An examination of attentional training in dysphoric and non-dysphoric individuals

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An examination of attentional training in dysphoric and non-dysphoric individuals.

by

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Abstract

The present study examined the longitudinal effects of attentional retraining on symptoms of depression. It was a replication and extension of an earlier study by Wells & Beevers (2010). Based on their baseline BDI scores, undergraduate psychology students were randomly assigned into one of 4 groups. Dysphoric participants were assigned into either the neutral training or the control condition. Non-dysphoric participants were assigned into either the dysphoric training or the control condition. All dysphoric participants showed a significant reduction in depressive symptoms throughout the study, $F(2, 73.55) = 21.88, p<.001$; however, no group differences were observed. The hypothesis that negative bias retraining condition would induce depressive symptoms from baseline to follow-up was not confirmed. Results were inconsistent with those of Wells and Beevers’ (2010). Implications of the findings on research on attentional retraining in the context of depression are discussed.
Acknowledgments

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Chapter 1: Introduction

1.1 Background

Depression is the single most common psychological disorder, with reported 12-month prevalence rates as high as 8.2% in Canada (Vasiliadis, Lesage, Adair, Wang, & Kessler, 2007). Successful long-term recovery from depression can be difficult, as relapse rates may be as high as 24% within 3 months following the end of a depressive episode (Keller, Shapiro, Lavori, & Wolfe, 1982), and there is evidence that rates of relapse increase with recurrent depression. Thus, it is important to investigate risk factors for both the onset of and relapse for depression.

Cognitive models are among the dominant psychological approaches to depression, and research has consistently shown the presence of a negative attention bias in depressed and dysphoric individuals (see Joormann & Quinn, 2014, for a review). The negative attentional bias is specific to and differs from the bias toward threatening stimuli found in anxious individuals in terms of duration (Gotlib & Joormann, 2010). However, a recent study demonstrated that an attentional bias for sad faces in dysphoric individuals has the same underlying factor of negative affectivity, as does the attention bias for threat-relevant information in anxious individuals (Oehlberg, Revelle, & Mineka, 2012). Other research suggests that the negative attentional bias seen in depression is more of a maintenance factor, rather than a potential risk factor for the onset of depression (see Armstrong & Olatunji, 2014, for a review), as individuals who are dysphoric may be no more likely than non-dysphoric/individuals to begin looking at negative stimuli, but are less likely to disengage their attention away from negative stimuli once they start to become aware of it (Clasen et al., 2013). Recent studies suggest that a negative attentional bias might play a role in maintenance of depression, because it interferes with recovery from sad mood (Clasen et al., 2013; Sanchez et al., 2013).
A recent focus in depression research has been to examine the modifiability of the negative attention bias. For example, a number of studies have investigated Cognitive Bias Modification (CBM) procedures (Koster, Fox, & MacLeod, 2009) in the context of anxiety and depression. Several training paradigms have been used to do study CBM procedures, including the dot-probe task (e.g., MacLeod et al., 2002; Wells & Beevers, 2010) and the spatial cueing task (Kruijt et al., 2013). The dot-probe task uses words or images as stimuli, in order to train depressed participants’ attention away from negative stimuli. To influence the elaborative stages of attention, found to be particularly associated with the selective bias for negative information (e.g., Bradley, Mogg, & Lee, 1997), the stimuli are often presented for a longer period of time than in other attentional bias studies (Oehlberg et al., 2012).

Until recently, it was not established whether the attentional bias is a precursor or a by-product of depression. In 2002, MacLeod and colleagues conducted a study, which examined the potential causal effects of attentional bias on emotional vulnerability. The authors presented participants with a stressful anagram task, followed by an attention training task, and an opportunity to perform the anagram task a second time. The dot-probe task consisted of 48 word pairs presented each for 12 times (for a total of 576 trials) at 500ms per trial. The authors demonstrated that training a neutral attentional bias in non-clinical individuals significantly reduced their vulnerability to experience negative emotion during the stressful anagram task, while the opposite was found for the negative attentional bias training. Further, the participants who underwent a negative attentional bias training had significantly more negative affect following completion of the anagram task, compared to the participants in the neutral training condition. These findings suggest that attention to emotional information mediates emotional vulnerability in healthy individuals.
More recently, researchers have investigated the effects of training a neutral attention bias in a sample of mildly (non-clinically) to severely (clinically) depressed individuals (Baert, De Raedt, Schacht, & Koster, 2010). These authors used a spatial cueing task to present participants with 50 positive and 50 negative words (each session consisted of 220 trials) during 10 daily at-home training sessions. In the positive attention bias training condition, in 90% of the trials that presented a positive word, a dot appeared at the same location as the previous position of the positive word. In the no-training condition, the dot appeared at the opposite location of a negative word 45% of the time and at the same location as a positive word 45% of the time. The task led to a small reduction in depressive symptoms post-training for the mildly depressed participants. In the moderately/severely depressed individuals, however, the training condition led to either no change or an increase in depressive symptoms. Surprisingly, for that group, the control condition was associated with a decrease in depressive symptoms. Baert et al., (2010) concluded that while attention bias training may be beneficial for mildly depressed persons, the training procedure may be detrimental to the more depressed individuals and thus should not be administered to them until their symptoms reduce in severity.

Haeffel and colleagues (Haeffel, Rozek, Hames, & Technow, 2012) found similar results to Baert et al., (2010), in a study that investigated the effect of cognitive bias modification on cognitively vulnerable individuals. These authors used a similar dot-probe task to the one used by MacLeod et al. (2002), except that a priming stimulus of a negative scene was presented on the screen for 750ms before each trial. The stimuli that followed were adaptive and maladaptive self-worth inference word pairs, each pair presented for 1000ms, followed by a dot-probe appearing in the location of either an adaptive or a maladaptive word. Participants were required to press a button to identify the location of the probe, in order to move on to the next trial, and
their reaction time was recorded. In the training condition, the probe appeared behind the positive word 95% of the time. In the non-training condition, the probe was equally likely to appear behind a positive or negative word. After the training procedure, participants were asked to solve difficult and unsolvable anagrams. Haeffel et al., (2012) found that participants in the positive attention training condition responded more quickly to adaptive stimuli than to maladaptive stimuli. This training effect was mediated by their cognitive vulnerability, in that this learning effect began to deteriorate after 20 trials in the cognitively vulnerable individuals. Despite this mediation effect, individuals in the training condition had significantly lower depressive symptoms, and spent more time trying to complete the difficult anagram tasks. The authors suggest that cognitive bias modification (CBM) tasks may be more difficult for cognitively vulnerable individuals and they recommend that CBM training be initially administered in low doses.

