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# Diagnosis Threat in a Mild Traumatic Brain Injury Population

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# DIAGNOSIS THREAT IN A MILD TRAUMATIC BRAIN INJURY POPULATION

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The present study examined the effect of diagnosis threat on neuropsychological test performance. Forty-nine participants with a history of mTBI were randomly assigned to either a Diagnosis Threat group or a Control group. The Diagnosis Threat group was told that they were selected to participate based on their history of head injury and that they might expect to perform more poorly on testing. Participants in the Control group were told to perform to the best of their ability. It was hypothesized that individuals who had a history of mild Traumatic Brain Injury (mTBI) made salient prior to testing (Diagnosis Threat group) would perform worse on neuropsychological testing compared with individuals who did not have a history of mTBI made salient. Additionally, it was hypothesized that individuals in the Diagnosis Threat group would rate themselves as putting forth less effort on the neuropsychological tests, feel less confident in their performance, feel they performed worse, and perceive the tests as harder compared to the control group. Finally, it was hypothesized that individuals in the Diagnosis Threat group would report lower academic self-efficacy than the Control group.

Results suggest that diagnosis threat alone may not compromise neuropsychological test performance. Additionally, the diagnosis threat condition did not result in lowered self-report ratings regarding the testing experience. However, the Diagnosis Threat group did report lower academic self-efficacy than the Control group, suggesting that diagnosis threat may contribute to a lowered belief in one's abilities without compromising their test scores. Limitations to the current study are discussed and recommendations are made for future studies.

## Dedication

This work, and the effort and sacrifice that accompanied it, is dedicated to the ultimate mentor, my father (Dr. Edward Trontel) who has imbued me with the most valuable gift I could receive, a deep curiosity for the world and a love of learning.

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## Diagnosis Threat in a Mild Traumatic Brain Injury Population

Stereotype threat is a phenomenon that develops as a result of a member of a stereotyped group being in a situation or doing something for which the stereotype about one's group applies (Steele, 1997). The threat itself can lead to changes in behavior consistent with what the stereotype implies. For example, negative stereotypes about African Americans and women can have an important impact on their academic performance, regardless of ability (e.g., Nguyen & Ryan, 2008, Spencer, Steele, & Quinn, 1999, Steele & Aronson, 1995). In performance situations, where testing is conducted, this phenomenon leads to test performance decreases, in which a member of a stigmatized group feels pressured by the possibility of confirming or being judged by a negative stereotype (Kit, Tuokko, & Mateer, 2008). Although early studies focused on how stereotype threat affected women and racial minority groups, Steele (1997) saw stereotype threat as occurring in any group in which a negative stereotype exists (e.g., older adults, skateboarders).

## Effects of Stereotype threat on Test Performance

Levy and Langer (1994) were one of the first research teams to acknowledge the role of stereotypes on test performance. They found that Chinese and American deaf cultures do not adhere to the widely held North American belief of deteriorating memory in older individuals and these two cultures do not highlight the memory performance decrements in their elders. Levy and Langer (1994) used this stereotype to see whether a positive belief could influence test scores. Indeed, the researchers found that Chinese and

American deaf individuals outperformed “normal” elderly Americans on a number of memory tasks.  The beliefs about aging accounted for the majority of the variability in test performance.

In 1995, Steele and Aronson administered a series of difficult items from the verbal section of the Graduate Record Examination to black and white undergraduate students.  The students were assigned to one of three groups. Students in the “diagnostic” group were told that they were taking an intelligence test. Students in the “nondiagnostic-only” group were told that they were taking a problem-solving test for the experiment. The third group, the “nondiagnostic-challenge” group, was told that they were taking a problem-solving test that was also a challenge.  Black students in the diagnostic group performed significantly worse than their black counterparts in the nondiagnostic group, black students in the nondiagnostic-challenge group, and white students in the diagnostic group (Steele & Aronson, 1995). No differences between the groups were found for self-reported academic competence, personal worth, or disruptive thoughts or feelings during testing. This remarkable display of stereotype threat propelled interest in this area of research.

Studies on stereotype threat have also targeted how identification with a racial minority group may influence test performance. In an exploratory study looking at how racial stereotype threat affects test performance, researchers found that the high identification in a stereotyped group lowered test performance (Hollis-Sawyer & Sawyer, 2008). Specifically, Asian-Americans (who the authors suggest are stereotypically better at cognitive tasks) scored highest on cognitive testing, followed by White participants, Hispanics, and African-Americans. Stereotype threat worked in both a negative and positive direction, enhancing performance in groups that would stereotypically perform better. Inducing stereotype threat worked to lower scores of African-Americans and Hispanics, while enhancing the scores of Whites and Asian Americans. Performance was better overall when the participants were told that the measure was not diagnostic of general ability (Hollis-Sawyer & Sawyer, 2008).

Stereotype threat need not be a result of ingrained feelings of inferiority. Indeed, Aronson, et al. (1999) found that mere exposure to a stereotype that predicted underperformance for their group could be related to underperformance in that group. In their first study, the researchers administered Caucasian males with high scores on a standardized math test a very challenging math exam. In one condition, the participants were asked to read materials indicating that Asian students outperform Caucasian students in mathematical domains and that the purpose of this study is to understand the gap in performance between the races. The control condition was just told they were taking a math test. Participants in the stereotype threat condition had significantly lower test performance than the control group. Interestingly, no differences were found on measures of anxiety, times spent on items, or the self-reported difficulty of the items.

Stereotype threat research has also studied gender differences. Spencer, Steele, and Quinn (1997) tested the effect of negative stereotype threat on intellectual performance by testing its effect on the standardized math test performance of women who were strong in math. By calling attention to gender differences on math tests, the researchers were able to negatively influence women's test performance on a math exam.

In the second part of the study, the threat was lowered by describing the test as not producing gender differences, and performance decreases were not found.

## How Stereotype Threat Influences Performance

The gap between minority and the dominant cultures' achievement persists even in the middle and upper socioeconomic classes (Miller, 1995; 1996). There is no evidence to suggest that there are genuine group differences in skills (Ramist, Lewis, & McCamley-Jenkins, 1994; Benbow & Arjmand, 1990). Regardless of whether an individual consciously adopts the stereotype, exposure to a stigmatized environment can increase apprehension toward confirming a negative stereotype. If the apprehension is too great, cognitive performance may be impaired, ultimately confirming the stereotype (Steele & Aronson, 1995). Research has found several key factors that contribute to this sequence of events. A few notable factors include domain identification, defense mechanisms, affective and physiological processes, an increase in negative cognitions, and a compromise of necessary cognitive functioning.

**Domain Identification.** For the effects of stereotype threat to be successful, some researchers have posited that an individual must identify with the domain in which they are being tested. For example, Aronson et al. (1999) examined how identification with the task would affect the role of threat on performance.  The researchers induced stereotype threat by invoking a comparison of White and Asian students. White males in the experimental group were told that Asian students outperform White students in math. The control group was only told they would be taking a math test. Not only did the researchers demonstrate the effects of stereotype threat on test performance, with the White males performing more poorly than the Asian males, but they also found that the threat was in part mediated by domain identification. In other words, white males who were highly identified with their math performance were more susceptible to the effects of stereotype threat and high math-identified students performed less well on the test when the stereotype was mentioned.

