IMPLICIT ASSOCIATIONS IN BLOOD-INJECTION-INJURY PHOBIA: CHANGES AT FOLLOW-UP TO EXPOSURE

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ABSTRACT

Current research has demonstrated that disgust plays a dominant role in the blood-injection-injury (BII) subtype of specific phobia and that disgust is extinguished less effectively during standard exposure to fear-eliciting stimuli. The current study examines the efficacy of one-session exposure to a disgust-elicitor through behavioral avoidance tasks (BATs), implicit associations tests (IATs), and self-report at a one-week follow-up. Participants completed all measures pre-exposure, post-exposure and at the one-week follow-up. A trend in phobic participants suggested significant decrease in avoidance from pre-exposure to follow-up and a significant decrease from post-exposure to follow-up. No significant changes were seen in implicit or explicit assessments of disgust, but a trend suggested possible improvement in implicit disgust cognitions from post-exposure to follow-up. The results suggest possible improvements in phobic responding following disgust-based exposure. Further research is warranted and the authors suggest that the addition of cognitive components to standard behavioral exposure may effect greater changes in disgust cognitions.

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CHAPTER 1

INTRODUCTION

A specific phobia is characterized by clinically significant levels of fear or anxiety in response to contact or anticipated contact with specific objects or situations. The fear or anxiety is perceived as excessive or unreasonable and can often lead to avoidance. To meet criteria for the disorder, the fear, anxiety, or avoidance must induce clinically significant levels of distress about phobic responding or the fear, anxiety, or avoidance must cause significant disruption to the individual's daily life (American Psychiatric Association, 2000).

Blood-Injection-Injury Phobia

Blood-Injection-Injury (BII) phobia is a type of specific phobia where the feared objects and situations relate to seeing or coming into contact with blood (one's own or another's), needles, blood-draws and injections, and injuries to oneself or another. BII phobia occurs in roughly 4% of the population and can result in avoidance of many medical settings, particularly blood-tests, injections and surgery (Agras, Sylvester, & Oliveau, 1969; Costello, 1982). Extreme cases can prevent the individual from receiving critical medical attention or treatment, for example a life-saving surgery (APA, 2000). Less severe cases of BII phobia can result in avoidance that restricts the sufferer from receiving routine preventative medical tests and assessments. Due to their avoidance of medical settings, individuals with BII phobia are the second least likely to present for treatment of all specific phobias (APA, 2000).

The Cognitive-Behavioral Model of Specific Phobias

Cognitive models suggest that anxiety disorders are the result of faulty information processing and maladaptive cognitive schemas (Salkovskis & Rachman, 1997; Teachman &

Woody, 2003). In specific phobias, these maladaptive cognitive schemas can result in maladaptive beliefs that are frequently centered on the perceived physical or psychological threats of encountering the feared stimuli (Salkovskis & Rachman, 1997). Such cognitive schemas and beliefs are often unrelated to the individual's past experience (i.e. not a result of conditioning) and maintain anxiety and avoidance through negative reinforcement (e.g. a non-threatening cue is perceived as threatening and avoidance reduces the anxiety of confrontation). Behavioral and cognitive conceptualizations of specific phobias have traditionally focused on the importance of a maladaptive fear schema but recent research indicates that disgust, rather than fear, is the key emotion in the acquisition and maintenance of BII phobia (Olatunji et al., 2008; Olatunji et al., 2007; Schniele et al., 2005; Tolin, 1999).

The Role of Disgust

Disgust is a revulsion response that motivates avoidance of disease and contamination (Rozin & Fallon, 1987; Rozin et al., 2000), and serves to prevent contact with or oral incorporation of an undesirable stimulus (Tolin, 1999). It has been suggested that disgust is evolutionarily-based (Seligman, 1971) because of its potential to prevent disease or poisoning through fear of contamination (Schienle et al., 2005). Disgust is considered a basic emotion characterized by parasympathetic activation (e.g. decreased heart rate, reduced skin temperature, reduced salivation; Stark et al. 2005), unique facial expressions (e.g. levator labii muscle activation recognized as a wrinkling of the upper lip; Vrana, 1994; 1993), the physiological state of nausea (Rozin et al., 2008), and distinct cognitive processes known as the 'law of contact' (i.e. once in contact the item is always contaminated) and the 'law of similarity' (i.e. an object resembling a contaminated object is also contaminated; Rozin et al., 1986).

Recent research has demonstrated the strong role of disgust in the acquisition and maintenance of pathological anxiety and BII phobia in particular (Olatunji et al. 2008; Olatunji et al. 2007; Schniele et al. 2005; Tolin, 1999). Research in BII phobia has primarily examined two types of disgust: core disgust and animal reminder disgust. Core disgust is associated with small animals, (e.g. snakes or spiders), food (e.g. spoiled milk), and body products (e.g. urine or feces). Animal reminder disgust is associated with blood, bodily punctures, injuries and mutilation, and is the most commonly examined disgust subtype in BII research because it relates to blood and injuries which are a core component of the phobia (Olatunji et al., 2008).

Empirical Support for the Primary Role of Disgust in BII Phobia

A growing body of research has revealed a compelling relationship between BII phobia and disgust. Across various methods, disgust has fairly consistently surfaced as the dominant emotional response in individuals with the disorder (de Jong & Merckelbach, 1998; Gerlach et al., 2006; Koch, 2002; Olatunji, Lohr, et al., 2007; Olatunji et al., 2008; Rusch & Carter, 2011; Schienle et al., 2005). Despite traditional phobia research on the emotion of fear, this current research suggests that future studies should more fully examine the influence of disgust on the causes and maintenance of BII phobia.

BII phobic (BIIP) individuals report higher levels of disgust in response to phobia-relevant stimuli. For example BIIP participants report significantly higher levels of disgust during venipuncture than non-phobic (NP) controls (Gerlach et al. 2006). Gerlach and colleagues collected self-reports of disgust, anxiety and embarrassment from 20 BIIP participants and 20 NP participants during a venipuncture procedure. BIIP participants reported higher levels of anxiety, disgust, and embarrassment during venipuncture than controls. These findings suggest that the venipuncture is experienced as significantly more disgusting to individuals who are BII phobic.

De Jong and Mercklebach (1998) demonstrated not only that is there a connection between disgust and BII phobia but that it is domain-specific. Disgust and specific phobia questionnaires were completed by 98 participants and results indicated that high levels of disgust sensitivity were significantly correlated with high scores on BII phobia questionnaires. In addition, the relationship between disgust and BII phobia was domain-specific where individuals with high scores on BII questionnaires reported increased disgust in response to items that tapped animal-reminder disgust. These findings suggest that BII phobic individuals experience increased disgust sensitivity compared to non-phobics and that animal-reminder stimuli elicits the greatest amount of disgust in these individuals.

Further self-report research on BII phobia conducted by Olatunji, Lohr and colleagues (2007) examined disgust sensitivity questionnaires and ratings of fear and disgust cognitive appraisals in response to images of blood, mutilation and injections. Compared to the NP participants, results indicated that the BIIP participants evinced greater overall disgust sensitivity and greater fear and disgust responding in response to all images. Disgust emerged as the dominant emotion in BIIP participants in response to images of blood and mutilation. Ratings of disgust and fear, however, were not significantly different in response to injection images suggesting that needle and injection stimuli are both disgust- and fear-elicitors for BIIP individuals. Furthermore, no significant differences were found between BIIP and NP participants in ratings of fear and disgust elicited by the injection images. The only significant differences appeared in response to the blood and mutilation images where BIIP participants rated the images as significantly more disgusting than NP participants.

