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The Utilization of Eyetracking to Understand Attention Switching in Socially Anxious and Depressed Individuals

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ABSTRACT

Individuals with social anxiety disorder (SAD) and major depressive disorder (MDD) have demonstrated differences in attention bias processing, leading to a differential processing of the world around them. As such, there is a pressing need to further understand these hypothesized attentional biases to lend to improved therapeutic deliveries. The present study utilized a novel eye-tracking paradigm to understand attentional biases in individuals with disorder-specific symptomology of SAD and MDD. A sample of 103 undergraduates completed measures of social anxiety, depression and a novel eye-tracking paradigm. Results showed that a combination of elevated SAD and MDD symptoms lends to a slower disengagement time from negative stimuli when compared to healthy control participants, regardless of negatively valenced stimuli (sad or disgust face). Contrary to expectation, individuals with elevated MDD symptoms did not demonstrate an overall difference in disengagement practices when compared to control participants.

Keywords: depression, social anxiety, eye-tracking, attentional bias

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CHAPTER I

INTRODUCTION

Major depressive disorder (MDD) and social anxiety disorder (SAD) are common, highly comorbid, and debilitating in nature. Independent lifetime prevalence rates of both disorders range from 13%-16%, with 37% of those diagnosed with one disorder evidencing clinical threshold of the other (Kessler, 2012). These high comorbidity rates are surpassed only by the personal and societal costs associated with the two disorders, which exceed 44.4 billion dollars annually in the United States (Collins, Westra, Dozois, & Burns, 2004). Given that anxiety disorders often precede the onset of MDD (Dalrymple & Zimmermann, 2011), identifying specific mechanisms that presage the onset of each disorder may inform prevention efforts, and perhaps reduce the risk of their sequelae.

Traditional models of both disorders point to disrupted attention processes as potential mechanisms for both disorders, with difficulties disengaging from emotion-congruent information linked to each (Bradley, Mogg, Millar, & White, 1995; Gotlib & Joormann, 2010; Sanchez, Vazquez, Marker, LeMoult, and Joorman, 2013). Specifically

anxiety is believed to be linked to threat-appraisal in both the early stage of attention (Mathews & MacLeod 1994; Williams, Mathews, & MacLeod, 1996), coupled with downstream cognitive processing of social stressors (Çek, Sanchez, & Timpano, 2016), while depression is associated with voluntary attentional bias towards dysphoric stimuli (Armstrong & Olatunji, 2012). Emergent literature points to difficulty in attention shifting away from dysphoric stimuli as specific to depression (Gotlib & Joormann, 2010; Donaldson, Lam, Mathews, 2007; Gotlib, Krasnoperova, Yue, & Joormann, 2003).

Empirical findings have been mixed with respect to the role of attention biases in the two disorders, with some supporting the above noted pattern of attention processing (Bradley, Mogg, Millar, & White, 1995; Holas, Krejtz, Cypryanska & Nezlek, 2014; Joorman & D'Avanato, 2010; Mathews & MacLeod, 2005; Mathews & Mackintosh, 1998; Mackintosh & Mathews, 2003; Mogg & Bradley, 1998; Mogg, Millar & Bradley, 2000; Perez, Baños, Ruipérez & Belloch, 1999; Wilson & MacLeod, 2003; Yiend & Mathews, 2001), and other failing to note such distinctions (Gotlib et al., 2004; LeMoult, Yoon, & Joormann, 2012; Kirkanski, Joormann, & Gotlib, 2014). Such mixed results may, in part, stem from the use of behavioral measures of attention that are confounded with motor activity in their measurement of attention responses. Efforts to overcome such limitations have employed eye tracking methodologies that do not require motor movement to ascertain indices of visual attention. However, these efforts have largely revolved around studying bias during naturalistic viewing paradigms, such as Stroop tasks or dot-probe tasks, in which participants' attention preferences are measured. Thus, it remains unclear whether SAD and MDD evidence differential patterns in disengaging attention away from disorder-specific stimuli.

The present study aims to overcome the above noted limitations in the literature by examining attention disengagement to disorder-specific stimuli as a mechanism for understanding attention biases for SAD versus MDD. In the sections below, further information on each disorder is provided, and a rational for the hypothesized disorder-specific attention deficits is discussed.

1.1 *Major Depressive and Social Anxiety Disorder*

Major Depressive Disorder is characterized by both anhedonia and sustained sadness, and is one of the most common mental health disorders in the United States. Over a one-year period, an estimated 15.7 million adults living in the United States suffered from at least one episode of MDD (Kessler et al., 2005). The median onset age for MDD is 32 years old, with prevalence rates between 20-26% for women and 8-12% for their male counterparts (Journal of the American Medical Association, 1996). The onset of depression demonstrates a chronic course, however, improvement of symptoms after four to six weeks of psychotherapy are above 80% (National Institute of Health, 1998).

Social Anxiety Disorder (SAD) is characterized by an excessive fear of social or performance situations in which the individual is concerned or embarrassed about performing inadequately or displaying visible anxiety symptoms in front of others. This disorder is one of the most common and chronic forms of anxiety disorders (Kircanski, Joormann, Gotlib, 2015), affecting 13% of the US population during their lifetime (Belzer, McKee, & Liebowitz, 2005; Kessler, 2013), and 7% within a given year (Kessler et al., 2005). SAD is the fourth most common psychological disorder worldwide (Kessler, 2005; Weeks, Howell, & Goldin, 2013). Unlike MDD, SAD demonstrates an adolescence onset, and exhibits a chronic course, with recovery falling below a 40% rate

over a decade follow-up period (Bruce et al., 2005; Kircanski, Joorman, & Gotlib, 2014). Indeed, estimates suggest that over one-third of those with SAD wait over 10 years before seeking treatment (Kaufman & Baucom, 2014), which speaks to the chronic course of the disorder.

1.2 *Models of Major Depression and Social Anxiety Disorders*

Major Depression Disorder. Cognitive models of MDD propose that depression is caused and maintained by biases in the processing of emotional information (Beck, 1979; Bower, 1981; Sanchez et al., 2013; Teasdale, 1988). Beck (1976) postulated that existing memory representations, or schemas, lead individuals to filter stimuli from the environment such that their attention is directed toward information that is congruent with their schemas. Beck (1976) further theorized that the schemas of depressed persons include themes of loss, separation, failure, worthlessness, and rejection; consequently, depressed individuals will exhibit a systematic bias in their processing of environmental stimuli or information that is relevant to these themes. Because of this bias, depressed people attend selectively to negative stimuli in their environment and interpret neutral and ambiguous stimuli in a schema-congruent way (Gotlib & Joormann, 2010). Moreover, dysfunctional schemas and processing biases are presumed to endure beyond the depressive episode, representing stable vulnerability factors for depression onset and recurrence. When the dysfunctional schemas are activated by stressors, specific negative cognitions are generated that take the form of automatic thoughts and revolve around pessimistic views about the self, the world, and the future (Gotlib & Joormann, 2010). Thus, governed by these dysfunctional schemas, a depression-prone individual

selectively attends to mood congruent information that maintains their dysphoric states that progress into the clinical manifestation of the disorder.

In regards to disengagement practices, Koster, Lissnyder, Derakhshan, & De Raedt (2011) propose the impaired disengagement hypothesis as a means to explain disengagement practices among individuals with high depressive symptomology. This hypothesis posits that the prolonged processing of self-referent material is due to impaired attentional disengagement from negative self-referent information (Koster, Lissnyder, Derakhshan, & De Raedt, 2011), which can account for prolonged disengagement time among individuals with high depressive symptoms. As such, when depressed individuals are exposed to mood-congruent, negative stimuli, such as sad faces, extended disengagement time are observed (Koster, Lissnyder, Derakhshan, & De Raedt, 2011). This extension of disengagement time is hypothesized to be a result of individuals demonstrating a difficulty to exercise attentional control in response to negative thoughts, thus likely experiencing persistent rumination.

Difficulties disengaging from negative stimuli may preclude depressed individuals from utilizing effective emotion regulation strategies such as distraction when confronted with stressful events, resulting in sustained processing of negative information, which can lead to prolonged negative affect (Sanchez et al., 2013). Additionally, these attentional bias may interfere with an individual's ability to reframe the presented negative stimuli through stimuli reappraisal (Sanchez et al., 2013). Difficulties with attentional disengagement may contribute to rumination of negatively valenced stimuli (Koster, De Lissnyder, Derakshan, & De Raedt, 2011).

Social Anxiety Disorder. Cognitive theories of SAD posit that the main process of SAD is self-directed attention triggered by social situations, with a corresponding withdrawal of adaptive attention to positive external cues (Clark & Wells, 1995; Rapee & Heimberg, 1997). Models of SAD (Clark & Wells, 1995) predict that information processing biases play a role in the maintenance of the disorder's psychopathology. Current evidence suggests that SAD increases attentional threat biases. Studies have supported this assumption by showing that individuals with a high level of social anxiety tend to display an attentional bias towards external threats, and a greater likelihood of favoring the threatening meaning of ambiguous cues (Peschard & Philippot, 2015). Furthermore, Rapee and Heimberg's (1997) theory posits that individuals with SAD come to view the world as a harsh and critical place, and consequently conduct their lives as though they are under the constant scrutiny of others. Socially anxious individuals are said to generate and attend to a negative self-impression based on their prior beliefs, feelings, and self-image. Subsequent self-evaluation of social performance is then driven by this negative self-impression, rather than by external feedback from others (Abbott & Rapee, 2004).

