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The effect of one-session exposure treatment on selective processing and explicit memory bias in snake- and spider-fearful participants

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The Effect of One-Session Exposure Treatment on Selective Processing and Explicit Memory Bias in Snake- and Spider-fearful Participants

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Dedication

This work is dedicated to my husband, Justin, and to my parents, Dennis and Theresa, whose support and love carry me through each day.

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Abstract

Unlike the empirically supported phenomenon of anxiety-induced selective processing bias, research on congruent explicit memory bias is inconclusive; indeed, there is evidence for recall decrements of threat-relevant information. There is also a paucity of literature examining the effects of treatment on these cognitive biases. Thus, the purpose of this study was to examine the effect of exposure treatment on selective processing and explicit memory bias in snake- and spider-fearful participants by measuring implicit and explicit memory for central and peripheral environmental details. Recall for environmental details in a fearful group that received treatment was compared to a fearful group that did not receive treatment and to a non-fearful control group to evaluate the presence of selective processing bias, explicit memory bias, and the effect of treatment on these phenomena. Results indicated no implicit or explicit memory biases in any participant group. There was, however, the presence of significant memory deficits, specifically for peripheral details, in fearful participants who did not receive treatment.

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Problem Statement

Selective processing bias refers to preferential encoding of threat-related information by anxious individuals compared to non-anxious individuals and to the encoding of neutral information. The occurrence of this bias, which is likely the product of numerous factors, has been empirically demonstrated in anxious subjects exposed to anxiety-inducing stimuli (Williams, Watts, MacLeod, & Mathews, 1997) as well as in non-anxious subjects exposed to threatening material (Li, Wang, Poliakoff, & Luo, 2007), and an evolutionary element to such bias has been suggested (LoBue & DeLoache, 2008). While a logical assumption may be that preferential recall for threat-relevant information is an inherent result of selective encoding of that information, a phenomenon which is regarded as congruent explicit memory bias, evidence of such a recall bias is mixed (see Coles & Heimberg, 2002, for a review); this lack of substantive evidence for congruent explicit memory bias may indicate distinctive adaptive reactions at various stages of cognitive processing. In a comprehensive literature review on the topic, Williams et al. (1997) confirmed their earlier proposal that automatic stages of processing favor bias for threat-related information while later strategic stages favor avoidance of such information, thus producing such discrepancy. However, the authors note that empirical findings incongruent with this theory suggest that the interplay between selective processing bias and subsequent explicit recall is complex and that a singular theory provides an inadequate representation of all cases. Further research is required to determine the relationship between selective processing and explicit memory bias and the variables that may affect the occurrence of these two phenomena.

The purpose of the present study was to investigate the presence of selective processing bias through the administration of several tests of implicit memory following confrontation with the feared stimulus in snake- and spider-fearful participants. In addition, explicit memory bias was evaluated to determine whether there were significant elaborative recall differences between snake- and spider-fearful individuals and non-fearful controls. Finally, the effects of one-session *in vivo* exposure therapy on selective processing and explicit memory bias were tested. This study sought to improve upon existing studies and marry the literature on selective processing and memory bias to produce data on differential cognitive processing in high- and low-anxious individuals and the factors that may produce or enhance such bias. In addition, the assessment of treatment outcome was used to determine whether an empirically supported treatment modified a necessary component of anxiety maintenance: hypervigilance to and persistent rumination on anxiety-provoking information.

Literature Review

Theories of Selective Processing

Many anxiety disorders appear to be characterized by disruption in memory that allows for the disproportionate recall of the feared situation or stimulus (DSM-IV-TR; American Psychiatric Association [APA], 1994; Coles & Heimberg, 2002; MacLeod, 1991); post-traumatic stress disorder, for example, is characterized by both enhancement of memory for the traumatic experience and concurrent paradoxical memory impairment of varied aspects of the event such that recurrent, intrusive, and fragmented recollections disrupt the normal functioning of the victim (DSM-IV-TR; American Psychiatric Association [APA], 1994). An agoraphobic's fear may be exacerbated by recall of a single instance of an

embarrassing or threatening situation that prevented immediate escape in the same manner in which a person with generalized anxiety disorder may recall anxiety-provoking experiences more readily than positive experiences that should negate that information. Memory bias in anxiety disorders has arisen from theories of selective processing, which collectively state that information that is deemed threatening is better encoded than other information and/or better encoded than a non-anxious individual's encoding of threatening information. Understanding selective processing and hypothetically resulting explicit memory bias has important clinical and scientific applications in that the maintenance of anxiety disorders may be contingent on continued selective processing and successful treatment should involve elimination or reduction of selective processing.

Because of the centrality of the issue, selective processing bias has received extensive empirical attention and theoretical explanations, such as those posited by Aaron Beck (Beck, 1976) and Gordon Bower (Bower, 1981, 1992). Beck's schema theory of cognition and emotion suggests that the development of maladaptive schemata associated with depression and/or anxiety occurs early in life, though those schemata lie dormant in the cognitive system until an elevation in depression/anxiety occurs and activates the schemata. Once the schemata are activated, they produce processing biases for schema-consistent information, thereby limiting cognitive processing availability for information that does not fit into the schema (MacLeod, 1990; MacLeod & Rutherford, 1992). The activated schema distort all information processing and make an individual prone to experience thoughts related to that schema, make negative predictions, and interpret ambiguous information in a manner such that it is consistent with the schema (Coles & Heimberg, 2002).

According to Bower's network model, information in long term memory is stored in hypothetical nodes, all of which are located within a network and have associative connections with numerous related nodes. The activation of a single emotional node, produced by one's current corresponding emotional state, spreads throughout that node's associative connections and primes, or partially activates, those connections that contain mood congruent information. As a result of primed associative nodes, mood congruent information is disproportionately available to the cognitive system, thereby inducing a processing bias favoring the encoding of emotionally congruent stimuli (Bower, 1981, 1992). Both theories suggest that selective processing automatically occurs without conscious intent; the theories differ in that Beck's model seems to suggest that biases are result of an ingrained trait while Bower's theory suggests that one's state is the cause of bias (MacLeod & Rutherford, 1992). It is important to note, however, that neither predicted different manifestations and varieties of memory bias for different emotional disorders (Coles & Heimberg, 2002), as is suggested in current research.

Empirical Examination of Selective Processing

Two main categories of experimental paradigms, identification tasks and interference tasks, have been utilized to test theoretical selective processing bias in anxious subjects (MacLeod, 1991). Identification tasks, in which emotionally threatening and neutral words are presented to participants in a manner incompatible with conscious recollection, have been used to determine if anxious individuals are more adept at identifying threat words despite ambiguity. Included in this category is the dichotomous listening procedure (Foa & McNally, 1986), in which two word types, threat and neutral, are simultaneously presented into the right and left ears using headphones and selective attention is revealed in the participant's

ability to better identify threat-related words. It is important to note, however, a methodological criticism for this particular procedure that was described by MacLeod (1991): apparent attention biases found using this procedure may be due to an anxiety-linked guessing strategy rather than to encoding selectivity. The white noise paradigm, in which participants are asked to encode threat-relevant and neutral sentences and then attempt to accurately repeat the sentences when they are presented with varying levels of background noise, has received limited use in phobia research (Olatunji, Sawchuk, Lee, Lohr, & Tolin, 2008).

Interference tasks, in which bias is indicated by a participant's inability to ignore the meaning behind emotionally threatening stimuli in order to perform some other simple task, are used extensively to determine if a participant allocates preferential attention to threatening stimuli compared to neutral stimuli. Included in this category is the dot probe paradigm, in which threat and neutral words are presented followed by a dot or a similar stimulus that serves to prompt participant response. Shorter response latencies when the dot is presented in the same area as the threat word theoretically indicate more attentional bias to that word. Also included in this category is the popular emotional Stroop color-naming task and the Spider Stroop (Watts, McKenna, Sharrock, and Trezise, 1986) that involves spider-related words. Stroop tasks most often involve the presentation of threat and neutral linguistic stimuli in various colors; the participant is instructed to ignore the word and simply name the color in which the word is printed. Longer response latencies are believed to indicate more attention devoted to the meaning of the word, which results in an inability to perform the required color-naming task due to that increased attention. The utility of the Stroop task has, however, been questioned in several studies by Thorpe and Salkovskis (1997a, 1997b). The

authors suggest lack of reliability intrinsic in this task given that some experiments have found decreases in Stroop interference regardless of group membership or word type (Thorpe & Salkovskis, 1997a). They also suggest that Stroop interference may merely reflect preoccupation, which is not necessarily indicative of anxiety. Nevertheless, it continues to be the dominant experimental paradigm in this area.

As is compatible with contemporary theories on cognitive bias, a great deal of empirical support for enhanced processing of threat-related information in anxious subjects has emerged using such traditional paradigms as those previously mentioned, though many do not evaluate subsequent explicit memory (Foa, Feske, Murdock, & Kozak, 1991; Hope, Rapee, Heimberg, & Dombeck, 1990; Mathews & MacLeod, 1985; McNally, Riemann, & Kim, 1990). Utilizing a dichotomous listening paradigm, Burgess et al. (1981), for example, tested the ability of individuals with agoraphobia, social phobia, and non-phobic controls to identify threatening and neutral words. Both phobic groups exhibited a disproportionate ability to detect threatening words compared to neutral words, indicating a selective processing bias for threatening words. MacLeod, Mathews, and Tata (1986) found that anxious subjects demonstrated bias toward threat cues regardless of personal relevance of those cues, suggesting enhanced processing of all threat-related information in anxious individuals. In a notable study that did evaluate explicit memory, Kindt and Brosschat (1998) used a negative priming and free recall task to investigate the hypothesis that selective processing bias operated in response to threatening stimulus-related words and cognitive avoidance replaced that bias in the presence of anxiety response-related words, such as “startled” or “terrified.” While individuals with spider phobia did show a selective processing and recall bias for threatening stimulus-related words, there was no diminished recall for

anxiety response-related words, thereby opposing the theory of cognitive avoidance for such stimuli. Cognitive bias for threat-related information has also been documented in the replicable phenomenon of "weapon focus," which occurs when a threatening stimulus (e.g., the weapon of an attacker) is selectively encoded and recalled at the expense of other details, such as the appearance of the attacker (Loftus, Loftus, & Messo, 1987; Steblay, 1992).

Though identification and interference tasks remain the mainstay of anxiety-induced attentional bias research, other methodologies have recently been utilized in an attempt to more effectively detect reflexive and subtle selective processing bias and these methodologies have revealed evidence for such bias. In a novel paradigm employed by Cisler, Ries, and Widner Jr. (2007), spider-fearful and non-fearful participants were tested not on the latency of their responses, as is the dependent variable in Stroop and dot probe paradigms, but on the accuracy of probe detection following identification of a valenced target word. The study employed a rapid serial visual presentation procedure (RSVP), which involved a computerized stream of words that included one target word and one probe word. Participants in the control group were instructed to ignore the fear-relevant target word when it appeared but report the presence of the neutral probe word, which appeared various milliseconds later than the target word, while those in the experimental group were instructed to report both the target word as well as the probe word. The authors hypothesized that those experimental group participants who had elevations in anxiety would respond with earlier detection of the probe compared to non-fearful participants following the presentation of the fear-relevant target word. Indeed, results indicated that highly spider-fearful participants demonstrated faster processing of the target word and that these participants were better able to quickly identify the following probe, which suggests increased vigilance as a result of

anxiety arousal. There was, however, some difficulty identifying the probe word if it immediately followed the target, which suggests some difficulty disengaging attention from a threat-relevant stimulus, though this result was also demonstrated in the low spider-fearful group.

Despite relative support for selective processing bias, studies reporting confounds that may operate to produce bias not attributable to selective encoding (Mathews & Klug, 1993) and avoidance of threat-related information in state-anxious individuals (Foa, McNally, & Murdock, 1989) also exist. One study found visual avoidance for fear-relevant stimuli compared to neutral stimuli, though no measure of automatic or strategic processing was administered (Tolin, Lohr, Lee, & Sawchuk, 1999). A study that implemented the white noise paradigm with spider-phobic and non-phobic participants (Olatunji, Sawchuk, Lee, Lohr, & Tolin, 2008) found no evidence of preferential processing of spider-related sentences in individuals with spider phobia. A study that utilized visual tracking technology (Rinck & Becker, 2006) found initial visual fixation on pictures of spiders by spider-fearful participants compared to non-fearful controls when those images were presented with pictures of butterflies, dogs, and cats, a finding that the authors hypothesized is attributable to automatic, involuntary processing of threat by spider-fearful individuals. However, this initial attentional bias was quickly followed by significant visual avoidance of the spider picture by the spider-fearful participants in favor of a picture that was subsequently rated as more pleasant: the picture of a cat. This result supports theoretical reflexive bias toward threat followed by avoidance of further elaboration of threat, which will later be discussed, but the authors found no significant recognition differences between spider phobic

participants and non-anxious controls on a test of recognition despite the attentional bias for threat-relevant information.

Variables that May Affect Selective Processing

Though there appears to be much evidence supporting processing bias in anxious subjects, occasional contradictory results or failures to replicate have led to the exploration of variables that may affect selective processing bias. The nature of the stimuli used in various paradigms designed to test selective processing has been examined in an effort to determine the ecological validity of the two most commonly used stimuli: valenced words and pictures. The presentation and subsequent priming tests for valenced words have produced results suggestive of the adequacy of such stimuli in detecting selective processing bias (Chen, Lewin, & Craske, 1996; Kindt & Brosschot, 1998; Lavy, Van den Hout, & Arntz, 1993; MacLeod & McLaughlin, 1995; MacLeod & Rutherford, 1992; Richards & Millwood, 1989). This has led to the use of valenced words in most studies examining this topic, though other stimuli have been used infrequently.

In several studies, pictorial stimuli were presented to determine their efficacy in producing bias. Lipp and Derakshan (2005) utilized the dot probe paradigm with pictures of snakes, spiders, mushrooms, and flowers to detect possible attentional bias in snake- and spider-fearful participants and found preliminary evidence for bias toward threat-relevant pictures in fearful participants. Kindt and Brosschot (1999) used pictorial stimuli in a Stroop test modification that was administered to spider phobic and non-phobic children; specifically, they used pictures of spiders and chairs superimposed on a colored circle and labeled these images as nonintegrated pictorial stimuli. They then compared recall for nonintegrated pictorial stimuli to nonintegrated linguistic stimuli, which involved threat and

neutral words superimposed in a colored circle, and integrated linguistic stimuli, which were the traditional Stroop stimuli of colored threat and neutral words. While bias was found for integrated and nonintegrated words, pictures elicited no selective processing bias in individuals with spider phobia, despite the spider phobic participants' judgment that pictures of spiders were the most aversive stimuli in terms of valence and arousal. An earlier study, however, by Kindt and Brosschot (1997) examined the same issue by exposing adult spider phobics and non-phobics to the same paradigm and found bias for threat-related words and pictures, though pictures elicited no greater bias as predicted. Similar results were presented by Lavy and Van den Hout (1993), though they reported that pictures elicited slightly less selective processing bias than linguistic stimuli.

In addition to the nature of the stimuli, another frequently investigated variable that may affect selective processing bias is the relative contributions of state and trait anxiety, though the effects of each are often difficult to dissociate due to their high correlation (MacLeod, 1990). MacLeod and Matthews (1991) suggest that increases in state anxiety produce the most consistent results favoring selective processing of threatening information: indeed, a study by Foa and McNally (1986) found that clinically anxious subjects' memory bias for threat-related words was completely eliminated by reduction in state anxiety through imaginal exposure and exposure and response prevention treatments. Chen, Lewin, and Craske (1996) used the linguistic Stroop paradigm to test the effects of increased state anxiety in spider phobics by presenting the feared stimulus before the Stroop and eliciting continued state anxiety by informing subjects that they would be physically contacting the spider after the computerized test. Spider phobics showed a selective processing bias toward threat-related information that was enhanced by state anxiety. The authors concluded that

elevations in state anxiety magnify bias that may have already been introduced by elevated trait anxiety, which other studies have also regarded as a necessary condition for selective processing (Broadbent & Broadbent, 1988; Richards & Millwood, 1989). A study examining the effects of trait anxiety on autobiographical memory (Richards & Whittaker, 1990) suggested that high trait anxious individuals showed autobiographical memory bias for anxiety-related memories in that they were able to produce memories associated with anxiety-related cue words faster than happiness-related cue words; this result was not, however, replicated in a later similar study (Levy & Mineka, 1998). There was no evidence that highly trait-anxious individuals detected fear-relevant stimuli faster than low-trait anxious individuals in a study that utilized a change detection paradigm, which involved subtle fear-relevant or fear-irrelevant changes to a computerized picture of a social scene (Mayer, Muris, Vogel, Nojoredjo, & Merckelbach, 2006).

MacLeod and Mathews' (1988) study involving college students with either high or low trait anxiety suggested an interaction between trait and state anxiety. Testing occurred once when state anxiety was low, which was early in the semester, and again when state anxiety was high, which was before an examination. Word pairs consisting of threat and neutral stimuli were used in a probe detection task to determine amounts of visual attention to each stimulus. Results indicated that selective processing was not present when state anxiety was low for either high or low trait anxious participants but, with increases in state anxiety, high trait anxious individuals showed selective processing for threat-related stimuli while low-trait anxious individuals showed avoidance of threat-related stimuli. These results were tested in a similar study (MacLeod & Rutherford, 1992) that sought to determine the contribution of state and trait anxiety as well as automaticity of bias using a masked and

unmasked Stroop procedure. On masked trials used to evaluate selective processing bias, elevations in state anxiety increased bias for threat-related information in high trait-anxious subjects but increased avoidance for such information in low-trait subjects. In the unmasked exposure condition designed to test for explicit memory bias, high state anxiety led to conscious avoidance of threat-related stimuli for both high- and low-trait subjects. These studies suggest a difference in the nature of selective processing bias based on both state and trait variables as well as on conscious and unconscious awareness, another variable that has received empirical attention in the literature that incorporates subsequent recall.

Effect of Selective Processing on Subsequent Recall

While the phenomenon of selective processing bias has received relatively substantial empirical support, research on explicit memory bias resulting from selective processing has yielded diverse results. One would logically expect that information that receives preferential attention during encoding would enjoy subsequent enhanced recall; indeed, some studies seem to have assumed this to be true (e.g., Wessel & Merckelbach, 1997), and there is evidence that does support this assumption (Kindt & Brosschat, 1998; Watts & Coyle, 1992). Friedman, Thayer, and Borkovec (2000), for example, found a significant explicit recall bias for threat-related words compared to non-threat words in subjects with generalized anxiety disorder. A study examining memory bias in high and low anxious adolescents used the Stroop paradigm with the addition of a word-stem completion task and a recognition task to assess explicit recall; though the high anxious group did not show a memory bias relative to the low anxious group on the word-stem completion task, there were significant differences in the recognition task (Potter, 1999). The high anxious group recalled more threat-related words than the low anxious group, thus exhibiting an explicit memory bias for threat-related

words. However, Mogg, Mathews, and Weinman (1987) reported no support for threat-related memory bias in anxious participants; they demonstrated poorer recall of threatening material compared to non-threatening material on recall and recognition tasks. Avoidance of threat-related stimuli (Watts & Dalgleish, 1991) and null results for stimulus-related words have been reported elsewhere (Watts & Coyle, 1993), including in a study that used video clips of spiders as the threatening stimuli and assessed explicit memory through recall and recognition tasks of the clips and their details (Thorpe & Salkovskis, 2000).

