Spring 2011

Cognitive Performance and Diagnosis Threat

Robert D. Salazar
University of South Florida

Cognitive Performance and Diagnosis Threat

by

Robert D. Salazar

A thesis submitted in partial fulfillment

of the requirements for the degree of

Bachelor of Arts

Honors College

Department of Psychology

University of South Florida

Spring 2011

Major Professor: Cynthia R. Cimino, Ph.D.

Shital Pavawalla, Ph.D.

Heather Belanger, Ph.D.

London C. Butterfield, M.A.

Table of Contents

Abstract

This study of the diagnosis threat involved a detailed review of the background principles, theories, and research established in stereotype threat and diagnosis threat literature. This paper is constructed upon the premise that non-neuropsychological factors can influence behavior within neuropsychological assessment and subsequently impact results. Further detriment can arise when medical professionals errantly view neuropsychological assessments as a direct measure of brain function instead of recognizing their true function as a behavioral assessment. The main goal of this paper is to highlight how non-neuropsychological factors, primarily the diagnosis threat, can affect neuropsychological assessment and attempt to provide an alternative explanation for a possibly debilitating stereotype that has surrounded concussion and mild traumatic brain injury. A study conducted in the fall of 2010 at the University of South Florida tested the diagnosis threat. A total of 265 undergraduate students (182 concussed; 83 neurologically healthy) were recruited for this study. Participants with a history of concussion were assigned to one of three groups: Diagnosis Threat (DT) condition, Gender Stereotype (GS) condition, or Neutral condition (N). The 83 neurologically healthy participants served as a control group. Results indicate that history of head injury did not impact performance. However, a negative relationship was found between symptom complaints and cognitive performance such that as symptom complaints increased, cognitive performance decreased. In addition, neurologically healthy participants reported greater post-concussive symptoms than head injured patients, supporting the claim that these symptoms are not specific to head injury.

Introduction

  The diagnosis threat is an application of the stereotype threat to patients of head injury. The primary concept of the stereotype threat is that the fear of confirming negative stereotypes impairs performance (Steele, 1997). Research has avidly sought to define the stereotype threat, suggesting that performance deficits within stigmatized groups (e.g. African Americans, women) may result from situational disadvantages instead of intrinsic inferiority. The diagnosis threat is a relatively new line of research that applies the principles of the stereotype threat to head injured patients. The primary understanding of the diagnosis threat is that the fear of being diagnosed with cognitive damage impairs performance on neuropsychological assessments. Research suggests that cognitive impairment may not be the result of a head injury, but may result from situational disadvantages. The negative stigma elicited by testing environments may essentially mimic the stereotype threat by inducing apprehension toward negative evaluation. As a result, neuropsychological assessments may overestimate the severity of head injuries and inaccurately diagnose head injuries. Whereas neuropsychological assessments are typically thought to be a beneficial source of information, the diagnosis threat suggests that these assessments may induce situational disadvantages which inadvertently elicit cognitive deficits even in the absence of cognitive damage.

  The diagnosis threat has been a topic of research for only about a decade; therefore, much research is still required to fully understand the features of this threat. The focus of this current paper is to review the history and components of the diagnosis threat with the goal of providing ideas for prospective research. For the purpose of this paper, the paper will begin with a thorough review of stereotype literature. The focus of this section is to establish a scholarly foundation for the diagnosis threat. Since the diagnosis threat is an extension of the stereotype threat, a detailed

review of the stereotype threat is necessary in order to understand the diagnosis threat. It is important to note that the topics and details discussed in this section will have direct application to the diagnosis threat in later sections. The review of stereotype threat will be followed by a review of the diagnosis threat. This section will apply the stereotype threat literature to a head injured population and will discuss how performance is impaired by this threat. An additional section will be devoted to a research study conducted at the University of South Florida. This study applied the current understanding of the diagnosis threat with the goal of furthering research in this field. The diagnosis threat is a new concept within neuropsychology and can provide advancements in the management and assessment of head injury.

Section I: Stereotype Threat

Introduction

Social psychology has recognized the negative effects of stereotypes. Prejudice, bias, and discrimination do not merely result in social segregation; research suggests that stigmatized testing environments can impair cognitive performance. The concept of how the fear of confirming negative stereotypes can impair an individual's performance has been termed the "stereotype threat" (Steele & Aronson, 1995; Aronson, Lustina, Good, Keough, Steele, & Brown 1999). Research has defined several notable features of this threat. First, stereotype threat is situation specific. Many studies have found that individuals of a stigmatized group perform poorly in stereotype salient situations, yet display no deficits in performance when stereotypes are not salient (Kinkela, 2008; Aronson et al., 1999; Spencer, Steele, & Quinn, 1999). Second, the stereotype threat is not limited to any particular group. Instead, the stereotype threat can be experienced whenever an individual's competence is questioned. (Steele & Aronson, 1995;Kinkela, 2008; Spencer et al., 1999) This has been demonstrated through a wide range of

research that has elicited the stereotype threat across a variety of stereotyped groups including age, gender, and race. Third, the manifestation of the stereotype threat requires an individual identification with the stigmatized domain. (Spencer et al., 1999; Davies, Spencer, Quinn, & Gerhardstein, 2002; Aronson et al., 1999; Corrigan & Holtzman, 2001). Personal relevance increases apprehension toward negative evaluation, thereby engendering the debilitating effects of the stereotype threat. Lastly, a variety of underlying mechanisms are suggested to account for the physiological and psychological effects of the stereotype threat (Davies et al., 2002; Aronson et al., 1999; Steele & Aronson, 1995; Spencer et al., 1999). Research has suggested that several factors work together to increase the negative impact of this threat; however, researchers have had difficulty identifying exactly how these mechanisms contribute to the stereotype threat (Kit, 2008). The stereotype threat is a complex social psychological effect which is composed of numerous factors and has varying influences on different groups and different situations. Research has sought to identify exactly how the stereotype threat affects performance and has attempted to produce intervention programs to ameliorate the effects of negative stigma.

What are Stereotypes?

Stereotypes are "knowledge structures that are learned by most members of a social group" and serve the purpose of identifying and establishing expectations of a group (Corrigan & Holtzman, 2001; Augoustinos & Ahrens, 1994; Esses, Haddock, & Zanna, 1994). Popular stereotypes include the idea that women are poor at math, African Americans are intellectually inferior, and that increased age is associated with increased memory deficits. Stereotypes are not necessarily negative and do not always result in discrimination; however, negative stigma often results in prejudiced and discriminatory behavior that gives many stereotypes a negative connotation (Corrigan & Holtzman, 2001; Corrigan & Watson, 2002). Although stereotypes

provide quick generalizations, stereotypes are nothing more than generalizations. A member of a stereotyped group does not necessarily embody the behaviors and values of the stereotype. In addition, individuals of a stereotyped group do not always believe that stereotyped behaviors apply to them (Corrigan & Watson, 2002). Despite this fact, there appears to be a striking relationship between a stereotyped group and the stereotyped behavior associated with that group. For example, the stereotype that categorizes women as mathematically inferior to men is indicated in career selection. Men are 4.5 times more likely to select mathematics related majors than women and women are 2.5 times more likely to drop out of college courses in mathematics, engineering, and the physical sciences (Davies et al., 2002). Women hold only 10% of jobs in mathematics, engineering, and the physical sciences (Davies et al., 2002). Furthermore, the national college drop-out rate supports the stereotype that African Americans are intellectually inferior as indicated by a 70% drop-out rate for African American college students, but only 42% for Caucasian students (Steele & Aronson, 1995). These trends are suggested to be a result of genetic and intellectual differences; however, social psychology research suggests that situational variables may contribute to this difference (Spencer et al., 1999).

The Stereotype Threat and Situational Context

Environmental context appears to have an important influence on behavior. Many studies indicate that stereotype-salient environments can elicit deficits in cognitive performance. Importantly, these deficits have been found in a range of stigmatized groups including age, gender, and race stereotypes and can therefore be attributed to situational constraints, not inherent inferiority of a certain group. Spencer et al., (1999) found a decrease in performance between women who were told that a mathematics test "had shown gender differences in the past" versus women who were told that the mathematics test "had never shown gender

8

differences in the past." Steele and Aronson (1995) found that African Americans who were informed that the experimental task was designed to measure intelligence displayed poorer accuracy than African Americans who were merely told the task was a "problem-solving task." Farina, Gliha, Boudreau, Allen, and Sherman (1971) applied this concept to a mental illness population and also demonstrated how environment affected performance. Mental patients who believed they were working with someone who knew about their mental history performed worse than mental patients who believed their partner did not know about their mental history. Similar effects were observed in individuals of low SES in Croizet & Claire (1998) and in ecstasy users in Cole, Michailidou, Jerome, & Sumnall (2006). The trend throughout these studies is that when an individual believes that a task is evaluating an intrinsic feature of one's identity and this feature is connected with a negative stereotype, the individual experiences a series of debilitating psychological and physiological effects which impair performance. However, members of a stigmatized group do not show deficits in performance when they believe that the task is not an evaluation of personal identity. This supports the hypothesis that the stereotype threat is a "situational predicament" and contradicts the claim that performance differences can be solely attributed to genetic or intellectual differences (Steele & Aronson, 1995).

Mechanisms of the Stereotype Threat

The main understanding of the stereotype threat is that stereotypes elicit environmental differences which raise disadvantages for members of a negative stereotype. Stereotypes are an inherent aspect of every culture and are integral to efficient social interaction; however, the negative stigma attached with certain stereotypes (e.g. intellectual inferiority of women and African Americans) can lead to prejudice and discrimination towards stereotyped groups (Corrigan & Holtzman, 2001). Regardless of whether an individual believes the stereotype,

encountering a stigmatized environment can increase apprehension toward confirming a negative stereotype. If this 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, achievement motivation, defense mechanisms.

Domain Identification

Domain identification is one of the primary components of the stereotype threat. In order for an individual to experience the apprehension of confirming a negative stereotype, the individual must identify with the domain (Steele, 1997; Aronson, et al., 1999). For example, a woman who does not consider mathematics to be a relevant component of her identity will likely not be negatively affected by the stereotype threat because her identity is not threatened. However, a woman who highly identifies with mathematics is more likely to experience the debilitating effects of the stereotype threat. Since mathematics is important to her identity, she may experience a greater risk when her competence is threatened. This effect was found in Aronson et al. (1999) which tested how Caucasian males responded to the stereotype threat. The stereotype threat was presented by emphasizing a "growing gap in academic performance" between Asian and Caucasian students. Results indicate that Caucasian students in the diagnostic condition (i.e. primed for stereotype threat) who indicated high mathematic identification during prescreen performed worse than moderately identified Caucasian students in the same condition. Conversely, Caucasian students in the control condition (i.e. not primed for stereotype threat) who indicated high mathematic identification performed better than moderately identified Caucasian students in the control condition. The fact that the performance of highly identified students decreased between the control and diagnostic conditions suggests that an increase in

domain identification led to an increase in stereotype threat and resulted in reduced performance. When students who were moderately identified in mathematics entered a "threatening" situation (i.e. the diagnostic condition), performance was not impaired, possibly because lower domain identification prevented an increase in stereotype threat. These findings suggest that an individual must personally identify with the stigmatized domain in order to be affected by the stereotype threat.

