IMPLICIT ASSOCIATIONS IN BLOOD-INJECTION-INJURY PHOBIA:

CHANGES AFTER PROLONGED EXPOSURE TO

A DISGUST-ELICITING STIMULUS

By

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American University

Submitted to the

Faculty of the College of Arts and Sciences

of American University

in Partial Fulfillment of

the Requirements for the Degree

Doctor of Philosophy

In

Psychology

Chair:

Michele Carter, Ph.D.

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Dean of the College of Arts and Sciences

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Date

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CHAPTER 1

INTRODUCTION

A specific phobia is characterized by clinically significant fear or anxiety that is elicited by certain objects or situations, which leads to avoidance behavior. The particular object or situation almost always provokes an immediate anxiety response, which can be expressed as a panic attack. Diagnostically, the individual must also recognize that the fear or anxiety caused by the stimulus is excessive or unreasonable and evidence significant distress or interference in functioning (American Psychiatric Association, 2000).

Blood-injection-injury (BII) phobia is a subtype of specific phobia characterized by anxiety or fear prompted by encountering blood or injuries, by seeing or having to receive an injection, or any other type of invasive medical procedure, such as surgery (APA, 2000). It is important to note that since the fear or anxiety typically leads to avoidance behaviors, an individual with BII phobia will often avoid potentially life-saving medical procedures or other, more routine procedures, which can be a detriment to their physical health and well-being. Due to the desire to avoid medical settings, individuals with BII phobia are less likely to present for treatment of their specific phobia; in fact, they are the second least likely to present for treatment out of all subtypes of specific phobia (APA, 2000).

Cognitive Models of Anxiety

A cognitive model posits that schemas, or mental structures, which represent particular objects or characteristics in the world, influence the processing of information. Schemas help organize current knowledge about the world and provide a framework for future understanding among individuals (Beck & Clark, 1997). Faulty information processing, or a maladaptive schema, can lead to psychopathology (Beck & Clark, 1997; Salkovskis & Rachman, 1997). Therefore, cognitive models can elucidate the processes that underlie anxiety and anxiety responses (Salkovskis & Rachman, 1997; Teachman & Woody, 2003), especially for specific phobias (Teachman & Woody, 2003).

A cognitive theory of anxiety suggests that maladaptive schemas influence information processing in the following ways: individuals are more attuned to threatening cues, more likely to construe vague cues as threatening, and more likely to recollect cues that are pertinent to their particular cognitive fear schema (Beck & Clark, 1997; Teachman, Gregg, & Woody, 2001). The fear schema is a "mental template" that guides the way an individual interprets the environment and responds to the phobic stimulus (Teachman et al., 2001).

Through the active selection of particular cues to interpret, as guided by the fear schema, an individual with a specific phobia would be more likely to search out and notice potentially threatening cues in the environment than an individual who has not acquired a specific phobia (Salkovskis & Rachman, 1997; Teachman et al., 2001). For example, an individual with a spider phobia might view a piece of dust blowing across the floor and their fear schema will be activated. The activated fear schema will lead the individual to interpret the benign blowing of the dust as the quick movements of a spider.

It may also lead the individual to view the grayish, fuzzy nature of the dust as a hairy, black spider. The fear schema influences the individual to interpret the benign dust as a threatening spider. Behaviorally, the person might begin to panic, experiencing physiological symptoms and flee the room in order to avoid the dust, which they incorrectly perceived.

Individuals with a specific phobia are also likely to have cognitions that contain maladaptive beliefs. Such maladaptive beliefs typically focus on physical or psychological threats that result from the encounters with the feared stimuli (Salkovskis & Rachman, 1997), despite the fact that these maladaptive beliefs are not necessarily accurate or supported by evidence from experience. Such schemas and maladaptive beliefs serve as constant reinforcement of anxiety, and symptoms cannot be easily amended without a change in the fear schema (Teachman & Woody, 2003). Although the fear schema was traditionally the most commonly discussed schema in cognitive conceptualizations of specific phobias, recent research suggests that disgust, rather than fear, plays the more important role in both the acquisition and maintenance of BII phobia (Olatunji, Connolly, & David, 2008; Olatunji, Lohr, Sawchuck, & Patten, 2007; Schniele, Schafer, Walter, Stark, & Vaitl, 2005; Tolin, 1999).

The Emotion of Disgust

Disgust is an emotion defined as "revulsion at the prospect of (oral) incorporation of an offensive object" (Page, 1994; Rozin, Haidt, & McCauley, 2008), which serves to prevent contact with an undesirable stimulus (Tolin, 1999). This revulsion at the prospect of oral incorporation has been hypothesized to be evolutionarily-based

(Seligman, 1971) because it can protect omnivores from poisoning (Schienle et al., 2005). Disgust is often said to be associated with the physiological state of nausea (Rozin et al., 2008) and there is a unique facial expression produced by the experience of disgust (Schienle et al., 2005; Tolin, 1999).

Although the emotion of disgust was written about scientifically in the 19th century by Charles Darwin (1890) in his book *The Expression of Emotions in Man and Animals*, there are no current comprehensive theories that explain the emotion of disgust (Curtis et al., 2004). Several theories, however, have attempted to explain the phenomenon.

For instance, related to the Seligman's (1971) assertion that disgust is an adaptive and protective emotion, Curtis and colleagues (2004) suggest that objects that are considered most disgusting are those that present infection potential. After surveying more than 40,000 individuals from a variety of cultures, Curtis and colleagues (2004) discovered that objects that present infection potential are deemed significantly more disgusting than those that do not. The researchers assert that this provides evidence for the hypothesis that the emotion of disgust may have evolved evolutionarily to protect humans from disease and infection. Conditioned taste aversion is a good example of this concept (Rozin & Fallon, 1980); if an individual consumes some type of food and becomes sick once, they may exhibit a tendency to avoid consuming that particular food in the future, while reporting the experience of disgust, to prevent a future illness and/or infection. Additionally, though disgust has often been defined at the revulsion at the prospect of oral incorporation, Curtis and colleagues (2004) propose that non-food objects (unrelated to oral incorporation), such as rats, can also present infection potential and induce the emotion of disgust.

Learning theories have also been used to explain the emotion of disgust. For instance, from an observational learning standpoint, it has been proposed that children learn disgust-responses from their parents (Rozin & Fallon, 1987). This observational learning may take the form of witnessing verbal and non-verbal expressions and responses to disgust-eliciting objects or situations. Rozin and Fallon (1987) assert that observational learning may be particularly salient during a child's toilet-training years; for example, parents socialize children to believe that feces (a disgust-elicitor) should be avoided and react in a way that demonstrates disgust.

Evaluative conditioning (EC) has also been described in the disgust literature (Schienle, Stark, & Vaitl, 2004; Olatunji, Forsyth, & Cherian, 2007). EC is a type of conditioning that occurs when a conditioned neutral stimulus takes on the valence of the unconditioned stimulus. This has been explained using the "law of contact" theory proposed by Rozin and colleagues (1986). This law states that, "once in contact, always in contact" (Rozin et al., 1986; p. 703) and proposes that a neutral (or pleasant) stimulus (e.g., a bowl of soup) can take on the properties of a disgust- eliciting stimulus (e.g., a flyswatter) when the two come into contact with one another. In many ways, evaluative conditioning is very similar to Pavlovian conditioning, but contains the extra component of magical thinking (Rozin & Fallon, 1987), which can make extinction of disgust more difficult than other emotions (Olatunji, Forsyth, & Cherian, 2007).

There are two types of disgust that, historically, have been most frequently examined in the BII literature: animal reminder disgust and core disgust. Recently, however, a third type of disgust has emerged: contamination disgust. Animal reminder disgust is associated with blood, injuries, bodily punctures and mutilations, all of which are considered body envelope violations. Although sometimes perceived as a misnomer because it does not relate specifically to small animals, animal reminder disgust reflects the "aversion of stimuli that serve as reminders of the animal origins of humans" (Olatunji, Tolin, et al., 2007); that is, animal reminder disgust is produced by stimuli that remind an individual of their own mortality. Core disgust is associated specifically with small animals such as a spider or snake, food such as spoiled milk, and body products, such as feces or urine. Stimuli categorized as core disgust often elicit a more general sense of offensiveness (Olatunji, Tolin, et al., 2007). Finally, contamination disgust is associated with concerns about interpersonal transmission of essences and/or disease; for example, the feeling of disgust produced by drinking out of a cup belonging to someone else (Olatunji, Haidt et al., 2008). When studying BII phobia, animal reminder disgust is the most commonly examined type of disgust, because it captures disgust produced by blood and injuries, a core component of the phobia (Olatunji et al., 2008).