Reconciliation for divergent findings in selective processing and subsequent recall may be found in the theory posited by Williams et al. (1997), which suggests that elevated anxiety results in emotionally-congruent integrative processing but emotionally-incongruent elaborative processing; thus, selective processing would operate in anxious individuals but further elaboration required to consciously recall threatening information would be hindered, resulting in an explicit memory avoidance for threat-relevant stimuli. This theory has been tested using a combination of implicit tasks to uncover selective processing bias and explicit tasks to test for conscious avoidance of that information. As described above, implicit memory tasks, such as the masked Stroop test, measure passive acquisition of previously exposed material (MacLeod & McLaughlin, 1995) while explicit memory tasks, such as free recall, measure strategic and conscious recollection of previously viewed material.

A study by MacLeod and McLaughlin (1995) examined whether subjects with generalized anxiety disorder (GAD) would show a recall advantage for threat-related words on an implicit memory task (tachistoscopic identification) and on an explicit memory task (recognition test) compared to non-phobic controls. Results indicated that the GAD group did show significantly higher levels of implicit memory for threat-related words relative to the

control group; however, there were no significant differences in explicit memory between participant group or word valence. Mathews, Mogg, May, and Eysenck (1989) reported similar evidence in that clinically anxious individuals showed memory bias for threat information if primed to do so, but no evidence for bias in explicit memory was suggested. In a series of experiments, Nugent and Mineka (1994) tested high and low trait-anxious subjects using implicit (word-stem completion) and explicit (free recall and recognition) tests of positive, neutral, social threat, and physical threat words. No evidence was found for implicit memory bias in anxious subjects and the slight evidence for explicit memory bias found in Experiment 1 was not replicated in Experiment 2. A literature review by Coles and Heimberg (2002) on memory bias in panic disorder, post-traumatic stress disorder, generalized anxiety disorder, and obsessive-compulsive disorder suggested that, while explicit memory bias for threat-relevant information enjoyed little support, there was modest support for implicit memory bias.

The utilization of cueing, a common memory enhancement technique in which recall prompts are provided to subjects, has been used to evaluate memory bias in anxious individuals by determining if cognitive failure occurs at encoding or retrieval and if hypothesized explicit inhibition can be released through cueing. For example, cues have been used in studies examining the next-in-line effect, a deficit of recall for events that occurred prior to performance in socially anxious individuals. A study by Bond (1985) tested pre-performance memory deficits with both a free and cued recall test and found that retrieval cues did not eliminate the next-in-line effect, though they did generally facilitate recall. A second study by Bond and Omar (1990) examined an alternative hypothesis, that pre-performance memory deficits were a result of state-dependent retrieval, by re-inducing

anxiety experienced at a previous performance through a requirement for a second performance. According to the theory of state-dependent retrieval, re-induction of the previous state under which encoding occurred should eliminate the next-in-line effect; in this case, those high in anxiety suffered a pre-performance memory deficit on both performance occasions. For the next-in-line effect, it appears that elevated anxiety produces deficits in encoding rather than inhibition during retrieval.

In a more directly relevant study, explicit memory cues in the form of a recognition test were used to examine memory for relevant and irrelevant threat and neutral words before and after the physiologically arousing condition of skydiving (Cavenett & Nixon, 2006). Relevant and irrelevant threat and neutral words were to be learned on the plane 10 minutes before the skydive was to occur for subjects in the experimental condition. Memory was tested in free recall and recognition tasks administered after the skydive. Though both memory assessment measures examined only explicit memory bias, the authors concluded that recognition cues did not eliminate selective processing bias for skydive-relevant stimuli; those in the experimental condition showed bias for skydive-relevant words while irrelevant words suffered poorer recall regardless of cueing, thus supporting a deficit in encoding. Results also indicated that valence of the word on the recognition test had no effect on recall, which may lend support to the theory that selective processing bias does not necessarily result in subsequent congruent explicit memory bias.

Thus, though mixed results have been frequently reported in this literature, it appears that there is limited support for explicit memory biases congruent with selective processing bias found on implicit memory tasks. This has led to theories of the existence of attentional biases only in reflexive, automatic processing followed by avoidance of cognitive elaboration

of the feared stimulus, a covert behavior that is also overtly displayed in individuals with specific phobia. It has also given rise to a variety of experimental methodologies used to detect implicit and explicit bias as well as critical analysis of numerous factors that may produce or alleviate bias. Despite the abundance of studies examining selective processing bias and explicit memory bias and the clinical implications of such phenomena, there have been relatively few studies on the effect of anxiety treatment on such bias, which may be at least partially due to the lack of definitive results for cognitive biases.

Effects of Treatment on Selective Processing and Explicit Memory Bias

Foa and Kozak (1986) proposed that behavioral treatments such as *in vivo* exposure therapy reduces anxiety by evoking fear and allowing for habituation and disconfirmation of threat associated with the feared-stimulus. Thus, if stimuli are no longer threatening, one may expect that they will not induce preferential encoding. Again, few studies have been conducted to determine the effects of empirically supported treatment on anxiety and cognitive bias, though those that have been conducted have generally found that treatment reduces cognitive bias (Watts, McKenna, Sharrock, & Trezise, 1986). McKay (2005) used a directed forgetting task, a Stroop task, and a dot-probe task to establish whether selective processing biases were evident after "worrier" and "non-worrier" subjects actively engaged in positive imagery, a component of many treatment programs for anxiety. Compared to subjects who were in the worry-induction group, those worriers who were instructed to engage in positive imagery showed a reduction in memory and selective processing bias for threat-related information. Lavy, Van den Hout, and Arntz (1993) tested spider phobics and non-phobic controls using a Stroop task followed by one session elaboration or non-elaboration exposure for phobic subjects. The elaboration treatment condition encouraged

subjects to elaborate as much information about the spider stimulus as possible, thus preventing cognitive avoidance, while the non-elaboration condition discouraged such elaboration. The selective processing bias for threat-related stimuli was reduced but not eliminated by treatment, and elaboration did not enhance selective processing bias reduction. Lavy and Van den Hout (1993) used a linguistic and pictorial Stroop task to test one-session exposure treatment outcome in spider phobics and found reduction in bias for linguistic stimuli and elimination of bias for pictorial stimuli.

Some studies, however, have produced incompatible results. Thorpe and Salkovskis (1997a) administered a Stroop task of spider, disgust, emotional, and neutral words to spider phobics to test the effect of one-session cognitive-behavioral treatment for phobia. Though the treatment was effective in reducing fear and negative beliefs toward the feared stimulus, participants who did and did not receive treatment showed a decrease in Stroop interference for all words types, including spider stimuli. The authors suggested that the Stroop may be an inadequate measure of selective processing given that phobics may not respond to semantic stimuli in the same manner in which they would respond to the actual stimulus. The effect of *in vivo* exposure therapy was also tested on general memory, recall for anxiety level, and recall for the phobic stimulus in spider-fearful subjects (Zoellner, Echiverri, & Craske, 2000). Improved recall for anxious responses was noted posttreatment, but there was no improved recall for stimulus details. This may indicate possible interference or avoidance caused by anxiety, even following one session of exposure treatment. As is evident, theoretical reduction in recall avoidance of threatening words as a result of empirically supported treatment has received little attention, and there have been calls for more examination of the effects of treatment on cognitive bias (Mobini & Grant, 2007).

Present Study in Relation to the Literature

Though few theories have obtained definitive empirical support in the literature on cognitive bias, the proposed study sought to resolve inconsistencies and introduce methodological improvements by altering typical experimental paradigms. Limited studies have used details of the stimuli or the experimental situation to determine whether selective processing bias and hypothetical subsequent explicit memory bias operate in the most ecologically valid paradigm: confrontation with the actual feared stimulus. In a notable exception, Wessel and Merckelbach (1997) tested Easterbrook's (1959) theories on arousal and cue utilization, which state that the perception of threat reduces the range of cues that can be encoded and makes relevant cues more likely to be encoded than irrelevant cues, by exposing spider phobics and non-phobic controls to a live spider and subsequently measuring their recall for stimulus-related (central) details and peripheral details related to the surrounding environment in a free and cued memory interview. Poorer recall for peripheral details was displayed by phobic subjects on the cued recall tests; however, the two groups did not significantly differ on memory for central details.

The proposed experiment approximated Wessel and Merckelbach's (1997) study, though flaws and assumptions were addressed in the current study in an attempt to better integrate the literature on selective processing bias and explicit memory bias. As recognized by the authors, the central details in Wessel and Merckelbach's study may not have been "central" to an anxious subject in that they were not necessarily threat-related; the present study addressed this issue by including details that would signal threat or safety to a stimulus-fearful subject. Though the number of details in the proposed study remained the same as those used in Wessel and Merckelbach's study, memory for features of the details

was also assessed. To address the issue of null results found in tests of explicit memory, two measures of implicit memory were added, which should have identified whether selective processing bias occurred at all, in addition to the three explicit memory tests that were used in this study. Further clarity was established through the non-clinical categorization of the participants, which reduced the likelihood that comorbid depression affected selective processing and explicit memory results. Thus, the current study measured both selective processing and memory bias in an experimental situation that presented a direct threat and should have elicited greater amounts of anxiety than typical valenced words or pictures.

In addition, the study examined the effect of one-session *in vivo* exposure therapy (Öst, 1997) on both selective processing and explicit memory bias. As mentioned previously, limited studies have examined treatment outcome in selective processing bias and explicit memory bias in participants with specific phobia. Although this study did not recruit clinically significant individuals who meet diagnostic criteria for specific phobia, the elicitation of anxiety during presentation of the feared stimulus was suggested through the use of various assessment measures; it was hoped that each participant's fear generally approximated the fear that a clinically significant individual would experience. The contribution of state and trait in both selective processing and explicit memory bias was examined, as well as the effect of retrieval cues on reducing potential inhibition experienced by anxious participants on measures of explicit memory.

By addressing relevant points in the literature and attempting to integrate methods used in various studies, this study represents a contribution to both the scientific and applied aspects of anxiety disorders in that further knowledge has been gained about a crucial component of anxiety - heightened cognitive sensitivity to threat-relevant stimuli - and how

that component differentially operates to maintain anxiety. The ultimate goal was to provide information that will inform treatment of specific phobia, specifically through the establishment of whether treatment can alleviate cognitive biases by allowing for the assimilation of non-threatening information regarding the feared stimulus. If theorized vigilance toward threatening stimuli and subsequent avoidance of that stimuli can be reduced, innocuous and positive stimuli can be integrated, perhaps eliminating the cyclic cognitive patterns involved in anxiety.

Research Questions and Hypotheses

The purpose of this study was to examine the effect of exposure treatment on theorized selective processing and explicit memory bias in snake- and spider-fearful participants by measuring recall of central and peripheral environmental details after treatment.

Research Questions

1. Will central and peripheral environmental details produce selective processing and explicit memory bias in the spider- and snake-fearful groups, which would be indicated by greater recall of central details on both implicit and explicit tests of memory in the experimental group of fearful individuals who does not receive treatment? Will there be explicit memory avoidance rather than explicit memory bias in the no-treatment experimental group, which would be evidenced by increased recall of central details on tests of implicit memory followed by a subsequent decreased recall of central details on test of explicit memory in the experimental group of fearful individuals who does not receive treatment?

2. Will one-session exposure treatment, an empirically supported and highly effective rapid treatment for specific phobia (Öst, 1997), eliminate selective processing bias and reduce potential inhibitory processes operating to suppress explicit recall of threat-relevant information? If treatment does eliminate both selective processing bias and explicit memory avoidance, one would expect to find equivalent recall for central details on implicit and explicit tests of memory between the experimental group that receives treatment and the control group; furthermore, there should be no significant differences between recall for central and peripheral details on implicit and explicit memory tests within the treatment group.
3. Are potential explicit memory deficits for central details, as is theorized in explicit memory avoidance, a result of encoding or retrieval failure, as assessed by the utilization of cueing on two explicit memory tasks? Encoding failure would be suggested by lack of statistically significant change when recall on explicit memory tests that do utilize cues (i.e. cued recall and recognition tests) is compared to the free recall test, an explicit memory test that did not utilize cues. Retrieval failure would be indicated by the opposite pattern: the presence of statistically significant change when recall on explicit memory tests that do utilize cues (i.e. cued recall and recognition tests) is compared to recall on the explicit memory test that did not utilize cues (i.e. the free recall test).
4. Will selective processing and explicit recall differences arise as a result of high or low state or trait anxiety in participants? For example, will those participants with high levels of both state and trait anxiety demonstrate greater selective processing bias and

explicit memory bias or avoidance than those who have high levels of either state or trait anxiety or low levels of both state and trait anxiety?

Hypotheses

1. Though the results of empirical examinations of anxiety-induced cognitive bias are mixed, there seems to be limited evidence suggesting the presence of selective processing bias for threat-relevant stimuli and reasonable empirical support for later explicit memory avoidance of those threatening stimuli. Thus, data should suggest selective processing for central details in untreated snake- and spider-fearful participants, as would be indicated by higher scores obtained for recall of central details compared to both the control group's recall of such details and the no-treatment group's recall for peripheral details on implicit memory tests. Explicit memory avoidance would be evidenced by decreased recall of selectively processed central details on tests of explicit memory in the no-treatment group.
2. One-session exposure treatment will eliminate selective processing bias and reduce inhibition of threat-relevant information characteristic of explicit memory avoidance, thus allowing for better explicit recall of all details such that recall for central and peripheral details will not significantly differ in the exposure treatment group. Additionally, the control group and the treatment group should generally equate on recall of central and peripheral details on all tests of implicit and explicit memory.
3. Explicit memory deficits will have resulted from retrieval failure given that, if selective processing bias followed by explicit memory avoidance are indeed present, there should be preferential encoding of central (threat) details and subsequent inhibition or avoidance of those encoded details in the untreated fearful group; that is,

central details should indeed be encoded, though retrieval may be inhibited. If retrieval failure is operating, cues may serve to release inhibition of central details, though cues are expected to facilitate recall rather than eliminate central detail avoidance (Bond,1985).

4. State and trait variables will interact. Those participants who demonstrate high levels of both state and trait anxiety will show the greatest selective processing bias and produce more explicit recall avoidance of central details. This result is expected only in the no-treatment group given that the treatment group should experience abatement of state anxiety following exposure treatment and the control group should show relatively little state anxiety throughout the experiment.

Participants and Setting

Participants

Participants were recruited from undergraduate courses at a Midwestern university and, in some instances, offered extra credit from their instructors for their voluntary participation. In addition to the possibility of extra credit, all fearful participants were offered one-session *in vivo* exposure treatment if they did not receive such treatment during the course of the experiment. To be considered "fearful," participants needed not to have met DSM-IV-TR (American Psychiatric Association [APA], 1994) criteria for specific phobia; rather, they obtained a score in the significantly fearful range (70-126) on the Fear of Spiders Questionnaire (FSQ) or on the Fear of Snakes Questionnaire (FSnQ), an instrument developed for this study from the FSQ. All participants must have had nominal levels of depression, as indicated by a score of six or below on the Depression Anxiety Stress Scales – 21-item version (DASS-21). In accordance with ethical considerations, those fearful

participants who reported medical conditions, including pregnancy and heart conditions, that could have been negatively impacted or exacerbated by anxiety induction were excluded from the study and, indeed, a number of individuals were excluded due to medical conditions reported in the initial online screening questionnaire. To be included in the control group, participants scored within the insignificant to non-fearful range (0-10) on the FSQ or the FSnQ; the animal that they reported to least fear was used in the case that the participant met criteria for both animals.

Participants were categorized into three groups (see Appendix A for a diagram of the study). The first group, which consisted of 15 randomly assigned snake- or spider-fearful participants, received one-session *in vivo* exposure treatment with either the snake or the spider, depending on the individual's fear. This fearful exposure treatment group was included in an effort to address the study's central question of whether exposure treatment produced an effect on selective processing and explicit memory bias or avoidance. The second group, which consisted of 15 randomly assigned snake- or spider-fearful participants, did not receive treatment for snake or spider fear during the course of the experiment. The purpose of this fearful no-treatment group was to evaluate selective processing bias and explicit memory bias/avoidance in fearful participants who did not receive treatment and, theoretically, experienced no abatement of their anxiety during the experiment. The control group, which consisted of 15 non-fearful participants, was included to determine whether selective processing bias for highly emotional information is unique to snake- or spider-fearful individuals. University Human Subjects Review Committee/Internal Review Board policies and procedures were closely followed to ensure ethical treatment of all participants.

Setting and Stimulus Materials

One classroom in the university was utilized for this study; it was divided by movable partitions so that detail exposure and treatment occurred in the same room, but the experimenter maintained control of the participant's visual field (see Appendix B for room layout). The right portion of the classroom was utilized for the Behavioral Avoidance Test (BAT) and detail exposure, during which time the room contained either a Chilean rose hair tarantula or a corn snake (Stimulus A) with all central details, a table upon which the cage for Stimulus A sat, and the peripheral details described below. It also had a 14-foot laminated ruler secured to the floor; the ruler began at the doorway and ended at Stimulus A's container, which was located on a table toward the far wall of the room. All other extraneous material was removed from the room or moved to the opposite side of the room behind the partition if removal was impractical. During treatment for the fearful exposure treatment group, the left portion of the room was utilized, and treatment involved either a small Chaco golden knee tarantula or a small gopher bull snake (Stimulus B) and the absence of any peripheral details or extraneous materials; that is, treatment involved only Stimulus B and a table upon which the cage for Stimulus B sat. All other items were removed or placed such that they did not interfere with treatment. In addition to the classroom, a separate office was utilized for study introduction and administration of the State Trait Anxiety Inventory (STAI, Form Y; Spielberger, Gorsuch, & Lushene, Vagg, & Jacobs, 1983), the Shipley Institute of Living Scale (SILS; Shipley, 1940; Zachary, 1991), and the Thought Evaluation Packet, which contained all implicit and explicit memory tests used in this study. Institutional Animal Care and Use Committee guidelines were adhered to for the care and handling of the snakes.

Due to concerns regarding the validity of the central details used in Wessel and Merckelbach's (1997) study, details were selected based on characteristics of the feared stimulus or its surrounding environment that may be particularly salient for anxious individuals (Lange, Tierney, Reinhardt-Rutland, & Vivekananda-Schmidt, 2004; Lavy & Van den Hout, 1993). The five central details for the BAT/detail exposure were (1) color/markings on the animal, (2) size of the animal, (3) amount and direction of movement of the animal, (4) a sign to the left of the container that read "Caution: Handle with Care," and (5) a red arrow with the word "exit" printed in white lettering posted on the right wall and pointing toward the door. While not directly related to the animal, the final two central details (the caution sign and exit arrow) were included based on evidence that phobic individuals not only show increased attention to a threat stimulus itself, but also to safety stimuli as well (Lange et al., 2004). Details such as the amount and direction of movement of the animal were recorded by the experimenter on a form called the Participant BAT Record during BAT/detail exposure (see Appendix C). The peripheral details, which were deliberately made novel and salient as in Wessel and Merckelbach's study, were (1) an artificial sunflower in a large blue vase, (2) a movie poster, (3) a white stuffed animal with a red bow on its neck, (4) a large tan/white conch seashell, and (5) a clear champagne glass with gold detailing. Features of the details were included in the implicit and explicit memory tests to better assess recall by increasing statistical power.

Measures (see Appendix D for list of acronyms)

Initial Online Assessments

Fear evaluation.