Another important finding of Aronson et al. (1999) indicates that Caucasian males, a group rarely associated with negative stigma, is susceptible to the stereotype threat. This suggests that a domain does not have to be heavily stigmatized in order to be affected by the stereotype threat. Instead, the stereotype threat appears to manipulate any domain by implying inferiority within highly identified individuals. The fact that Caucasian males are also susceptible to the stereotype threat indicates the pervasive nature of this threat. This study suggests that the stereotype threat is not exclusive to any particular group, yet is dependent upon manipulating personal fear of confirming incompetence.

Defense Mechanisms

In addition to domain identification, the stereotype threat affects other psychological processes which can affect cognitive performance. The defense mechanisms of "disengagement" and "disidentification" appear prevalent when an individual encounters a threatening environment (Corrigan & Hotzman, 2001; Steele, 1997; Spencer et al., 1999). The purpose of these defense mechanisms is to remove personal identity from the stigmatized environment in order to maintain self-esteem. Removing personal identity from a domain protects an individual from the negative effects of stereotype threat by eliminating the apprehension toward negative evaluation. Disengagement refers to a short term, situational detachment from an environment

(Corrigan & Hotzman, 2001). For example, women who are susceptible to the negative stereotype of poor math performance may learn to disengage from mathematical environments, instead placing personal identity in other non-mathematical academic domains (e.g. Art, English) (Corrigan & Holtaman, 2001; Spencer et al., 1999). Disidentification involves a more stable and long term detachment from not only certain situations, but from an entire domain (Corrigan & Hotzman, 2001). Individuals who frequently encounter negatively stigmatized environments may eventually disregard the stigmatized domain as an important identifying feature. For example, African Americans who constantly encounter racially stigmatized academic environments may disidentify from the entire domain of academics, eliminating academics as an important identifying feature (Corrigan & Holtaman, 2001; Spencer et al., 1999). Whereas women are able to preserve self-esteem through disengaging from a single academic situation, the negative stigma toward African Americans is much more pervasive and may require a more drastic disidentification in order to preserve self-esteem (Aronson et al., 1999; Corrigan & Holtzman, 2001).

Although disidentification and disengagement preserves self-esteem, reducing domain identification can lower motivation and subsequently reduce performance (Corrigan & Holtaman, 2001; Spencer et al., 1999). This process appears to facilitate a reinforcing effect within the stereotype threat. In order to cope with the stereotype threat an individual must disidentify or disengage; however, this often results in underperformance, ultimately reinforcing negative stereotypes. Even though research has indicated that intellectual differences are minimal to none in the absence of situational disadvantages, large disparities remain between stereotyped groups. Whereas popular practice attributes these disparities to intellectual or genetic inferiority, social psychology suggests that these disparities result from nothing more than mere situational

disadvantages. Unfortunately, the reinforcing effect engendered by the stereotype threat strengthens popular beliefs about stereotypes and appears to present a seemingly insurmountable obstacle to many targets of negative stigma. An encouraging note of stereotype threat research is the possibility that these intellectual disparities can be reduced or eliminated by addressing situational disadvantages; however, research must continue to define the boundaries of this threat in order to achieve notable improvements.

Direct versus Indirect Stereotype Targets

Stereotype threat appears to affect different groups in different manners. A goal of stereotype threat research has been to identify how different groups are affected by this threat and what characteristics determine different effects of the stereotype threat. Understanding the nuances of this complex threat will aid researchers in defining the boundaries of the stereotype threat. Aronson et al. (1999) claims that there are two different "targets" of stereotype threat, direct and indirect, and suggests that the stereotype threat affects each group is a unique manner. A key finding of Aronson et al. (1999) is that white males, who are typically not the object of negative stereotypes, can also be affected by the stereotype threat. Although white males are susceptible to the debilitating effects of stereotype threat, they "are much less likely than women to disidentify and drop out of math and science fields" (Aronson et al., 1999). Aronson suggests that this results from the difference between "direct" and "indirect" stereotype targets. A direct stereotype target is considered a group to which the stereotype explicitly applies (e.g. women and poor math skills; African Americans and poor intellectual capacity) (p. 41). In Aronson et al. (1999) the Asian students were considered the direct target of a positive stereotype (i.e. academic superiority). Indirect stereotype targets are considered the target of a stereotype only when they are compared to a direct stereotype target (p. 41). In other words, this group is not the object of a

specific stereotype, but becomes a target when the group is compared to another group. In this study Caucasian male students were considered the indirect stereotype target.

Aronson et al. (1999) explains how the stereotype threat affects direct targets differently than indirect targets. In this study a negative stereotype ("growing gap in academic performance" between Asian students and Caucasian students) was imposed upon a group of Caucasian students. Although Caucasian students are typically not the target of stereotypes (i.e. indirect stereotype target), the stereotype threat was elicited when this group was compared to a direct stereotype target (i.e. academically superior Asian students). This demonstrates that Caucasian males are susceptible to the stereotype threat; however, there is no indication that Caucasian males disengage from mathematical domains as drastically as females, possibly because they are indirect stereotype targets. Since Caucasian males are typically not considered mathematically inferior, their self-esteem is not threatened as often as women and therefore do not have to disengage from mathematics in order to maintain self-esteem. Females, however, are a direct stereotype target and experience much more stigma; therefore, they must disengage from the domain in order to preserve self-esteem (Aronson et al., 1999). The difference between direct and indirect stereotypes illustrates how two groups respond differently to the same situational disadvantage.

The stereotype threat presents large disadvantages for direct targets. Direct targets are more likely to encounter negatively stigmatized situations and are therefore more likely to experience the debilitating effects of stereotype threat. As a result, direct targets are likely to have a greater awareness of stereotypes or a higher "stigma consciousness" (Aronson et al., 1999). Higher stigma consciousness can encourage direct targets to feel more identified with their stereotype group (Steele & Aronson, 1995; Aronson et al., 1999). Higher identity increases

stereotype threat and subsequently increases disidentification and disengagement in stigmatized environments. This sequence of events ultimately exacerbates the stereotype threat, thereby confirming the negative stereotype and reinforcing a group's negative stigma. Although direct stereotype targets are presented with a series of disadvantages, indirect stereotype targets do not appear to experience these debilitating consequences. Since this group is not the constant target of negative stigma, the stereotype threat is likely to be less prevalent to these groups. More research is needed to identify how the stereotype threat affects different groups; however, Aronson's discussion of direct versus indirect stereotype targets provides an interesting perspective on how the stereotype threat varies across groups.

How Perception of Inferiority Affects Stereotype Targets

How Inferiority Impairs Performance

Inferiority appears to hold a crucial role in affecting stigmatized groups. Fear of being deemed "inferior" is essentially the foundation of the stereotype threat. Steele (1995) states that exposure to negative stigma produces "inferiority anxiety" which encourages the objects of negative stereotypes to adopt a "victim's identity" and lose motivation to succeed (p 797). Katz, Roberts, and Robinson (1965) suggest that the anxiety induced by the threat of inferiority impairs performance. This study assigned African Americans to a task that was framed as "research on eye-hand coordination" (i.e. neutral condition) or as a "measurement of intelligence" (i.e. diagnostic condition) and each condition was assigned to either an African American or a Caucasian experimenter. Questionnaires indicated greater anxiety with the Caucasian experimenter regardless of the condition; however, the level of anxiety appeared to either impair or improve performance. When the task was difficult and the experimenter was Caucasian, the diagnostic condition performed worse than the neutral condition. This suggests

that anxiety (termed "drive" in this article) markedly increased in the presence of the stereotype threat and may have impaired performance. Whereas the participants in the neutral group (i.e. without stereotype threat) experienced anxiety, they did not experience enough anxiety to impair performance; however, the anxiety elicited by the diagnostic condition (i.e. with stereotype threat) appeared to overwhelm the participants and harm performance (Katz et al., 1965). In addition, participants in the neutral condition performed better with the Caucasian experimenter instead of the African American experimenter. This suggests that the Caucasian experimenter elicited a moderate level of anxiety which benefitted performance; however, the inferiority anxiety produced in the diagnostic condition appeared to impair performance (Katz et al., 1965; Burgess and Hokanson, 1964).

How Inferiority Improves Performance

The perception of inferiority has been suggested to impair performance; however, several studies have found that performance improves when individuals are portrayed as superior against an inferior stereotype. The perception of superiority therefore appears to boost performance. Spencer et al., (1999) found that males performed better when the negative female stereotype threat was present compared to when the stereotype was not present (Aronson et al., 1999). Aronson et al. (1999) attributes this performance difference to the fact that comparison to an inferior direct stereotype target (i.e. females) boosted the male's performance (p. 41). Steele and Aronson (1995) found that when African American students and Caucasian students were primed for the stereotype threat (i.e. diagnostic condition), Caucasian students outperform African American students; however, when Caucasian students were not primed for the stereotype threat (i.e. neutral condition), they perform equally to African American students in the diagnostic condition. In the neutral condition, the Caucasian students were not compared to an inferior

group and exhibited a performance deficit. Whereas the direct stereotype target (i.e. African Americans) was impaired by the presence of a stereotype, the indirect stereotype target (i.e. Caucasians) appeared to benefit from the same stereotype. Similar results have been found in Croizet and Claire (1998) which found that high SES participants in the diagnostic condition performed better than low SES participants in the diagnostic condition. However, when high SES participants were not primed for the stereotype threat, (i.e. the nondiagnostic condition), high SES participants displayed equal performance with the low SES participants in the diagnostic condition. When the negative stereotype was removed, performance decreased, supporting the suggestion that comparison to an inferior group (i.e. the perception of superiority) improves performance.

These studies indicate that the behavior of control groups and indirect stereotype targets is also affected by situational variables. Of primary interest is that those who are not compared to an inferior stereotype appear to perform worse than individuals who are compared to an inferior group. Aronson (1999) states that indirect targets may "derive a benefit from comparisons with direct targets for which stereotypes allege inferior ability" (p. 42). Conversely, direct stereotype targets exhibit reduced performance when their abilities are compared to "superior" groups. The manner in which a group perceives inferiority appears to affect performance.

Negative Expectations and the Nocebo Effect

As previously mentioned, cognitive performance is often impaired when targets of negative stigma risk negative evaluation and are threatened with the possibility of confirming negative stereotypes (Steele, 1997). Various constructs are strongly involved with this effect including domain identification, achievement motivation, and disengagement. Negative expectations have also been suggested to be an important feature of the stereotype threat. Kit

(2009) discussed the effect of negative expectations, noting that "negative stereotypes tend to invoke a more cautious style of responding" while "positive stereotypes induce an 'explorative processing style' or a promotion focus/state of eagerness" (p. 98; Seibt and Forster, 2004). Dweck (1986) similarly notes that "individuals with a 'helpless pattern of responding' are challenge-avoidant and display little perseverance in the face of difficulty. A 'master-oriented' pattern is characterized by a degree of effort and perseverance in the face of obstacles" (p. 98; Kit 2009). The difference between holding negative expectations and positive expectations appears similar to differences between the diagnostic and neutral conditions in stereotype threat literature.

