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Attention retraining treatment for contamination fear: A randomized control trial

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Abstract

Although an attentional bias for threat-relevant information has been connected to the etiology of contamination-based obsessive-compulsive disorder (OCD), the treatment implications of such a bias remains unclear. Accordingly, the present investigation examined the hypothesis that direct manipulation of attention for threat-relevant stimuli (disgusted faces and disgusting objects) may effectively reduce symptoms of contamination fear, commonly observed in OCD. Participants were randomly assigned to one of three probe detection conditions: (1) training away from threat (2) training toward threat, or (3) no training (control condition). Self-reported symptoms, behavioral avoidance, and physiological responding during exposure to threat-relevant images was assessed before and after two attention retraining sessions conducted one week apart. The results revealed that attention was successfully manipulated for both training groups. However, the desired attention training bias was observed for disgusting objects and not disgusted faces. Contrary to predictions, symptom levels did not improve as a result of attention training. However, there was some evidence of significant associations between change in symptoms and the magnitude of the bias observed as a function of attention training. The implications of these complex pattern of findings for the feasibility of attention retraining as a treatment for OCD and other anxiety disorders will be discussed.

Introduction

Anxiety disorders are some of the most prevalent mental health illnesses in the population and they impart a significant amount of cost on society (Simon, Ormel, Von Korff, & Barlow, 1995). Given the prevalence and impact of anxiety disorders, there has been a renewed research focus on better understanding the causal mechanism of anxiety and its disorders. Cognitive models contend that various biases in information-processing may confer risk for the development of anxiety disorders (e.g., Beck & Clark 1997; Rapee & Heimberg, 1997 Williams, Watts, McLeod, & Matthews, 1997). Various experimental psychopathology research has supported this information processing model of anxiety disorders and studies have consistently found an attentional bias for threat-relevant information in specific phobia (Olatunji, Sawchuk, Lee, Lohr, & Tolin, 2008), social anxiety disorder, panic disorder, generalized anxiety disorder, and post-traumatic stress disorder, (see Mogg and Bradley, 2008 for review). Additionally, information-processing biases are considered automatic and have been evidenced to include a level of preconscious, sub-cortical processing not easily accessible during many cognitively-based treatments, (Delgado, Nearing, LeDoux, & Phelps, 2008). Attentional biases are among those biases found to be involved in anxiety (for a review see Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007). Indeed, Beck and Clark's model, for instance, specifically proposes that an excessive, automatic attentional vigilance for threat-relevant stimuli may lead to anxiety by causing anxious responding to be continuous and by contributing to irrational beliefs about one's vulnerability to threat.

Of the anxiety disorders, research examining the role of attention biases has been most inconsistent in obsessive-compulsive disorder (OCD). The *Diagnostic and Statistical Manual of Mental* Disorders, fourth edition, (DSM-IV) characterizes OCD as consisting of intrusive

thoughts, images or impulses (i.e. the obsessions), which are followed by repetitive behaviors or mental acts (i.e. the compulsions) that are often used to reduce distress associated with obsessions (American Psychiatric Association, 1994). A review of the research suggests that the inconsistent findings implicating attentional biases in OCD may be largely attributed to the heterogeneity of the disorder (Summerfeldt & Endler, 1998). Factor analysis of OCD symptoms has identified several subtypes of OCD including symmetry/ordering, hoarding, contamination/cleaning, and obsessions/checking that appear to be different across several domains such as heritability and comorbidity, (Mataix-Cols, do Rosario-Campos, & Leckman, 2005). This suggests that certain threats or concerns may be more relevant to a specific subtype (e.g., for a patient with contamination/cleaning OCD a toilet might be more threatening than for a patient with hoarding) than others. Specifically, contamination fear has been consistently linked with disgust with studies finding an increase in propensity for disgust to predict an increase in contamination fear (David, Olatunji, Armstrong, Ciesielski, Bondy & Broman-Fulks, 2009). Additionally, greater activation of the anterior insula, previously identified in the processing of disgust information is more active during exposure to disgust and subtype related stimuli in high contamination fearing individuals (Schienle, Schäfer, Stark, Walter, & Vaitl, 2005). Epidemiological research suggests that contamination obsessions and washing compulsions are the most common OCD concern (Rasmussen & Eisen, 1992). It may be this subtype that is primarily associated with an attentional bias for threat (Summerfeldt & Endler, 1998) as studies examining other subtypes have failed to find the same cognitive tendencies as in other anxiety disorders. This attentional bias in contamination fear may be largely characterized by a hypervigilant-avoidant process that consists of increased allocation for threatening stimuli

(i.e., restrooms, public telephone, door knobs) and subsequent avoidance (Mogg & Bradley, 2008).

Attentional Bias in OCD

Several studies employing various experimental tasks have attempted to delineate the nature of the attentional bias that may be associated with OCD. For example, Foa and McNally (1986) first demonstrated an attentional bias for threat in OCD through a dichotic listening task. Participants in this task heard unique passages of prose in each ear that contained certain target words (the words *pick* and a fear-relevant target word like *urine*). They were instructed to shadow the passage being read in their dominant ear and also to press a button every time they heard a target word in either passage. These individuals were found to have increased performance for detecting the fear-relevant words before treatment with exposure and response prevention but no bias toward fear-relevant words post therapy. Subsequent research has employed a modified Stroop task (Stroop, 1935) using OCD-related words (e.g., *dirty, precise, guilt,* and *clean*) to assess attention biases in OCD. In the Stroop task, participants are asked to name the color of a series of words; biases are observed when latencies are exhibited in naming the color of particular types of words, such as those that are negatively valenced. Findings with the Stroop task have generally been mixed with some indicating that OCD patients showed a significantly greater interference for OCD-relevant material suggesting the presence of bias (e.g., Foa, Ilai, McCarthy, Shoyer, & Murdock, 1994; Lavy, van Oppen, & van den Hout, 1994) and others (e.g., Moritz et al., 2004; Moritz et al., 2008) finding no significant Stroop effect. However, several studies with null findings did not use sub-type specific threatening material and many of these studies examined patients with checking concerns rather than contamination fear.

The dot-probe task has also been employed to assess attentional biases in OCD. In such a task, participants are instructed to view a computer screen on which two types of stimuli, one neutral and one threat relevant, are presented (side by side or one above the other). Immediately after the presentation of these stimuli is terminated, a dot probe (e.g., an asterisk or letter) appears on the screen, to which the participants are instructed to respond via button press. Dot probes occur behind a specific type of stimuli randomly with a 50% chance of occurring behind each type. To date, only two studies (Tata, Leibowitz, Prunty, Cameron, & Pickering, 1996; Amir, Najmi, & Morrison, 2009c) have measured biases of attention in OCD with the dot probe task, with the former finding an attentional bias toward contamination words and the later finding a significant bias toward OCD-relevant words as well as an attenuation of the bias over time. Most recently, Cisler and Olatunji (2010) found that individuals high in contamination fears showed a greater delay in disengaging from both disgusting and fearful stimuli on a spatial cueing task. Current eye tracking data (Armstrong, Olatunji, Sarawgi, & Simmons, 2010) is consistent with these results, finding that high contamination fearing individuals had a maintenance bias for both fear and disgust faces. These findings suggest that demonstration of an attentional bias in OCD may be partially contingent on the symptom subtype and the experimental task employed to probe for such biases.

Effects of Attentional Retraining on Anxiety Symptoms

To the extent that an attentional bias for threat is causal in the development anxious pathology, a growing body of research has begun to examine the feasibility of attentional retraining strategies or attention bias modification as a means of reducing anxious symptoms (Hakamata et al. 2010; for review please see Bar-Haim, 2010; Browing, Holmes, & Harmer, 2010). Studies on attention retraining as an intervention typically employ a modified dot-probe

paradigm to induce a bias away from threat-relevant stimuli. In this task, the probe is presented in one location relative to the stimuli (behind the threat stimuli or behind the neutral stimuli) a disproportionate amount of the time (table 1). In such a way, participants come to expect the dot-probe to appear in this location and will tend to focus their attention on the location where they believe the dot-probe will appear. Thus, a bias toward a specific type of stimulus (e.g. neutral word) can be induced in the participant over another stimulus type (e.g. negative word). For example, MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) found that the dot probe task could successfully and significantly produce a bias in attention. Furthermore, participants whose attention was trained toward threat demonstrated a significant amount of negative emotional response to a stressor (i.e., an anagram stress task), while the participants whose attention was trained away from negative information exhibited no such negative emotional response to the stressor. These results were replicated with children (Eldar, Ricon, & Bar-Haim, 2008) where it was also noted that children trained toward threat showed a larger frequency of anxious behavior in addition to the increase of self-report measures of anxiety.