Two questionnaires were used to measure fear level toward the animal and arachnid used in the experiment. The recently developed Fear of Spiders Questionnaire (FSQ; Szymanski & O'Donohue, 1995) is a 22-item self-report instrument that evaluates current fear of spiders with statements that are rated on an 8-point Likert scale where 0 indicates *totally disagree* and 7 indicates *totally agree* (see Appendix E); the mean score for spider phobic individuals in a study by Muris and Merckelbach (1996) was 89.1 (SD = 19.6). In addition to the FSQ, the Fear of Snakes Questionnaire (FSnQ) was developed from the FSQ for this study (see Appendix F). According to Szymanski and O'Donohue (1995), the FSQ is designed to evaluate five different domains of spider fear: (1) cognitive, (2) behavioral, (3) physiological, (4) negative attitudes, and (5) fear of harm by spiders. This particular instrument was chosen over the widely implemented Spider Phobia Questionnaire (SPQ; Watts & Sharrock, 1984) due to evidence that the FSQ provides a more valid discrimination between phobics and non-phobics, a more accurate measure of fear in the non-phobic range, and detection of reduction in phobic responses after treatment (Muris & Merckelbach, 1996; Szymanski & O'Donohue, 1995). Both Szymanski and O'Donohue (1995) and Muris and Merckelbach (1996) reported high levels of internal consistency (above $\alpha = .88$) for both spider phobics and non-phobic controls on the FSQ; the SPQ fell below acceptable limits for non-phobic controls. In addition, all authors reported good temporal stability for the FSQ and the ability of the FSQ to differentiate between spider phobics and non-phobic controls was indicated. Finally, the FSQ detected changes in fear as a result of both behavior therapy

(Muris & Merckelbach's, 1996) and cognitive restructuring (Szymanski & O'Donohue, 1995). Thus, the instrument demonstrated good test-retest reliability, internal consistency, and validity and is briefer than the 31-item SPQ, thereby increasing efficiency.

Assessment of comorbid depression.

To ensure that a comorbid condition of depression did not introduce a significant confound, the brief version of the Depression Anxiety Stress Scales (DASS; Lovibond & Lovibond, 1995), the DASS-21 (see Appendix G), was administered in addition to the FSQ and FSnQ; given the mean of a normal population (Henry & Crawford, 2005) on the depression scale, a cutoff score of 6 or below on the depression subscale was used as inclusion criteria. The DASS-21 is a self-report instrument containing three scales that assess the occurrence and severity of the emotional symptoms of depression, anxiety, and stress on a 4-point scale (0 = *did not apply to me at all*, 3 = *applied to me very much, or most of the time*). Henry and Crawford (2005) evaluated the psychometric properties of the DASS on a non-clinical adult sample and found satisfactory reliability of the three scales (α = .88 for Depression, .82 for Anxiety, and .90 for Stress) and, as has been confirmed in the full version, good convergent and discriminant validity; that is, the three scales are moderately highly correlated with each other, yet the instrument is able to adequately discriminate between the three related emotional states. A study by Antony, Bieling, Cox, Enns, and Swinson (1998) supported the reliability and validity of the DASS-21 in assessing features of depression, anxiety, and stress in both clinical and non-clinical adult populations. Their study yielded Cronbach's alphas for the DASS-21 Depression, Anxiety, and Stress subscales of .94, .87, and .91, respectively, and they found comparable scores on the DASS and the DASS-21 among several diagnostic groups and controls.

Assessment of participant characteristics and exclusionary factors.

An experimenter-created background questionnaire (see Appendix H) was used to assess characteristics of the participant as well as to screen participants for exclusionary factors. Basic demographic information was collected, including age, sex, occupation, and current college standing. Though all participants were required to disclose their first name, full disclosure of first and last name, university identification number, and contact information was voluntary and could be omitted; the purpose of collecting such identifying information was to allow students to receive course extra credit for their participation in the online screening portion of the study as well as to provide crucial information to the experimenter if the participant wanted to be contacted for further participation opportunities. Exclusionary criteria queried in the questionnaire included the existence of health conditions, traumatic brain injury, epilepsy, dementia, learning disabilities, allergies to snakes or spiders, a compromised immune system, and so on. Other information was included simply for the knowledge of the experimenter, such as how the participant heard of the study and if the participant had any intensely fearful experiences with either a snake or a spider.

Pre-stimulus Contact Assessments

Level of state and trait anxiety.

The State-Trait Anxiety Inventory (STAI, Form Y; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) is a self-report instrument that was used to assess each participant's current and general levels of anxiety before any experimental manipulation took place, though no assignment to any of the three groups was made based on the obtained data. The STAI consists of forty items designed to assess two dimensions of anxiety: state, which is temporary anxiety that may be elicited by a feared stimulus or situation, and trait, which is

stable and enduring anxiety. The State Anxiety subscale contains 20 statements regarding current anxious feelings that are self-rated on a 4-point Likert scale where 1 indicates *not at all* and 4 indicates *very much so*. The Trait Anxiety subscale contains 20 statements regarding general feelings of anxiety that are also self-rated on a 4-point Likert scale (1 = *almost never*, 4 = *almost always*). The scale was chosen for its psychometric soundness, brevity, and ease of administration and scoring (Spielberger, 1985); its use also allowed for comparison with other studies that included this measure. Test-retest reliability over a period of several weeks has been reported to be between .86 and .71 for the Trait Anxiety subscale and .54 and .27 for the State Anxiety subscale (Hedberg, 1972). In addition, good internal consistency has been reported (above $\alpha = .86$ for the Trait Anxiety subscale and above $\alpha = .83$ for the State Anxiety subscale), and construct validity is demonstrated by fluctuations in State Anxiety scores resulting from variable states of stress and overall stability of Trait Anxiety scores. The discriminative ability of this measure has been established in a college undergraduate sample (Metzger, 1976), thereby making it particularly useful in the current study.

Assessments Used During Stimulus Contact

Distress when presented with the feared stimulus.

The Behavioral Avoidance Test (BAT) and detail exposure was used to assess each participant's ability to approach the feared stimulus and allowed the participant to gain exposure to the central and peripheral details that were subsequently tested in implicit and explicit memory evaluation. As described in Koch, Spates, and Himle (2004), participants were instructed to approach Stimulus A as much as they could; unlike Koch et al. (2004), however, participants were instructed to avoid physical contact with the animal or its

container in an effort to relatively standardize exposure to details for all participants and to minimize distraction from handling the animal. Distance from the door to the animal was measured with the aid of the laminated ruler that was secured to the floor of the room. Participants approached the stimulus until an intolerable level of fear was reached, at which time the experimenter asked if that point was the maximum that they could possibly go. If further approach was rejected, the experimenter examined the ruler and recorded the distance traveled from the door as well as any overt signs of anxiety that the participant may have displayed, such as shaking or crying. When the participant reached a point at which he could go no further, he was instructed to remain at the point for one minute, after which time he exited the room with the experimenter. This procedure allowed for quantifiable assessment of level of fear toward the stimulus through approach; greater fear should have resulted in less approach.

The Subjective Units of Distress Scale (SUDS) was used in the BAT/detail exposure procedure to further quantify each participant's distress by requiring him to assign a numeric value to the anxiety experienced at various points in the experiment. Participants were instructed to assign a score of 100 to the *worst possible anxiety that they have or can imagine experiencing* and a score of 0 to *complete calmness*. The experimenter then asked for each participant's score at two points in the BAT: at the start of the BAT and the point at which the participant could go no further. SUDS ratings were also used in *in vivo* exposure treatment to determine if a satisfactory level of anxiety reduction was achieved on each treatment step.

Post-stimulus Contact Assessments

Measure of intellectual ability.

In order to evaluate and control the potential confound of intellectual ability on tests of memory, the Shipley Institute of Living Scale (SILS; Shipley, 1940; Zachary, 1991), a brief measure used for testing intelligence and detecting mild degrees of intellectual impairment, was administered to the participant upon returning to the experiment office immediately following BAT/detail exposure; this test additionally served as an interpolated distraction task prior to memory evaluation in an attempt to reduce potential recency effects. The SILS is divided into two main subscales, a 40-item Vocabulary Test and a 20-item Abstract Thinking Test, and yields six summary scores: the vocabulary score, abstraction score, total score, conceptual quotient, abstraction quotient, and estimated full scale Wechsler Adult Intelligence Scale or Wechsler Adult Intelligence Scale-Revised IQ scores. The Vocabulary Test measures general verbal abilities such as knowledge, reading ability, and verbal comprehension, while the Abstract Thinking Test measures cognitive and reasoning ability; significant discrepancy between scores on the two tests indicates cognitive impairment. Martin, Blair, Stokes, and Lester (1977) found acceptable test-retest reliability (coefficient of .80) and validity in a normative college sample, and this test has been recognized elsewhere for its excellent psychometric properties (Matthews, Lassiter, & Habedank, 2001).

Memory evaluation.

Following the SILS, five brief tests were administered to evaluate implicit and explicit memory for central and peripheral details presented in the BAT/detail exposure procedure. Two of these tests evaluated implicit memory. The first implicit memory test,

called the perceptual implicit memory test, involved pictures of the central and peripheral details as well as images of objects that were not included in the experiment; the pictures, which were each presented for one second in a PowerPoint 2003 presentation, had large portions removed from each of them, thereby making their identity ambiguous. Participants were instructed to verbally identify each picture as quickly as possible as it appeared in the center of the computer screen. Though many studies in the literature on anxiety and cognitive bias do not utilize a similar test because of the typically linguistic nature of studied materials, inclusion of this test is crucial given that several studies (Graf, Shimamura,& Squire, 1985; see also Kirsner, Dunn, & Standen, 1989 for a review) have found that similarity of the perceptual display between study and test maximizes priming (Roediger, Guynn, & Jones, 1994). Weldon and Roediger (1987), for example, found significantly more priming following a presentation of words on a word-stem completion task than a picture-fragment naming task; conversely, more priming occurred following a presentation of pictures on the picture-fragment naming task, thereby lending support to the assumption that a similar cognitive process underlies studying a picture and decoding its pictorial fragment.

The second implicit memory test was a word-stem completion test (see Appendix I), which was included simply to determine if any priming occurs despite presentation dissimilarity between study and test; participants were instructed to write down the first word that came to mind that begins with the two first letters printed on a sheet of paper (Coles & Heimberg, 2002; Mathews, Mogg, May & Eysenck, 1989). Several word stems were related to an attribute of a central or peripheral detail, which were labeled “critical words.” For example, if implicit encoding occurred, one would have expected a subject to fill in the word-stem “sh____” with the word “shell” to indicate that they encoded the peripheral detail

of the conch shell. To better assess for implicit encoding, word stems that were expected to produce critical words have been generally matched in terms of frequency with a Standard Frequency Index range between 45.8 and 59.8 (Carroll, Davies, & Richman, 1971).

The three explicit memory tests, a free and cued recall test and a recognition test, followed the two implicit memory tests. In the free recall task, participants were given a sheet of paper and asked to recall as many details as they could remember from the experimental situation, including complete descriptive details of the room and the feared stimulus (see Appendix J). Following this, a cued recall test containing explicit questions regarding all details was administered (see Appendix K). Finally, participants were given a recognition task, which included statements about all details as well as lures, or statements regarding objects that were not in the room, which participants were instructed to endorse by circling "T" if they deemed them to be true and "F" if there were deemed false (see Appendix L).

Assessment of thought during implicit memory tasks.

A final experimenter-created questionnaire entitled the Debriefing Questionnaire (Appendix M) was administered to all participants following the memory evaluations to assess, among other things, participant thought during both the perceptual implicit memory test and the word-stem completion implicit memory test; this questionnaire was useful to determine if those who were thinking about or recalling their previous surroundings were able to correctly identify more central and peripheral details on both these tasks and whether the tasks truly measured implicit memory given that endorsement of active recall during these tasks would call this assumption into question. Specifically, the questionnaire asked if the participant thought about the room which contained all central and peripheral details

during each test and if the participant actively attempted to recall items in the room during these tests. Additionally, in order to ensure that all fearful participants who desired treatment for their fear were able to receive treatment, those in the no-treatment group were asked if they desired treatment and were instructed to indicate dates and times that such treatment could be scheduled. In accordance with ethical considerations, the questionnaire also included several questions on the participant's current state of anxiety and whether he desired the usage of simple relaxation techniques such as deep breathing to alleviate anxiety that might have been provoked by the experimental procedures.

Treatment

One-session *in vivo* exposure therapy with no cognitive component was provided by the experimenter to those in the fearful exposure treatment group and to those fearful participants who were not in the treatment group but desired treatment at the end of the experiment. As outlined by Öst (1997) and utilized in several studies examining similar issues (Koch et al., 2004; Lavy & Van den Hout, 1993; Lavy, Van den Hout, Arntz, 1993; Thorpe & Salkovskis, 1997a), exposure treatment began with the verbal presentation of each treatment step to the participant. Following verbal description and instruction, the experimenter modeled each component necessary to complete that particular treatment step and allowed the participant to observe. The participant was then asked to complete each successive component either with initial assistance of the experimenter, which was gradually faded out, or independently. If anxiety became elevated to a point at which the subject did not feel he could continue, he said, "pause," which signaled to the experimenter to cease further treatment progression for approximately one minute; this practice occurred with several participants in this particular experiment, though the exact frequency was not

recorded. After the passage of one minute, the experimenter inquired whether the participant would like to continue and, if approved, treatment resumed; it should be noted that, in all instances in which a participant requested a brief break from treatment procedures, treatment always resumed following that break and no participant opted to discontinue treatment. SUDS levels were obtained for each treatment step. Exposure treatment was continued until all treatment steps were achieved with little to no report of subjective anxiety, as indicated by SUDS ratings of less than 20, or when the time limit of three hours was reached, though this never occurred in this experiment.

Similar treatment steps (Lavy & van den Hout, 1993; Lavy, van den Hout, Arntz, 1993; Öst, 1997; Koch et al., 2004; Thorpe & Salkovskis, 1997a) were utilized for both the spider and the snake, though there were some notable differences based on Koch et al.'s (2004) procedure. Initial treatment goals for both the spider and the snake were (1) progressing from the participant's initial BAT location to the outside of the container, (2) touching the container for 10 seconds while looking at the animal, (3) putting his fingertips inside the cage for 10 seconds while looking at the animal, and (4) touching the inside of the container with the hand on the bottom of the cage for 10 seconds while looking at the animal. The spider treatment steps were then (5) using an index card to guide the spider into a cup three times, (6) directing the spider around the cage with two fingers, (7) touching the spider with two fingers for 3 seconds, (8) touching the spider with at least two fingers for up to 60 seconds, (9) directing the spider across one hand with two fingers, (10) picking up the spider and allowing it to remain/crawl on the hand for up to 60 seconds, and (11) picking up the spider and allowing it to remain/crawl on the hand for more than 60 seconds but not in excess of 3 minutes.

Following steps 1 – 4, the snake treatment steps (Koch et al., 2004) were (5) touching the snake with two fingers for 3 seconds, (6) touching the snake with two fingers for up to 60 seconds, (7) touching the snake from underneath (cupping) for up to 60 seconds, (8) touching the snake with two fingers while the experimenter held the animal above the cage for up to 60 seconds, (9) touching the snake with one full hand while the experimenter held the animal above the cage for up to 60 seconds, (10) touching the snake with both hands while the experimenter held the animal above the cage for up to 60 seconds, (11) picking up the snake with both hands for up to 60 seconds, and, finally, (12) picking up the snake with both hands for more than 60 seconds but not in excess of 3 minutes.

Procedure

All individuals interested in participation were encouraged to complete the Screening Informed Consent Agreement (see Appendix N), both the FSQ and the FSnQ, the DASS, and the brief survey designed to gather background information, including relevant health conditions that contraindicated participation. The Screening Informed Consent and these assessment instruments were administered via SurveyMonkey.com, a website that allows online surveys to be created and administered in a secure format, and were used to determine eligibility for the study and to collect baseline data. Those who obtained a score equal to or higher than 70 for the fearful groups or equal to or lesser than 10 for the non-fearful control group and indicated interest in further participation were invited to meet with the experimenter in the experiment office for information about the study and to further participate if that individual so chose. Those who scored in the clinically significant range ($\geq$ 6) on the DASS-21 were excluded from meeting for the second portion of the experiment to reduce result confounding due to depressive symptoms. Those who indicated medical

conditions or other exclusionary criteria were also excluded from further participation. Fearful participants were randomly assigned to either the exposure treatment group or the no-treatment group prior to meeting with the experimenter; non-fearful participants were immediately assigned to the non-fearful control group. Random assignment was achieved when, after determining that a participant met criteria, a random group assignment number was selected that corresponded with either the treatment group or the no-treatment group. Upon meeting with the experimenter and prior to the initiation of any additional experimental procedures, all potential participants were given a copy of the Experiment Informed Consent Agreement (see Appendix O) and received a verbal explanation of that form as well as an opportunity to read the form in its entirety and ask any questions. Following obtainment of informed consent, the STAI was administered.

Members of the fearful exposure treatment group were then informed that they would be exposed to the feared stimulus (Stimulus B), though the exposure would involve one-session *in vivo* exposure treatment in an attempt to reduce their fear of that stimulus. Following exposure treatment of three hours maximum duration, the participant and the experimenter exited the room, and the room was arranged such that the partitions allowed viewing of only the central and peripheral details on the right side of the room; all details were placed throughout the right portion of the room but were generally located in the vicinity of Stimulus A. BAT/detail exposure then commenced. Just prior to BAT/detail exposure, participants were told that, upon entering the room, they should direct their attention to the features of their surroundings rather than to their thoughts or feelings. The participant was then instructed to enter the room and approach the animal as much as he was comfortable but to not touch the animal or its container. The experimenter, who remained at

the door and out of the participant's vision for the total duration of the BAT/detail exposure, was silent throughout the exposure, though a brief response was provided if participants asked a question during exposure. When the participant could go no further, he was instructed to remain at that point for one minute, after which time he exited the experiment room. During the one minute that the participant was in the room, the experimenter recorded the movements of Stimulus A as well as the reactions of the participant on the Participant BAT Record. Participants assigned to the fearful no-treatment group and the non-fearful control group did not receive exposure treatment; rather, they simply completed the STAI and went to the experiment room to complete BAT/detail exposure. All participants promptly returned to the experiment office following BAT/detail exposure and were given the SILS to complete upon entering the office.

Following completion of the SILS, the pictorial implicit memory test and the Thought Evaluation Packet for the central and peripheral details was administered. No time limit was imposed on these tests, though participants were instructed to respond as quickly as they could during tests of implicit memory. All participants were then asked to complete a debriefing questionnaire, given slips confirming their participation in the experiment should they desire extra credit, and thanked for their participation. Fearful participants who did not receive treatment were presented with the opportunity to indicate their desire for free treatment for their animal fear; though two individuals expressed interest in receiving treatment at a later date, those individuals did not respond to the experimenter's subsequent invitations to schedule the treatment. One should note that all the procedures described here were approved by the Human Subjects Institutional Review Board of Eastern Michigan University (see Appendix P), and all animal care and use for the snakes in this study was

approved by Eastern Michigan University's Institutional Animal Care and Use Committee (see Appendix Q).