Negative expectations can also induce what Kennedy (1961) termed the "nocebo phenomenon" (Hahn, 1999). This phenomenon is similar to the placebo effect under the premise that expectations can dramatically influence human behavior even in the absence of clinical explanation; however, the nocebo phenomenon implies that negative symptoms can be induced by negative expectations even in the absence of a legitimate illnesss (Hahn, 1997). Hahn (1999) recognizes that the negative expectations of the nocebo effect are learned through cultural beliefs and is affected by specific settings (p. 333). This presents a similar comparison to the conditions of the stereotype threat as stereotypes are culturally induced and the adverse effects of negative stigma are situation-specific.

The nocebo effect has been found to induce many adverse symptoms including headaches (Schweiger and Parducci, 1981), asthmatic symptoms (Luparello, Lyons, Bleecker, and McFadden, 1968), seizures (Lancman, Asconape, Craven, Howard, & Penry, 1994), allergies (Jewett, Fein, & Greenberg, 1990), and gastro-intestinal side effects (Myers, Cairns, and Singer, 1987). Hahn (1999) also notes that several studies have associated negative emotions with

greater incidence of adverse results. For example, Anda, Williamson, Hones, Macera, Eaker, Glassman, and Marks (1993) studied the effects of depression on ischemic heart disease and reported that individuals with a "depressive affect" were 1.6 times more likely to have nonfatal ischemic heart disease and 1.5 times more likely to have fatal ischemic heart disease than individuals who did not have depressive affect (Hahn, 1999). In addition, Frasure-Smith, Lesperance, & Talajic (1993) reported that depressed patients of myocardial infarction were 4.6-6.9 times more likely to die from heart disease compared to patients who were not depressed (Hahn, 1999). These studies indicate that negative expectations and negative emotions can induce adverse effects without legitimate clinical explanation, presenting similarities to the stereotype threat.

Research Limitations

Stereotype Threat is Complex

Although stereotype threat research has acquired much attention, several limitations have impeded the ability to adequately define this phenomenon. Kit (2008) acknowledges this fact stating,

> "… at the present time the construct of stereotype threat has yet to be clearly defined empirically. Theorists have deemed it to be the threatening feelings that arise from confirming or being judged by a negative stereotype. However, little research has devoted itself to intensely studying the nuances of this psychological state" (p. 134).

The vast diversity and complexity of the stereotype threat largely contributes to this limitation. The stereotype threat has been found to affect numerous domains such as gender, race, age, mental illness, ecstasy use, and low SES. Research has also suggested that the stereotype threat is not exclusive to a particular group. Those affected by this threat do not have

to be a member of a minority group nor have to believe the stereotype (Aronson et al., 1999). In addition, the stereotype threat is situation-specific. Since this threat does not apply across all situations, researchers must identify which situations elicit impaired performance. Likely one of the greatest challenges of research is identifying the underlying psychological and physiological mechanisms which contribute to the stereotype threat. Many mechanisms are suspected to account for this threat thereby increasing the difficulty of identifying exactly which mechanisms are present and how each contributes to this effect. Empirically defining the stereotype threat is essential to the development of research; however, the large scope of this phenomenon presents a daunting task.

Individual Differences

Individual differences between participants present a large limitation to research. The stereotype threat depends upon how an individual responds to situational threats; however, the manner in which each individual reacts to a situation is likely to vary. Despite this fact, research has sought to define major constructs which impact of the stereotype threat. Two of these constructs are stereotype activation and domain identification. Davies et al. (2002) studied these two constructs, finding that the diagnostic condition activated the stereotype threat in both males and females; however, deficits in performance were only found in females who found the stereotype self-relevant. Measuring stereotype activation and domain identification provided valuable information in this study. Neglecting these measurements could result in null findings and faulty assumptions that the stereotype threat was inactive when in fact the methods were too weak to detect the threat.

Self-Report Questionnaires

      Since the stereotype threat is marked by situational variables and personal perception, self-report questionnaires are currently the most effective and efficient form of measurement. Unfortunately this method is more susceptible to inconsistency and error than other concrete measurements. Lacking adequate measures presents difficulties in identifying the specific effects of the stereotype threat. Understanding individual differences between stereotyped groups may be hampered by this limitation. For example, African American females may suffer from the disadvantage of two stigmatized groups (gender and race). A stigmatized testing environment may therefore magnify the stereotype threat in comparison to other participants. These differences are often difficult to quantify, but may have a substantial effect on the results of an experiment. Unfortunately, current research lacks sufficient means of detecting these differences. Research advancements depend on the development of adequate methods to account for these complex details.

Situational Specificity

      Attaining situational-specificity is another challenge for research. Failure to simulate an environment that emulates the conditions of the stereotype threat can produce insignificant results. Spencer (1999) outlined several conditions that are critical to the stereotype threat: the test taker must believe that the test is a valid assessment of abilities, the test taker must care about the domain which is being tested, and the test must be difficult (p. 25). If the test is not difficult, the stereotype threat may not adequately disrupt cognitive processes; however, if the test is either extremely easy or difficult the test taker may not find the test to be a legitimate measurement of ability (Spencer et al., 1999). Attaining an optimum level of difficulty is an important element of research, but may be a challenging task. Null findings may therefore reflect

poor test difficulty, not the absence of stereotype threat. Research must also evaluate if the test taker held enough domain identification to be affected by the stereotype threat. Mere membership of a stereotyped group does not ensure that the stereotype threat will be elicited; therefore, research must also evaluate if null findings are the result of improper domain identification. The difficulty of attaining proper test validity, test difficulty, and domain identification presents a challenge to stereotype threat research.

Unfortunately, successful incorporation of these criteria does not ensure significant results within a lab setting. The stereotype threat relies heavily upon the risk of failure; however, a lab setting lacks what Aronson (1999) terms "fate control" (p. 42). Participants understand that failure within an experiment will not incur extreme consequences. The inability to establish a large risk can limit and even eliminate the magnitude of the stereotype threat. Studies such as Spencer et al. (1999), Davies et al. (2002), and Aronson et al. (1999) attempted to counter this limitation by selecting participants who were highly identified in mathematics. Holding high personal perceptions about mathematic skills increases the probability that the participants will personally invest in the task and emulate authentic stereotype threat conditions (Davies et al., 2002).

Conclusion

The complexity of the stereotype threat presents many challenges to research. The stereotype threat affects a wide range of individuals over a variety of situations and is mediated by numerous underlying mechanisms; therefore, consolidating all these variables into a single lab experiment is a daunting task. Individual differences between how participants perceive and react to the stereotype threat are a large limitation of research. This line of research is also limited by self-report. Future research should attempt to objectively measure this threat through

methods such as the lexical decision task used in Davies et al. (2002). Research must also identify the specific situational factors which activate the stereotype threat. Null findings may not indicate absence of the stereotype threat, but instead may indicate poor test difficulty, low domain identification, or poor stereotype activation. In order to effectively measure the stereotype threat, research must account for the myriad of variables that account for this effect. Despite these difficulties, defining this phenomenon can produce substantial rewards such as intervention programs focused on reducing or eliminating the consequences of negative stigma.

Section II: Diagnosis Threat

The diagnosis threat can be considered a sub-field of the stereotype threat. The same mechanisms which apply to the stereotype threat apply to the diagnosis threat with one major exception. The stereotype threat is strictly a social psychology phenomenon, dependent on situational and interpersonal variables to impair performance. The diagnosis threat is an adaption of this phenomenon to neuropsychology and is based upon the idea that the fear of diagnosis impairs performance.

Instead of characterizing the diagnosis threat as a distinct phenomenon, it is beneficial to consider the diagnosis threat as the stereotype threat applied to a neuropsychological population. However, terming this phenomenon, "the stereotype threat in a head injured population," would misrepresent the true basis of the diagnosis threat. The term "diagnosis" is essential to this phenomenon because the diagnosis is the primary feature of this threat. Whereas the stereotype threat strictly depends on a stereotype to impair performance, the diagnosis threat relies upon the risk of being labeled or "diagnosed" incompetent. Research must continue to identify how these threats differ, primarily how targets of the diagnosis threat are affected differently than targets of the stereotype threat. Understanding the diagnosis threat will provide social psychology with

another example of how negative stigma can impair performance while providing neuropsychology with important information on how to improve the assessment and treatment of head injury.

History

Julie A. Suhr and John Gunstad termed the diagnosis threat in 2002 with the article "'Diagnosis Threat': The Effect of Negative Expectations on Cognitive Performance in Head Injury." A primary theme of this article involves the concern that neuropsychological assessments are viewed out of context. Instead of strictly using neuropsychological assessments as a behavioral assessment, they are often misinterpreted as "direct measures of brain function" (p. 448). Neuropsychological tests may offer insight into cognitive damage; however, negative expectations, suggestibility, anxiety, and other factors can influence behavior within a neuropsychological assessment. Therefore, viewing a neuropsychological examination as a direct indication of cognitive function would present a disservice to patients. Other performance-impairing variables should be eliminated prior to diagnosing the severity of a head injury.

Only three articles have been published in reference to the diagnosis threat. Each article supports the suggestion that neuropsychological assessments may be influenced by non-neuropsychological factors. This research does not imply that head injured patients do not experience cognitive impairment; instead this research suggests that the severity of diagnosis may be exacerbated by other variables, thereby leading to improper conclusions.

Mild Traumatic Brain Injury

Patients of mild traumatic brain injury (MTBI) are the primary target of the diagnosis threat. A mild traumatic brain injury is typically defined as a head injury involving a loss of consciousness (LOC) less than 30 minutes, a Glasgow Coma Scale rating between 13 and 15,

and posttrumatic amnesia (PTA) less than 24 hours (Belanger, Curtiss, Demery, Lebowitz, & Vanderploeg, 2005; Suhr and Gunstad, 2002; Ozen and Fernandes, 2011). MTBI and head injury in general has become a prevalent topic in recent decades as an estimated 1.5 million people in the United States sustain a nonfatal brain injury (Belanger et al, 2005; Sosin, Sniezek, & Thurman, 1996). Iverson (2005) reports that 600 of 100,000 people sustain a brain injury with a loss of consciousness each year with 35% of these injuries resulting in emergency room visits and 25% resulting in no medical assistance (p. 306; Sosin et al., 1996). The economic consequences of MTBI are large; 44% of the 56 billion dollar annual cost of TBI in the United States is allotted to mild injuries (Thurman, 2001; Ozen & Fernandes, 2011; Belanger et al, 2005).