Other researchers examined the attention-retraining paradigm in formerly depressed individuals at a high risk for relapse (Browning, Holmes, Charles, Cowen, & Harmer, 2012). Participants were randomly assigned into one of the four groups: either a positive or no-training (control) condition that used either word or pictoral (i.e., pictures of faces) stimuli. The training was administered using a dot-probe task that participants completed at home, twice a day for two weeks. Each session consisted of 96 trials of positive-neutral, negative-neutral, and positive-negative stimuli pairs that were presented randomly for a duration of either 500 ms or 1000 ms. Participants’ depressive symptoms were assessed pre-training, post-training, and at follow-up two weeks later. The authors found that only the positive training task, when compared to the control version, that used pictures of faces as stimuli reduced participants’ depressive symptoms. However, the decrease in depressive symptoms was observed only at the follow-up assessment,
but not right after training. Additionally, the positive training task, when compared to the control version, that used face pictures as stimuli also reduced participants’ cortisol awakening response when it was assessed at follow-up, but not right after the training. These results suggest that modification of attentional biases plays a role in recurrence of depression.

While the above studies provide compelling evidence for the use of attention bias re-training to reduce depressive symptoms in non-clinical individuals, only one study has investigated the longitudinal effects of attention re-training in a controlled, laboratory setting. Wells and Beevers (2010) randomly assigned mildly depressed individuals to either a positive training condition or to a no training condition, for four sessions over a two-week period. They used a dot-probe task to present 12 pairs of faces (sad and neutral) for 3000 ms and 20 images (dysphoric or neutral) for 4500 ms over 196 trials per session. In the training condition, the probe appeared in the location of the neutral stimulus 85% of the time. In the no-training condition, it appeared in the location of neutral and sad stimuli 50% of the time. Outcomes included changes in attentional bias and mood after training, and at a follow-up session four weeks past baseline assessment. Wells and Beevers (2010) found that, compared to baseline, participants in the training condition exhibited significantly lower depressive symptoms at the end of the two weeks training ($d = 0.52$), and at follow-up two weeks later ($d = 1.04$). Further, the authors conducted mediational analyses, which demonstrated that the relationship between attention training and depressive symptoms at follow-up was mediated by changes in the attentional bias scores.

Despite the magnitude of their obtained effects, Wells and Beevers’ (2010) study had a shortcoming that could have potentially undermined the theoretical impact of their results. Specifically, they had a rather large attrition rate, as only 53% of participants completed the follow-up assessment, which was scheduled 4 weeks after baseline assessment of symptoms.
This attrition rate necessitated the use of data estimation procedures, which the authors reported resulted in findings that were similar to the ones obtained prior to the data estimation. However, because the groups were small to begin with (i.e., around 10 people in the training and control conditions at the follow-up assessment), it is difficult to confidently draw conclusions from the decrease in participants’ depressive symptoms at follow-up. Thus, replication of these findings was deemed to be necessary, to ascertain that the beneficial effects of attention bias retraining in dysphoric individuals could be replicated in a larger sample, and without the potential problems associated with a high attrition rate.

Replication findings are considered to be a gold standard in psychology; however, replication is rare (Bonett, 2012). The obvious advantage of replication is to confirm that previous results were not due to a failure to reject a true null hypothesis, which should happen 5% of the time given the conventional criteria (Francis, 2012). Of course, replication studies are also subject to the same Type I error, and failure to replicate should occur in 5% of the cases. Unfortunately, replication studies will null findings may not be likely to get published, because the results may not be deemed as interesting. One way to circumvent that problem is replication-extension studies. Replication-extension studies serve a multitude of purposes, in that they increase the generalizability of the findings and provide important information regarding the confidence interval of the true effect size (Bonett, 2012). Thus, replication-extension studies can play a pivotal role in theoretical advances of the research area.

1.2 The Present Study

In light of the above, the current study replicated and extended Wells and Beevers’ (2010) findings on re-training the negative attentional bias in dysphoric individuals. As mentioned above, this replication was considered to be crucial, to determine both the immediate and longer
term effects of attention training on depressive symptoms. However, in light of the retention difficulties in the Wells and Beevers (2010) study, enhanced efforts were made to improve on the retention of participants. The extension part of the current research used non-dysphoric individuals, and employed attentional training to acquire a negative attentional bias, and then examine the effects on mood. Thus, there were two aspects to the study. In one part, dysphoric participants were randomly assigned to either a no-training (NT) control condition or an attentional training (AT) toward neutral stimuli condition. This part of the study was essentially a direct replication of the work of Wells and Beevers (2010), with some methodological improvements. In the extension part of the study, non-dysphoric participants were randomly assigned to either a NT control or an AT toward negative stimuli condition.

The extension that was employed in the current study related to the fact that although it appears possible to retrain the negative attentional bias seen in dysphoric individuals towards a more neutral or positive one, and subsequently improve one’s mood (Wells & Beevers, 2010), no one had previously examined if the opposite is also valid, and whether training a negative attentional bias in normal individuals might contribute to depressed mood. Results suggest that non-dysphoric individuals tend to be either positively biased (Leyman et al., 2010) or significantly less negatively biased than their dysphoric/depressed counterparts (Peckham et al., 2010), and that they have an easier time to disengage their attention from negative stimuli (Joormann & Quinn, 2014). MacLeod and colleagues (2002) also provided preliminary evidence that attentional training can play a mediational role in emotional vulnerability in a non-clinical population; however, it remains unclear how that effect manifests itself in a non-dysphoric population, and over the long-term.
In line with Wells and Beevers (2010) findings, it was hypothesized that, for the dysphoric group, the attentional bias for sad images would significantly decrease in the AT condition, and that participants assigned to that training condition would also experience a decrease in depressive symptoms. It was also expected that the association between attention training and reductions in depressive symptoms would be mediated by change in attentional bias. For the non-dysphoric group, it was hypothesized that attentional bias for sad images would significantly increase in the AT condition and that participants assigned to that training condition would experience an increase in depressive symptoms. It was also expected that association between attention training and increases in depressive symptoms would be mediated by changes in attentional bias. Finally, given MacLeod and colleagues’ (2002) findings that impact of attentional training toward negative information was similar in terms of anxiety and depressive symptoms, it was expected that the AT group should experience a significant increase in anxiety symptoms as a result of the training.