Results

Description of Primary Statistical Analyses

1. An independent samples *t*-test was utilized to determine whether selective processing and explicit memory bias or avoidance was evident in fearful individuals by comparing recall of those in the non-fearful control group to recall of the experimental no-treatment group. The experimental treatment group was excluded in an effort to eliminate the effects of treatment on cognitive bias and better establish the existence of bias in fearful participants compared to non-fearful participants.
2. A 2 (type of detail) x 3 (group) analysis of variance and an analysis of covariance for all memory tests was used to determine the effect of treatment, as assessed in the experimental treatment group, on selective processing and/or explicit memory bias or avoidance that may have been indicated in the independent samples *t*-test for the non-fearful control and the no-treatment group.
3. A repeated measures analysis of covariance was used to determine if there were significant differences between tests that did and did not utilize recall cues, thus addressing the issue of whether potential explicit memory avoidance was a result of encoding or retrieval failure. The same statistical test was also used to determine if any memory deficits found within groups would benefit from the employment of cueing.
4. A one-way 2 (type of detail) x 4 (anxiety group) analysis of variance, an analysis of covariance, and a Pearson correlation were conducted to determine correlations

between level of state and trait anxiety, as measured by the STAI, and scores on the memory tests.

Demographics

Sample characteristics.

Forty-five undergraduate participants from a Midwestern university participated in both the initial online screening portion of the study as well as the procedural portion, though 608 students completed only the online screening portion and were excluded from the procedural portion for various reasons (see Appendix R) and some individuals were invited to participate in the procedural portion but did not (i.e. they did not respond to the experimenter's attempts to contact them, they did not show up for their scheduled appointment to meet with the experimenter, etc.). Those 45 participants who completed both the online and procedural portions ranged in age from 18 to 52 years with a mean of 22.36 years (SD = 7.46); a one-way ANOVA revealed non-significant differences among the three participant groups for age, F (2, 42) = 1.152, $p > .05$. The majority (78%) of the sample was female. There was a significant difference, F (2, 42) = 5.63, $p < .01$, between the treatment group and the control group on the variable of gender, indicating that there were significantly more men in the control group than the experimental treatment group. Most participants in this study revealed that they were college freshman at the time of participation (51%), with the rest of the sample endorsing sophomore class standing (11%), junior class standing (20%), senior class standing (13%), or other (2%). Data were missing on this variable for one person. There were no significant differences on the variable of college grade level between groups.

Descriptive Statistics and Initial Analyses

The initial screening phase included online administration of the FSQ, the FSnQ, the DASS-21, and the background questionnaire. Results of a one-way ANOVA confirmed that those who were assigned to either of the experimental groups did indeed score significantly higher than those who were assigned to the control group on either the Fear of Spiders Questionnaire, F (2, 42) = 26.786, $p < .001$, or the Fear of Snakes Questionnaire, F (2, 42) = 20.017, $p < .001$. The mean score for fearful participants in either of the two experimental groups on the FSQ was 72.60 (SD = 35.48), while the mean score on this measure for non-fearful participants was 5.60 (SD = 6.854). The mean score for fearful participants assigned to either of the two experimental groups on the FSnQ was 83.10 (SD = 34.511), while the mean score on this measure for non-fearful participants was 23.00 (SD = 22.159). While the mean score for non-fearful participants was higher on the FSnQ compared to the FSQ, it should be noted that, to be included in the control group, individuals need only to have achieved a score of equal to or lesser than 10 on either the FSQ or the FSnQ. It is, therefore, feasible that an individual might have met scoring criterion on one measure (i.e. the FSQ) and not the other (i.e. the FSnQ), in which case the individual would be presented with the stimulus for which they met criterion. The mean score on the DASS-21 Depression subscale was 1.78 (SD = 1.80) with a range of 0 to 6, and no significant differences ($p > .05$) were found on this particular subscale between groups. In regard to one-session *in vivo* exposure treatment, participants finished treatment with a range of 44 to 97 minutes and a mean time of 65 minutes (SD = 16 minutes); all participants achieved treatment termination criteria of SUDS ratings of 20 or below on all steps, including independently handling the animal for periods of time greater than one minute and to a maximum of three minutes, prior to

treatment cessation. Sixty percent of participants achieved SUDS levels of 20 or below after competing each step twice while 27% required completing the steps three times to achieve a SUDS level of 20 or below on each step. Only 13% required four rounds of completing the steps to achieve the treatment termination criteria.

Across groups, sixty percent of participants (n = 27) received the spider as Stimulus A compared to forty percent (n = 18) who received the snake as this stimulus. A one-way ANOVA with Tukey comparison revealed significant differences, F (2, 42) = 6.435, $p < .01$, between the control group and both the treatment and no-treatment experimental groups such that the control group contained significantly more participants who were exposed to the spider during BAT/detail exposure. During BAT/detail exposure, most participants (95.6%) received exactly 60 seconds of exposure, though one participant received 62 seconds and another participant received 80 seconds of exposure. The mean BAT/detail exposure time allowance was 60.49 (SD = 2.99). Total seconds in the room during BAT/detail exposure did not differ significantly by group. Following this procedure, the SILS was administered as an interpolated activity prior to memory evaluation. The mean estimated IQ, as assessed by the SILS, of the participants was 103.21 (SD = 8.86) with a range of 77 to 119; statistical analyses revealed non-significant differences on this measure between groups at the .05 alpha level.

Primary Analyses

Existence of selective processing and explicit memory bias in fearful individuals.

The primary focus of the first research question was whether selective processing and explicit memory bias would be present in fearful participants compared to non-fearful participants. In order to eliminate the potential effects of one-session *in vivo* exposure

treatment on fear level during the BAT/detail exposure procedure, comparisons were made between the non-fearful control group and the experimental no-treatment group using independent samples *t*-tests. The *t*-test revealed that, regardless of group membership, significantly more items that were in the room were correctly identified than items that were not in the room on the perceptual implicit memory test, $t\ (88) = 2.782$, $p < .01$, thereby suggesting that this particular test did indeed assess implicit memory for recently viewed objects. On both the perceptual implicit memory task and the word-stem completion task, however, there were no significant differences found on recall of central or peripheral details between non-fearful and fearful untreated individuals, which implies the absence of selective processing in any participant.

Significant differences were evident on several tests of explicit memory, however. On the free recall explicit memory test, fearful individuals in the no-treatment group recalled fewer items related to peripheral details than those in the non-fearful control group, $t\ (28) = 2.887$, $p < .01$. No-treatment group participants also received a significantly lower total score on this test compared to the non-fearful participants, $t\ (28) = 2.344$, $p < .05$. Comparable results were found on the cued recall test of explicit memory; again, fearful individuals responded correctly to fewer items related to peripheral details than non-fearful individuals, $t\ (22.884) = 2.339$, $p < .05$, which also resulted in significantly lower total test scores for fearful individuals, $t\ (28) = 2.469$, $p < .05$. The recognition explicit memory test yielded significant results for both central and peripheral details; fearful individuals responded correctly to fewer items related to both central, $t\ (28) = 2.175$, $p < .05$, and peripheral details, $t\ (28) = 2.200$, $p < .05$, compared to non-fearful individuals. The no-treatment group also received a total lower score than the control group on the recognition test, $t\ (28) = 2.293$, $p <$

.05. Table 1 presents the means and standard deviations obtained on all tests of implicit and explicit memory; in an effort to enhance clarity, the independent samples *t*-test was re-run using proportion correct rather than raw score correct given that all tests were comprised of a variety of possible points for central and peripheral details and total possible score. Equivalent results were obtained, and all data presented in Table 1 are provided in proportion correct.

Effect of one-session exposure treatment on selective processing and explicit memory bias or avoidance.

The second research question focused on the effect of treatment on selective processing bias and explicit memory bias/avoidance; treatment should have eliminated selective processing bias by altering cognitive appraisals of the previously threatening stimulus, thus equating the experimental treatment group with the control group. Additionally, hypothesized explicit recall avoidance of selectively processed central details should have been eliminated given the anticipated elimination of selective processing and reappraisal of the stimulus. As in the independent samples *t*-test implemented to address the first research question, a one-way ANOVA revealed no significant differences by group on either test of implicit memory, which suggests that selective processing was either not present in any participant or not appropriately measured by the tests utilized in this study. As previously mentioned, however, an independent samples *t*-test did reveal significant differences between items correctly identified that were in the room compared to items correctly identified that were not in the room on the perceptual implicit memory test that utilized ambiguous pictures, which suggests that this particular test was adequately measuring implicit memory.

Though there were no significant differences on measures of implicit memory that would have implicated selective processing in fearful individuals, explicit memory deficit, as opposed to explicit memory bias or avoidance, was revealed in those participants who did not receive one-session *in vivo* exposure treatment and thus remained fearful during the BAT/detail exposure. Results were generally equivalent to those found in the independent samples *t*-tests conducted to illuminate recall differences between fearful and non-fearful participants. On the free recall test of explicit memory, a significant difference, as indicated by a one-way ANOVA with Tukey comparison, was found between the no-treatment group and both the non-fearful control and the treatment group, $F\ (2, 42) = 5.053$, $p < .05$, on recall of peripheral details. The no-treatment experimental group recalled significantly fewer peripheral details than both the control group and the experimental treatment group, who did not significantly differ. Those in the no-treatment group did not, however, recall statistically greater numbers of central details than either the control group or the treatment group. In addition, participants in the no-treatment group received a significantly lower total score on this test than the treatment group, $F\ (2, 42) = 3.958$, $p < .05$, though they did not score significantly lower than the non-fearful control group.

On the cued recall test for explicit memory, there again was a statistically significant difference for recall for peripheral details between the no-treatment group and the non-fearful control group, $F\ (2, 42) = 4.052$, $p < .05$. Those in the no-treatment group recalled significantly fewer peripheral details, as well as characteristics of those peripheral details, than the non-fearful control group. There was also a significant difference for total points obtained on this particular test of explicit memory, $F\ (2, 42) = 3.961$, $p < .05$, such that the no-treatment group received a total lower score on this test than the control group.

The recognition test of explicit memory also revealed several significant differences between groups, though, unlike the results of the independent samples *t*-test, no significant differences for recall of central or peripheral details were indicated by group. The no-treatment group received a significantly lower total score on the recognition test than both the non-fearful control group and the treatment group, F (2, 42) = 4.305, $p < .05$, both of which obtained the same mean number correct. An additional finding on this test was that the treatment group responded correctly (i.e. indicating "F" for false) to lures significantly more often than those in the control group, F (2, 42) = 3.500, $p < .05$; that is, those in the control group more often endorsed items that were not actually in the room than those in the treatment group. Table 2 presents the means and standard deviations obtained on all tests of implicit and explicit memory on the ANOVA; as in the independent samples *t*-test used to compare the control and no-treatment groups, the ANOVA was re-run using proportion correct rather than raw score correct, given that all tests were comprised of a variety of possible points for central and peripheral details and total possible score. Equivalent results were again obtained, and all data presented in Table 2 are provided in proportion correct.

Results of analyses of covariance with both gender and Stimulus A animal as covariates.

Given that two variables, gender and Stimulus A animal, were found to be statistically significant between groups, two analyses of covariance (ANCOVA) were conducted to determine whether statistically significant differences found in the ANOVA were indeed attributable to group since between-groups equivalence could not be assumed on these variables. Thus, the dependent variable remained scores on each test while the independent variable was participant group with the effects of both gender and Stimulus A

animal controlled in separate ANCOVAs. The results of the ANCOVA in which Stimulus A animal was entered as a covariate revealed some instances in which significant differences were found by animal type but not by participant group, results that would not have been revealed in the ANOVA with group only as the independent variable. Animal type was found to be statistically significant, F (1, 41) = 5.065, $p < .05$, on recall of central details in the perceptual implicit memory test; those who received the spider as Stimulus A correctly identified more central details in this memory test than those who received the snake as Stimulus A, according to an independent samples t-test, t (42.939) = 2.983, $p < .01$. Significant animal differences were also found on recall for central details on the explicit cued recall memory test, F (1, 41) = 7.527, $p < .01$; as in the perceptual implicit memory test, those who received a spider as Stimulus A responded correctly to more items related to central details on the cued recall test compared to the responses on the same items by those who received a snake as Stimulus A, t (43) = 3.368, $p < .01$. The recognition test of explicit memory also revealed a difference by animal on recall for central details, F (1, 41) = 10.771, $p < .01$; again, the directionality favored those who received a spider as Stimulus A, t (23.945) = 3.515, $p < .01$.

Though there were several findings of significance by animal only, of principal importance is whether Stimulus A animal better accounted for significant group differences found in the ANOVA. On the cued recall test of explicit memory, group differences on recall for peripheral details found in the ANOVA became insignificant when animal was entered as a covariate, though group difference on this measure approached significance. Also on the cued recall test, animal differences became significant rather than group differences in the ANCOVA for total score on the test, F (1, 41) = 4.633, $p < .05$. An independent samples t-

test indicated that those who received a spider as Stimulus A scored significantly higher on the cued recall test than those who received a snake, t (43) = 2.894, $p < .01$. On the recognition test of explicit memory, both score on lures and total score, which were significant by group in the ANOVA, were non-significant when Stimulus A animal was accounted for in the statistical analysis.

A second ANCOVA was used to determine the impact of gender on the results found in the ANOVA, and several significant results emerged. Given that differences found by Stimulus A animal were likely arbitrary and gender differences were expected to produce a greater impact on the main findings, ANCOVAs with gender only as a covariate were conducted rather than ANCOVAs with both gender and animal as covariates. Table 3 provides the proportional means and standard deviations obtained on all tests of implicit and explicit memory on the ANCOVA in which gender was entered as a covariate. The ANCOVA revealed no significant results by group on measures of implicit memory, as is consistent with the results of the ANOVA, though tests of explicit memory did reveal results significant by gender. On the free recall test of explicit memory, no significant differences by gender or group were indicated for recall of central details. Group differences did indeed account for variations in scores on peripheral detail recall on the explicit free recall memory test, F (2, 41) = 5.344, $p < .01$ (see Table 4 and Figure 1), and it also accounted for the variation in total points obtained on the free recall test, F (2, 41) = 3.885, $p < .05$ (see Table 5 and Figure 2); thus, these results supported the results of the ANOVA in which group only was examined. For peripheral detail recall on the free recall test, the no-treatment group scored significant lower than the control group only. In regard to total score on this test, the no-treatment group scored lower than both the control and treatment group

A significant gender difference was indicated on the cued recall test of explicit memory, specifically in recall for central details, F (1, 41) = 6.268, $p < .05$; males responded correctly to more items related to central details on this test than did females, t (43) = 2.732, $p < .01$. When gender was taken into account, recall for peripheral details on the cued recall test remained significant by group, F (2, 41) = 3.905, $p < .05$ (see Table 6 and Figure 3), with the no-treatment group showing significant recall deficits for peripheral details compared to the control group on this measure; one should note that this finding is consistent with the results of the ANOVA. Also, total points obtained on the cued recall test remained significant by group, F (2, 41) = 3.675, $p < .05$, with the no-treatment group receiving a total lower score than both the control and treatment groups (see Table 7 and Figure 4).

On the recognition test of explicit memory, a significant gender difference was found on recall for central details, F (1, 41) = 4.549, $p < .05$, with males responding correctly to statements related to central details more often than females, t (34.076) = 3.324, $p < .01$. No significant differences by gender or group on the recognition test were found for recall of peripheral details and responses to lures, despite the significant group findings for lures in the ANOVA. Score differences on the total score on the recognition test of explicit recall remained attributable to group differences when gender was entered as a covariate, F (2, 41) = 4.751, $p < .05$ (see Table 8 and Figure 5); the no-treatment group received a significantly lower total score compared to the treatment group. Table 9 summarizes the findings of both the ANOVA and the ANCOVA with gender as a covariate.

Memory bias as a result of encoding or retrieval failure.

This study also sought to determine whether theorized explicit memory deficits were a result of encoding or retrieval failure by utilizing recall cues that were presented in both the

cued recall test and the recognition test. While no explicit memory bias or avoidance was indicated in any participant group in the ANOVA or ANCOVA, explicit memory deficits were indicated in the no-treatment group, specifically for peripheral details, and these deficits remained despite the use of cues in the cued recall test when gender was entered as a covariate. A repeated measures ANCOVA with a covariate of gender was used to determine if the use of cueing on explicit tests of memory assisted individuals in recall, which would thereby result in a higher total score on the cued memory test; a higher total score on the tests of explicit memory that utilized cues (i.e. the cued recall test and recognition test) compared to tests of explicit memory that did not utilize cues (i.e. the free recall test) would suggest retrieval rather than encoding failure. While no differences were found among groups, significant differences were indicated among tests such that, regardless of group membership, all participants tended to increase their proportion of total correct responses when cues were utilized. Total scores on the cued recall test did not significantly differ from scores on the free recall test, as was consistent with the results of the ANCOVA that suggested persistent peripheral detail explicit recall deficits and lower total scores for no-treatment group participants. However, all participants demonstrated significantly higher total scores on the recognition test than both the free recall and the cued recall test ($p < .01$; see Table 10). Figure 6, which utilizes proportions to more effectively reveal value differences, graphically illustrates the total score differences among groups on explicit tests of recall.

Given the existence of explicit memory deficits for peripheral details in the no-treatment group, a repeated measure ANCOVA with gender as a covariate was also conducted to determine if cues would assist fearful no-treatment participants in specifically

recalling the peripheral details they failed to report on the free recall test. Again, the ANCOVA revealed significance only by test, indicating that all participants improved their scores on cued versus non-cued tests of peripheral details ($p < .05$; see Table 11), and participants failed to show significant improvement on the cued recall test in comparison to the free recall test. Rather, drastic improvement was shown by all participants on the recognition test. Thus, for all participants, it appears that incomplete and somewhat ambiguous cues, such as those used in the cued recall test, failed to improve recollection of peripheral details while more complete cues, such as those utilized on the recognition test, dramatically improved recollection of these details, thereby suggesting that encoding of previously deficit peripheral details did indeed occur in the no-treatment group. Notably, however, the utilization of cues, whether ambiguous or unambiguous, failed to equate all groups on recollection of peripheral details. Figure 7 depicts the trends by group for proportion of peripheral details recalled on each test of explicit memory.

Effect of state and trait anxiety on memory bias.

The final research question sought to illuminate the effects of state and trait anxiety on cognitive bias; it was hypothesized that those participants who were high in both state and trait anxiety would show the greatest selective processing of central details followed by explicit memory avoidance of those details. There was a low and non-significant Pearson correlation (r = .21) between scores on the STAI State subscale and the STAI Trait subscale. Participants' scores on the STAI were grouped according to cutoff scores implemented in studies that evaluated the effects of trait anxiety on implicit memory (Harrison & Turpin, 2003; Schwerdtfeger, 2004); all participants were grouped as one of the following: high in both state and trait anxiety (n = 4), low in both state and trait anxiety (n = 23), high in state

anxiety but low in trait anxiety (n = 14), and high in trait anxiety but low in state anxiety (n = 4). A high score on either scale was achieved by a score of 40 or above while a low score on either scale was achieved by a score of 39 or below. A one-way ANOVA with Tukey comparison and an ANCOVA with gender as the covariate revealed no significant differences by any anxiety grouping on any measure of implicit or explicit memory used in this study. Additionally, there were no significant correlations between either state or trait anxiety and scores on any implicit or explicit memory measure.

Secondary Analyses

Selective processing and memory bias in fearful individuals grouped by fear indicators.

In an effort to more thoroughly assess selective processing and memory bias in fearful individuals, all participant data were recatergorized using various measures of fear level, which were recorded during BAT/detail exposure, as independent variables. SUDS levels were obtained for all participants upon initial exposure to Stimulus A at the beginning of the BAT; these SUDS levels were taken at the door of the classroom before the participant was asked to move as close to the stimulus as possible. SUDS levels were grouped according to low levels of fear (0-39), medium levels of fear (40-69), and high levels of fear (70-100), and a one-way ANOVA was conducted. No significant differences by SUDS ratings taken upon initial presentation of the feared stimulus were found on any measure of implicit or explicit memory. SUDS levels were also taken at each participant's stopping point, or the point at which the participant indicated he could go no further toward the stimulus, and were grouped in the same manner as described above. Again, no significant differences by SUDS

ratings taken upon maximum approach to the feared stimulus were found on any measure of implicit or explicit memory.