Disgust responding in BII phobia has also been linked to increased avoidance behavior. Koch and colleagues (2002) assessed fear and disgust in analogue BIIP participants in response to pictorial stimuli (mutilation, insects), core disgust in vivo stimuli (worm, cockroach) and animal reminder in vivo stimuli (bloody gauze, severed deer leg). Ratings of fear and disgust for the pictorial and in vivo stimuli were collected and participants engaged in a Behavioral Approach/Avoidance Task (BAT) with each in vivo stimulus. Findings demonstrated that BIIP participants reported significantly greater fear and disgust in response to all phobia-relevant stimuli than controls. BIIP ratings of disgust, however, were significantly higher than fear for both pictorial and in vivo stimuli. NP participants reported less disgust and demonstrated less avoidance on the BAT. Higher levels of self-reported disgust in BIIP participants correlated with increased avoidance on the BAT. Fear ratings did not contribute to avoidance of phobia-relevant stimuli in the BATs suggesting that disgust is the main influence on avoidance behavior, a major maintenance factor in BII phobia.

In a study conducted by Olatunji and colleagues (2008), high BII fear participants and low BII fear participants (as determined by a self-report measure of aversion to blood, injury and mutilation stimuli) completed self-report measures of disgust and engaged in three BATs presented in random order. The BAT stimuli were a severed deer leg (an animal reminder disgust-elicitor), a tarantula (a core disgust-elicitor), and a "contaminated cookie." For participants in the high BII fear group, higher scores on the Disgust Emotion Scale (DES) subscales (except Rotting Foods) were associated with greater avoidance of the severed deer leg in the animal reminder BAT. Furthermore, when controlling for gender and BII group membership (high or low), mutilation disgust, a subscale of the DES, contributed significant variance to avoidance in the animal reminder BAT. This second finding indicates that disgust has a direct influence on BII avoidance behavior even when controlling for BII fear.

As research accumulates on the influence of disgust in BII phobia, the dominance of disgust responding has emerged. BII phobic (BIIP) individuals report higher levels of disgust than NP controls (Gerlach et al., 2006) and high levels of disgust sensitivity are correlated with high scores on BII phobia questionnaires (de Jong & Mercklebach, 1998). Disgust ratings have been shown to contribute to avoidance behavior when fear ratings have not (Koch et al. 2002) and when controlling for levels of fear (Olatunji et al., 2008). Assessment methods in these studies are currently limited to behavioral and self-report measures which only imply the presence of maladaptive cognitive schemas theorized to be fundamental to the maintenance of BII phobia. In order to more thoroughly assess these maladaptive schemas, recent research has begun to assess implicit associations of fear and disgust in specific phobias.

The Implicit Association Test

The Implicit Association Test (IAT) has been used to assess the strength of maladaptive schemas through examination of automatic associations. The IAT is a reaction time test that measures cognitive schemas and automatic processes that are believed to be inaccessible through explicit means like self-report. The response time it takes to classify stimuli when paired categories match the participant's automatic associations are compared to response times when categories contradict the participant's automatic associations. The underlying assumption of the IAT is that the response latency (i.e. processing speed) indirectly measures the degree of association between two concepts (the paired categories) in an individual's cognitive network. The shorter the response latency, the more automatic the response is and the stronger the individual associates the two concepts in his/her memory.

The IAT logic extends to suggest that when two concepts that are closely related in an individual's cognitive network are paired they will produce faster reaction times. Conversely, associations that are less strong or do not exist in the individual's memory will have longer response latencies. This may be the result of a lack of association between the two concepts or it could result from those concepts being more strongly associated to other concepts than the one with which it is currently paired. If the concept in question is more closely related to a distinct concept from that to which it is paired, the IAT requires the individual to overcome previous associations that have become solidified in their cognitive networks in order to pair the two.

The IAT offers the benefits of gathering unbiased assessments of cognitive schemas and the role those schemas play in phobias like BII phobia. Common methods of self-report are valid but the IAT can potentially gather information that cannot be achieved through individual introspection and self-report, particularly in regards to cognitive schemas which the individual may not be explicitly cognizant of (Teachman & Woody, 2003). Furthermore, self-report can be vulnerable to demand characteristics, self-censoring and even providing false information whether intentionally or through a lack of self-awareness. The IAT has been shown to have good internal consistency, adequate stability and be difficult to manipulate (Egloff & Schmukle, 2002).

The Implicit Associations Test and Specific Phobia Research

Specific phobia research has used the IAT to assess relevant automatic associations as a means of evaluating the strength and character of maladaptive cognitive schemas in individuals with the disorder. For example, Teachman and colleagues (2001) used the IAT to examine automatic associations in snake and spider phobias to concepts of good-bad, danger-safety, afraid-unafraid, and disgusting-appealing. Of these four pairs, only afraid-unafraid and disgusting-appealing resulted in significant differences between the response times of each group. Participants categorized as spider phobic responded significantly faster to pairings of spider-afraid and spider-disgusting than participants categorized as snake phobic. The opposite was true for pairings of snake-afraid and snake-disgusting, where participants categorized as snake phobic responded faster. As predicted, these findings support the idea that individuals with a specific phobia will respond more quickly to word pairings of their phobic stimulus and strongly cognitively associated descriptive words, in this case regarding fear and disgust.

Rusch and Carter (2011) applied this methodology to BII phobic and fearful individuals to compare the strength of automatic associations of disgust and fear in response to mutilation images. The results demonstrated that response times for mutilation-disgust were faster than response times for mutilation-afraid in phobic and fearful participants. This pattern indicates that the concept of mutilation is more closely related to the emotion of disgust than fear in these individuals. The non-phobic participants did not evince this responding pattern suggesting that the relevant maladaptive schemas were not present in non-phobic individuals. These findings suggest the primacy of disgust schemas in BII phobia but does not address whether these schemas are altered following treatment.

The IAT has been used to demonstrate the most salient automatic associations in individuals with specific phobia but it can also be used to assess whether changes occur in maladaptive schemas following successful treatment. The implication of the cognitive-behavioral model of specific phobias is that symptoms can be reduced by breaking the pattern of negative reinforcement (reducing avoidance behavior) and that improvement in symptoms would be related to changes in maladaptive schemas (Beck & Clark, 1997; Teachman & Woody, 2003). Behavioral interventions like exposure therapy have been shown to reduce phobic symptomology as measured by self-report and behavioral assessments (Hirai et al., 2008; Olatunji, Smit et al., 2006; Ost, 1989; Ost, Hellstrom, & Kaver, 1992; Teachman et al., 2001;

Teachman & Woody, 2003). IAT research has begun to be used to document changes in maladaptive beliefs and cognitions following exposure (Teachman & Woody, 2003).

Treatment of BII Phobia

Exposure therapy has been shown to be effective in treating specific phobias (Choplin & Carter, 2011; Hirai et al. 2008; Olatunji, Smit, et al. 2006; Olatunji, Wolitzky, et al. 2009; Ost, 1989; Ost, Hellstrom, & Kaver, 1992; Teachman & Woody, 2003). Ost (1989) demonstrated positive outcomes from a one-session exposure treatment for BII phobia with 90% of participants retaining a clinically significant improvement in symptoms at follow-up (ranging from 6 months to 7 years). Ost, Hellstrom, & Kaver (1992) compared the efficacy of one versus five sessions of exposure using a 20-step BAT exposure technique. Both groups improved significantly on all measures of BII phobia but 80% of individuals in the five-session treatment group were significantly clinically improved at the one-week post-treatment assessment while 90% of individuals in the one-session treatment groups were significantly clinically improved one week after treatment.

Teachman and Woody (2003) examined whether CBT with exposure can affect the IAT response times of individuals with specific phobia. Spider phobic participants and controls were assessed prior to treatment using self-report measures of spider phobia, six IATs (two control tasks and four snake/spider tasks with word pairs of good-bad, afraid-unafraid, danger-safety and disgusting appealing), and a spider BAT to assess phobic avoidance. Participants then underwent a 90-minute cognitive-behavioral therapy (CBT) group session containing aspects of exposure, psychoeducation and cognitive therapy techniques. At the end of these sessions, the participants were asked to complete the IATs and the BAT once more in order to compare their response latencies and avoidance behavior from pre- to post-treatment. The results showed that the IAT was sensitive to changes after therapy; response latencies of phobic participants were slower between the phobia-relevant stimulus and words regarding fear and disgust. This result suggests that the group therapy session was able to lessen the maladaptive associations between phobia-relevant stimuli and the emotions of fear and disgust. This study provides a good example of how exposure and CBT can help to correct maladaptive cognitions relating to specific phobias that may not be explicit.