**Defense Mechanisms.** In addition to domain identification, research has also suggested the influence of "disengagement" and "disidentification" as defense mechanisms that operate when an individual is exposed to a stigmatized environment (Corrigan & Holtzman, 2001; Steele, 1997; Spencer et al., 1999). The defense mechanism of disidentification acts to remove personal identity from the stigmatized environment in order to maintain self-esteem. In other words, an individual is able to remove the apprehension of negative evaluation by deidentifying themselves from the domain. Disengagement refers to a short-term, situational detachment from the environment (Corrigan & Holtzman, 2001). These two defense mechanisms may work together. For example, women who are vulnerable to the negative stereotype that women perform more poorly at math may disengage from participation in math-related environments, and instead identify with other academic domains (Corrigan & Holtzman, 2001; Spencer et al., 1999). These two processes may work to lower motivation in the domain and therefore, reduce performance (Corrigan & Holtzman, 2001; Spencer et al., 1999).

**Affective and Physiological Processes.** Steele (1997) postulated that stereotype threat works to produce an emotional reaction that does one of two things, 1) forces the individual to remove the domain as part of their self-identity, or 2) reduces the individuals' motivation to perform. Other research has revealed that individuals report feeling more anxious in stereotype threat situations (Marx & Stapel, 2006; Spencer et al., 1999). In a study examining the effects of stereotype threat on women's math performance, Spencer, Steele, & Quinn (1999) found that when women were told that they would be taking a math test shown to reveal gender differences in the past, they performed significantly worse than when they were told the test revealed no gender differences. They then examined the mediating effects of evaluation apprehension, self-efficacy, and anxiety on the relationship between the stereotype manipulation and test performance. They found no significant effects for evaluation apprehension or self-efficacy. However, when anxiety was controlled for, the effect of stereotype threat manipulation on test score was somewhat weakened and was no longer significant. In other words, anxiety was a potential mediator and may help explain how stereotype threat operates to reduce performance.

In addition to affective processes, some studies have examined physiological factors as contributing to performance decreases in stereotype threat conditions. Studies have found that physiological arousal (e.g. heart rate) is an important factor in understanding stereotype threat. Blascovich, Spencer, Quinn, and Steele (2001) examined the effect of stereotype threat on blood pressure reactivity. They found that African Americans who were exposed to stereotype threat exhibited larger increases in mean arterial blood pressure during an academic test and performed more poorly on test items than did European Americans and African Americans under little or no stereotype threat.

**Negative cognitions.** Studies examining cognitive processes have found that negative thoughts are heightened during stereotype threat (Keller & Dauenheimer, 2003; Cadinu, Maass, Rosabianca, & Kiesner, 2005). In one study, sixty female participants were randomly assigned to a stereotype-threat and no-threat condition and asked to complete a difficult math test (Cadinu, Maass, Rosabianca, & Kiesner, 2005). Women in the threat condition reported significantly more negative thoughts related to the test and to math compared to women in the no-threat condition. The researchers found that the number of negative thoughts mediated the relationship between the threat and test performance, with an increase in negative thoughts creating poorer test performance in the threat condition. Additionally, some research suggests that individuals' negative expectations regarding their test performance may explain the relationship between stereotype threat and performance (Cadinu, Mass, Frigerio, Impagliazzo, & Latinotti, 2003).

**Reduced cognitive ability.** Stereotype threat also appears to undermine the cognitive processes required for good performance on intellectual tasks. Research by Schmader and Johns (2003) suggests that individuals experiencing stereotype threat have a reduction in their working memory capacity, which hinders their performance on cognitive tasks. Other studies have suggested that the threat experience increases mental workload, or the perceived difficulty of the test (Croizet, Despres, Gauzins, Hugeut, & Leyens, 2004).

Research has also explored how the cognitive and affective processes work together to create the performance decrements seen in stereotype threat. Research by Johns, Inzlicht, and Schmader (2008) suggests that individuals engaged in the stereotype experience attempt to regulate their emotions, specifically anxiety, and that this effort reduces an individual's executive resources, resulting in underperformance. However, when the individuals were provided with skills to effectively cope with their negative emotions using cognitive reframing, individuals improved their test performance. This suggests that affective and cognitive processes are likely to interact to undermine performance when individuals are experiencing stereotype threat.

### Applying Stereotype Threat to a Key Neurological Population

Given that stereotype threat appears to operate in racial and gender groups, Kit, Tuokko, and Mateer (2008) suggest that it is important to explore whether or not it is operating in other stigmatized groups, such as neurological populations. Amongst neurological populations, Traumatic Brain Injury (TBI), and particularly mild Traumatic Brain Injury (mTBI), is an increasingly important population to study. A majority of all head injury cases involve persons sustaining mild Traumatic Brain Injury (Sosin, Sniezek, & Thurman, 1996; Cassidy et al., 2005). There are roughly 1.7 million TBIs annually, with seventy-five percent attributable to mTBI (Faul, Xu, Wald, & Coronado, 2010).

A mild Traumatic Brain Injury can result in neuropsychological deficits in the early period following the trauma. These deficits include reduced processing speed and problems with attention and memory (Levin, Eisenberg & Benton, 1989; Makdissi et al., 2001; Mathias, Beall, & Bigler, 2004). Other common symptoms following an mTBI include poor concentration, memory difficulty, irritability, headache, fatigue, depression, anxiety, dizziness, light sensitivity, and sound sensitivity. This cluster of symptoms is commonly referred to as the postconcussion syndrome (PCS; American Psychiatric Association, 1994; World Health Organization, 1992). However, mTBI is typically inconsequential in terms of long-term, clinically significant residual impairment (Binder, Rohling, & Larabee, 1997). Indeed, the biological mechanisms for mTBI are thought to largely disrupt, rather than kill, neural cells (Iverson, 2005). In a majority of mTBI cases, standard imaging (e.g. fMRI, CT) does not reveal abnormalities (Belanger, Vanderploeg, Curtiss, & Warden, 2007).

The Diagnostic and Statistical Manual-IV-TR (DSM-IV-TR; American Psychiatric Association, 2000) diagnostic criteria for postconcussive syndrome suggest that symptoms and observable changes in neuropsychological status should be present for a minimum of 3 months to qualify for a syndrome.  During acute recovery, lowered performance on working memory, attention, executive functioning, memory, and processing speed tasks may be found (Frencham et al., 2005).  However, the majority of available studies suggest that impairments on standardized neuropsychological tests are typically fully recovered by 3 months post-mTBI (Binder, Rohling, and Larabee, 1997; Dikmen, Temkin, & Armsden, 1989).  Overall, the long-term effects of mTBI are typically inconsequential and the majority of patients make full recoveries.