As previously noted, attention bias to threat (e.g., disgust faces) is a cognitive vulnerability factor for social anxiety that occurs in the early stages of information processing (Çek, Sanchez, & Timpano, 2016). The utilization of disgust faces for threatening stimuli derives from the idea that socially anxious individuals scan their environment for feedback from their peers (Peschard & Philippot, 2015). Thus, a "disgust face", which is indicative of negative social feedback, would be viewed by someone with social anxiety as threatening. Individuals with elevated levels of SAD tend to exhibit

longer time to engage with threatening stimuli, but also exhibit late stage cognitive processing following the presentation of threatening stimuli, thus leading to longer disengagement times. By understanding engagement and disengagement practices of socially anxious individuals with regards to threatening stimuli, the etiology, maintenance, and treatment of SAD can be improved upon. Schofield et al. (2012) have investigated disengagement practices among socially anxious individuals, concluding that people with high levels of social anxiety were in fact slower to divert their attention away from disgust stimuli.

Additionally, Çek, Sanchez, & Timpano (2016) propose that post-event processing (PEP) is associated with disengagement practices among socially anxious individuals. PEP refers to repeated thinking about and reevaluation of the negative aspects of one's performance after a social situation (Çek, Sanchez, & Timpano, 2016), which is crucially important when considering cognitive vulnerability and maintenance factors of social anxiety symptoms. Thus, Çek, Sanchez, & Timpano (2016) posit that when individuals are experiencing high levels of social anxiety, they will take longer to disengage due to their attention to and subsequent dwelling on the presented stimuli. In a study conducted by Çek, Sanchez, & Timpano, (2016), participants were exposed to stimuli of happy, sad, disgust, and neutral faces and disengagement practices were observed using an eye-tracker with the goal of understanding attentional biases with disgust stimuli in socially anxious participants. Overall, Çek, Sanchez, & Timpano (2016) determined that individuals with elevated levels of social anxiety demonstrated longer disengagement times along with longer PEP times. This novel finding by Çek, Sanchez, & Timpano (2016) elucidates the idea that socially anxious people dwell, and

take longer to process, presented threatening stimuli, thus demonstrating difficulty diverting their attention away from the presented threat.

CHAPTER II

ATTENTIONAL BIASES

It is well established that the scope of attentional focus is limited, that there can be only one focus of attention at a given time, and that only information selected to be attended to undergoes extensive processing (Sears et al., 2010). Attention functions via selecting relevant stimuli in the environment for further scrutiny (Lavie et al., 2004). Because of this, when multiple sources of information compete for visual attention, an individual must prioritize visual allocation by shifting the focus of their attention from one source to another (Sears et al., 2010). Researchers studying selective attention in clinical populations have discovered attentional biases in the allocation of attentional foci, such that concern-related or mood-congruent material is given priority (Sears et al., 2010).

Attention biases in depression and social anxiety have largely been examined with respect to selective attention engagement (Armstrong & Olantunji, 2012), which reflects preferential attention allocation towards or away from a given stimulus. Attention biases may also reflect difficulty switching, or disengaging attention away from valenced stimuli, which somewhat reflects a capture of attention processes (Armstrong &

Olantunji, 2012). While there is some evidence for attention bias in both MDD and SAD, cognitive theories predict differential attentional deficits across the two disorders.

2.1 *Attention Bias in Major Depressive Disorder*

As previously noted, cognitive theories of depression posit that depression risk stems, in part, from negative information processing that is governed by, and filtered through, negative self-schemas (e.g., Beck 1979, 1987). This information processing involves biased allocation of attention, which reflects directed attention towards schema-congruent information in the environment (Williams, Watts, MacLeod, & Mathews, 1997).

Despite a clear theoretical basis for biased attention processing in depression, empirical findings on such biases in depression have been mixed. For example, Beck's (1976) model predicts that depression should be associated with an attentional bias for mood-congruent stimuli. Thus, mood-congruent interference effects should be present for depressed populations when compared with controls, which could be measured via the Stroop task (Mathews & MacLeod, 1986). The Stroop task asks participants to look at color words and proceed to read them aloud. Interestingly, the names of the color (i.e.: "red") is printed in a different color ink, such as blue. The "Stroop effect" is then observed, as participants will sometimes state the color of the printed word while disregarding the actual word that is printed. The "Stroop effect" is observed differently in individuals with disorder-specific symptomology. Research has shown that depressed populations exhibit inconsistent depression-related Stroop effects and strong memory biases (Dalgleish & Watts, 1990; Mathews & MacLeod, 1994; Mineka, Watson, & Clark, 1998; Mogg & Bradley, 2005; Williams et al., 1988). For instance, while some have

observed slower word and color naming performance on the Stroop among depressed participants, presumably indicating greater attention interference (Kertzman et al., 2010), others found that depressed individuals outperformed their non-depressed peers (Markela-Lerenc et al., 2006) in color-naming words.

Similar mixed findings were observed using the visual dot probe paradigm that examines biased attention allocation by priming the participants with a dot to the location of valenced and non-valenced words or faces in the visual field (Fritzsche et al., 2010; Gotlib et al, 2004a, b; MacLeod, Mathews, & Tata, 1986; Mogg et al., 1995; Rinck & Becker, 2005). For example, in a series of studies, Gotlib and colleagues (Gotlib, Kasch, et al., 2004; Gotlib, Krasnoperova, et al., 2004; Joormann & Gotlib, 2007) found clinically depressed participants exhibit an attentional bias toward sad faces**.** These findings were independently replicated by Fritzsche et al. (2010), who confirmed an attention bias towards sad faces and a bias away from happy faces among individuals who were in the middle of a depression episode. In contrast, others failed to show attentional biases among depressed participants who were exposed to negatively valenced words (Rinck & Becker, 2005) or faces (Mogg et al., 1995).

There is a surprising dearth of work that examines biased attention switching in depressed participants. Attention switching can be defined as one's ability to visually engage with specific stimuli, then diverting your visual attention to another presented stimulus in the same visual field. Although most emotional stimuli could initially draw our attentional focus, it is adaptive for people to shift away from that information if it poses no immediate relevance. Here, individuals will shift their attention elsewhere, as it would be maladaptive for a person to continue focusing on certain information

(particularly negative information) that no longer holds value. However, individuals with mood disorders, such as MDD or SAD, tend to perseverate on negative stimuli, which could be reflected in attentional inflexibility in response to disorder-specific inputs (such as disgust or sad faces).

The disengagement, or lack thereof, from negative stimuli can be framed in terms of attention switching processes. Due to certain cognitive mechanisms underlying these disorders, such as rumination in MDD or post-even processing (PEP) in SAD, disengagement from negative stimuli becomes a challenging task. Overall, individuals are less able to divert their attention from stimuli that is resonating with their symptomology. Attention switching is important when attempting to understand how depressed individuals interpret social interactions, thus impacting how these individuals regulate their emotions (Sanchez, Romero, & De Raedt, 2017). While some researchers have found that depressed individuals are characterized by deficits in emotional processing (Carton et al., 1999; Rubinow & Post, 1992), other researchers have independently failed to replicate these findings (Ridout et al., 2009). Such inconsistent results may in part be attributed to the use of low intensity stimuli, such as negatively valenced words, that may be insufficient to evoke adequate attention capture among depressed individuals. Indeed, the use of negative valenced faces has been shown to more robustly evoke attention biases among depressed persons (Gotlib & Joormann, 2010), that may in turn be evidenced in their difficulty disengaging from negatively valenced information (De Raedt & Koster, 2010; Peckham, McHugh, & Otto, 2010).

