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BRIEF REPORT

Attention to Emotional Information in Social Anxiety Disorder With and Without Co-Occurring Depression

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Abstract Despite the high comorbidity of Social Anxiety Disorder (SAD) and Major Depressive Disorder (MDD), we know little about how persons with co-occurring SAD–MDD compare to their counterparts with pure disorders. In the present study we investigated attention to facial emotional stimuli in adult women with SAD only ($n = 18$), MDD only ($n = 24$), co-occurring SAD–MDD ($n = 24$), and healthy controls (CTL; $n = 33$). Participants were exposed to angry, sad, neutral, and happy faces for 200 and 1,000 ms as cues in a Posner attention task. We examined patterns of attentional engagement, disengagement, and vigilance-avoidance as a function of cue valence. Across the attentional indices, both the SAD and SAD–MDD groups differed most consistently from the MDD and CTL groups: they exhibited differential patterns of attention to angry, sad, and happy faces, including relatively greater vigilance-avoidance for angry faces. There was little evidence for any MDD-associated biases in attention. Findings suggest that the attentional processing of emotional information in SAD generally overrides the potential influence of co-occurring MDD. Implications for the understanding and treatment of co-occurring SAD–MDD are discussed.

Keywords Social anxiety disorder · Depression · Comorbidity · Emotion · Attention

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Introduction

Anxiety disorders are the most prevalent of all mental disorders; moreover, Social Anxiety Disorder (SAD) is among the most common and chronic of the anxiety disorders. SAD is characterized by excessive fear of social and/or performance situations in which the person may be observed or evaluated by others (American Psychiatric Association 2000). SAD is experienced by approximately 7 % of the American population in a given year (Kessler et al. 2005), with a recovery rate of <40 % over 12 years (Bruce et al. 2005). In addition to having unique costs as an independent disorder, SAD is also highly comorbid with Major Depressive Disorder (MDD) (Kessler et al. 2005). In fact, persons diagnosed with SAD are four times more likely to develop MDD than are persons with no psychopathology (Chartier et al. 2003). Despite this high prevalence of comorbidity, we know little about the functioning of individuals with co-occurring SAD–MDD; most studies of clinical phenomena contrast participants with a single diagnosis against individuals with no psychiatric disorder, typically excluding, ignoring, or combining co-occurring disorders. The present study was designed to increase our understanding of comorbidity by directly comparing individuals diagnosed with SAD only, MDD only, and co-occurring SAD–MDD with respect to attention to emotional information, including a particular focus on vigilance-avoidance for threat-relevant information.

Several investigators have documented a propensity for individuals diagnosed with SAD to orient toward socially threatening information (e.g., angry facial expressions, social threat words) relative to neutral information at early, or automatic, stages of attention, often referred to as *vigilance* for threat (e.g., Mogg and Bradley 2002). Similar studies of other anxiety disorders have yielded parallel

findings of vigilance for threatening stimuli, typically when they are presented for 500 ms or less (e.g., Mogg et al. 1995). In response to stimuli that are presented for 500 ms or longer (e.g., Mogg et al. 2004; Pineles and Mineka, 2005; Vassilopoulos 2005), however, and other conditions of more elaborative processing (e.g., Amir et al. 1998), investigators have found that socially anxious individuals' initial bias toward threat shifts to either a lack of bias or *avoidance* of threat material. In conceptualizing this overall *vigilance-avoidance* pattern, theorists have posited that avoidance at later, or more elaborative, stages of attention reflects strategic efforts to decrease the anxiety elicited by threatening stimuli (Williams 1988), which ultimately prevents fear habituation (Foa and Kozak 1986). Indeed, some cognitive models suggest that strategic avoidance of external sources of threat is particularly relevant to SAD (reviewed in Heinrichs and Hofmann 2001). It is important to note, however, that not all studies have found these effects. For example, some studies have not found any evidence for vigilance at automatic or early stages of attention, or when they have documented evidence of such vigilance, they have found that attention to threat persists at longer stimulus durations (reviewed in Bögels and Mansell 2004).