For the purpose of BII research, conclusions drawn from the findings of Teachman and Woody (2003) are tempered by three limitations. First, differences in phobic responding patterns may exist between BII phobics and spider phobics, so it is not possible to know if these findings would generalize to BII phobia. Second, the treatment method employed contained three components making it difficult to distinguish which component was responsible for change or whether it was a combination of the three. Previous research has indicated that exposure alone has effectively produced reductions in behavioral avoidance in BII phobic individuals (Koch et al., 2002; Olatunji et al., 2008). Given the key role of disgust in BII phobia, a third limitation of the Teachman and Woody study is that exposure to a disgust-elicitor was not examined.

Olatunji, Smits et al. (2007) examined the decline rate of fear and disgust in a sample of BII phobics during a 30-minute exposure session using injection-based stimuli (BAT design). Participants completed self-report questionnaires of disgust sensitivity and BII phobia, and an injection-based BAT before and after exposure. Ratings of peak fear and disgust were examined for the trial perceived to be the most challenging by the participant that required at least three attempts. The results illustrated that the decay slope for fear was greater than that of disgust indicating that disgust extinguishes more slowly than fear. The authors suggest that residual disgust responding may partially account for the return of BII phobic symptoms after exposure but since there was no follow-up component in this study, that hypothesis was unable to be tested.

The study by Olatunji, Smits and colleagues (2007) would be strengthened by addressing two key issues. First, no information is reported regarding the levels of fear and disgust elicited by the exposure stimuli. Unlike other specific phobias, BII phobia-relevant stimuli are quite heterogeneous with different stimuli eliciting varying levels of fear and disgust (Olatunji, Lohr et al., 2007). The residual disgust responding they found might have been more effectively reduced with exposure to a stimulus that elicited more disgust. Second, the study did not examine whether changes in disgust and fear avoidance were maintained at follow-up.

Reductions in disgust following exposure may be associated with a diminished fear of contact with a disgusting stimulus (Davey, 1992; De Jong, Vorage, & Van den Hout, 2000; Matchett, & Davey, 1991). Other theories propose that the experience of disgust during exposure may more fully activate phobia-relevant maladaptive schemas, allowing them to be challenged and disconfirmed during exposure (Olatunji, et al. 2012). Hirai and colleagues (2008) compared the efficacy of a fear-based exposure treatment (BAT design) and a fear-disgust treatment. The exposure hierarchy was consistent between the two conditions with the addition of a few modules directly targeting disgust in the fear-disgust condition. Both fear-only and fear-disgust exposure significantly decreased fear and avoidance behavior toward BII stimuli after treatment. Both groups also had similar reductions in disgust responses and global as well as domain-specific disgust sensitivity. The fear-disgust group exhibited greater reduction in BII symptoms than the fear-only group but this difference was only on two out of thirteen BII symptom variables. Nevertheless, the effect size of the fear-disgust condition was slightly greater than that of the fear-only condition. Overall, the effect of the additional disgust modules was not very strong in terms of treatment outcome compared to the fear-only group.

The study by Hirai and colleagues suffers from a few methodological limitations. First, during both exposure conditions the researchers obtained ratings of both fear and disgust (Subjective Units of Distress Scale was used, SUDS: Wolpe, 1973) which later indicated that the fear-only stimuli was also eliciting disgust responses. This may be the result of the fear stimuli directly eliciting disgust or it could be a product of the researcher gathering SUDS scores for both fear and disgust in both conditions, triggering the participant to consider disgust in the fear-only condition. Second, because both disgust and fear were elicited in both conditions, the researchers cannot present an accurate depiction of the effects of the disgust-eliciting components in exposure treatment. The authors suggest that the use of a more effective and more appropriate disgust-elicitor would better demonstrate the results of disgust exposure on phobic responding. The disgust modules used by Hirai and colleagues were extensions of fear-based tasks that would have elicited contamination disgust (e.g. touching your hair after holding the vial of blood) instead of animal reminder disgust which has been shown to be the most salient for BII phobics (de Jong & Merckelbach, 1998; Olatunji et al., 2008). Finally, the study included a one-week follow-up assessment where treatment gains were maintained but due to the confounding of fear and disgust in the exposure conditions, the study was not able to truly address whether the effects of disgust exposure were maintained at follow-up.

Purpose of Current Research and Hypotheses

The results of Olatunji, Smits et al. (2007) illustrate the need for more effective means of decreasing disgust responding in BII phobia in the hopes of preventing the return of phobic responding. According to cognitive-behavioral models of anxiety, the maladaptive cognitive schemas and avoidance behavior are the two key elements in maintaining phobic responding. Teachman and Woody (2003) demonstrated that the IAT is an effective means of assessing the strength of cognitive associations between phobia-relevant stimuli and maladaptive emotional responses of fear and disgust. In addition, the IAT was sensitive to changes in schemas following treatment (Teachman & Woody, 2003). Initial research into the effects of disgust-specific aspects of exposure treatment (Hirai et al. (2008) is promising but methodological refinements are required to more accurately understand the effects of disgust exposure.

Rusch and Carter (in progress) examined whether exposure to an animal reminder disgust-elicitor altered maladaptive cognitive schemas and reduced avoidance behavior. The 30-minute exposure to a severed deer leg was expected to slow IAT response times between the concepts of mutilation and disgust and reduce avoidance of another animal reminder stimulus, a vial of blood. Following exposure, it was predicted that IAT response times of BIIP participants would not be significantly different from NP participants.

The current research investigated the strength of disgust automatic associations and avoidance at one-week following exposure. This study therefore examined: 1) whether disgust implicit associations to mutilation images changed from post-exposure to follow-up, 2) whether avoidance behavior remained constant from post-exposure to follow-up and 3) whether cognitive or behavioral improvements were better maintained at follow-up. It was hypothesized that decreases in avoidance after exposure to the disgust elicitor in the initial phase of the study study (Rusch & Carter, in progress) would be maintained at follow-up. In addition, the weakening of implicit associations between mutilation images and the concept of disgust were also expected to be maintained at follow-up. Finally, it was hypothesized that there would be no significant differences between maintenance of improvements in cognitive and behavioral measures.

CHAPTER 2

METHODS

Participants

Thirty participants who met criteria for having BII phobia as determined by the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; First et al., 2002) specific phobia section were compared to 30 non-phobic participants. Per Teachman and Woody (2003), participants who met criteria for moderate to severe depression, as determined by scores on the Beck Depression Inventory-Second Edition (BDI-II; Beck et al., 1996) were not qualified to participate in the study. A common side effect of depression is psychomotor retardation which could influence the results of the reaction time task in this study and the preceding one. Participants were also excluded if they met criteria for another specific phobia subtype that was more severe than the BII subtype. In addition, participants were not included if they were currently or had previously undergone treatment for BII phobia. Considering that research has consistently found that women report more BII fears than males (e.g. Labus, France & Taylor, 2000; Olatunji, Arrindell & Lohr, 2005; Schienle, et al., 2003), more women (N=51) than men (N=10) qualified and participated.

Measures

Demographics Questionnaire

The Demographics Questionnaire was used to determine the participant's age, sex, ethnicity and whether or not they were currently or had previously undergone treatment for a specific phobia.