**Causes of Post-mTBI Cognitive Complaints**

Given that a majority of mTBI patients recover quickly, why do a minority of mTBI patients continue to report problems (Ruff, 2005)? It may be that individuals who have psychopathology or other non-neurological injuries report similar symptoms. Symptoms found in mTBI exist in high base rates even in those never experiencing a brain injury, such as depressed, orthopedic injury, sleep disordered, or chronic pain populations (Lees-Haley & Brown, 1993; Rizzo & Tranel, 1996). Symptoms similar to mTBI are often reported in individuals with a history of substance abuse (Rimel, Giordani, Barth, Boll, & Jane, 1981), individuals who are seeking monetary compensation (Cook, 1972; McKinlay, Brooks, & Bond, 1983), and in cases of malingering (Binder & Rohling, 1996; Green, Rohling, Lees-Haley & Allen, 2001).

**Expectation as etiology.** Research also suggests experiencing an mTBI may activate commonly held expectations about the symptoms of head trauma. When asked to imagine having suffered a concussion in an automobile accident, individuals who had never actually sustained a head injury reported expectations for a cluster of symptoms virtually identical to those reported by concussed patients with PCS (Mittenberg, DiGiulio, Perrin, & Bass, 1992). An affective, somatic, and memory checklist of symptoms was administered to participants who had no history of head injury and subjects indicated their current experiences of symptoms. They were then asked to imagine having sustained a mild head injury in a motor vehicle accident. When given the same checklist again, they endorsed symptoms they expected to experience six months after the injury. The checklist was also administered to a group of patients with head injuries. The symptoms described by the imaginary head injury group were nearly identical to the postconcussion syndrome reported by the patients with head injury. In other words, although we assume that cerebral dysfunction is at the heart of experiencing postconcussive symptoms, the expectation of symptoms is another reason why individuals may experience these symptoms. Researchers have found that expectations may produce selective attention to these symptoms following injury and that individuals with mTBI tend to overestimate postconcussion symptom change in a manner consistent with their symptom expectations (Ferguson, Mittenberg, Barone, & Schneider, 1999).

Indeed, Mittenberg et al. (1992) found that when asked to estimate symptoms experienced before concussion, mTBI participants reported having significantly fewer symptoms than the control participants' reported base rate. In effect, by underestimating the degree of premorbid symptom experience, mTBI participants overestimated the degree of change in symptoms pre- to postinjury.

**The "good old days" bias.** The "good old days" bias is the tendency to see the past as "better than the present" (Gunstad & Suhr, 2001) and is not limited to a postconcussive population. Gunstad and Suhr (2004) apply this bias to a PCS population, stating that, "given that PCS symptoms are relatively non-specific, any negative event may result in report of more current PCS symptoms and fewer PCS symptoms in the past" (p. 392). For example, head injured athletes in one study reported significantly fewer premorbid PCS symptoms than current symptoms, suggesting that after experiencing a negative event, the individual is more likely to see premorbid situations and experiences as "better" than the present (Gunstad & Suhr, 2001). Iverson et al. (2010) also found that head injured patients reported significantly more post-injury symptoms compared to pre-injury reports and their premorbid symptom ratings were significantly lower than the control group. This demonstrates a critical underestimation of preexisiting symptoms and supports the idea that mTBI patients are likely to overestimate the effect of their injury on current symptoms.

**Nocebo Effect.** This is not to say that individuals fabricate their symptoms following a head injury. Cognitive problems continue to exist in the absence of intentionality. The nocebo effect suggests that if someone expects to perform poorly in a specific area of cognitive functioning they may actually develop these symptoms (Bootzin & Bailey, 2005; Hahn, 1997 & 1999; Mittenberg, Digiulio, Perrin, & Bass, 1992). Additionally, the expectation of threat may decrease an individuals' effort, leading to poorer test performance (Stone, 2002).

**Stereotype Threat in Neurological Populations: Introduction to Diagnosis threat**

Kit, Tuokko, and Mateer (2008) suggested that the application of stereotype threat to the neurological population is an important area of future research. In the earliest application of stereotype threat within the neurological arena, Suhr and Gunstad (2002; 2005) referred to the phenomenon as "diagnosis threat" and hypothesized that if having sustained an mTBI is made salient, then that person will perform in stereotyped ways consistent with that diagnosis.

Suhr and Gunstad (2002) randomly assigned a group of individuals with a history of head injury to either an experimental or a control group. Participants in the experimental group were informed that they were being assessed due to a history of mTBI. Participants in the control group were given neutral instructions that did not call attention to their history of mTBI. The researchers found that participants who had their history of mTBI made salient performed significantly worse on tests measuring general intellect and memory than participants in the control group.

Suhr and Gunstad (2005) replicated their previous study and found that the diagnosis threat group performed significantly more poorly than controls on tests of attention and working memory, psychomotor speed, and memory tasks. However, the groups did not differ on measures of executive functioning, post-test anxiety, or effort. In this study, they were also interested in how effort, anxiety, and depression might be related to differences in performance. However, no significant results were found, suggesting that these factors were not playing a significant role in the stereotype threat experience. Overall, these studies suggest that the presence of diagnosis threat is sufficient to negatively influence test performance regardless of effort, anxiety, and depression.

Another piece of research did not reveal significant performance decrements in a diagnosis threat design. In a study by Ozen and Fernandes (2011), half of the participants reported a history of head injury and half of the participants did not ("neutrals"). The two groups were further broken into diagnosis threat and control conditions. Individuals in the diagnosis threat condition performed worse only on one task of attention span, reported more attention failures than diagnosis threat controls or of head injury neutrals, and more memory failures compared to diagnosis threat controls. The researchers concluded that diagnosis threat may contribute to the prevalence and persistence of cognitive complaints, but may not have a strong effect on neuropsychological performance.

In conclusion, a small literature on diagnosis threat exists supporting the conclusion that individuals with a history of mTBI perform worse on neuropsychological tests when exposed to diagnosis threat. However, a follow-up study revealed that diagnosis threat worked only to alter self-report of symptoms and did not decrease neuropsychological performance. Given the inconsistent findings related to diagnosis threat, the purpose of the current study is to clarify the findings of Suhr and Gunstad (2002) to determine if the effects of diagnosis threat on neuropsychological performance can be reproduced in another sample.

## Hypotheses

1) Participants who were given test directions that call attention to the possible neurocognitive effects of their mTBI (Diagnosis Threat group) would perform significantly worse on tests of Memory (CVLT-II immediate recall, CVLT-II delayed recall) than participants who were given neutral test directions (Control group).

2) Participants in the Diagnosis Threat group would perform significantly worse on tests of Verbal and Visuospatial Ability (WAIS-III Information, WAIS-III Block Design) than participants who were in the Control group.

3) Participants in the Diagnosis Threat group would perform significantly worse on tests of Attention and Working Memory (WAIS-III Digit Span, WAIS-III Letter-Number Sequencing) than the Control group.

4) Participants in the Diagnosis Threat group would perform significantly worse on tests of Psychomotor Speed (WAIS-III Digit-Symbol Coding, TMT speed on Part A, TMT speed on Part B) than the Control group.

5) Participants in the Diagnosis Threat group would rate the effort they put forth on the tests as significantly less than participants in the Control group.

6) Participants in the Diagnosis Threat group would rate the tests as significantly more difficult than participants in the Control group.

7) Participants in the Diagnosis Threat group would report experiencing significantly more pressure during testing than the Control group.

8) Participants in the Diagnosis Threat group would report significantly lower confidence in their performance than the Control group.

9) Participants in the Diagnosis Threat group would report that they performed significantly worse than participants in the Control group.