In addition to SUDS ratings, the distance traveled toward Stimulus A during BAT/detail exposure was grouped according to the mean distance traveled, which was 13.47 (SD = 1.135) out of 14 possible feet. Those who traveled a distance of at least one standard deviation below the mean, which was approximately 12 feet or less, were deemed fearful, while those who traveled 13-14 feet were regarded as non-fearful in this particular fear assessment. According to an independent samples *t*-test, no significant differences on any measure of implicit or explicit memory existed when participants were grouped in this manner.

Correlation between response to debriefing questionnaire and implicit memory performance.

The debriefing questionnaire that was given to all participants at the conclusion of the experiment questioned, among other things, the participant's amount of thought given to the classroom used in the BAT/detail exposure during tests of implicit memory. Specifically, the questionnaire asked if, during each test of implicit memory, the participant thought about the classroom that he was in during BAT/detail exposure and whether he actively tried to recollect the materials in that classroom during tests of implicit memory. A Pearson correlation revealed only one significant correlation between responses on the debriefing questionnaire and performance on the implicit memory tests. Those who indicated that they thought about the classroom environment during tests of implicit memory test tended to score higher on the word stem completion test then those who indicated little or no thought given to the classroom ($r = .32$, $p < .05$).

Impact of estimated IQ on recall for central and peripheral details on implicit and explicit memory tests.

Due to the substantial variation among participants in IQ scores estimated by the SILS, several statistical analyses were conducted to determine the impact of IQ on recall for central and peripheral details on all tests of memory, both implicit and explicit. An independent samples *t*-test was first utilized with two participant groups, which were composed of participants with an average to high IQ cutoff of 100 or above and participants with an average to low IQ cutoff of 99 or less. No significant differences were found on any measure of implicit or explicit memory when participants were divided into these two IQ groups. To more thoroughly examine the issue, participants were also divided into three IQ groups: below average, which included those with an estimated IQ of 89 or less (n = 3); average, which included those with an estimated IQ of 90-109 (n = 31); and above average, which included those with an estimated IQ of 110 or greater (n = 11). No significant differences by IQ group were indicated on any test of implicit memory when an ANCOVA with gender as a covariate was used. However, on the free recall test of explicit memory, IQ group was significant for recall of peripheral details, F (2, 41) = 5.575, $p < .01$, and total points obtained on this test, F (2, 41) = 4.093, $p < .05$; in both instances of significance, those who were above average scored significantly higher than those who obtained an average estimated IQ. On the cued recall test of explicit memory, significance by IQ grouping was found on recall of peripheral details, F (2, 41) = 3.872, $p < .05$, such that those who were above average scored significantly higher than those who were below average intelligence.

Recall of stimulus-related central details compared to safety-related central details.

The central details included in the present study were divided into two categories: those that were reflective of Stimulus A characteristics and behaviors, such as coloration and markings of the stimulus, size of the stimulus, and stimulus movement, and those that were related to maintenance of safety, which included the red exit arrow and the caution sign; the safety-related central details were included to explore the possibility that fearful individuals selectively encode and elaborately process both threat- and safety-relevant details in a similar manner (Lange et al, 2004). Independent samples *t*-tests were used to determine participant recall of these two groups of central details on each test of implicit and explicit memory. Dramatically significant findings on the perceptual implicit memory task indicated that stimulus-related central detail images were correctly identified more often than safety-related central detail images, $t\ (88) = 4.178$, $p < .000$. The cued recall test of explicit memory and the recognition test of explicit memory also revealed significant differences; as in the perceptual implicit memory task, stimulus-related central details were recalled more often than safety-related central details in the cued recall test, $t\ (88) = 9.201$, $p < .000$, and the recognition test, $t\ (88) = 2.643$, $p < .01$. No significant recall differences, however, were found on the word-stem completion implicit memory task and the free recall test of explicit memory. An ANCOVA with gender controlled for as a covariate indicated no significant recall differences between stimulus- and safety-related central details by group.

Discussion

Implications of Results

One of the most intriguing results of the current study was the lack of evidence supporting selective processing of threat-relevant stimuli in fearful individuals, which was

indicated in the independent samples *t*-test comparing the no-treatment group to the control group as well as the ANOVA and ANCOVA in which all groups were compared with and without control for significant variables; this, of course, is inconsistent with the sizable literature that has fairly reliably demonstrated the existence of selective processing bias for threat-relevant stimuli in anxious individuals (Burgess et al., 1981; Kindt & Brosschat, 1998; MacLeod, Mathews, & Tata, 1986) and disproves the current hypothesis regarding the existence of selective processing bias in the no-treatment group. It appears that the perceptual implicit memory task did indeed assess implicit memory, as is evidenced by the significant difference between correct identification of items that were in the room compared to items that were not in the room, though total correct items identified tended to be rather low in general with a range of zero to three. The word-stem completion test, however, yielded no indications of assessment of implicit memory, which is likely due the limited presence of linguistic stimuli for which the test most appropriately evaluates. Thus, given the particular experimental methodology utilized in the current study, it appears that the perceptual implicit memory test would have yielded the most valid assessment of implicit memory for environmental details, though no indication of selective processing bias for central details was present in no-treatment participants who remained fearful throughout the experiment.

The lack of support for selective processing bias for threat-relevant stimuli could have resulted from numerous causes. First, it is noteworthy that threat-relevant central details were identified significantly more often than safety-relevant central details in the perceptual implicit memory task, a finding that may indicate that the processing of safety-relevant central details is not equivalent to the processing of threat-relevant central details. Perhaps, if all central details had been threat-relevant, differentiation among groups would have emerged

in the pattern hypothesized by theories of selective processing. Lack of support for selective processing bias could also have resulted from the participant sample in that those who participated in this particular experiment were not assessed for clinically significant specific phobia; rather, they were simply assessed for fear level toward snakes and spiders, among other things, without regard for diagnostic criteria. It is possible, given previously mentioned studies examining the effect of state anxiety on cognitive bias (Chen, Lewin, & Craske, 1996; Foa & McNally, 1986), that implicit memory bias exists in direct relation to the level of anxiety when presented with the feared stimulus, with greater amounts of state anxiety eliciting greater attentional biases, and that participants did not exhibit an adequate amount of state anxiety to elicit bias detectable on the measures used. Some state anxiety should have been elicited in those who indicated fear toward snakes or spiders and were included in either fearful participant group, however, given that the STAI was administered immediately following explanation of the Experiment Informed Consent Agreement, which stated that the participant would be exposed to the feared animal/arachnid. In addition to the lower level of anxiety demonstrated in the fearful participants, the approximation of a genuine threat situation used in this experiment, though more ecologically valid then the traditional use of pictures or words, may not have been sufficiently anxiety-provoking, particularly since the animal was caged and, in accordance with ethical informed consent standards, participants were informed of the controlled nature of the exposure. Finally, the reliability and validity of the two tests of implicit memory used remains uncertain given that both were created specifically for this experiment, though both were modeled after tests of implicit memory employed in this and other literatures.

Additionally, there was no evidence found for explicit memory bias, which coincides with the previously mentioned studies that have failed to demonstrate such bias (i.e. Mogg, Mathews, & Weinman, 1987; Thorpe & Salkovskis, 2000; Watts & Coyle, 1993), and there was no explicit memory avoidance of central details, as was suggested by Watts and Dalgleish (1991). Thus, the hypothesis that explicit memory avoidance of selectively processed central details was not supported in the current study. There was, however, explicit memory deficit in the no-treatment group on the independent samples *t*-test, the ANOVA, and the ANCOVA, a deficit that specifically occurred for peripheral details and total score on all tests of explicit memory. The results of this study replicated Wessel and Merckelbach's (1997) study in that fearful individuals in their study also demonstrated memory deficit for peripheral details. The lack of recollection for such details is particularly notable given that, in both the current study and Wessel and Merckelbach's (1997) study, peripheral details were deliberately chosen for their novelty, a characteristic that should have increased recollection. Clearly, those who remained fearful throughout this experiment attended less to peripheral details, but less attention allocated to peripheral details did not result in more attention allocation to central details. Rather, it is unclear where attention was directed, but it is feasible that attention may have been directed inward toward thoughts or bodily sensations instigated by the presentation of the feared stimulus. Attention may have also been directed toward a distracting and unrelated thought or stimulus that was consciously used to avoid full confrontation with the feared stimulus. Unfortunately, relative distribution of attention to stimuli other than the central and peripheral details utilized was not assessed in this study.

One-session *in vivo* exposure treatment, however, appeared to divert attention away from the internal or external stimulus that distracted those in the no-treatment group given that those in the treatment group, who were previously fearful of the animal/arachnid stimulus, consistently achieved explicit test scores that were almost equivalent to those in the control group, who indicated that they were not fearful of the stimulus. If fearful individuals in the no-treatment group were indeed distributing significant attention to internal stimuli, for example, this practice was prevented by prior utilization of a strictly behavioral treatment; no cognitive component, such as cognitive restructuring, was necessary to produce abatement of hypothesized catastrophic thinking or attention to bodily sensations, if these events did indeed occur in those who did not receive treatment. Furthermore, the treatment showed evidence of generalization given that the animal/arachnid used in treatment was much smaller and had different physical characteristics than the animal/arachnid used as Stimulus A. Results of this study suggest that this brief behavioral intervention adequately addressed not only the behavioral components of anxiety, such as avoidance of the feared stimulus, but also cognitive issues that seem to arise in those who fear a particular stimulus. The treatment used in this study appears to have served its purpose in that a previously feared stimulus became innocuous in cognitive appraisal and behavioral reaction to the stimulus. Thus, the hypothesis that treatment would alleviate possible selective processing bias and explicit memory avoidance was not supported given that these two phenomena were not demonstrated, but there were significant treatment effects and the control group and the treatment group did indeed generally equate on recall of central and peripheral details on all tests of implicit and explicit memory.

When participant group was replaced by other categorizations as the independent variable, null results were consistently obtained. In order to address one primary research question, which was to examine the effects of state and trait anxiety on selective processing and memory bias, participants were recategorized based on their STAI scores that were collected before any contact with the animal/arachnid stimulus, a procedure that yielded null results on all implicit and explicit memory evaluations. However, 51% of the participants were categorized as low in both state and trait anxiety, which leaves an inadequate sample of participants who achieved a high score on at least one subscale; with a larger sample, perhaps an interplay of state and trait anxiety, as has been suggested in the literature (MacLeod & Mathews, 1988; MacLeod & Rutherford, 1992) and as was hypothesized in the current study, would have emerged as a significant variable that affected scores on measures of implicit and explicit memory. Higher levels of state anxiety could feasibly have been induced by procedural changes, such as allowing fearful participants to view the feared stimulus following informed consent procedures but before additional experimental procedures commenced. Additionally, recatergorization of participants by fear level, as assessed by various fear measurements such as the two SUDS ratings collected during BAT/detail exposure and the amount of approach toward Stimulus A, yielded non-significant results on all selective processing and memory bias measures, a result that is again likely due to the extremely low number of participants who were categorized in the highly fearful range on these fear indicators. Indeed, only five participants were categorized as highly fearful based on SUDS ratings taken before any approach to Stimulus A commenced, and nine received a highly fearful categorization based on SUDS collected at maximum approach. Based on the

BAT results during Stimulus A presentation, only five participants were deemed highly fearful. These results serve as a testament to the non-clinical sample used in this study.

The study also attempted to better establish the effects of the use of cueing on explicit memory bias by including two cued measures of explicit memory, a cued recall test and a recognition test. Results of the ANOVA and the ANCOVA with gender as a covariate seem to show that, despite cues utilized in the cued recall test, peripheral detail memory deficit similar to those exhibited in the free recall test persisted. Only on the recognition test did participant groups show nonsignificant differences in recall for peripheral details. Results of a repeated measures ANCOVA indicated that, regardless of group membership, all participants increased their total score on cued tests, with the heavily cue-reliant recognition test yielding the highest scores for all participants. Group differences were further examined in an ANCOVA used to determine if cues would assist those in the no-treatment group recall the peripheral details on which they showed recall deficits compared to the other two participant groups. The results, which indicated improvement by all participants on only the recognition test, suggested that cues did facilitate recall, but only if the cues were unambiguous true or false statements.

Taken together, these results seem to indicate a deficit in retrieval rather than encoding, thus supporting the current hypothesis that favored such retrieval deficit; it is interesting, however, that there was little improvement in peripheral detail recall between the free and cued recall test for no-treatment group participants, which brings into question the quantity and quality of encoding in fearful individuals. Though cues did assist all participants in recollection of details, one should also note that those in the no-treatment group scored significantly lower than both control and treatment group participants on the recognition test.

This is particularly interesting given that even the most cue-oriented test of explicit memory did not equate this group with the control and treatment group, thereby accenting the deficit in encoding in the no-treatment group. This is consistent with literature that suggests the general facilitation of recall but not elimination of anxiety-induced recall deficit (Bond, 1985). However, it is also remarkable that, though the no-treatment group did indeed show a recall deficit for peripheral details on the free recall test, no such deficits or group differences on the variable of peripheral detail recall were indicated on the cued tests. It appears that cues were adequate to roughly equate all groups on explicit recall of all details.

Though statistically significant results are obviously of primary focus, one should also recognize trends in the data that might have become significant under altered conditions, such as an increase in the number of participants per group or lengthening of the memory assessment instruments. If one examines the means and standard deviations presented in the Tables 1, 2, and 3, a noticeable pattern of general recall deficit in the no-treatment group emerges. In the independent samples *t*-test in which the no-treatment and control groups were compared (see Table 1), the no-treatment group demonstrated recall deficits on all implicit and explicit measures; indeed, the only mean score of the no-treatment group that exceeded the mean score of the control group was the correct identification of lures on the recognition test. In the means and standard deviations found in the one-way ANOVA (see Table 2), it is noteworthy that, on tests of implicit memory, the control group demonstrated the most recall while the treatment and no-treatment groups showed close levels of deficit recall. Perhaps this is an indication of a general lack of immediate environmental awareness in fearful individuals that is not adequately addressed by treatment. Also in this statistical analysis, there was a fairly consistent pattern of greatest explicit recall in the control group,

followed by approximately equal recall in the treatment group, and consistent recall deficit in the no-treatment group on tests of explicit memory. When the significant variable of gender was entered as a covariate in the ANCOVA (see Table 3), result patterns were similar to those observed in the ANOVA. Perhaps fearful individuals exhibit a general disengagement with their surroundings when presented with a feared stimulus, causing recall deficits for both threat-relevant and irrelevant stimuli.

Limitations of the Study

One must consider the notable limitations of this study prior to reaching conclusions. Among the most prominent limitation is the nature of the memory assessments used in the current study; that is, multiple tests were used to assess both implicit and explicit memory, all of which could have introduced bias given that differences found could have been due to test differences rather than group differences. As previously mentioned, all tests were experimenter-created, which was unavoidable given the paradigm used but does introduce the issue of uncertain reliability and validity of the tests. Though the central details on each test of implicit and explicit memory were chosen in accordance with the literature, the possibility remains that some central details may not have been adequately threat-relevant to produce significant bias. Again, perhaps the inclusion of only threat-relevant central details would have produced results indicative of selective processing bias. Also, though attempts were made to equate groups for gender and animal, significant differences occurred with both these variables such that the control group differed from the experimental groups. This limitation was addressed with appropriate statistical procedures, but group differences should be noted. Additionally, the results of the study are limited by the small sample size and the lack of clinical relevance of participant fear level.

In regard to limitations introduced by the experimental procedures themselves, one should note that the time limit of ten minutes per subscale on the SILS was not imposed, though this is a minor limitation given that normative data were not used to interpret results and there is evidence that elimination of time limits does not significantly impact the estimation of full scale IQ (Heinemann, Harper, Friedmann, & Whitney, 1985). Additionally, the presence of the therapist, who conducted one-session *in vivo* exposure treatment for participants in the treatment group, during the BAT/detail exposure procedure may have artificially elevated the effectiveness of treatment; perhaps treatment participants showed reduced fear not as a result of treatment, but as a result of the presence of the therapist, who may have become a safety signal in the process of treatment. This effect was expectantly minimized by the requirement that experimenters stay near the door during BAT/detail exposure, thus out of the participant's line of vision, and remain silent unless requesting SUDS ratings. A third flaw in the experimental procedures of the current study was the single administration of the STAI before the commencement of experimental manipulation. In order to better illuminate the effects of state and trait anxiety on cognitive bias in future studies, levels of state anxiety should be evaluated both before and after the BAT/detail exposure procedure in order to determine the effects of treatment on participants in the treatment group; the administration of the STAI to assess state and trait anxiety before any experimental manipulation or stimulus contact took place may have affected the results of the statistical analyses in which participants were grouped according to STAI scores given that those who received treatment should have experienced a decrease in state anxiety that was not accounted for under the current methodology. Finally, the gold standard experimental procedure of blind assessment was not implemented in this paradigm for practical reasons,

though future experimenters may wish to incorporate such a procedure to eliminate possible experimenter bias.

Future Directions

Despite the limitations mentioned above, this study represents a contribution to the literature on this topic and establishes a guide for future research. Future experimenters may wish to examine the presence of selective processing or explicit memory bias or avoidance in clinically significant individuals in order to better understand how anxiety operates in a clinical population; perhaps results would have been more robust if anxiety was at a pinnacle when central and peripheral details were presented. Additionally, more control should be utilized in tests of implicit and explicit memory in order to avoid possible confounding of results. Anxiety levels throughout the experiment should also be assessed with measures other than self-report, perhaps with the addition of physiological measures (see Harrison & Turpin, 2003). In regard to the effects of treatment, it is imperative that future studies assess allocation of attention in fearful individuals to stimuli other then central and peripheral details; this could be achieved with a simple brief questionnaire that directly evaluates the thoughts or activities of a participant during presentation of the feared stimulus or a procedure in which the participant is asked to think aloud, verbally reporting all internal thoughts as they occur, during stimulus presentation. Further interesting research avenues may include a comparison of several treatments to determine if all are equally effective and, if not, exploration of reasons why some treatments may be more effective than others. Finally, the prolonged effects of initially effective treatment should be examined by assessing for selective processing and explicit memory bias at various times. Though much remains to be empirically tested in this literature, the preliminary data offered by this study on the

effectiveness of a commonly used treatment for specific phobia should be regarded as a demonstration of the usefulness of behavioral treatments for anxiety disorders.