In contrast, investigations of MDD have found an attentional bias toward disorder-relevant negative stimuli (e.g., sad faces, negative words) at later, but not at earlier, stages of attention, generally when stimuli are presented for 1,000 ms or longer (reviewed in Gotlib and Joormann 2010). Because SAD and MDD are highly comorbid, these divergent findings for each disorder highlight the need to understand the nature of attentional biases in co-occurring SAD–MDD, particularly with respect to the question of whether the biases that are central to each separate disorder are also observed in their co-occurrence. One intriguing model from the basic science literature proposes that because it is adaptive to be most responsive to threat, more so than to any other type of stimulus that may capture attention, the pattern of attentional processing of that characterizes SAD, including biases for threat-relevant information, should dominate attention or override other concurrent domains of responding (see Frewen et al. 2008; Kahneman and Tversky 2005). Extrapolating from this model, for the first time, to co-occurring SAD–MDD, the pattern of attentional processing that characterizes SAD would be expected to override the potential influence of co-occurring MDD. That is, co-occurring MDD would not be expected to disrupt the processing of emotional information in SAD. Notably, this hypothesis differs from previous speculations that depression, as an amotivational state, may impair orienting to threat in comorbid anxiety and depression (Mogg et al. 1995).

Only two studies have compared attentional biases in SAD only versus comorbid SAD and depression. Musa et al. (2003) found that participants with SAD only, but not those with comorbid SAD and MDD or dysthymia, exhibited an attentional bias toward social threat words presented for 500 ms. This finding is difficult to interpret, however, given that 500 ms represents a point during which attentional bias may shift in SAD. LeMoult and Joormann (2012) found an attentional bias away from angry faces at 1,000 ms in participants with comorbid SAD–MDD, but not in individuals with SAD only. They also found no difference between the SAD and SAD–MDD groups in attention toward sad faces. Although neither study included participants with MDD only, taken together with previous research they support the hypothesis that comorbid SAD–MDD is characterized by a strategic avoidance of threat and a dominance of the attentional pattern in SAD over that in MDD.

In the present study, we examined attention to facial emotional stimuli utilizing data from the widely-used Posner cued attention task completed by participants diagnosed with SAD only, MDD only, co-occurring SAD–MDD, and by never-disordered control participants (CTL). We chose to use the Posner task rather than the dot-probe task in this study because of its greater ability to isolate different components of attention (Posner 1980). We presented threat, sad, neutral, and happy stimuli to participants using two stimulus durations: one reflecting early attentional processes (200 ms) and the other reflecting later attentional processes (1,000 ms). This procedure allowed us to derive indices of engagement with, disengagement from, and vigilance-avoidance for the stimuli as a function of valence and presentation duration. We hypothesized that participants both with SAD only and with co-occurring SAD–MDD would exhibit differential patterns of attention to emotional stimuli relative to participants with MDD only and CTLs. More specifically, we hypothesized that participants both with SAD only and with co-occurring SAD–MDD would exhibit vigilance-avoidance for threat stimuli. We included participants with MDD only as a critical comparison group in order to determine whether this process is exhibited in MDD only in the presence of co-occurring SAD.

Methods

Participants

Ninety-nine women (18 SAD, 24 MDD, 24 SAD–MDD, and 33 CTL) between the ages of 18 and 60 years completed the study. Recruitment was conducted through local psychiatric clinics and online advertisements. Participants were initially screened for inclusion/exclusion criteria through a telephone interview. Exclusion criteria were: not

fluent in English; learning disabilities; history of severe head trauma; psychotic symptoms; bipolar disorder; and *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; *DSM-IV*; American Psychiatric Association 1994)-defined alcohol or substance abuse in the past 6 months. Participants who were identified as likely to meet inclusion criteria were invited to participate in a laboratory diagnostic evaluation based on *DSM-IV-TR* criteria using the Structured Clinical Interview for *DSM-IV* Axis I Disorders (SCID-I; First et al. 1996), administered by a trained interviewer. Participants in the SAD group met diagnostic criteria for current generalized SAD, with no current or lifetime MDD and no current generalized anxiety disorder (GAD). Participants in the MDD group met criteria for current MDD, with no current or lifetime SAD and no current anxiety disorders. Participants in the SAD–MDD group met criteria for current generalized SAD and current MDD, with no current GAD. Previous studies suggest that SAD and GAD are characterized by similar threat-related cognitive biases (e.g., Mogg et al. 1995). We excluded potential participants for the SAD and SAD–MDD groups on the basis of current GAD because we wanted to ensure that our study findings were related to primary SAD and were not confounded by co-occurring GAD. Finally, participants in the CTL group did not meet criteria for any current or lifetime Axis I disorder. Inter-rater reliability was excellent for the above diagnoses ($k = .92$–1.0).