Anxiety Disorders Interview Schedule

Either the primary investigator or a trained research assistant administered the Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown et al., 1994) specific phobia section to participants. The ADIS-IV uses an 8-point severity scale, where a score of four or more indicates that a clinical diagnosis is appropriate. A score of four or more on the ADIS-IV will qualify participants to complete the full study; scores below four are considered subclinical and will not be examined here. Meeting criteria for another specific phobia was not considered grounds for exclusion unless the other phobia was more severe or equally severe to the participant's BII phobia. In order to participate in the proposed study, the participant's most severe specific phobia must have been BII subtype. Research assistants were trained together and assessed to ensure similarity of ratings.

Disgust Scale-Revised

The Disgust Scale-Revised (DS-R; Haidt, McCauley, & Rozin, 1994; Modified by Olatunji et al., 2007) is a 25-item trait measure questionnaire developed to measure individual differences in disgust sensitivity. Questionnaire items cover three types of disgust: core disgust, animal reminder disgust, and contamination disgust (Haidt et al., 1994; Olatunji et al., 2007). The psychometric properties of the revised scale support the decision of Olatunji and colleagues (2007) to revise the original questionnaire. Cronbach's alphas from the revised version of the scale were .87 (whole scale), .80 (core disgust scale), .82 (animal reminder disgust scale) and .71 (contamination disgust scale) (Olatunji, et al., 2007). In the current study, the overall internal consistency reliability for the DS-R was good at pre-exposure and follow-up (α=.80 and α=.82, respectively). Internal consistency was acceptable for the animal reminder subscale (α=.756 and α=.783) and was questionable for the core disgust subscale (α=.63 and α=.70). However, internal consistency for the contamination subscale was poor (α=.596 and α=.573).

Beck Depression Inventory-Second Edition

The Beck Depression Inventory-Second Edition (BDI-II; Beck et al., 1996) is a 21 item inventory that assesses affective and somatic symptoms for Major Depressive Disorder (MDD). In a population of college students, the BDI-II was shown to have good reliability with a Cronbach's alpha of .90 (Storch et al., 2004). The IAT measures response latencies and so the BDI-II was used to determine if participants were prone to experiencing psychomotor retardation, a common symptom of depression. Slower response times in these participants might have been be more representative of their depressed state than of their implicit associations to the concepts presented.

Implicit Association Test

The Implicit Association Test (Teachman et al., 2001) is a computer-based task that asks participants to categorize words and images into superordinate categories. Scores depend on the time it takes participants to categorize the stimuli. Response times are said to demonstrate the level of association between two concepts in the participant's cognitive network. Shorter response times indicate a closer association between the two concepts.

The IAT used in the current study was a re-administration of the IAT used in the first phase. In accordance with the procedure of Teachman et al. (2001), the IAT used the contrasting descriptive categories of disgust-appealing. Ten images of each of two types were presented, 1) mutilation photos drawn from previous research by Connelly et al. (2006), and 2) neutral photos of flowers selected from the International Affective Picture System (IAPS; Lang et al., 2008). The participants were also asked to categorize words such as "gross" as either "disgusting" or "appealing". In each case, the superordinate categories are the latter pair, i.e. "disgusting-appealing". To ensure that all mutilation images elicited high levels of disgust, the images were selected from those used in previous research conducted by Connelly and colleagues (2006) where they were balanced and rated for disgust elicited. The images depict injuries to arms, legs, hands and feet. No images depict faces.

Scores are derived from response latencies in millisecond to the critical trials where mutilation images are paired with disgusting or appealing. The measures of interest are the difference between response speed for matching categories like "mutilation" and "disgusting", and latencies for non-matching categories like "mutilation" and "appealing".

Behavioral Approach/Avoidance Test

A five-step Behavioral Approach/Avoidance Test (BAT) was administered pre- and post-exposure in the first phase study and at the follow-up assessment. The BAT measured avoidance of a BII relevant disgust elicitor (vial of blood). See Appendix A for BAT steps. If the participant declined to engage in any step, the BAT was discontinued and the final step recorded by the researcher.

Exposure

The exposure period lasted up to 30 minutes and followed a Behavioral Approach/Avoidance Test design where the participant was asked to engage more with the animal reminder disgust stimulus (severed deer leg) as time passed (Olatunji et al., 2006; Olatunji et al., 2007, Page, 2001). Exposure procedures were in line with previous research (Smits, et al. 2002); see Appendix B for exposure hierarchy. During exposure, participants were asked to verbally report their level of anxiety on a scale from 1-10 to ensure that their anxiety had decreased to a four or below before proceeding to the next step in the hierarchy. If a participant was not ready to continue to the next step, they continued with the current step until their anxiety level decreased sufficiently. Upon completion of the final level of the hierarchy, exposure was discontinued.

Procedure

During the initial phase of the study (Rusch & Carter, in progress), after the participant signed the informed consent, the participants were asked to complete the BDI-II and the demographics questionnaire to assess the exclusion criteria. Following these questionnaires, the participants completed the Disgust Scale-Revised (DS-R) and the specific phobia section of the ADIS was administered to participants in order to determine their eligibility and categorization as either BII phobic or non-phobic. Participants were then requested to engage in the BAT with the vial of blood. Following these assessments, the participant was asked to complete the IAT. Once the IAT was complete, the participant underwent up to 30-minutes of exposure to the animal reminder disgust-eliciting stimulus. The exposure session concluded when the participant had either completed all of the steps or the 30-minute cap had been reached. Following the exposure session, the participant re-took the IAT and engaged in the BAT with the vial of blood again. After the second BAT, the participant was informed that the vial of blood was not real human blood. They were offered course credit or financial compensation for participating, given a list of referrals and dismissed. Table 1 provides an overview of the order of procedures for the initial phase of the study.

Table 1. Order of Procedures for Each Participant (Phobics and Non-phobic Controls)

1. Complete the packet of questionnaires
2. ADIS administration
3. Engage in pre-exposure BAT with vial of blood

4. Complete the disgust IAT
5. Engage in 30 minutes of exposure to the severed deer leg
6. Complete the disgust IAT again
7. Engage in post-exposure BAT with vial of blood
8. Debriefing

Participants returned to the lab 6-9 days following engagement in the initial study by Rusch and Carter (in progress). They began by reading and signing the informed consent form. Participants first completed the DS-R and then were asked to complete the BAT with the vial of blood. They were reminded that they were only being asked to engage in behaviors they felt comfortable with and should not, at any point, feel they needed to push themselves. Once they completed the BAT, they were asked to complete the disgust IAT on the computer. When the IAT was finished, participants were given credit or financial compensation for their time, thanked, and given a debriefing document and a list of appropriate referrals in case they would like to seek psychological help. Table 2 details the order of procedures during the follow-up assessment.

Table 2. Follow-up Order of Procedures for Each Participant (Phobics and Non-phobic Controls)

1. Complete the DS-R
2. Engage in BAT with vial of blood
3. Complete the disgust IAT
4. Debriefing

CHAPTER 3

RESULTS

Follow-up participants were American University undergraduate and graduate students the majority of whom self-identified as Caucasian (68.9%), female (83.6%) with an average age of 19.6 years (see Table 3). Of the participants who were scheduled for the study, 5 withdrew and 51 were excluded: 8 had high BDI scores, 14 were subclinical, 22 only reported fear/avoidance of needles and 7 were excluded for other issues (e.g. under 18, non-native English speakers who did not understand the questionnaires, etc.).

Table 3. Demographic Information

	First Phase		Follow-up	
Gender	*Number of Participants*		*Number of Participants*	
Female	65		51	
Male	11		10	
Race/ethnicity				
Caucasian	51		42	
African-American	8		6	
Hispanic	5		3	
Asian/Pacific Islander	6		4	
Other	6		6	
	All		Returners	
	Mean	*Standard Deviation*	*Mean*	*Standard Deviation*
Age	19.61	1.48	19.57	1.47

An independent samples t-test was conducted to determine if there were any significant differences in age between participants who returned for the follow-up (returners) and those who did not (non-returners). There were no significant differences between the groups on age, $t(74)=-.48$, $p=.63$. Chi-squared tests showed no significant differences between phobic returners and non-returners in the distribution of gender, x2(1, N=38)=1.54, p=.22, or ethnicity x2(1, N=38)=.05, p=.83, where the small sample size required recoding of all non-Caucasian participants into one category.