Chapter 2: Method

2.1 Participants

Participants were undergraduate psychology students at the University of Calgary who were recruited through the Research Participation System in the Department of Psychology, and who received course credit as compensation for their participation. A total of 265 participants participated in the screening part of the study (Part 1), which required them to fill out an online survey. Participants who met criteria for Part 2 of the study were offered further participation in the study. A total of 104 participants met these requirements and consented to participate in Part 2 of the study. Of those participants, 87 participants completed the attentional training part of the study, and 79 participants took part in the study to its completion. The data for the 8 participants
who completed the attentional training but did not complete the follow-up session were estimated.

Part 2 of the study took place in the Depression Research Laboratory at the University of Calgary. Participants completed each session individually with an experimenter present in the room. Participants who scored between 0 and 8 on the BDI during the screening portion of the study were randomly assigned to either the dysphoric training or no-training condition. Those who scored between 9 and 25 on the BDI were randomly assigned to either the neutral training or no-training condition. There were 42 participants in the non-dysphoric group (19 = dysphoric training and 23 = no training) and 45 participants in the dysphoric group (24 = neutral training and 21 = no training).

2.2 Measures

Beck Depression Inventory (BDI II; Beck et al., 1996): The BDI II is a 21-item self-report inventory that assesses the severity of symptoms of depression. The items are rated from 0 to 3, based on the severity of the symptoms. Total scores can range from 0 to 63 and can be grouped into four levels of severity: minimal depression (total score of 0-13), mild depression (total score of 14-19), moderate depression (total score of 20-28), and severe depression (total score of ≥ 29). The BDI has well-established psychometric properties (Beck, Steer, & Garbin, 1988), and is commonly used measure of depressive symptoms in university population research.

Beck Anxiety Inventory (BAI; Beck & Steer, 1993): The BAI is a 21-item self-report scale that assesses symptoms of anxiety experienced over the past week. The items are rated on a 4-point rating scale ranging from “not at all” to “severely” depending on the severity of the symptoms. Total scores can range from 0 to 63. The BAI has well-established psychometric properties (e.g., Hewitt & Norton, 1993; Osman, Kopper, Barrios, Osman, & Wade, 1997). The
BAI also has an internal reliability of 0.90 for the total scores, as well as convergent validity with other self-report anxiety measures, such as the Brief Symptom Inventory – anxiety subscales (Derogatis, 1992) (r = .69) (Osman et al., 1997).

### 2.3 Dot-Probe Task

The dot-probe task was replicated as closely as possible based on the Wells and Beevers (2010) paper and through e-mail communication with Tony Wells. Stimuli were presented in pairs and were followed by a probe that required a response from the participant after each trial. Pictorial stimuli were used instead of word stimuli because of recent research that suggests that pictures are better at showcasing negative attention bias, and to replicate the methodology of Wells and Beevers (2010).

**Stimuli.** The exact same set of stimuli as in Wells and Beevers’ (2010) study was used. A set of 12 pairs of faces, of different individuals (6 males and 6 females), each expressing either sad or neutral emotion, were taken from the Pictures of Facial Affect (POFA; Ekman & Friesen, 1976) set. As well, 20 images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2005) were used, based on a previous study’s success in using similar images to assess selective attention towards sad stimuli in a depressed population (c.f., Eizenman et al., 2003). Ten images of a neutral scene and 10 of a sad scene were selected. The stimuli were presented on a 20-inch LCD PC monitor.

**Design.** The set of 22 image pairs (12 POFA face pairs and 10 IAPS pairs) were presented in 9 blocks in each session for a total of 196 trials per session. Each POFA face pair was made up of one sad and one neutral face of the same actor. Each IAPS pair consisted of one sad and one neutral image. IAPS pairings were mixed during each new block so as to randomly
choose a sad and a neutral picture. On average, each training session took 25 minutes to complete.

POFA and IAPS images were presented for 3000 ms and 4500 ms respectively. Wells and Beevers (2010) suggested that a longer presentation time is needed to allow for greater activation of relevant schema which should result from a fuller processing of the content of the images (Mogg & Bradley, 2005). Each type of stimulus (emotional and probe) was equally likely to appear on each side of the screen. After each picture pair was shown, the probe (i.e., either a single or double white asterisk) appeared at the location of one of the images and remained there until the participant pressed a button corresponding to how many asterisks they saw. The latency and accuracy of each response was recorded by the computer.

Participants were told that they needed to indicate whether they saw one or two asterisks on the screen “as quickly and accurately as possible”. They used their index finger to press a keyboard key labeled * upon seeing one asterisk and their middle finger to press a keyboard key labeled ** upon seeing two asterisks. Prior to starting the training trial, all participants completed a practice trial consisting of 11 neutral-neutral pairs (5 IAPS and 6 POFA). The practice trials used an equal probability distribution for the probe for all participants. Participants did not move on to the training trial until they accurately responded to a minimum of 9 of the 11 practice trials. This procedure was taken directly from the Wells and Beevers (2010) study.

As stated above, participants were randomly assigned to attention training (AT) or no training (NT) conditions. The only difference between the two conditions was the probe location following the neutral-sad stimulus pair. However, the probe location for the AT and NT conditions differed between the dysphoric and non-dysphoric group. The probe appeared in the location of the neutral stimulus as often (50%) as in the location of the sad stimulus in the NT
condition, for both groups. In the AT condition for dysphoric group, however, the probe appeared in the location of the neutral stimulus 85% of the time. In contrast, the probe appeared in the location of the sad stimulus 85% of the time in the AT condition for the non-dysphoric group. Wells and Beevers (2010) suggested using the 85/15 ratio, in order to keep the intent of the study from being transparent, while still being able to assess the attentional bias of the participants. Attention bias in both AT and NT conditions was calculated in the first and fourth training sessions by presenting 60 standard dot-probe trials, in which the probe appeared 50% of the time in the location for each stimulus.