Measures

We administered the Social Phobia and Anxiety Inventory (SPAI; Turner et al. 1989) and the Beck Depression Inventory (BDI-II; Beck et al. 1996) to assess symptom severity of SAD and MDD, respectively. Participants in the clinical groups were required to score at or above clinical cutoffs on the measures pertaining to their respective diagnoses [$\geq$14 on the BDI-II (at least mild depressive symptoms) and $\geq$80 on the SPAI SP subscale (probable SAD)]; CTL participants were required to score below clinical cutoffs for both diagnoses. To enhance diagnostic purity, participants in the SAD group were required to score below 20 on the BDI-II, and participants in the MDD group were required to score below 100 on the SPAI SP subscale.[1] Finally, participants completed the Social Avoidance and Distress Scale (SADS; Watson and Friend 1969) and the Hamilton Rating Scale for Depression (HRSD; Hamilton 1960).

Materials

A stimulus set of 24 faces expressing angry, sad, neutral, and happy emotions was selected from the validated NimStim Face Stimulus Set (http://www.macbrain.org/faces/index.htm). We selected an equal number of male and female faces and an equal number of faces of different races/ethnicities.

Design

The Posner cued attention task included 384 trials. On each trial, participants were presented with a fixation cross in the center of a computer screen, flanked by two white frames on the left and right (19 cm $\times$ 16 cm, 5 cm apart), for 500 ms. Participants were instructed to direct their attention to the fixation cross. Next, a face cue was presented inside one of the frames, while the other frame remained empty. On half of the trials the cue was presented for 200 ms, and on the other half the cue was presented for 1,000 ms. After these durations the face cue disappeared, and the frames disappeared 50 ms later. Then, the target letter "E" or "F" was presented in the center of one of the locations in which a frame had been. On half of the trials the letter was presented in the same location as the cue ('valid' trials), and on the other half the letter was presented in the opposite location of the cue ('invalid' trials). Participants were instructed to indicate as quickly and accurately as possible using a response box key press whether the displayed target was an "E" or an "F." Following the response, the screen was blank for a variable inter-trial interval of 800–1,900 ms.

Based on initial piloting, the paradigm was divided into two blocks in order to simplify the task for participants, with one block including the 200-ms stimulus presentations and the other block including the 1,000-ms stimulus presentations, administered in counterbalanced order across participants within groups. Within each block, cue valences and valid and invalid trials were randomized. Participants completed 32 practice trials before completing the test trials.

Procedure

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients for being included in the study.

[1] The initial sample included 119 participants. We excluded 19 participants: 6 SAD participants scored above the BDI-II cutoff; 1 MDD participant scored below the BDI-II cutoff; 6 MDD participants scored above the SPAI SP subscale cutoff; 1 SAD-MDD participant scored below the BDI-II cutoff; and 5 CTL participants scored above the SPAI SP subscale cutoff.

Participants completed the telephone interview and SCID, followed by the HRSD and self-report questionnaires. Participants were scheduled to complete the laboratory session 1 week later. The task was presented using E-Prime software on an IBM-compatible computer and Dell 17-inch color monitor. Participants sat approximately 50 cm from the monitor and were seated directly facing the horizontal center of the screen.

Data Reduction and Statistical Analysis

Reaction time (RT) data were included for all trials on which participants gave a correct response. Error trials represented 1.79 % of the data. Outlier RTs (<150 or >1,000 ms) represented 3.06 % of the data and were also excluded. There were no group differences in the proportion of error trials or outlier RTs. Mean RT was computed for each participant as a function of cue valence and cue duration.

Following the procedures of previous studies that have used modified versions of the Posner cued attention task (e.g., Koster et al. 2006; Koster et al. 2005), we computed two indices of emotional modulation of attention as a function of cue valence (angry, sad, happy) and cue duration (200, 1,000 ms):

Engagement ($RT_{valid\ neutral\ cue} - RT_{valid\ valenced\ cue}$), for which a positive score indicates increased attentional engagement with the cue and a negative score indicate decreased attentional engagement with the cue; and
Disengagement ($RT_{invalid\ valenced\ cue} - RT_{invalid\ neutral\ cue}$), for which a positive score indicates slower disengagement of attention from the cue and a negative score indicates faster disengagement of attention from the cue.