Post-concussional Syndrome (PCS)

A controversial issue surrounding MTBI patients is whether the extended experience of concussion symptoms (i.e. PCS) is a common disorder within this population. The DSM IV-TR criteria for diagnosis of PCS includes (Lubit, 2010):

A. A history of head trauma that has caused significant cerebral concussion.

B. Evidence from neuropsychological testing or quantified cognitive assessment of difficulty in attention (concentrating, shifting focus of attention, performing simultaneous cognitive tasks), or memory (learning or recalling information).

C. Three (or more) of the following occur shortly after the trauma and last at least 3 months:

1. Becoming fatigued easily
2. Disordered sleep
3. Headache

4. Vertigo or dizziness

5. Irritability or aggression with little or no provocation

6. Anxiety, depression, or affective lability

7. Changes in personality (e.g. social or sexual inappropriateness)

8. Apathy or lack of spontaneity

D. The symptoms in criteria B and C have their onset following head trauma or else represent a substantial worsening of preexisting symptoms.

E. The disturbance causes significant impairment in social or occupational functioning and represents a significant decline from a previous level of functioning. In school-aged children, the impairment may be manifested by a significant worsening in school or academic performance dating from the trauma.

F. The symptoms do not meet criteria for dementia due to head trauma and are not better accounted for by another mental disorder (e.g. amnestic disorder due to head trauma, personality change due to head trauma).

A limitation of this diagnosis is that the proposed symptoms (e.g. headache, fatigue, irritability, etc) are not specific to a head injured population. In fact, Gunstad and Suhr (2001) found that sufferers of chronic headaches reported a higher frequency of some PCS symptoms than head injured patients. Furthermore, Iverson and McCracken (1997) reported that 94% of chronic pain sufferers in their sample reported three or more of the PCS symptoms outlined in Category C of the DSM-IV and 39% met self-report criteria for diagnosis (p. 787). Nonetheless, there is a widespread belief that mild head injuries can lead to persistent and chronic brain damage, despite research that indicates typical restoration of cognitive function within three

months of injury (Iverson, 2005; Leininger, Kreutzer, and Hill, 1991; Belanger et al., 2005; Whittaker, Kemp, and House, 2007).

Causes of PCS: Expectations as Etiology, The "Good Old Days" Bias, and Emotions

Recent research suggests that non-neuropsychological factors may influence the long lasting experience of concussive symptoms. Hahn (1999) discussed how negative expectations and nocebo effects can produce symptoms, suggesting that PCS symptoms may be influenced by expectations of deficit, not the head injury. Other popular non-neurological explanations for PCS include expectation as etiology (Mittenberg, DiGiulio, Perrin, and Bass, 1992), the "good old days" bias (Iverson, Lange, Brooks, and Rennison, 2010; Gunstad and Suhr, 2001), and emotional perceptions of illness (Whittaker et al., 2007; Leininger et al., 1991).

Expectation as Etiology

Mittenberg (1992) proposes that negative expectations, not head injury, may be the "etiology" of PCS (p. 200). This study had a head injured population rate the magnitude of PCS symptoms before and after head injury while a control group rated their current experience of PCS symptoms and also rated their imagined PCS symptoms based on an imaginary scenario of head injury. Mittenberg found that the head injured group reported significantly fewer premorbid symptoms than the control's baseline. This indicates that the MTBI patients underestimated these premorbid symptoms, possibly because they expect the head injury to account for all PCS symptoms. Furthermore, the reported incidence of PCS symptoms by head injured patients highly correlated with the imagined symptoms of the control group (r = 0.82). This high correlation suggests that mere expectation of symptoms can induce realistic experiences within MTBI patients. Overall, this study offers further evidence that PCS symptoms are not exclusive to head injury and that expectations may influence symptoms more than the actual head injury.

The "Good Old Days" Bias

The "good old days" bias is the tendency to see the past as "better than the present" (Gunstad and Suhr, 2001). This does not strictly occur in a PCS population, but can be experienced by anyone who experiences a negative event (Iverson et al., 2010; Gunstad and Suhr, 2001). Gunstad and Suhr (2004) applies this to PCS claiming, "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). This study found that head injured athletes reported significantly fewer premorbid PCS symptoms than current symptoms, affirming the notion that after experiencing a negative event, the victim tends to see previous situations and experiences as "better" than the present (Gunstad and Suhr, 2001). This effect was supported in Iverson et al. (2010) which tested head injured patients' symptom ratings before and after injury. Overall, MTBI patients reported significantly greater post-injury symptoms compared to the pre-injury reports. Premorbid symptoms ratings were also significantly lower than the control group ratings with MTBI patients reporting significantly lower incidence on 10 of 13 symptoms. Whereas 22.6% of the control group admitted the experience of six or more PCS symptoms, only 3.3% of the MTBI reported the presence of six or more symptoms. This demonstrates a severe underestimation of preexisting symptoms, further supporting the idea that head injured patients overestimate the effect of head injury on current symptoms.

Emotions and Perception of Illness

Along with expectation as etiology and the "good old days" bias, emotions and perception of illness appear to affect the long term experience of post-concussion symptoms. A study conducted by Whittaker (2007) compared illness perception with a measure of symptomatic and functional outcome. This did not find a relationship between symptomatic

outcome and the severity of head injury; instead, symptomatic outcome was strongly correlated with illness perception. Specifically, individuals who scored higher on categories of identity (beliefs concerning the illness label or diagnosis and associated symptoms) and consequences (beliefs concerning the effects an illness has on physical, social and psychological well-being) were found to have an elevated symptomatic outcome (p. 644-645). This suggests the perception of illness, not the specific illness, has an influence on symptomatic progression, supporting Mittenberg's (1992) claim that the mere "anticipation" of PCS can manifest authentic symptoms (p. 202).

According to Leininger et al. (1991), emotional disturbance may also account for symptomatic trends in a head injured population. Leininger et al. (1991) administered the Minnesota Multiphasic Personality Inventory (MMPI) to a group of head injured patients. This 10 scale assessment of emotional and personality function is typically presented to a psychiatric population; however, application to a minor head injured population reveals emotional disturbances similar to a psychiatric population. In this study, minor head injured patients scored above 70 (i.e. indicator of clinical disturbance) on 5 scales whereas the severe head injured group scored above 70 on only one scale. These five scales include:

1. Preoccupied with bodily functioning; complains of chronic fatigue, pain, and weakness; dissatisfied with life.
2. Sad; dysphoric, tense; feels guilty and useless.
3. Preoccupied with physical illness; self-centered; socially immature.
7. Anxious; ruminative; lacks self-confidence; has difficulty concentrating.
8. Confused; disorganized; has unusual thoughts and attitudes; feels isolated, misunderstood and unaccepted by others.

Of these five scales above 70, the minor head injured group scored significantly higher than the severe head injured group on three scales (1, 3, and 7). These findings reveal different emotional disturbances between mild and severe head injured patients, suggesting that mild head injured patients may perceive and report symptoms in a different manner. This also indicates how a psychiatric population can present the same emotional disturbances as a head injured population, presenting a possible confound in the accurate diagnosis of MTBI.

Conclusion

Although there is a wealth of evidence contradicting the idea that PCS is prevalent in an MTBI population, the association of PCS with MTBI has grown into a popular stereotype. The popular assumption that MTBI patients are at elevated risk for PCS may heighten negative stigma within neuropsychological assessments, presenting a situational predicament reminiscent of the stereotype threat. These patients are at risk of affirming a negative stereotype and being labeled inferior; therefore, the apprehension toward this diagnosis may essentially impair performance. It is important to note that PCS is possible in a MTBI population; however, the prevalence of PCS is likely overestimated. Iverson (2005) claims the popular estimate of 10-20% prevalence of PCS is too high and that the prevalence is likely less than 5% (p. 306). In addition, of this 5%, a variety of "preexisting problems and comorbidities" are likely to account for the persistence of symptoms (p. 310; Gunstad and Suhr, 2001). PCS symptoms may not indicate cognitive damage, instead a variety of other factors, including the diagnosis threat may account for these negative effects.

Stereotype Threat Applied to Diagnosis Threat

Overview

The aim of this current section is to discuss the concepts of stereotype threat in comparison to diagnosis threat. Earlier in this paper, the stereotype threat section overviewed several important features of stereotype threat which should be considered in the diagnosis threat. These features certainly do not account for all the mechanisms of stereotype threat; however, they are sufficient for the scope of this paper. Applying these features to the diagnosis threat is essential to the progression of research. The stereotype threat has been found to have different effects on different groups (e.g. Caucasian males versus Caucasian females; Caucasian females versus African American females) and is bound to have different effects within a MTBI population. The goal of this section is to present some of the similarities and differences between the stereotype and diagnosis threat with the intention of providing further information on how these threats function.

Applying Stereotype Threat to Diagnosis Threat

Since the diagnosis threat is a relatively new topic of research, little research has confirmed that the mechanisms of the stereotype threat are also present in the diagnosis threat (e.g. domain identification, achievement motivation, disengagement). Until these details are confirmed, research relies on the assumption that the general principles of the stereotype threat apply to the diagnosis threat. This assumption is not arbitrary; since the diagnosis and stereotype threat possess many similarities, research of the stereotype threat is largely applicable to the diagnosis threat. In order to understand the basic function of the diagnostic threat, this area of research must apply several hallmark features of the stereotype threat to this phenomenon.

Negative Stereotypes

An important similarity between these threats is the manner in which stigma and negative stereotypes apply to a head injured population. Increased interest and concern toward head injury may magnify negative opinions regarding head injury (Aronson et al, 1999; Mittenberg, Tremont, Zielinski, Fichera, and Rayls, 1996). In addition, medical environments including neuropsychological assessments may increase the salience of negative symptoms, subsequently inducing negative expectations and poor performance (e.g. Myers et al., 1987). These stigmatized conditions appear strikingly similar to the conditions of stereotype threat, suggesting that head injured individuals may also be susceptible to stereotype threat effects. Davies et al. (2002) described that when a target of negative stigma (e.g. head injured patients) encounters a situation in which negative stereotypes provide a plausible account for impaired performance, the stereotype threat (in this case diagnostic threat) increases the risk of negative evaluation and affects performance. Furthermore, this effect is irrespective of the negative stereotype to which the individual is affiliated (Aronson et al., 1999). These indicators suggest that a head injured population may be susceptible to the stereotype threat (i.e. diagnosis threat), possibly accounting for neuropsychological performance deficits in head injured patients.