10) Participants in the Diagnosis Threat group would have a significantly lower total score on the Academic Self-Efficacy Questionnaire.

## Method

### Participants

Over 2000 undergraduates at a Northwestern university enrolled in Introductory Psychology completed a screening evaluation. All participants received research credits required for their psychology classes or extra credit in exchange for participation in the study. The screening evaluation included a health history questionnaire that screened for psychiatric disorders, substance abuse, and neurological conditions other than head injury. It also included a head injury questionnaire (adapted from Suhr & Gunstad, 2002). Participants with a history of self-reported mild head injury (with loss of consciousness no less than one minute but no more than 30 minutes) with no symptoms suggestive of a mood disorder or neurological impairment were selected to participate in the study. Individuals who met criteria were then contacted by phone and asked to participate in the study. All participants were administered a series of standard neuropsychological tests in addition to self-report questionnaires.

A total of 54 subjects participated in the research. Five participants were excluded from the study after failing to meet inclusion criteria on the alcohol and drug questionnaire or on the depression measure. Of the 49 remaining participants, 21 were male (42.9%) and 28 were female (57.1%). Forty-five participants (91.8%) of the sample identified themselves as Caucasian/White, 2 (4.1%) as American Indian/Alaskan Native, 1 (2%) as African Origin, and 1 (2%) as Other. Participants ranged in age from 18-37, with an average age of 22.14 and a median age of 18 (30.6%). The mean number of completed years of education was 12.73 with a standard deviation of 1.01 years.

## Materials

***Medical and Health Questionnaire***. A medical and health history questionnaire was used to assess the participants' history of psychological, neurological, and substance abuse problems during the initial screening period. If participants endorsed any neurological or psychological problem other than a mild Traumatic Brain Injury, they were excluded from the study (Appendix A).

***Drug and Alcohol Questionnaire*.** A 33-question yes-or-no Drug and Alcohol Questionnaire was used to determine if participants met criteria for a drug or alcohol abuse problem. Participants were eligible to participate if they scored an 11 or below on the questionnaire (Appendix B).

***Head Injury Questionnaire*.** A head injury questionnaire was used to determine if individuals had a history of head injury (Adapted from Suhr and Gunstad, 2002). Participants were eligible to participate in the study if they endorsed a blow to the head in which they were unconscious for more than one minute but less than 30 minutes. Additionally, the questionnaire assessed for the presence and length of posttrauma amnesia (Appendix C).

***Patient Health Questionnaire*.** Self-reported depression was assessed using the Patient Health Questionnaire (PHQ-8). The PHQ-8 is an eight-item questionnaire that assesses symptoms of depression. Depression was assessed using a Likert-type scale asking individuals how often they have been bothered by symptoms of depression over the last 2 weeks (e.g. "Feeling down, depressed, or hopeless"), ranging from 0 (Not at all) to 3 (Nearly every day). Participants who received a score of 10 or above on the PHQ-8 were not included in the study. The PHQ-9 has a sensitivity of 88% and a specificity of 88% for major depression (Spitzer et al., 2000). In the current study, the PHQ-8 was used, which included all items from the PHQ-9 except for the 9$^{th}$ item about suicidal ideation. According to the authors of the PHQ-9, from which the PHQ-8 is obtained, the 9$^{th}$ item may be eliminated when used to assess depressive symptoms in persons with medical or nonpsychiatric conditions (Kroenke & Spitzer, 2001). Self-report anxiety was assessed using a Likert-type scale asking individuals how much pressure they experienced during testing, ranging from 1 (no pressure) to 9 (very much pressure) (Suhr and Gunstad, 2002 ; Appendix D).

***Neuropsychological measures.*** Attention and working memory was assessed using the total raw scores from the Digit Span and Letter-Number Sequencing subtests of the Wechsler Adult Intelligence Scale-III (WAIS-III; Wechsler, 1992). Psychomotor speed and executive functioning was assessed using the total number correct on the Digit Symbol subtest of the WAIS-III and the seconds it took to complete the Trail Making Test part A and B (TMT; Reitan, 1971). Verbal and Visuospatial ability was assessed using the total raw scores on Information and Block Design subtests of the WAIS-III. Auditory verbal learning was assessed using the total words from immediate recall and delayed recall scores on the California Verbal Learning Test-II (CVLT-II; Delis, Kramer, Kaplan, & Ober, 2000).

***Effort measures***. Effort was assessed by asking individuals how hard they tried on the cognitive tests from 1 (not at all) to 9 (very hard) on the Manipulation Check Questionnaire (MCQ; Appendix D). Participants were also administered the TOMM. The TOMM is a 50-item, two-alternative, forced-choice measure of client effort during neuropsychological assessment. Individuals who scored below a 44 on Trial 2 of the TOMM were said to have given inadequate effort and were not included in the analyses.

***Manipulation Check Questionnaire (MCQ).*** After completing the neuropsychological measures, participants were given the MCQ. Designed as a "manipulation check," the MCQ contained six questions designed to make certain all participants included in this study's analysis were able to recall why they were selected to participate in this study. Participants in the Diagnosis Threat group who did not report that their participation was based on their history of head injury were excluded from the analyses. On this questionnaire, participants rated how much effort they put into completing the tasks, how difficult they thought the tasks were, how confident they were in their performance, and how well they thought they did on tasks using a 9-point scale (adapted from Aronson et al., 1999 by Suhr and Gunstad, 2002) (Appendix E).

***Academic Self-Efficacy Questionnaire (ASEQ).*** *An academic self-efficacy questionnaire was used to assess participants' beliefs about their academic ability and performance (adapted from the College Academic Self-Efficacy Scale (CASES), Owen & Froman, 1988). The questionnaire contains 18 items that assesses how much confidence the participants have in their academic behavior (e.g. Paying attention to class discussion) on a Likert-type scale ranging from 1 (Very Little Confidence) to 5 (Quite Confident). Cronbach's alpha (an estimate of internal consistency) was .94 for the present study. Test-retest reliability coefficient of the original CASES over an 8-week period was r = +0.85 (Carifio & Rhodes, 2002). Test-retest reliability estimates for the current study are unknown (Appendix F).*

## Procedure

Participants were asked to read and sign the informed consent. They were then administered the PHQ-8 and the Drug and Alcohol Questionnaire. Participants were given an envelope containing instructions that determined their group assignment. The instructions were taken from Suhr and Gunstad (2002). Half of the participants were randomly assigned to the Diagnosis Threat group and half were randomly assigned to the

Control group. Those randomly assigned to the Control group received the following instructions:

> When the experimenter returns to the room, s/he will ask you to complete a brief collection of common neuropsychological tests. These tests will assess skills such as attention, memory, speed of information processing, problem solving skills, etc. Some of the tests are easy, some are more difficult. Please give your best effort. Questions about individual tests will be answered following the testing.