Importantly, there is evidence indicating that individuals with SAD respond to neutral facial expressions as if they were threatening faces (e.g., Cooney et al. 2006; Yoon and Zinbarg 2007); thus, these traditional indices of attentional engagement and disengagement, which compare RTs between valenced and neutral cues, may underestimate attention to threat in SAD.[2] Consequently, we also compared responses to shorter cue durations and longer cue durations on valid trials within each cue valence. Examining valid trials provides the most direct comparison of vigilance (i.e., more attentional engagement with the faces) at the shorter cue duration, and avoidance (i.e., less attentional engagement with the faces) at the longer cue duration. Accordingly, we computed an index of vigilance-avoidance as a function of cue valence (angry, sad, neutral, happy):

Vigilance-avoidance ($RT_{valid\ 1{,}000\text{-}ms\ valenced\ cue} - RT_{valid\ 200\text{-}ms\ valenced\ cue}$), for which a positive score indicates more attentional engagement with the 200-ms cue than with the 1,000-ms cue and a negative score indicates less attentional engagement with the 200-ms cue than with the 1,000-ms cue.

To examine both main and interactive effects of SAD and MDD as a function of cue valence, cue duration, and attentional index, we conducted separate repeated-measures analyses of variance (ANOVAs) on scores for engagement, disengagement, and vigilance-avoidance, respectively. Any significant interaction effects were decomposed by examining the underlying simple effects in a pre-specified order that was designed to optimize our understanding of group differences. First, we examined between-group differences in scores on the attentional index as a function of cue valence and cue duration. Next, we examined within-group differences in patterns of scores on the attentional index as a function of cue valence and cue duration. Finally, we examined between-group differences in these patterns of scores on the attentional index within groups as a function of cue valence and cue duration. Below, we describe in detail the significant main and interaction effects along with the groups' estimated marginal means derived from the models.

Results

Participant Characteristics

Demographic and clinical characteristics for the SAD, MDD, SAD–MDD, and CTL groups are presented in Table 1. There were no group differences in age, $F(3,98) = 2.20$, $p = .093$, proportion of college-educated participants, $\chi^2(3,N = 99) = 4.66$, $p = .198$, or distribution by race/ethnicity, $\chi^2(15,N = 99) = 13.94$, $p = .530$. The groups differed in current use of psychotropic medication, $\chi^2(3,N = 99) = 30.03$, $p < .001$; MDD and SAD–MDD participants were more likely to be taking medication than were SAD and CTL participants. The groups differed in additional diagnoses, $\chi^2(3,N = 99) = 22.47$, $p < .001$; SAD–MDD participants were more likely to have additional diagnoses than were SAD, MDD, and CTL participants, and SAD participants were more likely to have additional diagnoses than were CTL participants. Significant pairwise comparisons on the SPAI SP subscale, SADS, BDI-II, and HRSD are denoted in Table 1.[3]

[2] Supporting this possibility, in the present study the SAD group exhibited marginally greater vigilance-avoidance for neutral faces ($M = 17.10$) than did the CTL group ($M = -4.98$), $p = .06$.

[3] Importantly, we found that depressive symptom severity was not significantly associated with vigilance-avoidance for angry faces within the MDD group (BDI-II: $r = -.13$, $p = .56$; HRSD: $r = .16$, $p = .47$) or the SAD-MDD group (BDI-II: $r = .20$, $p = .35$; HRSD: $r = .20$, $p = .36$), or across the two groups (BDI-II: $r = .11$,

Table 1 Demographic and clinical characteristics of the SAD, MDD, SAD–MDD, and CTL Groups

