THE EFFECT OF ATTENTION TRAINING ON EMOTIONAL VULNERABILITY AND FOOD CONSUMPTION FOLLOWING A STRESSOR

by

TANYA RACHELLE SCHLAM

A Dissertation submitted to the

Graduate School-New Brunswick

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree of

Doctor of Philosophy

Graduate Program in Psychology

written under the direction of

G. Terence Wilson, Ph.D.

and approved by

_____

_____

_____

_____

New Brunswick, New Jersey

January, 2008

ABSTRACT OF THE DISSERTATION

The Effect of Attention Training on Emotional Vulnerability

and Food Consumption Following a Stressor

By TANYA RACHELLE SCHLAM

Dissertation Director:

G. Terence Wilson, Ph.D.

Individuals with anxiety typically display an attentional bias toward threat that may contribute causally to the development and maintenance of anxiety. C. MacLeod, E. Rutherford, L. Campbell, G. Ebsworthy, and L. Holker (2002) showed that manipulating attentional bias toward and away from threat can modify emotional vulnerability. This experiment attempted to replicate and extend this finding to undergraduates ($N = 67$) reporting average anxiety, but above-average emotional overeating tendencies. An objective outcome was added (calories consumed during a "taste test").

Participants were double-blindly assigned to an "attend-neutral" attention training condition of the dot probe task (in which the probes replaced neutral words to train a bias toward neutral words) or an "attend-negative" condition (in which the probes replaced negative words). It was hypothesized that the attend-neutral group would report less negative affect following a stressor and consume fewer calories than the attend-negative group.

Reaction times to each of the two types of trials (where probes replaced neutral or negative words) showed high internal consistency. However, Cronbach's alpha for attentional bias scores (the difference between reaction times to detect probes replacing neutral words and probes replacing negative words) was low pre- and posttraining (.50 and .33).

Perhaps related to the dot probe task's low reliability, the attend-neutral group's bias score did not change. The attend-negative group, however, developed the predicted bias toward negative words. Contrary to predictions, both groups reported equivalent negative affect increases following the stressor and consumed equivalent calories during the "taste test." In exploratory analyses of the top one-third of the sample on trait anxiety, the attend-negative group showed a trend toward the predicted greater increase in negative affect following the stressor compared with the attend-neutral group, $r = .39$ (a medium effect size). The two groups, however, consumed equivalent calories. A clinically or subclinically anxious sample that displays a bias toward threat seems to increase the likelihood of training a bias away from threat. At 1-month follow-up, unexpectedly, the attend-negative group reported decreased general distress compared to the attend-neutral group, who reported an increase, possibly suggesting that training *toward* threat could function as exposure and decrease anxiety.

Dedication

For my father

Carl C. Schlam (1936-1993)

who taught me to think like an academic

Acknowledgements

I am grateful to my advisor Terry Wilson for his encouragement, support, guidance, and wisdom. It has been a privilege to be his student. I would also like to thank my committee members Bob Karlin and Katharine Loeb for their valuable insights and recommendations. I am grateful to my committee member Jan Mohlman for her generosity with her time and expertise, for giving me detailed feedback on the manuscript, and for sharing her lab with me. Thanks also to Janet Latner for sharing her expertise on administering test meals.

I am particularly indebted to Jeffrey Vietri who patiently and tirelessly helped with everything involved in conducting an experiment using E-Prime. Many thanks to my research assistants who showed dedication and attention to detail both while testing participants and while entering data: Amanda Burns, Kimberly Elber, Jennifer Jacobs, and Christina Miller. I am particularly grateful to Kim for her expert help with recruitment. Thanks also to Marisa Skolnick and Mihir Karia for their help with data entry. This research was funded by a grant from the Rutgers Center for Obesity Research and Intervention.

On a more personal note, thanks to my fellow graduate student and friend Kore Nissenson for her help and perspective. Thanks to Susan Ellenberg who, in addition to being my mother-in-law, is a biostatistician; she cheerfully answered my statistical questions day or night. Thanks to my mother, Helena Schlam, my sister, Julia Schlam-Salman, and my grandmother, Bella Frenkil, for their love and support. Thanks to my beloved son Caleb who was born a few months after I finished data collection. Finally, I

am deeply grateful to my husband and best friend Jordan Ellenberg for his love, understanding, and support, and for cheerfully washing many a dish.

Table of Contents

List of Tables

List of Figures

The Effect of Attention Training on Emotional Vulnerability and Food Consumption Following a Stressor

Individuals who struggle with anxiety tend to notice and fixate on potential threats more than others do. Indeed, individuals with anxiety disorders and subclinical anxiety typically display an attentional bias toward threat, meaning that they preferentially allocate attention to threatening, rather than neutral, stimuli. A recent meta-analysis of 172 studies (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & Van IJzendoorn, 2007) concluded that the finding that individuals with clinical or subclinical anxiety display an attentional bias toward threat is robust (as is the finding that individuals who are not anxious do not show a bias), but represents only a small to medium effect size. The meta-analysis found evidence for an attentional bias toward threat across different types of anxiety disorders and from investigations utilizing different cognitive tasks to measure the bias (including the dot probe task and the emotional Stroop task). The meta-analysis also found evidence that individuals with anxiety show an attentional bias for threat both consciously (strategically) and preconsciously (automatically, in response to stimuli presented for short durations and then backwardly masked to preclude awareness).

The Role of Attentional Bias in Emotional Vulnerability

The meta-analysis concluded that there is essentially incontrovertible evidence that individuals with anxiety tend to display an attentional bias for threat (Bar-Haim et al., 2007). Evidence is also accumulating, although it is less incontrovertible, that an attentional bias for threat may contribute causally to the development and maintenance of anxiety. Some of this evidence is only correlational, but it is nevertheless suggestive. For

example, two studies demonstrated a prospective relationship between attentional bias for threat and subsequent emotional vulnerability to a stressor. In the first study (MacLeod & Hagan, 1992), women receiving a cervical exam who showed greater attentional bias toward negative words on a masked emotional Stroop task later reported experiencing greater negative affect in response to a real-world stressor (being diagnosed with cervical pathology requiring laser surgery). In the second study, described by MacLeod (1999), students from Singapore who showed greater attentional bias toward negative words on the emotional Stroop task following a mild stressor reported experiencing greater anxiety when they later immigrated to Australia. A third study (van den Hout, Tenney, Huygens, Merckelbach, & Kindt, 1995) found that attentional bias toward threat words on a masked emotional Stroop task was correlated with concurrently administered questionnaires assessing trait anxiety and emotional vulnerability.

These correlational studies are suggestive, but experimental studies are required to determine whether attentional bias plays a causal role in emotional vulnerability. A seminal investigation by MacLeod and colleagues (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) was the first to attempt to answer this question by experimentally manipulating attentional bias in the laboratory. They used a dot probe task to train the attention of undergraduates ($N = 64$ for both Study 1 and Study 2) with average levels of anxiety toward either negative or neutral words. Word pairs (one negative, one neutral word) appeared on the computer screen; subsequently, one was replaced by either one or two dots. Participants pressed a key to indicate whether they saw one or two dots. Participants were assigned to either the "attend-neutral" condition (in which the dots replaced the neutral words to train a bias toward neutral words) or the

"attend-negative" condition (in which the dots replaced the negative words). In both Study 1 and 2, following a stressor, the attend-neutral group reported less negative affect than the attend-negative group. MacLeod and colleagues concluded that "attentional bias can causally mediate emotional vulnerability" (p. 107).

Attention Training: A New Intervention?

Based on the MacLeod et al. (2002) findings, a novel intervention called *attention training* has been developed that attempts to correct attentional biases toward threat by training individuals with clinical or subclinical levels of anxiety to attend away from threatening stimuli and toward neutral stimuli. Such training generally uses the dot probe task, with threatening and neutral words or photographs as stimuli. Attention training shows promise as a method to decrease anxiety and to help individuals develop more effective affect regulation (for a review see Mohlman, 2004). Indeed, one unpublished treatment trial of attention training for social anxiety disorder (Schmidt, Richey, Buckner, & Cromer, 2007) and one unpublished treatment trial for undergraduates high in worry (in which 41% met criteria for generalized anxiety disorder; Vasey, Hazen, & Schmidt, 2002) reported within-group effect sizes comparable to the typical effect size of cognitive behavior therapy (CBT) for those disorders.

Attention training has additional attractive qualities. The intervention is inexpensive and easy to disseminate (no therapist is needed and attention training can be conducted over the web). Attention training is also a non-threatening and relatively low-effort intervention for the client that merely requires sitting in front of a computer for a few hours. Finally, the treatment is testable in truly double-blind placebo-controlled trials.

Attention training as an intervention also raises certain concerns. If researchers can address these concerns, they will be better equipped to design more effective attention training interventions. One issue is that the reliability of attentional bias as measured by the dot probe task in nonclinical samples is quite low. Schmukle (2005) found in a sample of university students that the dot probe task, whether with words or pictures, showed no internal consistency or 1- week test-retest reliability. He concluded that the task's unreliability accounts for the contradictory and negative findings in studies using the task because, in nonclinical samples, the dot probe task "does not lead to substantial and replicable effects" (p. 602). Although Schmukle explicitly states that his findings are not applicable to studies that manipulate attentional bias such as MacLeod et al. (2002), the unreliability of the dot probe task in nonclinical samples is nevertheless disconcerting and must be born in mind when evaluating results of investigations employing the dot probe task with nonclinical samples.

Another problem the field must address is that, although clinical trials of attention training seem to be obtaining good effects, researchers do not fully understand the mechanism behind the effects. For example, it is unclear whether attention training with the dot probe task affects automatic or strategic processing of threat or both. In addition, there is the theoretical challenge that exposure therapy is an effective treatment for anxiety and involves paying attention to threat in the short term, while attention training involves training attention away from threat. Koster et al. (Koster, Baert, Bockstaele, & De Raedt, 2007) discuss the intriguing idea that MacLeod et al.'s (2002) attend-neutral attention training might not be effective in the long term if it only enhances later-stage disengagement from threat. Koster et al. base this idea on the vigilance-avoidance

hypothesis (Mogg & Bradley, 1998) which is supported by some evidence that individuals high in anxiety initially orient and show vigilance toward threat, but then avoid threat during the later stages of processing (Koster, Verschuere, Crombez, & Van Damme, 2005). Consistent with the hypothesis that avoiding threat in the later stages of processing could maintain anxiety, it is theoretically possible that training attention *toward* threat words might be an effective intervention in its own right if it serves as a form of exposure and decreases unhelpful, later-stage avoidance of threat.

Because attention training is a new intervention, a number of the studies reviewed in this paper are not yet published. These studies are nonetheless cited because they provide important evidence for the theory that attentional biases play a causal role in the maintenance of anxiety. Two unpublished clinical trials of attention training for social anxiety disorder have found that training attention away from disgust faces meaningfully decreases symptoms (Amir & Beard, 2007; Schmidt et al., 2007). Both research groups conducted randomized, double-blind, placebo-controlled trials of attention training for participants with a primary diagnosis of generalized social anxiety disorder. Both trials tested the same pictorial version of the dot-probe task. In this task, two photographs of a face (one with a disgusted expression and one with a neutral expression) appeared on the computer screen. In the intervention condition, 80% of the time the probe (the letter "E" or "F") replaced the neutral rather than the disgust face. In the control condition, the probe was equally likely to replace the neutral or the disgust face.

In the Schmidt et al. (2007) study, 36 participants completed eight sessions, each consisting of a 15-minute dot probe task. At termination, 72% in the intervention condition versus 11% in the control condition had remitted from social anxiety disorder

based on diagnostic interviews, and this difference was significant. At 4-month follow-up, 64% in the intervention condition versus 25% in the control condition had remitted, but this difference was only a trend. At follow-up, the extent to which intervention participants showed a greater reduction in symptoms on the Liebowitz Social Anxiety Scale (Liebowitz, 1987), compared to control participants was similar to the symptom reduction found in recent trials of medication or CBT for social anxiety, compared to the reduction in the control condition. This study did not assess for reduction in attentional bias for disgust faces, but that is the assumed mechanism of change. The Amir and Beard (2007) study did assess attentional bias and found that the intervention condition showed a reduction in attentional bias for disgust faces. In the Amir and Beard study, 26 participants with social anxiety disorder were similarly randomized to eight sessions of the attention training or the control condition. The intervention decreased interviewer ratings on the Leibowitz Social Anxiety Scale (Liebowitz, 1987) in comparison to the control condition and the intervention condition's symptom decrease was maintained at the 1-year follow-up.

These two studies with clinical populations found remarkably strong effects for attention training. However, studies using normal or analogue populations and fewer sessions of attention training have often found less strong effects. Two studies have tested attention training with normal samples. MacLeod et al. (2002) found an effect of attention training on emotional vulnerability with a normal undergraduate sample. Koster et al. (2007), however, did not find an effect on anxiety in a sample of unselected undergraduates. This unpublished study evaluated whether attention training affects the early or late phase of threat processing. The study used a dot probe task with negative and

neutral pictures of faces. Participants had State-Trait Anxiety Inventory-Trait (STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) mean scores typical of normal undergraduate samples. Participants completed a pretest in the laboratory, then five sessions of attention training at home, followed by a posttest in the laboratory. In the intervention condition, the probe replaced the neutral pictures, whereas in the control condition, the probe was equally likely to replace either the negative or the neutral picture. Attention training significantly reduced attentional bias, but only on trials during the posttest where the pictures were presented for 1500 ms (as opposed to 100 ms or 30 ms). The training had no effect on trait anxiety scores or depression scores.

Koster et al. (2007) concluded that the training sped up the late phase of threat processing (attentional disengagement from threat), but did not affect early automatic processing. They argued that effective attention training needs to address early processing and that the lack of an effect on early processing in participants with normal levels of anxiety may explain why the training did not decrease trait anxiety. Koster et al. suggest that, "Training attentional avoidance responses at later stages of information processing might even be harmful, since it could interfere with habituation to the anxiety provoking stimuli" (p. 5). It is fairly clear that attention training decreases trait anxiety in individuals with high anxiety. It is unclear, however, whether attention training changes the early processing of threat for individuals with high anxiety, but changes only the late processing of threat for individuals with normal levels of anxiety. It seems possible that changing the early processing of threat requires numerous trials over weeks in order to automatize preferentially orienting away from threat.

In contrast to their study of attention training with participants with normal levels of anxiety, Koster and Verschuere (2007) found training effectively decreased the anxiety of participants high on STAI-T anxiety in an unpublished study. The study used a similar design to the one described above, but included (a) psychophysiological measures of emotional reactivity, (b) a 6-week follow-up, and (c) all pictures presented for 500 ms during the pre- and posttests. The training group showed decreased attentional bias for threat while the control group did not. Training did not affect skin conductance level and the findings for startle modulation were ambiguous, but training decreased self-reported trait anxiety at posttest and 6-week follow-up.

It is unclear whether one session of attention training with an analogue sample can affect mood or anxiety. Two unpublished studies by Amir, Beard, Klumpp, and Elias (2006) found an effect, but Harris and Menzies (1998) and an unpublished study by Reese and McNally (2007) did not. The Amir et al. study randomized socially anxious participants to either one session of attention training away from disgust faces or to placebo attention training and found that participants in the intervention condition reported less anxiety after giving a speech than controls. They replicated this finding. In contrast, Harris and Menzies found that one session of attention training toward or away from spider-related words for participants afraid of spiders changed their attentional bias, but did not affect their self-reported fear of spiders immediately following training. The authors point out that perhaps with the passage of time, participants' fear of spiders would have changed because their attention bias had changed, but this study did not include a follow-up.

Reese and McNally (2007) also found primarily negative results for one session of attention training with participants afraid of spiders and they included a 1-week follow-up. Their version of the dot- probe task used photographs of cows and spiders. In the intervention group, the probe consistently replaced the cows in order to train participants' attention away from the spider stimuli. Comparing the two groups across four time points (from baseline to 1 week follow-up), the intervention group did not show less bias for spider pictures than the control group. However, exploratory analyses found that if only the 1-day follow-up data were examined, the intervention group did show less bias than the control group. Nevertheless, overall this study did not find significant effects for attention training on attentional bias or fear of spiders; following training, in comparison to the control group, the intervention group did not report lower levels of spider fear or show less behavioral avoidance of a tarantula. Reese and McNally (2007) theorized that the effects of exposure to a real spider and spider photographs in both groups may have overshadowed any effect on symptom reduction attention training might have otherwise shown in the intervention group.

It is possible that multiple sessions of attention training would have been more effective than this single session intervention. However, this study also raises the possibility that perhaps intensely fear-provoking stimuli (such as photographs of spiders to someone afraid of spiders) may not be as effective for attention training as moderately threatening stimuli that allow for more ambiguous interpretations (disgust faces, negative words, or perhaps photographs of spider webs and dusty attics). Given some evidence that all people (anxious or not) orient to highly threatening stimuli, but people high in trait anxiety orient to moderately threatening stimuli more than people low in trait anxiety

do (Koster, Crombez, Verschuere, & De Houwer, 2006), optimal treatment may involve training people high in anxiety to orient away from moderately threatening stimuli as nonanxious people do.

In sum, given the mixed results of attention training and the unreliability of the dot probe task as a measure of attentional bias in nonclinical samples, a picture starts to emerge of a somewhat unreliable intervention that seems to be more effective when administered in multiple sessions with clinical populations perhaps using moderately threatening stimuli.

Emotional Vulnerability and Emotional Overeating

The current study attempted to replicate MacLeod et al.'s (2002) finding that one session of attention training affects emotional vulnerability in participants with normal anxiety levels and to extend it to individuals who report a tendency toward overeating, including individuals who report a tendency toward emotional overeating. Participants were selected for the current study if they reported scores at or above the median on tendencies toward overeating as assessed by the mean of three subscales: the bulimia subscale of the Eating Disorder Inventory-1 (EDI-1; Garner, Olmsted, & Polivy, 1983), and the emotional and external eating subscales of the Dutch Eating Behavior Questionnaire (DEBQ; Van Strien, Frijters, Bergers, & Defares, 1986). The bulimia subscale asks questions related to binge eating (consuming an objectively large amount of food in a brief period of time and experiencing a sense of loss of control). The emotional eating subscale measures the frequency with which individuals eat in response to negative emotions, and the external eating subscale measures the frequency with which individuals eat in response to the sight or smell of food. This combined measure of

tendency toward overeating was chosen because several studies have found the measure predicts grams of food consumed by female university students in the laboratory, although correlations have been fairly modest (r = .31 in Ouwens, Van Strien, & Van Der Staak, 2003a; r = .25 in Ouwens, Van Strien, & Van Der Staak, 2003b; and r = .27 in Van Strien, Cleven, & Schippers, 2000). The emotional eating subscale was not used alone because studies have only reported associations between the combined measure and food consumed in the laboratory.

The present study focused on individuals who report tendencies toward overeating, including individuals who report tendencies toward emotional eating, in part because such a sample permits the addition of an objective behavioral outcome measure (number of calories consumed during a "taste test" following a stressor) to the study design of MacLeod et al. (2002). An assumption of the current study is that, in this sample, the more negative affect individuals experience following a stressor, the more calories they subsequently will consume during a "taste test."

This study also focused on individuals who report tendencies toward overeating because such tendencies are associated with problems, including difficulties dieting successfully (Van Strien, 1997). Studies have also found that experiencing high levels of negative affect puts individuals at risk of consuming excess calories (Stice, 2002) and that eating in response to negative affect is associated with binge eating (Stice, Presnell, & Spangler, 2002). Researchers have only recently begun to evaluate attention training as an intervention for anxiety disorders, and it appears attention training has not yet been evaluated as an intervention for any eating or weight disorder. As obesity continues to become a more serious problem in the United States and the world (Battle & Brownell,

1996), it becomes more pressing to find ways, especially inexpensive and quick ways, to help prevent excessive weight gain and to facilitate weight loss and maintenance.

Reporting experiencing particularly intense affect is associated with engaging in maladaptive ways of coping with stressful situations (Flett, Blankstein, & Obertynski, 1996). Many people report that they sometimes overeat or binge eat in response to negative affect (Van Strien et al., 1986). In one study (Thayer, Newman, & McClain, 1994), 34% of participants reported that they eat to try to change a bad mood, and these participants were more likely than the rest of the sample to be overweight. Emotional eating also helps predict the onset of binge eating in adolescent girls (Stice et al., 2002).

A study of overweight women with and without binge eating disorder (BED; Le Grange, Gorin, Catley, & Stone, 2001) asked participants to monitor immediately following their binge episodes and found that both the women with and without BED reported higher negative affect and lower positive affect prior to binging. Another study (Greeno, Wing, & Shiffman, 2000) used handheld computers and found that obese women with BED reported being in a poor mood prior to binging, although this study did not find that obese women without BED reported being in a poor mood prior to binging. This study also found that obese women with BED reported more negative affect in general than obese women without BED reported. Thus, studies have found that negative affect is a common antecedent to binge eating, and it is theorized that people may overeat or binge eat in an attempt to avoid negative emotions (e.g., Elmore & de Castro, 1990).

A number of studies have examined the effect of laboratory stressors on food consumption. Lattimore (2001) tested a sample of female undergraduates and divided them into those who endorsed tendencies toward binge eating and those who did not. He

used a repeated measures design to compare the amount of ice cream consumed following two different stressors separated by a week: a scary movie and a Stroop task containing ego-threatening words. He found that participants who endorsed tendencies to binge eat reported significantly more anxiety following the Stroop task than following the scary movie and they subsequently consumed significantly more ice cream. In the Stroop task condition, participants who endorsed tendencies to binge eat also consumed more ice cream than participants who did not endorse tendencies to binge eat. This study provides supporting evidence for the effectiveness of ego-threatening stressors in inducing anxiety and subsequent overeating in those who are vulnerable to binge eating. The study also demonstrates that there are individual differences in how vulnerable people are to overeating following a stressor.