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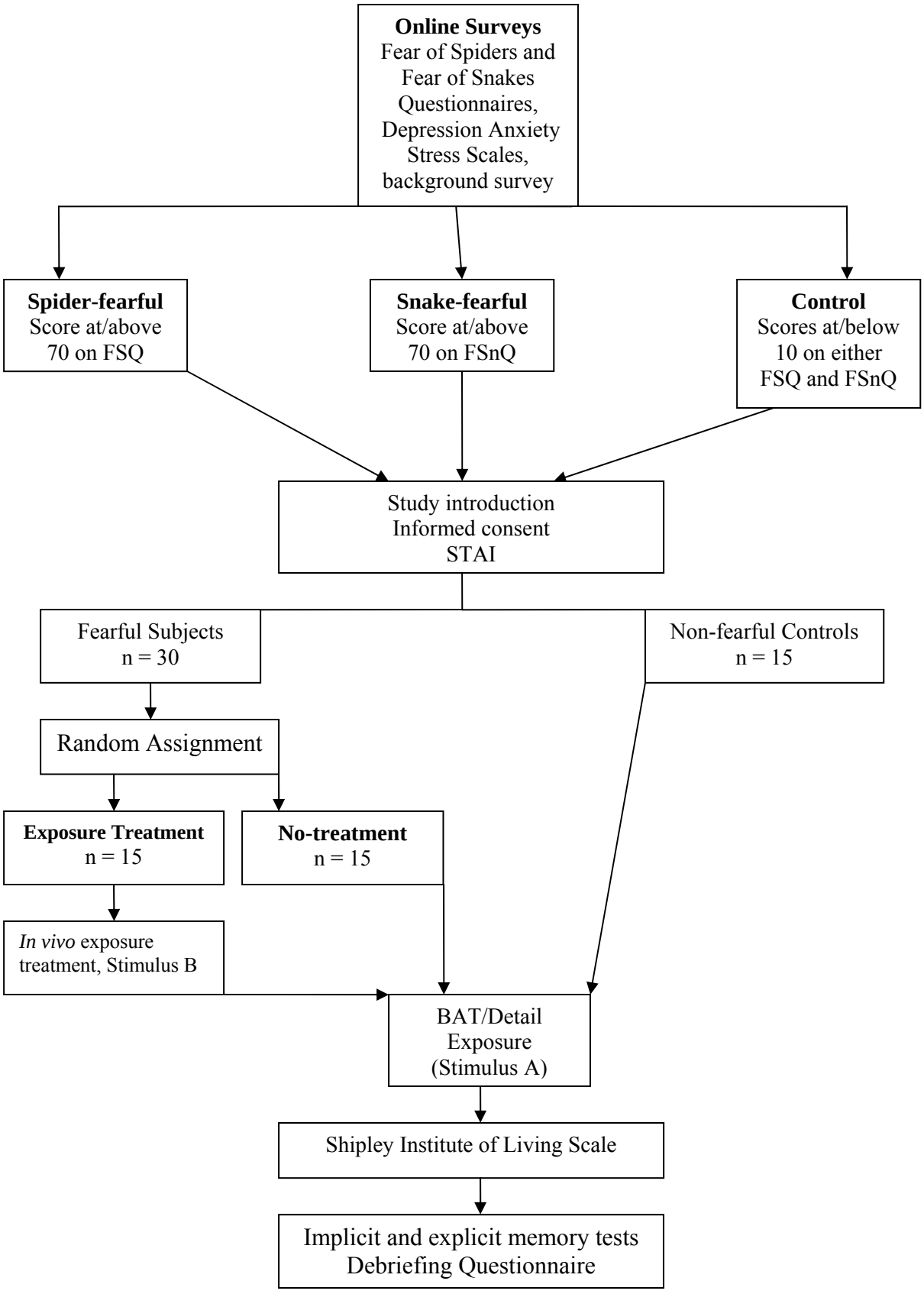
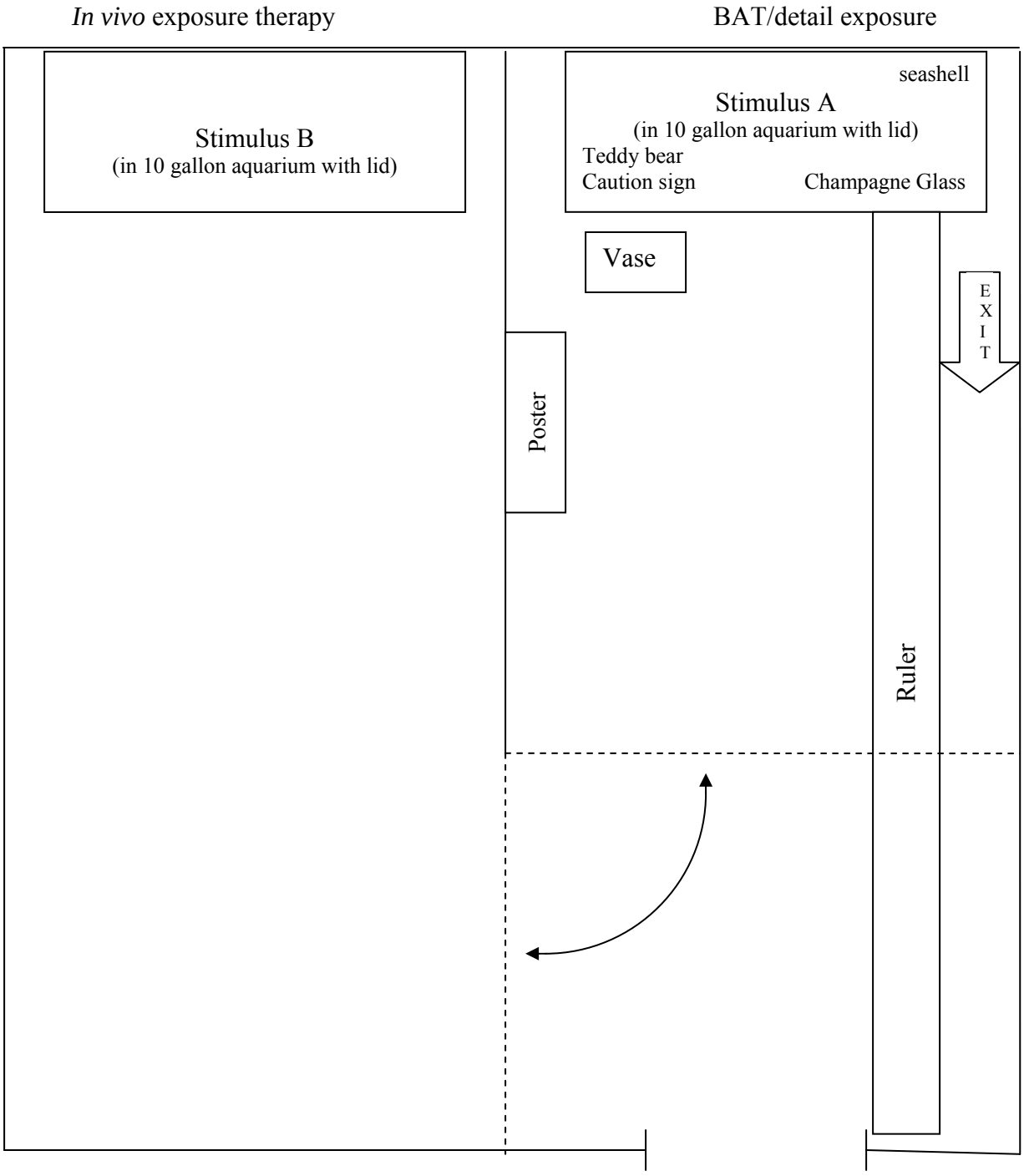
APPENDICES

Appendix A
Diagram of Study



Appendix B

Experimental Room
(20’ x 14.17’)



Appendix C

Participant BAT Record

Participant Number: _____
Participant Group (Circle): Control Exp. Tx Exp. No Tx
Date: _____
Experimenter: _____

SUDS rating at the door: _____
Distance from the door that the participant stopped: _____ feet
Note: If the participant is unable to enter the room or stops at the door, please record 0 (zero) feet.
SUDS rating at the stopping point: _____
Total time that participant remained in room (maximum of 1 minute):
_____ mins. _____ secs.

Please indicate any physical signs of distress exhibited by the participant: (Circle)
Crying

Shaking

Groaning, whimpering, other verbalizations

Covering eyes

Attempting to look away (wall, floor) or turn back

Other (please record):

Animal Movement

Because a threat detail is movement of the animal, please circle the type of animal and the choice(s) that best represent the general movement of the animal in the time period that the participant remained in the room:

Type of animal: (Circle) Rose Hair Tarantula Corn Snake

Amount of movement: (Check one)

☐ Very active (almost constant, swift body movements)

☐ Moderately active (moves for some of the exposure, but movement is slower)

☐ Inactive (mostly stays in one spot, may move head occasionally but doesn't move body)

General direction/area of movement: (Check one)

☐ Generally remained on the right side of the cage

☐ Generally remained on the left side of the cage

☐ Moved within the center of the cage

☐ Moved throughout the cage with no proclivity toward right, left, or center

Appendix D

Acronyms and Purpose of Measures Referred to in the Current Study

Acronym	Full Name	Purpose
BAT	Behavioral Avoidance Test	Fear assessment and detail exposure
DASS (-21)	Depression Anxiety Stress Scales (21-item version)	Initial online screening
FSnQ	Fear of Snakes Questionnaire	Initial online screening
FSQ	Fear of Spiders Questionnaire	Initial online screening
SILS	Shipley Institute of Living Scale	Assessment of IQ
SPQ	Spider Phobia Questionnaire	Not used in study, but referred to
STAI	State Trait Anxiety Inventory	Fear assessment prior to stimulus exposure
SUDS	Subjective Units of Distress Scale	Fear assessment during treatment and BAT

Appendix E

Fear of Spiders Questionnaire (FSQ)

For each item, please record a number to indicate how much you agree with the statement. Ratings can include any number between 0 (totally disagree) and 7 (totally agree).

Totally Disagree Totally Agree
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ----------7

____ 1. If I came across a spider now, I would get help from someone else to remove it.

____ 2. Currently, I am sometimes on the look out for spiders.

____ 3. If I saw a spider now, I would think it will harm me.

____ 4. I now think a lot about spiders.

____ 5. I would be somewhat afraid to enter a room now, where I have seen a spider before.

____ 6. I now would do anything to try to avoid a spider.

____ 7. Currently, I sometimes think about getting bit by a spider.

____ 8. If I encountered a spider now, I wouldn't be able to deal effectively with it.

____ 9. If I encountered a spider now, it would take a long time to get it out of my mind.

____ 10. If I came across a spider now, I would leave the room.

____ 11. If I saw a spider now, I would think it will try to jump on me.

____ 12. If I saw a spider now, I would ask someone else to kill it.

____ 13. If I encountered a spider now, I would have images of it trying to get me.

____ 14. If I saw a spider now, I would be afraid of it.

____ 15. If I saw a spider now, I would feel very panicky.

____ 16. Spiders are one of my worst fears.

____ 17. I would feel very nervous if I saw a spider now.

____ 18. If I saw a spider now, I would probably break out in a sweat and my heart would beat faster.

Appendix F

Fear of Snakes Questionnaire (FSnQ)

For each item, please record a number to indicate how much you agree with the statement. Ratings can include any number between 0 (totally disagree) and 7 (totally agree).

Totally Disagree Totally Agree
0 ---------- 1 ---------- 2 ---------- 3 ---------- 4 ---------- 5 ---------- 6 ----------7

____ 1. If I came across a snake now, I would get help from someone else to get rid of it.

____ 2. Currently, I am sometimes on the look out for snakes.

____ 3. If I saw a snake now, I would think it will harm me.

____ 4. I now think a lot about snakes.

____ 5. I would be somewhat afraid to go to a place where I have seen a snake before.

____ 6. I now would do anything to try to avoid a snake.

____ 7. Currently, I sometimes think about getting bit by a snake.

____ 8. If I encountered a snake now, I wouldn't be able to deal effectively with it.

____ 9. If I encountered a snake now, it would take a long time to get it out of my mind.

____ 10. If I came across a snake now, I would leave the vicinity of the animal.

____ 11. If I saw a snake now, I would think it will try to attack me.

____ 12. If I saw a snake now, I would ask someone else to get it away from me.

____ 13. If I encountered a snake now, I would have images of it trying to get me.

____ 14. If I saw a snake now, I would be afraid of it.

____ 15. If I saw a snake now, I would feel very panicky.

____ 16. Snakes are one of my worst fears.

____ 17. I would feel very nervous if I saw a snake now.

____ 18. If I saw a snake now, I would probably break out in a sweat and my heart would beat faster.

Appendix G

Depression Anxiety Stress Scales – 21-item version (DASS - 21)

INSTRUCTIONS: Please read each statements and choose the number which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement. The rating scale is as follows:

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

---

1. I found it hard to wind down.
2. I was aware of dryness of my mouth.
3. I couldn't seem to experience any positive feelings at all.
4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).
5. I found it difficult to work up the initiative to do things.
6. I tended to over-react to situations.
7. I experienced trembling (e.g., in the hands).
8. I felt that I was using a lot of nervous energy.
9. I was worried about situations in which I might panic and make a fool of myself.
10. I felt that I had nothing to look forward to.
11. I found myself getting agitated.
12. I found it difficult to relax.
13. I felt down-hearted and blue.
14. I was intolerant of anything that kept me from getting on with what I was doing.
15. I felt I was close to panic.
16. I was unable to become enthusiastic about anything.

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

18. I felt that I was rather touchy.

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

20. I felt scared without any good reason.

21. I felt that life wasn't worthwhile.

Appendix H

Background Information Questionnaire

1. What is your first name?
   _____

2. What is your age? _____

3. What is your sex? (Circle) M F

4. Are you employed? (Circle) Yes No

5. If yes, what is your occupation?
   _____

6. Are you a student of Eastern Michigan University? (Circle) Yes No

7. What is your current college standing? (Circle one)

   Did not attend college
   Some college, did not graduate and not currently enrolled
   Freshman
   Sophomore
   Junior
   Senior
   Second Bachelors
   Graduate Student (Masters or Doctoral level)
   Graduate of a 2 year college
   Graduate of a 4 year college
   Completed Graduate/Professional School

8. Do you have any health conditions that may be worsened if you become anxious or fearful, including any of the following? (Check all that apply)
   Asthma
   Heart condition of any kind
   Hypertension (high blood pressure)
   Lung disease, including any shortness of breath or trouble breathing
   Migraine
   Neurological problems
   Pregnancy or the possibility of pregnancy
   Recurring chest pain
   Seizer
   Stroke
   Ulcers
   Other (please describe):
   _____

9. Have you ever experienced an intensely fearful or traumatic experience related to a snake? (Circle) Yes No
   If yes, please briefly describe the experience in the box provided.

10. Have you ever experienced an intensely fearful or traumatic experience related to a spider? (Circle) Yes No
    If yes, please briefly describe the experience in the box provided.

11. Have you ever experienced any kind of traumatic brain injury? (Circle)Yes No

12. Do you suffer from epilepsy, dementia, or any other condition that affects normal brain functioning? (Circle) Yes No

13. Have you ever been diagnosed with a learning disability? (Circle) Yes No

14. Do you have any known allergies to a snake or a spider? (Circle) Yes No

15. Is your immune system in any way compromised (by a virus such as HIV or by cancer treatment, for instance)? (Circle)
    Yes No

16. How did you hear about this study?
    Flyer In-class announcement Friend/family member
    Other

16. Please provide the following contact information, as well as the best times to reach you, so that the experimenters can contact you for further participation.

    If you wish to be contacted to further participate in this study, do you prefer to be contacted by phone or by email? (Circle)
    I do not wish to further participate in this study Phone Email

    Phone Number/Email Address _____

    What is the best day to reach you by phone? (Circle all that apply)
    Sunday Monday Tuesday Wednesday Thursday Friday Saturday

    What is the best time to reach you by phone? (Circle all that apply)
    Morning (8am - noon) Afternoon (noon - 5pm) Evening (5pm – 8pm)

    17. If you would like your instructor to be informed of your participation in this phase of the experiment, please provide the following information (if you are not a student of Eastern Michigan University, you may skip this):
    First Name _____
    Last Name _____
    Emich ID _____

Appendix I

Word-stem Completion Test

The first two letters of a word are provided below. Please write the first word that comes to your mind that begins with the two letters. Work quickly and just write the first word that comes to mind.

1. sp_____ (spider)
2. sh_____ (shell)
3. sn_____ (snake)
4. mo_____ (movie)
5. cr_____
6. be_____ (bear)
7. dr_____
8. ar_____ (arrow)
9. ca_____ (caution)
10. ex_____ (exit)
11. sc_____
12. va_____ (vase)
13. fl_____ (flower)
14. we_____
15. st_____
16. bi_____
17. ra_____
18. st_____
19. bo_____ (bow)
20. ch_____(Christmas)

Appendix J

Free Recall Test

In the space below, please describe as many details as you can recall seeing in the room. Provide the name of every object, a brief description, and the general location of it in the room. Be as specific and as thorough as possible. Complete sentences are not necessary; you may choose to simply list the details you can recall and some specific features of those details. *Anything* that you saw in the room should be included in your list. An example is provided below.

Name	**Description**	**Location**
One table	*Dark wood top with silver legs, comes up to my waist and is about 3' by 8'*	*Back of room, almost against the wall but not quite, centered between the partition and the wall*
Champagne glass (also will accept flute, wine glass, or just glass)	Clear glass with a single gold stripe and a gold rim	On the table - right side of animal cage toward the front edge
Seashell (also will accept shell or conch)	Large shell with many points that is tan, pink, and white	On the table - right side of the animal cage toward the back edge
Teddy bear (also will accept bear or stuffed animal)	White and fuzzy with black eyes and nose and a bow on its neck	On the table - left of the animal cage, toward the front edge and behind a sign
Movie poster (also will accept poster)	Tim Burton's Nightmare Before Christmas, drawing with 7 characters on the perimeter of the poster and wording in the middle. Dark background	Left wall in front of cage
Vase with flower (also will accept vase with sunflower. The participant may also have these on two separate rows.)	Large blue vase with one yellow sunflower in it	On the floor in front of the left front leg of the table
Sign	Caution: Handle with Care. White sign with dark lettering	On the table – left of the animal cage in front of teddy bear
Arrow	Red arrow with white "exit" pointing back toward the door of the room	Right wall directly across from poster
Spider _ _ _ _ _ _ _ _ _ _ _ _ _ Snake	Hairy, brownish-red live spider, approximately size of fist. Hard part of its body that looked like armor. _ Bright red and orange patterned snake. Red eyes, several feet long and thick.	In the cage on the table (no area of cage needed)

Appendix K

Cued Recall Test

Please write your response to the questions below. Try to recall each detail that the question mentions if that detail was in the room and give your best answer to the question. This test may not ask about every detail that was in the room.

1. What color was the stuffed teddy bear on the room? __white_____

2. What was on the teddy bear's neck? _bow_____

3. What color was the word in the arrow on the wall? ___white____

4. What was the word written in the arrow on the wall? _Exit____

5. What words were printed on the sign near the animal's cage? _Caution: Handle with Care

6. On which side of the animal's cage was the sign located? (Circle)

   Right Left (correct)

7. Check the one box that best describes the general color of the animal in the cage?
   - ☒ (spider) Mostly brown/reddish brown
   - ☐ Mostly dark orange with some brown areas
   - ☒ (snake) Mostly red and orange
   - ☐ Mostly light red with a few white patches

8. Check the box or boxes that best describe any details or special markings that you noticed on the animal.
   - ☐ A single bright blue spot on its body
   - ☒ (spider) Fur or hair covering most of its body
   - ☒ (snake) Bright pattern on its body
   - ☐ Protruding fangs
   - ☒ (snake) Red eyes
   - ☒ (spider) A part of its body that looks hard, like armor

9. Check one box that best describes any movement you saw from the animal. (see Participant BAT Record/Animal Movement Form)
   - ☐ Very active (almost constant, swift movements)
   - ☐ Moderately active (moved for some of the time, but movement was slower)
   - ☐ Inactive (mostly stayed in one spot, moved only occasionally)

10. Check one box that best describes the direction of any movement you saw from the animal. (see Participant BAT Record/Animal Movement Form)

- ☐ Generally remained on the right side of the cage
- ☐ Generally remained on the left side of the cage
- ☐ Moved within the center of the cage
- ☐ Moved throughout the cage (did not stay toward the right, left, or center)

11. Circle the type of glass that was in the room.

coffee mug champagne glass (correct) shot glass beer mug

12. What color was the detailing on that glass? __gold_____

13a. Was the spider in the cage small enough to fit in the palm of your hand? (Circle one)

Yes (correct) No

13b. Was the snake in the cage about 2 inches in diameter? (Circle one)

Yes No (correct)

14a. Choose the object that most reflects the size of the spider in the cage.

penny quarter closed fist (correct) larger than closed fist

14b. Choose your best estimate of the general length of the snake in the cage.