Findings similar to those observed by MacLeod and colleagues (2002) has served as the foundation for research that is now geared towards modifying attentional bias toward threat among highly anxious individuals as a means of reducing anxious symptoms. For instance, after success in reducing outcome measures of anxiety in socially anxious students (Amir, Weber, Beard, Bomyea, & Taylor, 2008) Amir and colleagues (2009b) found that using word stimuli to train the attention of social phobia patients could significantly alter attention biases away from threat; they also found a reduction in anxiety. Similarly, Li, Tan, Qian, and Liu (2008) observed a significant training of attention in socially anxious individuals toward positive images as well as a reduction in their symptoms of anxiety post training. Also examining the feasibility of

attention retraining as an intervention for social anxiety disorder, Schmidt, Richey, Buckner, and Timpano (2009) employed emotionally charged faces rather than words as the target stimuli and observed that participants trained to have a bias away from disorder-relevant threat (angry or disgusted faces) reported less social and trait anxiety post training when compared to those who received no attention modification. In a similar study, Klumpp and Amir (2010) randomly assigned socially anxious individuals to one of three probe detection conditions: (1) attention training away from threat, (2) attention training to threat, or (3) attention randomly directed to threat and away from threat with equal frequency (control condition). The findings revealed that attention training to threat or away from threat, compared to no training, attenuated anxiety in response to a social stressor.

A recent study also employed a modified dot probe task with threatening and non-threatening words to retrain attention among patients with generalized anxiety disorder with patients who received attention retraining reporting significantly reduced anxiety compared to a control group that received no training (Amir, Beard, Burns, & Bomyea, 2009a). However, application of attention modification (away from threat) for the treatment of spider phobia found no significant differences in symptom reduction between the training group and the control group (Reese, McNally, Najmi, Amir, 2010; Van Bockstaele, Berschuere, Koster, Tibboel, De Houwer, & Crobez, 2011). Nevertheless, Reese et al. (2010) did find a reduction in attentional bias did predict reduction in self-reported spider fear for the training group. Previously, Harris and Menzies (1998) had attempted both augmenting the bias toward spider threat as well as reducing this bias, but the successful bias modification did not contribute to any change in outcome measures of spider fear. Only one study to date has applied attention modification for the treatment of OCD symptoms. Specifically, Najmi and Amir (2010) examined the

effectiveness of attention training in individuals with subclinical obsessive-compulsive symptoms of contamination fear and found that those randomized to receive attention retraining showed a significant reduction in attention bias for threat and completed significantly more steps on a threat-relevant behavioral avoidance test than those in the control group.

Delineating Conflicting Mechanisms

The observation that OCD symptoms are reduced subsequent to cognitive training that directs attention away from threat seems consistent with the theoretical notion that an attention bias towards threat contributes to the development of anxious symptoms (Beck & Clark, 1997). However, the beneficial effects of attention retraining away from danger appear to be quite inconsistent with behavioral theories of the development and maintenance of anxiety disorders (Zinbarg, Barlow, Brown & Hertz, 1992). Behavioral theories contend that anxiety disorders emerge largely as a function of avoidance of threat, whereas the information processing view contests that anxious symptoms are due to attentional vigilance for threat. A large body of research supports the underlying tenants of the behavioral model. For example, Tolin, Lohr, Lee, and Sawchuk (1999) found that despite experimenter instructions to study the pictures carefully for a subsequent recognition test, phobic subjects showed decreased viewing times for threat-relevant pictures compared to neutral pictures. Behavioral avoidance of threat has also been observed in OCD (Steketee, Chambless, Tran, Worden, & Gillis, 1996; Olatunji & Armstrong, 2009). Consistent with a behavioral model of OCD that capitalizes on extinction processes, effective treatment encourages systematic approach of threat, rather than avoidance of it, for the purposes of habituation and safety learning.

Exposure and response prevention (ERP) is currently the gold standard psychosocial treatment for OCD that is derived from the behavioral model of anxiety. In ERP, patients' are

systematically exposed to their anxiety-evoking object/situation without the opportunity to engage in the very avoidance behaviors that maintain their symptoms (Richard, Lauterback, & Gloster, 2007). Exposure allows a patient to habituate to the fear/anxiety and not only learn that the negative emotions will subside but also develop new memories and associations based on corrective information. Therefore, exposure and attention towards a threat-relevant object, rather than avoidance, is seen as a necessary component of effective treatment of OCD. Indeed, several randomized clinical trials have provided supportive evidence for the efficacy of ERP for the treatment of OCD (Abramowitz, 1997). Although ERP is based largely on the notion that OCD emerges from behavioral avoidance of threat, it may not be entirely inconsistent with information processing models of anxiety. For example, the vigilant-avoidant model of attention bias in anxiety suggests that once clinically anxious individuals disengage attention from threat, they proceed with a continued, long-term avoidance of this threat (Mogg & Bradley, 2005; Rohner, 2002). The vigilance and then subsequent avoidance of threat may also contribute to the maintenance of OCD as attentional avoidance of threat may inhibit reappraisal and fear extinction. Consistent with the vigilant-avoidant model of attention, it may be predicted that significant improvements in OCD may be observed following attention training away or towards threat. Attention retraining away from threat may modify the vigilance that occurs early during information processing and attention retraining towards threat may modify avoidance that occurs later during information processing.

The Present Study

The present study aims to evaluate the efficacy of attention retraining for reducing symptoms of contamination fear commonly observed in OCD. A major limitation of the current research on attention retraining as a treatment for anxious symptoms is that the overwhelming

majority of studies have trained attention away from threat. Thus, it remains unclear if training attention towards threat in OCD yields comparative or even better outcomes. Indeed, a recent study suggests that attention training away from threat and attention training to threat may yield equivalent reductions in anxious symptoms (Klumpp & Amir, 2010). This suggests that effects of ABM may be due in full or in part to an increase of attentional control, a more general cognitive deficit which may affect attention to threat, (Bar-Haim, 2010; Eysenck, Derakshan, Santos, & Calvo, 2007) Additionally, attention modification literature has almost entirely relied on words or faces for emotional stimuli during training. Therefore, this study also seeks to differentiate differences of training using both images of facial expressions and objects. It is predicted in the present study that participants identified as high in contamination fear randomized to receive two sessions of attention retraining away from disgust-relevant stimuli (ATA) and toward disgust-relevant stimuli (ATT) will demonstrate significant improvements in self-report contamination fear symptoms, behavioral avoidance, and physiological arousal during exposure to threat-relevant stimuli relative to those randomized to a no attention retraining (NT) condition. Furthermore, no significant differences were predicted between those in the ATA and ATT condition. Given the specific nature of the task, the beneficial effects of attention retraining away from threat were predicted to generalize to related constructs such as contamination cognitions and disgust sensitivity. However, these beneficial effects were not predicted to generalize to reductions in anxiety and depression.

Methods

Participants

Undergraduate students at Vanderbilt University were screened for potential participation in the present study. Participants who scored one standard deviation above the mean on the

Padua Inventory (PI; Burns et al. 1996) contamination fear subscale were recruited. Sixty participants volunteered and were randomized into one of the three training groups: attention training away from disgust (ATA; $n = 20$), attention training toward disgust (ATT; $n = 21$) and no training (NT; $n = 19$). The mean age of the ATA group (19.1 years) and the mean age of the ATT group (19.0 years) did not significantly differ from the mean age of the control group (19.25 years) nor did they differ significantly from each other. The sample was predominantly female and Caucasian with no significant differences for gender ($\chi^2 = .04$, $p = .98$) or ethnic ($\chi^2 = 8.28$, $p = .41$) distributions across groups. Additionally, none of the groups differed significantly for the PI screening score used to recruit participants (ATA mean = 21, S.D. = 4.4; ATT mean = 19.2, S.D. = 4.4; NT mean = 19.4, S.D. = 6.5).

Measures

The *Padua Inventory* (PI; Burns et al. 1996) contamination fear subscale is a 10-item measure of contamination obsessions and washing compulsions. Items are rated on a Likert scale of 0 to 4 on how frequently participants experience contamination thoughts or behaviors (0=not at all; 1=a little; 2=quite a lot; 3=a lot; 4=very much). The alpha coefficient at time 1 for the PI contamination fear subscale was .73.

The *Contamination Cognitions Scale* (CCS; Deacon & Olatunji, 2007) assesses participants' overestimation of the severity to which they would be contaminated as well as the likelihood of contamination for 13 objects. Two ratings were made on a scale of 0 to 100 of the likelihood and severity of contamination when being asked to imagine coming in contact with one of the 13 objects (0=not at all likely/bad, 50=moderately likely/bad and 100 "extremely likely/bad). The CCS had an alpha coefficient of .81 in the present study at time 1.

The *Disgust Scale –Revised* (DS-R; Haidt et al., 1994) is a 25-item questionnaire assessing sensitivity to a list of disgust eliciting experiences as well as the relationship between ratings of sensitivity to core disgust, animal-reminder disgust, and contamination. The DS-R uses a 5 point Likert scale with items in the first part being rated on how true the statement is about the individual and items in part two being rated on how disgusting an experience is perceived. At time 1, the alpha coefficient for the DS-R was .89.