Given the relatively high attrition rate, an independent samples t-test was also conducted to test whether there were significant differences in behavioral avoidance between phobic returners and non-returners prior to exposure. No significant differences were found between the groups' avoidance measured by the first BAT, *t*(36)=-.873, p=.389. Additionally, there were no significant differences between phobic returners and non-returners on total DS-R scores, *t*(36)=1.23, p=.227, or on animal reminder subscale scores, *t*(36)=.239, p=.813. Significant differences between the groups did arise on the core disgust subscale, *t*(74)=2.16, p=.034, where non-returners demonstrated higher levels of self-reported core disgust. Given the low reliability of the contamination subscale in this sample, comparisons on this subscale were not conducted. Since the follow-up assessment was the focus of the current study, the following analyses in this section will only address data from the returning sample.

Of the 31 returning non-phobic participants, 27 completed all BAT steps at the pre-exposure assessment. Twenty of the 30 phobic participants also completed all 5 BAT steps at initial assessment. All male participants (N=10) completed the entire BAT at pre-exposure. Significant differences in self-reported disgust and behavioral avoidance appeared between participants categorized as BII phobic or non-phobic by the ADIS-IV (see Table 4). Independent samples t-tests indicated that phobic participants completed significantly fewer steps in the pre-exposure BAT than non-phobics, *t*(59)=2.71, p=.009, and demonstrated greater overall disgust according to the Disgust Scale-Revised, *t*(59)=-3.91, p<.001. Significant differences also appeared in the animal reminder subscale *t*(59)=-5.23, p<.001, and almost appeared in the core subscale $t(59)=-1.97$, $p=.053$ where BII phobic participants self-reported greater disgust on these two subscales. No significant differences were found in pre-exposure IAT response times $t(58)=1.26$, $p=.21$ (See Table 4).

Table 4. Phobic vs Non-phobic Participants Pre-exposure

	Phobic (N=30*)		Non-phobic (N=31)	
	Mean	*Standard Deviation*	*Mean*	*Standard Deviation*
Mean highest BAT step completed	3.93[a]	1.89	4.87[b]	.34
Disgust Scale-Revised				
DS-R Total Mean	2.37[a]	.47	1.88[b]	.50
Animal Reminder	2.90[a]	.63	1.95[b]	.77
Core Disgust	2.40	.53	2.12	.58
IAT D Score	.52	.42	.64	.32

Note: Different superscripts indicate a significant difference between groups at the p<.05 level.
*One phobic participant did not have complete IAT data at pre-exposure due to a technical issue.

The IAT response latencies at follow-up were converted into standardized D scores to account for the confounding variable of general cognitive ability (Greenwald et al., 2003). The IAT data produces response latencies for matched (e.g. *disgusting* and *mutilation*) and non-matched pairs (e.g. *appealing* and *mutilation*) of superordinate categories. These data were used to calculate the average response latency for each individual to matched and non-matched pairs. The difference between these averages was computed to produce a d score, which is simply a difference score. To convert d scores into standardized D scores, they were first divided by the standard deviation. These numbers are then plugged into the D score formula: $D=2d/(\sqrt{(4 + d^2)})$. The D scores were used to compare IAT reaction times at follow-up to pre-exposure and post-exposure response latencies.

Since the D scores are calculated based on the difference between response times to matched and non-matched pairs, the higher the D score, the greater the difference in response times between the two. D scores range from -2 to +2, where more positive scores indicate a stronger connection between the matched pair concepts in the individual's mind (and the more difficult it is to override this connection in order to pair non-matched stimuli). If the D score were zero, it would indicate no difference in response times between matched and non-matched pairs, suggesting that the concepts of *mutilation* and *disgusting*, for example, were as closely linked in the individual's mind as *flowers* and *disgusting*. If the D score were negative, it would suggest that the individual more easily pairs *mutilation* with *appealing* than *disgusting*.

Hypothesis 1

It was hypothesized that decreases in avoidance after exposure to the disgust-elicitor in the first phase of the study (Rusch & Carter, in progress) would be maintained at follow-up. This hypothesis was mostly supported. A trend appeared suggesting significant increase in the average number of steps phobic individuals were willing to complete from pre-exposure to follow-up, $t(29)=-1.88$, $p=.070$. Significant improvements in avoidance behavior in phobic individuals were found between post-exposure and follow-up, $t(29)=-2.08$, $p=.046$. Of the 30 participants who returned for the follow-up, a subset of 10 participants demonstrated behavioral avoidance to the vial of blood pre-exposure (phobic avoiders). A trend appeared suggesting a possible significant increase in the number of BAT steps completed by phobic avoiders from pre-exposure to follow-up, $t(9)=-2.09$, $p=.066$. Interestingly, avoidance in this group significantly decreased from post-exposure to follow-up, $t(9)=-2.40$, $p=.040$[1] (see Table 5).

[1]Upon examination of the phobic avoider data, it was discovered that one individual experienced heightened avoidance following exposure, yet returned to pre-exposure avoidance levels at the follow-up assessment. Given the small sample size, the influence of this one individual was significant. Analyses run on

Non-phobic participants demonstrated a slightly different pattern of changes in behavioral avoidance. Significant differences in the average number of steps they were willing to complete appeared between pre-exposure and follow-up, *t*(30)=-2.11, p=.043. However, no significant differences were seen between from post-exposure to follow-up, *t*(30)=-1.00, p=.325 (See Table 5). Given that only four non-phobic individuals failed to complete the entire BAT at pre-exposure, any effect is solely a result of improvements in these individuals.

Table 5. Mean BAT Scores

	All Phobics (N=30)		All Non-phobics (N=31)		Phobic Avoiders (N=10)		All Avoiders (N=14)	
	Mean	*SD*	*Mean*	*SD*	*Mean*	*SD*	*Mean*	*SD*
Pre-exposure	3.93^{1}	1.96	4.87^{a2}	.34	1.80^{1}	1.99	2.43^{a}	1.95
Post-exposure	3.97^{a1}	1.85	4.97^{2}	.18	1.90^{a1}	1.97	2.71^{a}	2.13
Follow-up	4.33^{b1}	1.58	5.00^{b2}	.00	3.00^{b1}	2.26	3.57^{b}	2.10

Note: M = mean, *SD* = standard deviation; Different superscripts indicate a significant difference between groups (within-group significant differences indicated with letters, between-group significant differences indicated with numbers).

<u>Hypothesis 2</u>

Implicit associations between mutilation images and the concept of disgust were also expected to be maintained at follow-up. Significant changes in IAT reaction times did not appear in BII phobics during the first phase of the study, *t*(36)=-.034, p=.973 and this hypothesis was not supported. Only a trend suggested that implicit associations improved (i.e. slower reaction times) from pre-exposure to follow-up in BII phobics, *t*(28)=1.68, p=.104. This trend in was slightly stronger in BII phobics from post-exposure to follow-up *t*(29)=1.724, p=.095 (see Table

phobic avoiders without this participant suggest improvements from pre-exposure to follow-up, *t*(8)=-2.138, p=.065. These analyses show a weaker trend from post-exposure to follow-up *t*(8)=-1.955, p=.086. In the adjusted sample of all avoiders, significant improvement appears from pre-exposure to post-exposure *t*(12)=-2.214, p=.047 and from pre-exposure to follow-up *t*(12)=-2.889, p=.014. Only a trend appeared in all avoiders from post-exposure to follow-up, *t*(12)=-2.112, p=.056.

