Cogn Ther Res (2011) 35:68–78
DOI 10.1007/s10608-009-9279-1

ORIGINAL ARTICLE

Cognitive Biases in Depression and Eating Disorders

Jessica S. Benas · Brandon E. Gibb

Published online: 14 November 2009

Abstract This study examined the link between cognitive biases (i.e., attention biases and implicit associations) and symptoms of depression and eating disorders and whether the content of these biases is disorder-specific. These hypotheses were examined with a sample of 202 undergraduate women. Cognitive biases were measured via computer-based tasks (i.e., the probe detection task and the Implicit Association Test) and symptom levels were measured via interview and self-report. Partially supporting the main hypothesis, symptoms of depression and eating disorders were significantly correlated with disorder-specific implicit associations but not attentional biases. Partially supporting the specificity hypothesis, there was evidence for stronger associations between symptoms of eating disorders and eating specific implicit associations.

Keywords Cognitive biases · Depression · Eating disorders

Introduction

Depression and eating disorders are relatively common among young adults (Hudson et al. 2007; Kessler et al. 2005) and are associated with significant role impairment across a variety of domains (Hudson et al. 2007). The age of onset for these disorders is commonly around adolescence and young adulthood (Hudson et al. 2007; Kessler et al. 2005), with women being at increased risk for both disorders (Hankin et al. 1998; Hudson et al. 2007; Nolen-Hoeksema and Girgus 1994). Undergraduate women also have higher levels of body dissatisfaction, disordered eating habits, and dieting behaviors than undergraduate men, despite having similar body mass indices (Edman et al. 2007). For depression, rates of depression increase more steeply for females than males, culminating in a 2:1 gender difference by late adolescence (Hankin et al. 1998). Given this, young-adult women may be an especially important group to study for examining factors that may contribute risk for these disorders.

Lifetime comorbidity among these two disorders is high, and the lifetime comorbidity of eating disorders and depression usually exceeds the comorbidity of eating disorders and any other Axis I disorder (for a review, see O'Brien and Vincent 2003). Given this, it is important to understand factors that may be uniquely associated with each disorder as well as factors that may characterize their comorbidity. Cognitive models of psychopathology (e.g., Clark et al. 1999; Williams et al. 1997) suggest that various disorders are characterized by information-processing biases (e.g., attention and interpretation) but that the content or focus of these biases is disorder-specific. For example, cognitive theorists have hypothesized that depression is characterized by information-processing biases in attending to, interpreting, and remembering negative events, specifically those related to loss and failure (see e.g., Clark et al. 1999). Beck (1967, 1987) hypothesized that depressed individuals have maladaptive self-schemata containing dysfunctional attitudes relating to loss, failure, inadequacy, and worthlessness. These maladaptive self-schemata are hypothesized to give rise to negative beliefs about the self,

An earlier version of this paper was presented at the annual meeting of the Association for Behavioral and Cognitive Therapies, Orlando, FL, 2008.

J. S. Benas (✉) · B. E. Gibb
Department of Psychology, Binghamton University, P.O. Box 6000, Binghamton, NY 13902, USA
e-mail: jessica.benas@binghamton.edu; jbenas1@binghamton.edu

the world, and the future. Specifically, a depressed individual is hypothesized to regard him/herself as unworthy, inadequate and unlovable; interpret his/her interactions with the environment as burdensome and filled with insurmountable obstacles; and anticipate that current problems will continue in the future indefinitely (Clark et al. 1999).

Although focused on similar information processing processes, cognitive-behavioral theories of eating disorders (e.g., Cooper 2005a; Fairburn et al. 1998, 2003; Shafran et al. 2003) hypothesize that the content of these biases focuses on body image distortion and the importance of shape and weight on self-evaluation. According to the theories, individuals suffering from an eating disorder tend to have negative beliefs about their body, and that focusing on these negative beliefs increases distress and arousal. Engaging in maladaptive eating behaviors is hypothesized to quell these negative cognitions and the subsequent distress that accompanies them (Cooper 2005b).

A number of studies have supported the role of cognitive biases in the development and maintenance of depression and eating disorders (for reviews, see Clark et al. 1999; Friedman and Whisman 2004; Williams et al. 1997; Williamson et al. 1999). However, little research has examined the hypothesized specificity of these biases to one disorder versus another. Another limitation of previous research is that the majority has focused on self-report measures of cognitive bias, which may be subject to recall or response biases and demand characteristics such as social desirability (Vartanian et al. 2004). To address this, much of the current research on cognitive biases has employed computer-based measures of cognitive processes. For example, researchers have used probe detection tasks to assess attentional biases and the Implicit Association Test (IAT) to measure implicit associations. The probe detection task (MacLeod et al. 1986) assesses the extent to which participants attend to one type of stimuli versus another and the IAT measures implicit associations, which are defined as evaluative judgments that are automatically activated without the person's awareness of such activation (Greenwald et al. 1998). These implicit associations are latent beliefs that are not under conscious control (Vartanian et al. 2004), and are similar to the concept of underlying schema which are posited in cognitive theories of depression (e.g., Clark et al. 1999). These computer-based measures are free from the potential inflated relations that self-reported measures may have with self-reported symptoms (Vartanian et al. 2004).

Recent research has demonstrated that clinically depressed individuals exhibit an attentional bias specifically toward sad faces (as opposed to angry or happy facial expressions) (Gotlib et al. 2004a, b). Further, attentional biases for sad faces continue to persist even after recovery from depression (Joormann and Gotlib 2007). Although there have been fewer studies of implicit associations than attentional biases, there is evidence that individuals with elevated depressive symptoms show an increased negative bias for self-relevant information (i.e., a stronger implicit association for categories "me" and "bad") (for a review, see Friedman and Whisman 2004). As with attentional biases, research suggests that these implicit associations remain even after the depression remits (Meites et al. 2008).