Sanchez et al., (2013)'s approach to understanding shifting biases in MDD participants consisted of presenting stimuli that comprised emotional (happy, sad, and

disgust) and neutral facial expressions of the same person. These facial expression pictures were selected from the Karolinska Directed Emotional Faces database (Lundqvisk, Flykt, & Öhman, 1998). Each trial started with a black screen for 500 ms, followed by the display of a white fixation cross in the middle of a black screen for 500 ms. A white random 1-digit number (ranging from 1 to 9) replaced the fixation cross, appearing in the center for 1,000 ms. Participants were instructed to fixate on the number and say it aloud as quickly as possible. Immediately after the offset of the 1-digit number, a pair of faces (either happy-neutral, angry-neutral, or sad-neutral) was presented for 3,000 ms and participants were told to freely watch the screen without constraints. Fixation data was recorded with the eye-tracker during the 3,000 ms period and was used to estimate three indices of naturalistic processing employed in previous research: initial orientation, fixation frequency, and fixation time (Sanchez et al., 2013). Results showed that dysphoric and depressed participants evidenced difficulty disengaging visual attention away from sad faces (Sanchez et al., 2013). Given these slower disengagement times from sad faces in depressed and dysphoric participants, this proposes that mood-congruent stimuli impacts visual attention. Specifically, Sanchez et al.'s (2013) study confirms that depression is associated with difficulties disengaging attention from depression-related stimuli, such as sad faces. The depressed participants were slower to disengage from sad faces relative to control group participants, while the control group did not demonstrate attentional engagements or disengagements difficulties from other emotional stimuli, (i.e., angry faces, happy faces) (Sanchez et al., 2013). Specifically, depressed participants demonstrated an overall slower disengagement from sad stimuli when compared to the control groups. These difficulties disengaging could be

representative of deficits in inhibitory control, resulting in the prolonged processing of negative, goal-irrelevant aspects of presented visual information, hindering recovery from negative moods and leading to an overall sustained negative affect within the depressive episode (Gotlib & Joormann, 2010; Sanchez et al., 2013) This novel methodology to attention bias in depressed individuals is thought to be associated with a lack of inhibitory control over negative information and with the use of maladaptive emotion regulation strategies, which would result in sustained negative affect (Sanchez, Romero, & De Raedt, 2017).

Sanchez et al.'s (2013) study sought to understand if depressed individuals took longer to disengage from mood-congruent stimuli as a result of prolonged processing of negative stimuli. This difficulty in disengaging could be a result of deficits in inhibitory control (Sanchez et al., 2013). Malfunctioning inhibition of irrelevant negative stimuli could result in prolonged processing of negative, goal-irrelevant aspects of presented information and thereby hindering recovery from negative mood and leading to the sustained negative affect that characterizes depressive episodes (Sanchez et al., 2013; Gotlib & Joorman, 2010).

In summary, there is mixed evidence to suggest that depression is associated with biased attention towards mood-congruent stimuli, such as sadness (Gotlib & Joormann, 2010; Sanchez et al., 2013), and not in response to threat (Williams et al., 1988). Further, emerging evidence using eye tracking methods suggests that depression is linked to deficits in the capacity to disengage attention from sadness-related material, due to a deficit in inhibitory controls of cognitive processing.

2.2 *Attention Bias in Social Anxiety Disorder*

As previously noted, cognitive theories of social anxiety posit that social anxiety risk stems, in part, from preferentially attending to socially threatening information and thus exhibits enhanced memory for presented information. Accordingly, SAD is associated with quick detection and immediate attention to relevant stimuli, even when stimuli are presented subliminally (LeMoult, Yoon, & Joormann, 2012b).

Despite a clear theoretical basis for biased attention in social anxiety disorder, empirical findings on such biases in SAD are mixed. For example, while, as expected, socially threatening information has been shown to interfere in processing non-threatening information for socially anxious individuals on the Stroop task (Mogg et al., 1995), others showed that anxious individuals process information slower than their anxiety-free peers irrespective of whether the information is socially threatening (Mattia, Heimberg, & Hope, 1992). Similar mixed findings were noted though the utilization of the dot probe paradigm (Fritzsche et al., 2010; Gotlib et al, 2004a, b; MacLeod, Mathews, & Tata, 1986; Mogg et al., 1995; Rinck & Becker, 2005). For example, while Helfinstein, White, Bar-Haim & Fox (2008) demonstrated that socially anxious individuals were biased towards threatening stimuli, Mansell et al. (1999) and Bradley et al. (1995) deduced that in the absence of social-evaluative threat, high and low socially anxious individuals did not differ in their attention to facial expressions. In a similar fashion, Klumpp & Amir (2009) demonstrated an attentional bias with socially anxious individuals and threatening stimuli, but only when the threatening stimuli were in the bottom half of the computer monitor, thus calling into question if threatening stimuli need to be placed in a specific location on a computer monitor to trigger an attentional bias. Additionally, Weeks, Howell & Goldin (2013) found that regardless of positive or

negative stimuli presented to social anxious individuals, eye contact was significantly decreased when compared to their control counterparts.

As previously noted, attention bias to threat (e.g., disgust faces) is a cognitive vulnerability factor for social anxiety that occurs in the early stages of information processing (Çek, Sanchez, & Timpano, 2016). Individuals with elevated levels of SAD tend to exhibit elongated engagement towards threatening stimuli, but have also exhibited late stage cognitive process following the presentation of threatening stimuli. This mixed evidence with socially anxious individuals posits that individuals with SAD will demonstrate greater disengagement times when presented with threat-congruent stimuli.

As in the case of studies that examine attention bias in depression, some of these mixed findings may stem from the use of low intensity stimuli, such as words, versus stimuli that better capture salient threat information such as facial expressions (Rapee & Heimberg, 1997).

In summary, there is mixed evidence to suggest that anxious individuals both support biased attention towards threatening (i.e.: disgust) stimuli (Weeks, Howell, & Goldin, 2013; Schofield et al., 2012), and will demonstrate difficulty shifting away from these stimuli once they are detected (Çek, Sanchez, & Timpano, 2016; Schofield, 2012, Sanchez et al., 2013, 2016).

2.3 *Are biased attention allocation and disengagement difficulties disorder-specific risk factors?*

While literature on MDD and SAD suggests unique patterns of attention biases and between the two disorders, there is a surprising dearth of work that examines such biases in samples that show characteristics of both disorders. Selective processing of

threatening stimuli (i.e.: disgust faces) at early stages of visual presentation appears to be more characteristic to individuals with SAD, whereas individuals with MDD are instead associated with selective attention to mood-congruent stimuli (i.e.: sad faces) (Çek, Sanchez, & Timpano, 2016; Mathews & MacLeod, 2005). Visual attention studies have evidenced that a robust orientation bias toward threatening stimuli was evident in studies that examine SAD, while MDD studies concluded a lack of orientation bias toward threatening stimuli (Sears et al., 2011).

While advances have been made in the area of attention bias in SAD and MDD, notable methodological limitations are also evident. Until recently, studies that examine attention bias in both disorders have relied on behavioral measures such as the Stroop and Dot Probe tasks that require participant to press a keyboard button or to verbalize a response to detect attention. Such measures of attention reflect a mixture attention processes and individual differences in motor response that obscure the role of attention in SAD and MDD.

Studies that employ eye-tracking methods that directly and continuously measure overt visual attention are largely unhindered by the inherent limitations of behavioral reaction time measures (Armstrong & Olantunji, 2012). This is because eye movements are less susceptible to confounding processes of motor behavior, and allow the continuous recording of attention unlike behavioral Stroop tasks and Dot-Probe tasks (Armstrong & Olantunji, 2012). However, eye tracking studies have largely examined biased attention engagement, rather than the deficits in attention disengagement among depressed and socially anxious participants (Armstrong & Olantunji, 2012; Weeks, Howell, & Goldin, 2013; Kulke, Atkinson, & Braddick, 2015), because procedure for

detecting biases in attention shifts were unavailable. Recent work by Sanchez (2013) has provided one means of measuring visual attention shifting that may shed light on attention shifting biases related to SAD and MDD.

CHAPTER III

THE CURRENT STUDY

The current study examined the role of attentional biases in risk for MDD and SAD and their co-occurrence using novel methodology developed by Sanchez and colleagues (Sanchez et al., 2013). It was hypothesized that those with elevated MDD symptoms and low SAD symptoms would show a difficulty disengaging from sad to neutral faces. Similarly, it was hypothesized that individuals with elevated SAD and low MDD symptoms would demonstrate slower disengagement times from disgust faces. It was hypothesized that those with elevated symptoms of MDD and SAD would evidence the greatest difficulty disengaging their attention from both stimulus types, as cognitive theories of both MDD and SAD support the presentation of mood-congruent stimuli (sad and disgust faces) would lend to a longer disengagement period.

3.1 *Hypotheses*

H1: Individuals with elevated MDD symptoms and low SAD symptoms will show a difficulty disengaging from sad to neutral faces.

H2: Individuals with elevated SAD symptoms and low MDD symptoms will exhibit slower disengagement from disgust to neutral faces.

H3: Individuals with elevated symptoms of MDD and SAD will evidence the greatest difficulty disengaging their attention from sad and disgust stimuli.

CHAPTER IV

METHODS

4.1 *Participants*

No study to date has examined differences between groups with elevated MDD and/or SAD symptoms with respect to their ability to disengage from disorder-specific stimuli. Therefore, we based our power analysis on feasibility of recruiting a sample of affected participants based on logistic constraints. Our sensitivity analysis showed that a sample of N=45 is sufficient to a detect small-to-medium effect size (f =.25) across study hypothesis at a power = .80 and an α=.05.

Participants were recruited from Cleveland State University's undergraduate students enrolled in Introduction to Psychology (PSY 101), whereby these participants would receive research credit for their participation in the study, in partial fulfillment of the course. The sample consisted of 103 undergraduate students attending Cleveland State University and community participants, with 51% female. This sample's (N=103) eye-tracking data was then identified as either trackable or untrackable, leading to an

overall usable sample size of N=98. The subjects were all adults (M_{age} = 22.85) and primarily Caucasian (67%). The remainder of the racial composition was as follows: African American (23%), Latino (5%), and Other (3.9%).