6). Phobic avoiders did not demonstrate significant changes in D scores from pre-exposure to follow-up, $t(9)=1.02$, p=.337 or from post-exposure to follow-up, $t(9)=1.22$, p=.255.

A trend indicated possible significant changes in average D scores in non-phobic participants from pre-exposure to follow-up, $t(30)=1.96$, p=.059. No significant changes appeared from post-exposure to follow-up in non-phobics, $t(30)=1.06$, p=.295.

Table 6. Mean D Scores

	All Phobics (N=29)		Phobic Avoiders (N=10)		Non-phobics (N=31)	
	Mean	*Standard Dev.*	*Mean*	*Standard Dev.*	*Mean*	*Standard Dev.*
Pre-exposure	.52	.42	.49	.51	.64	.32
Post-exposure	.50	.38	.44	.29	.56	.30
Follow-up	.36	.38	.28	.36	.44	.48

Hypothesis 3

The third hypothesis predicted that decreases in avoidance and maladaptive cognitions would be maintained at follow-up, and that no significant differences would appear between maintenance of improvements in implicit and behavioral measures. This hypothesis was not supported since significant differences in behavioral measures were demonstrated but comparable changes in implicit measures were not. However, the data showed that decreases in phobic avoidance were strengthened from post-exposure to follow-up.

CHAPTER 4

DISCUSSION

The first hypothesis predicted that decreases in avoidance following exposure to the disgust-elicitor (severed deer leg) in the first phase of the study would be maintained at the one-week follow-up. This hypothesis was partially supported; however, there were no significant changes in avoidance immediately following exposure in the full sample of phobics. From the initial pre-exposure assessment to the follow-up one week later, a trend appeared suggesting an increase in the number of BAT steps phobic individuals were willing to complete. Significant differences did appear in avoidance behavior from post-exposure to follow-up. This suggests that phobic participants were willing to complete substantially more steps when they returned a week later but not immediately following exposure. Two-thirds of the phobic sample did not demonstrate avoidance at pre-exposure and consequently did not have any variability in their avoidance data. These results, therefore, are drawn from the behavior of the phobic participants who had room to improve after their initial assessment. Non-phobic individuals showed significant changes in the number of BAT steps they were willing to complete from pre-exposure to follow-up but no significant changes from post-exposure to follow-up.

While previous research has demonstrated disgust reduction in specific phobias following 30 minutes of exposure (Olatunji, Smits, et al. 2007; Smits, et al. 2002), it has been suggested that disgust extinction requires more exposure time than extinction of an emotion like fear (Olatunji, Huidjing, et al. 2011; Olatunji, Smits, et al, 2007; Olatunji, Wolitsky-Taylor, et al, 2009; Smits et al. 2002). Significant decreases in avoidance behavior immediately following exposure have been found in studies using longer treatment periods than the current study (30 minutes). For example, Teachman and Woody (2003) demonstrated significant changes in behavioral avoidance in spider phobic individuals following three 90-minute group therapy sessions, and Hirai et al. (2008) showed decreased avoidance following a combined exposure and psychotherapy design with exposure lasting for over 30 minutes.

Many of these studies, however, use the same or similar stimuli in the exposure session and the behavioral avoidance measures. A large amount of overlap between exposure tasks and BAT tasks in Hirai et al. (2008) could account for the immediate changes they reported. Olatunji, Smits, et al (2007) found significant decreases in disgust avoidance following only 30 minutes of exposure, but the exposure stimulus in their protocol was the exact same as the stimulus used for the BAT. Given that significant changes in avoidance were not found immediately following 30 minutes of exposure in the current study, it may be possible that a certain amount of time may be required for changes in avoidance behavior to generalize from the animal reminder disgust stimulus (severed deer leg) to the BII-specific stimulus (vial of blood). It is possible that the time elapsed from pre-exposure to post-exposure was not quite long enough for these changes to appear and that the passage of time in the intervening week prior to the follow-up allowed the generalization process to occur. While generalization literature has not examined this question directly, it has shown that increasing the time elapsing between the presentation of constant and variable stimuli can impair discrimination in humans (McAllister, McAllister, & Franchina, 1965). Furthermore, Desiderato and Wassarman (1967) found that anxious participants' generalized responses (verbal responses to visual stimuli) increased when tested after a delay as opposed to immediately following training.

In the current sample, of the 30 phobics who returned for the follow-up, only 10 demonstrated behavioral avoidance during the pre-exposure BAT. This subgroup, referred to as "phobic avoiders" demonstrated a trend suggesting an overall decrease in avoidance from pre-exposure to follow-up. Significantly more BAT steps, however, were completed by phobic avoiders from post-exposure to follow-up. Under close examination of the data, however, it was discovered that one individual demonstrated *increased* avoidance immediately following exposure with a return to pre-exposure levels upon follow-up assessment. In such a small sample, the data for this individual had a significant impact on the results. When analyses were re-run excluding this individual, the effect from post-exposure to follow-up was no longer significant, though a trend was still present.

The two sets of analyses suggest somewhat different conclusions. Improvements between the end of treatment and follow-up assessments have been documented in self-reported anxiety measures in spider phobia (Teachman & Woody, 2003), self-reported BII symptom measures, and disgust sensitivity measures (Hirai, et al. 2008). These studies, however, also found significant reductions from pre-treatment to post-treatment and often explain these changes as continuing effects of the treatment. If we consider the original sample of phobic avoiders where significant changes occur between post-exposure and follow-up but not immediately following exposure, it may be possible that previous studies have overlooked the importance of these later changes. The significant changes from post-exposure to follow-up may present an unrecognized aspect of the process of disgust extinction, with the possibility of the time elapsed following exposure as a relatively unexamined factor. The impact of time from post-exposure to follow-up may even enact a stronger effect than the immediate effect of exposure. Further follow-up assessments on phobic individuals were not included in the scope of this study but they might have served to further demonstrate the course and longevity of these changes.

On the other hand, if we address the individual who experienced increased avoidance following exposure as an outlier who should be removed from the data, the phobic avoider data suggests that the effect of time from post-exposure to follow-up is somewhat less important.

Interestingly, when this outlier is removed from the pool of all avoiders (phobic and non-phobic), the results align with previous specific phobia exposure research (e.g. Hirai, et al., 2008; Olatunji, Smits et al., 2007; Smits, et al., 2002). Participants complete significantly more BAT steps from pre-exposure to post-exposure, $t(12)=-2.214$, $p=.047$, from pre-exposure to follow-up, $t(12)=-2.889$, $p=.014$, and a strong trend appears from post-exposure to follow-up, $t(12)=-2.112$, $p=.056$. The increased sample size from 9 phobic avoiders to 13 avoiders appears to significantly alter the narrative of the data and may be more indicative of the true effect of the exposure session on disgust avoidance.

The lack of significant changes in the overall sample of returning non-phobics' avoidance from post-exposure to follow-up highlights a limitation of the study which is a ceiling effect in the BAT data. Only four of the 31 non-phobic follow-up participants failed to complete all five BAT steps, and the mean number of steps completed pre-exposure was only 4.97 out of 5.00. This ceiling effect appeared in the phobic data as well with only one-third of phobic participants completing fewer than five BAT steps pre-exposure. With a majority of both samples demonstrating no variability in their data, conclusions about the behavior of the full sample cannot accurately be made since analyses driven by the effects of the individuals who had room to improve after the first assessment. While the 5-step hierarchy has been effective in previous research (e.g. Koch, et al. 2002), it may have been more beneficial to include additional steps so that more subtle changes in avoidance behavior might have been detected by this assessment.