Regarding eating disorders, a number of studies have shown that individuals with eating disordered symptoms exhibit attentional biases for negative eating, weight, and shape words (Rieger et al. 1998; for a review, see Williamson et al. 1999). Results suggest that attentional biases are stronger among individuals with eating disorders than nonclinical controls and individuals with high levels of shape concern (Shafran et al. 2007). Regarding implicit associations, although a number of studies have utilized the IAT to examine negative implicit attitudes toward overweight individuals (Ahearn and Hetherington 2006; Teachman et al. 2003; Wang et al. 2004), there have been few studies examining the relation between actual symptoms of eating disorders and implicit eating-related cognitions. Research has found, for example, that women who implicitly associate being underweight with positive attributes report higher eating disorder symptoms (e.g., more drive for thinness) (Ahearn et al. 2008). Thus, more research is still needed to examine these associations.

As previously mentioned, cognitive theorists (e.g., Beck 1967, 1987; Clark et al. 1999; Cooper 2005a; Fairburn et al. 2003) have proposed that although the cognitive process of depressed individuals and eating disordered individuals are similar, the actual content or focus of the cognitive biases differ. However, little research has actually examined the hypothesized specificity of these biases to one disorder versus another. Given this, the primary goal of this project was to test the hypothesis that the content or focus of these biases is disorder-specific. We hypothesized that women's levels of depressive symptoms would be significantly associated with their attentional biases specifically toward depression-relevant stimuli, whereas levels of eating disordered symptoms would be significantly associated with attentional biases specifically toward eating-relevant stimuli. In addition, we hypothesized that levels of depressive symptoms would be significantly associated with implicit associations specifically for depression-relevant words, whereas levels of eating disordered symptoms would be significantly associated with implicit associations specifically for eating-relevant words. Further, we hypothesized that women with elevated levels of both depressive and eating disorder symptoms would exhibit attentional biases and implicit associations to both depression- and eating-relevant stimuli.

Method

Participants

Participants included 202 female undergraduate students, between the ages of 18 and 22, currently enrolled in a psychology class who participated in exchange for receiving course credit. The average age of the women in the sample was 18.93 years (SD = 1.17). The racial composition of the sample was as follows: 63% Caucasian, 11% African American, 14% Asian, 6% Hispanic, and 6% from other racial/ethnic groups. Seventy-three percent of the sample rated themselves as "average weight" while 23% of the sample rated themselves as "overweight" and 3% of the sample rated themselves as "underweight." Participants' height and weight were also measured by study personnel, and the mean observed BMI was 23.25 (SD = 3.53). A BMI under 18.5 is considered underweight, whereas a BMI of 25 or more is considered overweight or obese. According to these data, 8.2% of the women fell into the underweight category, 24% fell into the overweight category, and 67.8% fell into the normal weight category.

Measures

Attentional Biases

A modified probe detection task (MacLeod et al. 1986) was used to assess attentional biases toward different images (e.g., facial displays of emotion and pictures of food and body shape stimuli). In this task, two images (one neutral and the other either depression- or eating-relevant) are displayed simultaneously on the left and right side of a computer screen. Images for the depression attentional bias task were taken from a standardized set of actors displaying a variety of sad, happy, and neutral facial expressions (NimStim Face Stimulus Set; Tottenham et al. 2009). On these trials, images of an actor displaying either a sad or happy expression were presented simultaneously on the computer screen with a picture of the same actor displaying a neutral expression. Throughout the trials, the emotion face was presented with the same frequency on both the left and right sides of the screen. Images for the eating disorders attentional bias task were taken from previous research employing pictures of negative, positive, and neutral eating and body shape stimuli (e.g., a healthy salad and an empty table in a restaurant; Shafran et al. 2007). These images were also presented with equal frequency on the left and right side of the screen. Separate probe detection tasks were administered to assess biases for each disorder (i.e., trials blocks of depression- and eating disorder-relevant stimuli were randomly presented within the same experiment). For both tasks, each trial began with a 1,000 ms presentation of a centrally fixated cross, immediately followed by the presentation of the pictorial stimuli. After 1,000 ms, the pictures disappeared and one picture was replaced by either one or two asterisks. Probes appeared with equal frequency on either side of the screen and with equal frequency in the place of emotional versus neutral stimuli. The women were asked to press one of two buttons on a response box to indicate how many asterisks they saw. Preferential attention was evidenced by a shorter latency to indicate the presence of probes replacing emotional stimuli (depression- or eating-relevant) and a longer latency to indicate the presence of probes replacing neutral stimuli, whereas attentional avoidance was evidenced by the opposite pattern.

Mean bias scores (Joormann and Gotlib 2007; Mogg et al. 1995) were then calculated separately for each stimuli type (sad faces, happy faces, negative food, positive food, negative body shape, positive body shape) by subtracting the mean response time for cases in which the probe replaced the emotional stimuli from mean response times for cases in which the probe replaced the neutral stimuli. In line with previous research utilizing the probe detection task (Beevers et al. 2007; Mathews et al. 1996) trials with response errors (2.2%) and trials with response times shorter than 150 ms (.02%) or longer than 1,500 ms (.68%) were excluded.

Implicit Associations

The Implicit Association Test (Greenwald et al. 2003, 1998) was used to assess participants' implicit associations for depression and eating-related stimuli. The IAT rests on the assumption that it is easier to make the same behavioral response (i.e., a key press) to concepts that are strongly associated with one another than to concepts that are weakly associated with one another (Greenwald et al. 1998). The IAT procedure requires respondents to identify stimulus items and categorize them into one of four superordinate categories (Nosek et al. 2005). Association strengths are measured based on the reaction time for categorizing members of these superordinate categories. For example, because depressed individuals tend to strongly associate the concepts "me" and "bad", respondents are expected to identify and categorize items fallings into these categories quicker when they share the same response key than when two weakly associated concepts, such as "me" and "good", share the same response key (Nosek et al. 2005). The IAT has been used to assess implicit associations in a variety of domains (for a review, see Friedman and Whisman 2004). The IAT was developed, administered and scored according to recommended IAT procedures (Greenwald et al. 2003) and used

established depression- and eating disorder-relevant word lists (e.g., Smith and Rieger 2006). An IAT summary was created by calculating a *D* score for each subject by computing the difference in mean latency between the non-compatible (e.g., not me + bad) and compatible (e.g., me + bad) conditions and dividing by the standard deviation of response latency for all trials (Greenwald et al. 2003; Nock and Banaji 2007). Positive *D* scores reflect relatively faster responding (a stronger association) when "me" and "bad" are paired, and negative *D* scores reflect relatively slower responding (a weaker association) when "me" and "bad" are paired (Nock and Banaji 2007). For the purposes of this study, the superordinate categories "Me/Not Me", "Good/Bad" and "Fat/Thin" were included in the IAT. As with the probe detection task, separate tasks were administered to assess biases for each disorder (i.e., trials blocks of depression- and eating disorder-relevant stimuli were randomly presented within the same experiment). There were two IAT summary scores: one reflecting an implicit association for depression-relevant stimuli (i.e., a strong association between "me" and "bad") and one reflecting an implicit association for eating-relevant stimuli (i.e., a strong association between "me" and "fat").