Interestingly, evidence suggests that eating is not a particularly effective way to regulate emotion. Several studies have found that individuals who binge eat report negative affect after binge eating (Elmore & de Castro, 1990; Wegner et al., 2002), although it is possible that individuals who binge eat find negative emotions they experience after binge eating to be more tolerable than the emotions they experience prior to binge eating. One study found that informing people that eating has not been found to improve mood decreased food consumption following a stressor (Tice, Bratslavsky, & Baumeister, 2001). Once people understand that eating probably will not help them regulate their emotions, a natural question is: How can people vulnerable to emotional overeating attempt to regulate their emotions in a way *other* than eating?

Overview of the Present Investigation

The present investigation examined whether or not computerized training could manipulate attentional bias toward or away from negative emotional words in a sample reporting tendencies toward overeating. Furthermore, the investigation examined whether, following a lab stressor, the group trained away from negative words (the attend-neutral group) would report a better mood and consume fewer calories during a "taste test" than the group trained toward negative words (the attend-negative group).

This experiment included five separate phases: (a) an attentional training and testing phase using the dot probe task, (b) a lab stressor involving trying to solve anagrams and receiving false negative feedback, (c) a taste test, (d) a 1-day follow-up, and (e) a 1-month follow-up. (See Figure 1 for a flow chart of the study design.) The attention training and lab stressor phases were an attempt to replicate the MacLeod et al. (2002) findings (which were with undergraduates with average anxiety levels) and to extend the findings to undergraduates with average anxiety levels who also reported tendencies toward overeating.

In addition to recruiting participants who reported tendencies toward overeating, the current study differed from the MacLeod et al. (2002) studies by adding a 1-day and 1-month follow-up. An objective behavioral outcome measure (number of calories consumed during a test meal) was also added so as not to rely solely on self-report analogue scales. Also, the 10 negative items from the Positive and Negative Affect Scales (PANAS; Watson, Clark, & Tellegen, 1988) were included as an outcome measure (as MacLeod et al. suggested future studies do), in addition to the two analogue scales, so the outcome could be based on participants' responses to more than two items.

The pre- and posttest phase of the dot probe task included double the number of trials MacLeod et al. (2002) used (192 instead of 96) in an effort to improve the reliability of the measure of attentional bias. In addition, the anagram stress task was delivered entirely on the computer unlike in the original MacLeod et al. studies. Finally, due to difficulties with recruitment, this study recruited participants with scores ranging from the 25th to the 75th percentile of the screening sample on the STAI-T (Spielberger et al., 1983), while MacLeod et al. recruited participants with scores in the middle third on the STAI-T. Both MacLeod et al. and this study recruited participants with mid-range anxiety scores for several reasons: (a) so that participants would have relatively similar scores on trait anxiety, (b) so that there was room for an attentional bias to be trained either toward or away from negative words, and (c) so that the stressor would not be excessively upsetting.

This study tested the following hypotheses with participants who reported normal levels of trait anxiety, but above average tendencies to overeat:

H1: Training with the dot probe task will differentially affect the attend-negative and the attend-neutral groups' attentional biases. Training will cause an attentional bias toward negative words in the attend-negative group and toward neutral words in the attend-neutral group.

H2: Attention training toward negative versus neutral words will not affect mood prior to the stressor.

H3: The attend-neutral group will report less anxiety and depression in response to the anagram stressor than the attend-negative group.

H4: The attend-negative group will consume more calories than the attend-neutral group during the taste test following the stressor.

H5: The attend-negative group will report eating more than the attend-neutral group for the rest of the day after leaving the experiment.

H6: At the 1-day follow-up, the attend-negative and the attend-neutral group will report equivalent levels of negative affect.

H7: At the 1-month follow-up, the attend-negative and the attend-neutral group will report equivalent emotional eating frequency, equivalent change in general psychological distress since baseline, and equivalent change in body mass index (BMI) since baseline.

Method

Participants

Undergraduate students in introductory psychology classes ($N = 410$; 53.4% female) were screened to identify participants who met the experiment's inclusion criteria. All participants received course credit for participating in the screening study. Participants were recruited for the experiment if they reported: (a) normal or corrected-to-normal vision; (b) no allergies to chocolate, potatoes, or wheat (i.e., foods included in the taste test); (c) being between the ages of 18 and 30 (an upper age limit was imposed to create a somewhat homogenous sample); (d) scores on trait anxiety ranging from the 25th to the 75th percentile of the screening sample on the STAI-T; and (e) scores at or above the median on tendency toward overeating as assessed by the mean of three subscales: the bulimia subscale of the EDI-1 (Garner et al., 1983), and the emotional and external eating subscales of the DEBQ (Van Strien et al., 1986). Of the 120 participants who met the inclusion criteria, 78 (65%) accepted the invitation to come to the laboratory for the experiment. Those who accepted did not differ from those who declined in year in college, age, sex, BMI based on self-report, self-reported tendency toward overeating, or trait anxiety (all ps > .05).

Due to time constraints, and because Rutgers does not engage in mass screening of students in introductory psychology classes, it was necessary to determine cutoff scores for inclusion and begin recruiting participants for the experiment while continuing to screen new potential participants. Thus, it was not possible to establish cutoff scores for inclusion in the experiment based on the full screening sample. Therefore, once over 150 participants had been screened, cutoff scores for study inclusion were determined.

This subset of screening participants was judged to be large enough to be representative of the screening sample as a whole, and to yield a cutoff score approximately the same as if the entire screening sample had been used to determine the cutoff scores. Individuals were invited to participate in the experiment if they reported tendencies toward overeating at or above the median of the screening sample at that time (2.21) and trait anxiety scores ranging from the 25th to the 75th percentile of the screening sample at that time (STAI-T scores between 34 and 49). After all 410 participants completed the screening, it was determined that the tendency toward overeating median score chosen after the first 152 participants was slightly lower than the median based on the full sample (2.21 versus 2.31), but the STAI-T cutoff scores chosen matched the 25th to 75th percentile range of scores for the full sample exactly.

Participants' mean scores on the eating scales were generally somewhat higher than a normal comparison group, while their trait anxiety scores were generally comparable. Men who completed the experiment scored slightly higher on the emotional eating (M = 2.34, SD = .64) and external eating subscales (M = 3.36, SD = .54) of the DEBQ than a sample of normal male British university students ($M_{\text{emotional eating}}$ = 2.24, SD = .77 and $M_{\text{external eating}}$ = 3.16, SD = .55; Wardle, 1987). Women who completed the experiment scored somewhat higher on the emotional eating (M = 2.70, SD = .60) and external eating subscales (M = 3.59, SD = .58) of the DEBQ than a sample of normal female British university students ($M_{\text{emotional eating}}$ = 2.65, SD = .72 and $M_{\text{external eating}}$ = 3.12, SD = .51). Women who completed the experiment scored much lower on the emotional eating subscale than female British bulimia nervosa patients (M = 3.83, SD = .94), but women in the experiment scored slightly higher on the external eating subscale than

female British bulimia nervosa patients (*M* = 3.45, *SD* = .86; Wardle, 1987). There are no DEBQ norms for men with bulimia nervosa because the condition is so rare in men.

Women in the experiment reported binge eating over the past 3 months a mean of 0.94 times a week (*SD* = 1.32). Men in the experiment reported binge eating a mean of 0.73 times a week (*SD* = .87). These binge frequencies are below the 2 times a week that is a diagnostic criterion for bulimia nervosa and the 2 days a week that is a diagnostic criterion for BED (American Psychiatric Association, 2000). In the experiment, 22.7% of participants reported binge eating 2 or more times a week, while 53% reported not engaging in binge eating at all.

The mean STAI-T score for participants in the experiment was 40.04 (SD = 4.06), well below 57 (the mean score for individuals with Generalized Anxiety Disorder across six outcome studies; Fisher & Durham, 1999). The range of scores on the STAI-T was roughly comparable to the MacLeod et al. (2002) study, although MacLeod et al. only recruited participants from the middle third rather than the middle half of the sample on STAI-T scores. In the first MacLeod et al. study, STAI-T scores ranged from 34 to 45, and in the second study scores ranged from 35 to 42. The mean ages of the undergraduates in the two MacLeod et al. studies and in the current study were very similar.

Of the 78 undergraduates who participated in the main experiment, 11 were excluded from analyses. Seven (3 from the attend-neutral group and 4 from the attend-negative group; 9% of the total sample) were excluded because the computer malfunctioned during the experiment and the participants either did not complete the full experiment or completed some elements twice, making their data unusable. An additional

4 participants were excluded (3 from the attend-neutral group and 1 from the attend-negative group; 5% of the total sample) for a variety of reasons. One was excluded due to falling asleep during the training. Two were excluded due to dietary restrictions that precluded them eating the foods used in the taste test. Finally one participant could not complete the study due to experimenter error. Excluded participants did not differ from the rest of the participants in the experiment on (a) the screening measures, (b) the outcome measures (all *p*s > .07), or (c) the frequency with which they were assigned to the two experimental conditions, χ^2 (1, N = 78) = .17, *ns*.

The final sample consisted of 67 participants (40.3% male), 32 of whom were randomly assigned to the attend-neutral group and 35 to the attend-negative group. There were 13 males in the attend-neutral group and 14 in the attend-negative group. The two groups did not differ significantly in the percentage of members who were male. The majority of participants received course credit in exchange for their participation in the experiment, but 10 participants (14.9% of the final sample; 4 in the attend-neutral group and 6 in the attend-negative group) were paid $10 because they had already earned all the course credit they needed. Being paid was not significantly associated with assigned condition or any of the main screening or outcome measures (all *p*s > .05).

The participants in the experiment ranged in age from 18 to 24; their mean age was 18.93 years (*SD* = 1.23), and 70.1% were completing the second semester of their first year in college. Nearly half of the participants identified themselves as members of a minority group: 9% African American, 13.4% Asian, 13.4% Hispanic or Latino, 1.5% Native Hawaiian or other Pacific Islander, 7.5% South Asian, 3% who identified themselves as “other,” and 52.2% Caucasian. Participants who identified as members of a

minority group did not differ from participants who identified as Caucasian on any of the main screening or outcome variables.

Participants' height and weight were measured to calculate their BMI (weight in kilograms divided by height in meters squared). According to the World Health Organization's (1998) categories, 6% of the participants were underweight (BMI < 18.5); 40.3% were normal weight (18.5 $\leq$ BMI < 25); 34.3% were overweight but not obese (25 $\leq$ BMI < 30); and 19.4% were obese (BMI $\geq$ 30).

Materials

Dot probe task words. There were 96 pairs of words in which one was a negative emotional word and one was a neutral word. (See Appendix A for the word lists.) These words were derived from MacLeod et al. (2002), who had matched the words in each pair for word frequency and number of letters. There were approximately equal numbers of words with double letters in the negative word list (21 words) and in the neutral word list (17 words). MacLeod et al. asked 12 Australian psychology students to evaluate the words and determined that they rated the intended negative words as negative and the intended neutral words as neutral.

The majority of the MacLeod et al. (2002) words (182 of 192) were evaluated in a separate study (Mohlman, 2005). This evaluation was conducted in part to determine how American (as opposed to Australian) undergraduates would rate the words in terms of their valence and familiarity. The 10 words that were not evaluated by the American undergraduates were quite common words (except for the word *via*) and seem unlikely to be rated differently by Australians versus Americans. The sample for the word evaluation study was similar to the sample for the current study in that both samples were

undergraduates at the same university who were taking a psychology course. In the word evaluation study, undergraduates (*N* ranged from 67 to 79) rated the valence and familiarity of the MacLeod et al. words. Participants rated the valence of each word using a 5-point scale ranging from 1 (*very negative*) to 3 (*neutral*) to 5 (*very positive*). All intended negative words except one received a mean rating of less than 2.38, suggesting that participants saw these words as negative. (One word, *forlorn*, was rated a 2.53 which is still below *neutral*.) All neutral words except one received a mean rating of greater than 2.62, suggesting that participants saw these words as neutral. (One word, *shearing*, was rated 2.48.)

Participants also rated how familiar a word was using a 5-point scale ranging from 1 (*completely unfamiliar*) to 5 (*completely familiar*). Only 9 words out of 192 were given a mean rating of less than 2 using this scale, suggesting that only 9 words were completely unfamiliar to participants. Except for the word *forlorn*, these 9 words were all intended to be viewed as neutral words and participants successfully identified them as neutral words despite being unfamiliar with them. The unfamiliar words were distributed almost equally between the two word lists (four in one list and five in the other) so regardless of the list to which participants were randomized for training, they encountered a similar number of unfamiliar words during training. The valence and familiarity of the words therefore will not be discussed further.

The two lists (list ‘A’ and ‘B’) consisted of 48 word pairs each. One list was used in the pretest and training phase, and the other was used in the posttest ensuring that participants’ posttraining attentional bias was evaluated using new words. Participants in each condition were randomly assigned to receive the pretest and training using either list

A or list B. Which list was used for training was not associated with any of the outcome variables (all *p*s > .15).

Pilot food dot probe task words. At the end of the pretest and the posttest, participants' attentional bias was assessed using 10 pairs of words (one food word and one neutral word) presented twice to collect pilot data for future studies. These words will not be discussed further.

Anagram task stimuli. The anagram task was nearly identical to the task in the MacLeod et al. (2002) study except that 5 anagram strings were excluded due to having multiple solutions. There were 35 strings of letters: 14 were unsolvable and 21 were solvable, meaning that the letters could be made to form an English word. Six advanced psychology undergraduates rated the solvable anagrams as very difficult to solve, according to MacLeod et al. An example of a solvable anagram is "NIACUSEOT" (tenacious). An example of an unsolvable anagram is "AESIDUD." (See Appendix B for a full list of the anagram words.)

Experimental hardware. The computer tasks and most of the questionnaires were delivered on a Dell GX280 computer (Dell Inc., Round Rock, TX) with a 19 inch monitor (refresh rate 75 Hz) using E-Prime 1.1 software. The anagram stress task was videotaped using a Panasonic VHS Reporter Movie Camera AG-188 (Panasonic, Secaucus, NJ) in an effort to increase the intensity of the stressor. The taste test food was weighed using a My Weigh i500 digital scale (My Weigh, Phoenix, AZ).

Screening Measures (See Appendix D)

State-Trait Anxiety Inventory. The State-Trait Anxiety Inventory-Trait (STAI-T; Spielberger et al., 1983) is a 20-item questionnaire that assesses trait anxiety by asking

participants how they generally feel. Participants respond using a 4-point scale ranging from 1 (*almost never*) to 4 (*almost always*). The items are added together to calculate a total score, and scores can range from 20 to 80. The scale has good internal consistency and adequate test-retest reliability with undergraduates. In the current study's screening sample, Cronbach's alpha for the STAI-T was .92.

The Dutch Eating Behavior Questionnaire. The Dutch Eating Behavior Questionnaire (DEBQ; Van Strien et al., 1986) has 33 items that form three subscales: emotional eating (13 items), external eating (10 items), and restrained eating (10 items). This study only employed the emotional and external eating subscales. The emotional eating scale can be further subdivided into items that ask about eating in response to clearly labeled emotions and eating in response to diffuse emotions (Van Strien et al., 1986). An example of a question from the emotional eating scale is: "Do you have a desire to eat when you are feeling lonely?" An example of a question from the external eating scale is: "When preparing a meal are you inclined to eat something?" Participants respond using a 5-point scale ranging from 1 (*never*) to 5 (*very often*). Participants are also given the option on some questions of responding that the item is not applicable and such responses are coded as missing data.

To determine each scale score, the sum of the items is calculated for each person and then divided by the number of items answered. The two scales have good internal consistency and convergent validity (Van Strien et al., 1986). In the current study's screening sample, Cronbach's alpha was .94 for the emotional eating subscale and .85 for the external eating subscale. At the 1-month follow-up, Cronbach's alpha was .91 for the emotional eating subscale.

Eating Disorder Inventory-1. The Eating Disorder Inventory-1 (EDI-1; Garner et al., 1983) has a number of different subscales, but this study used only the seven-item bulimia subscale. The bulimia subscale has been used several times in combination with the DEBQ emotional and external eating subscales to predict food consumption in the laboratory (e.g., Van Strien et al., 2000). The bulimia subscales of the EDI-1 and the EDI-2 are identical. The bulimia subscale showed acceptable internal consistency in a nonclinical female sample (Garner & Olmsted, 1984; cited by Crowther, Lilly, Crawford, & Shepherd, 1992), and in a sample of male and female undergraduates it showed good 3-week test-retest reliability (Wear & Pratz, 1987). A study of female undergraduates (Crowther et al., 1992), however, found low internal consistency (Cronbach's alpha = .63) and low 1-year test-retest reliability (r = .44). In the current study's screening sample, the internal consistency of the bulimia subscale was acceptable (Cronbach's alpha = .83).

Questions about weight and dieting. Participants were asked to report their desired weight. This question was adapted from a study by Mann and colleagues (1997). Participants' desired BMI was calculated using their actual height and their desired weight. Participants were asked whether they were currently dieting. They were also asked: "Over the past 3 months how much of the time have you been on a diet in order to control your weight?" Participants responded using a 5-point scale ranging from 1 (*none or hardly any of the time*) to 5 (*nearly all of the time*). This question was adapted from the Questionnaire on Eating and Weight Patterns-Revised (QEWP-R; Spitzer, Yanovski, & Marcus, 1993, reprinted in Pike, Loeb, & Walsh, 1995).

Eating Disorder Diagnostic Scale. The Eating Disorder Diagnostic Scale (EDDS; Stice, Telch, & Rizvi, 2000) is a 22-item questionnaire that provides an overall eating disorder symptom composite, but this study used only 12 of the questions. These questions asked about binge eating frequency and asked participants to report their height and weight. The mean of 10 of these questions (excluding the questions about height and weight) was used to form an abbreviated eating disorder symptom composite. In the current study's screening sample, Cronbach's alpha was .82 for this abbreviated symptom composite. Participants' height and weight without shoes were measured at the end of the experiment using a balance beam scale. Their BMI was then calculated. There was a strong linear relationship between self-reported BMI at screening and measured BMI despite the passage of time (from 2 weeks to 2 months) between the two measures, $r = .98$, $p < .001$.

Demographic and other questions. Participants were asked their age, year in school, ethnic/racial group, their mother's and father's education levels (a proxy measure of socioeconomic status), and whether their vision was normal or corrected to normal. Participants were also asked if they had any food allergies.

Pilot measures included with screening measures. Participants also completed several exploratory measures unrelated to the current study. These measures asked primarily about emotion regulation and were part of pilot work to assist in the design of future studies.

Study Measures

The Depression Anxiety Stress Scale. The Depression Anxiety Stress Scale (DASS; Lovibond & Lovibond, 1995) consists of 42 items that form three subscales

(depression, anxiety, and stress). There is also a briefer, 21-item version (the DASS-21) that was given at the 1-month follow-up to reduce the time burden. Scores on the DASS-21 subscales are doubled so they are comparable to the DASS subscales. For both the DASS and the DASS-21, the three subscales (or the doubled subscales in the case of the DASS-21) were summed to form what will be referred to as the total DASS. The subscales do not permit diagnosis, but rather, based on analyses of the DASS-21, together assess "general psychological distress" (Henry & Crawford, 2005, p. 237). The subscales of both the DASS and the DASS-21 possess adequate concurrent validity and internal consistency (Antony, Bieling, Cox, Enns, & Swinson, 1998). In the current experiment, the depression, anxiety, and stress subscales and the total DASS had Cronbach's alphas of .88, .80, .90, and .93 respectively. At the 1-month follow-up, the 7-item depression, anxiety, and stress subscales and the total DASS had Cronbach's alphas of .62, .50, .77, and .83 respectively. The follow-up subscales were only 7 items each, and only 47 participants responded to the 1-month follow-up with complete data, so these lower Cronbach's alpha values are not surprising. Previous research with a much larger British community sample found adequate internal consistency for the DASS-21 subscales and total scale (Cronbach's alphas ranged from .82 to .93; Henry & Crawford, 2005). Henry and Crawford also found that doubling the DASS-21 scores led to scores quite similar to DASS-42 scores.

Positive and Negative Affect Scales. The negative scale of the Positive and Negative Affect Scales (PANAS; Watson et al., 1988) consists of 10 items that assess the extent someone is experiencing negative affect. The measure allows for different time frames; this study assessed negative feelings in the present moment. The present moment

negative affect scale has good internal consistency and fair 8-week test-retest reliability, particularly given that the present moment scales are designed to measure current mood (Watson et al., 1988). The present moment measure has been shown to be sensitive to changes in mood and to be sensitive to change following an event in a research study (McIntyre, Watson, Clark, & Cross, 1991). Consequently the negative affect scale was given three times during the experiment as well as during the screening and 1-day follow-up to measure changes in mood. In the screening sample, Cronbach's alpha for the negative affect scale was .91. The three times the scale was given during the experiment yielded Cronbach's alphas of .74, .78, and .90 chronologically. At the 1-day follow-up, Cronbach's alpha was .86. In the negative affect scale, participants are asked to what extent at the present moment they feel, for example, upset or nervous. The possible ratings range from 1 (*very slightly or not at all*) to 5 (*extremely*). The 10 items that make up the negative affect scale are summed. The potential scores thus range from 10 to 50.

Analogue scales. Following MacLeod et al.'s (2002) study design, participants were asked to complete analogue scales at several points during the main experiment. Participants were shown a 14.2 cm line on the computer screen that had anchors at either end reading "relaxed" and "anxious." Participants were asked to indicate with the cursor where on the line best fit their current mood. The line had no visible numbers, but was in fact divided into 30 equal sections ranging from 1 (*relaxed*) to 30 (*anxious*). On a new screen, participants were asked to indicate how they currently felt from the equivalent of 1 (*happy*) to 30 (*depressed*). The first time the analogue scales were presented, participants were also asked to indicate how they currently felt from the equivalent of 1

(*awake*) to 30 (*sleepy*). The depression and anxiety analogue scales appeared in a random order each time they were presented.