It should also be noted that significant changes from post-exposure to follow-up may have been influenced by the debriefing procedure at the end of the first phase. After the post-exposure BAT, the IRB required researchers to inform all participants that the vial of blood did not contain real human blood. This may have had an impact on the participant's willingness to engage with the stimulus during the follow-up assessment. During the first session, the participant believed that the highest level of the BAT hierarchy was to touch a vial of real blood with an ungloved finger. At the follow-up, completing the BAT hierarchy may only have been an indication of the participant's willingness to touch a vial of fake blood with an ungloved finger. Consequently, a score of 5 on a BAT during the first session might not have been equivalent to a score of 5 on the follow-up BAT. However, a significant proportion of individuals were still unwilling to engage in any or all of the BAT steps at follow-up. While it is expected that the effect of this information would have resulted in decreased avoidance in each participant in the follow-up assessment, the impact on avoidance during the follow-up assessment must be considered.

In the second hypothesis, significant changes in implicit associations were also predicted to be maintained at follow-up. This hypothesis was not supported since no significant changes in D scores (IAT response times) were found in the first phase of the study in either phobics or non-phobics. Only weak trends suggested changes from pre-exposure to follow-up and from post-exposure to follow-up in phobic participants' D scores. A trend also suggested changes from pre-exposure to follow-up in non-phobics but no significant differences were found between post-exposure and follow-up. No trends were present to suggest substantial changes in D scores in the subgroup of phobic avoiders.

The lack of significance may again be due to the slow rate at which disgust extinguishes during exposure. In the current study, the trend that appeared might indicate that the exposure session was able to initiate some cognitive change but was not long enough to produce significant results. As seen in Teachman and Woody (2003), longer treatment periods may be important in reducing maladaptive associations regarding disgust.

The significant changes demonstrated by Teachman and Woody (2003) may also be contingent upon the cognitive elements of their treatment protocol. The group therapy session design they implemented incorporated aspects of psychotherapy and CBT which may have played a role in more effectively changing maladaptive disgust associations. The current study only minimally targeted cognitions by collecting disgust SUDS scores throughout exposure, and by including brief psychoeducation after the first refusal to engage in a task (i.e. "I will continue asking you each minute if you would be willing to look at the deer leg. Oftentimes, people find that they become more used to the idea as time passes."). While assessments of changes in implicit associations were not conducted by Hirai et al. (2008), their protocol did incorporate psychoeducation regarding fear and anxiety, and exposure to fear-provoking stimuli and found significant changes in avoidance, and in self-reported symptom measures following treatment and at follow-up.

The results of this study, however, cast some doubt on the potential value of the IAT as an assessment instrument for disgust in specific phobia. To begin, the IAT did not distinguish between phobic and non-phobic individuals. In addition, although not statistically significant, D scores for the non-phobic group were higher than those for the phobic group, indicating a larger difference in response latencies to matched and unmatched pairs. A larger difference in these latencies would normally suggest that the *disgusting* and *mutilation* categories are more closely linked in the cognitive network of the participant. Therefore, the question arises of the added value of the IAT as an assessment tool when behavioral measures demonstrate a change that was not reflected in the IAT data. In this context, it is also important to note that while the self-report measure (Disgust Scale-Revised) was able to distinguish between phobic and non-phobic participants, phobic DS-R scores did not change significantly from pre-exposure to follow-up.

The IAT, consequently, was no more able to detect changes from pre-exposure to follow-up than the self-report measure. This may explain more about the ability of disgust exposure to affect behavioral rather than cognitive change, than about the validity of the IAT as an assessment tool.

The final hypothesis predicted improvements in avoidance and implicit measures would be comparable at follow-up. This hypothesis was not able to be effectively evaluated since significant changes in IAT response times were not found. Further research should compare these two following longer exposure sessions that include specific aspects geared towards cognitive change.

Recent work has more clearly categorized different types of disgust (Olatunji, Williams, et al., 2007; Olatunji, et al. 2012) but we are still learning how they interrelate with one another. The current study's findings suggest that the generalization process following disgust exposure may not be immediate, even between stimuli of the same type of disgust (i.e. animal reminder disgust). Instead, it may require the passage of time for the effects of exposure to one disgust-elicitor (e.g. severed deer leg) to impact avoidance of another (e.g. vial of blood). This pattern is particularly important for a disorder like the BII-subtype of specific phobia since phobia-relevant stimuli can vary widely, from needles and blood vials to mutilation. The current study is uniquely able to illustrate the importance of this process since significant changes were only seen after a one-week time gap. With high recurrence rates following exposure for many specific phobias, this study has exposed a new aspect of disgust exposure in the hopes of improving our understanding of the factors required for meaningful and lasting change.

Future research should examine what mechanisms can explain the impact of time following exposure and how it can substantially improve phobic responding, even in the absence of significant changes immediately following exposure. The processes that occur over that intervening week should also be explored in the context of exposure protocols that also target maladaptive cognitions. While no significant changes in IAT response times were found from pre-exposure to follow-up, a weak trend suggested a slowing of response times from post-exposure to follow-up. With the addition of cognitive therapy components, it would be interesting to assess whether the same one-week pattern occurred for cognitive changes as well as behavioral.

In the context of prior research, we begin to clearly see how treatment for maladaptive disgust responding must be approached differently than for an emotion like fear. For example, disgust declines more slowly (Olatunji, Smits, et al, 2007; Olatunji, Wolitsky-Taylor, et al, 2009) and, in certain instances, exposure can even enhance disgust cognitions (Thorpe & Salkovski, 1995). From the current study, we see that there may be hidden complexities in the generalization process from one disgust stimulus to another, significantly affecting the accuracy of treatment-outcome study designs that do not incorporate a follow-up assessment. Furthermore, research has also begun to show that conducting disgust exposure in multiple contexts can attenuate the later renewal of distressing disgust responding. Consequently, there may be greater value in a more varied exposure approach with multiple stimuli in several contexts. As research continues to be published emphasizing the important role that disgust plays in a number of disorders (e.g. specific phobia, OCD, PTSD), it becomes critical to better understand the mechanisms by which extinction of disgust responding effectively occurs in order to further improve treatment approaches for these disorders.

APPENDIX A

BEHAVIORAL APPROACH/AVOIDANCE TASKS

FOR THE VIAL OF BLOOD

Step 1. Looking at the vial of blood that will be placed on the table in front of the participant.

Step 2. Touching a spot on the table right next to the vial of blood while wearing a latex glove.

Step 3. Touching a spot on the table right next to the vial of blood while wearing no glove.

Step 4. Touching the vial of blood while wearing a glove.

Step 5. Pressing a gloveless finger against the vial of blood.

APPENDIX B

EXPOSURE HIERARCHY FOR DISGUST-ELICITING STIMULUS

(SEVERED DEER LEG)

Step 1. Looking at the stimulus that will be placed on the table in front of the participant.

Step 2. Touching a spot on the table right next to the deer leg while wearing a latex glove.

Step 3. Touching a spot on the table right next to the deer leg while wearing no glove.

Step 4. Touching the deer leg (the bloody part) while wearing a glove.

Step 5. Pressing a gloveless finger against the bloody part of the deer leg.

Note. The participant is not actually asked to behaviorally engage in the final step. They are just asked to answer with “yes” or “no.”

REFERENCES

Agras, S., Sylvester, D., & Oliveau, D. (1969). The epidemiology of common fears and phobia. *Comprehensive Psychiatry*, *10*, 151–156.

American Psychiatric Association (2000). DSM-IV-TR. American Psychiatric Association: Arlington, VA.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). Manual for the Beck Depression Inventory–II. San Antonio, TX: Psychological Corporation

Beck, A. T., & Clark, D. A. (1997). An information processing model of anxiety: Automatic and strategic processes. *Behaviour Research and Therapy*, 35, 49-58.

Brown, P.A., DiNardo, T.A., & Barlow, D.H. (1994). Anxiety disorders interview schedule for DSM-IV. Albany, NY: Graywind Publications.

Choplin, C. E., & Carter, M. M. (2011). A comparison of repeated exposure to fearful and disgusting stimuli among spider phobics. *Behavioral Interventions*, *26*, 23-40.