Participants randomly assigned to the Diagnosis Threat group received the following instructions:

> You have been invited to participate in this study because of your responses to one of the questionnaire included in this study. Your responses indicated a history of head injury/concussion. A growing number of neuropsychological studies find that many individuals with head injuries/concussion who have cognitive deficits on neuropsychological tests. Deficits in areas such as attention, memory, and speed of information processing are common – though other deficits sometimes emerge. This study examines the role that head injury may play in these cognitive areas to better understand the nature of the disorder.
>
> When the experimenter returns to the room, s/he will ask you to complete a brief collection of common neuropsychological tests. These tests will assess skills such as attention, memory, speed of information processing, problem solving skills, etc. Some of the tests are easy, some are more difficult. Please give your

best effort. Questions about individual tests will be answered following the testing.

Following the scenario, all participants were then administered the Academic Self-Efficacy Questionnaire. All participants were then administered a brief neuropsychological battery that included tests of memory, attention, psychomotor speed, executive functioning, verbal and visuospatial ability, and effort. The order of the battery was as follows: CVLT-II immediate recall, Information, Digit-Symbol Coding, Trails A & B, CVLT-II 20 minute delay, Digit Span, Block Design, L-N Sequencing, and TOMM.

Participants were given the Manipulation Check Questionnaire to determine that they understood the instructions and provided adequate effort. Participants were then debriefed. The examiner explained to each participant that the study was designed to examine whether or not drawing their attention to their previous head injury influenced their performance on cognitive tasks. It was explained that previous research suggests that even individuals who do not have neuropsychological impairment may perform more poorly simply due to an awareness of their head injury. They were given the name and number of the primary investigator on the study as well as the faculty supervisor should they have questions or concerns regarding the experiment (See Appendix G).

# Results

## Power

A priori power analysis for MANOVA revealed that to obtain adequate power (1-$\beta$ err prob = 0.95) assuming an effect size of .3, a total sample size of 46 participants was needed. A total of 49 participants were included in analyses.

## Demographic Information

A total sample size of 54 undergraduate students completed the questionnaires and neuropsychological measures. Three participants were excluded for exceeding the cutoff score on the PHQ-8 and 2 participants were excluded for exceeding the cutoff score on the Drug and Alcohol Questionnaire. Forty-nine participants were included in the analyses. Demographic information appears in Table 1. Chi-square analysis for gender revealed no significant gender differences between the two groups, $\chi^2$ (1, *N* = 49) = 0.170, $p>.05$. Group differences for Age and Education were analyzed using two separate one-way ANOVAs. There was no significant different found for Age, $F(1, 47) = 3.07$, $p>.05$ or Education, $F(1, 47) = 0.452$, $p>.05$. No participants included in the analyses had a current psychiatric illness, substance abuse issue, or a neurological condition other than a history of mTBI. All participants reported a history of one mild head injury, with loss of consciousness greater than 1 minute but no longer than 30 minutes.

Table 1. Demographic Characteristics of the Study Groups.

| Variable | Diagnosis Threat Group<br>N= 25 | Control Group<br>N= 24 |
|---|---|---|
| | *M* (SD) | *M* (SD) |
| Age | 23.72 (8.25) | 20.50 (3.67) |
| Education | 12.83 (1.13) | 12.63 (1.01) |

| | Percent | Percent |
|---|---|---|
| Male | 40 | 45.8 |

**Performance on Neuropsychological Measures**

***Memory***. Memory was analyzed using the CVLT-II. The means and standard deviations for the total number of words from immediate recall and delayed recall is presented in Table 2. To analyze the data, a MANOVA, with group status as the between groups measure and CVLT-II immediate recall total score and delayed recall score as the dependent variables was used. Individuals in the Diagnosis Threat group did not perform significantly different than individuals in the Control group on Memory. Group differences on Memory were not significant, $F(2, 46) = .754$, $p>.05$ (*partial eta = .03*).

***Verbal and Visuospatial Ability***. Verbal and Visuospatial ability was analyzed using the WAIS-III Information and Block Design subtests. The means and standard deviations for the WAIS-III subtest scaled scores are presented in Table 2. To analyze the data, a MANOVA was used. The group status was used as the between groups measure and the subtest raw scores (Information and Block Design) were the dependent variables. The Diagnosis Threat group performed significantly more poorly on Verbal and Visualspatial Ability compared to the Control group, $F(2, 46) = 5.37$, $p =.003$ (*Partial Eta Squared =0.19*). However, the Between-Subjects Effects reveal that the significant differences exist only on the Information (Verbal ability) subtest, $F(1, 47) = 10. 02$, $p = .003$ (*Partial Eta Squared = 0.18*), and not on the Block Design (Visuospatial ability) subtest, $F(1, 47) = 0.42$, $p>.05$ (*Partial Eta Squared = 0.01*). In other words, participants in the Diagnosis

Threat group performed significantly more poorly on a test of Verbal ability compared to the Control group, but the two groups did not perform significantly different on Visuospatial ability.

***Attention/Working Memory***. Attention and Working Memory were analyzed using the WAIS-II Digit Span and Letter Number Sequencing subtests. The means and standard deviations for the WAIS-III subtest raw scores are in Table 2. To analyze the data, a MANOVA was used. The group status was used as the between groups measure and the subtest raw scores (Digit Span and Letter Number Sequencing) were the dependent variables. The Diagnosis Threat group and the Control group did not differ significantly on Attention/Working Memory, $F(2, 46) = 0.581$, $p>.05$ (*Partial Eta Squared = .03*). Contrary to hypotheses, the two groups did not differ significantly on their Attention/Working Memory performance.

***Psychomotor Speed.*** Psychomotor speed was assessed using the TMT A & B and the Digit Symbol-Coding subtest of the WAIS-III. The means and standard deviations for the Digit Symbol-Coding raw scores and the TMT seconds to complete Trail A and Trail B are presented in Table 2. To analyze the data, a MANOVA was used. The group status was used as the between groups measure and the seconds to complete each Trail and the raw scores of Digit-Symbol Coding were the dependent variables. The Diagnosis Threat group and the Control group did not differ significantly on Psychomotor Speed, $F(3, 45) = 0.38$, $p>.05$ (*Partial Eta Squared =.07*).

Table 2. Performance on Neuropsychological Tests by Study Groups

| Neuropsychological Tests by Domain | Diagnosis Threat Group<br>N= 25<br>*M* (SD) | Control Group<br>N= 24<br>*M* (SD) |
|---|---|---|

| | | |
|---|---|---|
| Memory | | |
| CVLT-II immediate recall (of 75) | 57.84 (9.50) | 56.17 (8.58) |
| CVLT-II delayed recall (of 15) | 12.72 (2.34) | 11.92 (2.50) |
| Verbal/Visuospatial Ability | | |
| WAIS-III Information* | 15.52 (5.30) | 19.37 (2.80) |
| WAIS-III Block Design | 48.24 (10.15) | 50.13 (10.13) |
| Attention/Working Memory | | |
| WAIS-III Digit Span | 17.08 (4.06) | 18.13 (4.07) |
| WAIS-III L-N Sequencing | 11.44 (2.80) | 12.17 (1.97) |
| Psychomotor Speed | | |
| WAIS-III Digit-Symbol Coding | 78.76 (9.23) | 81.12 (11.66) |
| TMT speed on Part A | 27.41 (10.57) | 24.10 (10.70) |
| TMT speed on Part B | 58.71 (16.72) | 50.36 (18.18) |

*Note*. CVLT-II=California Verbal Learning Test-II. WAIS-III=Wechsler Adult Intelligence Scale-III. TMT=Trailmaking Test. * = differences exist between the two groups at *p*<05.