2.4 Procedure

**Part 1.** Participants were recruited using the Department of Psychology Research Participation System. They were invited to attend a screening session at a computer lab and were informed that they would have an opportunity to participate in a series of other sessions, provided that they met certain criteria. This type of screening served as quality control for the participants’ responses. Informed consent for the screening was obtained at the outset of session. Participants were screened in groups of five or fewer, using a computerized version of the BDI-II and the BAI. The participants who met the criteria for the dysphoric group (BDI-II score between 9 and 25) or the non-dysphoric group (BDI-II score between 0 and 8) were invited to come in for five more sessions. They had the opportunity to sign up at the end of the screening session and had the opportunity to sign the consent form that explained the remaining purpose of the study. Participants were told that the purpose of the study was to “investigate the relationship between mood and attention”. As a rationale for having to return to the lab several times, and because this rationale was successfully used in the Wells and Beevers (2010) study, participants were told that they were helping to validate an attention task. Details about the full purpose of
the study, and that it had to do with attention training and mood improvement, were given to the participants at the debriefing at the end of the experiment. However, participants were told at the beginning that their “mood may or may not change throughout the study” and that “if it did and it became distressing to them, they need to let the experimenter know about it”. This information was provided to fulfill the request of the research ethics board, and because of its concern regarding the dysphoric training condition.

Part 2. Upon being randomly assigned into either the training or non-training condition, participants took part in four training sessions over a two week period. After they completed these training sessions, they returned for a follow-up session two weeks later where they filled out more mood measures and were debriefed about the purpose of the study. Participants were also asked to write down what they thought was the true purpose of the study. None of the participants guessed this purpose correctly. To assess their depression and anxiety symptoms throughout the duration of the study, participants completed the BDI-II and the BAI several times: at baseline, at the end of the last training session, and at the follow-up session.

Wells and Beevers (2010) reported a high attrition rate, as only 53% of the participants completed the follow-up session four weeks post baseline. As such, one of the researchers’ main tasks in the current study was to ensure that as many as possible participants remained in the study. Participants were contacted the day before, as well as the day of, their scheduled appointments. If they missed a session, participants were contacted via e-mail to determine whether they were interested to reschedule the session and continue to participate in the study.
Chapter 3: Results

3.1 Demographics

All a priori analyses were conducted with a nominal Type I error rate of .05. To limit the risk of Type I error, follow-up analyses were subjected to a Bonferroni correction at the level of each group of comparisons. Data were analyzed using SPSS. Preliminary analyses consisted of descriptive statistics, and correlations were performed to examine any potential trends in the data and to establish homogeneity of variance.

Demographic characteristics of the dysphoric and non-dysphoric participants can be found in Table 1. There were no significant differences between training and no-training conditions in both the dysphoric and non-dysphoric groups in proportion of women, number of dropouts at the follow-up session, or age. Participants were predominantly female, Caucasian, and single.

3.2 Missing data

Prior to data analyses, the data were examined for missing information. After making the decision to include only participants who completed the attention task, it was determined that a limited amount of the BDI and BAI data at the follow-up session were missing. Specifically, 9.2% of BDI scores and 9.2% of BAI scores were missing at the follow-up session, which consisted of 2 participants’ data missing per group. Little’s MCAR test was not significant, $\chi^2 (4) = 3.32$, ns, which suggested that data was missing at random. Thus, it was deemed appropriate to use multiple imputation to estimate the missing data. Using multiple imputation, five new data sets were generated and the average of the five newly created data points for each participant was computed to create a new BDI and BAI value for him/her. Although Wells and Beevers (2010) used Full Information Maximum Likelihood (FIML) estimation, this option is no longer
available in SPSS; therefore, as multiple imputation is the new default option in SPSS, it was deemed an appropriate substitute for FIML.

3.3 Data cleaning

Only correct responses were used in the data analyses; therefore, 2.9% of data was eliminated. The number of incorrect responses eliminated did not differ between groups, $F(3, 86) = .093, \text{ns}$. Response latencies that were three standard deviations above or below the mean for each participant were also eliminated, which resulted in 1.9% of data loss and did not differ between conditions, $F(3, 86) = 1.016, \text{ns}$.

Additionally, as per guidelines suggested by Gotlib et al., (2004) response latencies that were smaller than 100ms and larger than 1000ms were removed, as responses outside these cut-offs would have been likely due to anticipatory or erroneous responding, respectively (Oehlberg et al., 2012). This procedure resulted in 1.30% loss of data, which did not differ between groups, $F(3, 86) = 1.355, \text{ns}$.

3.4 Attentional bias score

As per guidelines suggested by Gotlib et al., (2004) and also in line with Wells and Beevers (2010), the following formula was used to calculate the attentional bias scores at pre and post training, based on the participants’ responses on 60 standard dot-probe trials:

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

where:

- $R$ refers to the right positioning on the screen,
- $L$ refers to the left positioning on the screen,
- $p$ refers to the probe (i.e., one or two asterisks) and
- $e$ refers to the emotional (i.e., dysphoric) stimulus (i.e., picture).
Table 1

*Demographic characteristics of participants.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Dysphoric Group (n = 45)</th>
<th>Non-dysphoric Group (n = 42)</th>
<th>Total Sample (N = 87)</th>
<th>Chi-Square significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, $M (SD)$</td>
<td>20 (2.07)</td>
<td>20.79 (4.22)</td>
<td>20.38 (3.29)</td>
<td>.64</td>
</tr>
<tr>
<td>Gender, % female</td>
<td>86.7%</td>
<td>71.4%</td>
<td>79.3 %</td>
<td>.21</td>
</tr>
<tr>
<td>Marital Status, %</td>
<td>93.3%</td>
<td>90.5%</td>
<td>92%</td>
<td>.73</td>
</tr>
<tr>
<td>Ethnicity, %</td>
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<td></td>
<td></td>
<td>.72</td>
</tr>
<tr>
<td>Caucasian</td>
<td>46.7%</td>
<td>54.8%</td>
<td>50.6%</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>40%</td>
<td>33.3%</td>
<td>36.8%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>13.3%</td>
<td>11.9%</td>
<td>12.6%</td>
<td></td>
</tr>
</tbody>
</table>
Thus, RpLe refers to the probe appearing on the right side of the screen following appearance of the stimulus on the left side, and so on. Positive attentional bias scores indicate bias towards the emotional stimulus, whereas negative attentional bias scores indicate bias towards the non-emotional (i.e., neutral) stimulus (Gotlib et al., 2004).