Variable	SAD *M (SD)* or %	MDD *M (SD)* or %	SAD–MDD *M (SD)* or %	CTL *M (SD)* or %
Age	30.56 (11.22)	38.83 (12.19)	32.63 (10.99)	36.48 (12.33)
% college educated	83.33 %	79.17 %	60.00 %	78.79 %
Race/ethnicity[e]				
Non-Hispanic White	61.11 %	66.67 %	75.00 %	66.67 %
Hispanic	0.00 %	8.33 %	8.30 %	3.03 %
African-American	0.00 %	4.17 %	4.20 %	0.00 %
Asian-American	16.67 %	12.50 %	4.20 %	18.18 %
Native American	5.56 %	0.00 %	0.00 %	0.00 %
Other	16.67 %	8.33 %	8.30 %	12.12 %
% taking psychotropic medication[f]	0.00 %	50.00 %	41.70 %	0.00 %
% with one or more additional diagnoses	16.67 %	4.17 %	41.70 %	0.00 %
SPAI SP subscale score[g]	134.99 (25.85)[c]	76.17 (22.54)[b]	145.14 (17.57)[c]	39.23 (17.60)[a]
SADS score	20.22 (4.88)[c]	12.42 (6.63)[b]	22.67 (3.60)[c]	3.06 (2.82)[a]
BDI-II score	9.94 (6.42)[b]	26.88 (8.67)[c]	33.38 (9.85)[d]	1.42 (2.69)[a]
HRSD score	4.94 (2.71)[b]	13.83 (5.90)[c]	17.00 (4.32)[d]	1.88 (2.45)[a]

SAD = current generalized social phobia; MDD = current major depressive disorder; SAD–MDD = current generalized social phobia and major depressive disorder; CTL = no past or current psychiatric disorder; SPAI = Social Phobia and Anxiety Inventory; SADS = Social Avoidance and Distress Scale; BDI-II = Beck Depression Inventory-II; HRSD = Hamilton Rating Scale for Depression

[a,b,c,d] Significant pairwise comparisons, $p < .05$

[e] Due to rounding the percentages do not sum to 100.00 %

[f] Data were missing for one SAD participant

[g] Data were missing for one SAD participant and three MDD participants

Group Differences in Attention to Emotional Information

Engagement Scores

Raw scores for attentional engagement, disengagement, and vigilance-avoidance as a function of diagnostic group and face type are presented in Table 2. We examined engagement scores using a 2 (SAD diagnosis: absent, present) × 2 (MDD diagnosis: absent, present) × 3 (cue valence: angry, sad, happy) × 2 (cue duration: 200, 1,000 ms) × 2 (block order) repeated-measures ANOVA. The analysis yielded a significant main effect of cue valence, $F(2,182) = 6.60$, $p = .002$, $\eta^2_{\text{partial}} = .07$, which was qualified by a significant interaction of SAD diagnosis, cue valence, and cue duration, $F(2,182) = 4.68$, $p = .010$, $\eta^2_{\text{partial}} = .05$. When examining the simple effects underlying this three-way interaction, we found that participants with a diagnosis of SAD (SAD only and SAD–MDD) did not differ from participants without a diagnosis of SAD (MDD only and CTL) in engagement scores for any specific cue valence or cue duration, all *p*s > .136. However, participants with SAD differed significantly from participants without SAD in their overall patterns of engagement scores across the cue valences and cue durations. First, at the 200-ms cue duration, participants with SAD exhibited greater engagement with happy faces ($M = 10.35$) than with sad faces ($M = -1.70$), $p = .004$, whereas participants without SAD did not exhibit this effect (happy faces: $M = 3.31$, sad faces: $M = 4.17$), $p = .804$. These patterns of engagement as a function of SAD diagnosis differed significantly from one another, $t(97) = -2.20$, $p = .030$. Second, at the 1,000-ms cue duration, participants with SAD exhibited relatively greater engagement with sad faces ($M = -0.89$) than with angry faces ($M = -6.01$), $p = .203$, whereas participants without SAD exhibited less engagement with sad faces ($M = -4.32$) than with angry faces ($M = 2.74$), $p = .041$; these patterns of engagement as a function of SAD diagnosis differed significantly from one another, $t(97) = 2.58$, $p = .011$. No other main or interaction effects were significant.

Disengagement Scores

We examined disengagement scores by conducting a 2 (SAD diagnosis: absent, present) × 2 (MDD diagnosis:

Footnote 3 continued
p = .48; HRSD: $r = .22$, $p = .13$). In addition, participants in the MDD group and SAD-MDD group did not significantly differ in the number of past depressive episodes (MDD: $M = 6.18$; SAD-MDD: $M = 4.38$; $p = .35$) or the duration of the current episode in months (MDD: $M = 8.98$; SAD-MDD: $M = 14.89$; $p = .32$).