As per suggested IAT algorithm scoring guidelines (Greenwald et al. 2003), response latencies longer than 10,000 ms (10 s) were excluded (24 trials total, .05% of all trials). Contrary to the probe detection task, latencies for IAT trials with errors were not excluded. Research (Greenwald et al. 2003) suggests that these errors enhance IAT effects (*D* scores), as error responses are slower than correct responses (and more frequent) when the task requires giving a response when non-associated words share a response key.

Depressive Symptoms

The Hamilton Rating Scale for Depression (HRSD; Hamilton 1960) is a commonly used interviewer-administered measure of depressive symptoms. The HRSD is considered the "gold standard" in depression assessment and is the most widely used interviewer-administered assessment of depression severity (Nezu et al. 2002). It consists of 17 items that focused on symptoms of depression experienced over the past week. The HRSD has high inter-rater reliability and internal consistency and correlates highly with self-report measures of depressive symptoms (for a review, see Nezu et al. 2002). In this study, the HRSD had high inter-rater reliability (ICC = .93, $P < .001$).

The Beck Depression Inventory-II (BDI-II; Beck et al. 1996) is a 21-item self-report measure that was used to assess the severity of depression in the subjects. The BDI-II exhibits good reliability and validity (Beck et al. 1996) and had good internal consistency in this study ($\alpha = .90$).

Eating Disordered Symptoms

The Eating Disorder Examination (EDE; Cooper and Fairburn 1987; Fairburn and Cooper 1993) is a 62-item semi-structured interviewer-based measure created to assess the specific pathology associated with eating disorders present in the previous 4 weeks. The EDE assesses key behavior associated with eating disorders such as overeating (e.g., objective and subjective binging episodes, objective episodes of overeating) and extreme weight control methods (e.g., self-induced vomiting, laxative misuse, and intense exercising), as well as other behaviors associated with eating disorders psychopathology (e.g., food avoidance, eating in secret, avoidance of exposure to body shape, and reaction to prescribed weighing) (Fairburn and Cooper 1993). The EDE is suitable for both clinical and community populations (Fairburn and Cooper 1993). Items were rated in terms of the severity of their symptoms or the frequency of its occurrence. The inter-rater reliability of the EDE has been found to be uniformly high (Cooper and Fairburn 1987), and was also high in this study (ICC = .96, $P < .001$).

The Eating Disorder Examination Questionnaire (EDE-Q; Fairburn and Beglin 1994) is a self-report measure based directly on the EDE. The EDE-Q provides frequency data on key behavioral features of eating disorders and reflects the severity on certain aspects of eating disordered psychopathology. As with the EDE, items assess key behaviors of eating disorder psychopathology. Past research has demonstrated the psychometric adequacy of the measure (Luce and Crowther 1999). The EDE-Q exhibited good internal consistency in this study ($\alpha = .83$).

Procedure

Prior to participation, subjects read and signed a consent form outlining the procedures of the study. For each participant, the assessments took approximately 1.5 h to complete. The computer-based assessments were presented in counterbalanced order so that half of the sample completed the probe detection test first and half of the sample completed the IAT first. Results from an ANOVA revealed that no significant order effects existed (lowest $P = .20$).

Results

Preliminary Results

Preliminary analyses were conducted to examine the distributions of the study variables. Reaction times for both the probe detection task and the IAT in the sample were examined via a box plot analysis, and no outliers were

evident. In contrast, a number of the symptom measures exhibited significant skew. These variables were transformed (e.g., square root, log 10, inverse) to satisfy assumptions of normality prior to further analysis. Correlations among the study variables, as well as their means, standard deviations, and ranges are presented in Table 1. To facilitate comparisons with other studies, the means, standard deviations, and ranges presented are from the untransformed variables.

Focusing first on attentional biases, contrary to hypotheses depressive and eating disordered symptoms were not significantly correlated with any of the measures of attentional biases (see Table 1).[1] The first hypothesis, therefore, was not supported. Since we did not find any evidence for relations between symptoms and any attentional biases, it is not surprising that we also did not find support for our secondary hypothesis that women exhibiting high levels of both symptom types would exhibit attentional bias to both depression-relevant and eating-relevant stimuli.[2]

Focusing next on implicit associations, symptoms of depression were significantly related to both depression-relevant (HRSD: $r = .17$, $P = .01$; BDI-II: $r = .18$, $P = .01$) and eating-relevant implicit associations (HRSD: $r = .16$, $P = .02$). The self-reported measure of depressive symptoms, however, was not significantly related to eating-relevant implicit associations (BDI-II: $r = .13$, $P = .08$). A test of dependent correlations (Meng et al. 1992) was then used to determine whether depressive symptoms were significantly more strongly related to implicit associations for depression-relevant words than for eating-relevant words. This difference was not significant for the HRSD ($z = .13$, $P = .90$) or for the BDI-II ($z = -.62$, $P = .53$). Next, consistent with our hypothesis, symptoms of eating disorders were significantly related to eating-relevant implicit associations (EDE: $r = .25$, $P < .001$; EDE-Q: $r = .34$, $P < .001$). However, eating disorder symptom levels were also significantly related to depression-relevant implicit associations (EDE: $r = .14$, $P = .05$; EDE-Q: $r = .16$, $P = .02$). Partially supporting the specificity hypothesis, implicit associations for eating-relevant words were significantly more strongly related to eating disordered symptoms than depressive symptoms based on self-report ($z = 2.81$, $P = .01$), but not interviewer-administered ($z = 1.51$, $P = .07$) symptom measures, though the latter was a nonsignificant trend.