3 inches 5 inches 12 inches 24 inches (correct)

15. What was the color of the vase that contained the flower? __blue_____

16. Circle the type of flower in the vase.

sunflower (correct) dandelion daisy rose

17. Check one box that best describes where the seashell in the room was located.

- ☐ There was no seashell in the room
- ☐ On the left edge of the table
- ☒ On the right far edge of the table
- ☐ Directly behind the animal's cage

18. The seashell had how many points on it?

none (no shell) one two greater than 2 (correct)

19. The poster on the wall was advertising what movie?
Tim Burton's The Nightmare Before Christmas

20. How many characters were visible on the poster? (Circle)
One three seven (correct) fifteen

Appendix L

Recognition Test

Indicate whether each statement is true (T) or false (F) based on what you saw in the room.

1. There was a poster on the left wall.	**T**	F
2. A dictionary was on the floor under the animal's cage.	T	**F**
3. The animal in the cage was constantly moving.	**T**	**F**
4. There was vase in the room that contained a single sunflower.	**T**	F
5. The arrow on the right wall had the word "exit" printed on it and pointed toward the door.	**T**	F
6. There was a small votive candle on the table in front of you.	T	**F**
7. The sign near the animal's cage read "Caution: Do Not Touch."	T	**F**
8. The champagne glass in the room had gold detailing on it.	**T**	F
9. The arrow on the wall was green.	T	**F**
10. There was a large seashell in the room.	**T**	F
11. The lamp on the desk near the animal's cage had a beige lampshade.	T	**F**
12. The animal in the cage had a noticeable bright red marking on it.	**T**	**F**
13. The sneaker located under the poster was black and white.	T	**F**
14. There was only one live animal in the container on the table.	**T**	F
15. The stuffed animal in the room was white with a bow on its neck.	**T**	F
16. The animal was so small that it was difficult to see from a distance.	T	**F**
17. There were two ink pens on the table with the animal.	T	**F**
18. There was a picture of the animal on the sign to the left of the animal's container.	T	**F**
19. The broom was propped against the right wall near the arrow.	T	**F**
20. There was a movie poster of Charlotte's Web on the wall.	T	**F**

Appendix M

Debriefing Questionnaire

1. One of the tests you took involved quickly naming the identity of various pictures shown to you on the computer screen. It was labeled "Test 1." When you were taking this test, were you thinking about the laboratory (with the animal and several other items) that you had just been in? (Circle)
   Yes No

2. During that first test, did you actively try to remember what you saw in the laboratory with the animal and several other items in it? (Circle) Yes No

3. When you were taking the word stem completion test that required you to fill in a word beginning with the first two letters given (e.g., Be_____), were you thinking about the laboratory (with the animal and several other items) that you had just been in? (Circle)
   Yes No

4. During that word stem completion test, did you actively try to remember what you saw in the laboratory with the animal and several other items in it? (Circle)
   Yes No

5. If you have not already received treatment during the course of the experiment, are you interested in receiving free one session in vivo exposure treatment for fear that you might have toward either the spider or the snake? (Circle) Yes No

6. If so, please list available dates and times (3 hour blocks) that you have to complete such treatment.

7. Are you experiencing significant heightened fear or anxiety right now? (Circle)
   Yes No

8. On a scale of 1 to 10 (1 being the complete calm and 10 being incredibly fearful), how would you rate your anxiety right now? (Circle)
   1(calm) 2 3 4 5 6 7 8 9 10 (fearful)

9. Do you feel that you would like to learn some brief relaxation techniques to help you reduce your current fear? (Circle) Yes No

Appendix N

Screening Informed Consent Agreement

The Effect of Fear on Mental Activity in Spider- and Snake-fearful Participants: Initial Questionnaire Screening Phase

Investigators: Karen Stanley-Kime and Ellen Koch, Ph.D.

Purpose: The purpose of this research study is to gain a better understanding of the effects of fear on thinking in those who are and are not fearful of snakes or spiders.

Procedure: This study begins with filling out four online assessment tools, including the Fear of Spiders Questionnaire, Fear of Snakes Questionnaire, the Depression Anxiety Stress Scales, and a short background survey. These questionnaires ask for information about your fear toward spiders and snakes, general levels of depression and anxiety in your life, and some personal information about you. You will also be asked for your contact information so that, if you qualify for the study, the experimenter can contact you to invite you to further participate in the second part of the study. The surveys are brief and will take a maximum of 40 minutes to completely fill out, though you may finish significantly sooner than that. Qualification for participating in the second part of the study is based on your responses to each of the surveys and not everyone will be invited to participate in the second part of the experiment. The second part of the experiment will involve assignment to one of three groups: one group of fearful individuals who will receive free one-session treatment (experimental treatment group), one group of fearful individuals who will not receive the treatment (experimental no-treatment group), or the third group who are not fearful of either the snake or the spider and who will not need treatment (control group). If you are assigned to the group of fearful individuals who will receive treatment, you will be asked to physically contact a live snake or spider if you are able to do so. This is a part of treatment and the experimenter will be assisting you to get to the point that you are comfortable contacting the snake or spider. You will not be forced to make contact at any time. If you are chosen to further participate, the experimenter will contact you to provide further details about the second phase of the experiment so you can decide if you would like to continue to the second part of the experiment.

Risks: Risks of filling out these online surveys are minimal, though there is a chance that you may become upset or anxious by some of the questions that are asked in these questionnaires. In the event that you become upset by these surveys, you may seek free mental health assistance from Snow Health Center Counseling Services if you are an Eastern Michigan University student. If you are not a student of Eastern Michigan University, you may request a list of potential referral options from the primary investigators.

Benefits: If you are an Eastern Michigan University student, you may receive extra credit for your participation in this study only if it is approved by your instructor. If you indicate your instructor and provide your information at the end of the survey, we will notify your instructor of your participation. Your instructor can then assign extra credit points if

approved by him or her. If you are invited to further participate in the study, one of the benefits is that, if you are fearful of either a spider or a snake, you will receive free one-session treatment for your small animal fear during the course of the experiment in the case of membership in the experimental treatment group. The treatment involves gradually approaching the live, caged snake or spider with the assistance of the experimenter. The ultimate goal is to make you so comfortable that you will be able to physically contact the animal without fear or anxiety. This treatment, which has been shown to be effective and will take a maximum of 3 hours to be completed in one day, will also be offered to you if you are not assigned to the group of fearful individuals that received treatment during the experiment. Treatment will take place on the fifth floor of Mark Jefferson hall by a qualified graduate student in clinical psychology. This benefit does not apply to you if you are not fearful of either a spider or a snake. An additional benefit is that your participation will increase our knowledge of the effects of anxiety and possibly help us to improve anxiety treatment.

Confidentiality: All the information collected from you is strictly confidential and will be disclosed only to the experimenters of this study. That means that your name will not appear on any papers on which this information is recorded. The forms will all be coded, and the investigators will keep a separate master list with the names of participants and the corresponding code numbers. Once the data are collected and analyzed, the master list will be destroyed. All other forms will be retained for a minimum of five years in a locked file in 505D Mark Jefferson.

Withdrawal Without Penalty: Participation in this study is voluntary. You will not be penalized for refusing to participate in the study. Further, you are free to withdraw consent and discontinue your involvement in the study at any time without penalty. You may stop filling out the surveys at any time if you would like to withdraw consent.

Information regarding what to do if you have questions: If you have any questions about your participation in this study, please feel free to contact either Karen Stanley or Dr. Ellen Koch. You may also contact Eastern Michigan University's Human Subjects Review Committee (UHSRC), which is located in Starkweather Hall on the campus of Eastern Michigan University. You may phone the University Human Subjects Review Committee at (734) 487-0042 or you may email the Committee at human.subjects@emich.edu. You may also go to Starkweather Hall on the campus of Eastern Michigan University to speak with someone directly.

Karen Stanley-Kime (primary student investigator): (734) 834-1116 or kstanley2@emich.edu.

Dr. Ellen Koch (primary investigator/faculty advisor): (734) 487-0189 or ellen.koch@emich.edu.

This research protocol has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee as of July 9, 2007 to July 9, 2008. If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim

Dean of the Graduate School and Administrative Co-chair of UHSRC, human.subjects@emich.edu)

By checking the box below, I acknowledge that I have read, understood, and accepted the terms outlined above.

Appendix O

Experiment Informed Consent Agreement

The Effect of One-Session Exposure Treatment on Mental Activity in Spider- and Snake-fearful Participants: Treatment Phase

Investigators: Karen Stanley-Kime and Ellen Koch, Ph.D.

Purpose: The purpose of this research study is to gain a better understanding of the effects of anxiety treatment on thinking in those who are and are not fearful of snakes and spiders.

Procedure: Your eligibility for this study was based on the information you previously provided on the online surveys, including two surveys on your fear of spiders and snakes, one on depression and anxiety in your life, and one that asked about your background. The title of this initial phase of the experiment was "The effect of fear on mental activity in spider- and snake-fearful participants: Initial questionnaire screening phase." This is now the second part of the experiment. The experiment will begin with administration of the State Trait Anxiety Inventory, a short questionnaire that should take about 10-15 minutes to complete. You will then be assigned to one of three groups by the experimenter: one group of fearful individuals who will receive free one-session treatment (experimental treatment group), one group of fearful individuals who will not receive the treatment (experimental no-treatment group), or the third group who are not fearful of either the snake or the spider and who will not need treatment (control group). Those in the experimental treatment group will receive one session in-vivo exposure treatment to reduce their fear of snakes/spiders, which will take a maximum of 3 hours. This treatment means that, with the help of the experimenter, you will be exposed to a live caged snake or spider (depending on your individual fear) and asked to perform various tasks related to the snake or spider in an effort to reduce anxiety. This will include approaching the snake or spider. The eventual goal is to get you so comfortable that you can physically contact the snake or spider. The snake used in exposure treatment will be a gopher bull snake; the spider used for exposure treatment will be a Chaco golden knee tarantula. You will not be forced to make physical contact during treatment; this is up to you and the experimenter will never force you to do anything as part of treatment. Hand sanitizer will be available throughout the experiment and all areas that are in the proximity of the snake/spider will be sanitized by the experimenter to maintain participant health. If you are a member of the experimental no-treatment group or the control group, you will not receive any treatment; instead, you will simply be asked to approach the caged snake or tarantula as much or as little as is comfortable. Following this the Shipley Institute of Living Scale will be administered, which should take about 20 minutes, and five other brief assessment instruments. Thus, participation in this study will require up to a 3 and one half hours time commitment that must be completed in one day if you are assigned to the experimental treatment group. Those individuals who are in the experimental no-treatment group and the non-fearful group can expect up to a 45 minute time commitment to be completed in one day.

Risks: As in many experimental studies, risks are present. You may experience elevations in anxiety during this study. If you begin to feel very uncomfortable, you may take a break or

leave the situation if desired. You will choose how much you will approach the snake/spider. At no time will the experimenter ever force you to approach or make contact with the snake/spider. If you choose to make physical contact, you must do so only with the utmost care for the animal's/insect's safety and your safety. The trained experimenter will monitor the situation to make sure that there is no danger to yourself or the snake/spider. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available. In the unlikely event that you need medical treatment, Snow Health Center or the nearest hospital will be utilized and the experimenter will accompany you to the treatment facility if you would like. You will be responsible for the cost of any medical treatment you pursue. It is important to note that the snakes/spiders used in this study do have an amount of venom that is medically insignificant for most people, but could possibly be harmful if you are allergic to it. If you require counseling as a result of this study, it will be provided to you free of cost by Eastern Michigan University's Snow Health Center Counseling Services if you are a currently enrolled student. If you are not a currently enrolled student, a referral list will be provided upon request. You will be responsible for the cost associated with pursuing treatment. In addition, other treatments for phobias besides in vivo exposure treatment are available for you to pursue at any time. To ensure the well-being of the participants, emergency contact information will be provided to fearful participants completing treatment.

As with turtles, other reptiles, and some birds, there is the possibility of salmonella contamination; however, handling precautions and sanitation of all areas that the snake comes into contact with will be utilized to minimize this risk. In addition, hand sanitizer will be made available throughout the experiment for participant use.

Benefits: If you are an Eastern Michigan University student, you may receive extra credit for your participation in this study only if it is approved by your instructor. We will complete a form documenting your participation that you can provide to your instructor if desired. At which time the instructor can assign extra credit points if approved by him or her. If you are assigned to the treatment condition, you will receive the free one-session treatment for your snake/spider fear described above. Fearful participants that do not receive treatment during participation may choose to receive treatment after completing the study. If you are in this group and would like the one-session treatment for snake or spider fears, it will be offered to you free of charge and will take place on the fifth floor of Mark Jefferson hall. This is a highly effective treatment for quickly reducing fear; thus, there should be a beneficial reduction in the anxiety that you feel when you are around or think about a spider or a snake. However, if new information is released during the course of this study that negates the effectiveness of this treatment, the treatment may be altered and you will be informed and given the opportunity to consent to the new treatment. Finally, your participation will increase our knowledge of the effects of anxiety and may help us to improve anxiety treatment.

Confidentiality: All information obtained from you will remain confidential. The online questionnaires you have already filled out are on a secure website. Once data is collected, it will be stored in a password protected computer file in a locked office. Your name and contact information will not be disclosed to any unauthorized individuals. This study may be

submitted for publication or may be presented at various conferences. Your name and identifying information will not be mentioned in any written document or verbal presentation regarding this study. You will be given a unique participant number to conceal your identity and, once data is completely collected for this study, you will be identified only by number and your name/contact information will be destroyed.

Withdrawal Without Penalty: Participation in this study is voluntary. You will not be penalized for refusing to participate in the study. Further, you are free to withdraw consent and discontinue your involvement in the study at any time without penalty. You are also free to request a brief break at any point in the study if necessary.

Information regarding what to do if you have questions:
If you have any questions about your participation in this study, please feel free to contact either Karen Stanley-Kime or Dr. Ellen Koch. You may also contact Eastern Michigan University's Human Subjects Review Committee (UHSRC), which is located in Starkweather Hall on the campus of Eastern Michigan University. You may phone the University Human Subjects Review Committee at (734) 487-0042 or you may email the Committee at human.subjects@emich.edu. You may also go to Starkweather Hall on the campus of Eastern Michigan University to speak with someone directly.

Karen Stanley-Kime (primary student investigator): (734) 834-1116 or kstanley2@emich.edu.

Dr. Ellen Koch (primary investigator/faculty advisor): (734) 487-0189 or ellen.koch@emich.edu.

This research protocol has been reviewed and approved by the Eastern Michigan University Human Subjects Review Committee as of July 9, 2007 to July 9, 2008. If you have questions about the approval process, please contact Dr. Deb de Laski-Smith (734.487.0042, Interim Dean of the Graduate School and Administrative Co-chair of UHSRC, human.subjects@emich.edu)

By signing this form, I acknowledge that I have read, understood, and accepted the terms outlined above and have received a copy of this form.

_____ _____
Participant Signature Date

_____ _____
Research Assistant Signature Date

Appendix P

Human Subjects Institutional Review Board of Eastern Michigan University Approval

EASTERN MICHIGAN UNIVERSITY

July 9, 2007

Karen Stanley
1904 Timber Ridge
Ypsilanti, MI 48198

Dear Karen Stanley:

The Human Subjects Institutional Review Board (IRB) of Eastern Michigan University has granted approval to your proposal, "The Effect of One-Session Treatment on Selective Processing and Memory Bias in Spider- and Snake-Fearful Participants."

After careful review of your completion application, the IRB determined that the rights and welfare of the individual subjects involved in this research are carefully guarded. Additionally, the methods used to obtain informed consent are appropriate, and the individuals participating in your study are not at risk.

You are reminded of your obligation to advise the IRB of any change in the protocol that might alter your research in any manner that differs from that upon which this approval is based. Approval of this project applies for one year from the date of this letter. If your data collection continues beyond the one-year period, you must apply for a renewal.

On behalf of the Human Subjects Committee, I wish you success in conducting your research.

Sincerely,

Deb de Laski-Smith, Ph.D.
Interim Dean
Graduate School
Administrative Co-Chair
University Human Subjects Review Committee

Note: If project continues beyond the length of **one** year, please submit a continuation request form by **7/9/08**.

Reference # 070522

Cc: Ellen Koch

Appendix Q

Eastern Michigan University's Institutional Animal Care and Use Committee Approval

APPROVAL NOTIFICATION

EASTERN MICHIGAN UNIVERSITY
OFFICE OF RESEARCH DEVELOPMENT
Starkweather Hall

DATE: 06/04/2007

TO: Ellen Koch

FROM: Brian Anderson
ex officio
Institutional Animal Care and Use Committee

Eastern Michigan University's Institutional Animal Care and Use Committee (IACUC) has reviewed your Application To Use Animals In Research or Instruction referenced below. This project has been approved. The proposed animal use procedures are in compliance with University guidelines, State and Federal regulations and the standards of the "Guide for the Care and Use of Laboratory Animals."

When communicating with the IACUC Office, please refer to the Approval Number referenced below. The appropriate Approval Number must accompany all requisitions for animals and pharmaceuticals. No research, testing or instructional use of vertebrate animals may be initiated without an Approval Number.

The Approval Period for your Approval Number is also indicated below. However, the United States Department of Agriculture (USDA) requires an annual review of applications to use animals. Therefore, each year of this application, prior to the anniversary of its approval date, you will receive a short Annual Review Form. Your continued animal use approval is contingent upon the completion and return of this form. You will also be notified prior to the expiration of the Approval Period so that any renewal application can be prepared, submitted and reviewed in a timely manner and an interruption in the approval status of this project avoided.

Committee approval must be obtained prior to changes in procedures that could affect the humane use of animals. If changes are contemplated, a revised Animal Use Form (with the changes highlighted) must be submitted and approved prior to initiation of the modified procedures. Contact the Associate Provost's Office for more information.

TITLE: " The effect of one-session exposure treatment on selective processing and memory bias in spider and snake-fearful subjects"
APPROVAL PERIOD: to
IACUC APPROVAL NO.: 2007-030

cc: Committee

Note:
Please take sanitary precautions for those handling snakes.
Also, you should notify Slow Health Center regarding salmonella risk.

Appendix R

Summary of Online Screening Portion Responses

Preliminary Screening Totals

672
Total agreeing to consent

↓

64
Did not complete all online screening questionnaires and whose partially completed responses were discarded

↓

608
Completed all online screening questionnaires in their entirety

Initial Exclusionary Criteria

133	9	8
Requested not to be contacted for further participation	Omitted necessary contact information	Unable to give consent due to being under the age of 18

Primary Exclusionary Criteria

168	102	13
Failed to meet assessment measure criteria - 117 failed to meet DASS-21 criteria - 51 failed to meet FSQ/FSnQ criteria	Excluded due to health concerns - 100 indicated at least one medical condition - 1 indicated a compromised immune system - 1 had known allergies to snakes and/or spiders	Excluded due to compromised cognitive ability - 10 disclosed the presence of a learning disability - 3 indicated that they had sustained a traumatic brain injury

Other Exclusionary Criteria

18	12	1
Met criteria for further participation in the control group, but the control group no longer needed participants at the time of their completion of the online portion of the study	Responses were collected after the conclusion of procedural portion of the study	Responded to the online screening portion after previously completing the online screening portion and the procedural portion of the study

Note. Individuals may have met more then one initial exclusionary criteria and more then one primary exclusionary criteria. Those who met any initial exclusionary criteria could not have met any primary exclusionary criteria.