Connolly, K. M., O'Neill, H. K., Flessner, C. A., & Olatunji, B. O. (2006). Fear, disgust, and fainting in blood-injection-injury fears: A multi-method approach. *Anxiety, Stress, and Coping*, *19*(4), 409-420.

Costello, C. G. (1982). Fears and phobias in women: A community study. *Journal of Abnormal Psychology*, *91*, 280–286.

De Jong, P. J., & Merckelbach, H. (1998). Blood-injection-injury phobia and fear of spiders: Domain specific individual differences in disgust sensitivity. *Personality and Individual Differences*, *24*, 153-158.

Desiderato, O., & Wassarman, M. E. (1967). Incubation of anxiety: effect on generalization gradients. *Journal of experimental psychology*, *74*(4), 506–10.

Egloff, B., & Schmukle, S. C. (2002). Predictive validity of an Implicit Association test for assessing anxiety. *Journal of Personality and Social Psychology*, *83*(6), 1441-1455.

Gerlach, A. L., Nat, R., Spellmeyer, G., Vogele, C., Huster, R., Stevens, S., Hetzel, G., & Deckert, J. (2006). Blood-injury phobia with and without a history of fainting: Disgust sensitivity does not explain the fainting response. *Psychosomatic Medicine*, 68, 331-339.

Haidt, J., McCauley, C., & Rozin, P. (1994). Individual differences in sensitivity to disgust: A scale sampling seven domains of disgust elicitors. *Personality and Individual Differences*, 16, 701-713.

Hirai, M., Cochran, H.M., Meyer, J.S., Butcher, J.L., Vernon, L.L., & Meadows, E.A. (2008). A preliminary investigation of the efficacy of disgust exposure techniques in a subclinical population with blood and injection fears. *Behaviour Change, 25(3),* 129-148.

Kessler, R.C., McGonagle, K.A., Zhao, S., Nelson, C.B., Hughes, M., Eshlemen, S., et al. (1994). Lifetime and 12-month prevalence of DSM-III-R psychiatric disorders in the United States: Results from the National Comorbidity Survey. *Archives of General Psychiatry, 51,* 8-19.

Koch, M. D., O'Neill, H. K., Sawchuk, C. N., & Connolly, K. (2002). Domain-specific and generalized disgust sensitivity in blood-injection-injury phobia: the application of behavioral approach/avoidance tasks. *Anxiety Disorders, 16*, 511-527.

Labus, J.S., France, C.R., & Taylor, B.K. (2000). Vasovagal reactions in volunteer blood donors: analyzing the predictive power of the medical fears survey. *International Journal of Behavioral Medicine, 7,* 62-72.

Lang, P.J., Bradley, M.M., & Cuthbert, B.N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. Technical Report A-8. University of Florida, Gainesville, FL.

McAllister, W.R., McAllister, D.E., & Franchina, J.J. (1965). Dependence of equality judgments upon the temporal interval between stimulus presentations. *Journal of Experimental Psychology*, *70,* 602-605.

Olatunji, B. O., Arrindell, W. A., & Lohr, J. M. (2005). Can the sex differences in disgust sensitivity account for the sex differences in blood–injection–injury fears? *Personality and Individual Differences, 39*(1), 61–71.

Olatunji, B. O., Wolitzky-Taylor, K. B., Ciesielski, B., Armstrong, T., Etzel, E. & David, B. (2009). Fear and disgust processing during repeated exposure to threat-relevant stimuli in spider phobia. *Behaviour Research and Therapy, 47,* 671-679.

Olatunji, B. O., Lohr, J. M., Sawchuk, C. N., & Patten, K. (2007). Fear and disgust responding to heterogeneous blood-injection-injury stimuli: Distinctions from anxiety symptoms. *Journal of Psychopathology and Behavioral Assessment,* 29, 1-8.

Olatunji, B. O., Smits, J. A. J., Connolly, K., Willems, J., & Lohr, J. M. (2007). Examination of the decline in fear and disgust during exposure to threat-relevant stimuli in blood–injection–injury phobia. *Journal of Anxiety Disorders*, *21*(3), 445-555.

Olatunji, B. O., Tolin, D. F., Sawchuk, C. N., Williams, N. L., Abramowitz, J. S., Lohr, J. M. & Elwood, L. S. (2007). The disgust scale: Item analysis, factor structure, and suggestions for refinement. *Psychological Assessment, 19*(3), 281-297.

Olatunji, B. O., Connolly, K. M., & David, B. (2008). Behavioral avoidance and self-reported fainting symptoms in blood/injury individuals: An experimental test of disgust domain specificity. *Journal of Anxiety Disorders,* 22, 837-848.

Ost, L.G., Hellstrom, K., & Kaver, A. (1992). One versus five sessions of exposure in the treatment of injection phobia. *Behavior Therapy, 23,* 263-282.

Ost, L. (1989). One-session treatment for specific phobias. *Behavior Research and Therapy, 27*(1), 1-7.

Page, A. C. (1994). Blood-injury phobia. *Clinical Psychology Review, 14*(5), 443-461.

Rozin, P., & Fallon, A.E. (1987). A perspective on disgust. *Psychological Review, 94,* 23-41

Rozin, P., Haidt, J., & McCauley, C. R. (2008). Disgust. In M. Lewis, J. M. Haviland-Jones & L. F. Barrett (Eds.), Handbook of emotions, 3rd ed. (pp. 757-776). New York: Guilford Press.

Rozin, P., Haidt, J., & McCauley, C.R. (2000). Disgust. In M. Lewis, & J.M. Haviland (Eds.), Handbook of emotions (pp. 637-653). New York, New York: Guilford Publications.

Rozin, P., Millman, L., & Nemeroff, C. (1986). Operation of the laws of sympathetic magic in disgust and other domains. *Journal of Personality and Social Psychology, 50,* 703-712.

Salkovskis, P. M., & Rachman, S. (1997). <u>Frontier of Cognitive Therapy: The State of The Art and Beyond</u>. Guilford Press.

Schienle, A., Schafer, A., Walter, B., Stark, R., & Vaitl, D. (2005). Elevated disgust sensitivity in blood phobia. *Cognition and Emotion*, *19*(8), 1229-1241.

Schienle, A., Start, R., Walter, B., & Vaitl, D. (2003). The connection between disgust sensitivity and blood-related fears, faintness symptoms, and obsessive-compulsiveness in a non-clinical sample. *Anxiety, Stress & Coping, 16,* 185-193.

Seligman, M. E. P. Phobias and Preparedness. (1971). *Behavior Therapy*, *2*(3), 307-320.

Stark, R., Walter, B., Schienle, A., & Vaitl, D. (2005). Psychophysiological correlates of disgust and disgust sensitivity. *Journal of Psychophysiological, 19,* 50-60.

Storch, E. A., Roberti, J. W., & Roth, D. A. (2004). Factor structure, concurrent validity, and internal consistency of the beck depression inventory—second edition in a sample of college students. *Depression and Anxiety, 19,* 187-189.

Teachman, B. A., Gregg, A. P., & Woody, S. R. (2001). Implicit associations for fear-relevant stimuli among individuals with snake and spider fears. *Journal of Abnormal Psychology, 110*(2), 226-235.

Teachman, B. A., & Woody, S. R. (2003). Automatic processing in spider phobia: implicit fear associations over the course of treatment. *Journal of Abnormal Psychology, 112*(1), 100-109.

Tolin, D. F. (1999). The role of disgust in blood-injection-injury phobia. *The Behavior Therapist, 22*(5), 96-99.

Vrana, S.R. (1993). The psychophysiology of disgust: differentiating negative emotional contexts with facial EMG. *Psychophysiology, 30*, 279-286.

Vrana, S.R. (1994). Starle reflex response during sensory modality specific disgust, anger, and neutral imagery. *Journal of Psychophysiology, 8,* 211-218.

Wolpe, J. (1973). *The practice of behavior therapy* (2^{nd} ed.), Pergamon: New York.