Table 2 Raw Scores for Engagement, Disengagement, and Vigilance-Avoidance as a Function of Diagnostic Group

Variable	SAD *M (SD)*	MDD *M (SD)*	SAD–MDD *M (SD)*	CTL *M (SD)*
Engagement				
Angry 200 ms	2.15 (31.50)	−2.12 (25.34)	3.37 (25.42)	−2.47 (24.36)
Angry 1,000 ms	−5.61 (33.65)	6.59 (20.54)	−7.78 (30.52)	−1.08 (26.14)
Sad 200 ms	−1.48 (27.76)	7.09 (24.02)	−2.36 (32.10)	0.83 (25.21)
Sad 1,000 ms	−0.79 (28.94)	1.82 (26.02)	−1.43 (26.64)	−10.27 (27.10)
Happy 200 ms	12.32 (20.83)	3.86 (26.45)	7.25 (24.49)	3.08 (31.21)
Happy 1,000 ms	11.08 (35.31)	10.70 (34.34)	0.65 (31.44)	−2.37 (21.52)
Disengagement				
Angry 200 ms	−5.81 (27.40)	5.25 (35.51)	2.46 (29.98)	−9.45 (24.56)
Angry 1,000 ms	1.78 (30.02)	−3.36 (25.99)	−2.09 (24.65)	−7.58 (24.43)
Sad 200 ms	−4.82 (29.15)	−0.14 (27.15)	−0.66 (25.39)	−6.28 (18.61)
Sad 1,000 ms	−10.48 (25.67)	−2.36 (28.23)	3.54 (33.70)	6.07 (29.28)
Happy 200 ms	−9.88 (25.44)	−0.63 (27.86)	−0.71 (25.96)	−0.47 (24.94)
Happy 1,000 ms	6.19 (32.93)	4.71 (32.31)	4.11 (32.63)	−2.51 (24.91)
Vigilance-avoidance				
Angry	24.86 (34.16)	8.21 (43.87)	25.82 (39.19)	−6.38 (45.91)
Sad	16.41 (29.62)	22.19 (48.36)	13.74 (44.89)	6.12 (46.71)
Neutral	17.10 (38.88)	16.92 (44.93)	14.67 (33.50)	−4.98 (38.61)
Happy	18.33 (39.70)	10.08 (52.81)	21.27 (48.52)	0.47 (45.58)

SAD = current generalized social phobia; MDD = current major depressive disorder; SAD–MDD = current generalized social phobia and major depressive disorder; CTL = no past or current psychiatric disorder

absent, present) × 3 (cue valence: angry, sad, happy) × 2 (cue duration: 200, 1,000 ms) × 2 (block order) repeated-measures ANOVA. The analysis yielded a significant interaction of cue valence and block order, $F(2,182) = 3.60$, $p = .029$, $\eta^2_{\text{partial}} = .04$, which was qualified by a significant interaction of SAD diagnosis, cue valence, and block order, $F(2,182) = 3.07$, $p = .049$, $\eta^2_{\text{partial}} = .03$. When examining the simple effects underlying this three-way interaction, we found that participants with a diagnosis of SAD (SAD only and SAD–MDD) did not differ from participants without a diagnosis of SAD (MDD only and CTL) in disengagement scores for any specific cue valence or block order, all ps $> .107$, or in their overall patterns of disengagement scores across cue valences and block orders, all ps $> .061$. However, participants with SAD who first completed the 200-ms block differed significantly from participants with SAD who first completed the 1,000-ms block in their patterns of disengagement scores across cue valences. Specifically, participants with SAD who first completed the 200-ms block exhibited slower disengagement from happy faces ($M = 7.42$) than from sad faces ($M = -6.66$), $p = .003$, whereas participants with SAD who first completed the 1,000-ms block exhibited relatively faster disengagement from happy faces ($M = -4.96$) than from sad faces ($M = 0.69$), $p = .173$. These patterns of disengagement as a function of block order differed significantly from one another, $t(48) = -2.58$, $p = .013$.