3.5. Replication analyses

3.5.1. Effect of attentional retraining on bias score

A 2 (Time: training session 1, 4) x 2 (Training condition: AT, NT) repeated measures ANOVA for the attentional bias score revealed a non-significant main effect of time, $F(1, 43) = .003$, ns, training condition, $F(1, 43) = .58$, ns, and the time by training condition interaction was also non-significant, $F(1, 43) = 1.75$, ns. Finally, training conditions did not significantly differ in their attentional bias score at session 4, $F(1, 43) = 1.72$. Thus, the training task did not have the intended manipulation effect because it did not significantly increase attention for neutral stimuli and reduce attention for negative stimuli in the AT condition, but not in the NT condition. However, it should be noted that there was large variability in the attentional bias scores, even after the data cleaning procedures instated above. The means and standard deviations for attentional bias scores can be found in Table 2. Additionally, post-hoc analyses comparing the dysphoric and non-dysphoric groups did not reveal significant differences in initial attentional bias, $F(3, 83) = .49$, ns, suggesting that the groups did not differ in how quickly they responded toward either sad or neutral stimuli.

3.5.2. Effect of attentional retraining on symptoms of depression.

A 3 (Time: baseline, post-training, follow-up) x 2 (Training condition, AT, NT) repeated-measures ANOVA revealed a significant main effect of time, $F(2, 73.55) = 21.88$, $p<.001$. However, the assumption of sphericity was violated, $\chi^2(2) = 11.34$, $p = .003$; therefore the
Huynh-Feldt correction was used. The main effect of group was not significant, $F(1, 43) = 1.15, ns$, nor was the time by group interaction, $F(2, 73.55) = .175, ns$. The AT group showed a significant decrease in symptoms of depression compared to baseline at post-training $t(23) = 2.61, p<.05$, and at follow-up, $t(23) = 4.71, p<.001$. The NT group also showed a significant decrease in symptoms of depression compared to baseline at post-training, $t(20) = 2.95, p<.01$, and at follow-up, $t(20) = 3.45, p<.01$. Additionally, AT and NT groups did not differ in depressive symptoms at post-training, $t(43) = 1.07, ns$, or at follow-up, $t(43) = .62, ns$. The BDI scores at follow-up, post-training, and follow-up for both the AT and NT groups can be found in Table 3.

As per Wells and Beevers’ (2010) reported results, these analyses were also carried out without estimation of any missing data, and with the last observation carried forward method. Without data estimation, the 3 (Time: baseline, post-training, follow-up) x 2 (Training, AT, NT) repeated-measures ANOVA did not yield a significant time by group interaction, $F(2, 68.29) = .19, ns$ (the Huynh-Feldt correction was used because the assumption of sphericity was violated, $\chi^2(2) = 9.27, p = .01$). Similarly, using the last observation carried forward technique, the 3 (Time: baseline, post-training, follow-up) x 2 (Training, AT, NT) repeated-measures ANOVA did not reveal a significant time by group interaction, $F(2, 73.68) = .15, ns$ (the Huynh-Feldt correction was used because the assumption of sphericity was violated, $\chi^2(2) = 11.22, p = .004$).

3.5.3. Mediation analyses.

As part of the replication, mediational analyses were planned, in order to examine whether attention mediates the relationship between attention training condition (AT or NT) and depressive symptoms. Unfortunately, because the relationship between training condition and attentional bias at follow-up was not significant, it was deemed inappropriate to perform
Table 2

*Attentional bias scores pre- and post-training in the dysphoric group.*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Attentional bias score Before training, $M \ (SD)$</th>
<th>Attentional bias score After training, $M \ (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attentional training</td>
<td>2.23 (21.05)</td>
<td>-4.63 (23.94)</td>
</tr>
<tr>
<td>No-training</td>
<td>-.26 (21.87)</td>
<td>6.03 (30.51)</td>
</tr>
</tbody>
</table>

Table 3

*Depressive symptoms pre-and post-training and at follow-up in the dysphoric group.*

<table>
<thead>
<tr>
<th>Group</th>
<th>BDI Scores, $M \ (SD)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>Attentional training</td>
<td>15.46 (5.00)</td>
</tr>
<tr>
<td>No-training</td>
<td>14.00 (3.85)</td>
</tr>
</tbody>
</table>
mediational analyses. That is due to the fact that an analysis of mediation necessitates that there exists a significant relationship between the causal variable and the mediating variable (Jose, 2013, p. 47). Unlike Wells and Beevers’ (2010) findings, that was not found to be the case in the present study.

3.6 Extension analyses

3.6.1. Effect of attentional retraining on bias score

The means and standard deviations for attentional bias scores can be found in Table 4. A 2 (Time: training session 1, 4) x 2 (Training condition: AT, NT) repeated measures ANOVA did not reveal a significant main effect of time on attentional bias score, $F(1, 40) = .75$, ns. Additionally, there was no significant main effect of group on the bias score, $F(1, 40) = .07$, ns. The time by group interaction was also non-significant, $F(1, 40) = 1.44$, ns. Finally, the groups did not significantly differ in their attentional bias score at session 4, $F(1, 40) = .44$. Thus, the training task did not have the intended manipulation effect because it did not significantly increase attention for negative stimuli and reduce attention for neutral stimuli in the AT condition. However, it should be noted that there was again large variability in the attentional bias scores, even after the data cleaning procedures instated above.

3.6.2. Effect of attentional retraining on symptoms of depression.

The BDI scores at follow-up, post-training, and follow-up for both the AT and NT groups can be found in Table 5. A 3 (Time: baseline, post-training, follow-up) x 2 (Training, AT, NT) repeated-measures ANOVA did not reveal a significant main effect of time, $F(2, 80) = .06$, ns. The main effect of group was not significant, $F(1, 40) = .14$, ns, nor was the time by group interaction, $F(2, 80) = .03$, ns. The AT group did not show a significant increase in symptoms of
depression compared to baseline at post-training $t(18) = -0.18, ns$, and at follow-up, $t(18) = 0.27, ns$. The NT also did not show a significant increase in symptoms of depression compared to baseline at post-training, $t(22) = 0.07, ns$, and at follow-up, $t(22) = 0.10, ns$. Additionally, AT and NT groups did not differ in depressive symptoms at post-training, $t(40) = -0.20, ns$, or at follow-up, $t(40) = -0.35, ns$.

The above analyses were also carried out without estimation of any missing data, and with the last observation carried forward method. Without data estimation, the 3 (Time: baseline, post-training, follow-up) x 2 (Training, AT, NT) repeated-measures ANOVA did not yield a significant time by group interaction, $F(2, 66.31) = 0.01, ns$ (the Huynh-Feldt correction was used because the assumption of sphericity was violated, $\chi^2(2) = 6.37, p = .04$). Similarly, using the last observation carried forward technique, the 3 (Time: baseline, post-training, follow-up) x 2 (Training, AT, NT) repeated-measures ANOVA did not reveal a significant time by group interaction, $F(2, 73.13) = 0.01, ns$ (the Huynh-Feldt correction was used because the assumption of sphericity was violated, $\chi^2(2) = 7.12, p = .03$).