Next, we hypothesized that women with elevated levels of both depressive and eating disorder symptoms would exhibit attentional biases and implicit associations to both depression- and eating-relevant stimuli. These hypotheses were tested using a hierarchical linear regression, with each form of implicit association bias serving as the criterion variable in separate analyses. Depressive symptoms and eating disordered symptoms (measured by either interview or self-report) were centered and then each entered in the first step of the regression. In the second step of the regression, the depression × eating disorder symptom interaction was entered. Thus, four separate regression analyses were conducted.

First, regressions were examined with depression-relevant implicit associations as the criterion variable. For the interviewer administered measures, depressive symptoms, $t(199) = 1.85$, $P = .07$, $\beta = .14$, and eating disordered symptoms, $t(199) = 1.08$, $P = .28$, $\beta = .08$, were entered in the first step of the regression. Their interaction was entered in the second step, $t(198) = .70$, $P = .49$, $\beta = .05$. For the self-report measures of symptoms, depressive symptoms, $t(199) = 1.83$, $P = .07$, $\beta = .14$, and eating disordered symptoms, $t(199) = 1.40$, $P = .16$, $\beta = .11$, were entered in the first step, and their interaction was then entered in the next step, $t(198) = .61$, $P = .54$, $\beta = .04$.

Next, regressions were examined with eating-relevant implicit associations as the criterion variable. For the interviewer administered measures, depressive symptoms, $t(199) = .92$, $P = .36$, $\beta = .07$, and eating disordered symptoms, $t(199) = 3.04$, $P < .01$, $\beta = .23$, were entered in the first step of the regression. Their interaction was entered in the second step, $t(198) = 1.82$, $P = .07$, $\beta = .12$. For the self-report measures of symptoms, depressive symptoms, $t(199) = -.16$, $P = .87$, $\beta = -.01$, and eating disordered symptoms, $t(199) = 4.69$, $P < .001$, $\beta = .34$, were entered in the first step, and their interaction was then entered in the next step, $t(198) = 1.05$, $P = .30$, $\beta = .07$. Thus, contrary to prediction, the depression × eating disorder symptom interaction was not significantly related to either type of implicit association bias.

The Role of Body Mass Index

As stated above, participants' mean body mass index (as measured by weight in kilograms divided by height in meters squared) was obtained by study personnel. Post-hoc analyses revealed that BMI was significantly related to the following variables: IAT depression ($r = .15$, $P = .04$), IAT Eating, ($r = .33$, $P < .001$), EDE total score ($r = .44$, $P < .001$), and EDE-Q total score ($r = .49$, $P < .001$). Therefore, all correlation analyses were thus recalculated controlling for BMI. Regarding the hypotheses, symptoms

[1] Analyses were conducted to examine any potential non-linear relations (i.e., quadratic or cubic) between symptoms (as measured both by the interview and self-report measures) and attentional biases. No significant non-linear relations were observed.

[2] Results of these analyses can be obtained from the first author.

Table 1 Intercorrelations and descriptive statistics for study variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Atten. bias: sad	–											
2. Atten. bias: happy	.05	–										
3. Atten. bias: pos food	.16*	.13	–									
4. Atten. bias: neg food	−.06	.09	.12	–								
5. Atten. bias: pos shape	.35**	−.02	.01	−.04	–							
6. Atten. bias: neg shape	.21**	.03	.25**	−.01	.13	–						
7. IAT depression	−.07	.00	−.05	−.01	.08	.01	–					
8. IAT eating	−.10	.05	−.07	.04	.06	.04	.34**	–				
9. HRSD	.02	−.02	.02	.06	.08	.07	.17*	.16*	–			
10. EDE	−.04	.12	−.05	.04	.09	.07	.14	.25**	.40**	–		
11. BDI-II	.03	.01	.06	.03	.09	.07	.18**	.13	.74**	.37**	–	
12. EDE-Q	−.05	.13	−.01	.04	.18*	.06	.16*	.34**	.40**	.87**	.40**	–
Mean	2.68	3.54	1.73	.70	3.83	15.97	−.44	−.24	4.68	1.00	7.85	1.35
SD	31.15	28.62	50.36	48.06	54.18	62.47	.25	.29	4.43	1.03	7.20	1.16
Range	−74.74 to 87.47	−59.94 to 100.07	−125.71 to 146.30	−136.00 to 144.78	−146.80 to 151.42	−117.82 to 340.41	−1.16 to .29	−.91 to .79	.00 to 21.00	.00 to 4.44	.00 to 36.00	.00 to 5.00

Atten. bias: sad = attentional bias toward sad faces; atten. bias: happy = attentional bias toward happy faces; atten. bias: pos food = attentional bias toward positive food images; atten. bias: neg food = attentional bias toward negative food images; atten. bias: pos shape = attentional bias toward positive body shape images; atten. bias: neg shape = attentional bias toward negative body shape pictures; IAT depression = implicit association bias for depressive-relevant words; IAT eating = implicit association bias for eating-relevant words; HRSD = hamilton rating scale for depression: EDE = eating disorders examination; BDI-II = beck depression inventory-II; EDE-Q = eating disorders examination-questionnaire

* $P \leq .05$, ** $P < .01$

of depression were no longer significantly related to eating-relevant IAT biases (HRSD: $r = .13$, $P = .06$), nor were eating disorder symptom levels any longer significantly related to depression-relevant IAT biases (EDE: $r = .08$, $P = .24$; EDE-Q: $r = .10$, $P = .14$) after controlling for BMI. Importantly, however, the relation between eating relevant implicit associations and self-reported eating disorder symptoms was maintained even after statistically controlling for the influence of BMI ($r = .22$, $P < .01$), though the relation with interviewer-assessed eating disorder symptoms was reduced to a nonsignificant trend ($r = .13$, $P = .06$).