Table 1

Proportional means and standard deviations for all tests of implicit and explicit memory found in an independent samples t-test

Implicit		**Control**	**No-treatment**
Perceptual			
	Central Details	.16 (.17)	.07 (.14)
	Peripheral Details	.21 (.19)	.11 (.18)
Word Stem			
	Central Details	.07 (.18)	.03 (.09)
	Peripheral Details	.14 (.14)	.09 (.09)
Explicit			
Free Recall			
	Central Details	.44 (.27)	.37 (.24)
	Peripheral Details	.80 (.18)**	.60 (.21)
	Total Correct	.67 (.19)*	.51 (.18)
Cued Recall			
	Central Details	.63 (.17)	.53 (.15)
	Peripheral Details	.78 (.15)*	.61 (.25)
	Total Correct	.71 (.14)*	.57 (.16)
Recognition			
	Central Details	.88 (.13)*	.78 (.14)
	Peripheral Details	.93 (.11)*	.81 (.19)
	Lures	.94 (.08)	.98 (.06)
	Total Correct	.92 (.07)	.85 (.09)

Note. * indicates significance at the .05 level. ** indicates significance at the .01 level. In all cases of significance, the control group obtained more points than the no-treatment group.

Table 2

Proportional means and standard deviations for all tests of implicit and explicit memory found in a one-way ANOVA

Implicit		**Control**	**Treatment**	**No-treatment**
Perceptual				
	Central Details	.16 (.17)	.11 (.16)	.07 (.14)
	Peripheral Details	.21 (.19)	.13 (.14)	.11 (.18)
Word Stem				
	Central Details	.07 (.18)	.03 (.09)	.03 (.09)
	Peripheral Details	.14 (.14)	.08 (.11)	.09 (.09)
Explicit				
Free Recall				
	Central Details	.44 (.27)	.50 (.32)	.37 (.24)
	Peripheral Details	.80 (.18)	.77 (.19)	.60 (.21) * $^{C < A, B}$
	Total Correct	.67 (.19)	.67 (.16)	.51 (.18)* $^{C < B}$
Cued Recall				
	Central Details	.63 (.17)	.58 (.13)	.53 (.15)
	Peripheral Details	.78 (.15)	.77 (.14)	.61 (.25) * $^{C < A}$
	Total Correct	.71 (.14)	.67 (.11)	.57 (.16) * $^{C < A}$
Recognition				
	Central Details	.88 (.13)	.85 (.08)	.78 (.14)
	Peripheral Details	.93 (.11)	.92 (.14)	.81 (.19)
	Lures	.94 (.08)	1.00 (.00) * $^{B > A}$	.98 (.06)
	Total Correct	.92 (.07)	.92 (.06)	.85 (.09)* $^{C < A, B}$

Note. * indicates significance at the .05 level. ^{A} = Control group, ^{B} = Treatment group, ^{C} = No-treatment group

Table 3

Proportional means and standard errors for all tests of implicit and explicit memory found in the ANCOVA with gender as a covariate

Implicit		**Control**	**Treatment**	**No-treatment**
Perceptual				
	Central Details	.15 (.04)	.11 (.04)	.07 (.04)
	Peripheral Details	.21 (.05)	.14 (.05)	.11 (.05)
Word Stem				
	Central Details	.05 (.03)	.05 (.03)	.04 (.03)
	Peripheral Details	.13 (.03)	.09 (.03)	.09 (.03)
Explicit				
Free Recall				
	Central Details	.41 (.08)	.52 (.08)	.37 (.07)
	Peripheral Details	.82 (.05)	.76 (.05)	.59 (.05)** $^{C < A}$
	Total Correct	.67(.05)	.67 (.05)	.51 (.05)* $^{C < A, B}$
Cued Recall				
	Central Details	.60 (.04)	.61 (.04)	.53 (.04)
	Peripheral Details	.78 (.05)	.77 (.05)	.61 (.05)* $^{C < A}$
	Total Correct	.69 (.04)	.69 (.04)	.57 (.04)* $^{C < A, B}$
Recognition				
	Central Details	.86 (.03)	.87 (.03)	.78 (.03)
	Peripheral Details	.92 (.04)	.94 (.04)	.81 (.04)
	Lures	.95 (.02)	1.00 (.02)	.98 (.02)
	Total Correct	.90 (.02)	.93 (.02)	.85 (.02)** $^{C < B}$

Note. All significant findings are by group only. * indicates group significance at the .05 level. ** indicates group significance at the .01 level. ^{A} = Control group, ^{B} = Treatment group, ^{C} = No-treatment group

Table 4

ANCOVA results for peripheral details correctly identified on the free recall explicit memory test

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	7.539	1	7.539	.912	.345
Group	88.377	2	44.189	5.344	.009
Error	338.994	41	8.268		

Table 5

ANCOVA results for total correct responses on the free recall explicit memory test

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	.007	1	.007	.000	.985
Group	141.726	2	70.863	3.885	.029
Error	747.860	41	18.240		

Table 6

ANCOVA results for correct responses related to peripheral details on the cued recall explicit memory test

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	.235	1	.235	.067	.798
Group	27.511	2	13.755	3.905	.028
Error	144.432	41	3.523		

Table 7

ANCOVA results for total correct responses on the cued recall explicit memory test

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	15.872	1	15.872	2.118	.153
Group	55.077	2	27.539	3.675	.034
Error	307.194	41	7.493		

Table 8

ANCOVA results for total correct responses on the recognition explicit memory test

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	7.688	1	7.688	3.585	.065
Group	20.373	2	10.187	4.751	.014
Error	87.912	41	2.144		

Table 9

Comparison of ANOVA and ANCOVA results

			ANOVA	ANCOVA	
Implicit			Group Differences	Group Differences	Gender Differences
	Perceptual				
		Central Details			
		Peripheral Details			
	Word Stem				
		Central Details			
		Peripheral Details			
Explicit					
	Free Recall				
		Central Details			
		Peripheral Details	Significant	Significant	
		Total Correct	Significant	Significant	
	Cued Recall				
		Central Details			Significant
		Peripheral Details	Significant	Significant	
		Total Correct	Significant	Significant	
	Recognition				
		Central Details			Significant
		Peripheral Details			
		Lures	Significant		
		Total Correct	Significant	Significant	

Note. All significant findings had alpha levels of .05. Non-significant findings were omitted

Table 10

Cued versus non-cued explicit memory test results for repeated measures ANCOVA with gender as the covariate

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	.039	1	.039	1.053	.311
Group	.394	2	.197	5.338	.009
Error	1.511	41	.037		
Within Subjects					
Test	.131	1.716	.076	6.922	.003
Test x Gender	.020	1.716	.012	1.064	.342
Test x Group	.041	3.431	.012	1.089	.364
Error	.775	70.337	.011		

Table 11

Cued versus non-cued test results for recollection of peripheral details based on a repeated measures ANCOVA with gender as the covariate

Source	SS	dF	MS	F	Sig.
Between Subjects					
Gender	6.039	1	6.039	.001	.977
Group	.751	2	.376	5.362	.009
Error	2.871	41	.070		
Within Subjects					
Test	.154	1.913	.080	6.451	.003
Test x Gender	.058	1.913	.030	2.424	.098
Test x Group	.050	3.827	.013	1.059	.381
Error	.976	78.453	.012		

Figure Captions

Figure 1. Proportion of points obtained from recollection of peripheral details on the free recall test of explicit memory based on ANCOVA results with gender entered as a covariate.

Figure 2. Proportion of total points obtained on the free recall test of explicit memory based on ANCOVA results with gender entered as a covariate.

Figure 3. Proportion of points obtained from recollection of peripheral details on the cued recall test of explicit memory based on ANCOVA results with gender entered as a covariate.

Figure 4. Proportion of total points obtained on the cued recall test of explicit memory based on ANCOVA results with gender entered as a covariate.

Figure 5. Proportion of total points obtained on the recognition test of explicit memory based on ANCOVA results with gender entered as a covariate.

Figure 6. Proportion of total correct responses on tests of explicit memory based on a repeated measures ANCOVA results with gender entered as a covariate.

Figure 7. Proportion of peripheral details correctly identified on tests of explicit memory based on a repeated measures ANCOVA results with gender entered as a covariate

Figure 1

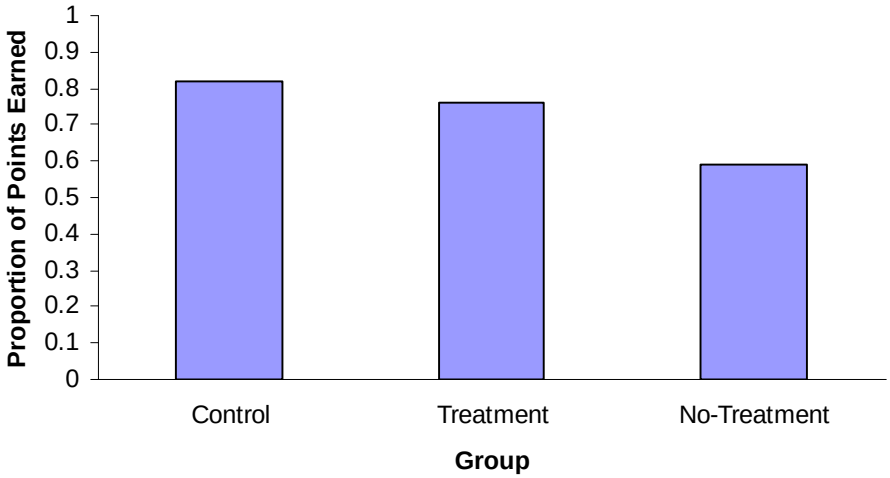
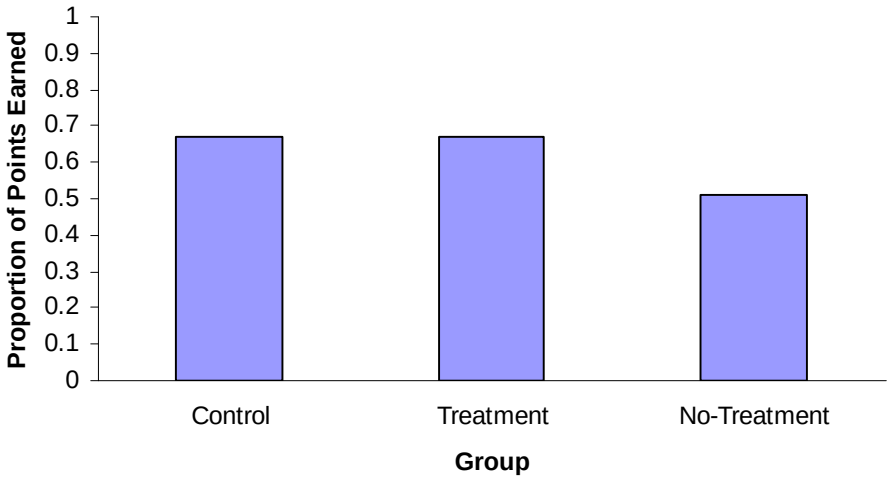

Proportion of Points Earned
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Control
Treatment
No-Treatment
Group

Figure 2


Proportion of Points Earned
1
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0.8
0.7
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0.4
0.3
0.2
0.1
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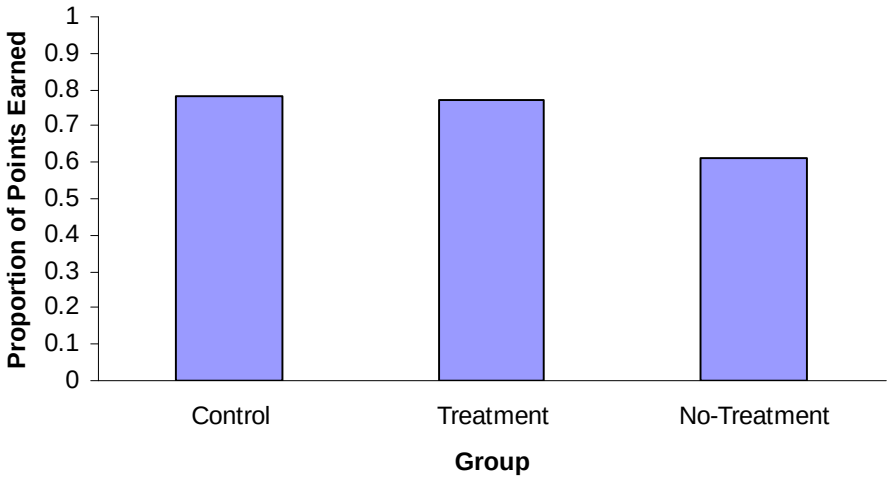
Control
Treatment
No-Treatment
Group

Figure 3


Proportion of Points Earned
1
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0.8
0.7
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0.4
0.3
0.2
0.1
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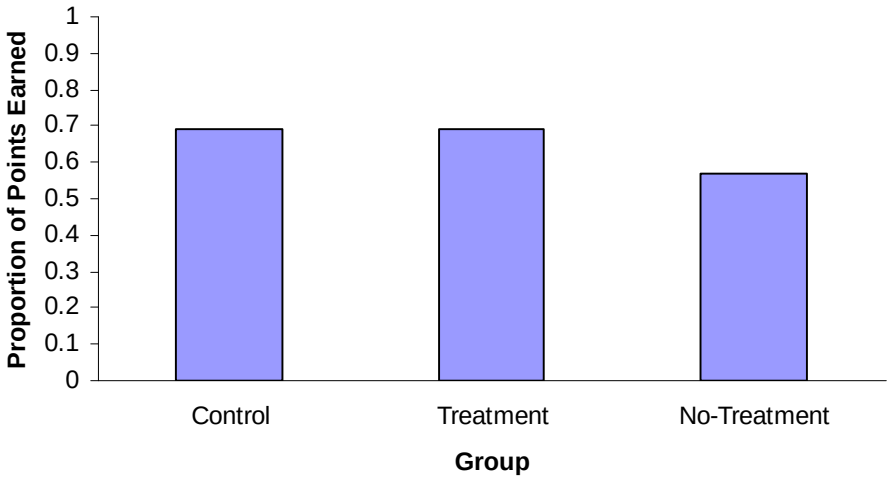
Control
Treatment
No-Treatment
Group

Figure 4


Proportion of Points Earned
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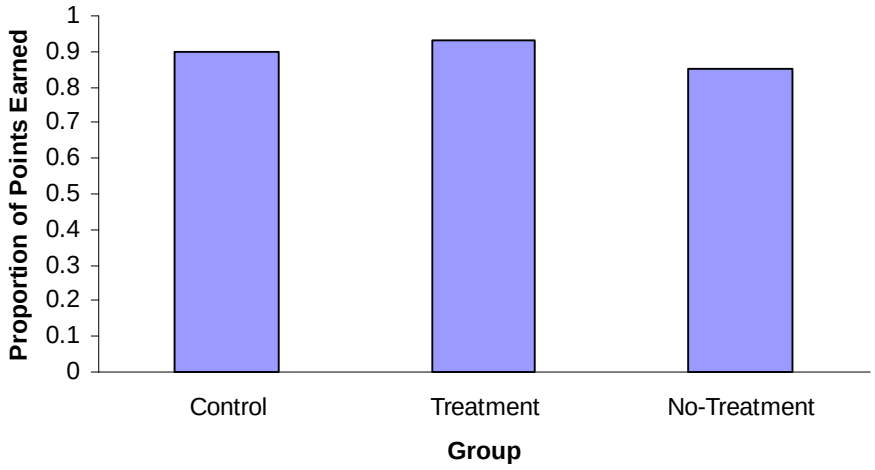
Control
Treatment
No-Treatment
Group

Figure 5


Proportion of Points Earned
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0.3
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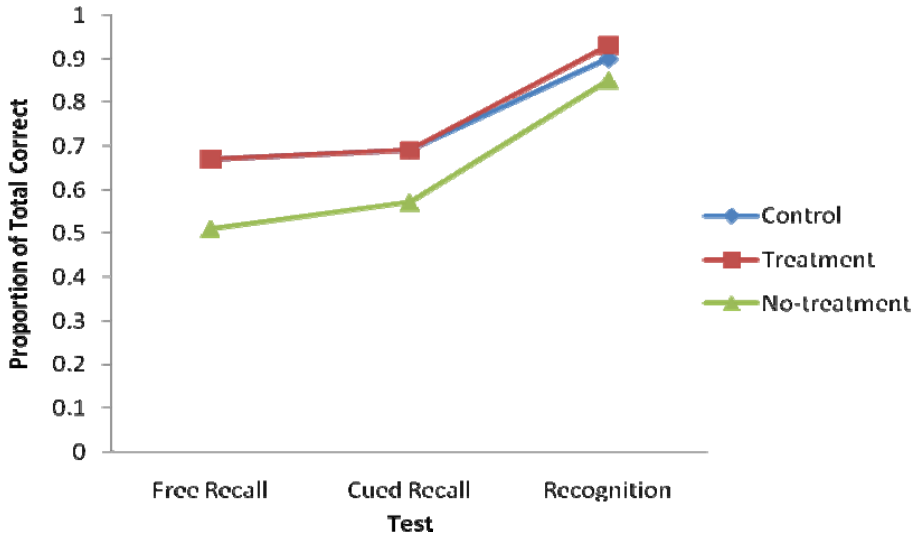
0.1
0
Control
Treatment
No-Treatment
Group

Figure 6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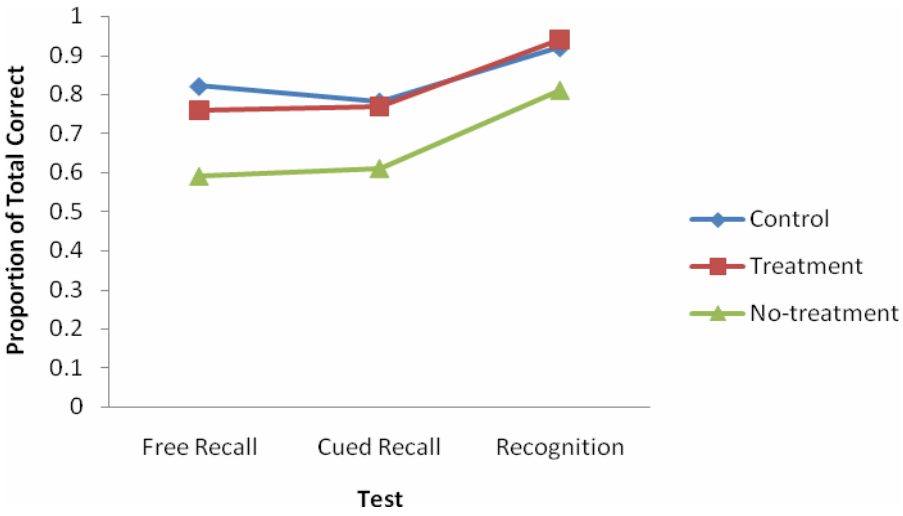
Proportion of Total Correct
Free Recall
Cued Recall
Recognition
Test
Control
Treatment
No-treatment

Figure 7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Proportion of Total Correct
Free Recall
Cued Recall
Recognition
Test
Control
Treatment
No-treatment