Hunger rating. Two items from the Hunger Scales (Grand, 1968) were used. Participants were asked to estimate the amount of time that had passed since they last ate, and they were asked to report how hungry they were on a scale from 1 (*not hungry at all*) to 7 (*extremely hungry*).

Taste test rating sheet. The rating sheet asked participants how sweet and how salty the foods tasted to them using Green's labeled magnitude scale (Green et al., 1996). This scale was used to collect pilot data on whether those who eat less in the laboratory are more likely to be supertasters who are sensitive to salty and sweet tastes. The rating sheet also inquired how much the participant likes or dislikes each food. There were several other distractor questions on the sheet.

Date of last menstrual period. Female participants were asked the first day of their last menstrual period. This information was gathered because some studies have found menstrual cycle phase affects caloric consumption (e.g., Lyons, Truswell, Mira, Vizzard, & Abraham, 1989).

Next Day Follow-up Measures

The day after the experiment, all participants received an e-mail asking them how much food they ate over the rest of the day on which they participated in the experiment. This item assessing naturalistic eating was taken from Shapiro (1998). Possible responses ranged from 1 (*much less than usual*) to 7 (*much more than usual*). Participants also completed the negative scale of the PANAS.

One Month Follow-Up Measures

Additional follow-up measures were e-mailed to participants 1 month after they completed the experiment. To encourage retention, the follow-up questionnaire was brief. Participants were asked questions on their current weight, how often they binge eat, the DASS 21, and the emotional eating subscale of the DEBQ. It was hypothesized that, because of the brevity of the intervention, there would be no differences between groups at 1-month follow-up. The responses to the follow-up were collected to confirm this hypothesis and to explore pilot hypotheses unrelated to the current study.

Tasks

Dot probe task. The dot probe task was modeled closely after MacLeod et al. (2002). Each trial started with a fixation point of three plus signs in the center of the screen for 500 ms. The plus signs were replaced by two words presented for 500 ms: one negative and one neutral. The words were .5 cm high in white, upper case, bold letters in 19 point Courier New. One word appeared in the upper half of the screen just above where the fixation point had been and one appeared just below. There was a 2 cm gap between the bottom of the upper word and the top of the lower word. Both words disappeared and then one of the words was replaced by either one or two small dots. The dots were red periods in 8 point Courier New (2 pixels). Participants were instructed to respond as quickly as possible by pressing the "a" key if they saw one dot or the "l" key if they saw two dots. The "a" and "l" keys were labeled with stickers with the appropriate number of dots. The computer recorded participants' response latencies to 1 ms accuracy. The fixation point to begin the next trial appeared 500 ms after their response.

The position (upper or lower) of each specific word was fixed, whereas in MacLeod et al. (2002) it was random. Negative words overall, however, were equally

likely to appear in the upper or lower position. For each trial, there was a 50% chance the probe would be one dot and a 50% chance it would be two dots. The probe was equally likely to replace the top or the bottom word.

Participants first completed a pretest of 192 test trials. Following the pretest, participants completed 576 training trials in which they were randomly assigned to one of two conditions. In the attend-neutral condition, the dots always replaced the neutral word, with the aim of causing participants to respond to the contingency and focus their attention on the neutral word, so as to be focused in the correct location and respond more quickly when the probe appeared. In the attend-negative condition, the dots always replaced the negative word. Training was followed by 192 posttest trials. In test trials, the dots were equally likely to replace either the negative word or the neutral word.

The posttest trials used word pairs that had not been seen before. These new words tested whether the attention training generalized to new stimuli. Half the participants in each condition completed the pretest and training with word list A, but the posttest with word list B, while half the participants in each condition completed the pretest and training with list B, but the posttest with list A. List A and B each contained 48 word pairs. During the test and training trials, all words from either List A or List B were presented once in random order before they were presented a second time in a different random order, and so on. Each time a given word pair appeared during the pretest or posttest, it was chosen at random whether the probe would replace the negative word or the neutral word. During the pretest and posttest, response latencies to trials in which the probe replaced the neutral word minus response latencies to trials in which the

probe replaced the negative word were used to determine participants' attentional bias and whether it had shifted from pre- to posttraining.

Anagram stressor. In the stress task, participants were asked to solve anagrams in a short amount of time while being videotaped. The stress task was designed to be a somewhat upsetting, ego-threatening experience that would challenge participants' emotion regulation capabilities. This stress task was modeled closely on MacLeod et al.'s (2002) stress task which was in turn modeled after one used in a previous study (Mogg, Mathews, Bird, & Macgregor-Morris, 1990). In the current study, participants viewed strings of letters on the computer and tried to form words from the letters. They typed in their solution or pressed the "enter" key to skip that anagram if they could not solve it. The instructions and false negative feedback were communicated via the computer screen. The experimenter was present in the room to start and stop the video camera but did not comment except to state that the video camera was on and the participant could press the space bar to start the anagram task.

Participants were informed via the computer screen that anagrams are frequently included on intelligence tests and that "ability to do well on this type of…exercise [has] been shown to be highly predictive of academic intelligence and success in school" (Tice et al., 2001, p. 59). They were then informed that "they should solve at least five or six within 3 minutes. At the end of this task, they were informed that their performance was well below average for university students (false negative feedback)" (Mogg et al., 1990, p. 1232). They were also told that, because their accuracy was unusually low, the video of them would be shown in a class demonstration. (In fact, the video of their performance was taped over and was never viewed.) In the MacLeod et al. (2002) study neither group

found the stressor extremely distressing, assuaging any concerns that the stressor might be excessively taxing.

Procedure

Participants from the general psychology subject pool signed up via the internet to participate in a preliminary screening study. After sign-up, participants received an e-mail with an attachment containing an informed consent form (see Appendix C), the screening questionnaires (see Appendix D), and additional pilot questionnaires. Participants were encouraged to e-mail or call the experimenter if they had any questions about the informed consent form. After asking their questions, if any, participants completed the questionnaires and returned them via e-mail if they consented to participate in the study.

All participants were assigned a study ID number and their answers to the questionnaires were printed out without any identifying information attached except the ID number. All electronic e-mail responses were deleted. Responses to the questionnaires were entered into a data base with no identifying information attached. Their e-mail addresses, associated study ID numbers, and signed consent forms were stored separately. Their answers to the questionnaires were analyzed and those participants who met the inclusion criteria for the experiment were individually contacted and invited to sign up on a website for an additional in-person study called “Perception and Personality” that would last an hour and a half in exchange for either course credit or $10.

Participants were contacted via e-mail 2 days before the main experiment, and via phone the night before, to remind them of their appointment. Participants were told not to eat for at least 3 hours before the study. If they inquired why, they were told that not

eating would ensure their sense of taste would be sharper for the taste test. In fact, this request was an attempt to standardize how long it had been since participants had last eaten.

The main investigator and four female research assistants each tested approximately 20% of the sample. They followed detailed written instructions which standardized those elements of the experiment not already standardized by the computer. Each research assistant observed the main investigator test one participant and then tested one participant independently while being observed. All deceptive material was delivered via the computer, and the research assistants were instructed to remain neutral and not to comment following the anagram stressor.

When participants arrived at the study, the experimenter gave them an informed consent form to read and any questions they had were answered. Participants read that they were being asked to participate in a "study of perception and personality" lasting approximately 90 minutes. They signed the informed consent form if they agreed to participate in one session plus two brief follow-up sessions over e-mail (one the next day and one in a month). The participants who were not paid were told they would receive three research participation credits for the session that day, and one additional research credit if they responded to the two follow-up e-mails. Participants signed an additional section on the informed consent form which read: "By signing below, you are granting us permission to video tape you during a puzzle task on the computer. This video may be shown in certain classes for demonstration purposes."

Participants were assigned to one of four experimental conditions: the attend-negative condition using word list A for the pretest, the attend-negative condition using

word list B, the attend-neutral condition using word list A, or the attend-neutral condition using word list B. There were separate randomization lists for each sex to ensure approximately equal numbers of men and women in the four conditions. Blocked randomization was used so that after every 4 men (or 4 women) were tested, all four conditions had been assigned. Within each block of four, the order of the conditions was randomly determined using a random number generator on the website http://www.randomizer.org.

The experimenter typed the participant's sex and ID number into the computer which then ran the condition linked with their ID number; the correspondence between ID numbers and condition was preprogrammed according to the randomization lists by a research assistant not involved in testing participants. The study was double blind. The experimenter was not present in the room while participants completed the dot probe task and was therefore blind to condition. Participants were also blind to condition. At the conclusion of the study, participants typed into the computer what they thought the study was about, and none of the participants mentioned being trained to attend to either negative or neutral words, or that the dot probe task was intended to affect emotional vulnerability.

Participants completed the experiment individually in a small, quiet room. Participants first completed the DASS questionnaire on paper and then were seated 60 cm away from the computer screen. The experimenter told participants she would be outside the door and to open the door if they had any questions. The experimenter then left the room. Almost all instructions were on the computer, so as to standardize the experiment as much as possible. Participants began the computerized portion of the study by

completing three analogue mood scales (each on a different screen) indicating their current mood and how sleepy they felt. They also completed the negative scale of the PANAS as an additional baseline measure of mood. Participants then read instructions on the dot probe task which included the following (adapted from the MacLeod laboratory's "Research Paradigms," 2002):

> Your job is to press the correct button as quickly as you can when you see the dots appear. If one dot appears, you should press the key labeled with one dot. If two dots appear, you should press the key labeled with two dots…. Put your left index (pointer) finger on the key labeled with one dot and your right index finger on the key labeled with two dots now…. It is important to respond as quickly as you can without making mistakes…. You will be given two rest breaks…. This part of the experiment will last around 45 minutes.

Participants completed 10 practice trials before they completed the pretest of their attentional bias using the dot probe task. Then, as part of pilot research, participants' bias toward 20 food words was assessed. Participants had a rest break and then received attention training either toward or away from negative words, after which they had a second break. Participants then completed a posttest of their attentional bias toward negative words and then food words. Participants then completed a second analogue anxiety and depression scale. The computer then asked participants to sit and rest for 4 minutes to allow any immediate effects of the attention training such as a potential mood induction to dissipate. Participants completed the analogue mood scales for the third time and then the negative scale of the PANAS for the second time.

The experimenter re-entered the room, set up the video camera, and videotaped participants while they attempted to solve difficult or insoluble anagrams. Participants read instructions, including the following adapted from MacLeod et al. (2002). The paragraph also incorporated phrases from Tice et al. (2001, p. 59).

> Anagrams are frequently included on intelligence tests and the ability to do well on this type of exercise has been shown to be highly predictive of academic intelligence and success in school. In this task you will be presented with an anagram on the screen. When you have unscrambled the letters to form a word, type the word into the computer…. If you cannot solve the anagram press the "enter" key and the next anagram will appear on the screen. You will be given three minutes to solve as many anagrams as you can. You should be able to solve at least five or six within 3 minutes…. The task will be videotaped and you will be rated according to your performance on the task. Although it is not likely, if your score is in the upper or lower 10 percent, you will be asked for permission for the videotape to be used for teaching purposes in psychology lab classes.

When participants completed the anagram task, they read on the computer: "Your accuracy was unusually low and your performance was well below average for university students. This video will therefore be used for later demonstration purposes." These sentences incorporated a phrase from Mogg et al. (1990, p. 1232). The experimenter unplugged the video camera, put the lens cap back on the camera, turned the camera to face the wall, and left the room. Participants then completed another set of analogue mood scales and the negative scale of the PANAS, followed by questions about how much time had passed since they last ate and how hungry they were.

Participants were then given a bogus taste test. Unbeknownst to them, the amount of food they consumed was measured for use as a dependent variable. Participants sat at a desk with (from left to right) a napkin, a bowl with 150 g of potato chips, a plate with 430 g of small, soft chocolate chip cookies, a bowl of 450 g of chocolate covered candies, and a bottle of water. The selection of foods served was modeled after Ward and Mann (2000). The experimenter left the participants alone for 10 minutes to complete the taste test. The form instructed participants: "Feel free to eat as much as you need to answer these questions accurately." At the end of the form, participants were told: "Once you have answered all the questions, feel free to eat more if you like." The foods were

weighed after the participants left the experiment to determine how many grams they consumed, to the nearest .10 grams.

After the taste test, participants completed the analogue rating scales on the computer one final time. The experimenter then looked at these final ratings to check that participants were not excessively distressed following the anagram stressor. Female participants then entered into the computer the first day of their most recent menstrual period, and all participants rated how stressful they found the anagram task and typed in what they thought the studies were about. Participants then read on the computer a debriefing of the anagram task that informed participants that the anagrams were difficult or impossible to solve, and that, "How well you were able to solve the anagrams in no way reflects your intelligence or academic ability" (see Appendix F for the full debriefing). The experimenter asked participants how surprised they were by the debriefing and asked if they had any questions. The experimenter then took participants to a separate room and measured their height and weight. All participants were thanked for their participation and either paid or given research credit.

Participants were e-mailed the next day to assess their mood and how much food they ate for the rest of the day after they left the experiment. Participants were also e-mailed 28 days after they completed the experiment and asked to answer 5 more minutes of questions. At the end of the study after the 1 month follow-up, all participants, including those who chose not to complete the follow-up, were e-mailed full debriefing information explaining the intent of the study, the purpose of the attention training, and that during the taste test we were also interested in how much food they consumed (see Appendix F). Participants were informed that if they were disappointed that they were not

assigned to the attend-neutral condition, they could contact the experimenter and arrange to complete that condition. No participants chose this option. Participants were also told:

> Since you reported that you sometimes eat in response to emotions such as stress or sadness, we wanted to let you know about one strategy that you may find helpful to reduce the frequency with which you eat in response to emotions. Many people find it helpful to make sure that they eat regularly. Research suggests that eating 3 meals and 2 to 3 snacks every 3 to 4 hours can be very helpful in preventing overeating and binge eating.

Finally, participants were provided with telephone numbers of resources for general psychological counseling and eating disorders counseling.

In summary, participants who reported average levels of anxiety and above average tendencies toward overeating were randomly assigned to receive attention training either toward or away from negative words. Following training, all participants experienced a stressor followed by questionnaires and a taste test which evaluated whether, as predicted, the attend-neutral group reported a better mood poststressor and consumed fewer calories than the attend-negative group. Participants filled out questionnaires at the 1-day and 1-month follow-up.

Results

Preliminary Analyses

Attrition analysis. Of the 67 participants in the experiment, 62 (92.54%) completed the 1-day follow-up questionnaire within 2 weeks. This number does not include four participants who were excluded because they responded too late to the questionnaire (between 19 and 42 days after it was originally sent). The questionnaire asked about current mood and what participants had eaten for the rest of the day after they left the experiment. It was meant to evaluate short-term effects of the intervention, and it was deemed unlikely that participants would remember what they ate after so much time had passed. Participants responded to the questionnaire after a mean of 1.47 days (*SD* = 2.47). Means and frequencies from the participants in the 1-day follow-up versus those who dropped out were compared via visual inspection and *t* tests (although with only 5 dropouts the *t* tests were of limited value). The participants in the 1-day follow-up did not appear to differ from the dropouts on the following variables measured at either the screening or at baseline: experimental condition, age, year in school, sex, race, whether they were paid to participate, BMI, binge eating frequency, tendency toward overeating, STAI-T score, PANAS negative affect scale, analogue depression scale, or total DASS.

Of the 67 participants in the experiment, 50 (74.63%) completed the 1-month follow-up questionnaire within 2 weeks. This number does not include four participants who were excluded because they responded too late to the questionnaire (between 22 and 55 days after it was originally sent). Participants responded to the questionnaire after a mean of 2.46 days (*SD* = 3.16). *T* tests and chi-square analyses (where appropriate) were

used to compare the groups and showed that participants in the 1-month follow-up did not differ from dropouts on any of the screening or baseline variables listed in the previous paragraph.

Attend-negative versus attend-neutral group at baseline. The attend-negative and attend-neutral group were compared on all baseline measures to check that the groups were equivalent. *T* tests and chi-square analyses (where appropriate) were used to compare the groups. The two groups did not differ on any variables of interest measured during screening or at baseline (see Table 1) except for differing on baseline measures of negative emotion.

During screening, the attend-negative and attend-neutral groups did not differ on trait anxiety (as measured by the STAI-T) or on negative affect (as measured by the PANAS; for means and *t*-test results see Table 2). During the experiment, however, participants completed four baseline measures of negative emotion that all suggested that the attend-negative group felt worse on average than the attend-neutral group. Employing a Bonferroni correction, the *p* value necessary for significance was set at .01 to control for the number of tests performed. The attend-negative group reported higher scores than the attend-neutral group (but only at the .05 level) on the analogue depression scale, the negative affect scale of the PANAS, and the total DASS measuring depression, anxiety, and stress over the past week. There was a similar trend for the attend-negative group to report higher anxiety than the attend-neutral group on the analogue anxiety scale ($p = .06$; see Table 2 for all means and *t*-test results).

Because these findings suggested a potential failure to randomize on mood but not at the .01 significance level, the outcome analyses were performed twice: once as

originally planned, and once using analysis of covariance (ANCOVA) with the baseline analogue depression scale score as a covariate. The analogue depression scale was chosen as a covariate because (along with the total DASS) it differed the most between the two groups, and because the analogue depression scale showed the largest number of strong correlations with the main outcome variables. In general, when other measures of negative mood at baseline were added to the analogue depression scale as additional covariates, they did not substantially change the results. This finding is not surprising given that the measures of negative mood are conceptually similar and correlated.

Data Preparation

Outliers were defined as reaction times to dot probe trials shorter than 200 ms or longer than 2000 ms and were discarded along with incorrect responses. These exclusions resulted in 4.2% of the trials being deleted. Then, for every participant, reaction times that were 3 standard deviations above or below that participant's mean reaction time for each of eight types of trials were also discarded. The eight types of trials varied according to test phase (pretest vs. posttest), type of word preceding the probe (negative vs. neutral), and location of the probe (upper vs. lower position on screen). This filtering eliminated an additional 1.5% of the trials. Thus, 94.3% of the reaction time data were included in the analyses. MacLeod et al. (2002) used median reaction times to control for outliers, but this study used means with excluded outliers to allow for greater sensitivity to detect an effect and because the approach seems to be becoming standard practice (e.g., Koster et al., 2006).

After excluding outliers, attentional bias scores were calculated using MacLeod and Mathews' (1988) formula, which involves subtracting the reaction time to detect

probes replacing negative words from the reaction time to detect probes replacing neutral words. A positive score thus indicates greater attention to negative words (i.e., that the individual detects probes replacing negative words faster than probes replacing neutral words), while a negative score indicates greater attention to negative words. The percentage of the attend-negative group (57%) and the attend-neutral group (50%) who pretraining showed an attentional bias toward negative words (i.e., a positive attentional bias score) did not differ, χ^2 (1, N = 67) = .34, *ns*.

The internal consistency of the attentional bias scores pre- and poststressor was calculated, as was the internal consistency of the reaction times that form the bias scores (reaction times to trials in which the probe replaces the neutral word and reaction times to trials in which the probe replaces the negative word; see Table 3). Both odd-even split-half reliability and Cronbach's alpha were calculated as measures of internal consistency. Before calculating these measures, outliers and errors were excluded from the reaction time data, as they were in the main analyses. The remaining trials were numbered odd or even in order of administration. To determine the odd-even split-half reliability for the bias scores, two separate mean bias scores were calculated using either only the odd or only the even trials; these numbers were then correlated and the Spearman-Brown formula was applied. The odd-even split-half reliability for the reaction times was calculated by correlating the mean reaction time for the even and odd trials and then using the Spearman-Brown formula to adjust the correlation.

Cronbach's alpha was subsequently calculated. There were missing data due to the exclusion of outliers and errors, and calculating Cronbach's alpha involves listwise deletion. Therefore, Cronbach's alpha was calculated for the maximal number of trials

that permitted up to 90% (between 83.5% and 89.6%) of the sample to have complete data and therefore to be included in the reliability analyses. The bias scores used to determine Cronbach's alpha were calculated following Schmukle (2005); quadruplets were formed of the four different types of reaction time trials that make up a bias score. Trials were listed in order of administration and quadruplets were formed with the next available trial of the type that was needed. Thus, for pretraining bias scores, 43 quadruplets were formed from 172 trials, and bias scores were calculated for each quadruplet. Cronbach's alpha was calculated using these 43 bias scores. Because of missing data, Cronbach's alpha for posttraining bias scores was calculated using only 41 bias scores.

Both the odd-even split-half reliability and Cronbach's alpha were very high and ranged from .96 to .99 for reaction times to specific types of trials (trials in which the probe replaces the neutral word or the anxiety word). The odd-even split-half reliability for the bias scores, however, ranged from .47 (pretraining) to .40 (posttraining). Similarly, Cronbach's alpha for the bias scores was low and ranged from .50 (pretraining) to .33 (posttraining). Results in the current study were the same whether the data were analyzed using reaction times to negative and neutral trials or using bias scores. Therefore, although reaction times to negative and neutral trials possess much greater internal consistency than bias scores, results will be reported using bias scores for ease of comprehension.

Main Analyses of the Effects of the Attention Training

H1: Training with the dot probe task will differentially affect the attend-negative and the attend-neutral groups' attentional biases. Training will cause an attentional bias

toward negative words in the attend-negative group and toward neutral words in the attend-neutral group. This hypothesis was partially supported in that training differentially affected the two groups' attentional biases once analogue depression was included as a covariate. Training caused an attentional bias toward negative words in the attend-negative group, but did not affect the attentional bias of the attend-neutral group. Attentional bias scores were first analyzed using a mixed-design 2 X 2 analysis of variance (ANOVA) with Experimental Condition (attend negative vs. attend neutral) as the between-groups factor and Time (pretraining vs. posttraining) as the repeated measures factor. There were no significant main effects, and the predicted Experimental Condition X Time interaction was not significant, $F(1, 65) = 2.53$, $p = .12$, $\eta_p^2 = .04$.