Empirical Evidence of the Influence of Disgust in BII Phobia

The role of disgust in BII phobia has been assessed in recent research through a variety of methods including self-report (de Jong & Merckelbach, 1998; Gerlach et al., 2006; Olatunji, Lohr et al. 2007), behavioral tasks (Koch, 2002; Olatunji et al., 2008), physiological measures (Schienle et al., 2005), and implicit association tests (Rusch, 2011). Across all of these methods, disgust has fairly consistently emerged as the dominant emotional response, compared to the emotion of fear, of individuals classified as BII-phobic or fearful. For this reason, the emotion of disgust, rather than fear, should be targeted most by researchers in order to learn more about BII phobia.

de Jong and Merckelbach (1998) found that the relationship between BII phobia and disgust is specific to a certain type of disgust, animal reminder disgust. High levels of disgust sensitivity were significantly correlated with high scores on a measure of BII phobia (de Jong & Merkelbach, 1998). Specifically, there was a significant correlation between animal reminder disgust and BII phobia, but no significant correlation between core disgust and BII phobia. From this finding, the researchers concluded that BII phobia is most closely associated with animal reminder disgust rather than core disgust.

Gerlach and colleagues (2006) studied participants categorized as BII-fearful or phobic and non-fearful controls as they underwent venipuncture (blood draw). Participants were asked to self-report their levels of disgust, anxiety, and embarrassment during the venipuncture procedure. Those categorized as BII phobic reported significantly higher levels of disgust, anxiety and embarrassment than their non-fearful counterparts, indicating that BII-fearful or phobic individuals experience venipuncture as significantly more disgusting than do non-phobics. BII phobic individuals were also split into two groups (those with a history of fainting at the sight of blood and those without such history) and compared. No differences in self-reported disgust, anxiety, or embarrassment emerged between the two groups. Additionally, all BII phobic individuals demonstrated higher levels of arousal than non-phobic controls, evidenced by heart and respiration rate, perhaps indicating the experience of fear.

Olatunji, Lohr and colleagues (2007) exposed BII phobics and non-phobics (NP) to pictorial stimuli of blood, mutilation and injections and asked them to self-report on their emotional response to the stimuli. BII phobic individuals responded with greater levels of fear and disgust than did NP participants across all pictures. Disgust emerged as the strongest emotion reported by BII phobic individuals for blood and mutilation pictures, but not for injection images. There was no significant difference between disgust and fear ratings given by BII phobics on injection images, indicating that a needle is similarly associated with both disgust and fear. Additionally, there was no significant difference in disgust or fear ratings on injection images between BII phobics and NP. The only difference that emerged between BII phobics and NP was for disgust ratings on mutilation and blood images. Overall, BII phobics reported greater disgust sensitivity than did NP, which is consistent with findings from previous literature.

Behavioral data has also demonstrated that disgust is the most common emotional response among BII phobic individuals when exposed to BII stimuli. For instance, Koch and colleagues (2002) asked BII phobic and NP participants to engage in a behavioral approach/avoidance task (BAT) with both core disgust elicitors (worm, cockroach) and animal reminder disgust elicitors (bloody gauze, severed deer leg) as stimuli. The BAT required participants to approach each stimulus in a systematic manner. Participants gave separate ratings for each task in the BAT for each stimulus. Higher levels of self-reported disgust in BII phobics led to increased avoidance on all BATs; NP reported less disgust and demonstrated less avoidance on each BAT than did BII phobics. Fear ratings did not contribute to increased avoidance on the same tasks, indicating that perhaps fear does not influence avoidance behavior, while disgust does.

Schienle and colleagues (2005) had participants engage in a conditioning experiment where they were shown pairs of pictures. The first picture, which was affectively neutral, was considered the conditioned stimulus; the second picture, which consisted of disgust-inducing or fear-inducing stimuli, was considered the unconditioned stimulus. During exposure to the aforementioned images, an electromyogram (EMG) was used to record facial expressions representative of disgust for each participant. The EMG demonstrated that participants with BII phobia displayed disgust responses to the conditioned neutral stimulus more quickly than did non-phobic controls. The authors assert that this may indicate that BII phobic individuals associate the emotion of disgust with neutral stimuli more easily than non-phobics. However, BII phobic individuals also responded with increased heart and respiration rate, indicating that perhaps physiologically, they were responding with fear.

Olatunji, Connolly, and colleagues (2008) exposed high BII fear and low BII fear participants to three different tasks. The tasks consisted of BATs with the following stimuli: a severed deer leg (an animal reminder disgust elicitor), a tarantula (a core disgust elicitor), and a "contaminated cookie." The contaminated cookie task asks each person to touch, press to his or her lips, and eventually, take a bite out of a cookie that has come into contact with the stimuli of interest in some manner. For those categorized as high BII fear, higher scores on all subscales (except Rotting Foods) of the *Disgust Emotion Scale* (DES) were associated with increased behavioral avoidance of the animal reminder stimuli (the severed deer leg), indicating that higher levels of disgust accompany increased behavioral avoidance of stimuli. Specifically, significant associations were found between avoidance on the severed deer leg BAT and disgust sensitivity towards small animals, injections and blood draws, mutilation and death, and smells. Significant associations were also found between disgust sensitivity and avoidance of the contaminated cookie task and spider BAT as well.

Many studies demonstrate that the emotion of disgust plays a central role in BII phobia. BII phobic individuals self-report significantly more disgust sensitivity to a variety of stimuli than do NP individuals (de Jong & Merckelbach, 1998; Gerlach et al., 2006; Olatunji, Lohr et al., 2007), and behavioral measures also indicate that disgust plays a central role in BII phobia (Koch et al., 2002; Olatunji, Connolly et al., 2008; Schienle et al., 2005). Additionally, research on implicit associations demonstrates that the concept of mutilation is most closely related to the concept of disgust (rather than fear), which will be described in more depth later (Rusch, 2011). Since research demonstrates that the emotion of disgust plays a dominant role in BII phobia, recent research has begun to examine the ways in which disgust responding can be reduced in BII phobic individuals.

<u>One-session Treatment in BII Phobic Individuals</u>

Hirai and colleagues (2008) examined whether or not the one-session treatment of specific phobias developed by Ost (1989) would successfully reduce BII phobia symptoms for a subclinical population of participants. After undergoing one-session treatment, which either focused on reducing fear or reducing both fear and disgust, participants were reassessed for BII symptoms. After one-session treatment, which included psychoeducation and exposure components, participants, on average, significantly reduced their BII symptoms. Specifically, participants significantly reduced their fear and avoidance of BII stimuli and demonstrated a decline in global disgust sensitivity ratings. In order to calculate the difference in the magnitude of change between fear-only and fear-disgust groups, the researchers subtracted the mean of the fear-only group from that of the fear-disgust group and then divided this figure by the pooled standard deviation. The calculations yielded a positive effect size, so the researchers concluded that this "indicates a larger magnitude of change for the fear-disgust group than the fear-only group" (Hirai et al., 2008, p.141).

However, the authors suggest that the fear-disgust condition did not sufficiently target disgust. Specifically, the authors suggest that perhaps the disgust-related tasks were merely extensions of the fear tasks and were not sufficiently disgust-inducing. The disgust tasks asked participants to engage in the fear task (e.g., holding a hypodermic needle, holding an open vial of blood, and finger painting with blood) and then rub their hands through their hair in order to elicit disgust. However, this almost certainly elicited contamination disgust, rather than animal reminder disgust, a significant flaw in the study since it is known that animal reminder disgust is most closely associated with BII phobia (de Jong & Merckelbach, 1998; Olatunji, Connolly et al., 2008). Therefore, the current study will use an animal reminder disgust elicitor rather than hoping to elicit disgust through a contamination task.

Additionally, Hirai and colleagues (2008) did not offer a condition that exposed participants to a primarily disgust-inducing stimulus. By combining the fear and disgust tasks in the study, Hirai and colleagues (2008) were not able to tease apart the effect that exposure to a primarily disgust-inducing stimulus truly has on reducing BII phobia symptoms and responding. Therefore, the current study will seek to identify whether or not exposure to a primarily disgust-eliciting stimulus, rather than a disgust- and fear-eliciting task, can lead to a reduction in maladaptive schemas among BII phobic individuals and whether or not exposure to a primarily disgust-eliciting stimulus can reduce behavioral avoidance of another general disgust-elicitor (a vial of blood).