Mittenberg et al. (1992) demonstrated that the imagined PCS symptoms of a control group highly correlated with the actual symptoms reported by the head injured group (r = 0.82). The general population's ability to accurately categorize the negative effects of head injury may indicate a negative stereotype. Corrigan and Holtzman (2001) explained that stereotypes are culturally and socially induced. A main catalyst for the social perception of head injury may be the media (Davies et al., 2002). Although there is little empirical evidence outlining the effects of media on public perception of head injury, increased attention by reputable media sources such

as National Geographic, Sports Illustrated, and the National Football League suggest that head injury is receiving notable attention within the general public. In October 2010 the NFL, a 9 billion dollar industry in the United States, instituted protective measures against concussions by issuing fines and suspensions for flagrant hits to the head (Livingston, 2010; Castleton, 2011). Meanwhile, Sports Illustrated entitled their November 2010 magazine issue "Concussions" and National Geographic published an article "Lasting Impact" in the February 2011 edition (King, 2010; Shyr, 2011). Each source highlights the possible damage of head injuries and discusses current research of head injury. According to the Washington Times, Sports Illustrated has 3.5 million subscriptions and is read by 23 million adults each week. WordPress.org reports that more than 50 million people receive the National Geographic magazine each month. The publications by Sports Illustrated and National Geographic and the restrictions implemented by the NFL provide no empirical evidence for negative stereotypes within public perception; however, they illustrate the media awareness of head injury. Increased concern toward head injury may inadvertently produce negative stigma toward head injured individuals. Research should continue to explore public perception of head injuries. If public perception has established a negative stereotype of head injuries, head injured patients are at increased risk of negative stigmatization and ultimately the diagnosis threat.

Stigma Visibility and MTBI

One of the defining features that separate the diagnosis threat from the stereotype threat is stigma visibility. In general, the stigmatized object of the diagnosis threat (mild head injury) is not visible to the general public. Whereas many targets of stereotype threat are unable to dissociate from the visible features of negative stigma (e.g. gender, age, race), head injured patients are able to dissociate from negative stigma because their injury is not visible. Even if

stereotype targets do not believe the stereotype, they cannot deny their gender, age, or race; therefore, they are more susceptible to the stereotype threat. Since mild head injuries contain very low stigma visibility, MTBI victims may not experience constant situational fear or discrimination and may subsequently evade the negative consequences of the stereotype and diagnosis threat.

Farina et al. (1971) observed the effect of stigma visibility. This study assessed performance of a mental illness population, finding that when others were not aware of their mental history (low stigma visibility) the participant performed better than when the participant's mental history was known to others (high stigma visibility). This study may have similar effects on MTBI individuals. Since an MTBI patient's cognitive history is largely hidden, they may not be a common diagnosis threat target; however, in situations where a MTBI patient's cognitive history is salient (e.g. neuropsychological evaluation), stigma visibility is increased and performance will likely decrease as demonstrated in Farina et al. (1971).

Situational Context

The situational context of the diagnosis threat appears much more limited than the stereotype threat, largely because of stigma visibility. Low stigma visibility within a MTBI population suggests that stigmatized situations are less pervasive than in highly stigmatized populations. This is supported by the idea that the stereotype threat is a "situational predicament" and is elicited only under certain situational contingencies (Steele & Aronson, 1995). Since stigmatization is key to this situational predicament, low stigma visibility would inhibit the pervasiveness of this threat in an MTBI population. Spencer et al. (1999) also suggests that in order for the stereotype threat to be induced the test must difficult, the test taker must view the assessment as a valid measure of abilities, and the test taker must care about the domain which is

being tested. These principles can reasonably apply to the diagnosis threat and should be explored through future research. The primary difference between the "situational predicament" of the diagnosis threat and the "situational predicament" of the stereotype threat is that an MTBI population holds low stigma visibility and appears to require more direct situational manipulations.

Defense Mechanisms

If the diagnosis threat is fueled by negative stereotypes and is activated in the same manner as the stereotype threat, targets of the diagnosis threat may also employ the same defense mechanisms as targets of stereotype threat. However, stigma visibility and the situational constraints of the diagnosis threat may limit the necessity of defense mechanisms. Within this paper, the primary concept of defense mechanisms is that when encountered with a threatening situation, an individual will disidentify or disengage from the situation in order to preserve self-esteem (Corrigan & Watson, 2002). This process does not appear to apply to the diagnosis threat. Head injured patients may not have to disidentify from many real life situations because low stigma visibility inhibits the constant fear of discrimination. Even within a highly stigmatized environment (e.g. neuropsychological assessment), these defense mechanisms may be unnecessary because patients entering a neuropsychological assessment will not easily discount the importance of the situation. Individuals seeking assessment usually identify with the possibility of injury and are likely motivated to perform well in hopes of avoiding a poor diagnosis; therefore, disengaging from the situation would appear counteractive. Furthermore, defense mechanisms would not benefit these individuals in the same manner as defense mechanisms benefit stereotype threat targets. Stereotype threat targets are able to disidentify in order to place value in another domain which improves self-esteem (e.g. women valuing arts

instead of mathematics); however, disidentifying from a neuropsychological assessment increases the likely diagnosis of "cognitive impairment." This diagnosis is pervasive across many domains of life and would largely hinder self-esteem. Overall, defense mechanisms such as disidentification and disengagement may not hold an important role in the diagnosis threat. Instead, the diagnosis threat may rely more upon anxiety, apprehension, and negative expectations to impair performance.

Negative Expectations, Suggestibility, Iatrogenesis

Negative expectations, more so than defense mechanisms, appear to largely influence MTBI patients. Research suggests that the mere expectation of PCS symptoms can induce a realistic experience in a patient (e.g. "good old days" bias; expectation as etiology). Properly defining the causes of PCS symptoms can be difficult since symptoms are not exclusive to head injury. Mittenberg (1992) explains that, "expectations become salient when the patient lacks an obvious, immediate, and adequate alternative explanation for their symptoms" (p. 203). Since it is difficult to identify a definite cause of common PCS symptoms (e.g. headache, fatigue, irritability), the most plausible explanation takes precedence, in this case head injury. The expectation that head injury is the source of PCS symptoms may therefore lead to a self-diagnosis and subsequent submission to the title of "cognitively impaired." Research should continue to identify how negative expectations are activated and how these expectations can be reduced in a neuropsychological evaluation.

Several researchers suggest that preventative and ethical measures within a neuropsychological environment may induce the exact deficit which is being tested. Bootzin and Bailey (2005) raise the importance of iatrogenic effects or 'physician caused,' "unplanned, often negative effects of treatment" (p. 872). The process through which a physician informs patients

of possible symptoms may make the patient "hypersensitive to their own reactions" to injury (p. 874). In addition, Mittenberg et al. (1996) proposes that, "attentional bias, anxiety, and depression" increases "subjective intensity and frequency of [symptom] occurrence" (p. 143). These factors are likely to be prevalent within a neuropsychological population and as a result, patients may overreact to benign symptoms, mistaking them for head injury symptoms.

Open communication about the consequences of head injury is considered essential to ethical measures and to the prevention of long term damage; however, research suggests that emphasizing these negative symptoms may present a series of self-doubt, fear, anxiety, and negative expectations which may ultimately induce deficits even in the absence of true cognitive damage. Myers et al., (1987) studied how consent forms influence the side effects of drugs. Two groups (groups A and B) signed a consent which mentioned possible gastrointestinal side effects and another group (group C) signed a consent form which did not mention possible gastrointestinal side effects. Group C reported significantly fewer minor gastrointestinal symptoms than groups A and B. Of the 81 patients who discontinued the experimental therapy because of minor gastrointestinal symptoms, only five of these patients were from group C. Negative expectations appear to influence symptom experience and can be triggered through a variety of manners. Diagnosis threat research holds a critical role in identifying these behavioral confounds and offering a more accurate form of neuropsychological assessment.

Indirect Stereotype Target and the Strength of Activation Cue

The difference between direct and indirect stereotype targets may appear trivial, but can hold important implications for the diagnosis threat. Indirect stereotype targets are defined as a group that is not a target of negative stigma until compared as inferior to another group (Aronson et al., 1999). For example, Caucasian males are not typically a target of negative stigma because

Caucasian males are perceived to be proficient at mathematics; however, when they were compared to mathematically superior Asian males in Aronson et al. (1999) they became a stereotype target. This concept directly applies to a head injured population. Since head injuries carry low stigma visibility, there is reason to believe that head injured patients are not a direct stereotype target. However, research demonstrates that specifically identifying inferiority (e.g. cognitive damage) elicits a stereotype or diagnosis threat (Suhr and Gunstad 2002; 2005). Like Caucasian males, a head injured population may not be affected by the stereotype threat until they are specifically suggested to be inferior (e.g. within neuropsychological assessment).

Since MTBI patients are typically indirect stereotype targets, the strength of the stereotype activation cue may need to be stronger than in typical stereotype threat research. Stereotype research suggests that different stereotyped groups require different levels of cuing in order to activate the stereotype threat. For example, in Spencer et al. (1999) the mere sight of gender differences elicited the stereotype threat in females (direct stereotype target). This suggests that little priming is required to evoke the stereotype threat. Since the negative stereotype toward females and mathematics is highly pervasive, little cueing was needed to elicit a stereotype threat. Other stereotypes may require a stronger form of priming in order to induce this threat. The diagnosis threat presents another variable to this research. Preliminary findings suggest that a head injured population requires stronger cues to elicit the diagnosis threat, possibly because this population is an indirect stereotype target (e.g. Suhr and Gunstad, 2002; Ozen and Fernandes 2011). Research should continue to identify the unique characteristics of a head injured population and explore the situational constraints necessary to elicit impairment.

Intervention Programs

Future research will hopefully provide valuable information regarding the situational influences on behavior within a neuropsychological assessment. A beneficial goal of this research would be the development of intervention programs or procedures to negate the negative stigma of neuropsychological testing. Social psychology has produced several studies which indicate that intervention programs benefit targets of negative stereotype. The intervention program administered by Mittenberg et al. (1996) had favorable results within a head injured population. This intervention was administered in the form of a manual that provided information on how to interpret symptoms (e.g. attributing symptoms to stress, anxiety, etc. instead of head injury) and offered instructions for thought stopping, replacement of negatively biased thoughts, and other modes of facilitation (p. 141-142). In comparison to the control group, the treatment group demonstrated significantly shorter symptom duration, fewer symptom ratings, and less symptom severity. This suggests that "brief, early psychological intervention" can ameliorate the consequences of negative stigma (p. 143).

Conclusion: Application of the Diagnosis Threat to War Veterans

Hoge, Goldberg, and Castro (2009) reviewed the post-deployment screening of war veterans, providing an applied illustration of the diagnosis threat. The United States' recent war activity has increased interest in the effects of head injury; however, treating PCS and MTBI are marked by the same limitations outlined throughout this paper. Screening for MTBI is plagued by subjective reporting which is dependent upon retrospective accounts. In fact, simply agreeing with being "dazed" or "confused" accounts for two-thirds of MTBI cases (p. 1588). A causal association is often established between PCS symptoms and head injury even though PCS symptoms are commonly experienced in the general population and can also be caused by other

conditions such as PTSD, anxiety, depression, or the mere intensity of war (p. 1589).