However, because the interaction approached a trend ($p = .12$), exploratory analyses were conducted using independent samples *t* tests to clarify the form of this interaction. Attentional bias scores pretraining did not differ between the attend-negative ($M = -3.77$, $SD = 19.07$) and the attend-neutral group ($M = -1.87$, $SD = 13.28$), $t(65) = -.47$, $p = .64$. Posttraining, however, the attend-negative group took longer to respond to probes that replaced neutral words than to probes that replaced negative words. In contrast, the attend-neutral group took longer to respond to probes that replaced negative words than to probes that replaced neutral words. Thus, posttraining, the attend-negative group to showed a bias toward negative words ($M = 4.77$, $SD = 16.77$) and the attend-neutral group showed a bias toward neutral words ($M = -2.32$, $SD = 15.39$), and there was a trend for these biases to differ significantly from each other, $t(65) = 1.80$, $p = .08$, $r = .22$. Within subjects *t* tests for each condition alone showed that the attend-neutral group's attentional bias scores did not change from pretest to posttest (*M*s = -1.87 to -

2.32), $t(31) = .12$, $p = .91$. The attend-negative group's attentional bias scores, however, increased from pretest to posttest (Ms = -3.77 to 4.77), $t(34) = -2.09$, $p = .04$, $r = .34$.

Because the two groups differed on the analogue depression measure at baseline, the omnibus ANOVA described above was rerun as an ANCOVA with analogue depression as a covariate. There was now a main effect of Time reflecting that, averaged across both groups, attentional bias toward negative words increased. Of more interest was the predicted Experimental Condition X Time interaction, $F(1, 64) = 4.55$, $p = .04$, $\eta_p^2 = .07$ (See Figure 2). Hierarchical regression was used to determine that Experimental Condition accounted for 6.40% of the variance in change in attentional bias scores while analogue depression pretraining accounted for 3.10% of the variance (higher analogue depression pretraining was associated with experiencing a larger change in attentional bias).

In sum, at pretest both groups showed some tendency to respond faster to probes that replaced neutral words than to probes that replaced negative words. Attention training had the predicted effect on the attend-negative group and increased their attentional bias toward negative words. Attention training had little effect on the attend-neutral group; they were already responding faster to probes that replaced neutral words than to probes that replaced negative words and attention training did not appreciably enhance that.

H2: Attention training toward negative versus neutral words will not affect mood prior to the stressor. As hypothesized, attention training toward negative versus neutral words did not directly affect mood. (It was hypothesized that the attention training would instead only affect emotional vulnerability following a stressor.)

To test for any effects of attention training on mood prior to the stressor, a mixed-design 2 X 2 X 3 ANOVA was performed with Experimental Condition (attend negative vs. attend neutral) as the between-groups factor and two repeated measures factors, Analogue Scale Type (anxiety vs. depression) and Time (pretraining, posttraining, and after a 4-minute rest). There was a significant main effect of Time, $F(2, 65) = 26.44$, $p < .001$, $\eta_p^2 = .29$, reflecting that from pretraining to posttraining both groups increased in self-reported anxiety and depression, but to the same extent. Following the 4-minute rest both groups returned close to baseline on self-reported anxiety and depression. MacLeod et al. (2002) found a similar increase in negative mood during attention training, and they included the rest break to help dissipate any direct effects training had on mood. In both the MacLeod et al. study and the current study, the rest break appeared to accomplish this goal. In the current study, in addition to the main effect of Time, there was also a main effect of Experimental Condition, $F(1, 65) = 9.49$, $p < .01$, $\eta_p^2 = .13$, reflecting that starting at baseline pretraining and across the other two time points the attend-negative group was consistently higher than the attend-neutral group on self-reported anxiety and depression. This finding highlights the failure to randomize on mood. There were no interactions between Experimental Condition and mood, confirming that, as predicted, attention training did not differentially affect one group's mood prior to the stressor.

H3: The attend-neutral group will report less anxiety and depression in response to the anagram stressor than the attend-negative group. This hypothesis was not supported. Contrary to prediction, the attend-negative and the attend-neutral groups reported equivalent increases in negative affect following the stressor. Congruent with this finding, the attend-negative and attend-neutral groups did not differ in their self-

report of how stressful they found the anagram task to be (*M*s = 4.94 vs. 5.19 respectively on a scale ranging from 1, *not at all stressful*, to 7, *extremely stressful*), $t(63) = -.62$, *ns*. These results did not change when analogue depression was included as a covariate in an ANCOVA.

Both the attend-negative and the attend-neutral group reported feeling slightly worse after the stressor than before, but to the same extent. The pattern was the same whether examining the change in scores on the analogue anxiety and depression scales or on the PANAS from pre- to poststressor. First, change on the anxiety and depression analogue scales from pre- to poststressor was examined using a mixed-design 2 X 2 X 2 ANOVA with Experimental Condition (attend negative vs. attend neutral) as the between-group factor and two repeated measures factors, Time (prestressor vs. poststressor) and Analogue Scale Type (anxiety vs. depression). There was a large main effect of Time reflecting that, as predicted, collapsing across groups the stressor caused combined analogue anxiety and depression scores to increase from pre- to poststressor (from $M_{\text{prestressor}} = 10.22$ to $M_{\text{poststressor}} = 14.49$), $F(1, 65) = 39.35$, $p < .001$, $\eta_p^2 = .38$. This finding served as a manipulation check and suggested that participants experienced the stressor as somewhat upsetting.

There was also a main effect of Experimental Condition, indicating that the attend-negative group had higher mean scores overall (averaging pre- and poststressor scores) than the attend-neutral group on the combined analogue anxiety and depression scales ($M_{\text{attend-negative}} = 13.73$ vs. $M_{\text{attend-neutral}} = 10.98$), $F(1, 65) = 5.81$, $p < .05$, $\eta_p^2 = .08$. This effect reflected the failure to randomize completely on mood at baseline. Contrary to prediction, there was no interaction between Experimental Condition and Time,

indicating that both groups' scores on the analogue scales increased to the same extent following the stressor.

Results were similar when the analysis was repeated as an ANCOVA, including analogue depression at baseline as a covariate. There was still a main effect of Time reflecting that, as predicted, across both groups the stressor caused analogue anxiety and depression scores to increase from pre- to poststressor ($M_{prestressor}$ = 10.25 to $M_{poststressor}$ = 14.52), $F(1, 64) = 11.24$, $p < .001$, $\eta_p^2 = .15$. The main effect of Experimental Condition, however, was no longer significant after controlling for baseline depression. Exploratory examination of the analogue anxiety scale change scores, controlling for analogue depression at baseline, revealed that the attend-negative group did show a somewhat larger increase in analogue anxiety from pre- to poststressor ($M = 4.91$, $SE = 1.23$) than the attend-neutral group ($M = 3.54$, $SE = 1.29$), but this difference was not significant, $F(1, 64) = .57$, $p = .45$, $\eta_p^2 = .01$.

Thus, analyses of the analogue mood scales suggested that, contrary to predictions, the attend-neutral group did not report less negative affect following the stressor than the attend-negative group. Analyses of the negative PANAS scores yielded similar results. The change in scores on the negative scale of the PANAS from pre- to poststressor was analyzed using a mixed-design 2 X 2 ANOVA with Experimental Condition (attend negative vs. attend neutral) as the between-group factor and Time (prestressor vs. poststressor) as the repeated measures factor. There was a large main effect of Time reflecting that, as predicted, collapsing across groups the stressor caused negative PANAS scores to increase from pre- to poststressor ($M_{prestressor}$ = 13.53 to $M_{poststressor}$ = 17.20), $F(1, 65) = 35.01$, $p < .001$, $\eta_p^2 = .35$. This finding confirmed that

participants experienced the stressor as somewhat upsetting. Contrary to prediction, there was no interaction between Experimental Condition and Time, indicating that both groups' negative PANAS scores increased to the same extent following the stressor.

Extreme outliers, however, appeared to be influencing these findings. Skewness and kurtosis values were calculated for negative PANAS change scores for each experimental condition separately and then converted into *z*-scores. These analyses showed that the attend-neutral condition's scores were skewed ($z = 5.5$). Using a box plot, extreme outliers in each experimental condition were identified as values that were greater than the upper quartile + 3 (interquartile range) or lower than the lower quartile − 3 (interquartile range). Three extreme outliers were identified (all in the attend-neutral condition) and removed, correcting the skewed distribution ($z = 1.48$). The variances still were not equal, however, so an independent samples *t*-test that did not assume equal variances was conducted to compare the two groups' change scores on the negative PANAS from pre- to poststressor. With the 3 outliers removed, the attend-negative group showed a trend toward the predicted larger increase in negative PANAS scores than the attend-neutral group (*M*s = 3.69 vs. 2.14), $t(52.56) = 1.69$, $p < .10$, $r = .23$.

An ANCOVA was then performed with the 3 outliers removed and with two covariates: the analogue depression score and the negative PANAS score from the beginning of the main experiment. In the ANCOVA, the predicted interaction between Experimental Condition and Time was not significant. Hierarchical regression on the sample minus the 3 outliers revealed that the negative PANAS at baseline accounted for 10.7% of the variance in change in negative PANAS scores from pre- to poststressor. Analogue depression at baseline accounted for an additional 4.1% of the variance and

experimental condition accounted for a mere 0.6% of the variance. The entire model accounted for 15.4% of the variance in change in negative PANAS scores. In sum, participants in both groups found the stressor mildly upsetting, but to the same extent. There were some suggestions that outliers might be contributing to this null finding, but overall it appears that, contrary to predictions, the attend-neutral group did not find the stressor less upsetting than the attend-negative group.

H4: The attend-negative group will consume more calories than the attend-neutral group during the taste test following the stressor. This hypothesis was not supported. Contrary to prediction, both groups consumed a statistically identical number of calories. Although the attend-negative group did consume more calories (M = 431.45 calories, SD = 231.91) than the attend-neutral group (M = 375.24 calories, SD = 171.21), this difference was not significant, $t(62.33) = 1.14$, $p = .26$, $r = .14$. When these analyses were redone using ANCOVA with analogue depression as a covariate, pretraining analogue depression predicted calories consumed and condition did not. High analogue depression prior to beginning the experiment was associated with consuming more calories regardless of condition, $r(65) = .33$, $p < .01$. This correlation provides supporting evidence for the study's assumption that worse mood is associated with eating more. In addition, worse mood on the negative PANAS immediately prior to the taste test was associated with consuming more calories, $r(65) = .36$, $p < .01$.

Although the two groups consumed the same number of total calories, exploratory analyses were conducted to determine whether the attend-negative group consumed more calories of M&M's, cookies, or potato chips than the attend-neutral group. The attend-negative group did consume more M&M's than the attend-neutral group, but the two

groups consumed a statistically equivalent amount of cookies and potato chips. Examining the full sample, the attend-negative group ate more calories of each of the three foods, but they only consumed significantly more calories of M&M's (M = 75.57 calories, SD = 86.91) than the attend-neutral group (M = 42.35 calories, SD = 38.41), $t(47.69) = 2.05$, $p = .04$, $r = .28$. When this analysis was redone using ANCOVA with analogue depression as a covariate, pretraining analogue depression predicted M&M calories consumed and condition no longer did. In sum, the attend-negative group ate significantly more candy calories than the attend-neutral group, but it appears that any differences between the groups in calories consumed were probably due to failure to randomize completely on mood.

Effect of attention training on the subgroup high in anxiety. Because these findings only partially replicated MacLeod et al.'s original findings, two subgroups were analyzed post hoc. First, exploratory analyses were conducted with the top one-third of the sample on trait anxiety as measured by the STAI-T at screening. The decision to examine this subgroup separately was based on two findings: (a) positive results for attention training have generally been found only with anxious samples (with the notable exception of MacLeod et al., 2002), and (b) anxious samples show an attentional bias toward threatening stimuli that can be modified by attention training. Indeed, in this entire sample, higher trait anxiety on the STAI-T (which was assessed during screening approximately 2 weeks to 2 months prior to the experiment) was associated both with showing a higher attentional bias score for threat on the pretest at the trend level ($r = .21$, $p = .08$) and with showing greater change in attentional bias score toward avoiding threat regardless of condition ($r = .25$, $p < .05$).

For these reasons, the top one-third of the sample on trait anxiety was analyzed separately as a group. This group had STAI scores between 42 and 49. (Participants were originally selected for the study if they were in the middle 50% of the screening sample on trait anxiety, which explains the limited upper range of STAI scores.) This group with higher anxiety was small (n = 23) and not the originally planned sample, and multiple tests were conducted, so results on this subgroup should be taken only as suggestive. Due to the small sample size and perhaps due to their limited range on trait anxiety, the attend-negative and the attend-neutral groups no longer differed on any pretraining measures of mood (all ps > .13). When the attend-negative and the attend-neutral group were compared on the four primary outcome measures from the experiment, only one was a trend and one neared a trend due in part to the small sample size. All effect sizes, however, were higher than with the full sample, and ranged from small to medium.

Although the attend-neutral and attend-negative groups did not differ significantly in their attentional bias change scores, the direction of the results was interesting. In these exploratory analyses, the attend-negative group increased in vigilance for negative words from pre- to posttraining ($M_{\text{change score}}$ = -7.19, SD = 26.23) while the attend-neutral group decreased ($M_{\text{change score}}$ = 11.53, SD = 30.72), $t(21) = -1.56$, p = .13, r = .32 (a medium effect size). Both groups increased in anxiety and depression following the stressor, but the attend-negative group showed a trend toward the predicted greater increase on the combined depression and anxiety analogue ratings ($M_{\text{change score}}$ = 6.32, SD = 5.98) than the attend-neutral group ($M_{\text{change score}}$ = 3.06, SD = 2.48), $t(18.71) = 1.82$, p = .09, r = .39 (a medium effect size; see Figure 3). Increases in negative affect on the PANAS from pre- to poststressor followed the same pattern but were not significant; the attend-

negative group increased more in negative affect following the stressor ($M_{\text{change score}}$ = 4.14, *SD* = 4.64) than the attend-neutral group ($M_{\text{change score}}$ = 2.00, *SD* = 2.74), but not significantly so, $t(20.92) = 1.39$, $p = .18$, $r = .29$. Finally, during the taste test following the stressor, the attend-negative group consumed more calories (*M* = 481.48, *SD* = 270.18) than the attend-neutral group (*M* = 403.86, *SD* = 229.04), but this difference was not significant, $t(21) = .71$, *ns*, $r = .15$.

In sum, examining only the subgroup of participants high in anxiety, attention training may have changed participants' attentional bias scores in the predicted direction, and the effect size was medium. The attend-negative group showed some signs of the predicted heightened emotional vulnerability to the stressor compared with the attend-neutral group. Contrary to predictions, the two groups ate an equivalent number of calories.

Effect of attention training on the subgroup who did not guess the study's purpose. After examining the subgroup of participants high in anxiety, one other subgroup was considered: the unsuspecting participants. Unsuspecting participants did not guess the anagram task involved deception and did not accurately guess elements of the study's goals. Suspecting participants, in contrast, either reported no surprise when the anagram task was debriefed or guessed elements of the study's goals accurately. Four participants guessed that the study investigated, as one participant put it: "How much you eat after a stressful experience." No participants, however, guessed that the attention training was designed to affect their emotional vulnerability in response to a stressor.

Participants in the attend-negative group were no more likely to be suspecting than participants in the attend-neutral group (30.77% versus 34.78%), $\chi^2 (1, N = 49) =$

.09, *ns*. Suspecting was not associated with any of the relevant outcome variables (all *p*s > .20). Purely descriptively, however, among only the unsuspecting participants, the attend-negative group did eat more calories than the attend-neutral group (mean calories consumed = 505.45 vs. 375.36), $t(31) = 1.60$, $p = .12$, $r = .28$. The *n* was small in this analysis, but this close-to-medium effect size is double the small effect size found for the sample as a whole (in the whole sample, mean calories consumed by the attend-negative vs. the attend-neutral group = 431.45 vs. 375.24), $t(62.33) = 1.14$, *ns*, $r = .14$.

H5: The attend-negative group will report eating more than the attend-neutral group for the rest of the day after leaving the experiment. This hypothesis was not supported. The attend-negative group reported eating the same amount as the attend-neutral group, *M*s = 3.88 versus 3.83 on a scale ranging from 1 (*much less than usual*) to 4 (*as much as usual*) to 7 (*much more than usual*); $t(60) = .18$, *ns*.

H6: At the 1-day follow-up, the attend-negative and the attend-neutral group will report equivalent levels of negative affect. This hypothesis was supported, and the two groups reported equivalent levels of negative affect. Examining negative PANAS scores at the 1-day follow-up, there was a trend for the attend-negative group to report being in a worse mood ($M = 14.64$, $SD = 4.55$) than the attend-neutral group ($M = 12.62$, $SD = 4.92$), $t(60) = 1.67$, $p < .10$, $r = .21$. This finding disappeared once participants' mood at the beginning of the experiment was controlled for by examining participants' change scores on the negative PANAS from the beginning of the experiment to the 1-day follow-up. Then the attend-negative and the attend-neutral groups had equivalent change scores (*M*s = .24 vs. -.24 where a larger score indicates a larger increase in negative mood); $t(60) = .41$, *ns*.

H7: At the 1-month follow-up, the attend-negative and the attend-neutral group will report equivalent emotional eating frequency, equivalent change in general psychological distress since baseline, and equivalent change in BMI since baseline. This hypothesis was partly supported. As predicted, the groups were equivalent on emotional eating and binge eating at the 1-month follow-up. Surprisingly, however, the attend-negative group reported an improvement in general distress from baseline in comparison to the attend-neutral group who reported a decline. The attend-negative group also reported greater weight loss since baseline than the attend-neutral group. These findings remained essentially the same when the sample included the four participants excluded because they responded too late to the follow-up.

The 1-month follow-up was designed to collect pilot data and to confirm that at 1 month there would be no differences between groups on emotional eating or change in general distress. The attend-negative and attend-neutral groups were indeed equivalent at 1-month follow-up on emotional eating (*M*s = 2.38 vs. 2.50 on a scale in which 2 means *seldom* and 3 means *sometimes* having a desire to eat when feeling a range of negative emotions), $t(48) = -.68$, *ns*. The attend-negative and attend-neutral groups were also equivalent at 1-month follow-up in how often they reported binge eating over the past 4 weeks (*M*s = 1.61 vs. 1.55 binges a week), $t(48) = .12$, *ns*.

At baseline during the main experiment, the attend-negative group reported experiencing more general psychological distress over the past week than the attend-neutral group on the total DASS. At 1-month follow-up, contrary to expectations, the attend-negative group decreased in general distress on the total DASS from baseline, while the attend-neutral group increased. The attend-negative group decreased an average

of 2.6 points on the total DASS (*SD* = 13.16) while the attend-neutral group increased an average of 4.64 points (*SD* = 11.20), and the difference between the two groups' DASS change scores was significant, $t(47) = -2.03$, $p < .05$, $r = .28$. When this finding was examined separately by condition, a paired-samples *t*-test revealed that the attend-negative group decreased on the total DASS, but not significantly so (from $M = 23.86$ to 21.26, $t(27) = 1.05$, $p = .31$, $r = .20$), while there was a trend for the attend-neutral group to increase on the total DASS (from $M = 17.00$ to 21.63, $t(20) = -1.90$, $p < .08$, $r = .39$).

In exploratory analyses, the three individual subscales that form the total DASS were then examined separately. Among these 7-item subscales administered at the follow-up, however, only the stress subscale showed adequate internal consistency (Cronbach's alpha = .77), while the depression and anxiety subscales were unacceptably low (Cronbach's alpha = .62 and .50 respectively). The low internal consistency of the depression and anxiety subscales limits the interpretability of the findings that examine these measures separately and increases the likelihood that the findings are due to chance. Nevertheless, these exploratory analyses were conducted in an effort to clarify the findings using the total DASS and the stress subscale, which did show adequate internal consistency.

The attend-negative and the attend-neutral group differed at the .05 level in change scores on the stress scale and the anxiety scale, but they were equivalent in change scores on the depression scale. When the findings were examined separately by experimental condition, a paired-samples *t*-test revealed that the attend-negative group decreased significantly on the DASS anxiety scale (from $M = 6.29$ to 4.49, $t(27) = 2.61$, $p < .05$, $r = .45$), while the attend-neutral group increased slightly in anxiety but not

significantly so (from $M = 3.95$ to 4.67, $t(20) = -.67$, *ns*, $r = .15$). The attend-negative group decreased on the DASS stress scale but not significantly, while the attend-neutral group increased in stress but only at the trend level ($p = .10$).

Thus, the attend-negative group reported a significant decrease in anxiety during the month between the experiment and the follow-up while the attend-neutral group reported an increase in stress at the trend level. These patterns contributed to the significant difference in direction between the two groups' change scores in general distress on the total DASS over 1 month. Congruent with these findings and similarly contrary to original expectations, there was a trend for the attend-negative group to report greater weight loss than the attend-neutral group during the month between the experiment and the follow-up (-1.08 BMI units vs. -.48 BMI units), $t(48) = -1.93$, $p < .06$, $r = .27$.

Discussion

The present investigation hypothesized that training with the dot probe task would differentially affect the attend-negative and the attend-neutral groups' attentional biases. This hypothesis was supported thus replicating one of MacLeod et al.'s (2002) findings. The present effect was not as pronounced as in MacLeod et al., however, and although the attend-negative group developed the predicted attentional bias toward negative words, the attend-neutral group did not significantly increase in attentional bias toward neutral words. Moreover, the finding was significant only after controlling for differences in baseline depression. It has recently been suggested, however, that individual differences in depression should perhaps be included as a covariate in analyses of attentional bias (Bar-Haim et al., 2007).