The *State-Trait Anxiety Inventory- Trait Version* (STAI-T; Spielberger et al., 1983) is a 20-item scale that measures dispositional anxiety symptoms as opposed to current symptoms of anxiety (state anxiety). Items in STAI-T are rated based on frequency via a 4 point scale (1= not at all, 2=somewhat, 3=moderately so, 4=very much). The alpha score at time 1 was .94.

The *Center for Epidemiologic Studies Depression Scale* (CES-D; Radloff, 1977) is a 20-item self - report scale designed to measure depressive symptomotology in the general population. The items of the scale are symptoms associated with depression which have been used in previously validated longer scales and assesses symptoms on a scale of 0 "rarely or none of the time" to 3 "most or all of the time". The CES-D had an alpha coefficient of .70 at time 1 of the present study.

Materials

A set of 10 pairs of facial expressions, each from a different actor and each expressing disgust and neutral emotions, were selected from the Karolinska Directed Emotional Faces (KDEF; Lundqvist, D., Flykt, A., & Öhman, A. 1998). In addition, 20 images from the International Affective Picture System (IAPS; Lang et al., 2001) were chosen, 10 displaying neutral content and 10 displaying a disgusting/contaminated scene or image. Lastly 5 disgust expressions and 5 neutral expressions from the KDEF as well as 5 disgust and 5 neutral images

from the IAPS, none of which were present in the original pairs of facial expressions from the set of 20 IAPS images above, were chosen for a separate image rating task. Although attention retraining studies have typically employed words as threat stimuli, the present study employs facial expressions and images because such stimuli are a more similar representation of threat participants would encounter in everyday life, and results may, therefore, be more generalizable.

Behavioral Avoidance Task

Participants were escorted into a public restroom located across the hall from the laboratory and asked to engage in five behavioral tasks. For the tasks, participants were asked in the following order to: 1) touch the inside of the sink, 2) touch the inside of the trash can, 3) touch the toilet seat, 4) touch the rim of the toilet, and 5) touch the inside of the toilet bowl. Immediately after each task, participants gave both anxiety and disgust ratings on an 11-point scale (0 = no anxiety/disgust at all to 10 = severe anxiety/disgust). Participants were also given the option to decline to engage in any task they did not wish to complete. If a participant chose not to complete one of the five steps, he/she was asked to imagine performing the task and then provide the anxiety and disgust ratings. All participants were asked if they were willing to engage in each task for a measure of compliance, such that the behavioral task did not stop once a participant declined to engage in a step and the participant had to decline to engage in each step individually before imagined anxiety and disgust ratings were given.

Image Rating Task

The 20 images chosen for the image rating task were presented separately for 4000ms each. During the period of image presentation, participants' Galvanic skin response (GSR) was measured. GSR was digitally recorded using BIOPAC GSR100C module for MP100. Ag–AgCl electrodes were used and attached with Velcro straps (BIOPAC Systems, Goelta, CA) to the

most distal phalanges of the second and third digits on the hand which the participants were not using to respond. A saline-based gel was used as a conductive electrolyte. Skin conductance was monitored at 200 Hz and was stored off line for analysis, using AcqKnowledge software (BIOPAC Systems, Goleta, CA). After each presentation of an image, participants were asked to rate how pleasant the image made them feel on a scale of 0 to 8 (with anchors at 0=most unpleasant, 4=neither pleasant nor unpleasant, 8=most pleasant).

Dote Probe Task

A set of 20 image pairs (10 face pairs and 10 IAPS image pairs) were presented in nine blocks in each session for a total of 200 trials per session. Each KDEF pair consisted of one disgust face and one neutral face of the same actor; trials were balanced for the gender of the actor. One IAPS neutral image was always paired with one IAPS disgusting/contaminated image in the IAPS pairs; however the pairings were randomly chosen during each new block such that all possible pairings occurred with equal frequency by the end of the task. Each trial consisted of a white fixation cross on a black background in the middle of the screen for 1000 ms, followed by an image pair. Both KDEF pairs and IAPS pairs were presented for 4500 ms, as depicted in Figure 1. The relatively long stimulus durations were intended to allow participants time to fully process the content of the stimuli, as longer durations may allow for more elaborated processing and greater activation of relevant schemata (Mogg & Bradley, 2005). Following the offset of the images, a small single or double white asterisk probe on a black background appeared in the location of one of the images and remained on the screen until the participant pushed a corresponding response button on the keyboard to indicate how many asterisks were presented. The computer recorded the latency and accuracy of each response. Each type of emotional stimulus (disgust or neutral) appeared on each side of the screen with equal probability.

Attention Training

Participants were randomly assigned to either the attentional training away from disgust (ATA; *n* =20) attentional training towards disgust (ATT; *n* = 20) or no attentional training (NT; *n*= 20) conditions. The conditions differed only in the probability of the probe location following the neutral-disgust stimulus pair. In the NT condition, the probe appeared in the location of the neutral stimulus and the disgust stimulus with equal probability (50%). In the ATA condition, the probe appeared in the location of the neutral stimulus 85% of the time, while in the ATT condition, the probe appeared in the location of the disgust stimulus 85% of the time. 85% was used rather than 100% to keep the intent of the study from being transparent.

Procedure

Participants were administered two sessions of attention retraining. During the first session, participants completed the above measures followed by the BAT. Participants then completed the image rating task to assess objective physiological and subjective responding to threat-relevant stimuli. Participants were then randomized into the three attention retraining conditions of the dot probe task. The participants returned to the lab exactly one week later for the second attention retraining session. During this session they first completed the dot probe task and then the image rating task, symptom measures, and BAT were completed for assessment of the training effects.

Results

Randomization Check

Participants self-report scores, BAT data and physiological responding before attention retraining was assessed using a one-way Analysis of Variance (ANOVA) to ensure there are no significant differences between participants randomized to the ATA, ATT, and NT groups (see

figure 2). No significant differences ($p > .05$) were found for any of the self-report measures. Additionally, at time 1, groups did not differ in the BAT compliance, average disgust and anxiety ratings for the BAT, or in physiological responding to disgust or neutral images.

Attention Retraining Manipulation Check.

An attentional bias score was computed for each participant in order to determine the effectiveness of the attention retraining manipulation via the dot-probe paradigm. Separate bias scores toward disgust faces and disgust objects for each participant were calculated using reaction times (RT) to the dot probe with a formula adapted from MacLeod & Matthews (1988) and Mogg, Miller, & Bradley (2000). Bias right (BR) is equal to the RT when both the disgust and dot probe are on the right side of the screen (Right Probe – Right Emotion; RpRe) subtracted from the RT when the disgust image on the right side of the screen and the dot probe is on the left (Right Probe – Left Emotion; RpLe). Bias left (BL) is found by subtracting RT when both the disgust and dot probe are on the left side of the screen (Left Probe – Left Emotion; LpLe) from the RT when the disgust image on the left side of the screen and the dot probe is on the right (Left Probe – Right Emotion; LpRe). Thus, the attentional bias score is the sum of BR and BL divided by two:

BR = RpLe – RpRe BL = LpRe – LpLe Bias Score = (BR + BL)/2

Based on this computation, positive scores reflect attention bias towards disgust and negative scores reflect attention bias away from disgust. Average bias scores per participants were calculated for the first training session and for the second training session separately and then an overall average bias score across all trials during both time 1 and time 2 was calculated.

Between Groups Analysis. A 3 (group: ATA, ATT, NT) x 2 (image type: faces, objects) mixed-factor ANOVA for attentional bias scores yielded a significant main effect of type [F (1,

58) = 8.26, $p < .01$, $_{p}\eta^2 = .13$], which was qualified by a type by group interaction [F (2, 114) = 11.49, $p < .001$, $_{p}\eta^2 = .29$], (see figure 2). A posthoc Univariate ANOVA revealed a significant main effect of group for bias toward disgust objects [F (2, 114) = 7.63, $p < .01$, $_{p}\eta^2 = .21$]. Pairwise comparisons with a Bonferroni adjusted alpha of .0125 revealed that the bias toward disgust objects was significantly lower in the ATA group (M = -19.92, S.D. = 33.41) than in the NT group (M = 15.75, S.D. = 25.03), p = .001, and also significantly lower than in ATT group (M = 3.718, S.D. = 28.11), p = .04. However, the disgust object bias did not differ between the NT group ant the ATT group significantly, p = .59. A posthoc Univariate ANOVA also revealed a significant main effect of group for bias toward disgust faces [F (2, 114) = 3.33, $p < .05$, $_{p}\eta^2$ = .04]. Pairwise comparisons with a Bonferroni adjusted alpha of .0125 revealed no significant differences between the bias for disgust faces between the ATA group (M = -6.11, S.D. = 37.31) and both NT group (M = -29.45, S.D. = 24.80), p = .07 and ATT group (M = -7.78, S.D. = 30.76), p = 1.00; additionally no significant differences were found between the NT and ATT group for bias toward disgust faces p = .10.