4.2 *Measures*

4.2.1 *Demographics*

Participants completed a brief survey that assessed basic demographic information such as age, sex, and racial background.

4.2.2 *Major Depressive Disorder Scale*

The Center for Epidemiologic Studies Depression Scale (CES-D) is a 20-item scale measuring depressive symptoms in the general population (Radloff, 1977). Participants made responses on a 4-point Likert scale to such prompts as "I was bothered by things that usually don't bother me." Prior research demonstrated the CES-D to be a reliable and valid measure of depression ($\alpha > .85$) (Hann, Winter, & Jacobsen, 1999; Radloff, 1977).

4.2.3 *Social Anxiety Disorder Scale*

The Social Interaction Anxiety Scale (SIAS) contains 20 items which are rated from 0 (not at all characteristic or true of me) to 4 (extremely characteristic or true of me). Items are self-statements describing one's typical cognitive, affective, or behavioral reaction to a variety of situations requiring social interaction in dyads or groups (e.g., going to a party, talking to an attractive member of the opposite gender, expressing one's feelings). The SIAS was scored by summing the ratings (after reversing the 3 positively-worded items), and total

scores range from 0 to 80. Higher scores represented higher levels of social interactional anxiety (Mattick & Clarke, 1989).

4.2.4 *Eye-tracking Measures*

Participants viewed pictorial face pairs that comprised emotional and neutral expressions from the same individual. Faces were taken from the Karolinska Directed Emotional Faces (KDEF) database (Lundqvisk, Flykt, & Öhman, 1998). Based on a similar design from Sanchez et al. (2013), KDEF frontal view pictures that displayed discrete expressions of happiness, disgust, and sadness were used. The emotional faces were chosen based on the (1) specificity of the emotion being portrayed and (2) being of equal intensity across the three emotion categories. A total of 24 happy, 24 sad, and 24 disgust face stimuli (12 men and 12 women for each emotion category, along with each actor's neutral expression stimulus) were utilized for the eye tracking (ET) tasks.

4.3 *Experimental Protocol*

4.3.1 *Design*

The ET task consisted of 72 trials (24 happy-neutral, 24 sad-neutral, and 24 disgust-neutral pairs). Emotional and neutral faces were equally presented on the left and right side of the screen across trials. The main experiment was preceded by two practice trials to orient participants to the task. The experimental design was similar to the one used in Sanchez et al. (2013). More specifically, each trial of the ET task started with a black screen for 500 ms, followed by a fixation cross in the middle of the screen for another 500 ms. A single, random digit (i.e., 1-9) replaced the fixation cross and remained on the screen for 1,000

ms; participants were instructed to say this number aloud so as to ensure their attention was oriented to the center of the screen prior to the presentation of the face pairs. Immediately after the digit offset, a pair of faces were presented on the screen for 3,000 ms. Participants were instructed to view these faces naturally, as if at home watching television. During this free-viewing period, indices of naturalistic stimulus processing assessed the following: initial orienting, fixation frequency and fixation percentage bias score.

The engagement-disengagement task followed the free-viewing period. This task was comprised of three conditions: one-third of the trials assessed attentional engagement with the emotional face in the pair; one-third of the trials assessed where participants disengaged from the emotional face and engaged with the neutral face in the presented pair; and one-third are "control trials." The control trials consisted of a free-viewing task and were followed by a fixation cross denoting the next trial. For the emotional engagement trials, after the 3,000-ms free-viewing period, the face pair remained on the screen until the participant fixated on the neutral face; this was referred to as the "wait for fixation" period. Once a fixation was deployed onto the neutral face for at least 100 ms, stimulus presentation continued and a rectangular or oval frame encompassed the emotional face. Participants were instructed to shift their gaze as quickly as possible toward the frame and indicate the shape by pressing one of two keys on a keyboard corresponding to "rectangle" or "oval." This engagement condition measured how long participants took to disengage attention from the neutral face and engage with the emotional face. For the disengagement trials, a similar

procedure was used. However, instead of having participants fixate toward the neutral face during the "wait for fixation" period, the trial proceeded once a fixation was deployed to the emotional face in the pair. Furthermore, after initial fixation to the emotional face, the rectangle or oval frame surrounded the neutral face. Thus, disengagement was determined by the amount of time needed to shift gaze from the emotional face toward the neutral face. All three trial conditions were randomly presented, and both types of frames were equal in their presentation and whether or not they appeared in the left and right positions during the engagement and disengagement conditions.

4.3.2 *Eye-tracking apparatus*

Eye movements are recorded using a Sensomotoric Instruments (SMI) RED250 (N=41) or a Tobii-branded 3X-120 (N=57) mobile eye tracking unit. Each participant's eye position to the stimulus monitor was captured from an infrared light that is sent, via a camera, to the participant's eyes, and gaze position at any given time was determined by the eye acting as a "retro-reflector," extrapolating eye position from pupil illumination and reflection off of the cornea. Pupil reflection moved with the eye so as to determine the "center" of the eye at all times; corneal reflection remained fixed so as to be used as an anchor point for the head with respect to the infrared camera. Both eye tracking systems provided a 120 Hz measure of eye-gaze position, while both stimulus presentation and eye movement recording were conducted using SMI Experiment Center software. Visual fixations were defined as gaze resting within 0.5-1.0° visual angle for at least 100 ms (Manor & Gordon, 2003) within pre-determined areas of interest

(AOIs). AOIs comprised the entirety of the facial stimuli for both the free-viewing and engage-disengage tasks; a "target" AOI encompassed the non-frame facial image during the "wait for fixation" trials. Once a definable, 100-ms fixation was recorded within this AOI, the engagement-disengagement task commenced.

4.4 *Analytic Plan*

Following data collection, all statistical analyses were completed using IBM SPSS Statistics software (IBM, Inc., 2013). Descriptive statistics, including range, mean, and standard deviations were calculated, and correlations were performed. Symptom groups were created based on previously validated cut-offs on the CES-D and the SIAS. A score of 20 or greater has been determined to be the threshold for "high depression" criteria on the CES-D (Hann, Winter, & Jacobsen, 1999; Radloff, 1977), while a score of 34 or greater was determined to be the threshold for "high social anxiety" criteria (Mattick & Clarke, 1989). Despite efforts to oversample for social anxiety, only three groups emerged based on the above noted criteria: a control group (N=66), a high depression group (N=21), and a high depression and high social anxiety group (N=11).

CHAPTER V

RESULTS

5.1 *Descriptive Statistics*

Bivariate correlations are presented in Table IV. Pearson correlations were conducted to examine bivariate correlations between all study variables. Age and sex were found to be uncorrelated with SIAS scores, CES-D scores, and disengagement from sad or disgust stimuli and thus were not entered as potential covariates in analyses.

Age and gender negatively correlated with one another, r=-.26, p<.01, which is indicative of younger participants being male, while older participants were female. As predicted, CES-D scores correlated with disengagement from sad stimuli, r=.29, p<.05, indicating a longer disengagement times from sad stimuli was associated with elevated depression symptoms.

Intriguingly, disengagement times from sad stimuli positively correlated with disgust stimuli, r=.63, p<.01, indicating that individuals who took longer to disengagement from one negative valenced stimuli also took longer to disengage from the other negative valenced stimuli. It should be noted that these correlations consist of the control group, high MDD participants, and high MDD and high SAD participants.

5.2 *Hypotheses Testing*

H1: *Individuals with elevated MDD symptoms and low SAD symptoms will show a difficulty disengaging from sad to neutral faces.*

The first aim of the study sought to understand disengagement practices of individuals with elevated MDD symptoms and low SAD symptoms when presented with a sad to neutral face sequence. Per the hypothesis, a repeated measure ANOVA in which the within-subject factor was the stimulus type (disgust vs. sad faces) and the between-subject factor was disorder group membership based on symptom levels (control group, high MDD, or high MDD & high SAD) revealed no significant differences in stimulus types as a function of elevated MDD, SAD or MDD and SAD symptoms, F(2, 92) =1.36, p=.262, η^2=.029. Follow up analyses revealed that participants who were classified as high MDD on average did not vary in disengagement from sad stimuli time (M= 250.22, SD= 72.98) when compared to the control group (M=247.36, SD= 68.52).

H2: *Individuals with elevated SAD symptoms and low MDD symptoms will exhibit slower disengagement from disgust faces.*

The second aim of the study sought to understand disengagement practices of individuals' elevated SAD symptoms and low MDD symptoms when presented with a

disgust to neutral face sequence. Due to study limitations and demographics, a sample that consisted of elevated SAD symptoms and low MDD symptoms was not attained and was thus not analyzed.

H3: *Individuals with elevated symptoms of MDD and SAD will evidence the greatest difficulty disengaging their attention from both stimulus types.*

The third aim of the study sought to understand disengagement practices of individuals with elevated SAD and elevated MDD symptoms when presented with both sad and disgust stimuli. The aim of this testing was to predict disengagement times from sad and disgust stimuli relevant to SAD and MDD symptomology.