3.6.3. Effect of attentional retraining on symptoms of anxiety.

The BAI scores at baseline, post-training, and follow-up for both the AT and NT groups can be found in Table 6. A 3 (Time: baseline, post-training, follow-up) x 2 (Training, AT, NT) repeated-measures ANOVA revealed a significant main effect of time, $F(2, 80) = 12.38, p<.001$. The main effect of group was not significant, $F(1, 40) = .39, ns$, nor was the time by group interaction, $F(2, 80)=1.02, ns$. The AT group showed a significant decrease in symptoms of anxiety compared to baseline at post-training $t(18) = 3.14, p<.01$, but not at follow-up, $t(18) = 1.29, ns$, because the symptoms of anxiety increased again after training was over. The NT also showed a significant decrease in symptoms of anxiety compared to baseline at post-training,
Table 4

*Attentional bias scores pre- and post-training in the non-dysphoric group.*

<table>
<thead>
<tr>
<th>Condition</th>
<th>Attentional bias score</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before training, $M$ (SD)</td>
<td>After training, $M$ (SD)</td>
<td></td>
</tr>
<tr>
<td>Attentional training</td>
<td>-5.05 (17.71)</td>
<td>3.73 (20.68)</td>
<td></td>
</tr>
<tr>
<td>No-training</td>
<td>1.33 (22.09)</td>
<td>-0.24 (18.30)</td>
<td></td>
</tr>
</tbody>
</table>

Table 5

*Depressive symptoms pre-and post-training and at follow-up in the non-dysphoric group.*

<table>
<thead>
<tr>
<th>Group</th>
<th>BDI Scores, $M$ (SD)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Post-training</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Attentional training</td>
<td>4.21 (2.39)</td>
<td>4.32 (3.38)</td>
<td>4.05 (3.46)</td>
</tr>
<tr>
<td>No-training</td>
<td>4.57 (2.68)</td>
<td>4.52 (3.41)</td>
<td>4.48 (4.33)</td>
</tr>
</tbody>
</table>

Table 6

*Anxiety symptoms pre-and post-training and at follow-up in the non-dysphoric group.*

<table>
<thead>
<tr>
<th>Group</th>
<th>BAI Scores, $M$ (SD)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>Post-training</td>
<td>Follow-up</td>
</tr>
<tr>
<td>Attentional training</td>
<td>25.79 (4.10)</td>
<td>23.58 (2.78)</td>
<td>24.68 (4.24)</td>
</tr>
<tr>
<td>No-training</td>
<td>26.13 (3.38)</td>
<td>22.48 (5.36)</td>
<td>23.52 (3.45)</td>
</tr>
</tbody>
</table>
\[ t(22) = 3.34, p<.05, \text{ and at follow-up, } t(22) = 4.87, p<.001. \] Additionally, AT and NT groups did not differ in anxiety symptoms at post-training, \( t(40) = .81, \text{ ns,} \) or at follow-up, \( t(40) = -.98, \text{ ns.} \)

### 3.6.4. Mediations analyses.

Mediations analyses were planned, to examine whether attention mediates the relationship between training condition (AT or NT) and symptoms of depression. Unfortunately, the relationship between training condition and attentional bias at follow-up was not significant and it was deemed inappropriate to perform mediations analyses (c.f., Jose, 2013. p. 47).

### 3.7 Ancillary analyses

In an effort to clarify the lack of significant group differences in the decrease in depressive symptoms in the replication component of the study and the lack of significant increase in depressive symptoms, as well as group differences in the extension component of the study, post-hoc analyses were conducted to examine temporary changes in mood. Throughout the duration of the study, participants were asked to fill out a mood visual analog scale (VAS) before and after they did the attention task in each session. The mood VAS consisted of a 10cm line that had -5 (“most sad ever”) at one end of the horizontal line and +5 (“not sad at all”) at the other end. Participants were asked to place a vertical mark on the line to indicate how sad they were feeling at that moment. Change scores in sadness ratings were calculated for each session by subtracting the score on the mood VAS administered before the attention task from the score on the mood VAS administered after the attention task. A negative change score indicated that participants became sadder by the end of the session, whereas a positive change score indicated that participants became less sad by the end of the session.
3.7.1 Temporary mood changes in dysphoric participants

A 4 (Time: session 1, session 2, session 3, session 4) x 2 (Training, AT, NT) repeated-measures ANOVA revealed a significant main effect of time, $F(2.42, 99.36) = 5.30, p<.05$ (the Huynh-Feldt correction was used because the assumption of sphericity was violated, $\chi^2(5) = 29.74, p <.001$). The main effect of group was not significant, $F(1, 41) = .63, ns$, nor was the time by group interaction, $F(2.24, 99.36)=.61, ns$. These results suggest that both the AT and NT groups became progressively less sad during the training sessions throughout the two week period. In other words, while at first the training sessions appeared to induce sadness in both groups, that was not the case by the last training session. The mood VAS change scores at each session for both the AT and NT groups can be found in Table 7.

3.7.2 Temporary mood changes in non-dysphoric participants

A 4 (Time: session 1, session 2, session 3, session 4) x 2 (Training, AT, NT) repeated-measures ANOVA did not reveal a significant main effect of time, $F(2.05, 82.13) = .24, ns$ (the Huynh-Feldt correction was used because the assumption of sphericity was violated, $\chi^2(5) = 34.76, p <.001$). The main effect of group was not significant, $F(1, 40) = .70, ns$, nor was the time by group interaction, $F(2.05, 82.13) = .51, ns$. These results suggest that both the AT and NT groups remained equally sad during the training sessions throughout the two week period. The mood VAS change scores at each session for both the AT and NT groups can be found in Table 8.
Table 7

*VAS change scores across sessions in dysphoric participants*

<table>
<thead>
<tr>
<th>Group</th>
<th>Attentional training</th>
<th>No-training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training session <em>M (SD):</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 1</td>
<td>-4.54 (16.68)</td>
<td>-8.26 (9.96)</td>
</tr>
<tr>
<td>Session 2</td>
<td>-1.88 (14.32)</td>
<td>-1.21 (10.18)</td>
</tr>
<tr>
<td>Session 3</td>
<td>-.88 (8.43)</td>
<td>-1.58 (8.82)</td>
</tr>
<tr>
<td>Session 4</td>
<td>3.33 (8.27)</td>
<td>-.42 (7.27)</td>
</tr>
</tbody>
</table>