Furthermore, referral to a specialty TBI or polytrauma clinic occurs under the suspicion of PCS,

not upon solid evidence of cognitive dysfunction (p. 1590). This evidences an errant diagnosis

process that holds a premeditated cause of injury and can possibly elicit iatrogenic effects. In

addition, a federal regulation established in 2008 awards a 40% disability to veterans who report

three or more PCS symptoms, despite research that supports an association between

compensation and heightened symptom reporting (p. 1590). According to research, these

conditions present an excellent stage for the diagnosis threat. Negative expectations are apt to

proliferate throughout this process; additional psychological and neurological conditions are

likely present and confound symptom report; subjective reporting can lead to inaccurate

conclusions and are subject to nocebo effects, iatrogenic effects, "good old day" bias, and

negative expectations. Stigma visibility also runs high in these environments and veterans are

subsequently primary targets of being labeled inferior. The process through which veterans are

treated for MTBI and PCS appears to be highly susceptible to the diagnosis threat and may be

guilty of Suhr and Gunstad's (2002) claim that many clinicians and researchers ignore the fact

that "neurospcyhological tests assess behavior and are not direct measures of brain function" (p.

448). Although medical practices are dedicated to providing the utmost care and provision to war

veterans, current treatment measures may in fact induce illness.

Current Research

Suhr and Gunstad (2002)

To date, there have been three published studies designed to specifically test the

diagnosis threat. Suhr and Gunstad (2002) was the initial diagnosis threat study and included a

sample of 36 undergraduates with a previous history of head injury (LOC < 30 minutes; no

depression or neurological history) who were divided into "neutral" or "diagnosis threat" conditions. The diagnosis threat condition was primed for a negative stereotype by suggesting, that "individuals with head injuries/concussions show cognitive deficits on neuropsychological tests. Deficits in areas such as attention, memory, and speed of information processing are common – though other deficits sometimes emerge" (p. 450-451). The neutral condition was not primed for a stereotype; instead they were briefly informed of general testing information (p. 450). The primary goal of this experiment was to observe how the diagnosis threat affects assessments of memory, intellect, attention, and psychomotor speed. A secondary goal was to assess how the diagnosis threat would affect self-confidence about the cognitive tests, perceived difficulty of the tasks, and effort in completing the tasks.

The results of Suhr and Gunstad (2002) found that the diagnosis threat condition performed worse than the neutral condition on assessments of memory (AVLT immediate recall, AVLT delayed recall, AVLT delayed recall, and CFT delayed recall) and general intellect (WAIS Information and Block Design). No significant differences were found in attention and speed of information processing. Questionnaires indicate that the diagnosis threat group reported significantly less effort on the tasks; they found the tests to be more difficult, they had less confidence in their performance, and they perceived themselves as doing less on the tests. Furthermore, in the diagnosis threat group, effort was found to significantly correlate with AVLT immediate recall, CFT delayed recall, and WAIS Information. Self-ratings of test difficulty, confidence in performance, pressure to perform, and performance success were also highly correlated. These results support the negative effect of the diagnosis threat on performance while also suggesting that effort and other perceptions may be affected by negative stereotypes.

Suhr and Gunstad (2005)

Suhr and Gunstad (2005) was an extension of Suhr and Gunstad (2002) and sought to identify how anxiety, effort, and depression are affected by the diagnosis threat. Fifty-three undergraduates with a history of head injury were divided into neutral and diagnostic groups identical to the ones used in Suhr and Gunstad (2002). Depression was measured prior to the experimental task; anxiety and effort was measured after the experimental task.

The results indicate performance differences similar to Suhr and Gunstad (2002), but do not indicate effects of effort, anxiety, or depression. The diagnosis threat condition performed worse on tests of memory (CFT delayed recall and WMT Paired Associates), psychomotor speed (Digit Symbol test), and attention/working memory (Digit span, Letter Number Sequencing, and Mental Arithmetic subtests of the WAIS-III). No group differences were found in executive functioning. These results support the claim that diagnosis threat affects performance, but does not reveal how effort, anxiety, and depression measures are affected.

Ozen and Fernandes (2011)

Ozen and Fernandes (2011) provides further research on symptom expectation and self-report. This study included 43 undergraduate students with a history of mild head injury (LOC < 30 minutes; PTA < 24 hours; injury at least 6 months prior to experiment) and 44 undergraduates without history of a head injury. To test the diagnosis threat, participants were divided into neutral and diagnosis threat conditions and were administered a neuropsychological battery designed to assess attention span and working memory, processing speed and cognitive flexibility, and immediate verbal memory. Manipulation of study title and experiment instructions defined the neutral and diagnosis conditions. The manipulations in this experiment were markedly more subtle than Suhr and Gunstad (2002; 2005). The diagnostic threat condition

was told the experiment was entitled, "Working memory in young adults who have experienced a head injury compared to young adults who have not experienced a head injury" (p. 3). The group was also informed that the purpose of the study was "to investigate the potential long-lasting negative effects of a MHI on memory and attention" (p. 2). The neutral condition was not primed for a negative stereotype; they were informed that the study was entitled "Working Memory and Attention in Young Adults" and that the purpose of the study was to "examine memory and attention in young adults" (p.2-3). The Attention-related Cognitive Error Scale (ARCES; Carriere, Cheyne, & Smilek, 2008) and the Memory Failures Scale (MFS; Carriere et al., 2008) were administered after the experimental task. Other measures of depression and anxiety were also administered after the experimental task.

The results indicate that the diagnosis threat condition did not exclusively experience a deficit of performance across any neuropsychological assessment. The entire head injured group, both in the neutral and diagnosis condition, performed worse than controls on the Digit Span forward task. No other performance differences were found; however, the memory, attention, and anxiety questionnaires produced significant results. For attention, the diagnosis head injured group reported greater attention failures than the diagnosis controls and neutral head injured group. For memory, the diagnosis head injured group reported greater memory failures than the diagnosis controls. For anxiety, the neutral condition reported greater anxiety than the diagnostic head injured group or the neutral controls.

These results demonstrate how self-report is affected by the diagnosis threat. When a head injured group was presented with the diagnosis threat, they endorsed significantly greater attention and memory failures. The study also found that the neutral group reported increased anxiety, possibly because the neutral group was unable to attribute failure to head injury. Since

43

the diagnosis head injured group had a plausible reason for failure (i.e. head injury) they may have had lower expectations and therefore less anxiety, whereas the neutral group did not have lowered expectations and as a result may have experienced more pressure to perform well (p. 8). Despite the self-report differences, performance was not affected by condition manipulation. Instead, this study supports the idea that the diagnosis threat can affect self-reports, providing valuable questions regarding the accuracy of self-reported symptoms in head injured populations.

Limitations of Current Research and Future Research

These three articles provide a background for diagnosis threat research; however, more research must be conducted in order to attain adequate knowledge of this threat. Since the diagnosis threat is a complex phenomenon, research is challenged with the daunting task of defining the mechanisms and situational variables active in this threat. Thus far, research in this field has presented more questions than solid empirical evidence; nonetheless, a few preliminary conclusions can be derived from these articles.

The self-report measures of Suhr (2002) and Ozen (2011) suggest the diagnosis threat reduces confidence and increases the perception of failure. Interestingly, Ozen (2011) did not find differences in performance whereas Suhr (2002; 2005) found differences in performance. Ozen (2011) demonstrated that the presence of the diagnosis threat does not always impair performance and Suhr (2005) revealed that the diagnosis threat does not always impact self-report. These studies indicate that the diagnosis threat can elicit different results across different situations, suggesting that subtle situational manipulations may affect overall performance. Limited research does not provide sufficient understanding of these differences.

The characteristics of a MTBI population are a large limitation of diagnosis threat research. Ultimately, research in this field is limited by the fact that this population possesses low stigma visibility. Since a mild head injured population possesses low stigma visibility, participants in diagnosis threat research may not fully identify with the negative stereotype and may subsequently evade the diagnosis threat. Research may therefore be confounded by the fact that diagnosis threat activation is not congruently activated across a head injured population, despite identical stereotype manipulation. Since researchers cannot guarantee that the same situation affects all head injured participants similarly, measuring situational factors through questionnaires may provide beneficial information. For example, current diagnosis threat research fails to measure stigma identification. Inclusion of this feature may offer important conclusions about the diagnosis threat. The stereotype manipulation of Suhr (2002; 2005) may have been pervasive to an extent which mandated little stigma identification in order to be affected by the threat. On the other hand, Ozen's (2011) manipulation was less pervasive and may have required higher stigma identification to elicit performance deficits. These conclusions are speculative until future research measures these domains.

Another limitation of current research is the generalizability of these results. Current research has employed a testing sample and environment which fails to emulate realistic diagnosis threat conditions, presenting a large barrier to generalizbility. Each study has used a testing population of highly functioning undergraduate participants without previous psychiatric, psychological, or substance abuse history. This population likely does not represent a population that is at primary risk of the diagnosis threat. Furthermore, these undergraduates are likely not invested into head injuries, unlike patients in a realistic testing environment who are typically invested in the presumption that something is wrong. MTBI patients likely hold negative

expectations and possess sufficient knowledge of the symptoms to be expected, possibly making them more susceptible to situational pressure. An undergraduate population may not possess preexisting knowledge and expectations and therefore may be less susceptible to pressure; however, if the diagnosis threat is elicited in this highly functioning population, this threat can reasonably be elicited in other populations. Overall, the environmental context of current research fails to capture the true situational confounds of the diagnosis threat. To the credit of current research, attaining an authentic neuropsychological environment is difficult and contains many ethical and practical hurdles. A feasible alternative would be assessing these situational variables (e.g. domain and stigma identification, negative expectations, etc.) through questionnaires to identify how different elements relate to the diagnosis threat.

Research is also limited by the subjective nature of the diagnosis threat and the subjective evaluations available to assess a head injured population. For example, the diagnosis of MTBI is based upon behavioral symptoms. Since these symptoms are not entirely objective, they may be impacted by other variables (e.g. suggestibility, low expectations, iatrogenesis), increasing the ambiguity of diagnosis. MTBI also varies in degree of intensity, source of injury, and resulting symptoms. These injuries are rarely identical, increasing variability between MTBI patients. Furthermore, neuropsychological assessments often include self-report. The subjective nature of these assessments can be susceptible to inaccuracies.

Future research should employ certain measures to overcome current limitations. This includes testing a more generalized population outside of highly functioning undergraduates. In addition, objective measures, such as the lexical decision task used in Davies, et al. (2002) would help standardize research. Future research also has the daunting task of identifying the key elements of the diagnosis threat. Current understanding is largely marked by speculation and

lacks solid evidence to account for how the diagnosis threat affects performance. Research

should identify how negative expectations, nocebo effects, negative emotions, and other

variables interact with the situational pressure of the diagnosis threat. In addition, research

should explore how situational factors such as domain identification, test difficulty, and

perception of test validity influence the diagnosis threat.

The complexity of the diagnosis threat presents many limitations for current research.

Nonetheless, null findings within research may not indicate absence of the diagnosis threat, but

may indicate the experiment's inability to adequately assess the complexity of this threat.

Progress in this line of research will offer important information concerning how expectations

and situational constraints affect behavior.