The repeated measures ANOVA examined group differences in their ability to disengage from disorder-specific stimuli failed to show group differences, $F(2, 92) = 1.36$, $p = .26$, $\eta^2 = .03$. This finding is indicative of controls, participants high in MDD, and participants high in MDD and SAD do not differ significantly in disengagement time from sad or disgust stimuli. It can then be hypothesized that regardless of individuals specific diagnostic groups, disengagement practices were not impacted by elevated social anxiety or depressive symptoms. Although statistical significance was not observed between controls, the elevated depressive group, and the elevated depressive and anxious group, and stimuli types (sad and disgust faces), the main effect of being exposed to a specific stimuli demonstrated a trend-level difference $F(1, 92) = 3.79$, $p = .06$, $\eta^2 = .04$. This finding suggests a trend for longer disengagement times in response to sad relative to disgust faces.

CHAPTER V

DISCUSSION

With the high prevalence of comorbid social anxiety and depression diagnoses, it was imperative to understand the link between cognitive risk and maintenance factors of both social anxiety and major depressive disorder symptoms, leading to a potential identification of delivering existing treatments more effectively. The present study examined disengagement practices from negatively valenced stimuli, namely sad and disgusted faces. Specifically, it examined the relationship between the symptomology of social anxiety disorder, major depressive disorder, and participants' disengagement times after viewing disorder-specific stimuli.

As a result of a limited sample of participants who experienced low MDD and high SAD symptomology, three groups were created for data analysis. The first group consisted of control participants who did not score highly on either the CES-D scale or the SIAS scale. The second group consisted of participants who scored highly on the CES-D but did not score highly on the SIAS. The third group consisted of participants who scored highly on both the CES-D and the SIAS. Although these three groups, with an increase in participant size, could have given way to a true interaction study, participant sample numbers were not great enough to analyze a true interaction

experience. As such, these three groups were then analyzed with their respective disengagement times from negatively valenced stimuli exhibiting either a sad face or a disgust face.

The first aim of the study sought to understand disengagement practices of individuals with elevated MDD symptoms and low SAD symptoms when presented with a sad to neutral face disengagement sequence. It was hypothesized that these individuals would demonstrate difficulty disengaging from a sad face towards a neutral face. As research conducted by Joorman and Gotlib (2007) has demonstrated, depressed individuals present with difficulty disengaging from stimuli that is emotionally relevant to themselves. This study examined how a negatively valenced stimuli would impact the disengagement practices in depressed individuals. The overall goal of this hypothesis was to expand upon further research by incorporating sad and disgust stimuli to participants who scored highly on the CES-D.

Individuals with depression have been observed to use schemas to exhibit a systematic bias in the processing of their environmental stimuli or information that is relevant to their current symptomology. As a result of this attentional bias, depressed individuals have been observed attending selectively to negative stimuli in their environment and interpreting neutral and ambiguous stimuli in a schema-congruent way (Gotlib & Joormann, 2010). The first aim of this study was to confirm if this attentional bias was observed in our sample of participants.

Literature to date suggests that individuals with high MDD symptomology should demonstrate longer times to disengage from sad stimuli (Sanchez, Romero, & De Raedt, 2017). Interestingly, individuals in our sample who reported high depressive symptoms

(scores greater than or equal to 20 on the CES-D) did not show a difference in disengagement practices when compared to the control group of participants. Indeed, this is consistent with the current eye-tracking literature, which discussed mixed results among studies. As demonstrated by Gotlib and colleagues (Gotlib, Kasch, et al., 2004; Gotlib, Krasnoperova, et al., 2004; Joormann & Gotlib, 2007), clinically depressed participants exhibited an attentional bias toward sad faces. In contrast, Rinck & Becker (2005) failed to show attentional biases among depressed participants who were exposed to negatively valenced words, and Mogg et al. (1995) failed to show an attentional bias among depressed participants when these participants were exposed to negatively valenced faces. However, individuals who reported high depressive symptomology and low social anxiety symptomology disengaged faster from the sad stimuli when compared to the combination group of high social anxiety and high depressive symptomology individuals. Again, this is contradictory to the current literature as it was expected for the depressive-symptomatic group to exhibit longer disengagement times from symptom-specific stimuli, such as sad faces. In a series of studies by Gotlib and Joormann (2010), participants who were experiencing a depressive episode demonstrated longer disengagement times when exposed to negatively valenced stimuli that was congruent to their depressive symptomology. Similarly, research conducted by Sanchez and colleagues (2013) evidenced that depressed participants demonstrated a difficulty with disengaging visual attention away from sad faces. One potential explanation for this observed correlation rests in the notion that individuals suffering from comorbid depression and social anxiety symptoms could take longer to disengage from any type of negatively valenced stimuli, regardless if it resonates with the individual's symptomology.

The second aim of the study sought to understand disengagement practices of individuals with elevated SAD symptoms and low MDD symptoms. It was hypothesized that these individuals would exhibit slower disengagement from the presented faces. Cognitive theories of SAD posit that the main process of SAD is self-directed attention triggered by social situations, with a corresponding withdrawal of adaptive attention to positive external cues (Clark & Wells, 1995; Rapee & Heimberg, 1997). Current evidence suggests that SAD will increase attentional threat biases. Studies have supported this assumption by showing that individuals with a high level of social anxiety tend to display an attentional bias towards external threats, and a greater likelihood of favoring the threatening meaning of ambiguous cues (Peschard & Philippot, 2015). Thus, it would be expected to observe slower disengagement times in individuals with SAD symptomology when they are presented with the disgust stimuli. Due to the small amount of participants who scored highly on the SIAS (equal to or above a 34 for social anxiety indication) and with the understanding that these high scoring SIAS individuals also presented with high levels of MDD on the CES-D (equal to or above 20 for major depressive disorder indication), this aim was not able to be analyzed. Given the current study and its present findings, one would hypothesize that with a larger sample of strictly socially anxious individuals, these individuals would demonstrate slower disengagement times from disgust stimuli.

The third aim of the study sought to understand disengagement practices of individuals with elevated SAD and MDD symptoms when presented with both sad and disgust stimuli. It was hypothesized that individuals with elevated symptoms of MDD and SAD would evidence the greatest difficulty disengaging their attention from both

stimulus types. Given the previous research on attentional bias in individuals with MDD and SAD, it was expected that these participants will demonstrate the longest amount of time to disengage from both stimuli, as cognitive models of both disorders posit disengagement difficulties.

Across the three groups, a trend emerged that participants in general tended to disengage faster from the disgust stimuli, but did not demonstrate a significant change when participants were presented with the sad stimuli. Additionally, individuals with high social anxiety and high depressive symptomology were slower to disengage regardless of the negative stimuli presented to them when compared to the control group. This could be explained due to a hallmark feature of socially anxious individuals is that they are constantly searching out feedback from their peers, thus these negative valenced stimuli resonate with their symptomology, eliciting a longer disengagement time from the presented stimuli.

One interesting aspect of disengagement practices arose with group 3, which consisted of individuals with both high social anxiety symptomology and high depressive symptomology (N=11). When looking at disengagement practices, the presence of social anxiety inhibited disengagement from both sad and disgust stimuli, leading to an overall longer average time to disengage from presented stimuli. This could be explained by the cognitive model of socially anxious individuals, with SAD being associated with quick detection and immediate attention to relevant stimuli, even when stimuli are presented subliminally (LeMoult, Yoon, & Joormann, 2012b). Thus, if socially anxious individuals engage with stimuli that are either judgmental, threatening, or offering a type of negative

feedback, they will first engage with the negative stimuli and then take longer to divert their gaze to from the negative stimuli to the neutral stimuli.

However, the mean difference between our high CES-D and high SIAS group and our control group was not significant, with an approximate difference between the two groups at 63 ms. This practice was not observed in the depression-only group, which indicated that the disengagement from sad and disgust stimuli is specific to individuals with depression coupled with social anxiety.

As such, individuals with high CES-D scores demonstrated disengagement from sad faces on average *M*=250.22 ms., and demonstrated disengagement from disgust faces on average *M*=224.78 ms. Contrary to our hypothesis, no mean differences were discerned when comparing our control group's average sad stimuli disengagement time to our high depression sad stimuli disengagement time (*M*=250.22, *SD*=72.98). Additionally, no discernable differences between disgust disengagement times were observed between the elevated MDD group and our control group.

6.1 *Limitations*

The findings for this study should be considered with several limitations. First, the sample for this study was comprised of an undergraduates and community sample, which limits the ability to generalize the findings from this study to clinical populations. Second, data collection was varied between two different laboratory settings utilizing two different branded eye-trackers. Out of 103 participants, 42 participants were exposed to the SMI eye-tracker, while the remainder of the participants were exposed to the Tobii eye-tracking system. Thus, it is unclear if this mechanical difference impacted disengagement times from sad and disgust stimuli. The most glaring limitation of this

study was lack of participants suffering from social anxiety symptomology without complementary depressive symptomology to fulfill the original study hypothesis. The main aim of our study was to further understand the disengagement practices of individuals with elevated social anxiety symptoms. Without a sample of strictly socially anxious individuals, this study was unable to further the literature regarding disengagement practices and disordered-specific stimuli and their relationship to social anxiety. Without a larger sample of strictly socially anxious individuals, the study is not generalizable to clinical populations, and cannot help to further identify cognitive risk factors or improve upon therapeutic delivery techniques.