Implicit Association Tests

Schemas operate automatically to influence cognitive processes; subsequently, such schemas influence behavior as well. An Implicit Association Test (IAT) is a type of reaction time test that measures schemas and automatic processes that cannot always be discovered through introspection and self-report. The primary underlying assumption in the use of IATs to study schemas is that processing speed (response latency) indirectly measures the degree of association between two concepts or ideas in the cognitive network, or schema, of an individual. The response latency when pushing buttons on a keyboard in response to visual stimuli is thought to demonstrate how closely related the two concepts are in the individual's memory; in other words, the reaction time latency is a reflection how closely associated two concepts are in the schema present in the individual's mind (Teachman et al., 2001).

Specifically, in response to pairings of words, images, or concepts that are closely related, individuals should demonstrate faster reaction times because they are easy connections to identify. Conversely, pairings of words, images or concepts that are less closely related in an individual's cognitive network should have slower reaction times. The reaction times for unrelated pairings are slower due to the fact that the individual must override relationships and connections within their cognitive network that have been consistently strengthened over time.

For example, when the concept of flowers is paired with the concept of appealing, this flowers-appealing pairing should elicit faster reaction times than when the concept of flowers is paired with the word disgusting (a flowers-disgusting pairing). This is because in an individual's schema, the word *appealing* is more readily accessible and more closely related to flowers than the concept of *disgusting* based on the individual's previous experiences and understanding of flowers. In order to pair flowers and disgusting together, the individual must override more accessible associations in their cognitive network (e.g., beautiful, fragrant, colorful) to get to the concept of disgusting, which is related much more distantly. For that reason, the reaction time is greater.

Using an IAT is highly beneficial in that it allows for a more objective exploration of schemas; this is often more desirable than having a participant engage in a less objective method of schema studying such as introspection, used in the completion of self-report measures (Teachman & Woody, 2003). Introspection allows an individual to self-censor and increases the possibility of giving false information, whether intentional or not. The IAT, however, can detect more subtle changes that individuals might experience in their cognitive networks. For example, an individual may be accustomed to reporting that they experience something as disgusting, when in actuality, after exposure to the disgust-eliciting stimulus, they have reduced their disgust responding. This reduction may be detected with the use of an IAT, where self-report methods could not. Additionally, Egloff and Schmukle (2002) demonstrated that IATs have good internal consistency, adequate stability, and are not easily faked; even when participants were instructed to generate a specific response, they were not able to successfully do so.

Implicit Associations Among Individuals with Specific Phobia

Teachman and colleagues (2001) utilized an IAT to examine the cognitive associations of individuals with snake phobia and spider phobia. Four word pairings were used in four separate IATs: good-bad, danger-safety, afraid-unafraid, and disgusting-appealing. Images of spiders and snakes were also present in the IAT and were sorted into categories by the participant during the reaction time task. The only significant differences that emerged were for the word pairings of afraid-unafraid and disgusting-appealing. That is, spider phobic individuals responded with significantly faster reaction times to pairings of spiders-afraid and pairings of spiders-disgusting than snake phobics did. Snake phobic individuals, on the other hand, responded significantly faster to pairings of snakes-afraid and pairings of snakes-disgusting than to the same words paired with spiders. Participants with a particular specific phobia responded with faster reaction times to pairings of words that are relevant to their particular specific phobia.

To examine whether or not maladaptive implicit cognitions can be ameliorated among spider phobic individuals, Teachman and Woody (2003) provided phobic individuals (spider phobic) the opportunity to engage in three 90-minute cognitive-behavioral therapy (CBT) group treatment sessions as part of the study. They required participants to complete four IATs (i.e., good-bad, danger-safety, disgusting-appealing, afraid-unafraid) before and after group treatment. The CBT group treatment sessions included exposure to the feared stimulus, psychoeducation, and cognitive-behavioral therapy techniques. For spider phobics, reaction times between the stimulus of interest (either a spider) and *disgusting* and *afraid* slowed. This indicates that the maladaptive associations between spider and disgusting/afraid were reduced after group therapy. This is the first research indicating that maladaptive implicit schemas can be reduced through CBT.

However, the study leaves several questions unanswered. First, it is unknown if the findings of Teachman and Woody (2003) regarding spider phobics would occur with BII phobics as well. Second, it is unknown what component of CBT contributed to the reaction time change. Third, Teachman and Woody (2003) did not expose participants to a primarily disgust-eliciting stimulus, rather they exposed participants only to the phobic stimulus.

Rusch (2011) examined the role of disgust in BII phobia through the use of an IAT. The IAT contained images of mutilation and the two descriptor categories of disgusting-appealing and afraid-unafraid (as in Teachman & Woody, 2003). Individuals categorized as BII-fearful or phobic according to scores on the *Mutilation Questionnaire* (MQ; Kleinknecht & Thorndike, 1990) had faster reaction times to pairings of mutilation-disgusting than to pairings of mutilation-afraid, indicating that for BII phobics, the concept of mutilation was more closely related to the emotion of disgust in the cognitive networks of BII phobic individuals than to fear. The same differences did not exist for NP participants indicating that NP controls do not differ in how closely they relate mutilation images to the concepts of afraid and disgusting in their cognitive networks. Therefore, maladaptive schemas related to disgust and mutilations images may contribute to the maintenance of the specific phobia (Beck & Clark, 1997), so an aspect of treatment should focus on reducing such cognitive associations. However, it is unknown if exposure to threat-relevant stimuli can produce such change, which the current study will examine.

Research on implicit cognitions and BII phobia has indicated that disgust is the stronger emotion than fear for those categorized as BII phobic (Rusch, 2011). Therefore, it should be examined whether or not implicit associations can be changed after exposure to a phobic-relevant stimulus since cognitive models of anxiety indicate that maladaptive schemas can lead to and facilitate the maintenance of a specific phobia (Beck & Clark, 1997).

Hypotheses and Purpose of the Current Study

The current study sought to identify whether or not exposure to a disgust-eliciting stimulus would reduce maladaptive associations among BII phobic individuals. The reduction in maladaptive associations would be evidenced by a change in reaction time scores on disgust-mutilation pairings from the IAT from pre- to post-exposure. It was predicted that after undergoing 30 minutes of exposure (consistent with the protocol employed by Smits et al., 2002) to an animal reminder disgust elicitor (severed deer leg; as used in Olatunji, Connolly et al., 2008), participants categorized as BII phobic would have significantly different reaction times on the disgust IAT than they did at baseline. Specifically, it was predicted that the scores of BII phobic participants would look more similar to reaction time scores of non-phobic (NP) controls after undergoing exposure.

Additionally, the further a BII phobic participant progresses through the exposure hierarchy (e.g., completing the entire hierarchy versus only being willing to look at the severed deer leg or only being willing to touch a spot on the table next to the leg), the greater cognitive change they were expected to exhibit. That is, someone who can complete the hierarchy during the 30-minute exposure period would have a greater change in their reaction times than a participant who only completed one or two of the steps in the hierarchy.

Finally, participants were given a pre- and post-exposure BAT with another disgust-eliciting stimulus (vial of blood) to determine whether or not exposure to the severed deer leg generalized to another animal reminder disgust-elicitor, a vial of blood. It was predicted that participants would demonstrate a reduction in avoidance behavior after undergoing 30 minutes of exposure to the severed deer leg. That is, it was predicted that participants would be willing to engage in more steps of the BAT with the vial of blood after exposure to the disgusting stimulus. It was predicted that NP individuals were able to complete both the pre- and post-exposure BAT in entirety, as they should not exhibit avoidance behaviors.

CHAPTER 2

METHODS

Participants

Participants in the present study consisted of 30 BII phobic individuals and 38 non-phobic individuals. Participants were recruited via three methods: postings on Blackboard (as students enrolled in psychology class could obtain credit for participation in research), a daily electronic newsletter (Today@AU), and flyers posted on campus. In order to determine whether or not an individual was categorized as BII phobic or non-phobic (NP), the *Anxiety Disorders Interview Schedule for DSM-IV* (ADIS-IV; Brown et al., 1994) specific phobia section was administered by a trained research assistant. Participants who met criteria for moderate to severe depression, as measured by scores on the *Beck Depression Inventory-Second Edition* (BDI-II; Beck et al., 1996), were excluded. Depression could considerably influence the reaction time task. Three participants were excluded due to their BDI-II score (total score > 20), which may indicate moderate to severe depression.

Additionally, participants were excluded if they met criteria for another specific phobia of the same severity or greater than BII phobia. Participants were also excluded from the study if they were currently in or had previously received treatment for BII phobia. No participants were excluded on either of these bases. Participants were also asked if they have taken part in a similar study where they encountered a severed deer leg. Only one participant indicated that she had participated in such a study; the participant was categorized as non-phobic.