Correlations for each group between bias scores of faces and objects in both the overall average bias scores and bias scores during the second training session also demonstrate group differentiation (table 1). The average bias score for faces was significantly and negatively correlated with the average bias score fore objects in the neutral condition ($p < .01$). This suggests that, in the absence of training, individuals high in contamination fear have a bias toward disgust objects, which is associated with their bias away from disgust faces. However, a significant positive correlation between average bias score for faces and average bias score for objects was found among individuals high in contamination fear in the ATA group ($p < .01$). This shows a synchronization of bias away from disgust for both faces and objects when

individuals are trained to attend away from disgust. Although the overall average bias score for faces was not correlated with the overall average bias score for objects in the ATT group, bias scores for faces during the second training session and bias scores for objects during the second training session were positively correlated ($p < .05$), indicating a synchronization of bias toward disgust after training attention toward disgust.

Effects of Attention Retraining on Symptoms.

Changes in self-report, behavioral, and physiological symptoms were examined using a 3 (group: ATA, ATT, NT) x 2 (time: pre, post retraining) mixed-factor ANOVA. Results of this analysis are discussed here and reported below in tables 2-4.

Self-report measures. A significant main effect of time for the Padua Inventory [F (1, 58) = 4.30, $p < .05$, $_{p}\eta^2 = .07$] was revealed, although neither a significant main effect of group nor a significant interaction of time by group was found. Additionally, no other measures yielded any significant main effects of time or group or any significant interactions.

Behavioral measures. A significant main effect of time was found for ratings of anxiety [F (1, 58) = 8.82, $p < .01$, $_{p}\eta^2 = .13$] and disgust [F (1, 58) = 22.08, $p < .001$, $_{p}\eta^2 = .28$]. No main effect of time was found for BAT compliance, nor a main effect of group for any of the behavioral measures. Analysis yielded no significant main effect of group or group by time interaction.

Physiological measures. No significant main effects of group or time or significant interactions of group by time were found for galvanic skin response to neutral or disgust objects and faces (table 4).

Association between Symptom Change and Attention Retraining.

Self-report measures. As shown in table 5, change in contamination disgust over the one-week period, as assessed by the DS-R contamination subscale, was significantly negatively correlated with bias scores at time 2 toward disgust objects. Additionally, some moderately strong associations ($r > .35$) were found between change scores of these symptom measures and bias scores during the second session, but did not reach significance due to the small sample size within group. The bias toward disgust objects had a moderate, negative association with change in the total DSR score for the ATA group ($r = -.36$) and with change scores of trait anxiety in the ATA group ($r = -.37$). Bias toward disgust facial expressions was also moderately correlated in the NT group with change in trait anxiety ($r = .36$) and BAT compliance ($r = -.36$). In the ATA group, change scores of BAT ratings of anxiety were moderately and negatively associated with bias toward disgust faces (-.43).

Behavioral measures. Change scores of ratings of anxiety during the BAT were significantly, negatively correlated with bias toward disgust objects at time 2 in the NT group ($p < .01$) and in the ATA group ($p < .05$). In the NT group, attentional bias toward disgust objects was also significantly, but positively correlated with change scores for ratings of disgust during the BAT ($p < .05$). Additionally, bias toward disgust facial expressions, in the NT group, was moderately and negatively associated with change in BAT compliance. See table 6.

Physiological measures. Neither overall bias nor bias scores at time 2 were significantly correlated with change in average physiological responding to any stimuli category during the ratings task (disgust and neutral facial expressions as well as disgust and neutral objects). However moderate correlations were found in the NT group between bias toward disgust facial expressions and change in physiological responding to all stimuli categories (disgust faces $r = .56$; disgust objects $r = .58$; neutral faces $r = .56$; neutral objects $r = .52$). Moreover, a moderate,

negative correlation was revealed in the NT group between bias toward disgust objects and change in physiological responding to disgust objects (r = -.47). Lastly, the ATA group showed a moderate, negative correlation between bias toward disgust facial expressions and change in physiological responding to disgusts objects (r = -.40) as well as neutral faces (r = -.37). See table 7.

Discussion

Cognitive models posit that an attentional bias towards threat may play a role in the development of OCD, particularly the contamination subtype (e.g., Summerfeldt & Endler, 1998; Tata et al., 1996). Accordingly, strategically training the allocation of attention away from threatening stimuli among OCD patients may be a viable treatment option. This approach certainly seems viable for other anxiety symptoms as recent research has shown that attention retraining away from threat-relevant stimuli results in significant decreases in symptoms of social anxiety (Amir et al., 2008), GAD (Amir, Beard, Burns, and Bomyea, 2009a), and pathological worry (Hazen et al., 2009). One study also found that contamination fearing participants, whose attention was trained away from threat, completed significantly more steps when approaching their feared objects compared with participants who received no traing (Najmi & Amir, 2010). The present study builds on this prior research by examining the efficacy of attention retraining for reducing contamination concerns in an analog sample. This investigation examined both attention retraining away from threat and attention retraining toward threat as potential mechanisms.

Examination of the effects of the attention retraining manipulation revealed that those who received attention retraining away from disgust, where the probe appeared in the location of the neutral stimulus 85% of the time, exhibited a reduced attentional bias towards threat

compared to those who received no training and those whose attention was trained toward threat. However, this effect was observed only when the threat stimuli were objects compared to faces. These initial findings suggest that facial expressions may not be sensitive to detecting the effects of attention retraining. In a recent meta-analysis of attention bias modification studies using the dot-probe task, Hakamata et al. (2010) found that the use of words achieved greater effects than faces. The absence of an effect of attention retranining on faces versus objects may reflect important differences in stimulus properties. For example, the objects may be more salient indicators of contamination that is easily identifiable and threat-relevant. The facial expression of disgust, however, is more ambiguious as a referant for contamination. Infact, research has shown that the facial expression of disgust is often perceived as conveying anger (e.g., Susskind, Littlewort, Bartlett, Movellan, & Anderson, 2007). This would explain a lack of bias toward disgust facial expressions in the NT group as the facial expressions of disgust may not convey a specific enough threat to individuals with contamination fear. Moreover, Adolphs (2002) suggests that disgust facial expressions may be particularly difficult to discriminate from netural expressions. Such trouble in discriminating the disgust facial expression may hinder training as once again, the threat is not easily or quickly identifiable. Neuroimaging reseach has also shown that while disgusting images led to activation in the amygdala, insula, and orbitofrontal cortex, disgust facial expressions did not lead to any significant activation (Schafer, Schienle, Vaitl, 2005). One interpretation of these findings is that disgust scenes are more salient and attract more attention than do facial expressions of disgust. While disgust scenes may draw and hold attention more easily as well as offer more details or information for the participant to examine over the 4500ms presentation period, a participant may lose interest in the facial expressions after distinguishing each. Thus, training would lack any effect on facilitating response during

congruent trials as the participant would be less likely to be attending to one expression over the other. Additionally, disgust evoking scenes/objects lead to emotional processing wheres facial expressions are largely limited to emotion recognition (Davidson & Irwin, 1999). The difference between emotion processing and recognizing emotional expressions may, therefore, account for some of the differences in training attention with these stimuli; the different attentional biases for these disgust stimuli in the absence of training may also be a result of emotion processing versus emotion recognition. Indeed, the cognitive models of anxiety disorders posit only a cognitive bias (e.g., attentional biases) towards processing threat relevant information (MacLeod & Rutherford, 1992). Therefore, the dot-probe task designed to retrain attentional bias may only be effective for stimuli which activate emotional information processing and not merely emotion recognition. Contrary to predictions, the present study found that attention training towards threat or away from threat did not result in significant symptom changes in contamination fear. Although this is inconsistent with prior research that has demonstrated significant therapeutic effects of attention retraining (Amir et al., 2008; Amir, Beard, Burns, and Bomyea, 2009a; Hazen et al., 2009, it is important to note that recent research has also failed to find therapeutic effects for attention retraining. For example, Reese et al. (2010) randomly assigned spider-fearful individuals to receive either attention training or control procedures. Although both groups declined in spider fear and avoidance, reduction in attentional bias did not produce significantly greater symptom reduction in the training group than in the control group. Van Brokstaele et al (2011) also successfully trained attention towards or away from spiders and found that attention training had no effect on self-reported spider fear, implicit spider associations, physiological, and behavioral measures of spider fear. A consistent finding across these results is that attention is rather malleable. For example, the present study revealed that bias for disgust objects can be

significantly reduced by training participants to allocate their attention away from disgust objects through modification of the contingences of the modified dot probe task. However, the ability to modify attention in the experimental context does not appear to always translate into symptom improvement. The discrepancy between the present study and those that have found a treatment benefit for attention retraining may be the result of important methodological differences. For example, prior research typically employs lexical stimuli whereas the present study employed images of objects and facial expressions. It has been observed that words may be more ideal stimuli for attention bias modification because they are more efficient in addressing and identifyinge abstract themes that are broadly relevant to anxiety in ways that pcitures cannot (Bar-Haim, 2010).