The analysis of disengagement scores also yielded a significant interaction of SAD diagnosis, MDD diagnosis, cue valence, and cue duration, $F(2,182) = 3.74$, $p = .026$, $\eta^2_{\text{partial}} = .04$. When examining the simple effects underlying this four-way interaction, participants with a diagnosis of SAD did not differ from participants without a diagnosis of SAD in disengagement scores for any specific cue valence or cue duration as a function of MDD diagnosis, all ps $> .066$, and participants with a diagnosis of MDD did not differ from participants without a diagnosis of MDD in disengagement scores for any specific cue valence or cue duration as a function of SAD diagnosis, all ps $> .083$. However, specific diagnostic groups differed significantly from one another in their patterns of disengagement scores across cue valences and cue durations. First, at the 1,000-ms cue duration, participants with SAD only exhibited slower disengagement from angry faces ($M = 3.97$) than from sad faces ($M = -9.37$), $p = .040$, whereas participants with SAD–MDD exhibited relatively faster disengagement from angry faces ($M = -2.09$) than from sad faces ($M = 3.54$), $p = .300$, and CTL participants exhibited faster disengagement from angry faces ($M = -7.43$) than from sad faces ($M = 6.19$), $p = .004$. These patterns of disengagement differed significantly between participants with SAD only and participants with SAD–MDD, $t(40) = -2.05$, $p = .049$, and between participants with SAD only and CTL participants,

$t(49) = 3.57$, $p = .001$. Second, at the 1,000-ms cue duration, participants with SAD only exhibited slower disengagement from happy faces ($M = 10.31$) than from sad faces ($M = -9.37$), $p = .004$, whereas CTL participants exhibited relatively faster disengagement from happy faces ($M = -2.54$) than from sad faces ($M = 6.19$), $p = .075$. These patterns of disengagement differed significantly between participants with SAD only and CTL participants, $t(49) = -3.08$, $p = .003$. No other main, interaction, or simple effects were significant.

Vigilance-Avoidance Scores

Finally, we examined vigilance-avoidance scores using a 2 (SAD diagnosis: absent, present) × 2 (MDD diagnosis: absent, present) × 4 (cue valence: angry, sad, neutral happy) × 2 (block order) repeated-measures ANOVA. As predicted, the analysis yielded a significant interaction of SAD diagnosis and cue valence, $F(3,273) = 3.14$, $p = .026$. When examining the simple effects underlying this two-way interaction, participants with a diagnosis of SAD (SAD only and SAD–MDD) exhibited greater vigilance-avoidance scores for angry faces ($M = 24.58$) than did participants without a diagnosis of MDD (MDD only and CTL) ($M = 0.01$), $p = .005$; there were no significant group differences for sad, neutral, and happy faces. The analysis also yielded a main effect of block order, $F(1,91) = 12.82$, $p = .001$. Pairwise comparisons indicated that participants who completed the 1,000-ms block first exhibited greater vigilance-avoidance scores ($M = 24.88$) than did participants who completed the 200-ms block first ($M = -0.85$), $p = .001$. No other main or interaction effects were significant.

Discussion

The present study was designed to examine attention to emotional information in SAD and the role of co-occurring MDD, a common diagnostic comorbidity. Across the attentional indices, participants both with SAD only and with co-occurring SAD–MDD exhibited differential patterns of attention to angry, sad, and happy faces, including greater vigilance-avoidance scores for angry faces, relative to participants with MDD only and CTL participants. Thus, the presence of co-occurring MDD did not significantly affect the attentional pattern that characterized participants with SAD only.

In contrast, there was little evidence of differential processing of sad stimuli in participants with MDD only or with SAD–MDD. In fact, the only significant effect for MDD diagnosis indicated that participants with co-occurring SAD–MDD, compared to participants with SAD only, exhibited relatively slower disengagement from sad than from angry faces at the longer cue duration. In co-occurring SAD–MDD, the predominance of the attentional pattern that characterizes SAD, combined with the lack of evidence for the attentional pattern that characterizes MDD, is consistent with findings reported by LeMoult and Joormann (2012) in their sample of comorbid SAD–MDD participants. Importantly, however, we also found no attentional biases in participants with MDD only relative to the other groups. Several previous studies have similarly failed to find depression-associated biases in attentional processes (e.g., Karparova et al. 2005; Koster et al. 2006; Suslow et al. 2004; Wisco et al. 2012). We should note here that we examined attention only to facial stimuli, which may be particularly relevant to SAD. This is a limitation of this study, and future investigations should include an assessment of responses to valenced verbal material or other types of valenced images (e.g., emotional scenes) across pure and comorbid diagnostic groups.