Participants that met criteria for injection phobia (i.e., were determined by the trained research assistant to exhibit only clinically significant fear and avoidance of receiving injections) were not included in the current study. They were excluded as some previous research indicates that needles/injections elicit equal amounts of disgust and fear among BII phobic individuals (Olatunji, Lohr et al., 2007), indicating that injection-only phobics may not respond to disgust-elicitors in the same way that blood/injury phobic individuals respond. 18 participants were excluded for their categorization as injection-only phobic. Finally, if a participant did not complete the 30-minute exposure to the severed deer leg or complete the hierarchy, the participant was excluded from the data. That is, if an individual declined further participation in the study and dropped out at any point, the data were not included in any analyses. Two individuals dropped out during the 30-minute exposure to the severed deer leg; two participants dropped out of the study during the first IAT. Three participants also withdrew from participation immediately after reading the informed consent document and prior to signing it. One participant withdrew during the ADIS administration.

Measures

Demographics Questionnaire. The Demographics Questionnaire, created by the researcher, was designed to assess participant sex, age, ethnicity, previous participation in a similar study, and treatment history.

Anxiety Disorders Interview Schedule for DSM-IV (ADIS-IV; Brown et al., 1994). Participants were given the specific phobia section of the ADIS-IV by trained interviewers. The ADIS-IV includes an 8-point severity scale on which each diagnosis is rated, with severity scores of four or greater signifying that a clinical diagnosis is appropriate. Participants that received a score of zero, one, or two were categorized as non-phobics, as they do not meet clinical criteria for a diagnosis of a specific phobia. Participants who received a rating of three, were considered subclinical and also excluded.

Disgust Scale-Revised (DS-R; Haidt, McCauley, & Rozin, 1994; modified by Olatunji et al., 2007). The DS-R is a 25-item trait measure questionnaire that was developed to measure individual differences in disgust sensitivity. Items in the questionnaire represent three distinct categories (subscales) of disgust: core disgust, animal reminder disgust, and contamination disgust (Haidt et al., 1994; Olatunji, Williams et al., 2007). When the DS-R was examined by Olatunji, Williams, and colleagues (2007), Cronbach's alpha was good (α=.87). Cronbach's alpha was good for the core disgust subscale (α=.80), good for the animal reminder disgust scale (α=.82), and acceptable for the contamination disgust subscale (α=.71). However, other studies did not demonstrate the same success in terms of internal consistency reliability for the DS-R. Olatunji, Haidt, and colleagues (2008) found a range in the contamination disgust subscale internal consistency reliability among the four separate studies within the paper (range: α=.37 to α=.61). In the current study, internal consistency reliability for the DS-R overall was acceptable (α=.77). Additionally, internal consistency reliability for the core disgust subscale was questionable (α=.64), acceptable for the animal reminder subscale (α=.74), and poor for the contamination subscale (α=.58). No analyses were run with the contamination subscale due to poor internal consistency reliability.

Beck Depression Inventory—Second Edition (BDI-II; Beck et al., 1996). The BDI-II contains 21 items; the items measure affective and somatic symptoms for Major Depressive Disorder (MDD). When examined in a population of college students, the BDI-II demonstrated good internal consistency reliability, as Cronbach's alpha was .90 (Storch et al., 2004). In the current study, internal consistency reliability for the BDI-II was acceptable (α=.77). The BDI-II was included to exclude any participants with scores that indicate moderate to severe depression, as psychomotor retardation is sometimes a symptom of MDD (APA, 2000). The slowed response times of such participants would add error variance to the data due to their depressive state instead of BII phobia.

Implicit Association Test (Greenwald, McGhee, & Schwartz, 1998). An IAT is a timed response-task in which participants classify words or images into superordinate categories. Response times for classification are recorded by a computer program and are said to measure the association between two concepts in an individual's cognitive network. Smaller reaction times indicate closer associations between concepts (See https://implicit.harvard.edu/implicit/demo/ for a sample test and information about IATs).

In accordance with part of the procedure employed by Teachman and colleagues (2001), one set of opposing descriptive categories were used for the IAT: disgusting-appealing. The current study utilized mutilation images from Connolly and colleagues (2006), which portray a variety of bloody injuries to arms, legs, feet, and hands; the images contain only the injured body part. The neutral stimuli (flowers) were selected from the International Affective Picture System (IAPS; Lang et al., 2008). For each of the two categories (mutilation and flowers), ten pictures were utilized, producing 20 total images in the IAT.

Mutilation images from a previous study conducted by Connolly and colleagues (2006) were used in the IAT. Word stimuli, borrowed from Teachman and colleagues (2001), were also used in the IAT. The IAT task asks participants to categorize words into superordinate, or general, categories. For example, participants are asked to classify a word, such as “repulsive,” as either “disgusting” or “appealing”—the latter two words being the superordinate categories. “Repulsive” should be correctly categorized into the “disgusting” superordinate category.

A brief description of what participants actually encountered when completing the IAT follows. First, participants sat down at a computer and read directions on the computer screen. Participants were instructed to place a left-hand finger on the “e” key and a right-hand finger on the “i” key (pointer fingers). The instructions indicated that two words would appear in the top corners of the screen (one on the upper left side and upper right side), and that they would be sorting words that appeared in the middle of the screen into one of the two categories at the top of the screen using the “e” and “i” keys (a word that belonged in the upper left hand category would be classified as such by the participant pressing the “e” key; a word that belonged in the upper right hand category would be classified as such by the participant pressing the “i” key). This first trial was considered a learning trial and reaction times were not recorded. The second trial, also a learning trial, was similar to the first learning trial, but asked participants to categorize images (rather than words) into categories. See Figure 1.

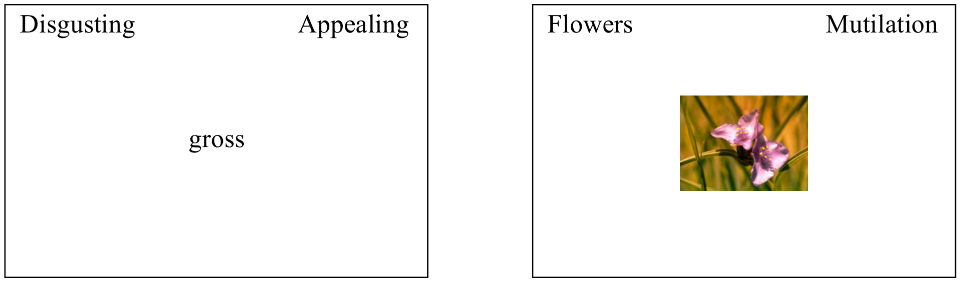

Figure 1

Learning Trials Example Screens

Note. A participant must press the "e" key during each of these trials to correctly categorize the word or image.

Next, participants completed two trials of interest in which reaction time scores are recorded. They are considered non-matched pair and matched-pair trials. Participants are instructed to categorize the word or image that appears in the center of the screen into one of the categories in the upper corners, again using the "e" or "i" keys. See Figure 2.

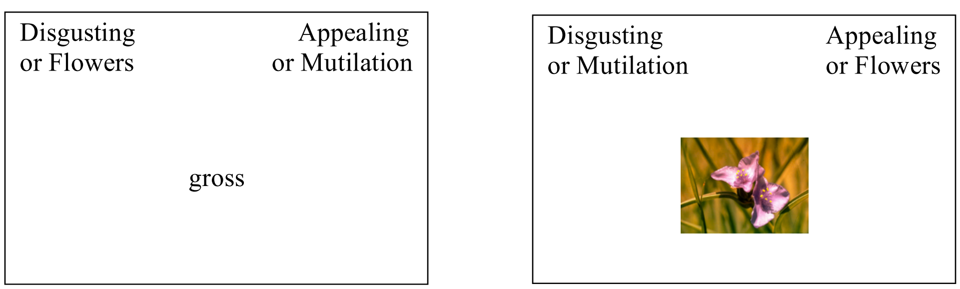

Figure 2

Non-Matched Pair and Matched-Pair Trials Example Screens

Note. The trial on the left is considered a non-matched pair trial, as disgusting and flowers are assumed to be less closely related than appealing and flowers. The participant must press the "e" key during the trial to correctly categorize the word or image. The trial on the right is considered a matched pair trial; the participant must hit the "i" key in order to correctly categorize the image.

Response latencies in milliseconds were recorded for the disgusting-mutilation IAT using the DirectRT software program before and after the participant underwent 30 minutes of in vivo exposure to an animal reminder disgust-eliciting stimulus. Therefore, one measure of interest was the difference between response latencies for each participant before and after exposure. In order to examine the difference, two primary reaction times, one for the disgust IAT that was completed pre-exposure to the severed deer leg and one completed post-exposure, were calculated for each participant upon completion of the disgust IAT.