Another methodological issue that may account for the absence of an attention training benefit in the present study is that of timing. In the present study, stimulus pairs were presented for 4500ms. A recent meta-analysis suggests that shorter stimulus presentation times of approximately 500ms appear to be optimally effective for obtaining the desired treatment effect of attention bias modification (Hakamata et al., 2010). Cognitive theories posit that the cause and maintenance of anxiety in part stems from an early, automatic and preconscious bias toward threatening information (Bar-Haim, 2010). 500ms displays of affective stimuli, therefore, more appropriately address this initial bias by training individuals to direct their attention quickly towards the emotion behind which the dot probe appears more often and to keep their attention focused there for the short duration before the dot-probe appears. With a 4500ms presentation time, participants in this study received no incentive to adjust early allocation of attention toward a particular emotion. Instead, participants in the ATA or ATT groups could easily have allowed initial allocation of attention toward either neutral or disgust images regardless of training

condition, as long as they learned to focus their attention toward a particular emotion by the end of the display time. As such, the training in this study would not have addressed the cognitive mechanisms at work in the attentional bias which contributes to anxiety. This would also explain the lack of difference between groups in outcome measures, as the automatic and early bias of attention may not have been altered via the present training task. Moreover, the use of eye tracking technology during the dot probe task may have elucidated whether training was in fact changing the early, automatic attentional bias toward disgust or causing a certain maintenance or later bias in the direction of training.

These findings as well as others that have not found a treatment benefit for attention modification paradigms also raise the posibility attention retraining may be beneficial for some anxious conditions and not others. Indeed, the majority of the positive findings have employeed attention retraining for more difuse anxiety disorders (e.g., generalized anxiety disorder and social anxiety disorder; Amir et al. 2009a; Schmidt et al. 2009) and the negative findings have addressed more focused fear disorders (Harris & Menzies, 1998; Reese et al., 2010; Van Bockstaele, 2011). There is evidence that for more focal fears, cognitive biases may play a less central role (Öhman & Mineka, 2001). There may be important differences between anxiety disorders (i.e., being viewed on a spectrum; see Lang & McTeague, 2009 for a review), such that biases in attentional for threat are more causal in some anxiety disorders and less causal in others. This view certainly questions the generalizability of cognitive models of anxiety disorders (Beck & Clark, 1997) across the anxiety disorder spectrum. However, it is important to note that an attention bias for threat have proven difficult to replicate in some anxiety disorders (e.g., OCD; Summerfeldt & Endler, 1998).

Attention retraining tasks such as the modified dot-probe may function largely to increase attentional control and therefore may lead to reductions in anxiety or other symptom measures, (Eysenck, Derakshan, Santos, & Calvo, 2007). Attention control is a more general cognitive process and function of executive control which includes focusing and shifting of attention (Derryberry & Reed, 2002; Eysenck, Derakshan, Santos, & Calvo, 2007). Indeed, Eldar and Bar-Haim (2010) have shown that attention training using the dot-probe task resulted in a modulation of attentional control but not of early attentional allocation. Therefore, engagement with the dot-probe task may have increased efforts of attentional control instead of early, automatic attentional biases for the groups who received training yielding no main effect of training condition but a main effect of time, as seen with a measure of contamination fear as well as behavioral measures of anxiety and disgust. The present study did find bias scores for objects during the second training sessions were significantly related to change scores in self-reported contamination disgust, as well as BAT ratings of anxiety and disgust. Specifically, attention bias, by time 2 and in the absence of training, was not associated with a change in contamination disgust sensitivity but was negatively associated with a change in BAT ratings of anxiety and disgust. However, attention bias achieved by time 2 in the ATA group was negatively correlated with contamination disgust sensitivity and positively associated with BAT ratings of anxiety but not disgust. This suggests that while training did not significantly change these scores, certain bias scores achieved by training can be associated with a change in contamination disgust as well as anxiety during behavioral tasks and no longer be associated with a change in disgust for behavioral task. As such reaching a target bias score from disgust may be beneficial for some desired changes in symptoms.

Although the present study adds to the growing body of research on the feasibility of employing attention retraining as a treatment for anxiety-related disorders, inferences made based on the findings must consider the study limitations. For example, the present study employed a contamination fearful analogue sample making it difficult to generalize to patients with OCD. Furthermore, there is some evidence that attention training affects anxious participants whereas non-anxious participants seem not to respond to it (Eldar & Bar-Haim, 2010). This finding highlights the importance of research with anxious samples that are sufficiently symptomatic. More recent work has also identified important experimental parameters that appear to help maximize the desired attention retraining effect (Hakamata et al., 2010). Such parameters, that were not employed in the present study include, a shorter stimulus presentation time (~500ms), the use of lexical stimuli, and the presentation of stimuli in a Top-Bottom orientation as opposed to a Side-by-Side orientation. Although it is largely unclear why some of these experimental parameters increase the likelihood of detecting symptom reduction after attention retraining, future research that employs such parameters may indeed detect much stronger effects than those found in the present study.

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Table 1.

Correlations of bias scores toward disgust at time 2 between faces and objects and correlation of bias scores toward disgust faces and objects averaged across time between faces and objects.

		Time 2 Face Bias	Time 2 Object Bias	Average Face Bias	Average Object Bias
Neutral Group:					
	Time 2 Face Bias	---	-.70**	.86**	-.57*
	Time 2 Object Bias		---	-.55*	.47*
	Average Face Bias			---	-.59**
	Average Object Bias				---
Away Group:					
	Time 2 Face Bias	---	.28	.91**	.57**
	Time 2 Object Bias		---	.27	.85**
	Average Face Bias			---	.65**
	Average Object Bias				---
Toward Group:					
	Time 2 Face Bias	---	.48*	.70**	.16
	Time 2 Object Bias		---	.15	.71**
	Average Face Bias			---	.07
	Average Object Bias				---

Note: *$p < .05$; **$p < .01$.

Table 2.

Descriptive statistics for the self-report measures at each assessment time point and F-tests of main effects of time, training group, and their interaction

Variable	Neutral		Away		Toward		Main Effect of Time	Main Effect of Condition	Time X Condition Interaction
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	*F*(1, 58)	*F*(2, 57)	(2, 114)
PI							4.30*	.83	.69
M	20.68	20.95	18.35	20.00	17.92	19.00			
S.D.	4.94	5.59	5.77	5.88	6.49	7.62			
DS-R							3.90	1.68	1.74
M	62.68	59.37	67.75	68.10	60.52	58.76			
S.D.	16.41	15.12	11.63	10.51	19.17	18.86			
DS-R C subscale							.57	.96	2.78
M	9.68	8.52	10.45	10.95	9.52	9.52			
S.D.	3.54	3.42	3.94	3.68	4.32	4.39			
CES-D							3.06	.02	2.80
M	26.11	23.42	24.15	24.60	24.48	24.29			
S.D.	8.10	7.34	6.26	6.02	6.40	7.47			
STAI							.06	.67	.24
M	45.47	45.63	41.25	42.40	45.95	45.38			
S.D.	13.99	14.80	12.13	11.74	11.08	12.20			
CCS-L							1.43	.073	1.39
M	661.69	633.50	576.40	693.87	595.35	629.30			
S.D.	251.09	256.20	302.75	399.49	277.13	336.51			
CCS-S									
M	571.94	584.50	511.27	553.00	559.00	590.50	1.52	.159	.127
S.D.	225.33	256.86	276.74	295.39	268.32	281.33			

Note: PI = Padua Inventory; DS-R = Disgust Scale-Revised; DS-R C subscale = Disgust Scale Revised, contamination subscale; STAI = State-Trait Anxiety Inventory; CES-D = Center for Epidemiological Studies-Depression scale; CCS-L = Contamination Cognition Scale, likelihood of contamination subscale; CCS-L = Contamination Cognition Scale, severity of contamination subscale. *$p < .05$; **$p < .01$.

Table 3.

Descriptive statistics for the behavioral measures at each assessment time point and F-tests of main effects of time, training group, and their interaction.

Variable	Neutral		Away		Toward		Main Effect of Time *F*(1, 58)	Main Effect of Condition *F*(2, 57)	Time X Condition Interaction (2, 114)
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2			
BAT-Comply							2.03	2.27	1.01
M	2.00	2.37	2.60	2.60	3.24	3.33			
S.D.	1.25	1.57	2.14	1.96	1.61	1.56			
BAT-Anxiety							8.82***	.27	.49
M	30.47	26.79	27.00	24.65	29.29	23.86			
S.D.	10.46	10.48	11.98	14.22	19.11	11.09			
BAT-Disgust									
M	34.79	28.89	33.05	29.65	34.57	26.81	22.08***	.06	1.12
S.D.	7.83	9.23	9.65	10.82	17.87	11.04			

Note: *$p < .05$; **$p < .01$; ***$p < .001$.