6.2 *Recommendations for Future Research*

The design of this study reveals several limitations that could be addressed in future research. The first is recruiting a clinical population sample in hopes of examining the clinical implications of eye-tracking. The second is recruiting individuals who are suffering from social anxiety without a depression component. This would allow study results to be generalizable to socially anxious populations, potentially leading to revised delivery of treatments. Lastly, there is room to explore additional stimuli that might cause increased disengagement times in socially anxious and depressed individuals.

6.3 *Strengths and Clinical Implications*

The present study was able to examine a novel addition to the present literature. Although it has been well researched that individuals with high depressive symptomology will demonstrate an attentional bias towards negatively valenced stimuli, specifically sad faces, we were unable to confirm this attentional bias. The elevated MDD participants did not demonstrate considerable differences in attentional bias towards

specific stimuli when compared to our control group. A second novel finding that would add to the present literature involves the disengagement practices of individuals with both elevated SAD and MDD. These individuals demonstrated an overlap of disengagement practices by exhibiting a significantly longer time to direct their attention away from both sad and disgust stimuli. This finding, if replicated with a clinical population, can add to the plethora of therapy deliverance techniques with regards to individuals who are diagnosed with both SAD and MDD.

REFERENCES

Abbott, M.J. and Rapee, R.M. (2004) Post-event rumination and negative self-appraisal in social phobia before and after treatment, *Journal of Abnormal Psychology*, *113*(1), 136–144. doi: 10.1037/0021-843x.113.1.136.

Armstrong, T. and Olatunji, B.O. (2012) Eye tracking of attention in the affective disorders: A meta-analytic review and synthesis, *Clinical Psychology Review*, *32*(8), 704–723. doi: 10.1016/j.cpr.2012.09.004.

Beck, A.T. (1979) *Cognitive therapy and the emotional disorders*. Philadelphia: Plume Books.

Belzer, K. D., McKee, M. B., & Liebowitz, M. R. (2005, November). Social anxiety disorder: current perspectives on diagnosis and treatment. Primary Psychiatry, *12*(11), 35-48

Bower, G.H. (1981) Mood and memory, *American Psychologist*, *36*(2),129–148. doi: 10.1037/0003-066x.36.2.129.

Bradley, B.P., Mogg, K., Millar, N. and White, J. (1995) Selective processing of negative information: Effects of clinical anxiety, concurrent depression, and awareness, *Journal of Abnormal Psychology*, *104*(3), 532–536. doi: 10.1037//0021-843x.104.3.532.

Bruce, S.E., Yonkers, K.A., Otto, M.W., Eisen, J.L., Weisberg, R.B., Pagano, M., Shea, M.T. and Keller, M.B. (2008) Influence of psychiatric Comorbidity on recovery and recurrence in generalized anxiety disorder, social phobia, and panic disorder: A 12-Year prospective study, *FOCUS*, *6*(4), 539–548. doi: 10.1176/foc.6.4. foc539.

Carton, J.S., Kessler, E.A. and Pape, C.L. (1999) *Journal of Nonverbal Behavior*, 23(1), pp. 91–100. doi: 10.1023/a:1021339410262.

Çek, D., Sánchez, A., & Timpano, K. R. (2016). Social Anxiety–Linked Attention Bias to Threat Is Indirectly Related to Post-Event Processing Via Subjective Emotional Reactivity to Social Stress. Behavior therapy, *47*(3), 377-387.

Clark, DM.; Wells, A. A cognitive model of social phobia. In: Heimberg, RG.; Liebowitz, MR.; Hope, DA.; Schneier, FR., editors. Social Phobia: Diagnosis, assessment and treatment. New York: Guilford Press; 1995. p. 69-93.

Collins, K.A., Westra, H.A., Dozois, D.J.A. and Burns, D.D. (2004) Gaps in accessing treatment for anxiety and depression: Challenges for the delivery of care, *Clinical Psychology Review*, *24*(5), 583–616. doi: 10.1016/j.cpr.2004.06.001.

Dalgleish, T. and Watts, F.N. (1990) Biases of attention and memory in disorders of anxiety and depression, *Clinical Psychology Review*, *10*(5), 589–604. doi: 10.1016/0272-7358(90)90098-u.

Dalrymple, K.L. and Zimmerman, M. (2011) Treatment-seeking for social anxiety disorder in a general outpatient psychiatry setting, *Psychiatry Research*, *187*(3), 375–381. doi: 10.1016/j.psychres.2011.01.004.

De Raedt, R. and Koster, E.H.W. (2010) Understanding vulnerability for depression from a cognitive neuroscience perspective: A reappraisal of attentional factors and a new conceptual framework, *Cognitive, Affective, & Behavioral Neuroscience*, *10*(1), 50–70. doi: 10.3758/cabn.10.1.50.

Donaldson, C., Lam, D. and Mathews, A. (2007) Rumination and attention in major

depression, *Behaviour Research and Therapy*, *45*(11), 2664–2678. doi: 10.1016/j.brat.2007.07.002.

Fritzsche, A., Dahme, B., Gotlib, I.H., Joormann, J., Magnussen, H., Watz, H., Nutzinger, D.O. and von Leupoldt, A. (2009) Specificity of cognitive biases in patients with current depression and remitted depression and in patients with asthma, *Psychological Medicine*, *40*(05), 815. doi: 10.1017/s0033291709990948.

Gotlib, I.H. and Joormann, J. (2010) Cognition and depression: Current status and future directions, *Annual Review of Clinical Psychology*, *6*(1), 285–312. doi: 10.1146/annurev.clinpsy.121208.131305.

Gotlib, I.H., Kasch, K.L., Traill, S., Joormann, J., Arnow, B.A. and Johnson, S.L. (2004) Coherence and specificity of information-processing biases in depression and social phobia, *Journal of Abnormal Psychology*, *113*(3), 386–398. doi: 10.1037/0021-843x.113.3.386.

Gotlib, I.H., Krasnoperova, E., Yue, D.N. and Joormann, J. (2004a) Attentional biases for negative interpersonal stimuli in clinical depression, *Journal of Abnormal Psychology*, *113*(1), 127–135. doi: 10.1037/0021-843x.113.1.121.

Gotlib, I.H., Krasnoperova, E., Yue, D.N. and Joormann, J. (2004b) Attentional biases for negative interpersonal stimuli in clinical depression, *Journal of Abnormal Psychology*, *113*(1), 127–135. doi: 10.1037/0021-843x.113.1.121.

Hann, D., Winter, K. and Jacobsen, P. (1999) Measurement of depressive symptoms in cancer patients: evaluation of the Center for Epidemiological Studies Depression Scale (CES-D)., *Journal of Psychosomatic Research*, *46*(5), 437–43.

Helfinstein, S.M., White, L.K., Bar-Haim, Y. and Fox, N.A. (2008) Affective primes

suppress attention bias to threat in socially anxious individuals, *Behaviour Research and Therapy*, *46*(7), 799–810. doi: 10.1016/j.brat.2008.03.011.

Holas, P., Krejtz, I., Cypryanska, M. and Nezlek, J.B. (2014) Orienting and maintenance of attention to threatening facial expressions in anxiety – an eye movement study, *Psychiatry Research*, *220*(1-2), 362–369. doi: 10.1016/j.psychres.2014.06.005.

Joormann, J. and D'Avanzato, C. (2010) Emotion regulation in depression: Examining the role of cognitive processes, *Cognition & Emotion*, *24*(6), 913–939. doi: 10.1080/02699931003784939.

Joormann, J. and Gotlib, I.H. (2007) Selective attention to emotional faces following recovery from depression, *Journal of Abnormal Psychology*, *116*(1), 80–85. doi: 10.1037/0021-843x.116.1.80.

Kaufman, E.A. and Baucom, K.J.W. (2013) Treating Comorbid social anxiety and Major Depression: The challenge of diagnostic overshadowing, *Clinical Case Studies*, *13*(3), 265–281. doi: 10.1177/1534650113508220.

Kertzman, S., Reznik, I., Hornik-Lurie, T., Weizman, A., Kotler, M. and Amital, D. (2010) Stroop performance in major depression: Selective attention impairment or psychomotor slowness? *Journal of Affective Disorders*, *122*(1-2), 167–173. doi: 10.1016/j.jad.2009.08.009.

Kessler, R.C. and Bromet, E.J. (2013) The Epidemiology of depression across cultures, *Annual Review of Public Health*, *34*(1), 119–138. doi: 10.1146/annurev-publhealth-031912-114409.

Kessler, R.C., Chiu, W.T., Demler, O. and Walters, E.E. (2005) Prevalence, severity,

and Comorbidity of 12-Month DSM-IV disorders in the national Comorbidity survey replication, *Archives of General Psychiatry*, *62*(6), 617. doi: 10.1001/archpsyc.62.6.617.