With respect to the specific patterns of attention that characterized participants with an SAD diagnosis, we found that these patterns included greater engagement with happy faces than with sad faces at the early stage of processing, but greater engagement with sad faces than with angry faces at the later stage of processing. This latter finding has some parallels with our results for SAD diagnosis and vigilance-avoidance in response to angry faces; in particular, both of these effects include a relative avoidance of threat stimuli at the later stage of attention. It is important to note that we operationalized vigilance-avoidance in a manner that captures the extent to which individuals exhibit greater attentional engagement at shorter stimulus durations and less engagement at longer durations; thus, this is not an absolute measure of vigilance or avoidance. Although similar results were not fully reflected in the engagement or disengagement indices, we had constructed our index of vigilance-avoidance based on the fact that these traditional indices, which compare RTs between valenced and neutral cues, may underestimate attention to threat in SAD (see Cooney et al. 2006; Yoon and Zinbarg 2007). Nevertheless, future studies using the Posner task or other attention tasks should examine this index of vigilance-avoidance further. In addition, given that participants with SAD exhibited several differential patterns of attention across angry, sad, and happy faces in this study, and recent findings of SAD-associated biases for emotional faces more generally (e.g., Campbell et al. 2009; Klumpp et al. 2013), future studies should continue to include multiple different types of emotional stimuli.

This study represents the first extrapolation of a basic science model to co-occurring SAD–MDD, in which SAD-driven attentional processing was hypothesized to dominate or override the potential influence of concurrent MDD.

Taken together, the findings are consistent with this formulation and have implications for the understanding and treatment of persons with co-occurring anxiety disorders and depression. For example, if SAD-based attention is predominant in the initial stages of information processing in co-occurring SAD–MDD, interventions such as attentional bias modification programs may be most effective for comorbid individuals by initially working to decrease responsivity to threatening stimuli. In addition, our analyses indicated that the SAD and SAD–MDD groups exhibited enhanced vigilance-avoidance as an overall pattern of attention to threat material, whereas differences between participants with and without SAD in the components of engagement and disengagement were nonsignificant. Intriguingly, elevated vigilance-avoidance may be best conceptualized and treated in SAD as an overall temporal pattern, whereas attempting to address only one of its components may not produce the most effective results.

The analyses also yielded two effects in which task block order influenced patterns of attention: participants who first completed the block of longer stimulus durations exhibited greater vigilance-avoidance across cue valences, and participants with SAD exhibited differential patterns of disengagement from sad versus happy faces as a function of block order. Because block order affected vigilance-avoidance scores for all groups and cue valences, as well as disengagement scores for participants with SAD across cue durations, the interpretation of these findings is unclear. It is possible that participants were able to orient to the 200-ms facial stimuli more easily if they had seen them previously during the 1,000-ms block. In addition, participants' arousal levels may have differed as a function of cue duration due to the blocking of this variable, confounding interpretation of the results. In the future, investigators using attentional paradigms might randomize stimulus duration in order to reduce any systematic biases in the data.

There are two additional limitations of this study that warrant discussion. First, we focused on attentional bias in our samples of pure and co-occurring SAD and MDD participants; further studies are needed to examine other aspects of functioning in this highly common and impairing form of diagnostic comorbidity. Second, we restricted our sample to women in order to increase statistical power, and we used relatively stringent standards to recruit participants into each group on the basis of diagnoses and symptom measures. While these aspects of the study likely enhanced our ability to identify group differences, they also limit generalizability of the findings, and future work should examine these effects in larger and more heterogeneous samples.

In sum, the current results suggest that the pattern of attention to emotional information that characterizes SAD generally overrides the potential influence of co-occurring MDD. While numerous models have been proposed to understand the causes of comorbidity of anxiety and depressive disorders, few studies have directly compared individuals with co-occurring disorders to their counterparts with pure diagnoses. More broadly, conventional models and methods of clinical practice focus on treating single disorders. Future translational research should help to generate a more complete model of anxiety and depression co-occurrence, which will ultimately aid in the development of more personalized and effective interventions for the significant proportion of individuals with co-occurring SAD–MDD.

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Conflict of Interest Katharina Kircanski, Jutta Joormann, Ian H. Gotlib declare that they have no conflict of interest.

Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (national and institutional). Informed consent was obtained from all individual subjects participating in the study.

Animal Rights No animal studies were carried out by the authors for this article.

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