Table 8

*VAS change scores across sessions in non-dysphoric participants*

<table>
<thead>
<tr>
<th>Group</th>
<th>Attentional training</th>
<th>No-training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training session <em>M (SD):</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 1</td>
<td>.11 (7.25)</td>
<td>-2.83 (9.19)</td>
</tr>
<tr>
<td>Session 2</td>
<td>-.53 (6.87)</td>
<td>-2.83 (7.17)</td>
</tr>
<tr>
<td>Session 3</td>
<td>-2.21 (3.84)</td>
<td>-2.83 (10.02)</td>
</tr>
<tr>
<td>Session 4</td>
<td>-2.47 (5.56)</td>
<td>-2.04 (10.42)</td>
</tr>
</tbody>
</table>
Chapter 4: Discussion

The aims of the present study were to replicate the Wells and Beevers’ (2010) study, and to extend it so as to determine whether there is a bidirectional effect of attention on mood. Part 1 of the study screened participants, and recruited those who met the criteria for Part 2 of the study. Part 2 of the study investigated the effects of attentional retraining towards neutral stimuli in a dysphoric sample (replication component), as well as effects of attentional retraining towards negative stimuli in a non-dysphoric sample (extension component). The results for the replication component are discussed first below, followed by the extension component.

The expected change in attentional bias following AT was not observed in the replication component of the study. This finding was surprising, given the robust effect of AT on attentional bias reported by Wells and Beevers (2010). Specifically, they found that attentional bias toward sad images in dysphoric participants decreased in the AT condition toward neutral stimuli, but no changes occurred in the no-training group. A later study by Tsumura and colleagues (2012) showed that one session of attentional retraining using depression-related and neutral stimuli also served to reduce bias toward negative stimuli in dysphoric participants in the training group, but not in the no-training group. However, the lack of change in attentional bias in the current study was consistent with a similar study of participants who had to undergo attentional retraining towards positive stimuli using a spatial cuing task at home over a period of 10 sessions (Baert et al., 2010). It was also in line with findings of a recent study by Kruijt and colleagues (2013) who did not find a change in attentional bias to sad facial expressions after one session of attentional retraining with dysphoric participants.

There are several possible reasons as to why the Wells and Beevers (2010) results did not replicate in the current research. It is possible that no change in attentional bias was observed in
the present study because of the variability in attentional bias scores that was observed before training. Specifically, roughly half of the participants did not exhibit negatively biased attention. This result was somewhat surprising, as dysphoric participants typically exhibit an attentional bias toward negative information more so than non-dysphoric participants (Leyman et al., 2011; Peckham et al., 2010). However, one recent study also did not find a bias toward sad stimuli in a depressed sample of participants when assessed by an exogenous cuing task (Clasen et al., 2013).

It may be that the use of neutral and sad image pairs to assess attentional bias in a dysphoric sample made it difficult to obtain a clear picture of the baseline bias. Leyman and colleagues (2011) found that dysphoric participants showed not only a bias toward sad images, but also toward neutral images, when they presented them with trials that included four faces that depicted sad, happy, angry, and neutral expressions. They suggested that when neutral facial expressions are presented alongside faces depicting emotion, the neutral faces may be interpreted as containing emotional information (Leyman et al., 2011). Because the stimuli were presented in pairs (one sad and one neutral) in the present study, it may be that participants interpreted the neutral images as dysphoric, and so the neutral stimuli competed for their attention. Anecdotal evidence during participant debriefing suggests this possibility, as several participants stated that they thought the neutral faces “looked sad”. The rationale behind the use of neutral and sad picture pairs (instead of sad and happy) that was provided by Wells and Beevers (2010) was that training effects may be more likely to generalize outside the laboratory because there are more neutral than happy stimuli in the environment. In the future, it would be helpful to investigate whether using happy and sad picture pairs produces a “cleaner” assessment of the participants’ baseline attention.
The hypothesized change in depressive symptoms was observed, but both the training and no-training groups experienced a significant reduction in depressive symptoms. This finding differed from that of Wells and Beevers (2010) who found that the training and no-training conditions differed in symptoms of depression at the follow-up session. Given the lack of significant change in attentional bias in the present study, the absence of a group effect when it comes to depressive symptoms was to be expected. Specifically, Wells and Beevers’ (2010) mediational analyses revealed that attentional bias mediated the change in mood, which was not the case in the present study. The lack of group differences in the present study was also not in line with the meta-analytical finding of the presence of medium-sized effect for the relationship between attentional bias and depression in dysphoric/depressed participants, when assessing it using a dot-probe task (Peckham et al., 2010).

Consequently, the decrease in depression scores that was observed in the current study might be best explained by regression to the mean. Regression to the mean is an artifact that often occurs in psychological research and has been observed in the context of depressive symptom scores in undergraduate student samples (Flett et al., 1995). Past research noted a regression to the mean at a two-week follow-up after the initial screening in a depressed sample of university students, pointing to instability of depressive symptoms in this sample (Hammen, 1980). A similar study found a decrease in depressive scores in a depressed student sample 3 months after a baseline assessment (Flett et al., 1995). It should also be noted that many events can happen during a one-month period in a university student’s life (e.g., exams, new relationships); therefore, the transient nature of the self-reported distress (Coyne, 1994) can make the repeated measurement of depressive symptoms potentially problematic.
The attentional training task used in the current research was replicated as closely as possible through the information provided in their article, as well as through personal e-mail communication with Dr. Tony Wells. The data cleaning procedures and analyses were also followed as closely as possible based on the available information. As previously stated, the failure to replicate could have been due to Type I error; however, given that none of the effects replicated, that seems to be an unlikely explanation. Similarly, the effects in Wells and Beevers’ (2010) study were considered to be moderate to large, which should have increased their replicability. Hence, from a statistical standpoint, it is unclear why the results did not replicate. From an experimental perspective, it is possible that the current participants were somehow qualitatively different from those in the Wells and Beevers’ (2010) study. It may also be that participants differed on variables that were not measured in the present study. Specifically, Wells and Beevers (2010) reported using only the BDI-II as the outcome measure; however, they may have used other assessment measures and chose not to report them. Thus, a different method to assess depressive symptoms may have yielded more diverse results.