**Academic Self-Efficacy Questionnaire**

It was hypothesized that the Diagnosis Threat group would self-report significantly lower academic self-efficacy compared to the Control group. An independent sample's *t*-test revealed that the Diagnosis Threat group had a significantly lower total score on the Academic Self-Efficacy Scale compared to the Control group, $t$ (47) = -2.97, $p$ = .005 (*Cohen's d =0.85;* large effect; Table 3).

Table 3. Academic Self-Efficacy by Study Groups

| | Diagnosis Threat Group N= 25 *M* (SD) | Control Group N= 24 *M* (SD) | *t* |
|---|---|---|---|
| Academic Self-Efficacy Questionnaire Total Score | 58.48 (14.5) | 68.79 (9.08) | -2.967* |

*= $p < .01$

## Ratings on the Manipulation Check Questionnaire

Independent sample *t*-tests were used to assess whether participants in the Diagnosis Threat group differed from the Control group on how difficult they found the tests to be, how much pressure they felt during testing, confidence in their performance, and how well they performed on the tests. Participants in the Diagnosis Threat group did not differ from the Control group on how difficult they found the tests to be, $t(47) = -0.01$, $p>.05$, how much pressure they felt during testing, $t(47) = 0.52$, $p>.05$, confidence in their performance, $t(47) = -0.62$, $p>.05$, or how well they believed they performed on the tests, $t(47) = -.046$, $p>.05$. Overall, the Diagnosis Threat group and the Control group did not differ on their self-report answers and did not perceive the testing experience differently (Table 4).

Table 4. Posttest Self-Report Ratings on the MCQ by Study Groups.

| Self-Rating | Diagnosis Threat Group<br>N= 25<br>*M* (SD) | Control Group<br>N= 24<br>*M* (SD) |
|---|---|---|
| How difficult tests were (high=difficult) | 6.08 (1.22) | 6.08 (1.24) |
| How much pressure felt (high=more) | 4.72 (2.07) | 4.42 (2.04) |
| Confidence in performance (high=confident) | 6.24 (1.23) | 6.46 (1.25) |
| How well they felt they performed (high = good performance) | 6.12 (1.01) | 6.25 (0.99) |

## Performance on Effort Measures

***Test of Memory Malingering (TOMM).*** An independent samples t-test, with the group status as the between groups measure and the Trial 2 score as the within groups measure, was used to analyze the data. Performance on the TOMM did not differ between groups. A t-test revealed no significant differences between the Diagnosis Threat group and the Control group on Effort, $t$ (47) = -0.91, $p$>.05. Means and standard deviations for the two groups on the TOMM Trial 2 are shown in Table 5.

***Self-report of effort***. An independent samples *t*-test was used to determine if participants in the Diagnosis Threat group rated themselves as putting forth less effort on the tasks (MCQ question 2). Table 5 displays the means and standard deviations of the self-report of error for both groups. Participants in the Diagnosis Threat group did not differ significantly on their self-reported effort compared to participants in the Control group, $t$(47) = 0.37, $p>.05$. Overall, participants in the Diagnosis Threat group did not put forth less effort or report that they put forth less effort than the Control group.

Table 5. Effort by Study Groups.

| Effort Measure | Diagnosis Threat Group<br>N= 25<br>*M* (SD) | Control Group<br>N= 24<br>*M* (SD) |
|---|---|---|
| TOMM Trail 2 scores | 48.76 (5.99) | 49.87 (0.45) |
| Self-report effort (high=more effort) | 8.40 (0.764) | 8.12 (1.04) |

## Discussion

The concept of diagnosis threat proposes that calling attention to a participant's history of head injury will result in actual decrement on standardized cognitive measures (Suhr & Gunstad, 2002). The effect of negative expectancies on self-reported symptoms following mild TBI has been demonstrated in several studies (e.g., Ferguson, Mittenberg, Barone, & Schneider, 1999; Mittenberg, DiGuilio, Perrin, & Bass, 1992). The current study was designed to expand the literature by examining the effects of both negative expectancy and diagnosis threat on both self-reported performance and on actual neuropsychological test performance in a high-functioning group of university undergraduate students with histories of mTBI.

It was hypothesized that participants assigned to a Diagnosis Threat group would perform significantly worse on neuropsychological measures when compared with a Control group. Neurocognitive measures included tests sensitive to verbal and visuospatial ability, immediate and delayed recall, attention and working memory, and psychomotor speed. Exposure to a reminder of a previous self-reported head injury constituted the Diagnosis Threat condition, in keeping with Suhr and Gunstad's proposal that making salient a participant's history of head injury produced a decrement in their performance on cognitive measures.

The current study did not reveal evidence that the Diagnosis Threat condition reduced actual neuropsychological test performance. Indeed, participants in the Diagnosis Threat condition and in the control condition performed similarly on all cognitive measures, except on a test of general information. Given that the test is very robust in the presence of mTBI, the finding might represent a statistically spurious result, and the effect size was only small to moderate. However, poor performance on a test robust to neurological insult may be an extremely interesting result, suggesting that something about the Information subtest may elicit diagnosis threat based on the nature of the subtest (e.g. asking questions specific to the culture, questions about prominent figures of a certain racial identity).

The results of the current study are consistent with results of Ozen and Fernandes (2011) who found no neuropsychological differences when comparing a diagnosis threat group and a neutral group, Ozen and Fernandes (2011) did find, however, that participants in the diagnosis threat group were more likely to report memory difficulties. As in Ozen and Fernandes' study and in the current study, Salazar (2011) failed to detect a diagnosis threat effect on cognitive performance in a study with similar conditions. On the other hand, Salazar found that the presence of complaints was related to decreased performance. That is, it was not a history of actual mTBI that determined performance but, rather, self-perception of deficits independent of whether or not a consussion had been sustained.

Additionally, the current study hypothesized that participants in the Diagnosis Threat condition would report that test tasks were more difficult, would experience greater performance pressure, would be less confident in the adequacy of their performance, as well as believe they performed at a lower level than participants in the Control condition. Contrary to the hypothesis, the Diagnosis Threat condition did not produce significant differences in their experience of testing when compared to the control condition. However, the research by Ozen and Fernandes (2011) found that participants reported greater self-perceived memory dysfunction, suggesting that although test performance is not affected, diagnosis threat may affect self-perception.

Interestingly, while there was no observed decrement in performance on formal testing among participants in the Diagnosis Threat condition, there was an observed relationship between the Diagnosis Threat condition and self-perceived cognitive problems. There were significantly lower academic self-efficacy ratings in the Diagnosis Threat participants, suggesting that diagnosis threat might depress confidence and estimation of achievement. The findings were consistent with those of Ozen and Fernandes and with Salazar who also found that symptom reports increased when exposed to diagnosis threat. The disparity created by diagnosis threat between beliefs about performance and actual performance is an important piece of information to add to our understanding of this new research area. In future research it would be interesting to have both a symptom complaint questionnaire as well as an academic self-efficacy questionnaire to examine how the two are related.-

The current research is important because, when coupled with previous research, it did not confirm proposals that diagnosis threat affects actual neurocognitive test performance. If diagnosis threat were a potent phenomenon, affecting actual test performance, the validity of neurocognitive assessment might be called into question. Moreover, there was no measured difference between the Diagnosis Threat and Control conditions on formal effort testing. Consequently, diagnosis threat might affect participant's perception of their performance, both during testing and in their lives, in general, without affecting assessment of their levels of cognitive performance when subjected to formal neuropsychological evaluation. As self-report is a common method of communication to both medical and mental health professionals, an individual's self-perception of their performance may indeed be a crucial component of treatment.