Discussion

The primary purpose of the study was to examine cognitive biases in depression and eating disorders and to test the hypothesis that the content or focus of these biases is disorder-specific. We found that symptoms of depression were significantly related to implicit associations for both depression-relevant and eating-relevant words. In addition, symptoms of eating disorders were significantly related to implicit associations for both depression-relevant and eating-relevant words. Although there was no evidence for the specificity of depressive implicit associations to depressive symptom levels, there was evidence for the specificity of eating-related implicit associations to eating disordered symptoms. It should also be noted that the full specificity hypothesis was supported when controlling for the effects of body mass index. Lastly, there was no support for the comorbidity hypotheses that symptoms of depression or eating disorders would be associated with cross-domain cognitive biases only in the presence of high levels of comorbid symptoms (i.e., no significant depression × eating disorder interactions predicting cognitive biases). A nonsignificant trend was observed, however, suggesting that it may be beneficial to explore this again in future studies.

Contrary to hypotheses, women's symptoms of depression or eating disorders were not significantly related to any of the types of attentional bias examined. There are some potential reasons why this may have occurred. First, stronger effects may be observed in other samples, as there may have been a restriction of range on symptom measures in this undergraduate population. Second, with regard to depressive attentional biases, theorists (e.g., Clark et al. 1999) have suggested that depressive schema remain latent until activated by a negative event or mood. Therefore, priming individuals into a negative mood state may have helped activate latent cognitions. This can be done through exposure to sad music (e.g., Jefferies et al. 2008) to activate depressive cognitions or exposure to advertisements with thin models (e.g., Brown and Dittmar 2005) to activate negative eating and appearance related schema. Research has demonstrated, for example, that formerly depressed individuals who are induced into a negative mood state divert their attention toward negative stimuli significantly more than vulnerable individuals not induced into a negative mood state (Ingram and Ritter 2000) and that attentional biases for negative information following a mood induction procedure (but not prior to), combined with higher levels of life stress prospectively predict increased dysphoria (Beevers and Carver 2003). Although research on priming attentional biases in eating disorders is less prevalent, there is evidence to suggest that priming effects do exist. For example, research has shown that exposure to pictures of thin models increases weight-related anxiety among women with a thin-ideal internalization (Brown and Dittmar 2005) and individuals with body dissatisfaction who are primed to a thin ideal show significant interference on an attentional Stroop task (Johansson et al. 2005). Future research, therefore, should implement these priming procedures to examine whether attentional bias specificity can be found.

It may also be beneficial to include a more precise measurement of attention allocation. Depressive attentional biases as reflected in the probe detection task are thought to reflect depressed individuals' difficulty disengaging their attention from schema-congruent stimuli (see Joormann 2009; Mathews and MacLeod 2005). In line with schema models of depression (e.g., Beck 1976), depressed individuals also appear to direct their initial gaze more frequently and rapidly to negative information and have longer fixations on negative stimuli than non depressed individuals (Caseras et al. 2007). A limitation of the probe detection task is that it only measures attentional allocation at a single time point, at the offset of the stimuli. During longer stimulus presentation times (e.g., 1,000 ms), individuals may shift their focus repeatedly between the stimuli prior to stimulus offset, which may decrease the sensitivity of the measure (Caseras et al. 2007). Thus, potentially important effects may be observed when measuring an individual's gaze throughout the entire duration of stimulus exposure. Eye tracking devices have been used in previous studies of attentional allocation to record patterns of attentional allocation across an entire test trial (e.g., Caseras et al. 2007; Kellough et al. 2008; Nummenmaa et al. 2006). Recent research of attention biases that track eye movements allows continuous monitoring of attention, providing a measure of initial orienting (as indexed by the direction and latency of the first shift in gaze) and attention maintenance (as measured by the total duration of gaze) (Caseras et al. 2007). With regard to eating disorders, eye-tracking research has demonstrated that during a 5,000 ms probe presentation,

women with a low drive for thinness, compared to those with a high drive for thinness, look significantly longer at models' body regions (e.g., leg and midsection), suggesting an attentional avoidance pattern among individuals at risk for an eating disorder (Janelle et al. 2003). This is consistent with past research utilizing manual 500 ms probe presentation times which have noted attentional avoidance of thin physique words among individuals with eating disorders (Rieger et al. 1998). Eye-tracking research in the realm of depression has demonstrated that during a 3,000 ms probe presentation, dysphoric individuals show a significantly greater bias to maintain gaze longer on negative scenes as compared to nondysphoric individuals (Caseras et al. 2007). This is consistent with past research utilizing manual 1,000 ms probe presentations times which have noted vigilance for negative stimuli among depressed subjects (e.g., Bradley et al. 1997; Mogg et al. 1995). Thus, although the current study attempted to replicate the presentation times used in previous depression research using the dot probe (e.g., Joormann and Gotlib 2007), it is possible that other theoretically meaningful effects may be happening prior to the offset of cues, and future research would benefit from tracking initial orientation and frequency of gaze shifting in both depressed and eating disordered individuals.

The current study exhibited a number of strengths including the focus on computer-based assessments of cognitive biases and interviewer-rated measures of symptoms, as well as the relatively large sample size and the use of multiple assessments of each construct. This said, some limitations should be acknowledged. First, due to the cross-sectional nature of the study, no causal conclusions can be drawn. Prospective research is needed to determine whether these cognitive biases are more likely to contribute to the development of elevated disordered symptoms or vice versa. Past research suggests that dysfunctional cognitive styles first develop in childhood and stabilize by early adolescence (see Cooper 2005b; Garber and Flynn 1998; Haines et al. 1999). There is also a dramatic rise in the prevalence of both depression (Hankin et al. 1998) and eating disorders (Steinhausen et al. 2005; Striegel-Moore et al. 2004) in adolescence. Therefore, the time period of late childhood and adolescence appears to be a particularly important area of focus.

Secondly, given the relatively low point prevalence of depressive and eating disorders (Blazer et al. 1994; Hudson et al. 2007), this study focused on continuous symptom levels.[3] Future studies would benefit from the inclusion of an outpatient sample and analyses focused on disordered versus non-disordered groups to see if similar effects exist. Lastly, as previously mentioned, future research would benefit from the utilization of an eye-tracker to more precisely assess individuals' patterns of attentional allocation across the entire stimulus presentation as well as the inclusion of a mood induction procedure to activate or prime latent cognitive vulnerabilities. Further, although this was not necessarily a limitation, it should be noted that the study included only female participants. This decision was made based on research suggesting that women, compared to men, are at greater risk for depression and eating disorders (Edman et al. 2007; Hankin et al. 1998; Hudson et al. 2007; Nolen-Hoeksema and Girgus 1994), experience more feedback from peers to alter their weight (McCabe and Ricciardelli 2001), and exhibit more depressive symptoms in response to peer stressors (Hankin et al. 2007). This said, however, it would be important to know whether these results replicate with a male sample. Given evidence that the focus of body concerns in men with eating disorder symptoms may differ from that in women (e.g., Olivardia et al. 2004), these studies will need to incorporate different stimuli to assess eating-relevant cognitive biases. Specifically, these studies should utilize stimuli that tap the desire to be muscular rather than thin.