Part III: Applied Study

Introduction

A study at the University of South Florida applied the principles presented throughout

this paper. A pilot study was conducted throughout the summer of 2010, followed by the final

study in the fall of 2010. The primary purpose of this experiment was to determine if moderate

threat cues are able to elicit the diagnosis threat. Suhr and Gunstad (2002, 2005) employed

blatant cues that directly connected head injury with cognitive deficits and noted the specific

cognitive deficits to which the patients were at risk. Each study found deficits in cognitive

performance; however, Ozen (2011) employed a subtle cue and did not find cognitive deficits.

Stereotype threat literature emphasizes the situational specificity of this threat (e.g. Steele &

Aronson, 1995); therefore, understanding the diagnosis threat is dependent upon knowing which

situations elicit the threat. This present study attempts to provide further information on the

situational variables specific to the diagnosis threat by observing the effects of a moderate threat

cue. In addition, this study introduces another situational variable by employing a group format unlike previous studies that used a one-on-one format. An additional feature of this study was the inclusion of a gender stereotype threat with the objective of comparing the stereotype threat to the diagnosis threat. Further observations were conducted on how domain identification relates to the diagnosis threat and how self-report is affected by the diagnosis threat. This study applies the concepts presented throughout this paper and attempts to provide further information on the non-neurological factors that may influence neuropsychological assessments.

Hypotheses

Based upon the theories, research, and principles discussed throughout this paper several hypotheses emerge:

Hypothesis 1: The situational manipulations of this study will be the primary source of cognitive performance difference across groups. A moderate threat cue will be sufficient to elicit the diagnosis threat and the stereotype threat. The presence of these threats will promote differences in cognitive performance across groups as demonstrated in previous research. Although current diagnosis threat research has only used one-on-one group administration format, a group format resembles previous gender stereotype threat studies (e.g. Spencer et al., 1999) and will achieve similar results within a head injured population.

Hypothesis 2: A history of concussion will impair performance only when the diagnosis threat is salient such that head injured participants will exhibit cognitive deficits only in the diagnostic threat condition.

Hypothesis 3: Increased identity with concussion and higher symptom report will increase the magnitude of the diagnosis threat and will increase performance deficits within the diagnosis threat group.

Hypothesis 4: Gender differences will emerge only when the stereotype threat is present such that females will perform worse than males only in the gender stereotype condition.

Hypothesis 5: When gender and concussion stereotypes are not present, cognitive performance in a head injured population will resemble that of a healthy population. Therefore, the neutral condition and the control condition will produce similar results, demonstrating that the stereotype manipulation is the primary source of performance differences across groups.

Method

Participants

Recruitment of undergraduate students took place through an online prescreen pool at the University of South Florida. Participants who endorsed a history of concussion defined as a blow to the head involving a brief (i.e., < 30 minutes) alteration in consciousness (AOC) or loss of consciousness (LOC) on the prescreen pool were eligible to take part in the study and were randomly assigned to one of three experimental conditions. Exclusion criteria included: a history of TBI involving LOC greater than 30 minutes; any other neurological history (e.g., stroke, attention-deficit hyperactivity disorder, learning disability, etc.); a prior history of treatment for substance abuse; history of psychiatric hospitalization; and history of any psychiatric conditions other than depression or anxiety. Participants were eligible for the control condition if they denied a history of concussion as defined above. Other exclusionary criteria for the control participants were the same as those of the experimental groups.

A total of 265 undergraduate students (113 male, 152 female) volunteered to participate. This included 182 head injured participants (73 male, 109 female) and 83 non-head injured controls (40 male, 43 female). Course credit was offered in exchange for participation. The ages ranged from 17-60 years with a mean of 20.5. Participants answered a second screening

questionnaire to ensure that participants met criteria for the study. This screen found 50

participants (19%) with improper qualifications. These 50 participants received credit for

participating; however, their data was excluded from analysis. An additional glitch in the sign-up

process mandated the elimination of the data of 10 other participants. Overall, the data of 60

participants (22.6%) were excluded from analysis. This amounted to 29% of the original control

group (24 participants) and 19% of the head injury group (36 participants). The final sample used

for analysis included 205 participants with 146 head injured participants (59 male, 87 female)

and 59 non-injured controls (25 male, 34 female). Age ranged from 17-60 with an average age of

20.4.

Measures

  Experimental Task: The experimental task assessed verbal working memory through 17

mental arithmetic items adapted from the Wechsler Adult Intelligence Scale – Fourth Edition

(WAIS-IV) Arithmetic subtest. The arithmetic problems were prerecorded and administered

through computer speakers. The speaker was male. A beep indicated the beginning of each

problem and was followed by the prerecorded question. After the arithmetic question was

administered a 30 second interval was allotted during which the participants answered the

problem. At the end of the 30 second answering period, a beep alerted the participants of the next

problem. Participants were informed not to work out problems on the answer sheet. The task was

approximately 15 minutes.

  Self-Report Questionnaires: Participants were asked to complete six separate

questionnaires to collect the following information: demographics; pre-screen check; concussion

injury history; extent of identification with gender label; extent of identification with label of

someone with a concussion (only head injured participants); and severity of postconcussive symptoms. In total, the questionnaires required approximately 15 minutes to complete.

*Demographics***:** A demographics questionnaire was employed to assess age, gender, years of schooling and any psychological, psychiatric, neurological, or other medical conditions.

Pre-Screen Check: The pre-screen check included the same exclusionary criteria as the initial pre-screen questionnaire. Participants indicated if they had experienced 1) a "concussion or head injury" 2) being "knocked out" and 3) a "blow to the head that resulted in feeling 'dazed' or 'confused' immediately afterwards." Questions regarding loss of consciousness and post-traumatic amnesia were also included.

Concussion History: A concussion history questionnaire identified whether the participant had experienced a concussion or head injury. Those who indicated head injury indentified the cause of injury, number of head injuries, time since last head injury, time since most severe head injury, alterations or loss of consciousness, and symptoms attributed to the head injury.

Self-Identity Measure: Two measures of identity were used: one for gender identity and one for concussion identity. These questionnaires consisted of four questions which were answered on a 7 point Likert-type scale with 1 indicating "strongly disagree" and 7 indicating "strongly agree." The healthy control group did not receive a concussion identity questionnaire.

Symptom Measure: The Neurobehavioral Symptom Inventory was administered to assess the presence of concussion symptoms. The directions instructed the participants to rate the experience of 22 symptoms on a 4 point Likert-type scale (0 = none; 4 = very severe). The head injured group was instructed to rate the experience of symptoms since the head injury and the control group was instructed to rate the symptoms according to how much they "disturb you". In

addition, the head injured participants were asked to indicate if the symptoms are believed to be related to the concussion (yes or no).

Procedure

The study was entitled "The Impact of Self-Beliefs on Cognitive Performance" and was approved by the university Institutional Review Board. The experiment occurred in a classroom environment and was administered in a group setting. Informed consent was obtained and concussed participants were randomly assigned to one of three possible instruction set manipulations: (1) a Diagnosis Threat (DT) instructional set, (2) a Gender Stereotype (GS) threat instructional set, and (3) a Neutral (N) task instructional set. The DT condition was provided with the following instructions that informed them of their selection for the study based on history of concussion:

> *You have been invited to participate in this study because your responses on a pre-screening questionnaire completed at the beginning of the term indicated that you have a history of receiving a blow to the head that resulted in a loss of consciousness and/or feelings of being dazed, confused and/or disoriented. Any of these are indicative of having had a concussion. Studies suggest that individuals can experience problems with concentration and memory after a concussion. The aim of this study is to examine the extent to which concussion impacts concentration and memory abilities. This will be assessed by a series of mental arithmetic problems. You will hear each problem one at a time followed by a 30 second interval to answer each question. A beep will indicate the beginning of the next question. You will not be allowed to work out the mental arithmetic problems on scratch paper. Please write your answers on the next page entitled Mental Arithmetic Response Sheet. Do not make any stray marks on your response sheet, and you may only use a pen. Please give your best effort on this task. The remainder of the session will consist of completing several questionnaires in the sealed portion of your packet. Please do not break the seal until the first task is completed.*

Participants in the gender condition were provided with the following task instructions which emphasized gender differences in arithmetic performance:

> *You will be completing an arithmetic test to examine gender differences in math performance. You will hear each problem one at a time followed by a 30 second interval to answer each question. A beep will indicate the beginning of the next question. You will*

not be allowed to work out the arithmetic problems on scratch paper. Please write your answers on the next page entitled Arithmetic Response Sheet. Do not make any stray marks on your response sheet and, you may only use a pen. Please give your best effort on this task. The remainder of the session will consist of completing several questionnaires in the sealed portion of your packet. Please do not break the seal until the first task is completed.

Both the neutral concussed and neurologically-healthy control condition received the following neutral task instructions:

The first part of this experiment consists of a problem solving task. You will hear each problem one at a time followed by a 30 second interval to answer each question. A beep will indicate the beginning of the next question. You will not be allowed to work out the problems on scratch paper. Please write your answers on the next page entitled Problem Solving Response Sheet. Do not make any stray marks on your response sheet, and you may only use a pen. Please give your best effort on this task. The remainder of the session will consist of completing several questionnaires in the sealed portion of your packet. Please do not break the seal until the first task is completed.

After reading the instructions, the experimental task was administered. At the conclusion of the task, participants completed a series of questionnaires and were debriefed. The total session time spanned approximately 30 minutes.

Results

Demographics

Groups were not different in age, $F(3,260) = .447$, $p > .05$, or year in school, $F(3,261) = 1.838$, $p > .05$. Sex distribution was not different among groups, $\chi^2(3) = 1.23$, $p > .05$. All participants in the Diagnosis Threat (DT), Gender Stereotype (GS), and Neutral (N) groups reported a history of at least one concussion defined as receiving a blow to the head and resulting in either a period of alteration in consciousness lasting less than 30 minutes or loss of consciousness lasting less than 30 minutes. The concussion groups were not significantly different in time since injury, $F(2,123) = 1.68$, $p > .05$. Furthermore, there was not a significant

difference of duration of LOC between groups, $\chi^2(4) = 2.84$, $p > .05$. Overall, all groups were comparable in demographic variables, and all concussion groups were comparable in injury characteristics.

Arithmetic Task Performance

A Group X Gender analysis of variance (ANOVA) on the arithmetic task performance revealed a significant main effect of Gender, $F(1,197) = 16.39$, $p < .05$, such that the arithmetic scores for males ($M = 11.11$, $SD = 2.92$) were significantly higher than females ($M = 9.50$, $SD = 2.77$). There was also a main effect of Group, $F(3, 197) = 2.79$, $p < .05$. Post-hoc analyses revealed that the GS group performed significantly better on the arithmetic task ($M = 11.14$, $SD = 2.66$) than the DT condition ($M = 9.53$, $SD = 3.03$), $p < .05$. No significant interaction was found $F(x,x) = x$, $p > .05$.