**Limitations.** The current study might have been affected by unexamined temporal gradients with respect to the time between the reported concussive insult and testing. Diagnosis threat might be a more cogent variable if assessment occurs closer to the time of injury. Future studies would do well to include a measure of when the reported head injury occurred to see if length of time since injury plays a role in diagnosis threat. It may also be interesting to record the number of concussive injuries the person has sustained to determine if number of injuries increases the presence of diagnosis threat. Moreover, the severity of injury was not taken into account in the current study, and Salazar (2011) found that loss of consciousness attending the injury versus an absence of loss of consciousness resulted in performance differences. Whether the difference is due to diagnosis threat or to actual cognitive impairment remains to be investigated. Time since injury, severity of injury, and frequency of injury may contribute to identification with the diagnosis as well as overall performance in a diagnosis threat condition.

The extent to which a diagnosis of an mTBI is important to the participant was unexamined. The participants in the current study were functioning well, socially and academically. The saliency of a diagnosis might affect actual test performance, particularly in a clinical setting and, even more importantly, in a clinical setting in which litigation or other potential social reinforcement of the brain injured role is present. Consequently, studies in clinical settings might result in different results. Research (e.g., Aronson, et al., 1999) suggested that identification with the task affects the role of threat on performance. Steele (1997) emphasizes the importance of domain identification in eliciting anxiety, apprehension, and cognitive deficits. The current study could have been strengthened by determining the degree to which participants were identified with his/her performance on a specific cognitive measure or with the diagnosis of head injury itself. The relatively high functioning college student group may not identify with concussion or cognitive impairment. Mere identification as a college student might reduce their susceptibility to diagnosis threat, inasmuch as they have demonstrated cognitive competence.

Finally, use of a control group with no history of mTBI might be considered. The presence of a non-injured control group might allow us to compare performance of a diagnosis threat mTBI group, a neutral mTBI group, and a control non-mTBI group.-

**Conclusion.** The current study serves as a replication of previous work by Suhr and Gunstad (2002). The concept of diagnosis threat was developed in the laboratory, and it is only in this laboratory setting that support for actual performance decrements has been found. Moreover, Knud and Neuliep (1996) argue that research should not be accepted until it has been verified by multiple replications, adding that there is practically no literal replication work being done or at least published. Shapin and Schaffer (1985) describe replication as "…the set of technologies which transforms what counts as belief into what counts as knowledge" (p. 105), and Schmidt (2009) calls the absence of replication a "blind spot in the social sciences' tool box" and recommends that the field be more explicit and intentional about production of replication studies (p. 99). Currently, research in the field of psychology places value chiefly on significant results, which may compromise the number of published replication studies in which the results are nonsignificant. However, the findings of the present study, although nonsignficant, contain potentially important implications regarding the potency of diagnosis threat.

The findings of this study suggest that simply making an individual's history of head injury salient is insufficient to affect performance on neuropsychological measures, despite previous research by Suhr and Gunstad (2002; 2005), which found that exposure to a diagnosis threat condition significantly decreased participants' test scores. Given inconsistent findings, further research in this area is needed. Ultimately, diagnosis threat may not be a significant factor in cognitive performance, suggesting that neuropsychological test scores remain robust to the effects of diagnosis threat. Diagnosis threat appears to influence an individual's self-perception of abilities without compromising their test performance. Previous research thus far has only included self-report measures related to participants' perceptions of their performance on the study testing experience. Ozen and Fernandes (2011) were the first to reveal that the impact of diagnosis threat may be in self-report differences, and they concluded that diagnosis threat may be related to cognitive complaints rather than to neuropsychological performance. The current study is the first research in this area to look specifically at the influence of diagnosis threat on participants' overall self-perception (i.e. academic self-efficacy). The findings of this study help elucidate how diagnosis threat operates in a mild Traumatic Brain Injury population and suggests that diagnosis threat impacts a person's self-perception, although it does not appear to affect test performance. Despite the current findings, it remains important for clinicians and researchers to be mindful of potential diagnosis threat when providing diagnoses, administering cognitive tests, and when interpreting findings.

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# APPENDIX A

Medical History Form

*PLEASE FILL OUT THIS MEDICAL AND HEALTH HISTORY QUESTIONNAIRE*
Date________ Age__________ Sex ________ Ethnicity________________ GPA _________

Were there any known difficulties with your birth? Yes No
If yes, describe___________________________________________________________________

## Education

Did you ever have to repeat any grades? Yes No
Were you ever placed in special education classes? Yes No

What is the highest grade you have <u>completed</u>? ______
(e.g., if you are a college freshman you have completed 12 yrs. of ed.)

## Medical and Health History

| | Yes | No |
|---|---|---|
| 1. Have you ever been diagnosed with any neurological condition? | ___ | ___ |

If so, please indicate what type:
Brain/head injury ________
Other (please specify): ________________________

2. Are you currently receiving services from Disability Services For Students (DSS)? ___ ___

   If so, please indicate for what reason(s) you receive services:
   ____________________________________________________

3. Are you currently experiencing significant problems with your mood (anxiety and/or depression) or any other psychiatric condition? ___ ___
   If so, please list: ______________________________________

4. Are you currently receiving treatment for your mood (anxiety and/or depression) or any other psychiatric condition? ___ ___

5. Have you ever felt you should cut down on your drinking/drug use? ___ ___

6. Have you ever been annoyed by people that criticize your drinking/drug use? ___ ___

7. Have you felt bad or guilty about your drinking or drug use? ___ ___

8. Have you ever had a drink first thing in the morning to steady your nerves or to get rid of a hangover? ___ ___

9. Do you often drive under the influence of alcohol/drugs? ___ ___

## APPENDIX B

**Drug and Alcohol Questionnaire**

**Directions**: The following questions concern information about your involvement with drugs and alcohol. Drug abuse refers to (1) the use of prescribed or "over-the-counter" drugs in excess of the directions, and (2) any non-medical use of drugs. **Consider the past year** (12 months) and carefully read each statement. Please be sure to answer every question by circling YES or NO.