To facilitate comparison between the strength of MacLeod et al.'s (2002) attention training and the current investigation's training, attentional bias scores were calculated for MacLeod et al. Study 1 and 2 (using only the long exposure condition from Study 1). In Study 1 and 2, the attend-negative group's mean attentional bias score increased by 13 and 19 ms respectively, whereas in the current study, using a different sample and training software, scores increased only 8.54 ms. In MacLeod et al. Study 1 and 2, the attend-neutral group's mean attentional bias score decreased 17 and 7 ms respectively, whereas in the current study their score decreased 0.45 ms.

Given that the attend-neutral training had no effect in the current study, it is not surprising that attention training had no subsequent effect on emotional vulnerability. MacLeod et al. (2002) observe that their study did not determine whether the attend-neutral condition decreased emotional vulnerability or the attend-negative condition

increased emotional vulnerability or both. The present study, because there was no effect of training on the attend-neutral group's attentional bias, suggests that perhaps, in MacLeod et al., it was the attend-neutral condition that decreased emotional vulnerability. Clinical trials of attention training (Amir & Beard, 2007; Schmidt et al., 2007) support this conclusion because these trials evaluate an attend-neutral condition, but no attend-negative condition, and the attend-neutral condition leads to decreased anxiety.

For unclear reasons, the attend-negative training did not create as large a shift in attentional bias as in MacLeod et al. (2002). One possible reason is that having 192 test trials (vs. MacLeod et al.'s 96 test trials), in which the probe was equally likely to replace the negative or the neutral word, served to untrain the bias. This explanation lacks plausibility, however, because the attend-negative group's attentional bias remained despite the added test trials. A second possible reason is that the dot probe task's lack of internal consistency and test-retest reliability in nonclinical samples (Schmukle, 2005) may have contributed to the attend-neutral training showing no effect and to the differences between the MacLeod et al. findings and the current ones. A third possible reason is that the red probes in the present study were too bright and easy to discriminate. MacLeod et al. also used red probes, but the probes may have been more difficult to discriminate. Recent attention training research has not used dots as probes, but rather the letters E and F, or degraded arrows (e.g., >> and <<). Such probes may be more challenging to discriminate than dots, and therefore may help participants remain engaged in the training. A final possible reason the current training was less potent than MacLeod et al.'s training is that some other element of the MacLeod et al. training (which was created using different software than in the present study) caused their

training to be particularly effective. The current study's findings suggest that less potent attention training may be required to train a bias toward negative stimuli than toward neutral stimuli perhaps because readily adopting a bias toward threat, if the situation demands it, is evolutionarily adaptive.

The attend-neutral training in the present study very slightly decreased attentional bias scores in the whole sample, and more substantially (but still not significantly) decreased bias scores in the subgroup with scores in the top one-third of the sample on trait anxiety ($M_{\text{STAI-T}} = 44.73$). In this subgroup, the attend-negative condition increased bias scores to approximately the same extent as in the sample as a whole (7.19 ms and 8.54 ms respectively). However, the attend-neutral group's mean attentional bias score decreased by 11.53 ms in the subgroup high in anxiety compared with 0.45 ms in the sample as a whole. The decrease in the subgroup high in anxiety is comparable with the 11 ms decrease Vasey et al. (2002) reported among the attend-neutral condition after 5 sessions of attention training in a sample high in anxiety (for the whole sample $M_{\text{STAI-T}} = 54.8$; the Vasey et al. attention training program was adapted and used in the current study so similar results are not surprising, although the Vasey et al. study used 5 sessions rather than 1.)

Why was the attend-neutral training more effective for the subgroup high in anxiety than for the sample as a whole? Individuals high in trait anxiety tend to exhibit an attentional bias *toward* threat, perhaps providing more opportunity to train their attention *away* from threat. Individuals with normal anxiety levels tend to exhibit no initial attentional bias toward threat, perhaps making it more difficult to train their attention away from threat. It is also possible that the attentional biases of individuals high in

anxiety are particularly malleable. However, both the subgroup high in anxiety and the sample as a whole showed similar increases in bias scores in the attend-negative condition, suggesting equivalent malleability. (Somewhat surprisingly, in the attend-negative condition at baseline, the subgroup high in anxiety and the sample as a whole had similar mean bias scores: -2.45 and -3.77 respectively. In the attend-neutral condition at baseline, as expected, the subgroup high in anxiety showed a slight bias toward threat while the whole sample did not: 2.19 and -1.87 respectively. In the attend-neutral condition, therefore, there was somewhat more opportunity to train a bias away from threat in the subgroup high in anxiety than in the sample as a whole.)

Due to recruitment difficulties, the current study included participants with a somewhat broader range of trait anxiety scores (in the middle half of the screening sample) than MacLeod et al. (2002) did (in the middle third of their screening sample). Because this broader range included participants with higher levels of trait anxiety, one might have expected the broader range to increase the likelihood of finding an effect of attention training, but it did not. On the contrary, MacLeod et al. recruited a sample with lower mean trait anxiety than in the current study, but successfully trained them to attend away from threat. That this effect was not seen in the current study suggests that perhaps such training requires a more potent version of attention training than the current study employed.

Given that the attend-neutral training did not decrease attentional bias toward threat in the sample as a whole, one might have predicted that training would not modify emotional vulnerability following a stressor, and, indeed, it did not. It seems likely that this failure to replicate MacLeod et al. (2002) occurred because the attention training was

not sufficiently potent. There is some support for this notion in the exploratory analyses of the subgroup highest in anxiety. Among these participants, for whom attention training might be expected to have the strongest effects, the direction of the results analyzing the effect of training on attentional bias was consistent with the MacLeod et al. findings. One might have predicted, therefore, that, for this subgroup, training would modify emotional vulnerability following a stressor, and, indeed, it did at the trend level.

Consistent with the finding in the sample as a whole that both groups showed comparable emotional vulnerability following the stressor, both groups consumed a comparable number of calories during the taste test following the stressor. Among participants unsuspecting of the stressor or the study, however, the attend-negative group consumed more calories than the attend-neutral group, and, although this finding was neither significant nor a trend, it was a close-to-medium effect size. This finding, together with the finding of a correlation between negative mood and calories consumed, supports the study's assumption that if individuals who report emotional overeating tendencies reported an increase in negative mood following the stressor, they would subsequently consume more calories.

In sum, these findings support the conclusion that, although the attend-negative training successfully manipulated participants' attentional bias, attention training in this study was not potent enough to affect emotional vulnerability or calories consumed following a not-always-convincing stressor. It can be theorized that for attention training to have been effective, it would have needed to be spread across multiple sessions or the sample would have needed to report clinical or subclinical levels of anxiety.

Attention training also did not affect participants' negative affect at the 1-day follow-up, and it did not affect the amount of food participants ate for the rest of the day after leaving the experiment. The measure of food consumption for the rest of the day, however, was only a single item and was based on self-report which can be unreliable. At the 1-month follow-up, surprisingly, the attend-negative group reported a decrease in general distress in comparison to the attend-neutral group, who reported an increase. Exploratory analyses showed this finding was due in part to the attend-negative group decreasing significantly in anxiety from baseline to follow-up (a medium sized effect), although the low internal consistency of the anxiety subscale limited the interpretability of this finding. The attend-neutral group also marginally increased in general distress on the total DASS from baseline to follow-up, and this change represented a medium sized effect.

These findings for general distress could be explained by regression to the mean, or they could be a chance finding, particularly given that only 47 participants (70% of the sample) provided complete follow-up data, but these are not the only possibilities. Unfortunately, the DASS was not assessed prescreening, but another measure of distress--the negative scale of the PANAS--was assessed during the screening, three times during the main experiment, and at the 1-day follow-up. The screening time ranged from approximately 2 weeks to 2 months before the main experiment. At all five time points, the attend-negative group reported scores on the negative scale of the PANAS that were approximately 1 point higher than the attend-neutral group reported (whether examining the full sample or the 1-month follow-up sample). During the variable time between the screening and the main experiment, the group differences in mood remained stable and

there was no suggestion of regression to the mean. This finding provides some supporting evidence that the groups' negative mood scores were fairly stable over time and that the attend-negative training could have contributed to the decrease in that group's distress.

Given that the attend-neutral group's attentional bias did not change significantly following training, it seems likely that their trend to increase in general distress on the total DASS is due to regression to the mean. Another possibility is that this finding provides preliminary support for Koster et al.'s (2007) theory that if attend-neutral attention training only encourages late-stage disengagement from threat, it should not decrease anxiety in the long-term and could in fact increase it (due to replicating the pattern sometimes found in high-anxiety individuals of avoiding threat during late-stage processing. It is theorized that such avoidance of threat prevents individuals from learning that the threat is harmless). Koster et al. further theorize that the attend-neutral condition in the MacLeod et al. (2002) study may not provide a sustainable reduction in emotional vulnerability. Rather, they argue, "Attentional avoidance of threat can temporarily reduce emotional reactivity to stress. However, in anxious individuals further strengthening attentional avoidance will probably not be helpful in obtaining a permanent reduction in anxiety" (p. 13).

To explore Koster et al.'s (2007) theory further, the subgroup high in anxiety was examined separately. In this subgroup, attention training decreased the attend-neutral group's attentional bias scores by 11.53 ms. This subgroup, however, showed the same pattern as the full sample, in which the attend-negative group reported a decrease in general distress on the total DASS and the attend-neutral group reported an increase at the 1-month follow-up. This finding, although the sample size is quite small, lends

preliminary support for Koster et al.'s contention that training individuals high in anxiety to avoid threat during later stages of threat processing could be harmful.

Koster et al.'s (2007) contention is not supported by the positive findings emerging from clinical trials of attention training for individuals with social anxiety (Amir & Beard, 2007; Schmidt et al., 2007). Perhaps these trials, in which attention training occurred twice a week for 1 month, successfully reduce preconscious, early attention to threat. It may require many repetitive trials to retrain a preconscious bias. However, MacLeod et al. (2002) with only one session of training in Study 1 caused a 5 ms reduction in attentional bias scores on preconscious trials in the attend-neutral group, in addition to a 17 ms reduction on conscious trials. These findings suggest multiple sessions of training may affect preconscious, early stages of threat processing.

There is some preliminary, meta-analytic evidence that nonanxious individuals show a preconscious attentional bias *away* from threat on dot probe tasks with subliminal trials using words, but some studies have failed to find this small effect (Bar-Haim et al., 2007). If the finding is valid, it lends support for Koster et al.'s (2007) idea that training clinically anxious individuals to avoid threat preconsciously may be therapeutic and may teach them to attend to threat as nonanxious individuals do.

The meta-analysis also found that anxious individuals show a larger attentional bias toward threat on subliminal than supraliminal dot probe trials and the effect size is twice as large (Bar-Haim et al., 2007). Bar-Haim and colleagues conclude "that conscious processes contribute relatively little to the threat-related attentional bias reported in dot-probe studies" (p. 15). The meta-analytic finding lends support to the idea

that for attention training to be maximally therapeutic, it needs to modify early automatic attentional biases toward threat.

No clinical trials of attention training have investigated the long-term effects of training late-stage processing *toward* threat. If individuals do not display a bias, training them to attend to negative words during the late stages of threat processing may, in the short term, increase emotional vulnerability (partly perhaps due to the mood induction-like effect of attending to numerous negative words), but in the long term may function as exposure, inoculating them and improving their mood. By contrast, if individuals do not display an attentional bias toward threat, training them in one session to avoid negative words during the late stages of threat processing may decrease emotional vulnerability in the short term (although in this study it did not), but may in the long-term have no effect, or even a somewhat negative effect.

Almost all attention training studies have compared an attend-neutral condition with a placebo condition in which half the trials are attend-neutral trials and half are attend-negative. This study is the first and only study to include a long-term follow-up of an attend-negative condition. It seems possible, although these findings are preliminary and speculative, that the attend-negative condition (if it only affects late-stage processing) may in fact also be therapeutic. It may have struck some readers as counterintuitive that attention training encourages avoidance of threatening stimuli to treat anxiety when exposure therapy (arguably the most powerful and well-validated, known psychological intervention for anxiety) involves approaching threatening stimuli. More research is required to determine the long-term effects of training attention toward threatening stimuli. Nevertheless, the present investigation's 1-month follow-up provides

preliminary, suggestive evidence that training participants with normal anxiety levels for one session to attend to negative words (most likely in the conscious, late stages of threat processing) may actually serve as therapeutic exposure and decrease general distress at follow-up.

Thus, at least theoretically, both the attend-neutral and the attend-negative condition of attention training could be therapeutic, depending on whether the attention training affects the earlier or later stages of processing. Drawing on the vigilance-avoidance hypothesis (Mogg & Bradley, 1998), in theory, to be therapeutic, the attend-neutral condition would need to affect the early, automatic stages of processing, while the attend-negative condition would need to affect the later, strategic stages of processing. It seems possible that in the current study, the attend-negative training affected the later stages of processing and the attend-neutral training had no significant effect on processing. The conclusion that the attend-negative training affected the later stages of processing is supported by the Koster et al. (2007) finding in a normal undergraduate sample that the attend-neutral condition only affected the later stages of processing and did not decrease anxiety.

In sum, perhaps due to the attend-negative condition serving as a form of exposure, the attend-negative group reported less general distress at the 1-month follow-up. The attend-negative group also reported a trend toward greater weight loss than the attend-neutral group at the 1-month follow-up. It is not known whether this weight loss was intentional, however, at the screening both the attend-negative and the attend-neutral group reported on average wanting to weigh considerably less than their actual measured weight (*M*s = 4.42 vs. 3.41 BMI units), $t(47) = .87$, *ns* (analyses reported in this

paragraph were performed only on those participants who completed the 1-month follow-up for ease of comparison). Indeed, 85.7% of participants reported at screening a desired weight lower than their measured weight. The attend-negative group's measured BMI (M = 27.18, SD = 6.45) and the attend-neutral group's measured BMI (M = 25.73, SD = 5.53) were equivalent and just over the threshold for being considered overweight (BMI $\geq$ 25), according to the World Health Organization (1998). One might expect participants in both conditions to report weight loss because, although they were physically weighed during the experiment, their weight at the 1-month follow-up was obtained by self-report. For undergraduate women (the majority of this sample), measured weight tends to be higher than self-reported weight (Jacobson & DeBock, 2001).

The attend-negative group may, in fact, have lost more weight than the attend-neutral group over the month, or (perhaps due to their on average improved mood) they may have optimistically and incorrectly estimated they lost more weight. Alternatively, the trend may be spurious, particularly given that both groups reported equivalent emotional eating and binge eating frequency at the 1-month follow-up. The finding is suggestive, however, given (a) its close-to-medium effect size, (b) its synchrony with the finding that condition affected mood at the 1-month follow-up, and (c) the plausibility that mood could affect weight loss in a sample reporting tendencies toward emotional eating.

Limitations

An important limitation of all studies using the dot probe task in nonclinical samples is that the reliability of the task has not been established. Schmukle (2005) reported finding neither internal consistency nor test-retest reliability for attentional bias

scores from the dot probe task. The current investigation found very high odd-even split-half reliability and Cronbach's alpha for reaction times to specific types of trials, but not for bias scores. This finding has, to my knowledge, not been reported before for the dot probe task. In the current study, Cronbach's alpha for bias scores was low at both pre- and posttraining (.50 and .33), but considerably higher than the Cronbach's alpha of 0.00 that Schmukle generally found. Schmukle analyzed only 16 bias scores, while the current study analyzed over 40, which probably contributed to the difference in alphas between the two studies. An important conclusion, based on these findings, is that dot probe task studies with nonclinical samples need to include well over 192 test trials to attempt to achieve traditionally acceptable levels of internal consistency for the bias scores.

Another central limitation of this study—perhaps related to the low internal consistency of the bias scores—is that the attend-neutral training had little or no effect on attentional bias scores. Additionally, the attend-negative condition did not modify attentional biases to the same extent that MacLeod et al. (2002) did. Another limitation is that, despite randomization, the groups were not equivalent on negative mood at the beginning of the experiment. This failure of randomization complicated analyses and affected the study's power to detect an effect. An additional limitation is that nearly one third of the sample either suspected that the anagram task involved deception or guessed elements of the study's goals (e.g., that the study evaluated how much food they ate during the taste test). Analyses suggested that unsuspecting participants may have been more likely than suspecting participants to show the predicted pattern in which the attend-negative group consumed more calories than the attend-neutral group following the stressor. One final limitation deserves mention. Following MacLeod et al. (2002), this

investigation evaluated only a single session of attention training. It may be that one session is not enough to reliably change attentional biases and behavior. Both Harris and Menzies (1998) and Reese and McNally (2007) evaluated one session of attention training for individuals with a fear of spiders and failed to decrease anxiety. Amir et al. (2006), however, found an effect for one session of attention training with socially anxious individuals, and they replicated this finding. It seems likely that the efficacy of a single session of attention training depends upon the potency of the attention training and, perhaps, the type and severity of problem the intervention attempts to address.

Future Directions

Given the findings from this investigation, future investigations of attention training may want to consider that the type of computer software and details of the program (such as the exact distance separating the negative and the neutral word or the ease of detecting the probe) may affect the potency of the attention training. For example, if the distance separating the negative and the neutral word is too small or the probe is too bright, participants may be able to view the probe replacing either word out of their peripheral vision without shifting their eye gaze. Such a situation could partially or fully interfere with training. It would be helpful if future research determined which elements of an attention training program affect its potency (e.g. the type of probe, how easy it is to discriminate the probe, whether the stimuli are words or photographs, and whether the contingency between the probe and the type of stimulus the probe follows is explained to participants).

This investigation presented preliminary findings that support the novel idea that training individuals to attend toward threat (presumably during the late stages of

attentional processing) could be an effective intervention in its own right and may be worth exploring. Such an exploration, and indeed attention training research in general, would be aided by research elucidating whether a preconscious bias toward threat can be altered by multiple sessions training attention away from threat. Such research would help solidify the theory behind attention training and help resolve the possible paradox that one study (Koster et al., 2007) found attention training with nonanxious individuals only altered late-stage processing of threat, yet several studies have found it to be clinically effective with anxious individuals. More generally, the field would benefit from fine-grained examinations of the time course of attentional biases toward threat in individuals high in anxiety and controls.

It also might prove fruitful to use event-related fMRI to examine individuals high in anxiety, comparing those who were randomized to and received extensive attention training away from threat with those who received a placebo attention training condition (in which 50% of probes replaced neutral stimuli and 50% replaced negative stimuli). Would the amygdala and associated networks show less reactivity to threatening stimuli following training away from threat?

In addition to attention training, researchers have begun evaluating other new methodologies to correct cognitive biases. One such methodology, interpretation training, resembles attention training in that it uses multiple trials on the computer. Interpretation training attempts to correct maladaptive interpretation biases of ambiguous stimuli that evidence suggests may play a causal role in anxiety (Wilson, MacLeod, Mathews, & Rutherford, 2006). In one version of interpretation training (Beard, Amir, Elias, & Klumpp, 2006), participants read a word (e.g. “embarrassing”) followed by an ambiguous

scenario (“people laugh after something you said”). Participants then answer whether the word and the scenario are related, and receive corrective feedback if they endorse a maladaptive interpretation such as endorsing that “embarrassing” is related to “people laugh after something you said.” An unpublished study (Beard et al., 2006) evaluated eight sessions of this interpretation versus placebo training in a sample ($N = 33$) reporting elevated symptoms of social anxiety and found interpretation training led to a significant reduction in symptoms compared to the control condition.

One session of a different version of interpretation training (Murphy, Hirsch, Mathews, Smith, & Clark, 2007) in a socially anxious sample also produced positive results (lowered anticipated anxiety regarding meeting two strangers) compared to a control condition. This version of interpretation training involves presenting a positive or neutral outcome to a situation the participant might typically envision negatively and then asking a question about the content of the scenario to encourage the participant to process the positive or neutral content. It might be worthwhile to evaluate interpretation training in an analogue sample high on body shape and weight concerns to test whether interpretation training can help participants view ambiguous situations (e.g., a stranger is staring at you) as neutral or positive (“he must think he has seen you before”) rather than as negative (“he must think you look fat”). It also might be worthwhile to test interpretation training as an intervention for emotional overeating or binge eating to help participants automate responding to negative emotions in a way other than eating. In this training, a positive scenario might describe feeling bored and sad while washing the dishes after dinner, but leaving the kitchen and deciding to call a friend (rather than eating more food).

Conclusion

Attention training uses computerized tasks that were not available to prior generations of researchers, and, as such, is a genuinely new, and potentially quite powerful, inexpensive, and easy to disseminate, strategy for altering cognitive processing and emotion. Findings from neuroscience emphasize the necessity of multiple repetitions to help people form new, automatic, well-worn pathways of responding. The repetition provided by attention training with the dot probe task may facilitate the development of such new pathways. Strong findings from independent laboratories are beginning to emerge on the efficacy of attention training with clinical samples (Amir & Beard, 2007; Schmidt et al., 2007).

The current study showed that in a sample with normal levels of anxiety, an attentional bias toward threat can be trained, yet not affect short-term emotional vulnerability or calories consumed following a stressor. The preliminary, unexpected finding that training attention toward threat appeared to decrease general distress in comparison to the attend-neutral condition at the 1-month follow-up is worthy of further exploration given the support for such a phenomenon from the exposure therapy literature and from the vigilance-avoidance hypothesis (Mogg & Bradley, 1998). More generally, the null findings in this study emphasize the probable importance in attention training studies of recruiting a clinically or subclinically anxious sample likely to display an attentional bias toward threat to increase the likelihood of training a bias away from threat. The findings also emphasize the probable importance of utilizing multiple training sessions to increase the likelihood of producing an effect.