Despite these limitations, this project was an important test of the cognitive content specificity hypothesis (e.g., Clark et al. 1999; Williams et al. 1997), given the high comorbidity of depression and eating disorders (e.g., Hudson et al. 2007). The study was also an important first step in utilizing both the probe detection task and the IAT to assess depressive and eating related biases in the same study. Although research has supported the presence of information-processing biases in a variety of disorders (for reviews see Mathews and MacLeod 2005; Williamson 1996), little research has examined the hypothesized specificity of these biases to one disorder versus another.

In addition to the potential theoretical implications raised in this study, there are also potential clinical implications. Elucidating specific biases would be useful, given that research has suggested, for example, that less than half of individuals with bulimia seek treatment for their eating disorder, although the majority of these individuals do seek treatment for an emotional problem (Hudson et al. 2007). Therefore, it may be important to assess for eating related issues even when the individual does not include these problems among their presenting complaints. Computerized tasks such as the probe detection task and the IAT, which measure cognitions outside of a person's awareness, may help identify presenting problems or vulnerabilities that the patient is unwilling to endorse, which in turn are contributing to the maintenance of the disorder. Although specificity was only partially supported in the current

[3] We would like to mention, however, that post hoc analyses of analogue groups (high scores for both disorders, low scores for both disorders, and high scores for one disorder with low scores for the other disorder) revealed that no group effects existed.

study, further research may fully support the specificity hypotheses upon refinement of the measures (e.g., utilizing an eye tracking device or mood induction to assess attentional biases, utilizing different word sets in the IAT). Further, utilizing computerized procedures such as the IAT throughout the course of treatment may be useful, as it has been shown to be sensitive to clinical change in treatment and is resistant to attempts to 'fake good' (for a review, see Nock and Banaji 2007). Such utilization can also test hypothesized mechanisms of clinical change.

In addition, preliminary data suggests the utility of additional research testing other forms of cognitive biases. It is possible that the specific words used in the current IAT (e.g., "Good/Bad" and "Fat/Thin") signal themes that cut across the theoretical cognitive content in both depression and eating disorders, thus explaining why both types of implicit associations were related to symptoms of each disorder. Evidence for specificity may be more strongly supported if other thematic words are utilized. Research has suggested that different forms of negative cognitions such as low self-esteem (Southall and Roberts 2002) and body dissatisfaction (Allgood-Merten et al. 1990; Fabian and Thompson 1989; Stice et al. 1998; Thompson et al. 1995) contribute risk to the development of depressive symptoms. Cognitive-behavioral theories of eating disorders (e.g., Cooper 2005a; Fairburn et al. 1998, 2003; Shafran et al. 2003) hypothesize that cognitive biases focus on body image distortion and the importance of shape and weight on self-evaluation. Further research is needed to determine if these results replicate when examining implicit body dissatisfaction and implicit self-esteem, as well as implicit beliefs of weight and shape importance (e.g., "Important/Unimportant", "Me/Not Me" and "Fat/Thin").

In conclusion, it was hoped that the results from the project would better identify cognitive factors specific to depression and eating disorders, which can lead to more targeted intervention programs and more specified treatment approaches. Despite previous studies examining cognitive biases in depression and eating disorders (e.g., Gotlib et al. 2004a, b; Rieger et al. 1998), research had yet to integrate these findings to examine the potential specificity of these cognitive biases to the two disorders. This study was an initial step in examining these issues, especially with regard to implicit associations inherent in eating disorders, with findings supporting the specificity of eating-relevant implicit associations to eating disorder symptoms.

References

Ahearn, A. L., Bennett, K. M., & Hetherington, M. M. (2008). Internalization of the ultra-thin ideal: Positive implicit associations with underweight fashion models are associated with drive for thinness in young women. *Eating Disorders, 16*, 294–307.

Ahearn, A. L., & Hetherington, M. M. (2006). The thin ideal and body image: An experimental study of implicit attitudes. *Psychology of Addictive Behaviors, 20*, 338–342.

Allgood-Merten, B., Lewinsohn, P. M., & Hops, H. (1990). Sex differences and adolescent depression. *Journal of Abnormal Psychology, 99*, 55–63.

Beck, A. T. (1967). *Depression: Causes and treatment*. Philadelphia: University of Pennsylvania Press.

Beck, A. T. (1976). *Cognitive therapy and emotional disorders*. New York: New American Library.

Beck, A. T. (1987). Cognitive models of depression. *Journal of Cognitive Psychotherapy, 1*, 5–37.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck depression inventory manual* (2nd ed.). San Antonio: The Psychological Corporation.

Beevers, C. G., & Carver, C. S. (2003). Attentional bias and mood persistence as prospective predictors of dysphoria. *Cognitive Therapy and Research, 27*, 619–637.

Beevers, C. G., Gibb, B. E., McGeary, J. E., & Miller, I. W. (2007). Serotonin transporter genetic variation and biased attention for emotional word stimuli among psychiatric inpatients. *Journal of Abnormal Psychology, 116*, 208–212.

Blazer, D. G., Kessler, R. C., McGonagle, K. A., & Swartz, M. S. (1994). The prevalence and distribution of major depression in a national community sample: The national comorbidity survey. *American Journal of Psychiatry, 151*, 979–986.

Bradley, B. P., Mogg, K., & Lee, S. C. (1997). Attentional biases for negative information in induced and naturally occurring dysphoria. *Behavior Research and Therapy, 35*, 911–927.

Brown, A., & Dittmar, H. (2005). Think "thin" and feel bad: The role of appearance schema activation, attention level, and thin-ideal internalization for young women's responses to ultra-thin media ideals. *Journal of Social and Clinical Psychology, 24*, 1088–1113.