These times were then converted to D scores, which correct for the confounding variable of general cognitive ability (Greenwald et al., 2003). D scores were calculated according to the method proposed by Greenwald and colleagues (2003). Specifically, difference scores (d) in reaction times between block 3 (non-matched pairs) and block 5 (matched pairs) were calculated. These difference scores were then divided by the standard deviation of the mean scores to standardize. Next, the difference score (d) is plugged into the D score formula which is the following: D=2d/(square root of (4 + d^2)). This produces an overall D score for participants on the pre-exposure disgust IAT and the post-exposure disgust IAT.

Each D score falls between -2 and +2. The more positive the D score is, the more the person believes that mutilation images are most closely paired with the concept of disgusting (rather than appealing). If the D score is very close to zero, this indicates that there is no real difference in the way that people perceive the relationship between flowers-disgusting or mutilation-disgusting. The more negative the D score is, the more the person believes that mutilation images are most closely associated with the concept of appealing (rather than disgusting) in their cognitive network; this finding would be unlikely and considered counterintuitive.

Exposure. Participants underwent 30 minutes of in vivo exposure to a severed deer leg (Smits et al., 2002). See *Appendix A* for exposure hierarchy regarding the severed deer leg. Participants could not move on to the next step in the hierarchy until their subjective disgust ratings had decreased to a four on the 0-10 scale. Participants were asked their level of disgust verbally. If the participant declined engaging in the next step in the exposure hierarchy, they continued sitting with the previous step until their disgust rating decreased to a zero or time expired. If the participant completed the entire exposure hierarchy (the final step being willingness to touch the severed deer leg with no glove on but not actually having to) prior to the 30-minute time limit expiring, the researcher discontinued the exposure; this occurred for several non-phobic individuals throughout the course of the study. All BII phobic individuals, however, completed the full 30 minutes of exposure to the severed deer leg. If the participant told the researcher that they no longer wish to participate in the exposure and/or study, the deer leg was be removed from their presence immediately. This occurred two times over the course of the study. Participants did not report or display any serious physical symptoms. The researcher then debriefed and dismissed the participant. Data from the excluded participants are not included in the final analyses.

BAT. Participants engaged in a BAT pre- and post-exposure. The BAT consisted of several tasks that a participant was asked to complete with another disgust-eliciting stimulus (vial of blood). See *Appendix B* for BAT steps (consistent with Olatunji, Connolly et al., 2008). If the participant declined to engage in a step, the BAT was immediately discontinued and the step at which the participant declined engagement was be noted by the researcher.

Procedure

Participants were first administered the specific phobia section of the ADIS to determine whether or not the participant met criteria for BII phobia. Participants were then asked to complete the self-report questionnaires. Next, the participant engaged in the brief BAT with the vial of blood.

The BAT with the vial of blood contained five steps (see *Appendix B*). The participant was given a “score” from zero to five based on the number of steps that they completed. If a person was not even willing to look at the vial of blood, the individual received a score of zero; if the person was willing to look at the vial of blood only, but would go no further, the participant received a score of one, and so on. Each participant received a score on the pre- and post-BAT that were compared during analyses.

Next, the participant was asked to complete the disgusting-mutilation IAT. Upon completion of the IAT, the participant engaged in up to 30 minutes of exposure to the disgust-eliciting stimulus, as described previously. After completing the entire hierarchy or after 30 minutes of exposure, the participant engaged in the disgust IAT for a second time. Finally, the participant was asked to, once again, engage in the BAT with the vial of blood. Upon completion of the final step, the participant was given credit for engaging in the study, a list of referrals, and dismissed. See *Table 1* for a description of the order of procedures.

Table 1

Order of Procedures for Each Participant

Step 1	Complete the BDI-II
Step 2	Complete the packet of remaining questionnaires (DS-R, Demographics)
Step 3	ADIS administration
Step 4	Engage in pre-exposure BAT with vial of blood
Step 5	Complete the disgust IAT (pre-exposure)
Step 6	Engage in 30 minutes of exposure to the severed deer leg
Step 7	Complete the disgust IAT (post-exposure)
Step 8	Engage in post-exposure BAT with vial of blood
Step 9	Debriefing

Note. BDI-II = Beck Depression Inventory-Second Edition; DS-R = Disgust Scale-Revised; ADIS = Anxiety Disorders Interview Schedule; BAT = behavior approach/avoidance task; IAT = Implicit Association Test

Each participant was continually reminded that they should not push themselves to the point of extreme discomfort during their participation in the study. Specifically, prior to each exposure task (both BATs and the 30-minute exposure session), the researcher read from a script the following phrase, *"I am going to be asking you a series of questions about whether or not you would be willing to do certain things. Please keep in mind that we are interested in knowing what you feel comfortable doing. Do NOT push yourself as far as possible. Just do what you are comfortable doing."* Participants were also reminded that they could choose to withdraw from participation at any point throughout the study. If the participant declined further participation, they were still given course credit or payment, as if they had completed the entire study.

Eight participants withdrew at some point during the study. Two individuals dropped out during the 30-minute exposure to the severed deer leg; two dropped out of the study during the first IAT; three withdrew from participation immediately after reading the informed consent document and prior to signing it; and one participant withdrew during the ADIS administration. Of the participants who withdrew after the ADIS administration, all were categorized as BII phobic. It is not unreasonable to assume that those who withdrew at any point (e.g., during the informed consent) would have been categorized as BII phobic, as they exhibited avoidance behavior of the threat-relevant stimuli.

All research assistants were trained in how to handle a participant that experiences a panic attack. Although an unlikely scenario, given that participants were told not to push themselves further than they are reasonably comfortable doing, this event could occur. Research assistants were taught the various symptoms of panic attacks and were instructed to keep a lookout for such symptoms in the participant. If the research assistant sensed at any time that the participant was becoming too uncomfortable, the research assistant removed the stimulus from view immediately; this did not occur during the course of the study.

If the participant indicated that they wanted to withdraw from the study or reported that they were having physical or other symptoms that they deemed too unpleasant, the researcher also immediately removed the stimulus from the participant's view; again, five participants chose to withdraw from the study after signing the informed consent document and commencing participation, but no one reported any serious physical symptoms.

CHAPTER 3

RESULTS

Participants were American University undergraduate or graduate students. The majority of participants self-identified as Caucasian (64.7%), female (88.2%), and had a mean age of 19.5-years-old (see Table 2).

Table 2

Demographic Information

	BII phobic		Non-phobic	
Gender				
Female	28		32	
Male	2		6	
Race/ethnicity				
Caucasian	18		26	
African-American	3		5	
Hispanic	4		1	
Asian/Pacific Islander	3		3	
Other	2		3	
	M	*SD*	*M*	*SD*
Age	19.37	1.13	19.58	1.43
BDI-II	7.90	4.83	7.63	5.26

Note. BII = blood-injection-injury; *M* = mean; *SD* = standard deviation; BDI-II = Beck Depression Inventory-Second Edition

A chi-square test was run to determine whether or not there was a significant difference in gender distribution between BII phobic and non-phobic individuals. There was no significant difference in gender distribution between BII phobic and non-phobic individuals, $x^2(1)=1.34$, $p=.25$. Another chi-square test was run to determine whether or not there was a significant difference in distribution of ethnicities/race between phobic and non-phobic individuals. As there was not significant power to run this statistic for each individual ethnicity, two categories (Caucasian and non-Caucasian) were created to compare the distribution between phobic and non-phobic participants. There was no significant difference in ethnicity distribution between BII phobic and non-phobic participants, $x^2(1)=.52$, $p=.47$.

An independent samples t-test was conducted to determine whether or not there was a significant difference between phobic and non-phobic participants on age. There was no significant difference between groups on age, $t(66)=.67$, p=.51. An additional independent samples t-test was computed to determine whether or not there was a significant difference in mean BDI-II scores between phobic and non-phobic individuals. There was no significant difference between groups on mean BDI-II scores, $t(66)=-.22$, p=.83.

There was a significant difference in mean total scores on the Disgust Scale-Revised between BII phobic and non-phobic individuals, $t(66)=-4.20$, p=.00. BII phobic participants evidenced significantly higher mean DS-R scores than non-phobic participants (see Table 3). Independent samples t-tests were also conducted for each subscale of the DS-R (except for the contamination disgust subscale, which was excluded from analyses due to poor internal consistency reliability) to determine whether or not there was a difference in means between BII phobic and non-phobic individuals.