Appendix A: Word Lists Used in Dot Probe Task
Taken From MacLeod et al. (2002)

List A

PARKED	SUFFER
DRIED	WOUND
PHYSICS	ATTACKS
SMELLED	VICTIMS
AISLE	TEASE
CONNECTIONS	DISCOURAGED
PASTEL	GLOOMY
MYTHOLOGY	TORMENTED
CLARETS	PANICKY
FETCHING	INSECURE
WAGONS	HORROR
DATA	DEAD
DETAIL	AFRAID
HANDLE	BITTER
HILL	EVIL
SIPPED	FRIGHT
REMARKS	DISEASE
BATTERIES	WORTHLESS
QUANTITY	REJECTED
CREW	BOMB
OWNED	WORST
APPROXIMATE	CATASTROPHE
RACKET	LETHAL
LIGHTED	IGNORED
TRAGIC	RECTOR
TERROR	PUPILS
TRAP	TENT
HAZARD	BALLOT
HOPELESS	FEATHERS
INADEQUATE	TRANSITION
FORLORN	KEYHOLE
COFFIN	EDITED
STRANGLED	SIGNATURE
APPREHENSION	INSTRUMENTAL
FEAR	NOTE
TROUBLE	EVENING
WORRY	INNER
ENEMY	CHECK
DISTRESS	CREATURE
NAUSEA	CONFER
TRAGEDY	REQUEST

SAD	PAT
SUFFERED	RECORDED
DESTROYED	FURNITURE
DAMAGE	CAMPUS
HARM	POND
INFERIOR	SHEARING
SLUGGISH	TEXTURED

List B

FILED	GRAVE
SADDLE	CANCER
VARIABLES	DESPERATE
LEAGUE	DANGER
MUSEUM	DEFEAT
CARS	SHOT
ENJOIN	TRAUMA
SHOP	KILL
CONTEXT	WORRIED
MULTITUDE	POWERLESS
STAGECOACH	DEVASTATED
CURVE	ANGRY
VARIED	THREAT
RECALL	SEVERE
INTEGRAL	SINISTER
BOTTLES	ASSAULT
READ	LOST
TOMATOES	DESPISED
WATERPROOF	HUMILIATED
HOLDER	INJURY
COEFFICIENT	INTIMIDATED
TRACT	AWFUL
SCANS	MOURN
PLANET	SCARED
CONFLICT	DETAILED
DULL	FLEW
MURDER	JUNIOR
AGITATION	FIREPLACE
INCURABLE	RECLAIMED
STRESS	CITIES
HOSTILE	ROLLING
PAIN	LAWS
GRIEVING	HALLMARK
SICKLY	TOKENS
CRY	VIA

ANXIETY	JOURNAL
DYING	LISTS
HURT	CORE
MUTILATED	DECANTING
SUFFOCATING	CONSTITUENT
LONELY	JERSEY
PATHETIC	CLEANERS
VIOLENT	THEREBY
HATRED	FITTED
DISMAL	MIDWAY
FUTILE	ATTIRE
DEATHBED	SOFTENER
UNHAPPY	BRIDGES

Appendix B: Word List for Anagram Task
Taken From MacLeod et al. (2002)

Solutions are given in lower case letters. ns means not solvable.

OLWGFNA	ns
EOTSBT	obtest
EMSTKI	kismet
KDNITE	ns
VDAOCO	ns
GEIDLH	ns
ALLRGON	ns
UTAFIE	ns
DNOEIG	ns
EYEHLK	ns
COMEPR	ns
HREAFTS	fathers
ICIRMOSCC	ns
AINNTRTSO	ns
OFFCIITECN	ns
ACLADIR	radical
SIAAVEBR	abrasive
RISECET	recites
AIPTLRA	partial
PPSORALO	proposal
TRNTHEGS	strength
OSLURDEH	shoulder
NIACUSEOT	tenacious
ITWHEG	weight
RPECACI	caprice
TYIHEASR	hysteria
OIRUPMTPM	Impromptu
AESIDUD	ns
ACANSETIF	fascinate
OLINUES	elusion
VETIIFUG	fugitive
EETMAID	mediate
THGRUOH	through
IUTRUCE	ns
CEENRYEGM	Emergency

Appendix C: Informed Consent Forms

Study of Personality and Mood
Informed Consent Form for General Psychology Students

You are invited to participate in a research study that is being conducted by Tanya Schlam, M.S., who is a graduate student in the Psychology Department at Rutgers University. The purpose of this research is to increase understanding of college students' personality, mood, and behavior. This research is also designed to recruit participants for another study going on this semester. In the current study, you will be asked about your moods and your behaviors in certain situations. This study should last approximately 30 minutes. You may be contacted by e-mail or phone in the next few weeks and asked if you would like to sign up to participate in a 90 minute study and receive 3 research credits.

In this study, you will be asked to complete questionnaires that take approximately 30 minutes to fill out. All of the information you provide will be kept strictly confidential. What confidential means is that your responses are stored with no identifying information about you on them except that there is an ID number on them. In a separate locked drawer, there will be a list that links your name and contact information with that ID number.

Your e-mail responses will be printed and your e-mail address will be removed from your responses. Your original e-mail response will then be deleted from the e-mail account. Your questionnaires will be assigned an ID number. A list linking your name and contact information with this ID number will be kept separate and secure. Besides this ID number, no identifying information about you (e.g. your name or e-mail address) will be recorded on any of the questionnaires or associated with any of the data collected. Tanya Schlam and her research assistants at Rutgers University will record and process all data. The instructor of your general psychology class will never see any of your responses and your responses will have no impact on the grade you receive in the class.

The identity of any individual participating in this study will not be revealed in any report of the study. The following demographic information about you will be collected: your name, e-mail addresses, phone number, age, and ethnicity. Your name, e-mail addresses, and phone number will be stored separately from your questionnaire in a locked drawer in a locked office.

Any risks associated with participation in the study are both minimal and unlikely. It is possible that you may become upset while filling out the questionnaires. If you do become upset, you may ask the experimenter about counseling and appropriate referrals will be provided to you. These referrals will include the names of counseling services on campus that may be able to provide low cost treatment for students. One place on campus that offers students treatment at reduced fees is the Rutgers Psychological Clinic at 732-445-6111. Any fees associated with the counseling will be your financial responsibility.

Participant's Initials _____

This informed consent form was approved by the Rutgers Institutional Review Board for the Protection of Human Subjects on X/XX/XXXX; approval of this form expires on X/X/XXXX.

The potential benefits of participating in this study include an increased awareness of your moods and behaviors. You will also be helping to increase scientific knowledge about college students' moods and behaviors. There is no cost associated with participation in this study. In exchange for filling out the questionnaires today, you will receive 1 research credit toward fulfilling the General Psychology research participation requirement.

Participation in this study is completely voluntary. You may refuse to participate or withdraw from this study at any time without penalty.

Approximately 300 undergraduates will participate in this study. If you are interested in the group results of this study, you may request a copy of the paper reporting this study's findings from Tanya Schlam.

You have been given the opportunity to ask questions and have them answered. If you have further concerns, you may contact the investigator, Tanya Schlam, or her advisor Dr. G. Terence Wilson. Tanya Schlam can be reached at (732) 445-6112 ext. 854. You can also email her at taschlam@eden.rutgers.edu. Dr. Wilson can be reached at (732) 445-2194 or through email at tewilson@rci.rutgers.edu.

The Institutional Review Board (IRB) at Rutgers, the State University of New Jersey, has approved the recruitment of participants for this study. If you have any questions about your rights as a research subject, you may contact:

Rutgers University Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559
Tel: 732-932-0150 ext. 2104
Email: humansubjects@orsp.rutgers.edu

By writing your name below and responding to this e-mail, you are agreeing to participate in this research study and you are agreeing to potentially be contacted about a future study this semester. You may print out a copy of this consent form to keep.

Name of Participant: _____

Date: _____

Signature of Investigator: _____

Date: _____

Name of Investigator: _____

This informed consent form was approved by the Rutgers Institutional Review Board for the Protection of Human Subjects on X/X/XXXX; approval of this form expires on X/X/XXXX.

Study of Perception and Personality
Informed Consent Form for General Psychology Students

You are invited to participate in a research study that is being conducted by Tanya Schlam, M.S., who is a graduate student in the Psychology Department at Rutgers University. The purpose of this research is to increase understanding of the relationship between task performance, personality, and perception. In the current study, you will be asked to fill out some questionnaires about your mood. You will then complete a task on the computer, followed by a puzzle solving task. Finally, you will complete a taste test and be asked to fill out some additional questionnaires. This study should last approximately an hour and a half. You will then be contacted by e-mail or phone tomorrow and approximately one month from now and asked to answer a few more questions over e-mail that together should take approximately 10 minutes. If you answer these follow-up questions you will receive one additional research credit.

All of the information you provide will be kept strictly confidential. What confidential means is that your responses are stored with no identifying information about you on them except that there is an ID number on them. In a separate locked drawer, there will be a list that links your name and contact information with that ID number.

Your e-mail responses will be printed and your e-mail address will be removed from your responses. Your original e-mail response will then be deleted from the e-mail account. Your questionnaires will be assigned an ID number. A list linking your name and contact information with this ID number will be kept separate and secure. Besides this ID number, no identifying information about you (e.g. your name or e-mail address) will be recorded on any of the questionnaires or associated with any of the data collected. Tanya Schlam and her research assistants at Rutgers University will record and process all data.

The identity of any individual participating in this study will not be revealed in any report of the study. The following demographic information about you will be recorded: your name, e-mail addresses, phone number, age, and ethnicity. Your name, e-mail addresses, and phone number will be stored separately from your questionnaire in a locked drawer in a locked office.

Although it is possible that you may become upset while filling out the questionnaires or completing one of the tasks in this study, we do not believe they will cause any more distress than you experience in every day living. If you do become upset, you may ask the experimenter about counseling and appropriate referrals will be provided to you. These referrals will include the names of counseling services on campus that may be able to provide low cost treatment for students. One place on campus that offers students treatment at reduced fees is the Rutgers Psychological Clinic at 732-445-6111. Any fees associated with the counseling will be your financial responsibility.

The potential benefits of participating in this study include an increased awareness of yourself and your behaviors. You will also be helping to increase scientific knowledge about college students' thoughts and behaviors.

Participant's Initials _____

This informed consent form was approved by the Rutgers Institutional Review Board for the Protection of Human Subjects on XX/X/XXXX; approval of this form expires on XX/XX/XXXX.

There is no cost associated with participation in this study. In exchange for filling out the questionnaires today, you will receive three research credits toward fulfilling the General Psychology research participation requirement.

Participation in this study is completely voluntary. You may refuse to participate or withdraw from this study at any time without penalty.

Approximately 64 undergraduates will participate in this study. If you are interested in the group results of this study, you may request a copy of the paper reporting this study's findings from Tanya Schlam.

You have been given the opportunity to ask questions and have them answered. If you have further concerns, you may contact the investigator, Tanya Schlam, or her advisor Dr. G. Terence Wilson. Tanya Schlam can be reached at (732) 445-6112 ext. 854 or through email at taschlam@eden.rutgers.edu. Dr. Wilson can be reached at (732) 445-2194 or through email at tewilson@rci.rutgers.edu. The Institutional Review Board (IRB) at Rutgers, the State University of New Jersey, has approved the recruitment of participants for this study. If you have any questions about your rights as a research subject, you may contact:

Rutgers University Institutional Review Board for the Protection of Human Subjects
Office of Research and Sponsored Programs
3 Rutgers Plaza
New Brunswick, NJ 08901-8559
Tel: 732-932-0150 ext. 2104
Email: humansubjects@orsp.rutgers.edu

By writing your name below, you are agreeing to participate in this research study and you are agreeing to participate in two brief follow-up sessions over e-mail (one tomorrow and one in a month). You will be given a copy of this consent form to keep.

Signature of Participant: _____
Date: _____
Name of Participant (please print): _____

Signature of Investigator: _____
Date: _____
Name of Investigator (please print): _____

***By signing below, you are granting us permission to video tape you during a puzzle task on the computer. This video may be shown in certain classes for demonstration purposes.**

Signature of Participant: _____

This informed consent form was approved by the Rutgers Institutional Review Board for the Protection of Human Subjects on XX/XX/XXXX; approval of this form expires on XX/XX/XXXX.

Appendix D: Screening Questionnaires

The State-Trait Anxiety Inventory and the Eating Disorder Inventory Bulimia Scale are not included due to the questionnaires being copyrighted.

Dutch Eating Behavior Questionnaire

DIRECTIONS: The following questions are about your eating behavior. They refer to your typical eating patterns. For example, if you have recently changed your eating patterns refer to your previous eating behavior when responding to the questions.

1) Do you have the desire to eat when you are irritated?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

2) Do you have the desire to eat when you have nothing to do?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

3) Do you have a desire to eat when you are depressed or discouraged?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

4) Do you have a desire to eat when you are feeling lonely?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

5) Do you have a desire to eat when somebody lets you down?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

6) Do you have a desire to eat when you are cranky?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

7) Do you have a desire to eat when something unpleasant is about to happen?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

8) Do you have a desire to eat when you are anxious, worried or tense?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

9) Do you have a desire to eat when things are going against you or when things have gone wrong?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

10) Do you have a desire to eat when you are frightened?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

11) Do you have a desire to eat when you are disappointed?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

12) Do you have a desire to eat when you are emotionally upset?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

13) Do you have a desire to eat when you are bored or restless?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

14) If food tastes good to you, do you eat more than usual?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

15) If food smells and looks good, do you eat more than usual?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

16) If you see or smell something delicious, do you have a desire to eat it?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

17) If you have something delicious to eat, do you eat it right away?

__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

18) If you walk past the bakery, do you have the desire to buy something delicious?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

19) If you walk past a snackbar or café, do you have the desire to buy something delicious?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

20) If you see others eating, do you also have the desire to eat?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

21) Can you resist eating delicious foods?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

22) Do you eat more than usual, when you see others eating?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

23) When preparing a meal are you inclined to eat something?
__ 1 never
__ 2 seldom
__ 3 sometimes

__ 4 often
__ 5 very often

Items from the Eating Disorder Diagnostic Scale

1. During the past **6 months** have there been times when you felt you have eaten what other people would regard as an unusually large amount of food (e.g., a quart of ice cream) given the circumstances?
YES NO

2. During the times when you ate an unusually large amount of food, did you experience a loss of control (feel you couldn't stop eating or control what or how much you were eating)?
YES NO

3. How many **DAYS per week** on average over the **past 6 MONTHS** have you eaten an unusually large amount of food and experienced a loss of control? 0 1 2 3 4 5 6 7

4. How many **TIMES per week** on average over the **past 3 MONTHS** have you eaten an unusually large amount of food and experienced a loss of control?
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

During these episodes of overeating and loss of control did you…

5. Eat much more rapidly than normal?. . . . . .YES NO

6. Eat until you felt uncomfortably full?. . . . . .YES NO

7. Eat large amounts of food when you didn't feel physically hungry?. . . . . YES NO

8. Eat alone because you were embarrassed by how much you were eating?. . . . . YES NO

9. Feel disgusted with yourself, depressed, or very guilty after overeating?. . . . . YES NO

10. Feel very upset about your uncontrollable overeating or resulting weight gain?. . .YES NO

Questions about dieting

Over the past year how much of the time have you been on a diet in order to control your weight?

1 None or hardly any of the time
2 About a quarter of the time
3 About half of the time
4 About three-quarters of the time
5 Nearly all of the time

Are you currently dieting in order to control your weight?
___ Yes
___ No

Demographic Questions

Your age _____

Your sex:
[ ] Male [ ] Female

What year are you in school?
[ ] first year [ ] sophomore [ ] junior [ ] senior [ ] other (write in)____

<u>Father/father figure's education</u>

Grade School Graduate__
Some High School__
High School Graduate__
Some College__
College Graduate__
Advanced Degree__

<u>Mother/mother figure's education</u>

Grade School Graduate__
Some High School__
High School Graduate__
Some College__
College Graduate__
Advanced Degree__

Is your vision normal or corrected to normal (for example through wearing contacts or glasses)?
[ ] Yes [ ] No

Do you have any food allergies?
[ ] Yes [ ] No

If yes, what are they?

_____

How much do you weigh? If uncertain, please give your best estimate. _____lbs.

How tall are you? _____ft. _____in.

What is your ethnic/racial group? (Please place an X next to one.)

[ ] Asian
[ ] Black or African American
[ ] Hispanic or Latino
[ ] Native American or Alaska Native
[ ] Native Hawaiian or Other Pacific Islander
[ ] South Asian
[ ] White
[ ] Other (write in) _____

Appendix E: Study Questionnaires

The Depression Anxiety Stress Scale

Please read each statement and circle a number 0, 1, 2 or 3 that indicates how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

1	I found myself getting upset by quite trivial things
2	I was aware of dryness of my mouth
3	I couldn't seem to experience any positive feeling at all
4	I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)
5	I just couldn't seem to get going
6	I tended to over-react to situations
7	I had a feeling of shakiness (eg, legs going to give way)
8	I found it difficult to relax
9	I found myself in situations that made me so anxious I was most relieved when they ended
10	I felt that I had nothing to look forward to
11	I found myself getting upset rather easily
12	I felt that I was using a lot of nervous energy
13	I felt sad and depressed
14	I found myself getting impatient when I was delayed in any way (eg, elevators, traffic lights, being kept waiting)
15	I had a feeling of faintness
16	I felt that I had lost interest in just about everything
17	I felt I wasn't worth much as a person
18	I felt that I was rather touchy
19	I perspired noticeably (eg, hands sweaty) in the absence of high temperatures or physical exertion
20	I felt scared without any good reason
21	I felt that life wasn't worthwhile

Reminder of rating scale:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree, or a good part of time
3 Applied to me very much, or most of the time

22 I found it hard to wind down

23 I had difficulty in swallowing

24 I couldn't seem to get any enjoyment out of the things I did

25 I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)

26 I felt down-hearted and blue

27 I found that I was very irritable

28 I felt I was close to panic

29 I found it hard to calm down after something upset me

30 I feared that I would be "thrown" by some trivial but unfamiliar task

31 I was unable to become enthusiastic about anything

32 I found it difficult to tolerate interruptions to what I was doing

33 I was in a state of nervous tension

34 I felt I was pretty worthless

35 I was intolerant of anything that kept me from getting on with what I was doing

36 I felt terrified

37 I could see nothing in the future to be hopeful about

38 I felt that life was meaningless

39 I found myself getting agitated

40 I was worried about situations in which I might panic and make a fool of myself

41 I experienced trembling (eg, in the hands)

42 I found it difficult to work up the initiative to do things

Analogue Mood Scales

At different points during this experiment you will be asked to report your feelings using an analogue mood scale. When this happens, please use the mouse to put the cursor on a point on the line that corresponds with your mood at that particular moment.

Then please press the mouse button to record your decision. You will be asked to do this on the next screen.

Place an X on the line to indicate your current mood:

relaxed……anxious

Place an X on the line to indicate your current mood:

happy ……depressed

Place an X on the line to indicate your current mood:

awake …….sleepy

The Positive and Negative Affect Scales--Negative Scale

On the next few screens you will see a number of words that describe different feelings and emotions. Read each item and then type in the appropriate number as your answer.

Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

1 very slightly or not at all
2 a little
3 moderately
4 quite a bit
5 extremely

__ distressed
__ upset
__ guilty
__ scared
__ hostile
__ irritable
__ ashamed
__ nervous
__ jittery
__ afraid

Hunger Rating

What time is it now? _____

Please estimate (to the nearest 15 minutes) how much time has passed since you last ate something:

_____ hours and _____ minutes

How hungry are you? (*Circle one number.*)

1----------2----------3----------4----------5----------6----------7
not hungry at all extremely hungry

Taste Test Rating Sheet

Taste Test Questions

The experimenter will return in 10 minutes. Please remain seated for that time.

Feel free to eat as much as you need to answer these questions accurately.

Smell each food.

Which of the foods, if any, has the strongest smell?

[ ] 1. Cookies
[ ] 2. M&M's
[ ] 3. Potato chips
[ ] 4. None have a strong smell

Now taste each food.

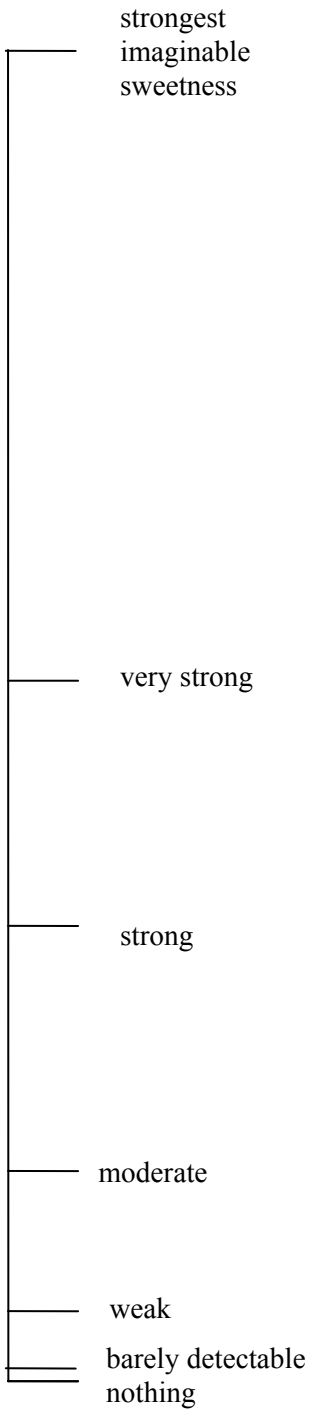
Which food is the crunchiest?