Caseras, X., Garner, M., Bradley, B. P., & Mogg, K. (2007). Biases in visual orienting to negative and positive scenes in dysphoria: An eye movement study. *Journal of Abnormal Psychology, 116*, 491–497.

Clark, D. A., Beck, A. T., & Alford, B. A. (1999). *Scientific foundations of cognitive theory and therapy of depression*. New York: Wiley.

Cooper, M. J. (2005a). Cognitive theory in anorexia nervosa and bulimia nervosa: Progress, development and future directions. *Clinical Psychology Review, 25*, 511–531.

Cooper, M. J. (2005b). A developmental vulnerability-stress model of eating disorders: A cognitive approach. In B. L. Hankin & J. R. Z. Abela (Eds.), *Development of psychopathology: A vulnerability-stress perspective* (pp. 328–354). Thousand Oaks, CA: Sage.

Cooper, Z., & Fairburn, C. (1987). The eating disorder examination: A semi-structured interview for the assessment of the specific psychopathology of eating disorders. *International Journal of Eating Disorders, 6*, 1–8.

Edman, J. L., Yates, A., Aruguete, M. S., & DeBord, K. A. (2007). Negative emotion and disordered eating among obese college students. *Eating Behaviors, 6*, 308–317.

Fabian, L. J., & Thompson, J. K. (1989). Body image and eating disturbance in young females. *International Journal of Eating Disorders, 8*, 63–74.

Fairburn, C. G., & Beglin, S. J. (1994). The assessment of eating disorders: Interview or self-report questionnaire? *International Journal of Eating Disorders, 16*, 363–370.

Fairburn, C. G., & Cooper, Z. (1993). The eating disorder examination. In C. G. Fairburn & G. T. Wilson (Eds.), *Binge eating:*

Nature, assessment, and treatment (12th ed., pp. 317–360). New York, NY: Guilford Press.

Fairburn, C. G., Cooper, Z., & Shafran, R. (2003). Cognitive behaviour therapy for eating disorders: A "transdiagnostic" theory and treatment. *Behaviour Therapy and Research, 41*, 509–528.

Fairburn, C. G., Shafran, R., & Cooper, Z. (1998). A cognitive behavioural theory of anorexia nervosa. *Behaviour Therapy and Research, 37*, 1–13.

Friedman, M. A., & Whisman, M. A. (2004). Implicit cognition and the maintenance and treatment of major depression. *Cognitive and Behavioral Practice, 11*, 168–177.

Garber, J., & Flynn, C. (1998). Origins of the depressive cognitive style. In D. K. Routh & R. J. DeRubeis (Eds.), *The science of clinical psychology: Accomplishments and future directions* (pp. 53–93). Washington, DC: American Psychological Association.

Gotlib, I. H., Kasch, K. L., Traill, S., Joormann, J., Arnow, B., & Johnson, S. L. (2004a). Coherence and specificity of information-processing biases in depression and social phobia. *Journal of Abnormal Psychology, 113*, 386–398.

Gotlib, I. H., Krasnoperova, E., Yue, D. N., & Joormann, J. (2004b). Attentional biases for negative interpersonal stimuli in clinical depression. *Journal of Abnormal Psychology, 113*, 127–135.

Greenwald, A. G., McGhee, D. E., & Schwartz, J. L. K. (1998). Measuring individual differences in implicit cognition: The implicit association test. *Journal of Personality and Social Psychology, 74*, 1464–1480.

Greenwald, A. G., Nosek, B. A., & Banaji, M. R. (2003). Understanding and using the implicit association test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*, 197–216.

Haines, B. A., Metalsky, G. I., Cardamone, A. L., & Joiner, T. (1999). Interpersonal and cognitive pathways into the origins of attributional style: A developmental perspective. In T. Joiner & J. C. Coyne (Eds.), *The interactional nature of depression* (pp. 65–92). Washington, DC: American Psychological Association.

Hamilton, M. (1960). A rating scale for depression. *Journal of Neurology, Neurosurgery and Psychiatry, 23*, 56–62.

Hankin, B. L., Abramson, L. Y., Moffit, T. E., Silva, P. A., McGee, R., & Angell, K. E. (1998). Development of depression from preadolescence to young adulthood: Emerging gender differences in a 10-year longitudinal study. *Journal of Abnormal Psychology, 107*, 128–140.

Hankin, B. L., Mermelstein, R., & Roesch, L. (2007). Sex differences in adolescent depression: Stress exposure and reactivity models. *Child Development, 78*, 279–295.

Hudson, J. I., Hiripi, E., Pope, H. G., & Kessler, R. C. (2007). The prevalence and correlates of eating disorders in the national comorbidity survey replication. *Biological Psychiatry, 61*, 348–358.

Ingram, R. E., & Ritter, J. (2000). Vulnerability to depression: Cognitive reactivity and parental bonding in high-risk individuals. *Journal of Abnormal Psychology, 109*, 588–596.

Janelle, C. M., Hausenblas, H. A., Fallon, E. A., & Gardner, R. E. (2003). A visual search examination of attentional biases among individuals with high and low drive for thinness. *Eating and Weight Disorders, 8*, 138–144.

Jefferies, L. N., Smilek, D., Eich, E., & Enns, J. T. (2008). Emotional valence and arousal interact in attentional control. *Psychological Science, 19*, 290–295.

Johansson, L., Lundh, L., & Andersson, G. (2005). Attentional bias for negative self-words in young women: The role of thin ideal priming and body shape dissatisfaction. *Personality and Individual Differences, 38*, 723–733.

Joormann, J. (2009). Cognitive aspects of depression. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of depression* (2nd ed., pp. 298–321). New York: Guilford.

Joormann, J., & Gotlib, I. H. (2007). Selective attention to emotional faces following recovery from depression. *Journal of Abnormal Psychology, 116*, 80–85.

Kellough, J. L., Beevers, C. G., Ellis, A. J., & Wells, T. T. (2008). Time course of selective attention in clinically depressed young adults: An eye tracking study. *Behaviour Research and Therapy, 46*, 1238–1243.

Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the national comorbidity survey replication. *Archives of General Psychiatry, 62*, 593–602.