The hypothesized change in attentional bias toward sad images following attentional retraining was not observed in the extension component of the study. This finding was inconsistent with that of MacLeod and colleagues (2002) who found that one session of attentional retraining toward negative stimuli caused quicker responding toward probes that appeared at the location of negative stimuli. One explanation is that employment of a more condensed training paradigm (i.e., 576 trials in one session in MacLeod et al. (2002), compared to 196 trials twice a week over two weeks in the current study) may be a more successful method of retraining attention. However, the MacLeod et al., (2002) study had a non-clinical anxious
sample, which makes it difficult to compare their study to the present one. Future research could study the effects of these differences directly.

Additionally, it was found that about half of the participants in the non-dysphoric group in the present study did not exhibit a bias toward neutral stimuli at baseline, but instead were biased towards negative stimuli. One explanation for a lack of a consistent bias toward either stimuli can potentially be due to a recent finding that non-dysphoric individuals have a bias toward happy stimuli when presented with four faces depicting a sad, happy, angry, and neutral facial expression, with no difference in fixation times between neutral and sad faces (Leyman et al., 2011). Because the stimuli in the present study consisted solely of sad and neutral pictures, it is possible that both the neutral and sad pictures competed for the non-dysphoric participants’ attention. Thus, future research might use sad and happy picture pairs to assess the initial attentional bias in a non-dysphoric sample.

Another plausible explanation for the lack of change in attentional bias could relate to limitations of the dot-probe task as an attentional retraining tool. In particular, fatigue and disinterest may have contributed to participants’ responses to the task (Kruijt et al., 2013). Unless an eye-tracking device is used, it is difficult to tell whether participants attend to the stimuli as instructed (Yiend, 2010). Further, given a moderately long presentation time (3000-4500 ms), participants’ attention may have wavered. Thus, although participants were instructed at each training session to respond to each trial “as quickly and as accurately as possible”, anecdotal evidence suggests that participants did not pay full attention. During debriefing, several participants stated that they spent part of their time gazing at the center of the screen where the fixation cross appeared at the start of each trial, rather than to the image pairs. Future researchers should consider attentional tasks that engage participants and limit distractibility.
Unlike the dysphoric individuals, whose attention is posited to be difficult to disengage from negative stimuli, non-dysphoric individuals have not been found to have difficulty with disengagement (see Joorman & Quinn, 2014 for a review). Consequently, even if non-dysphoric participants attended more to the sad images than the neutral ones, as was hypothesized in the AT condition, they would not have had the same negative schemas activated, as would the dysphoric participants (Beck, 1976).

Contrary to the hypothesis, there was no significant increase in depressive symptoms post-training in the negative attention training condition. This result was not expected, as previous research has found that a single session of attentional retraining toward negative information caused an increase in negative mood after having to perform a stressful task post-training (MacLeod et al., 2002). The differences in results may be due to the fact that the participants in the MacLeod et al., (2002) study had anxious traits and were not necessarily dysphoric. Another explanation is that individuals who are non-dysphoric are resilient against depression because they employ cognitive strategies to prevent them from becoming depressed. For instance, in a naturalistic viewing task, Leyman and colleagues (2010) found that non-dysphoric participants focused more on happy than sad and neutral faces. Such attentional deployment could have served a defense strategy to prevent sadness. Future studies should investigate resiliency factors in the context of attention and depression. In terms of the participants’ anxiety symptoms observed in the present study, the findings were not in line with those of MacLoed et al., (2002). They appear to be an anomalous result and the interpretation of their pattern is unclear (i.e., anxiety decreased in both groups post-training, and increased in the AT group at follow-up). Further research is required to help elucidate the consequential effects of attention retraining in a dysphoric context on anxiety.
Despite the failure to replicate the Wells and Beevers (2010) study, there are several noteworthy theoretical strengths to the present study. First, it was a direct replication of a previous study that had important implications for the field of attentional retraining and necessitated a replication given the high attrition rate. The present study had a 9% attrition rate before the follow-up session, compared to 47% observed by Wells and Beevers (2010). Consequently, the groups in the present study, even prior to the data estimation procedures that were used, were roughly twice the size of the previous study. Although Wells and Beevers (2010) reported similar results regardless of whether they employed data estimation procedures or not, it was considered difficult to draw conclusions from their results based on such small group sizes (roughly n = 10). The fact that the attentional retraining results did not replicate in a larger sample calls into question the validity of the dot-probe as a means of attentional retraining, which is an issue that should be addressed in future research.

Another strength of the study is that it was the first to examine whether there is a bidirectional relationship between attention and mood in a longitudinal context and in a controlled laboratory setting. Although prior research has attempted to address this question through a single attentional retraining session, it did not examine it in the context of dysphoria (MacLeod et al., 2002). As well, previous research did not determine whether attentional training had lasting effects. The present study addressed both those issues and thus attempted to bridge these gaps in the literature.

The present study also had several limitations. It is difficult to understand why attentional effects were not observed in the attentional training conditions. This failure to replicate and extend may have been due to participants not paying full attention to the stimuli, as suggested by anecdotal reports. Alternatively, this result may be because such attentional training does not
cause a decrease in sadness in dysphoric individuals (e.g., Baert et al., 2010), and an increase in sadness in non-dysphoric individuals. An eye-tracking device could have served to clarify this issue by providing information regarding the attentional engagement with the stimuli (e.g., Sanchez et al., 2013).

Another limitation of the study was that non-dysphoric participants’ emotion regulation abilities were not assessed. Some research suggests that emotion regulation affects the relationship between attention and mood (Joormann & Gotlib, 2010). Hence, it would have been interesting to examine whether the AT task failed to affect the non-dysphoric participants because their emotion regulation abilities buffered against sad mood. Finally, as also stated by Wells and Beevers (2010), the present study did not have a control group that did not take part in any attention training task. Given the lack of group effect in the replication component, a control group could have served an important role to determine whether the obtained mood effect was simply a regression to the mean.

The present study replicated and extended the Wells and Beevers’ (2010) study, which found that attentional training reduces symptoms of depression through a change in attentional bias. The replication was not successful and attention was not found to be related to a change in mood. These results have consequences for the cognitive bias modification literature and suggest that more research is needed to find attention retraining paradigms with optimal stimuli and presentation times that consistently lead to a change in mood. Further, the extension did not yield significant changes, in either attention bias or associated mood. This result holds important implications for our understanding of vulnerability to depression. Further research into the topic is imperative to help elucidate the relationship behind attention and negative emotion, the factors that may affect this relationship, and the modifiability of attentional biases.
References

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