[ ] 1. Cookies
[ ] 2. M&M's
[ ] 3. Potato chips

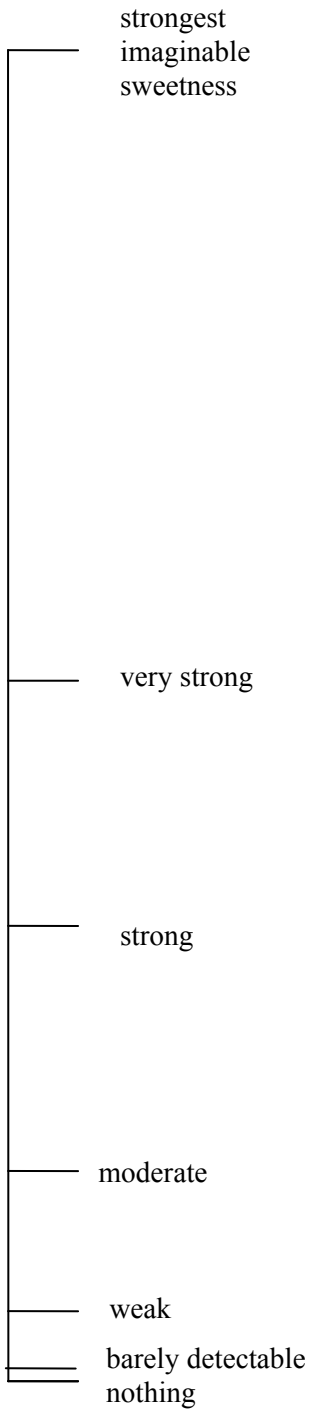
If you could only eat one of these foods, which would it be?

[ ] 1. Cookies
[ ] 2. M&M's
[ ] 3. Potato chips

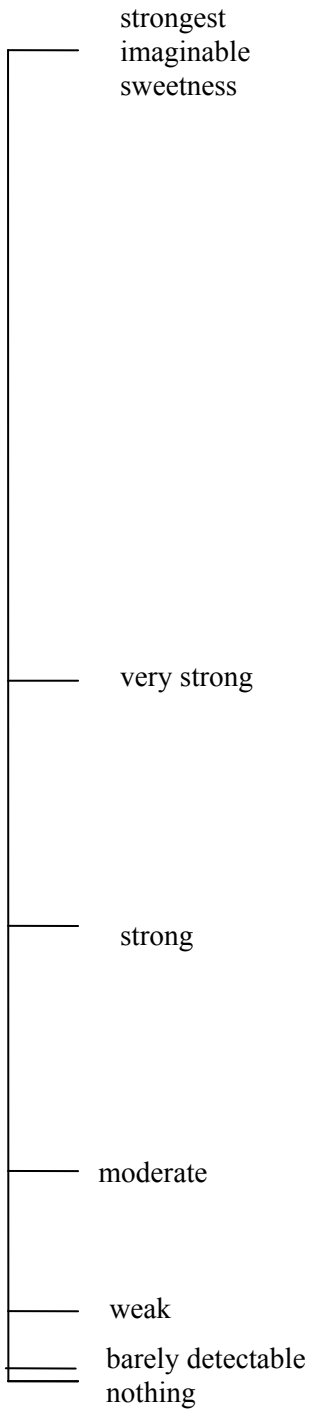
How sweet do the cookies taste to you? (Place an X on the vertical line.)



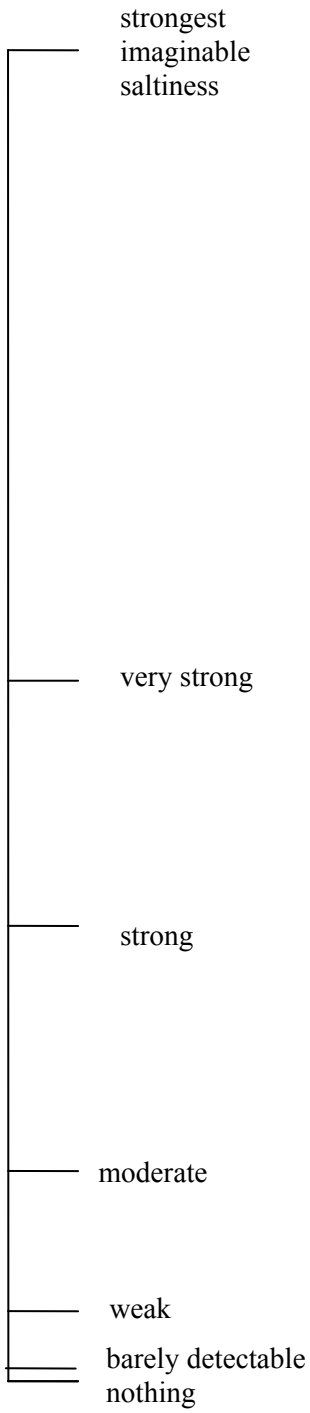
How sweet do the M&Ms taste to you? (Place an X on vertical the line.)



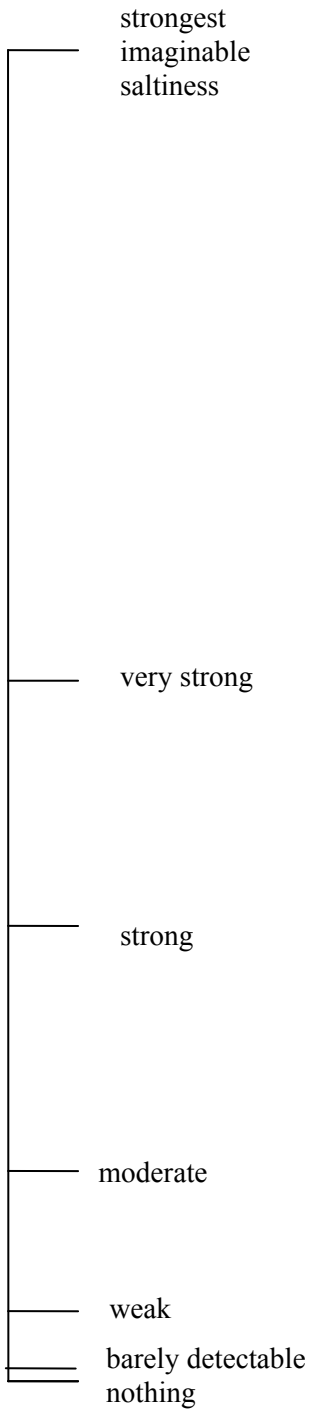
How sweet do the potato chips taste to you? (Place an X on the vertical line.)



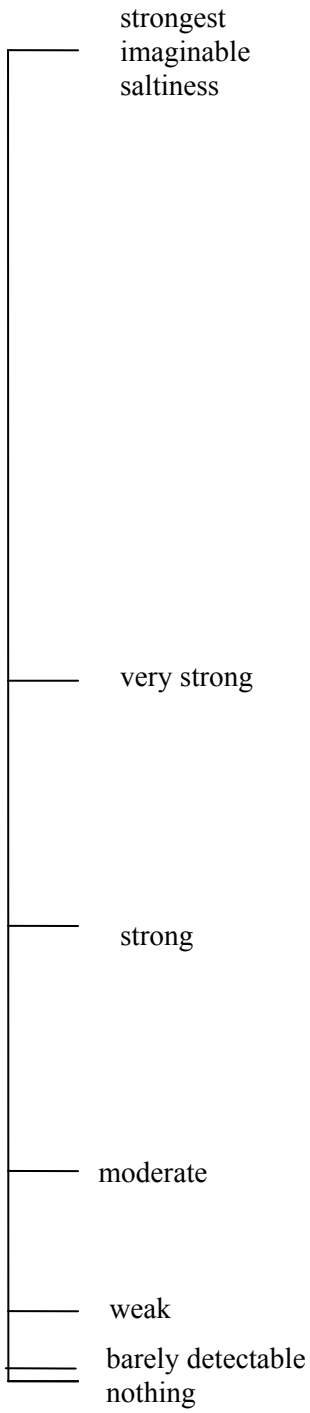
How salty do the cookies taste to you? (Place an X on the vertical line.)



How salty do the M&Ms taste to you? (Place an X on the vertical line.)

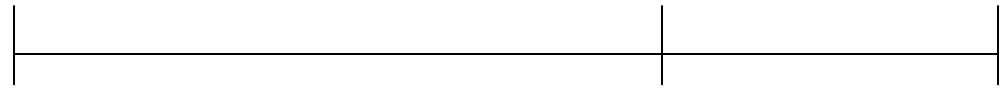


How salty do the potato chips taste to you? (Place an X on the vertical line.)



Do you like or dislike the cookies (*check one*)?
[ ] Like [ ] Dislike

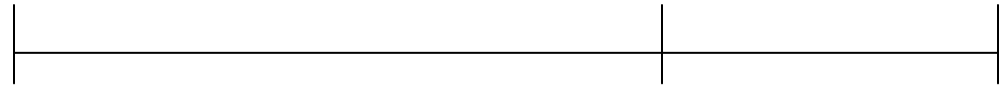
How much do you like or dislike them (*place an X on the horizontal line*)?



0 Extremely

Do you like or dislike the M&Ms (*check one*)?
[ ] Like [ ] Dislike

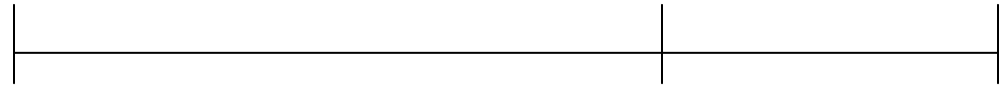
How much do you like or dislike them (*place an X on the horizontal line*)?



0 Extremely

Do you like or dislike the potato chips (*check one*)?
[ ] Like [ ] Dislike

How much do you like or dislike them (*place an X on the horizontal line*)?



0 Extremely

Once you have answered all the questions, feel free to eat more if you like.

If you are a woman, what was the first day of your most recent menstrual period (month/day/year)? (If you don't know, please make your best guess.) _____

How stressful did you find the anagram task (*circle one response*)?

1----------2----------3----------4----------5----------6----------7
not at all stressful extremely stressful

What do you think these studies are about?

_____

_____

_____

One Day Follow-Up Questions

After you left the experiment on Thursday, February 3 [*correct date was added in*], until you went to sleep that night, how much did you eat?

___ 1 much less than usual
___ 2
___ 3
___ 4 as much as usual
___ 5
___ 6
___ 7 much more than usual

Please list below (as best you can remember) specifically what you ate from after the experiment until you went to sleep. Please list approximate quantities as well as approximate caloric values if you know them.

The Positive and Negative Affect Scales—Negative Scale

Indicate to what extent you feel this way right now, that is, at the present moment. Place an X next to your answer.

1) distressed
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

2) upset
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

3) guilty
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

4) scared
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

5) hostile
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

6) irritable
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

7) ashamed
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

8) nervous
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

9) jittery
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately

___ 4 quite a bit
___ 5 extremely

10) afraid
___ 1 very slightly or not at all
___ 2 a little
___ 3 moderately
___ 4 quite a bit
___ 5 extremely

One Month Follow-Up Questions

The Dutch Eating Behavior Questionnaire, Emotional Eating Subscale

DIRECTIONS: The following questions are about your eating behavior. They refer to your typical eating patterns over the past month. Put an X next to your answer.

1) Do you have the desire to eat when you are irritated?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

2) Do you have the desire to eat when you have nothing to do?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

3) Do you have a desire to eat when you are depressed or discouraged?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

4) Do you have a desire to eat when you are feeling lonely?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

5) Do you have a desire to eat when somebody lets you down?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

6) Do you have a desire to eat when you are cranky?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

7) Do you have a desire to eat when something unpleasant is about to happen?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

8) Do you have a desire to eat when you are anxious, worried or tense?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

9) Do you have a desire to eat when things are going against you or when things have gone wrong?
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

10) Do you have a desire to eat when you are frightened?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

11) Do you have a desire to eat when you are disappointed?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often

__ 5 very often

12) Do you have a desire to eat when you are emotionally upset?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

13) Do you have a desire to eat when you are bored or restless?
__ 0 not applicable
__ 1 never
__ 2 seldom
__ 3 sometimes
__ 4 often
__ 5 very often

14) How many TIMES PER WEEK on average over the past 4 WEEKS have you eaten an unusually large amount of food and experienced a loss of control?
_____ (0-14)

15) How much do you weigh? If uncertain, please give your best estimate.
____ pounds

The Depression Anxiety Stress Scale (the DASS-21)

DIRECTIONS: Please read each statement and type an X to indicate how much the statement applied to you *over the past week*. There are no right or wrong answers. Do not spend too much time on any statement.

1) I found it hard to wind down
__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

2) I was aware of dryness of my mouth
__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

3) I couldn't seem to experience any positive feeling at all

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

4) I experienced breathing difficulty (eg, excessively rapid breathing, breathlessness in the absence of physical exertion)
__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

5) I found it difficult to work up the initiative to do things
__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

6) I tended to over-react to situations

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

7) I experienced trembling (eg, in the hands)

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

8) I felt that I was using a lot of nervous energy

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

9) I was worried about situations in which I might panic and make a fool of myself

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

10) I felt that I had nothing to look forward to

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

11) I found myself getting agitated

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

12) I found it difficult to relax

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

13) I felt down-hearted and blue

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

14) I was intolerant of anything that kept me from getting on with what I was doing

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

15) I felt I was close to panic

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

16) I was unable to become enthusiastic about anything

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

17) I felt I wasn't worth much as a person

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

18) I felt that I was rather touchy

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

19) I was aware of the action of my heart in the absence of physical exertion (eg, sense of heart rate increase, heart missing a beat)

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

20) I felt scared without any good reason

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

21) I felt that life was meaningless

__ 0 Did not apply to me at all
__ 1 Applied to me to some degree, or some of the time
__ 2 Applied to me to a considerable degree, or a good part of time
__ 3 Applied to me very much, or most of the time

Thank you very much!

Appendix F: Debriefing Statements

Debriefing of the Anagram Stressor

(This debriefing is an expansion of the one used by MacLeod et al., 2002.)

Before you leave we want to let you know that this experiment involved some deception. You were asked to solve some anagrams in a short amount of time. You were told that most college students can solve 5 or 6 of these anagrams in 3 minutes. In fact, these anagrams were chosen because they are extremely difficult. Indeed, 14 of the 35 anagrams were impossible to solve. If you have any doubt as to whether these anagrams truly were unsolvable, consider one from the actual study: OLWGFNA. There is no way to rearrange these letters to make an English word. Even a computer can't do it!

Everyone was told that they did well below average on the anagram task. How well you were able to solve the anagrams in no way reflects your intelligence or academic ability. You were told the anagrams were easily solvable to create a somewhat stressful situation and to see how this affected your mood.

You also were told that you would be videotaped trying to solve the anagrams and that the video might be chosen to be shown in a class demonstration. We have no intention of using the video, which will be erased shortly. You were only told you were being videotaped to make the situation a little more stressful.

To help make sure this experiment is valid and will help contribute to our knowledge of how people handle a somewhat stressful situation, please do not share the information that the anagrams are difficult and impossible to solve with any Rutgers

students until after the semester ends. Thank you very much for your cooperation and help with this experiment!

After this debriefing, you may withdraw from this study if you want to and the main investigator will remove from the files all record of your involvement. If you wish to withdraw from this study or if you have any questions, let the experimenter know now or you can contact the main investigator Tanya Schlam at taschlam@eden.rutgers.edu or 732-445-6112 x 854.

Final Debriefing Statement

You were selected for this study because on the questionnaires you filled out during the screening you reported normal levels of anxiety (i.e., you did not report being especially anxious) and you reported that you sometimes eat in response to emotions such as stress or sadness.

In the main study, you completed a computer task where you were asked to press one of two keys depending on whether you saw one or two dots. You were randomly assigned to one of two conditions: either the dots almost always replaced a negative word or the dots almost always replaced a neutral word. You then completed a somewhat stressful anagram solving task and reported your mood.

As you have already been told, the anagram solving task was supposed to be stressful and many of the anagrams were extremely difficult. Indeed, 14 of the 35 anagrams were impossible to solve. You were only videotaped during the anagram task to make the situation a little more stressful. The videotape was erased and nobody ever watched it. Finally, although we were interested in how salty and sweet you thought the food was during the taste test, we were also interested in how much of the food you ate and the food was weighed before and after the experiment.

It was predicted that if you were in the group assigned to the condition where the dots almost always replaced a neutral word, you would report a slightly better mood and less frustration than the other group after the anagram task because you would have temporarily gotten used to paying attention to neutral information instead of negative

information. It was also predicted that if you were in the group where the dots almost always replaced a neutral word, you would eat a little less food during the taste test and for the rest of the day because you probably were less frustrated by the anagram task than if the dots had replaced the negative words.

It was predicted that if you were in the group assigned to the condition where the dots almost always replaced a negative word, you would report a slightly worse mood and more frustration than the other group after the anagram task because you would have temporarily gotten used to paying attention to negative information instead of neutral information. It was also predicted that if you were in the group where the dots almost always replaced a negative word, you would eat a little more food during the taste test and for the rest of the day because you probably were more frustrated by the anagram task than if the dots had replaced the neutral words.

Since you were only in a slightly better or slightly worse mood than usual, it is possible that this experiment may not have affected your eating that day at all. By the morning after the experiment, any effect the experiment could have had should have been gone. Nevertheless, if you are disappointed that you didn't get assigned to the condition where the dots almost always replaced a neutral word, we would be happy to arrange for you to complete that condition. If you would like to know which condition you were assigned to, please contact us and we will let you know.

Because the study is not finished, we do not yet know if our prediction that one group would report a slightly better mood and eat a little less was accurate. If you are interested in the group results of this study, you may request a copy of the paper reporting this study's findings from Tanya Schlam, and she will send it to you when it is ready.

Since you reported that you sometimes eat in response to emotions such as stress or sadness, we wanted to let you know about one strategy that you may find helpful to reduce the frequency with which you eat in response to emotions. Many people find it helpful to make sure that they eat regularly. Research suggests that eating 3 meals and 2 to 3 snacks every 3 to 4 hours can be very helpful in preventing overeating and binge eating.

In case you are interested, one place on campus that offers students treatment at reduced fees is the Rutgers Psychological Clinic at 732-445-6111. If you would like information on places that treat eating disorders, please call the Rutgers University Eating Disorders Clinic at (732) 445-2292.

After this debriefing, you may withdraw from this study if you want to and the main investigator will remove from the files all record of your involvement. If you wish to withdraw from this study or if you have any questions, please contact the main investigator Tanya Schlam at taschlam@eden.rutgers.edu or 732-445-6112 x 854.

Thank you for participating in this study.

Appendix G: Tables

Table 1

Means and Standard Deviations of Baseline Characteristics by Condition

	Attend Negative *n* = 35		*Attend Neutral* *n* =32	
Measure	*M*	*SD*	*M*	*SD*
Age	19.06	1.37	18.78	1.07
Tendency toward overeating (at screening)	2.74	0.42	2.71	0.43
Number of binges a week	1.00	1.23	0.70	1.08
Time of day of study	2:10pm	2:45	1:10pm	2:40
Fatigue: 1 (*awake*) to 30 (*sleepy*)	14.00	7.09	12.38	8.02
Hunger: 1 (*not hungry at all*) to 7 (*extremely hungry*)	4.40	1.65	4.58	1.18
Number of minutes since last ate	378.53	265.91	422.10	237.94
Number of days since last menstrual period (for women)	15.52	14.30	16.11	10.82
Experimenter measured body mass index	26.91	6.05	25.69	5.62

Note. The attend-negative and attend-neutral groups did not differ on any of these measures (all *p*s > .14).

Table 2

Means and Standard Deviations of Baseline Negative Emotion Measures by Condition

Measure	*Attend Negative* $n = 35$ *M* (*SD*)	*Attend Neutral* $n = 32$ *M* (*SD*)	*t*	*df*	*p*
State-Trait Anxiety Inventory-Trait (at screening)	40.66 (3.96)	39.36 (4.11)	1.33	65	.19
PANAS negative scale (at screening)	14.89 (4.78)	14.33 (5.65)	.44	65	.66
PANAS negative scale (at baseline of experiment)	14.54 (4.02)	12.75 (2.97)	2.09	62.34	.04
Analogue depression scale (at baseline)	10.46 (5.22)	7.41 (5.23)	2.39	65	.02
Analogue anxiety scale (at baseline)	11.20 (5.93)	8.09 (7.18)	1.94	65	.06
Total Depression Anxiety Stress Scale (at baseline)	25.23 (16.09)	17.31 (9.64)	2.47	56.39	.02

Note. A Bonferroni correction was performed to control for the number of tests performed and a *p* value of .01 was set as the criterion for significance for the experiment's baseline measures.

Table 3

Internal Consistency of the Dot Probe Task Based on Reaction Times and Attentional Bias Scores (in Milliseconds) Pre- and Posttraining

		M (SD)	*Odd-even split-half reliability using the Spearman-Brown formula*	*Cronbach's alpha*
Pretraining				
	Reaction times to trials in which the probe replaced the neutral word	552.12 (51.06)	.99	.97
	Reaction times to trials in which the probe replaced the negative word	554.98 (54.77)	.97	.97
	Attentional bias scores	-2.86 (16.46)	.47	.50
Posttraining				
	Reaction times to trials in which the probe replaced the neutral word	535.94 (57.10)	.97	.96
	Reaction times to trials in which the probe replaced the negative word	534.55 (54.26)	.97	.96
	Attentional bias scores	1.38 (16.40)	.40	.33

Appendix H: Figures

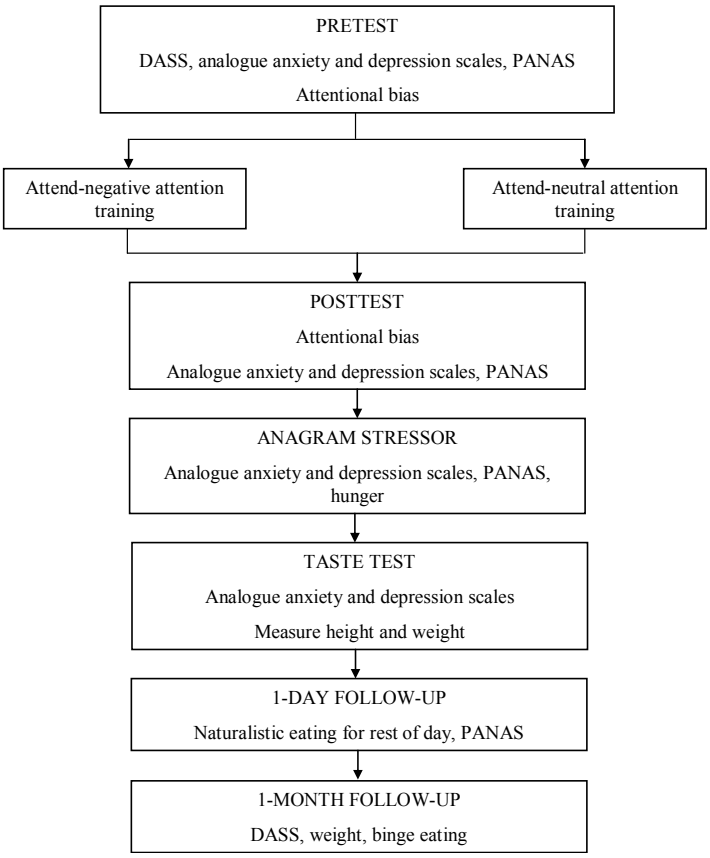


Figure 1. Flow chart of the study design.