Kessler, R.C., Petukhova, M., Sampson, N.A., Zaslavsky, A.M. and Wittchen, H.-U. (2012) Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States, *International Journal of Methods in Psychiatric Research*, *21*(3), 169–184. doi: 10.1002/mpr.1359.

Kircanski, K., Joormann, J. and Gotlib, I.H. (2012) Cognitive aspects of depression, *Wiley Interdisciplinary Reviews: Cognitive Science*, *3*(3), 301–313. doi: 10.1002/wcs.1177.

Kircanski, K., Joormann, J. and Gotlib, I.H. (2014) Attention to emotional information in social anxiety disorder with and without Co-Occurring depression, *Cognitive Therapy and Research*, *39*(2), 153–161. doi: 10.1007/s10608-014-9643-7.

Klumpp, H. and Amir, N. (2009) Examination of vigilance and disengagement of threat in social anxiety with a probe detection task, *Anxiety, Stress & Coping*, *22*(3), 283–296. doi: 10.1080/10615800802449602.

Koster, E. H., De Lissnyder, E., Derakshan, N., & De Raedt, R. (2011). Understanding depressive rumination from a cognitive science perspective: The impaired disengagement hypothesis. Clinical psychology review, *31*(1), 138-145.

Kulke, L., Atkinson, J. and Braddick, O. (2015) Automatic detection of attention shifts in infancy: Eye tracking in the fixation shift paradigm, *PLOS ONE*, *10*(12), e0142505. doi: 10.1371/journal.pone.0142505.

Lavie, N., Hirst, A., de Fockert, J.W. and Viding, E. (2004) Load theory of selective

attention and cognitive control, *Journal of Experimental Psychology: General*, *133*(3), 339–354. doi: 10.1037/0096-3445.133.3.339.

LeMoult, J., Yoon, K.L. and Joormann, J. (2012a) Affective priming in major depressive disorder, *Frontiers in Integrative Neuroscience*, 6. doi: 10.3389/fnint.2012.00076.

LeMoult, J., Yoon, K.L. and Joormann, J. (2012b) Affective priming in major depressive disorder, *Frontiers in Integrative Neuroscience*, 6. doi: 10.3389/fnint.2012.00076.

Lundqvist, D., Flykt, A., & Öhman, A. (1998). The Karolinska Directed Emotional Faces KDEF, CD ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institutet, ISBN 91-630-7164-9.

Mackintosh, B. and Mathews, A. (2003) Don't look now: Attentional avoidance of emotionally valenced cues, *Cognition & Emotion*, *17*(4), 623–646. doi: 10.1080/02699930302298.

MacLeod, C., Mathews, A. and Tata, P. (1986) Attentional bias in emotional disorders, *Journal of Abnormal Psychology*, *95*(1), 15–20. doi: 10.1037/0021-843x.95.1.15.

Mansell, W., Clark, D.M., Ehlers, A. and Chen, Y.-P. (1999) Social anxiety and attention away from emotional faces, *Cognition & Emotion*, *13*(6), 673–690. doi: 10.1080/026999399379032.

Markela-Lerenc, J., Kaiser, S., Fiedler, P., Weisbrod, M. and Mundt, C. (2006) Stroop performance in depressive patients: A preliminary report, *Journal of Affective Disorders*, *94*(1-3), 261–267. doi: 10.1016/j.jad.2006.04.011.

Mathews, A. and Mackintosh, B. (1998) *Cognitive Therapy and Research*, 22(6), 539–560. doi: 10.1023/a:1018738019346.

Mathews, A. and MacLeod, C. (1986) Discrimination of threat cues without awareness

in anxiety states, *Journal of Abnormal Psychology*, *95*(2), 131–138. doi: 10.1037/0021-843x.95.2.131.

Mathews, A. and MacLeod, C. (1994) Cognitive approaches to emotion and emotional disorders, *Annual Review of Psychology*, *45*(1), 25–50. doi: 10.1146/annurev.ps.45.020194.000325.

Mathews, A. and MacLeod, C. (2005) Cognitive vulnerability to emotional disorders, *Annual Review of Clinical Psychology*, *1*(1), 167–195. doi: 10.1146/annurev.clinpsy.1.102803.143916.

Mattick, R. and Clarke, J. (1989) Development and validation of measures of social phobia scrutiny fear and social interaction anxiety, *Behavior Research Therapy*, *36*(4), 455–70.

Mineka, S., Watson, D. and Clark, L.A. (1998) COMORBIDITY OF ANXIETY AND UNIPOLAR MOOD DISORDERS, *Annual Review of Psychology*, *49*(1), 377–412. doi: 10.1146/annurev.psych.49.1.377.

Mogg, K. and Bradley, B.P. (1998) A cognitive-motivational analysis of anxiety, *Behaviour Research and Therapy*, *36*(9), 809–848. doi: 10.1016/s0005-7967(98)00063-1.

Mogg, K. and Bradley, B.P. (2005) Attentional bias in generalized anxiety disorder versus Depressive disorder, *Cognitive Therapy and Research*, *29*(1), 29–45. doi: 10.1007/s10608-005-1646-y.

Mogg, K., Bradley, B.P. and Williams, R. (1995) Attentional bias in anxiety and depression: The role of awareness, *British Journal of Clinical Psychology*, *34*(1), 17–36. doi: 10.1111/j.2044-8260.1995.tb01434.x.

Mogg, K., Millar, N. and Bradley, B.P. (2000) Biases in eye movements to threatening facial expressions in generalized anxiety disorder and depressive disorder, *Journal of Abnormal Psychology*, *109*(4), 695–704. doi: 10.1037//0021-843x.109.4.695. *National Institute of Health* (1998) Available at: (Accessed: 10 November 2016).

Peckham, A.D., McHugh, R.K. and Otto, M.W. (2010) A meta-analysis of the magnitude of biased attention in depression, *Depression and Anxiety*, *27*(12), 1135–1142. doi: 10.1002/da.20755.

Peschard, V. and Philippot, P. (2015) Social anxiety and information processing biases: An integrated theoretical perspective, *Cognition and Emotion*, *30*(4), 762–777. doi: 10.1080/02699931.2015.1028335.

Pérez, M.G., Rivera, R.M.B., Fuster, A.B. and Rodríguez, M.Á.R. (1999) Attentional biases and vulnerability to depression, *The Spanish journal of psychology*, *2*, 11–19. doi: 10.1017/s1138741600005412.

Radloff, L.S. (1977) The CES-D scale: A self-report depression scale for research in the general population, *Applied Psychological Measurement*, *1*(3), 385–401. doi: 10.1177/014662167700100306.

Rapee, R.M. and Heimberg, R.G. (1997) A cognitive-behavioral model of anxiety in social phobia, *Behaviour Research and Therapy*, *35*(8), 741–756. doi: 10.1016/s0005-7967(97)00022-3.

Ridout, N., Dritschel, B., Matthews, K., McVicar, M., Reid, I.C. and O'Carroll, R.E.

(2009) Memory for emotional faces in major depression following judgement of physical facial characteristics at encoding, *Cognition & Emotion*, *23*(4), 739–752. doi: 10.1080/02699930802121137.

Rinck, M. and Becker, E.S. (2005) A comparison of Attentional biases and memory biases in women with social phobia and Major Depression, *Journal of Abnormal Psychology*, *114*(1), 62–74. doi: 10.1037/0021-843x.114.1.62.

Rubinow, D.R. and Post, R.M. (1992) Impaired recognition of affect in facial expression in depressed patients, *Biological Psychiatry*, *31*(9), 947–953. doi: 10.1016/0006-3223(92)90120-o.

Sanches, L.A., Fang, L. and Koster, E.H.W. (2016) Testing the attentional scope model of rumination: An eye-tracking study using the moving window paradigm, *Biological Psychology*. doi: 10.1016/j.biopsycho.2016.10.011.

Sanchez, A., Vazquez, C., Marker, C., LeMoult, J. and Joormann, J. (2013a) Attentional disengagement predicts stress recovery in depression: An eye-tracking study, *Journal of Abnormal Psychology*, *122*(2), 303–313. doi: 10.1037/a0031529.

Sanchez, A., Vazquez, C., Marker, C., LeMoult, J. and Joormann, J. (2013b) Attentional disengagement predicts stress recovery in depression: An eye-tracking study, *Journal of Abnormal Psychology*, *122*(2), 303–313. doi: 10.1037/a0031529.

Sanchez, A., Romero, N., & De Raedt, R. (2017). Depression-related difficulties disengaging from negative faces are associated with sustained attention to negative feedback during social evaluation and predict stress recovery. PloS one, *12*(3), e0175040.

Schofield, C.A., Johnson, A.L., Inhoff, A.W. and Coles, M.E. (2012) Social anxiety and

difficulty disengaging threat: Evidence from eye-tracking, *Cognition & Emotion*, *26*(2), 300–311. doi: 10.1080/02699931.2011.602050.

Sears, C.R., Newman, K.R., Ference, J.D. and Thomas, C.L. (2011) Attention to emotional images in previously depressed individuals: An eye-tracking study, *Cognitive Therapy and Research*, *35*(6), 517–528. doi: 10.1007/s10608-011-9396-5.