Table 4.

Descriptive statistics for the average physiological responding to each stimuli type at each assessment time point and F-tests of main effects of time, training group, and their interaction.

Variable	Neutral		Away		Toward		Main Effect of Time $F(1, 58)$	Main Effect of Condition $F(2, 57)$	Time X Condition Interaction (2, 114)
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2			
Disgust Faces							.78	.61	.42
M	-.01	.01	.01	.00	-.01	.00			
S.D.	.03	.03	.02	.03	.04	.06			
Disgust Objects							.00	.48	.73
M	-.01	.00	.01	.00	.00	.00			
S.D.	.03	.04	.02	.03	.03	.06			
Neutral Faces							.03	.64	.85
M	-.01	.00	.01	.00	-.01	.00			
S.D.	.03	.04	.02	.02	.04	.06			
Neutral Objects							.08	.14	1.55
M	.00	.01	.02	.00	.01	.01			
S.D.	.02	.04	.02	.02	.03	.06			

Note: $*p < .05$.

Table 5.

Correlations for each group between bias scores at time 2 and change scores for self-report measures of contamination fear, anxiety, disgust-related variables, and negative affect.

		PI	DS-R	DS-R C subscale	STAI	CES-D	CCS-L	CCS-S
Neutral Group:								
	Face Bias	-.04	-.03	-.05	.36	.11	.02	.30
	Object Bias	-.24	-.25	-.10	-.12	-.14	-.18	-.23
Away Group:								
	Face Bias	.19	-.27	-.27	-.22	.04	.37	.15
	Object Bias	-.08	-.07	-.58*	-.37	.12	.24	-.03
Toward Group:								
	Face Bias	.08	-.10	-.07	-.20	-.33	-.27	-.32
	Object Bias	.06	-.36	-.08	.00	-.09	-.15	-.16

Note: PI = Padua Inventory; DS-R = Disgust Scale-Revised; STAI = State-Trait Anxiety Inventory; CES-D = Center for Epidemiological Studies-Depression scale; CCS-L = Contamination Cognition Scale, likelihood of contamination subscale; CCS-L = Contamination Cognition Scale, severity of contamination subscale. *$p < .05$; **$p < .01$.

Table 6.

Correlations for each group between bias scores at time 2 and change scores for the behavioral avoidance task compliance, anxiety ratings. and disgust ratings.

		BAT Compliance	BAT Anxiety	BAT Disgust
Neutral Group:				
	Face Bias	-.36	.32	.24
	Object Bias	-.30	-.63**	-.48*
Away Group:				
	Face Bias	-.15	-.43	-.18
	Object Bias	-.05	.49*	.33
Toward Group:				
	Face Bias	.15	.03	.08
	Object Bias	.19	.15	.24

Note: *$p < .05$; **$p < .01$.

Table 7.

Correlations for each group between bias scores at time 2 and change scores for the average physiological responding to each stimuli type during the ratings task.

		Disgust Faces	Disgust Objects	Neutral Faces	Neutral Objects
Neutral Group:					
	Face Bias	.56	.58	.56	.52
	Object Bias	-.23	-.47	-.28	-.30
Away Group:					
	Face Bias	-.05	-.40	-.37	-.35
	Object Bias	.20	-.05	.00	-.08
Toward Group:					
	Face Bias	-.11	-.19	-.17	-.09
	Object Bias	.29	.27	.28	.24

Note: $*p < .05$.

Figure Captions

Figure 1. Progression of the dot-probe task. A fixation cross, first appears in the middle of the scree, followed by a 4500ms presentation of two stimuli (one disgust image and one neutral image) in a Side-by-Side orientation. The offset of the two affective stimuli is immediately followed by presentation of the dot-probe (one or two asterisks).

Figure 2. Average, overall bias score across time in each group for both faces and objects.

Figure 3. Padua Inventory contamination subscale at each time point for the ATA, ATT, and NT groups.

Figure 4. BAT measures of compliance, anxiety and disgust at each time point for the ATA, ATT, and NT groups.

Figure 5. Average physiological responding to disgust faces and objects at each time point for the ATA, ATT, and NT groups.

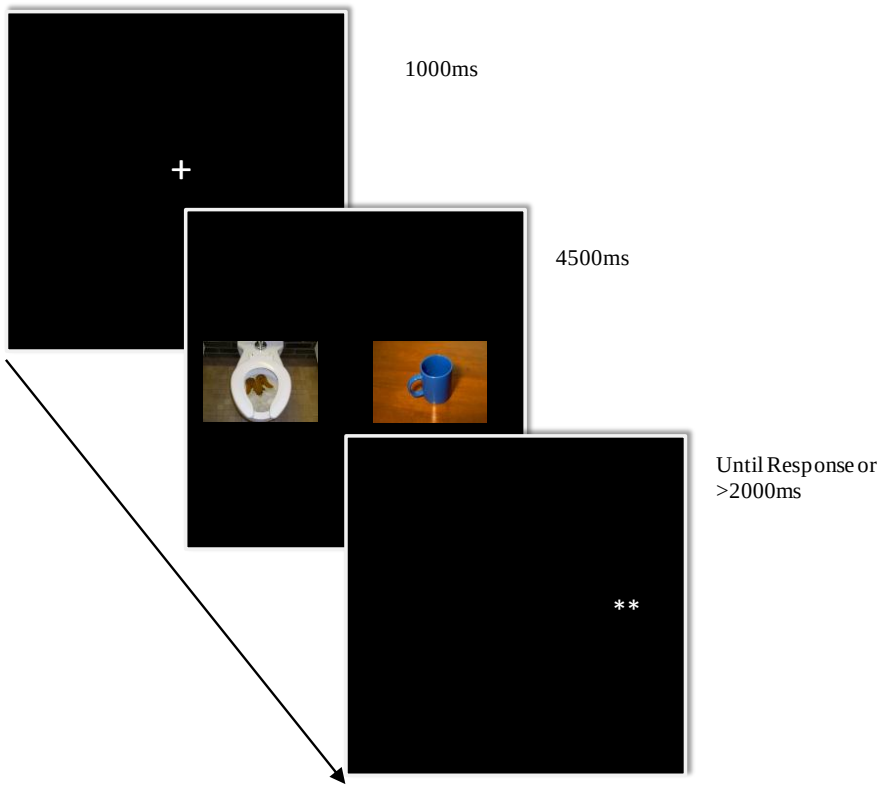

Figure 1.

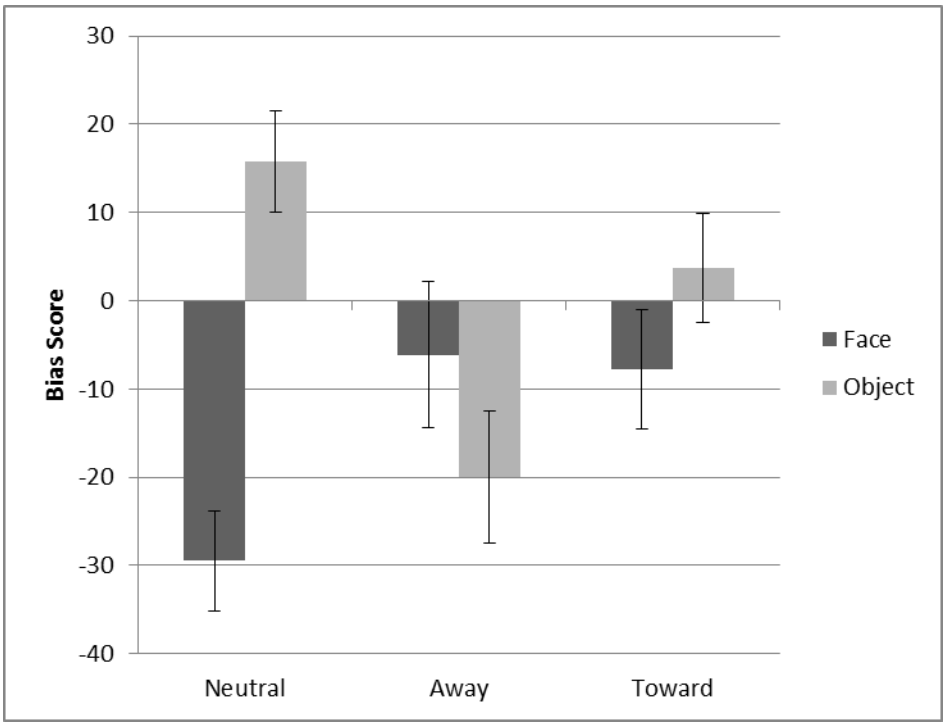
30
20
10
0
-10
-20
-30
-40
Bias Score
Neutral
Away
Toward
Face
Object

Figure 2.