There was a significant difference in mean animal reminder disgust subscale scores between BII phobic and non-phobic individuals, $t(66)=-4.74$, $p=.00$; BII phobic individuals evidenced significantly higher mean scores than non-phobic individuals on the subscale. This is consistent with previous findings that demonstrate BII phobic individuals self-report significantly higher levels of disgust in relation to animal reminder disgust stimuli (de Jong & Merckelbach, 1998; Olatunji, Haidt et al., 2008) and stimuli related to mutilation and death (Koch et al., 2002) than non-phobic controls. There was also a significant difference in mean core disgust subscale scores between BII phobic and non-phobic individuals, $t(66)=-2.86$, $p=.01$.

The overall mean for the DS-R in random samples of university undergraduate students is comparable to those participants categorized as non-phobic in the current study ($M=51.86$ in Cisler et al., 2009; $M=50.45$ in van Overveld et al., 2011). Currently, there are no published articles that employ the five-point response scale proposed by Olatunji, Williams and colleagues (2007) in the modification of the Disgust Scale (Haidt, McCauley, & Rozin, 1994). Therefore, previous subscale data cannot be directly compared to the current study.

Table 3

Scores from the Disgust Scale-Revised (DS-R)

	BII phobic	Non-phobic

	M	*SD*	*M*	*SD*
DS-R total score (0-100)	60.83[a]	13.31	48.34[b]	12.07
DS-R Subscale Means (0-4)				
Animal reminder disgust	2.86[a]	0.60	2.07[b]	0.75
Core disgust	2.54[a]	0.59	2.15[b]	0.54

Note. DS-R Subscale Means = the average of all items belonging to the indicated subscale (in accordance with current scoring methods of the DS-R; Haidt et al., 1994, modified by Olatunji et al. 2007). Different superscripts indicate a significant difference between groups.

Hypothesis 1

The first hypothesis predicted that after undergoing 30 minutes of exposure to an animal reminder disgust elicitor (severed deer leg), participants categorized as BII phobic would have significantly different reaction times on the disgust IAT than they did at baseline. A paired-samples t-test was conducted to test this hypothesis. The hypothesis was not supported, as there was no significant difference for BII phobic individuals in D scores between pre-exposure and post-exposure to the severed deer leg, $t(29)=.25$, $p=.80$. Non-phobic individuals also evidenced no significant difference in D scores between pre- and post-exposure, $t(37)=.87$, $p=.39$ (see Table 4).

Table 4

Mean D Scores

	BII phobic		Non-phobic	
	M	*SD*	*M*	*SD*
Pre-exposure	0.54	0.33	0.63	0.32

Post-exposure	0.52	0.38	0.57	0.31

Note. M = mean; *SD* = standard deviation. D scores range between -2 and +2; more positive D scores indicate a close relationship between disgust and mutilation; more negative D scores indicate a close relationship between appealing and mutilation; D scores near zero indicate no difference in association between disgust-mutilation and appealing-mutilation.

<u>Hypothesis 2</u>

The second hypothesis predicted that the further a BII phobic participant progressed through the exposure hierarchy with the severed deer leg, the greater the difference in D scores (ΔD) between pre- and post-exposure the participant would exhibit. Difference in D scores was calculated as follows: (pre-exposure D score - post-exposure D score) = ΔD. If the resulting value is positive, it indicates a lessening of strength of associations between mutilation-disgusting because the pre-exposure D score is larger than the post-exposure D score.

To test this hypothesis, a correlation was conducted to examine the relationship between progression through the hierarchy (a score from 0 to 5) and ΔD scores from pre- to post-exposure. It was predicted that progression through the hierarchy would be positively correlated with the cognitive changes undergone, as evidenced by difference in D scores (larger positive ΔD scores signifying greater change in the direction of lessening of the association between disgust and mutilation). Participants ranged from being willing to complete all steps (5) in their entirety to being unwilling to look at the severed deer leg (0) over the course of the 30-minute exposure session.

Of BII phobic individuals during the exposure to the severed deer leg, 20.7% were not willing to look at the leg, 3.4% were willing to look at the deer leg but do nothing more, 6.8% were willing to touch a spot next to the leg on the table with a gloved hand, 24.1% were willing to touch a spot on the table next to the leg with no glove on, 13.8% were willing to touch the leg with a glove on, and 31.0% were willing to complete the BAT in its entirety by agreeing to touch the deer leg with a gloveless hand (though they were not instructed to do so). There was no significant correlation between progression through the hierarchy and ΔD score, r=-.03, p=.88.

Hypothesis 3

Finally, it was predicted that BII phobic participants would be being willing to engage in more steps of the BAT with the vial of blood after exposure to the severed deer leg, demonstrating that exposure to the severed deer leg would generalize to another animal reminder disgust-eliciting stimulus (vial of blood). This hypothesis was not supported, as there was no significant difference in the number of steps that BII phobic participants engaged in from pre-exposure to post-exposure, $t(29)$=-1.13, p=.27 (see Table 5).

It was also predicted that NP individuals would be able to complete both the pre- and post-exposure BATs in their entireties. This hypothesis was not supported in full, as four non-phobic individuals (10.5%) were only willing to complete four steps during the pre-exposure BAT; the majority of non-phobic individuals (89.5%; 34 participants) were willing to complete all five steps of the pre-exposure BAT, as predicted. Additionally, during post-exposure, all participants except one were willing to complete the BAT in its entirety. There was no significant difference in the mean number of BAT steps that non-phobic individuals were willing to complete between pre- and post-exposure, $t(37)$=-1.78, p=.08.

Independent samples t-tests were conducted to compare mean number of steps completed on three BATs (pre-exposure with vial of blood, severed deer leg, and post-exposure with vial of blood) between BII phobic and non-phobic participants.

At pre-exposure, there was a significant difference between mean number of steps completed by BII phobic versus non-phobic individuals, $t(66)=3.70$, $p=.00$. Specifically, BII phobic participants engaged in significantly fewer BAT steps ($M=3.67$, $SD=2.02$) than non-phobic participants ($M=4.89$, $SD=.31$).

There was a significant difference in the mean number of steps completed by BII phobic and non-phobic participants during the 30-minute exposure to the severed deer leg, $t(66)=4.13$, $p=.00$. Specifically, BII phobic participants engaged in significantly fewer BAT steps ($M=2.90$, $SD=1.94$) than non-phobic participants ($M=4.42$, $SD=1.06$).

Finally, there was a significant difference between BII phobic individuals and non-phobic individuals during the post-exposure BAT with the vial of blood, $t(66)=3.61$, $p=.00$. BII phobic participants engaged in significantly fewer steps ($M=3.90$, $SD=1.83$) than non-phobic participants ($M=4.97$, $SD=0.16$).

Table 5

Behavioral Approach/Avoidance Task (BAT) Results

	BII phobic		Non-phobic	
	M	*SD*	*M*	*SD*
Pre-exposure BAT (vial of blood)	3.67[a]	2.02	4.89[b]	0.31
30-minute exposure (deer leg)	2.90[a]	1.94	4.42[b]	1.06

Post-exposure BAT (vial of blood)	3.90[a]	1.83	4.97[b]	0.16

Note. M = mean; *SD* = standard deviation; means and standard deviations represent the average number of steps (0-5) completed. Different superscripts signify significant differences between groups.

Although there were no significant differences in the number of steps completed for BII phobic individuals during the BAT from pre- to post-exposure, of the 30 individuals categorized as BII phobic, 18 participants (62.1%) were willing to complete all five BAT steps in their entirety at pre-exposure. Of those 18 individuals, all were willing to complete the BAT in the entirety at post-exposure as well. For these 18 individuals, a ceiling effect is created in which there is no opportunity to evidence a significant increase in the number of steps that the participant is willing to complete from pre- to post-exposure.

The remaining 12 participants who were not willing to engage in the BAT in its entirety at pre-exposure, four were unwilling to complete any of the steps at pre- and post-exposure, four were willing to complete more steps at post-exposure than pre-exposure, three exhibited no change in the number of steps they were willing to complete, and one was willing to complete less steps at post-exposure than at pre-exposure.

Additional analyses were conducted with the 12 individuals categorized as BII phobic who demonstrated behavior avoidance on the pre-exposure BAT with the vial of blood. This was done to determine whether or not they represented a more severe group of phobic individuals as compared to the other 18 BII phobic participants. The 12 behavior avoidant (BA) BII phobic participants were compared to the 18 BII phobic individuals and non-phobic individuals on all analyses (see Table 6).