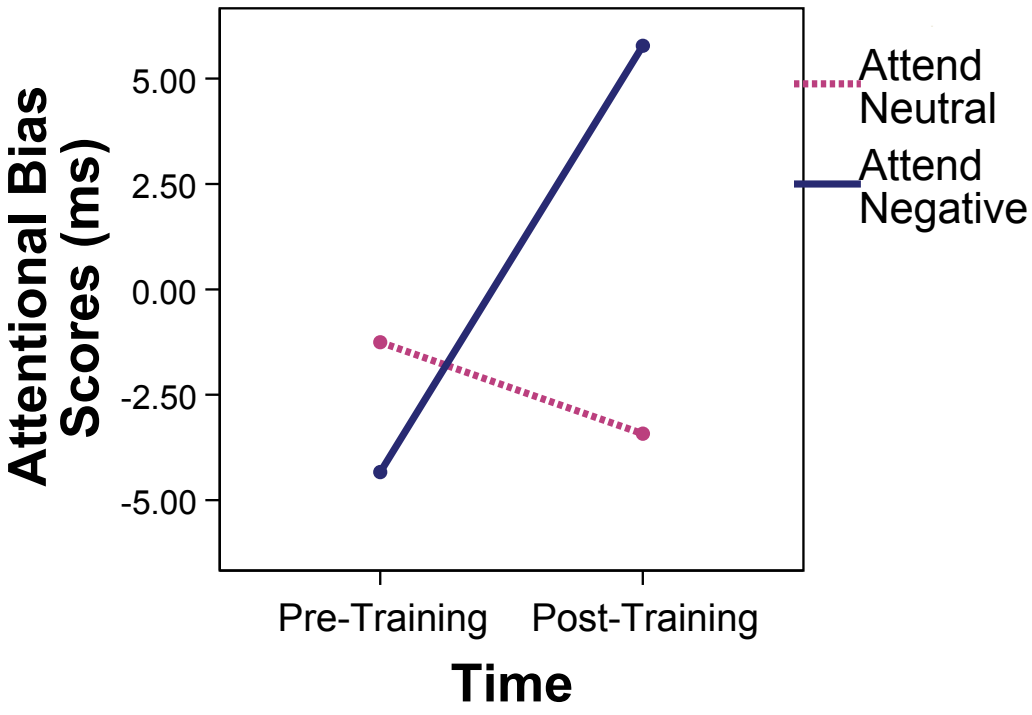


Figure 2. Change in attentional bias scores from pretraining to posttraining controlling for baseline analogue depression score.

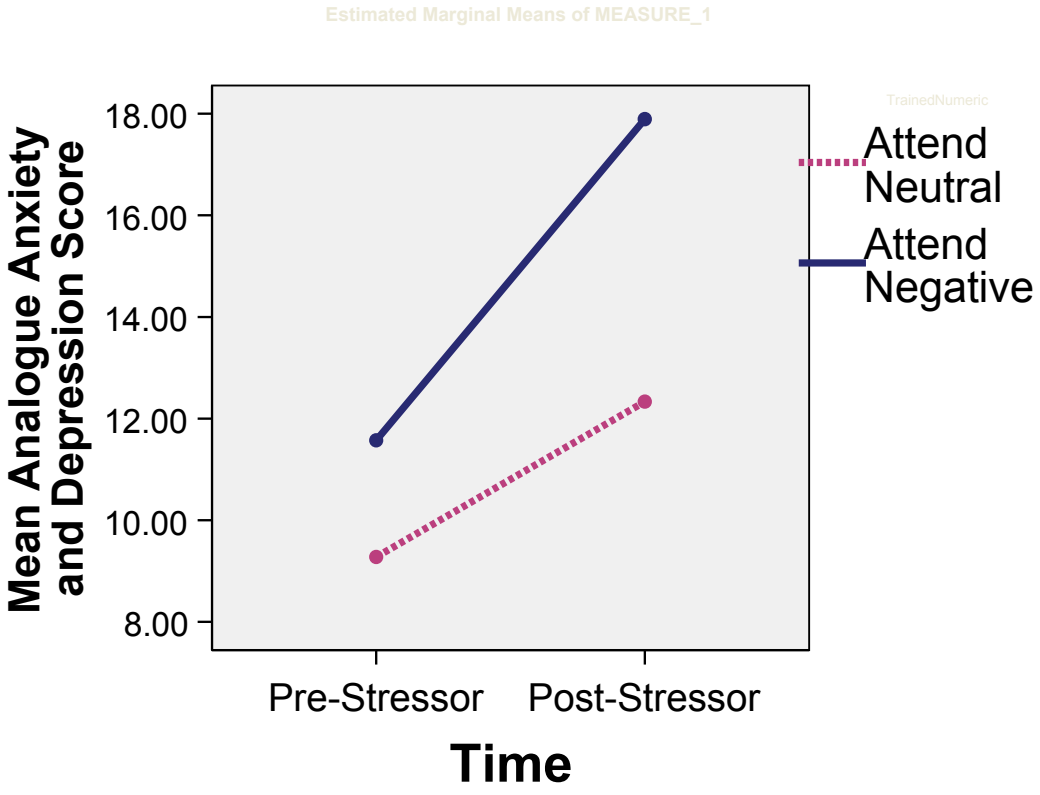


Figure 3. Effect of the stressor on analogue anxiety and depression scores at the trend level for the top one-third of the sample on trait anxiety.

References

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders* (4th ed., text revision). Washington, DC: Author.

Amir, N., Beard, C. L., Klumpp, H., & Elias, J. (2006, November). *Attention training in social anxiety: A randomized, placebo controlled trial*. Paper presented at the 40th annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago.

Amir, N., & Beard, C. (2007, July). Attention and interpretation training as treatments for social anxiety [Abstract]. In Fifth World Congress of Behavioural and Cognitive Therapies Abstract Booklet (p. 145). Barcelona, Spain. Abstract retrieved October 5, 2007, from http://www.wcbct2007.com/downloads/abstract_congress.pdf

Antony, M. M., Bieling, P. J., Cox, B. J., Enns, M. W., & Swinson, R. P. (1998). Psychometric properties of the 42-item and 21-item versions of the Depression Anxiety Stress Scales in clinical groups and a community sample. *Psychological Assessment, 10*, 176-181.

Bar-Haim, Y., Lamy., D., Pergamin, L., Bakermans-Kranenburg, M. J., & Van IJzendoorn, M. H. (2007). Threat-related attentional bias in anxious and nonanxious individuals: A meta-analytic study. *Psychological Bulletin, 133*, 1-24.

Battle, E. K., & Brownell, K. D. (1996). Confronting the rising tide of eating disorders and obesity: Treatment vs. prevention and policy. *Addictive Behaviors, 21,* 755-765.

Beard, C. L., Amir, N., Elias, J., & Klumpp, H. (2006, November). *Interpretation modification in social anxiety: A randomized, placebo controlled trial*. Paper presented at the 40th annual meeting of the Association for Behavioral and Cognitive Therapies, Chicago.

Crowther, J. H., Lilly, R. S., Crawford, P. A., & Shepherd, K. L. (1992). The stability of the Eating Disorder Inventory. *International Journal of Eating Disorders, 12***,** 97–101.

Elmore, D. K., & de Castro, J. M. (1990). Self-rated moods and hunger in relation to spontaneous eating behavior in bulimics, recovered bulimics, and normals. *International Journal of Eating Disorders, 9***,** 179–190.

Fisher, P. L., & Durham, R. C. (1999). Recovery rates in generalized anxiety disorder following psychological therapy: An analysis of clinically significant change in the STAI-T across outcome studies since 1990. *Psychological Medicine, 29*, 1425-1434.

Flett, G. L., Blankstein, K. R., & Obertynski, M. (1996). Affect intensity, coping styles, mood regulation expectancies, and depressive symptoms. *Personality and Individual Differences,* 20, 221-228.

Garner, D. M., & Olmsted, M. P. (1984). *Eating Disorder Inventory manual*. Odessa, FL: Psychological Assessment Resources, Inc.

Garner, D. M., Olmsted, M. P., & Polivy, J. (1983). Development and validation of a multidimensional eating disorder inventory for anorexia nervosa and bulimia. *International Journal of Eating Disorders, 2*, 15-34.

Grand, S. (1968). An investigation of the role of vocal conflict and hunger in associative priming. *Journal of Experimental Psychology, 77*, 31-40.

Green, B. G., Dalton, P., Cowart, B., Shaffer, G. Rankin, K., & Higgins, J. (1996). Evaluation of the 'labeled magnitude scale' for measuring sensations of taste and smell. *Chemical Senses,* 21, 323-334.

Greeno, C. G., & Wing, R. R., & Shifman, S. (2000). Binge antecedents in obese women with and without binge eating disorder. *Journal of Consulting and Clinical Psychology,* 68, 95-102.

Harris, L. M., & Menzies, R. G. (1998). Changing attentional bias: Can it effect (sic) self-reported anxiety? *Anxiety, Stress, and Coping, 11*, 167-179.

Henry, J. D., & Crawford, J. R. (2005). The short-form version of the Depression Anxiety Stress Scales (DASS-21): Construct validity and normative data in a large nonclinical sample. *British Journal of Clinical Psychology,* 44, 227-239.

Jacobson, B. H., & DeBock, D. H. (2001). Comparison of body mass index by self-reported versus measured height and weight. *Perceptual and Motor Skills, 92*, 128-132.

Koster, E. H. W., Baert, S., Bockstaele, M., & De Raedt, R. (2007). *Attentional retraining procedures: Manipulating early or late components of attentional bias?* Manuscript submitted for publication.

Koster, E. H. W., Crombez, G., Verschuere, B., & De Houwer, J. (2006). Attention to threat in anxiety-prone individuals: Mechanisms underlying attentional bias. *Cognitive Therapy and Research,* 30, 635-643.

Koster, E. H. W., & Verschuere, B. (2007, July). Experimentally manipulating attentional bias to threat: Effects on trait anxiety, attention, and psychophysiological responses [Abstract]. In Fifth World Congress of Behavioural and Cognitive

Therapies Abstract Booklet (p. 64). Barcelona, Spain. Abstract retrieved October 5, 2007, from http://www.wcbct2007.com/downloads/abstract_congress.pdf

Koster, E. H. W., Verschuere, B., Crombez, G., & Van Damme, S. (2005). Time-course of attention for threatening pictures in high and low trait anxiety. *Behaviour Research and Therapy, 43*, 1087-1098.

Lattimore, P. J. (2001). Stress-induced eating: An alternative method for inducing ego-threatening stress. *Appetite,* 36, 187-188.

Le Grange, D., Gorin, A., Catley, D., & Stone, A. A. (2001). Does momentary assessment detect binge eating in overweight women that is denied at interview? *European Eating Disorders Review,* 9, 309-324.

Liebowitz, M. R. (1987). Social phobia. *Modern Problems in Pharmacopsychiatry, 22*, 141-173.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy, 33*, 335-343.

Lyons, P. M., Truswell, A. S., Mira, M., Vizzard, J., & Abraham, S. F. (1989). Reduction of food intake in the ovulatory phase of the menstrual cycle. *American Journal of Clinical Nutrition, 49*, 1164-1168.

MacLeod, C. (1999). Anxiety and anxiety disorders. In T. Dalgleish & M. Powers (Eds.),*The handbook of cognition and emotion* (pp. 447-477). Chichester, England: Wiley.

MacLeod, C., & Hagan, R. (1992). Individual differences in the selective processing of threatening information, and emotional responses to a stressful life event. *Behaviour Research and Therapy, 30*, 151-161.

MacLeod, C., & Mathews, A. (1988). Anxiety and the allocation of attention to threat. *Quarterly Journal of Experimental Psychology, 40*, 653-670.

MacLeod, C., Rutherford, E., Campbell, L., Ebsworthy, G., & Holker, L. (2002). Selective attention and emotional vulnerability: Assessing the casual basis of their associations through the experimental manipulation of attentional bias. *Journal of Abnormal Psychology, 111*, 107-123.

Mann, T., Nolen-Hoeksema, S., Huang, K., Burgard, D., Wright, A., & Hanson, K. (1997). Are two interventions worse than none? Joint primary and secondary prevention of eating disorders in college females. *Health Psychology, 16,* 215-225.

McIntyre, C. W., Watson, D., Clark, L. A., & Cross, S. A. (1991). The effect of induced social interaction on positive and negative affect. *Bulletin of the Psychonomic Society, 29*, 67-70.

Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational analysis of anxiety. *Behaviour Research and Therapy, 36*, 809-848.

Mogg, K., Mathews, A., Bird, C., & Macgregor-Morris, R. (1990). Effects of stress and anxiety on the processing of threat stimuli. *Journal of Personality and Social Psychology, 59*, 1230-1237.

Mohlman, J. (2004). Attention training as an intervention for anxiety: Review and rationale. *The Behavior Therapist, 27*, 37-41.

Mohlman, J. (2005). [Valence and familiarity of positive and negative words]. Unpublished raw data.

Murphy, R., Hirsch, C. R., Mathews, A., Smith, K., & Clark, D. M. (2007). Facilitating a benign interpretation bias in a high socially anxious population. *Behaviour Research and Therapy*, 45, 1517-1529.

Ouwens, M. A., Van Strien, T., & Van Der Staak, C. P. F. (2003a). Absence of a disinhibition effect of alcohol on food consumption. *Eating Behaviors,* 4, 323-332.

Ouwens, M. A., Van Strien, T., & Van Der Staak, C. P. F. (2003b). Tendency toward overeating and restraint as predictors of food consumption. *Appetite,* 40, 291-298.

Pike, K. M., Loeb, K., & Walsh, B. T. (1995). Binge eating and purging. In D. B. Allison (Ed.), *Handbook of assessment methods for eating behaviors and weight-related problems: Measures, theory, and research* (pp. 303-346). Thousand Oaks, CA: Sage Publications.

Reese, H. E., & McNally, R. J. (2007, July). Attentional training for reducing spider fear in spider-fearful individuals [Abstract]. In Fifth World Congress of Behavioural and Cognitive Therapies Abstract Booklet (p. 145). Barcelona, Spain. Abstract retrieved October 5, 2007, from http://www.wcbct2007.com/downloads/abstract_congress.pdf

Research paradigms: Cognition and emotion laboratory department of psychology, the University of Western Australia (2002, April 3). Retrieved August 29, 2004, from http://www.psy.uwa.edu.au/user/labs/cogemo/atrain.htm

Schmidt, N. B., Richey, J. A., Buckner, J. D., & Cromer, K. R. (2007). Attention training for generalized social anxiety disorder. Manuscript submitted for publication.

Schmukle, S. C. (2005). Unreliability of the dot probe task. *European Journal of Personality, 19*, 595-605.

Shapiro, N. (1998). Self-esteem and the effect of feedback on laboratory and later eating in normal weight and overweight women. Unpublished doctoral dissertation, American University, Washington, DC.

Spielberger, C. D., Gorsuch, R. L., Lushene, R., Vagg, P. R., & Jacobs, G. A. (1983). *Manual for the State-Trait Anxiety Inventory (Form Y)*. Palo Alto, CA: Mind Garden.

Spitzer, R. L., Yanovski, S. Z., & Marcus, M.D. (1993). *The Questionnaire on Eating and Weight Patterns-Revised (QEWP-R, 1993).* (Available from the New York State Psychiatric Institute, 722 West 168th Street, New York, NY 10032).

Stice, E. (2002). Risk and maintenance factors for eating pathology: A meta-analytic review. *Psychological Bulletin, 128,* 825-848.

Stice, E., Presnell, K., & Spangler, D. (2002). Risk factors for binge eating onset in adolescent girls: A 2-year prospective investigation. *Health Psychology, 21*, 131-138.

Stice, E., Telch, C. F., & Rizvi, S. L. (2000). Development and validation of the eating disorder diagnostic scale: A brief self-report measure of anorexia, bulimia, and binge-eating disorder. *Psychological Assessment, 12,* 123-131.

Thayer, R. E., Newman, J. R., & McClain, T. M. (1994). Self-Regulation of mood: Strategies for changing a bad mood, raising energy, and reducing tension. *Journal of Personality and Social Psychology,* 67, 910-925.

Tice, D. M., Bratslavsky, E., & Baumeister, R. F. (2001). Emotional distress regulation takes precedence over impulse control: If you feel bad, do it! *Journal of Personality and Social Psychology,* 80, 53-67.

van den Hout, M., Tenney, N., Huygens, K., Merckelbach, H., & Kindt, M. (1995). Responding to subliminal threat cues is related to trait anxiety and emotional vulnerability: A successful replication of MacLeod and Hagan (1992). *Behaviour Research and Therapy, 33,* 451–454.

Van Strien, T. (1997). The concurrent validity of a classification of dieters with low versus high susceptibility toward failure of restraint. *Addictive Behaviors,* 22, 587-597.

Van Strien, T., Cleven, A., & Schippers, G. (2000). Restraint, tendency toward overeating and ice cream consumption. *International Journal of Eating Disorders,* 28, 333-338.

Van Strien, T., Frijters, J. E. R., Bergers, G. P. A., & Defares, P. B. (1986). The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *International Journal of Eating Disorders,* 5, 295-315.

Vasey, M. W., Hazen. R., & Schmidt, N. B. (2002, November). *Attentional retraining for chronic worry and generalized anxiety disorder (GAD)*. Paper presented at the 36th annual meeting of the Association for Advancement of Behavior Therapy, Reno.

Ward, A., & Mann, T. (2000). Don't mind if I do: Disinhibited eating under cognitive load. *Journal of Personality and Social Psychology, 78,* 753-763.

Wardle, J. (1987). Eating style a validation study of the Dutch Eating Behaviour Questionnaire in normal subjects and women with eating disorders. *Journal of Psychosomatic Research,* 31, 161-169.

Watson, D., Clark. L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social psychology, 54*, 1063-1070.

Wear, R. W., & Pratz, O. (1987). Test-retest reliability for the Eating Disorder Inventory. *International Journal of Eating Disorders, 6*, 767-769.

Wegner, K. E., Smyth, J. M., Crosby, R. D., Wittrock, D., Wonderlich, S. A., & Mitchell, J. E. (2002). An evaluation of the relationship between mood and binge eating in the natural environment using ecological momentary assessment. *International Journal of Eating Disorders, 32*, 352-361.

Wilson, E. J., MacLeod, C., Mathews, A., & Rutherford, E. M. (2006). The causal role of interpretive bias in anxiety reactivity. *Journal of Abnormal Psychology, 115*, 103-111.

World Health Organization (1998). *Obesity: Preventing and managing the global epidemic.* Geneva, Switzerland: Author.

Curriculum Vita

Tanya Rachelle Schlam

1989-1993	**Yale University**, B.A. in Humanities with distinction, Cum Laude, Phi Beta Kappa
1993-1995	**Hebrew University**, Jerusalem, Israel, Dorot Fellow, studied Hebrew
1995-1996	**New York University**, M.A. in Educational Theater
1998-2000	**Hunter College of City University of New York**, Psychology Major
2001-2004	**Rutgers University**, M.S. in clinical psychology
2005-2008	**Rutgers University**, Ph.D. in clinical psychology

Positions Held

1996-2001	**Drama Specialist**, The Heschel School, New York, NY, 20 hours weekly
1999-2001	**Research Assistant** for Dr. Walter Mischel, Columbia University Psychology Department, 10 hours weekly
2002-2003	**Therapist**, Rutgers Psychological Clinic
2002-2004	**Instructor**, Infant and Child Development Lab, Rutgers University
2002-2005	**Therapist**, Rutgers Eating Disorders Clinic
2003-2005	**Therapist**, Rutgers Anxiety Disorders Clinic
2006-2007	**Psychology Intern**, Department of Psychiatry, University of Wisconsin American Psychological Association approved clinical psychology internship
2008-	**Postdoctoral Fellow**, University of Wisconsin Center for Tobacco Research and Intervention

Publications

Schlam, T. R., & Wilson, G. T. (2007). Relapse prevention for eating disorders. In K. Witkiewitz & G. A. Marlatt (Eds.), *Therapist's guide to evidence-based relapse prevention* (pp. 169-190). Burlington, MA: Elsevier.

Schlam, T. R., & Wilson, G. T. (2007). Eating disorders. In N. Kazantzis & L. L'Abate (Eds.), *Handbook of homework assignments in psychotherapy: Research, practice, and prevention* (pp. 279-296). New York: Springer.

Wilson, G. T., & Schlam, T. R. (2004). The transtheoretical model and motivational interviewing in the treatment of eating and weight disorders. *Clinical Psychology Review, 24*, 361-378.