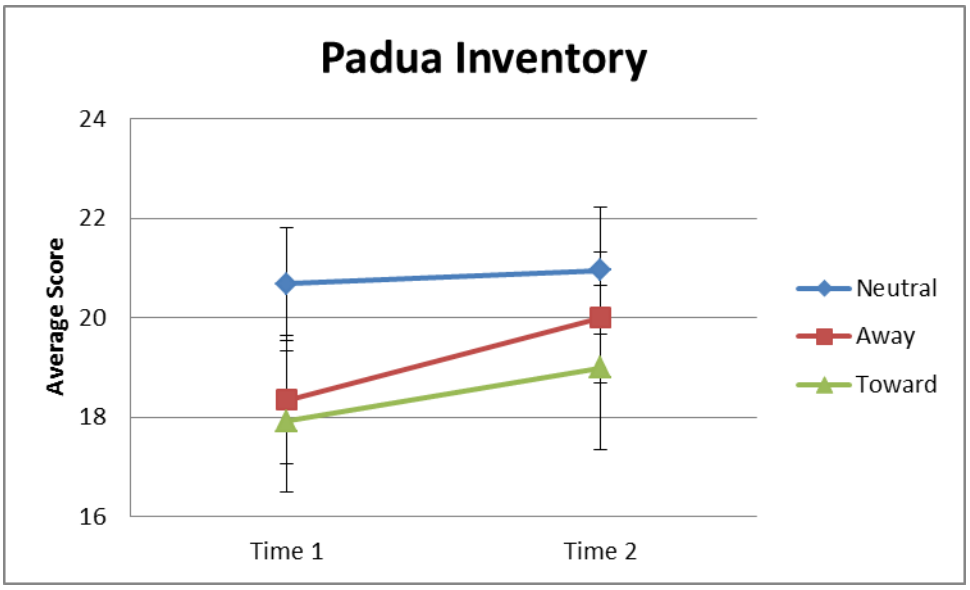
Padua Inventory
Average Score
24
22
20
18
16
Time 1
Time 2
Neutral
Away
Toward

Figure 3.

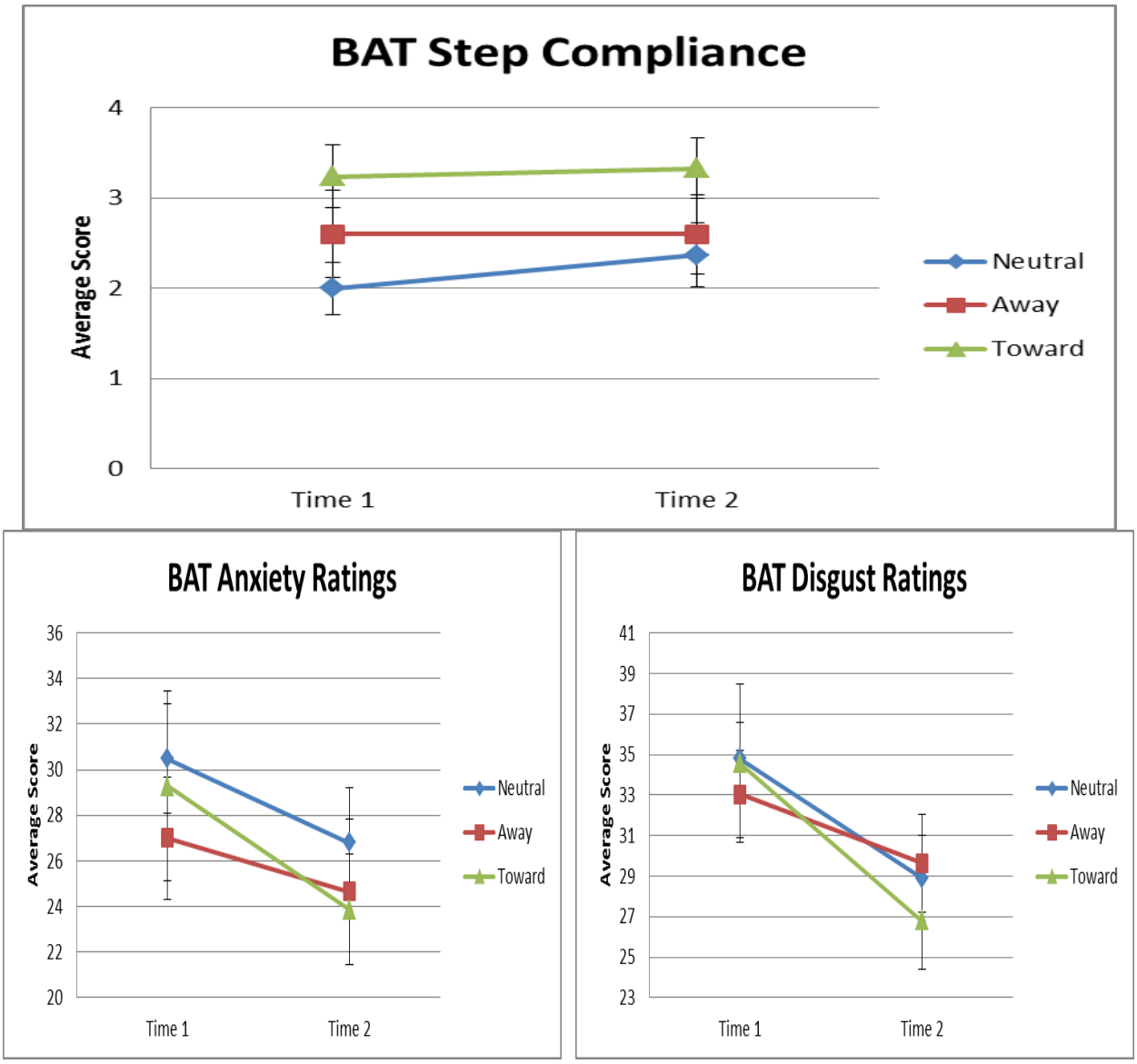
BAT Step Compliance
Average Score
4
3
2
1
0
Time 1
Time 2
Neutral
Away
Toward
BAT Anxiety Ratings
Average Score
36
34
32
30
28
26
24
22
20
Time 1
Time 2
Neutral
Away
Toward
BAT Disgust Ratings
Average Score
41
39
37
35
33
31
29
27
25
23
Time 1
Time 2
Neutral
Away
Toward

Figure 4.

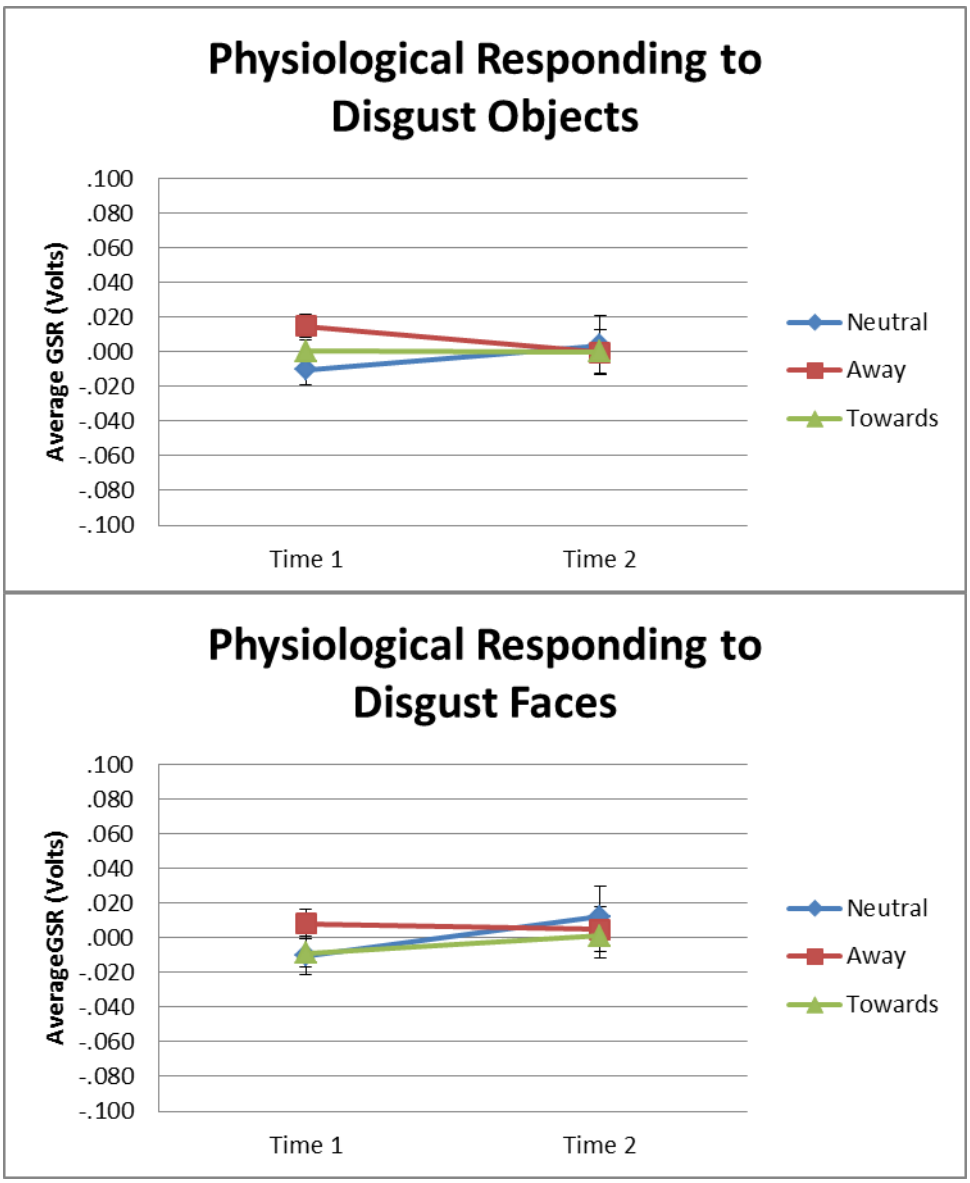
Physiological Responding to Disgust Objects
Average GSR (Volts)
.100
.080
.060
.040
.020
.000
-.020
-.040
-.060
-.080
-.100
Time 1
Time 2
Neutral
Away
Towards
Physiological Responding to Disgust Faces
AverageGSR (Volts)
.100
.080
.060
.040
.020
.000
-.020
-.040
-.060
-.080
-.100
Time 1
Time 2
Neutral
Away
Towards