Luce, K. H., & Crowther, J. H. (1999). The reliability of the eating disorder examination-self-report questionnaire version (EDE-Q). *International Journal of Eating Disorders, 25*, 349–351.

MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15–20.

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology, 1*, 167–195.

Mathews, A., Ridgeway, V., & Williamson, D. A. (1996). Evidence for attention to threatening stimuli in depression. *Behavior Research and Therapy, 34*, 695.

McCabe, M. P., & Ricciardelli, L. A. (2001). Parent, peer, and media influences on body image and strategies to both increase and decrease body size among adolescent boys and girls. *Adolescence, 36*, 225–240.

Meites, T. M., Deveney, C. M., Steele, K. T., Holmes, A. J., & Pizzagalli, D. A. (2008). Implicit depression and hopelessness in remitted depressed individuals. *Behaviour Research and Therapy, 46*, 1078–1084.

Meng, X., Rosenthal, R., & Rubin, D. B. (1992). Comparing correlated correlation coefficients. *Psychological Bulletin, 111*, 172–175.

Mogg, K., Bradley, B. P., & Williams, R. (1995). Attentional bias in anxiety and depression: The role of awareness. *British Journal of Clinical Psychology, 34*, 17–36.

Nezu, A. M., Nezu, C. M., McClure, K. S., & Zwick, M. L. (2002). Assessment of depression. In I. H. Gotlib & C. L. Hammen (Eds.), *Handbook of depression* (pp. 61–86). New York: The Guilford Press.

Nock, M. K., & Banaji, M. R. (2007). Prediction of suicide ideation and attempts among adolescents using a brief performance-based test. *Journal of Consulting and Clinical Psychology, 75*, 707–715.

Nolen-Hoeksema, S., & Girgus, J. S. (1994). The emergence of gender differences in depression during adolescence. *Psychological Bulletin, 115*, 424–443.

Nosek, B. A., Greenwald, A. G., & Banaji, M. R. (2005). Understanding and using the implicit association test: II. Method variables and construct validity. *Personality and Social Psychology Bulletin, 2*, 166–180.

Nummenmaa, L., Hyönä, J., & Calvo, M. G. (2006). Eye movement assessment of selective attention capture by emotional pictures. *Emotion, 6*, 257–268.

O'Brien, K. M., & Vincent, N. K. (2003). Psychiatric comorbidity in anorexia and bulimia nervosa: Nature, prevalence, and causal relationships. *Clinical Psychology Review, 23*, 57–74.

Olivardia, R., Pope, H. G., Borowiecki, J. J., & Cohane, G. H. (2004). Biceps and body image: The relationship between muscularity and self-esteem, depression, and eating disorder symptoms. *Psychology of Men & Masculinity, 5*, 112–120.

Rieger, E., Schotte, D. E., Touyz, S. W., Beumont, P. J. V., Griffiths, R., & Russell, J. (1998). Attentional biases in eating disorders: A visual probe detection procedure. *International Journal of Eating Disorders, 23*, 199–205.

Shafran, R., Fairburn, C. G., Nelson, L., & Robinson, P. H. (2003). The interpretation of symptoms of severe dietary restraint. *Behaviour Research and Therapy, 41*, 887–894.

Shafran, R., Lee, M., Cooper, Z., Palmer, R. L., & Fairburn, C. G. (2007). Attentional bias in eating disorders. *International Journal of Eating Disorders, 40*, 1–12.

Smith, E., & Rieger, E. (2006). The effect of attentional bias toward shape- and weight-related information on body dissatisfaction. *International Journal of Eating Disorders, 39*, 509–515.

Southall, D., & Roberts, J. E. (2002). Attributional style and self-esteem in vulnerability to adolescent depressive symptoms following life stress: A 14-week prospective study. *Cognitive Therapy and Research, 26*, 563–579.

Steinhausen, H., Gavez, S., & Metzke, C. W. (2005). Psychosocial correlates, outcome, and stability of abnormal adolescent eating behavior in community samples of young people. *International Journal of Eating Disorders, 37*, 119–126.

Stice, E., Killen, J. D., Hayward, C., & Taylor, C. B. (1998). Support for the continuity hypothesis of bulimic pathology. *Journal of Consulting and Clinical Psychology, 66*, 784–790.

Striegel-Moore, R. H., Franko, D. L., Thompson, D., Barton, B., Schreiber, G. B., & Daniels, S. R. (2004). Changes in weight and body image over time in women with eating disorders. *International Journal of Eating Disorders, 36*, 315–327.

Teachman, B. A., Gapinski, K. D., Brownell, K. D., Rawlins, M., & Jeyaram, S. (2003). Demonstrations of implicit anti-fat bias: The impact of providing causal information and evoking empathy. *Health Psychology, 1*, 68–78.

Thompson, J. K., Coovert, M. D., Richards, K. J., Johnson, S., & Cattarin, J. (1995). Development of body image, eating disturbance, and general psychological functioning in female adolescents: Covariance structure modeling and longitudinal investigations. *International Journal of Eating Disorders, 18*, 221–236.

Tottenham, N., Tanaka, J. W., Leon, A. C., McCarry, T., Nurse, M., Hare, T. A., et al. (2009). The NimStim set of facial expressions: Judgments from untrained research participants. *Psychiatry Research, 168*, 242–249.

Vartanian, L. R., Polivy, J., & Herman, C. P. (2004). Implicit cognitions and eating disorders: Their application in research and treatment. *Cognitive and Behavioral Practice, 11*, 160–167.

Wang, S. S., Brownell, K. D., & Wadden, T. A. (2004). The influence of the stigma of obesity on overweight individuals. *International Journal of Obesity and Related Metabolic Disorders, 28*, 1333–1337.

Williams, J. M. G., Watts, F. N., MacLeod, C., & Mathews, A. (1997). *Cognitive psychology and emotional disorders* (2nd ed.). New York: Wiley.

Williamson, D. A. (1996). Body image disturbances in eating disorders: A form of cognitive bias? *Eating Disorders: The Journal of Treatment and Prevention, 4*, 47–58.

Williamson, D. A., Muller, S. L., Reas, D. L., & Thaw, J. M. (1999). Cognitive bias in eating disorders: Implications for theory and treatment. *Behavior Modification, 23*, 556–577.