and/or to assess the eye movements of carefully diagnosed depressed and GAD individuals as they participate in the face dot-probe task.

It is important to note that the negative attentional biases demonstrated by the depressed participants in the present study were specific to the emotion of sadness, supporting the content-specificity hypothesis. The depressed individuals demonstrated an attentional vigilance only for depression-relevant (sad) faces; they did not exhibit an attentional bias for the other negative (i.e., angry) faces or for other emotional (i.e., happy) faces. Thus, neither the negative valence hypothesis nor the emotionality hypothesis was supported. Our results, obtained using a carefully selected sample of depressed individuals, do not support Bradley et al.'s (1998) results indicating that dysphoria is related to avoidance of happy faces. It should be noted, however, that Bradley et al. used a 500-ms stimulus exposure duration in a sample of dysphoric participants. It is unclear, therefore, whether clinically depressed participants would show biases to any of these faces when shorter stimulus exposure durations are used. Although the current finding that depressed participants showed an attentional bias only for sad faces is consistent with the results of several other studies showing that depression-related attentional biases may be content-specific (e.g., Westra & Kuiper, 1997), it leaves unanswered the question of the nature of the relation between the wide range of negative emotions that depressed individuals encounter in their lives and the more narrow range of emotions that influence their attentional functioning.

The current findings also have implications for understanding the problematic interpersonal functioning of depressed persons. Depressed individuals have been found consistently to be less socially skilled than nondepressed persons are (see Gotlib & Hammen, 2002, for a review of this literature), and it is not surprising that other people either avoid interacting with them or behave negatively in their interactions (Gotlib & Meltzer, 1987; Segrin, 2000). The results of the current study may elucidate the manner in which depressed individuals process the negative social cues emitted by their interaction partners and suggest that depressed individuals show an attentional bias to the negative responses emitted by others around them. It is not difficult to imagine that the heightened awareness of rejection that results from this negative attentional bias, coupled with an enhanced sensitivity to negative situations (e.g., Lewinsohn, Lobiz, & Wilson, 1973), makes the experience of repeated interpersonal failures all the more distressing for depressed persons and likely increases the intensity of their depressive symptoms. It will be important in future research to examine the associations between negative attentional bias for emotional facial expressions and social skills, interpersonal difficulties, and social support, in samples of both men and women.

In this context, it will also be important in future research to examine systematic attentional biases for interpersonal stimuli in samples of participants with social phobia or social anxiety. We carefully selected our depressed participants to exclude the cooccurrence of the two anxiety disorders that are most frequently comorbid with depression, i.e., GAD and panic disorder; we did not control for comorbid social phobia. Interestingly, several studies have now found that participants with social phobia and social anxiety direct their attention away from negative faces (e.g., Chen, Ehlers, Clark, & Mansell, 2002; Mansell et al., 1999). Given these results, it is unlikely that the current finding of a depression-associated sustained attention to sad faces is due to comorbid social phobia. Nevertheless, the use of different exposure times and control conditions (i.e., the use of household objects instead of neutral faces in Chen et al.'s study) makes it difficult to compare across investigations, and research examining more explicitly differences in the attentional functioning between depressed and social phobic participants is clearly warranted.

Another promising avenue for future research involves an examination of whether previously depressed participants demonstrate attentional biases for negative interpersonal cues. Studies using words as stimuli on the Stroop task have found little evidence that attentional biases in depression persist beyond the episode, at least in the absence of priming (Gilboa & Gotlib, 1997; Gotlib & Cane, 1987; Hedlund & Rude, 1995), suggesting that cognitive biases might be a symptom of, rather than a vulnerability for, depression. It may be, however, that these negative results are due to short stimulus exposure times and/or to the use of words as stimuli. It is important to note that interpersonal functioning has been found to remain impaired following recovery from depression (e.g., Billings & Moos, 1985a, 1985b; Gotlib & Lee, 1989), raising the possibility that cognitive biases for negative social stimuli may also persist after recovery. Indeed, if attentional biases for social stimuli are found to serve a functional role in the onset and/or maintenance of depression, information-processing paradigms can be fruitfully applied to the diagnosis and treatment of depression and, ultimately, to the prevention of this disorder.

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