Table 6

Behavior Avoidant (BA) BII Phobic Individuals Compared to BII Phobic and Non-phobic Participants Across All Measures

	BII phobic		Non-phobic		Behavior Avoidant	
	M	*SD*	*M*	*SD*	*M*	*SD*
Age	19.33	1.08	19.58	1.43	19.42	1.24
BDI-II	8.11	5.31	7.63	5.26	7.58	4.21
DS-R total	57.17[a]	10.82	48.34[1]	12.07	66.33[2b]	12.82
AR disgust subscale	2.81	.68	2.07[1]	.75	2.93[2]	.46
Core disgust subscale	2.36[a]	.53	2.15[1]	.54	2.83[2b]	.58
Pre-exposure BAT	5.00[a]	.00	4.89[1]	.31	1.67[2b]	1.87
30-minute exposure	3.67[a]	1.71	4.42[1]	1.06	1.75[2b]	1.71
Post-exposure BAT	5.00[a]	.00	4.97[1]	.16	2.25[2b]	1.96
Pre-exposure D score	.47	.36	.63	.32	.64	.26
Post-exposure D score	.53	.44	.57	.31	.51	.30

Note. For BII phobic, N=18; for non-phobic, N=38; for behavioral avoiders, N=12. AR = Animal Reminder. For pre-exposure BAT, 30-minute exposure, and post-exposure = means signify mean number of steps completed in the hierarchy (0-5). Different alphabetic superscripts indicate significant differences between BII phobic and Behavior avoidant BII phobic individuals. Different numeric superscripts indicate significant differences between non-phobic individuals and behavior avoidant BII phobic participants.

There was no significant difference in the mean number of steps completed by behavior avoidant BII phobic individuals between the pre-exposure BAT and the post-exposure BAT, $t(11)=-1.13$, $p=.28$, suggesting that the exposure to the severed deer leg did not have a significant effect on the number of steps that such individuals were willing to complete. Additionally, there was no significant difference in mean D scores for behavior avoidant BII phobic individuals between pre-exposure and post-exposure, $t(11)=1.25$, $p=.24$. A post-hoc power analysis was run to determine the amount of individuals that would be needed to potentially push the results into significance; it was determined that 40 behavior avoidant BII phobic individuals would be necessary.

A significant finding emerged regarding the amount of steps completed during the 30-minute exposure to the severed deer leg as it relates to the difference in D scores between pre- and post-exposure. Specifically, for the 12 behavior avoidant BII phobic individuals, there was a significant correlation between progression through the hierarchy (deer leg exposure mean number of steps completed) and difference in D scores, $r=.62$, $p=.03$. This suggests that the further an individual is willing to progress through the exposure hierarchy, the greater the change in D scores they will exhibit.

Additionally, there was a significant difference in mean scores on the core disgust subscale of DS-R between behavior avoidant phobics and BII phobics, $t(28)=2.27$, $p=.03$. Behavior avoidant phobics demonstrated significantly higher mean scores on the core disgust subscale ($M=2.83$; $SD=.58$) than their non-behavior avoidant BII phobic counterparts ($M=2.36$, $SD=.53$). This could suggest that core disgust is a better predictor of behavioral avoidance than BII phobia in general, though this is inconsistent with the literature that suggests that animal reminder disgust is most predictive of behavioral avoidance of BII-related stimuli (de Jong & Merckelbach, 1998; Olatunji, Haidt et al., 2008).

CHAPTER 4

DISCUSSION

Support for the first hypothesis (i.e., after undergoing 30 minutes of exposure to an animal reminder disgust elicitor (severed deer leg), participants categorized as BII phobic would have significantly different reaction times on the disgust IAT than they did at baseline) was not found. Participants, regardless of status as BII phobic or non-phobic, did not evidence a significant change in D scores from pre- to post-exposure, signifying no change in cognitions. It is entirely possible that the hypothesis was incorrect and the lack of significant findings reflects that fallacy.

Alternatively, rather than the hypothesis being incorrect, there are several possible reasons why the hypothesis was not supported. First, perhaps the 30-minute exposure to the severed deer leg was not sufficient in length to produce changes in disgust-related cognitions. Smits and colleagues (2002) found that self-reported levels of disgust decreased after spider phobic individuals engaged in a 30-minute exposure to a tarantula; however, disgust decreased significantly more slowly than fear, indicating that disgust takes longer to decline than fear; this may help to explain the lack of significant findings in the current study. Additionally, Smits and colleagues (2002) found no evidence for a global decrease in disgust sensitivity at post-exposure to the tarantula. If the disgust IAT in the current study measures core beliefs, or more global ratings, this may also help to explain the fact that participants did not significantly decline in their D scores from pre- to post-exposure.

Additional evidence to suggest that the 30-minute exposure to a disgust elicitor may not have been sufficient time to produce changes in disgust cognitions is provided by Teachman and Woody (2003). Though the study was conducted with spider phobics, findings may be applicable to BII phobia as well. Teachman and Woody (2003) provided three 90-minute group therapy sessions to phobic participants, which included gradual in vivo exposure to threat-relevant stimuli. Though exposure did not constitute the entirety of each session, participants did engage in much more than 30 minutes of exposure, the length of time provided in the current study.

In addition, Olatunji, Wolitzsky-Taylor, and colleagues (2009) provided individuals expressing significant contamination concerns with a 30-minute exposure to a contamination disgust elicitor. At post-exposure, participants reported a significant decline in fear, but not in disgust. This study provides additional support for the phenomenon that the emotion of disgust habituates more slowly than fear. Although not directly comparable to the current study, as the disgust elicitor was contamination-based and the participants were not BII phobic, the study nonetheless provides evidence that individuals habituate to disgust more slowly than fear; this is relevant to the current study in the context of non-significant results. For this reason, perhaps the one-session treatment first proposed by Ost (1989), would apply to those who experience primarily the emotion of fear, rather than disgust, in response to threat-relevant stimuli.

In addition to the possibility that support for the first hypothesis was not obtained due to an insufficient length dedicated to exposure, it is also possible that significant differences in mean D scores were not produced because the study did not directly target maladaptive cognitions; rather, the intervention included behavioral methods (exposure) only. Teachman and Woody (2003) found that, after undergoing three 90-minute group therapy sessions for spider phobia, participants significantly reduced their maladaptive cognitions related to threat-relevant stimuli, as measured by an IAT. As indicated previously, behavioral interventions were included as part of the treatment, but the therapy contained a cognitive component as well. Specifically, during exposure, participants were instructed to challenge their negative automatic assumptions about spiders (e.g., "Spiders are not really dangerous"), which may have contributed to the reduction in D scores from pre- to post-treatment.

However, participants in the current study were asked to verbally report their level of disgust (0-10 scale) at 15-second increments to assess whether or not the experience of disgust was decreasing, perhaps providing a small cognitive component to the exposure. Additionally, participants were given brief psychoeducation about habituation after refusing the first task (i.e., "I will continue asking you each minute if you would be willing to look at the deer leg. Often times, people find that they become more used to the idea as time passes"), an additional slight cognitive component. Future studies may consider adding a more explicit cognitive component to exposure, such as that provided by Teachman and Woody (2003).

Additional evidence of the importance of targeting cognitions, rather than just behaviors, is provided by Thorpe and Salkovskis (1995). Specifically, Thorpe and Salkovskis (1995) found that spider phobic individuals did not significantly change the majority of their negative cognitions about spiders and the strength with which they believed such cognitions after exposure to images of spiders. One cognition related to disgust (i.e., "I would feel disgusted"), however, did significantly change among spider phobics from pre- to post-exposure. In particular, spider phobic individuals increased their belief in this cognition, indicating that the exposure actually strengthened the belief in disgust cognitions, rather than reducing the belief. Additionally, since exposure did not decrease any negative cognitions or maladaptive beliefs in spider phobic individuals, such a finding may help explain why, in the current study, individuals did not evidence significant reductions in their implicit disgust associations related to threat-relevant stimuli.

The second hypothesis predicted that the further a BII phobic participant progressed through the severed deer leg exposure hierarchy, the greater the difference scores in D scores (ΔD) the participant would exhibit. Since participants did not evidence a significant difference in D scores, support was not obtained for the second hypothesis, for the reasons previously indicated.

The third hypothesis predicted that BII phobic individuals would be willing to engage in significantly more steps of the BAT with the vial of blood at post-exposure, as compared to pre-exposure. This hypothesis was not supported, as there was no significant difference in number of steps completed by BII phobic individuals between the pre-exposure BAT and post-exposure BAT. There are several possible explanations for the lack of statistical significance. First, as indicated in the results section, 18 of the 30 BII phobic individuals were willing to complete all five BAT steps at pre-exposure in their entirety. This completes a ceiling effect in which no progress can be evidenced during the post-exposure BAT.