| | | |
|---|---|---|
| 1. Have you used drugs other than those required for medical reasons? | YES | NO |
| Have you abused prescription drugs? | YES | NO |
| Do you abuse more than one drug at a time? | YES | NO |
| Can you get through the week without using drugs (other than those required for medical reasons)? | YES | NO |
| Are you always able to stop using drugs when you want to? | YES | NO |
| Do you abuse drugs on a continuous basis? | YES | NO |
| Do you try to limit your drug use to certain situations? | YES | NO |
| Have you had "blackouts" or "flashbacks" as a result of drug use? | YES | NO |
| Do you ever feel bad or guilty about your drug/alcohol abuse? | YES | NO |
| Does near relative or close friend ever worry or complain about your involvement with drugs/alcohol? | YES | NO |
| Do your friends or relatives know or suspect you abuse drugs? | YES | NO |
| Has drug/alcohol abuse ever created problems between you and a near relative or close friend? | YES | NO |
| | | |

| | | | |
|---|---|---|---|
| | Has any family member ever sought help for problems related to your drug/alcohol use? | YES | NO |
| | Have you ever lost friends because of your use of drugs/alcohol? | YES | NO |
| | Have you ever neglected your family or missed work because of your use of drugs/alcohol? | YES | NO |
| | Have you ever been in trouble at work because of drug/alcohol abuse? | YES | NO |
| | Have you ever lost a job because of drug/alcohol abuse? | YES | NO |
| | Have you gotten into physical fights when under the influence of drugs/alcohol? | YES | NO |
| | Have you ever been arrested, even for a few hours, because of unusual behavior while under the influence of drugs/alcohol? | YES | NO |
| | Have you ever been arrested more than once for driving while under the influence of drugs/alcohol? | YES | NO |
| | Have you engaged in illegal activities in order to obtain drug? | YES | NO |
| | Have you ever been arrested for possession of illegal drugs? | YES | NO |
| | Have you ever experienced withdrawal symptoms as a result of heavy drug intake? | YES | NO |
| | Have you had medical problems as a result of your drug/alcohol use (e.g., memory loss, hepatitis, severe shaking, bleeding, liver trouble, etc.)? | YES | NO |
| | Have you ever gone to anyone for help for a drug/alcohol problem? | YES | NO |
| | Have you ever been in a hospital for medical problems related to your drug/alcohol use? | YES | NO |
| | Have you ever been involved in a treatment program specifically related to drug use? | YES | NO |
| | Have you been treated as a psychiatric inpatient or outpatient for problems related to drug/alcohol abuse? | YES | NO |
| | Do you feel you are a normal drinker? (“normal”- drink as much or less than most other people) | YES | NO |
| | Have you ever awakened the morning after some drinking the night before and found that you could not remember a part of the evening? | YES | NO |
| | Can you stop drinking without difficulty after one or two drinks? | YES | NO |
| | Have you ever attended a meeting of Alcoholics Anonymous (AA)? | YES | NO |
| | Do you drink before noon fairly often? | YES | NO |

## APPENDIX C

Head Injury Questionnaire (Adapted from Suhr and Gunstad, 2002)

Head Injury History

Have you ever experienced a concussion or brain injury? Yes No

Were you knocked unconscious? Yes No

If YES, how long were you unconscious? (circle one)

Less than 1 minute
1-30 minutes
More than 30 minutes

Do you remember the event before or after your head injury? Yes No

If NO, how long of a time period were you unable to remember? (circle one)

A few seconds
Less than 5 minutes
Less than 30 minutes
30 to 60 minutes
More than 60 minutes

## APPENDIX D

Patient Health Questionnaire (PHQ-8)

[redacted]

**APPENDIX E**

Manipulation Check Questionnaire (MCQ)

(Adapted from Suhr and Gunstad, 2002)

Please indicate why you were selected to participate in this study:

______________________________________________________________________

______________________________________________________________________

How hard did you try on the tests?

1 2 3 4 5 6 7 8 9

Not at all Very hard

How difficult did you find these tests?

1 2 3 4 5 6 7 8 9

Not at all difficult Very difficult

How much pressure did you feel during testing?

1 2 3 4 5 6 7 8 9

No pressure at all Very pressured

How confident are you in your performance?

1 2 3 4 5 6 7 8 9

Not confident at all Very confident

How well did you do on the tests?

1 2 3 4 5 6 7 8 9

Very poorly Very well

**APPENDIX F**

Academic Questionnaire (Adapted from CASES questionnaire)

How much confidence do you have about doing each of the behaviors listed below? Circle the letters that best represent your confidence.

**1 2 3 4 5**

**Very←------------------------------------ ------------------------------------→Quite**

**Little**

***CONFIDENCE***

| Little | | | | Lots | |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 1. Taking well-organized notes during a lecture. |
| 1 | 2 | 3 | 4 | 5 | 2. Paying attention to class discussion. |
| 1 | 2 | 3 | 4 | 5 | 3. Taking “objective” tests (multiple-choice, T-F, matching) within the time frame given. |
| 1 | 2 | 3 | 4 | 5 | 4. Taking essay tests within the time frame given. |
| 1 | 2 | 3 | 4 | 5 | 5. Writing a high quality term paper. |
| 1 | 2 | 3 | 4 | 5 | 6. Listening carefully during a lecture on a difficult topic. |
| 1 | 2 | 3 | 4 | 5 | 7. Earning good marks in most courses. |
| 1 | 2 | 3 | 4 | 5 | 8. Studying for sustained periods of time. |
| 1 | 2 | 3 | 4 | 5 | 9. Attending class on time. |
| 1 | 2 | 3 | 4 | 5 | 10. Attending class consistently in a dull course. |
| 1 | 2 | 3 | 4 | 5 | 11. Making a professor think you’re paying attention in class. |
| 1 | 2 | 3 | 4 | 5 | 12. Remembering most ideas you read in your texts. |
| 1 | 2 | 3 | 4 | 5 | 13. Remembering most ideas presented in class. |
| 1 | 2 | 3 | 4 | 5 | 14. Paying attention while studying. |
| 1 | 2 | 3 | 4 | 5 | 15. Remembering the information you read in the textbook. |
| 1 | 2 | 3 | 4 | 5 | 16. Remembering information from lecture. |
| 1 | 2 | 3 | 4 | 5 | 17. Finishing all your homework every day |
| 1 | 2 | 3 | 4 | 5 | 18. Focusing on a task for a lengthy period of time |

# APPENDIX G

## Debriefing Statement

Thank you for participating in this study.  Throughout the course of this experiment, you may have had questions regarding the nature or purpose of this study.  If you still have these questions, the experimenter will be glad to answer them for you at this time.

The purpose of this study was to investigate the influence of negative expectations on neuropsychological test performance. Specifically, this study was interested in examining whether or not drawing your attention to your previous head injury influenced your performance on cognitive tasks. Previous research suggests that even individuals who do not have neuropsychological impairment may perform more poorly simply due to an awareness of their head injury (Suhr & Gunstad, 2002, 2005).

**You will receive a total 3 credits for participating in this study.**

Your answers to these questions, as well as your performance on the testing measures, will be kept completely confidential.

Although a slight amount of discomfort is normal, if you experienced a significant amount of discomfort during the course of the experiment, please address your concerns to the experimenter at the present time. If you feel uncomfortable doing so, you may contact the faculty supervisor of the project, Dr. X.

The Office of the Vice President for Research and Development, in conjunction with the Institutional Review Board (IRB) for the use of human subjects in research, oversees research at the University of Montana. If you have any questions about your rights as a research subject, you may contact the Chair of the IRB through The University of Montana Research Office at (406) 243-6670.

**IMPORTANT:**

We request that you not discuss the details of this experiment with anyone who may be a future participant in the study. Thank you for your cooperation.