Teasdale, J.D. (1988) Cognitive vulnerability to persistent depression, *Cognition & Emotion*, *2*(3), 247–274. doi: 10.1080/02699938808410927.

Weeks, J.W., Howell, A.N. and Goldin, P.R. (2013) Gaze Avoidance In Social Anxiety Disorder, *Depression and Anxiety*, *30*(8), 749–756. doi: 10.1002/da.22146.

Williams, J.M.G., Mathews, A. and MacLeod, C. (1996) The emotional Stroop task and psychopathology, *Psychological Bulletin*, *120*(1), 3–24. doi: 10.1037//0033-2909.120.1.3.

Williams, M.J.G., Watts, F.N., MacLeod, C.M., Mathews, A. and Williams, J.G. (1997) *Cognitive psychology and emotional disorders*. 2nd edn. United Kingdom: John Wiley & Sons.

Wilson, E. and MacLeod, C. (2003) Contrasting two accounts of anxiety-linked attentional bias: Selective attention to varying levels of stimulus threat intensity, *Journal of Abnormal Psychology*, *112*(2), 212–218. doi: 10.1037/0021-843x.112.2.212.

Yiend, J. and Mathews, A. (2001) Anxiety and attention to threatening pictures, *The*

Quarterly Journal of Experimental Psychology Section A, *54*(3), 665–681. doi: 10.1080/713755991.

APPENDICES

Table 1 *Results of ANCOVA Analyses*

	Type III SS	*df*	Mean Square	*F*	*p*
Within Subjects					
Task	10799.7	1	19799.7	3.79	.055
Task * DxG	7750.26	2	3875.13	1.36	.262
Error	262353	92	2851.67		
Between Subjects					
DxG	20494.6	2	19247.3	1.83	.166
Error	514110	92	5588.26		

Note. Task: disengagement from disgust or sad stimuli; DxG: diagnostic group per CES-D and SIAS scores

Table II. *Means and standard deviations of study variables*

Measure	Mean	Standard Deviation
Age	22.85	8.89
SIAS score	35.49	16.29
CES-D score	16.71	11.66
Disengagement Sad (MS) overall	255.06	84.42
Disengagement Disgust (MS) overall	244.31	83.82
Disengagement Sad Control Group	247.36	68.52
Disengagement Sad High CES-D	250.22	72.98
Disengagement Sad High CES-D and High SIAS	310.50	155.35
Disengagement Disgust Control Group	245.29	83.64
Disengagement Disgust High CES-D	224.78	56.95
Disengagement Disgust High CES-D and High SIAS	275.66	119.57

Note. Social anxiety was measured using the Social Interaction Anxiety Scale (SIAS; threshold for social anxiety is equal to or above 34); depression was measured using the Center for Epidemiological Study, Depression scale (CES-D; threshold for depression is equal to or above 20); disengagement sad and disgust were measured in milliseconds.

Table III. *Demographic Characteristics*

Characteristic	Study Sample N = 103 (%)
Gender	
Female	50.5
Male	49.5
Age	
18-29	87.2
30-44	6.9
45-63	4.9
Race	
African American	23.3
Caucasian	67.0
East Asian	0.0
Latino	4.9
Native American	0.0
Other	3.9
Pacific Islander	0.0
South Asian	1.0

Table IV. *Correlations of Study Variables*

	Age	Gender	SIAS	CES-D	High SIAS&CES-D	Disengagement SAD	Disengagement Disgust
Age	1.00						
Gender	-.26**	1.00					
SIAS	-.18	.70	1.00				
CES-D	.07	-.02	.07	1.00			
High SIAS&CES-D	-.05	.07	.57**	.78**	1.00		
Disengagement SAD	.06	-.12	.11	.29*	.20*	1.00	
Disengagement Disgust	.05	-.02	.07	.16	.15	.63**	1.00

Note. Social Anxiety was measured using the Social Interaction Anxiety Scale (SIAS); depression was measures using the Center for Epidemiological Studies, Depression scale (CES-D), High SIAS&CES-D are participants who scored at or above threshold for both the SIAS and CES-D.

** = $p < .01$, * = $p < .05$

APPENDIX B

1. Social Interaction Anxiety Scale (SIAS)

Social Interaction Anxiety Scale (SIAS)

Patient Name: _____ **Date:** _____

Instructions: For each item, please circle the number to indicate the degree to which you feel the statement is characteristic or true for you. The rating scale is as follows:

0 = **Not at all** characteristic or true of me.
1 = **Slightly** characteristic or true of me.
2 = **Moderately** characteristic or true of me.
3 = **Very** characteristic or true of me.
4 = **Extremely** characteristic or true of me.

CHARACTERISTIC	NOT AT ALL	SLIGHTLY	MODERATELY	VERY	EXTREMELY
1. I get nervous if I have to speak with someone in authority (teacher, boss, etc.).	0	1	2	3	4
2. I have difficulty making eye contact with others.	0	1	2	3	4
3. I become tense if I have to talk about myself or my feelings.	0	1	2	3	4
4. I find it difficult to mix comfortably with the people I work with.	0	1	2	3	4
5. I find it easy to make friends my own age.	0	1	2	3	4
6. I tense up if I meet an acquaintance in the street.	0	1	2	3	4
7. When mixing socially, I am uncomfortable.	0	1	2	3	4
8. I feel tense if I am alone with just one other person.	0	1	2	3	4
9. I am at ease meeting people at parties, etc.	0	1	2	3	4
10. I have difficulty talking with other people.	0	1	2	3	4
11. I find it easy to think of things to talk about.	0	1	2	3	4
12. I worry about expressing myself in case I appear awkward.	0	1	2	3	4
13. I find it difficult to disagree with another's point of view.	0	1	2	3	4
14. I have difficulty talking to attractive persons of the opposite sex.	0	1	2	3	4
15. I find myself worrying that I won't know what to say in social situations.	0	1	2	3	4
16. I am nervous mixing with people I don't know well.	0	1	2	3	4
17. I feel I'll say something embarrassing when talking.	0	1	2	3	4
18. When mixing in a group, I find myself worrying I will be ignored.	0	1	2	3	4
19. I am tense mixing in a group.	0	1	2	3	4
20. I am unsure whether to greet someone I know only slightly.	0	1	2	3	4

2. Center for Epidemiological Studies—Depression Scale (CES-D)

Center for Epidemiologic Studies Depression Scale (CES-D), NIMH

Below is a list of the ways you might have felt or behaved. Please tell me how often you have felt this way during the past week.

	During the Past Week			
	Rarely or none of the time (less than 1 day)	Some or a little of the time (1-2 days)	Occasionally or a moderate amount of time (3-4 days)	Most or all of the time (5-7 days)
1. I was bothered by things that usually don't bother me.	☐	☐	☐	☐
2. I did not feel like eating; my appetite was poor.	☐	☐	☐	☐
3. I felt that I could not shake off the blues even with help from my family or friends.	☐	☐	☐	☐
4. I felt I was just as good as other people.	☐	☐	☐	☐
5. I had trouble keeping my mind on what I was doing.	☐	☐	☐	☐
6. I felt depressed.	☐	☐	☐	☐
7. I felt that everything I did was an effort.	☐	☐	☐	☐
8. I felt hopeful about the future.	☐	☐	☐	☐
9. I thought my life had been a failure.	☐	☐	☐	☐
10. I felt fearful.	☐	☐	☐	☐
11. My sleep was restless.	☐	☐	☐	☐
12. I was happy.	☐	☐	☐	☐
13. I talked less than usual.	☐	☐	☐	☐
14. I felt lonely.	☐	☐	☐	☐
15. People were unfriendly.	☐	☐	☐	☐
16. I enjoyed life.	☐	☐	☐	☐
17. I had crying spells.	☐	☐	☐	☐
18. I felt sad.	☐	☐	☐	☐
19. I felt that people dislike me.	☐	☐	☐	☐
20. I could not get "going."	☐	☐	☐	☐

SCORING: zero for answers in the first column, 1 for answers in the second column, 2 for answers in the third column, 3 for answers in the fourth column. The scoring of positive items is reversed. Possible range of scores is zero to 60, with the higher scores indicating the presence of more symptomatology.

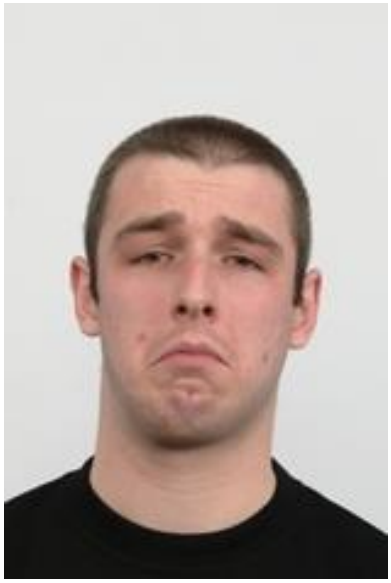
APPENDIX C

Eye tracking Stimuli

Male Disgusted with frame

Female Disgusted without frame

Female Sad with frame



Male Sad without frame