Figure 5.

Appendix A

Padua Inventory (WSUR)

INSTRUCTIONS: The following statements refer to thoughts and behaviors which may occur to everyone in everyday life. For each statement, choose the reply which best seems to fit you and the degree of disturbance which such thoughts or behaviors may create. Rate your replies as follows:

0 = not at all; 1 = a little; 2 = quite a lot; 3 = a lot; 4 = very much

_____ 1. I feel my hands are dirty when I touch money.

_____ 2. I think even the slightest contact with bodily secretions (perspiration, saliva, urine, etc.) may contaminate my clothes or somehow harm me.

_____ 3. I find it difficult to touch an object when I know it has been touched by strangers or by certain people.

_____ 4. I find it difficult to touch garbage or dirty things.

_____ 5. I avoid using public toilets because I am afraid of disease and contamination.

_____ 6. I avoid using public telephones because I am afraid of contagion and disease.

_____ 7. I wash my hands more often and longer than necessary.

_____ 8. I sometimes have to wash or clean myself simply because I think I may be dirty or "contaminated."

_____ 9. If I touch something I think is "contaminated," I immediately have to wash or clean myself.

_____ 10. If an animal touches me, I feel dirty and immediately have to wash myself or change clothing.

Appendix B

Disgust Scale- Revised

ABOUT HOW MUCH TIME PER DAY DO YOU SPEND WASHING YOURSELF AND/OR YOUR HOME OR OTHER BELONGINGS? _____ HOURS and _____ MINUTES

Please indicate how much you agree with each of the following statements, or how true it is about you. Please write a number (0-4) to indicate your answer:

0 = Strongly disagree (very untrue about me)
1 = Mildly disagree (somewhat untrue about me)
2 = Neither agree nor disagree
3 = Mildly agree (somewhat true about me)
4 = Strongly agree (very true about me)

____1. I might be willing to try eating monkey meat, under some circumstances.
____2. It would bother me to be in a science class, and to see a human hand preserved in a jar.
____3. It bothers me to hear someone clear a throat full of mucous.
____4. I never let any part of my body touch the toilet seat in public restrooms.
____5. I would go out of my way to avoid walking through a graveyard.
____6. Seeing a cockroach in someone else's house doesn't bother me.
____7. It would bother me tremendously to touch a dead body.
____8. If I see someone vomit, it makes me sick to my stomach.
____9. I probably would not go to my favorite restaurant if I found out that the cook had a cold.
____10. It would not upset me at all to watch a person with a glass eye take the eye out of the socket.
____11. It would bother me to see a rat run across my path in a park.
____12. I would rather eat a piece of fruit than a piece of paper
____13. Even if I was hungry, I would not drink a bowl of my favorite soup if it had been stirred by a used but thoroughly washed flyswatter.
____14. It would bother me to sleep in a nice hotel room if I knew that a man had died of a heart attack in that room the night before.

How disgusting would you find each of the following experiences? Please write a number (0-4) to indicate your answer:

0 = Not disgusting at all
1 = Slightly disgusting
2 = Moderately disgusting
3 = Very disgusting
4 = Extremely disgusting

____15. You see maggots on a piece of meat in an outdoor garbage pail.
____16. You see a person eating an apple with a knife and fork
____17. While you are walking through a tunnel under a railroad track, you smell urine.
____18. You take a sip of soda, and then realize that you drank from the glass that an acquaintance of yours had been drinking from.
____19. Your friend's pet cat dies, and you have to pick up the dead body with your bare hands.
____20. You see someone put ketchup on vanilla ice cream, and eat it.
____21. You see a man with his intestines exposed after an accident.
____22. You discover that a friend of yours changes underwear only once a week.
____23. A friend offers you a piece of chocolate shaped like dog-doo.

____24. You accidentally touch the ashes of a person who has been cremated.
____25. You are about to drink a glass of milk when you smell that it is spoiled.
____26. As part of a sex education class, you are required to inflate a new unlubricated condom, using your mouth.
____27. You are walking barefoot on concrete, and you step on an earthworm.

Appendix C

(CES-D; Radloff, 1977)

INSTRUCTIONS: Indicate how often you have felt the following way during the past week. Rate your replies as follows:

0 = none of the time (< 1 day); 1 = some (1-2 days); 2 = occasionally (3-4 days); 3 = most of the time (> 5 days)

_____ 1. I was bothered by things that usually don't bother me.
_____ 2. I did not feel like eating; my appetite was poor.
_____ 3. I felt that I could not shake off the blues even with help from my family or friends.
_____ 4. I felt I was just as good as other people.
_____ 5. I had trouble keeping my mind on what I was doing.
_____ 6. I felt depressed.
_____ 7. I felt that everything I did was an effort.
_____ 8. I felt hopeful about the future.
_____ 9. I thought my life had been a failure.
_____ 10. I felt fearful.
_____ 11. My sleep was restless.
_____ 12. I was happy.
_____ 13. I talked less than usual.
_____ 14. I felt lonely.
_____ 15. People were unfriendly.
_____ 16. I enjoyed life.
_____ 17. I had crying spells.
_____ 18. I felt sad.
_____ 19. I felt that people dislike me.
_____ 20. I could not get "going."

Appendix D

The State-Trait Anxiety Inventory, Form Y

STAI Form Y-2

DIRECTIONS: A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
1. I feel pleasant	1	2	3	4
2. I feel nervous and restless	1	2	3	4
3. I feel satisfied with myself	1	2	3	4
4. I wish I could be as happy as others seem to be	1	2	3	4
5. I feel like a failure	1	2	3	4
6. I feel rested	1	2	3	4
7. I am "calm, cool, and collected"	1	2	3	4
8. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
9. I worry too much over something that doesn't really matter	1	2	3	4
10. I am happy	1	2	3	4
11. I have disturbing thoughts	1	2	3	4
12. I lack self-confidence	1	2	3	4
13. I feel secure	1	2	3	4
14. I make decisions easily	1	2	3	4
15. I feel inadequate	1	2	3	4
16. I am content	1	2	3	4
17. Some unimportant thought runs through my mind and bothers me	1	2	3	4
18. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
19. I am a steady person	1	2	3	4
20. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

Appendix E

CCS

Instructions: Below is a list of objects. Please read the description of each object and try to imagine what would happen if you touched that object and were unable to wash your hands afterward. For each object listed, answer two questions:

(1) What is the likelihood that touching the object would result in your being contaminated? Answer using the following 0-100 scale:

0	10	20	30	40	50	60	70	80	90	100
not at all likely					moderately likely				extremely likely	

(2) If you actually did become contaminated by touching the object, how bad would it be? Answer using the following 0-100 scale:

0	10	20	30	40	50	60	70	80	90	100
not at all bad					moderately bad				extremely bad	

Object	Likelihood that touching object would cause contamination (0-100 scale)	If actually contaminated, how bad would it be? (0-100 scale)
Toilet handle in public restroom		
Toilet seat in public restroom		
Sink faucet in public restroom		
Public door handles		
Public workout equipment		
Public telephone receivers		
Stairway railings		
Elevator buttons		
Animals		
Raw meat		
Money		
Unwashed produce (e.g., fruits, vegetables)		
Foods that other people have touched		