Since participants were already willing to complete the highest number of steps possible at pre-exposure, so there was no possibility that they could evidence an increase in willingness to engage in tasks at post-exposure. This may lead to the incorrect conclusion that the independent variable (i.e., exposure to the severed deer leg) had no effect on the dependent variable (i.e., number of steps completed in the BAT at post-exposure). If there had been a more extensive BAT involving more steps, subtle improvements may have been detected. For instance, Teachman and Woody (2003) had participants engage in a BAT that consisted of 12 steps, rather than just five, as in the current study, and significant results were produced.

Additionally, since the majority of BII phobic participants were willing to engage in the BAT with the vial of blood to completion at pre-exposure, this suggests that perhaps the vial of blood was not a significantly challenging task. BII phobic individuals met criteria for the study if they endorsed clinically significant concerns regarding the sight of blood and/or injuries, whether on themselves or on someone else. Of the individuals that were willing to complete the BAT in its entirety, many reported that they were only significantly bothered by and fearful of their own blood and/or injuries, but not those of others. For this reason, the vial of blood may not have served as the optimum threat-relevant stimulus. However, given research limitations and ethical issues, it would be impossible to present a person with their own blood and/or injury to induce disgust. It was also pre-planned that the vial of blood would be a less challenging task than the deer leg; the most challenging task was chosen for the exposure, in the hope that it would take participants longest to habituate to disgust during that task, as opposed to the vial of blood.

Another possibility is that exposure to the severed deer leg was not generalizable to the vial of blood. Although a severed deer leg and a vial of blood would both be subsumed by the category of animal reminder disgust, perhaps they elicit subtle differences in disgust experienced. The category of animal reminder disgust includes stimuli that serve as reminders of "our own mortality and inherent animalistic nature" (Olatunji, Haidt et al., 2008, p. 1244). Within this category are injuries to the body (or body envelope violations), death, and beliefs and feelings regarding sex practices. Perhaps the vial of blood tapped into disgust related to body envelope violations, while the severed deer leg produced disgust more closely related to death, as the deer leg may have served as a reminder of the participant's own mortality.

Although there is no current empirical literature that suggests that these subtle differences in disgust exist, research on disgust and BII phobia is still a relatively new area. As recent as 2007, contamination disgust was subsumed under the category of core disgust (Olatunji, Tolin et al., 2007), and only the two-factor model of disgust (the two factors being core and animal reminder disgust) first proposed by Rozin and colleagues (2000) was being examined. For this reason, it is not unreasonable to hypothesize that subtle differences between disgust elicitors will continue to be teased apart as research expands. Perhaps this is some of the first evidence of such differences.

It was also predicted that NP individuals would be able to complete both the pre- and post-exposure BATs in their entireties; this hypothesis was not supported in full, as four non-phobic participants were only willing to complete the first four steps of the BAT, but not the final step, during the pre-exposure BAT. Of the four participants who were not willing to complete the pre-exposure BAT in its entirety, they produced a mean DS-R score of 53.00 (*SD*=16.02), which is slightly higher than the overall mean 48.34 (*SD*=12.07) and the mean of participants who completed all BAT tasks at pre-exposure

(*M*=47.79, *SD*=11.71). This suggests that perhaps the four individuals who were not willing to complete all five steps of the BAT, although categorized as non-phobic, evidenced slightly greater disgust sensitivity than the rest of the non-phobic participants, which may have influenced their willingness to complete the BAT in its entirety. At post-exposure, the majority of non-phobic individuals (37 of the 38 non-phobic participants) were willing to engage in the BAT in its entirety, providing partial support for the hypothesis that all non-phobic individuals would be willing to complete the BAT in full at post-exposure.

As expected, there were significant differences between number of steps completed during the pre- and post-exposure BATs and during the exposure with the severed deer leg between BII phobic and non-phobic individuals. Specifically, BII phobic individuals engaged in significantly fewer steps during each interaction with a stimulus than their non-phobic counterparts. This is consistent with findings from others studies that demonstrate increased behavioral avoidance of disgust-elicitors by BII phobic individuals, as compared to non-phobic controls (Koch et al., 2002; Olatunji, Connolly et al., 2008; Olatunji, Smits et al., 2007).

There are several limitations to the current study. Five participants categorized as BII phobic withdrew from the study at various time points (two during the IAT, two during the exposure to the severed deer leg, and one withdrew from participation during the ADIS administration). Three participants declined participation in the study after reading the informed consent document. This suggests that eight individuals exhibited such significant behavioral avoidance of (potential) phobic stimuli, that they were unable to complete the current study. This is highly unfortunate, as participants with such extreme responses to threat-relevant stimuli may have helped produce significant results. For instance, if a highly phobic individual, such as one of the eight who declined participation, had engaged in the current study, they may have been less willing to engage in BAT steps at pre-exposure and demonstrate a significant increase in the steps that they were willing to engage in at post-exposure, pushing toward significant results.

An additional limitation is that it may have also been important to include a self-report disgust measure as the final step in the current study, but one was not included. As implicit associations may change more slowly than explicit associations (Teachman & Woody, 2003), there may have been changes detected had a self-report measure of explicit associations regarding disgust been used. However, re-administration of the DS-R could have caused issues in terms of demand characteristics and individuals attempting to maintain consistency in their responses during participation in the study.

Additionally, individuals who suffer from severe BII phobia may be less likely to engage in a psychology experiment in general. Such individuals may self-select out of participating in such a study that advertises as a study on disgust. Individuals with BII phobia are the second least likely to present for treatment among those diagnosed with a specific phobia (APA, 2000), again suggesting that there may have been a group of individuals who self-selected out of participation in the current study. Had such individuals participated in the current study, this may have increased the likelihood of finding significant results, as more severe phobic individuals would have the opportunity to demonstrate greater changes than those with a slightly less severe phobia.

Concerns such as that cited previously call into question the idea of scientific rigor versus clinical relevance (Ross, 1981). Had the current study focused primarily on gathering clinically-relevant information, the researchers may have recruited only a small group of highly phobic individuals in order to provide more extensive clinical treatment (e.g., several sessions of exposure therapy versus a brief 30-minute exposure) and examine results on implicit associations from only a few participants. Although clinically relevant, such an experiment would be criticized for the lack of generalizability of findings and for being less scientifically rigorous. In contrast, however, though scientifically rigorous, the current study may have been discouraging for individuals with a severe specific phobia, as they would not be receiving extensive treatment for their phobia; rather, they would be briefly exposed to the phobic stimulus without a likelihood of producing a long-term change in their status as phobic.

If able to redesign the study, it may have been useful to only include a very specific type of BII phobic individual and exclude all others. Many individuals categorized as BII phobic did not demonstrate behavioral avoidance on the BAT with the vial of blood. For this reason, more stringent criteria for inclusion in the study may have produced more significant results, as there were significant findings related to D scores from the IAT when analyses were run with only behavior avoidant BII phobic individuals.

Additionally, the ability to utilize a more intense disgust-eliciting stimulus and/or include a greater number of steps during the BAT would be ideal if redesigning the study. For instance, this might include asking participants to put on a glove and touch the blood in the vial or asking participants to finger-paint with blood (as in Hirai et al., 2008). However, this poses challenges in terms of receiving IRB approval, so would likely not be possible.

Future studies should consider adding a cognitive component to the exposure aspect (Teachman & Woody, 2003) of the study and a cognitive only component to determine whether or not targeting cognitions improves outcomes in terms of behavioral avoidance and on an IAT. Studies could examine the addition of cognitive restructuring during exposure therapy to determine whether or not this addition is successful in creating cognitive changes as measured by an IAT. Additionally, to help tease apart which aspect of treatment is most helpful in reducing maladaptive cognitions, researchers may consider the use of cognitive restructuring only (without behavioral exposure) to determine to what extent this is helpful in changing cognitions.

Using the IAT as a diagnostic tool may be helpful for clinicians in the future to measure to what extent their clients are experiencing cognitive changes. Participants in the study conducted by Teachman and Woody (2003) maintained gains acquired in treatment at a two-month follow-up, perhaps indicating that a change in cognitions is an important aspect in maintenance of gains. If this is the case, clinicians might consider using the IAT as an assessment throughout the course of treatment to monitor an individual's cognitive network and maladaptive beliefs in relation to their specific phobia.

Although few significant results were found in the current study, there is still helpful information to be drawn from the findings. BII phobic individuals evidence significantly higher scores on the animal reminder disgust and core disgust subscales of the DS-R. This indicates that perhaps, in targeting specific disgust-related cognitions, clinicians should focus on these two types of disgust.

APPENDIX A

EXPOSURE HIERARCHY FOR DISGUST-ELICITING STIMULUS

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.”

APPENDIX B

BEHAVIORAL APPROACH/AVOIDANCE TASK STEPS FOR 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.

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