When all concussed individuals were compared to those without a history of concussion (i.e., controls), no significant group differences emerged on arithmetic task performance, $F(1, 203) = .056$, $p > .05$, indicating that a history of concussion in and of itself did not negatively impact task performance.

When comparing task performance in concussed individuals who experienced LOC with concussed individuals who experienced AOC, a significant difference emerged, $F(1, 144) = 3.77$, $p = .05$. More specifically, individuals who experienced LOC ($M = 9.75$, $SD = 2.82$) performed significantly worse than those who experienced merely an alteration in consciousness ($M = 10.66$, $SD = 2.87$).

No significant differences were found when examining whether identifying as someone who has had a concussion impacted task performance, $F(1,144) = .811$, $p > .05$.

Symptom Reporting

A Group X Gender analysis of variance (ANOVA) on total symptom reporting (i.e., total score on the NSI) revealed a significant main effect of Gender, $F(1,187) = 20.50$, $p < .05$, such that male participants ($M = 9.23$, $SD = 9.86$) reported significantly fewer symptoms than female participants ($M = 16.09$, $SD = 11.32$). There was also a main effect of Group, $F(3, 187) = 2.67$, $p < .05$. Post-hoc analyses revealed that the control group ($M = 16.00$, $SD = 11.85$) reported significantly more symptoms than the GS group ($M = 10.56$, $SD = 9.11$), $p < .05$; no other significant group differences in symptom reporting emerged.

When all concussed individuals were compared to those without a history of concussion (i.e., controls), a significant group difference emerged on symptom reporting, $F(1, 193) = 5.09$, $p < .05$, such that those without a history of concussion (i.e., control participants) had greater symptom reports ($M = 16.00$, $SD = 11.85$) than those with a concussion history ($M = 12.05$, $SD = 10.80$). This finding is consistent with research indicating that a non-injured population can exhibit higher symptom ratings than a head injured population (e.g. Chan, 2001; Garden & Sullivan, 2010; Iverson & Lange, 2003).

When comparing symptom reporting in concussed individuals who experienced LOC with concussed individuals who experienced AOC, no significant differences emerged, $F(1, 136) = .16$, $p > .05$. Similarly, when examining whether identifying as someone who has had a concussion impacted symptom reporting, no significant differences were found, $F(1,136) = 2.67$, $p > .05$.

Correlations

Analyses were completed to explore potential relationships between arithmetic task performance, symptom reporting, identification with having had a concussion, and presence of

LOC. There was a significant negative relationship between arithmetic task performance and symptom reporting such that task performance decreased as symptom reporting increased, $r = -.190$, $p < .01$. No other correlations were significant, r's $< .14$.

Discussion

The conditions of group format and moderate threat cues likely account for the results of this study. Primarily, this study found that the diagnosis threat condition did not exhibit cognitive deficits, suggesting that history of head injury did not affect performance. This is consistent with Ozen & Fernandes (2011) which employed a subtle threat cue and did not find cognitive deficits in the diagnosis threat condition. These results suggest that eliciting the diagnosis threat in a non-neurological population requires a blatant threat cue similar to Suhr and Gunstad (2002, 2005).

In addition, LOC participants performed significantly worse than AOC participants, possibly indicating that the severity of injury affects cognitive performance. However, this performance difference was not reflected in symptom reports, contradicting the finding that increased symptom report resulted in lower cognitive performance. Although LOC participants did not appear to perceive a cognitive deficit, they demonstrated cognitive deficits in the experimental task. This difference between LOC and AOC may indicate that the severity of head injury affects cognitive performance; however, within mild head injury patients, this deficit may not present barriers to daily function. Another possibility is that LOC may encourage greater identification with head injury and vulnerability to cognitive impairment than AOC. Steele (1997) advocates the importance of domain identification in eliciting anxiety, apprehension, and cognitive deficits. Although there is no indication in self-report, it is possible that LOC

represents higher identification with cognitive impairment and is sufficient to affect performance within a testing environment. Additional research should continue to explore this effect.

This study also found a relationship between symptom report and cognitive performance such that as symptom report increased, cognitive performance decreased. Contrary to predictions, this relationship was not specific to concussion history; in fact, non-head injured participants reported higher symptom ratings than concussed participants. High symptom ratings in a non-injured population are not uncommon and have been documented in previous research (e.g. Chan, 2001; Garden & Sullivan, 2010; Iverson & Lange, 2003). For example, previous research suggests that over 70% of neurologically healthy samples can meet diagnosis criteria for post-concussive syndrome (Iverson & Lange, 2003).Since this current study revealed a negative relationship between symptom report and cognitive performance it appears that the severity of complaint, not the presence of head injury, has primary influence on cognitive performance, further demonstrating that PCS symptoms are not exclusive to MTBI. Coincidentally, the head injured population in the current sample reported fewer symptoms than the non-injured population; however, other studies (e.g. Mittenberg, DiGiulio, Perrin, and Bass, 1992; (Iverson, Lange, Brooks, and Rennison, 2010; Gunstad and Suhr, 2001; Whittaker et al., 2007) indicate a high symptom rating in a concussed population which, according to the current study, may subsequently translate into increased cognitive deficits. Lower symptom ratings in this study's head injured participants may indicate denial or lack of identification with concussion. This is a high possibility considering that the sample was a non-clinical, highly functioning sample which is unlikely to identify with cognitive impairment. If the sample did not identify or denied concussion, they may have been protected from the debilitating effects of diagnosis threat.

Overall, the findings of this study further support the idea that head injury symptoms are not specific to head injury.

Contrary to predictions, a stereotype threat effect was not found in gender. Instead an overall gender difference was found across all groups in which males performed better and reported significantly fewer symptoms than females. The fact that a specific gender stereotype threat was not found may be the result of what Nguyen and Ryan (2008) term the "prove it wrong" phenomenon, in which the participant acquires motivation instead of apprehension from the threat (p. 1315). Another possibility may be that a stereotype threat was elicited across all conditions. Since the test was administered in a group format, the testing environment and the mere sight of gender differences may have been sufficient to elicit a stereotype threat. This is consistent with previous stereotype threat research which reveals that very subtle manipulations can elicit cognitive impairment (e.g. Croizet & Claire, 1998; Spencer et al., 1999). Spencer et al. (1999) employed mixed groups similar to the current experiment. This assessment made no reference to gender differences. Instead, the assessment was only labeled as a "development of some new tests" (p. 9). Nonetheless, gender differences still emerged. This suggests that an explicit reference to gender difference is not essential to eliciting a gender stereotype threat, possibly accounting for the gender differences in the current study.

This current study furthers research regarding the situational variables of the diagnosis threat. Moderate cues were not found to elicit cognitive deficits any more than the subtle manipulations of Ozen and Fernandes (2011). In addition, the group format may have diffused individual pressure and weakened the threat strength. Eliciting the diagnosis threat in a non-neurological population appears dependent upon the criteria of Suhr and Gunstad: one-on-one test administration and blatant threat cues. However, these conditions may change within a

58

clinical population. This present study is largely limited by the non-generalizable nature of the testing sample. This highly functioning population may not identify with concussion or cognitive impairment. Although the diagnosis threat is prevalent in a college population, many college students may have already found a way to overcome or cope with this threat in order to achieve their current education. After all, in order for this sample to attain their current education status they must have demonstrated cognitive competence to some degree; therefore, they may not be as susceptible to moderate or subtle suggestions of intellectual or cognitive inferiority. Future research should continue to observe how domain identification and the magnitude of threat cue strengthens or weakens the diagnosis threat.

Conclusion

This paper has identified many facets of the diagnosis threat, including the history, mechanisms, and research within this field. A review of the stereotype threat established the premise of the diagnosis threat. This includes the fundamental effect that when an individual is presented with the threat of confirming cognitive incompetence, a series of negative expectations, anxiety, and negative emotions elicit cognitive deficits. Furthermore, this effect is not specific to any particular group. The diagnosis threat is specific to a head injured population and suggests that non-neuropsychological factors may affect neuropsychological assessment. A study at the University of South Florida applied current knowledge of the diagnosis threat and sought to test a critical feature of the diagnosis threat: situational-specificity. The stereotype threat, and subsequently the diagnosis threat, is largely dependent upon situational pressures. The current study offered information regarding how the testing format (e.g. group setting and moderate threat cue) affects the strength of diagnosis threat. Despite the current advancements in this line of research, research in this field is limited and much growth must occur before notable

improvements are achieved. Nonetheless, this topic of research offers promising indication that

two separate fields of psychology (social psychology and neuropsychology) are able to combine

efforts to collectively understand a phenomenon, hopefully encouraging further collaboration

within these fields.

References

Anda, R., Williamson, D., Jones, D., MacEra, C., Eaker, E., Glassman, A., et al. (1993). Depressed affect, hopelessness, and the risk of ischemic heart disease in a cohort of U.S. adults. *Epidemiology, 4*(4), pp. 285-294.

Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). When white men can't do math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social Psychology, 35*(1), 29-46.

Augoustinos, M., Ahrens, C., & Innes, J. M. (1994). Stereotypes and prejudice: The australian experience. *British Journal of Social Psychology, 33*(1), 125-141.

Belanger, H. G., Curtiss, G., Demery, J. A., Lebowitz, B. K., & Vanderploeg, R. D. (2005). Factors moderating neuropsychological outcomes following mild traumatic brain injury: A meta-analysis. *Journal of the International Neuropsychological Society, 11*(3), 215-227.

Bootzin, R. R., & Bailey, E. T. (2005). Understanding placebo, nocebo, and iatrogenic treatment effects. *Journal of Clinical Psychology, 61*(7), 871-880.

Burgess, M., & Hokanson, J. E. (1964). Effects of increased heart rate on intellectual performance. *The Journal of Abnormal and Social Psychology, 68*(1), 85-91.

Carriere, J. S. A., Cheyne, J. A., & Smilek, D. (2008). Everyday attention lapses and memory failures: The affective consequences of mindlessness. *Consciousness & Cognition, 17*(3), 835-847.

Castleton, S. A. (2011). *The $9 Billion Solution*. Retrieved from http://emedicine.medscape.com/article/292326-overview

Chan, R. C. K. (2001). Base rate of post-concussion symptoms among normal people and its neuropsychological correlates. *Clinical Rehabilitation, 15*(3), 266-273.

Cole, J. C., Michailidou, K., Jerome, L., & Sumnall, H. R. (2006). The effects of stereotype

    threat on cognitive function in ecstasy users. *Journal of Psychopharmacology, 20*(4),

    518-525.

Corrigan, P. W., & Holtzman, K. L. (2001). Do stereotype threats influence social cognitive

    deficits in schizophrenia? In D. L. Penn (Ed.), *Social cognition and schizophrenia.* (pp. 175-

    192). Washington, DC US: American Psychological Association.

Corrigan, P. W., & Watson, A. C. (2002). The paradox of self-stigma and mental illness. *Clinical*

    Psychology: Science and Practice, 9(1), 35-53.

Croizet, J., & Claire, T. (1998). Extending the concept of stereotype and threat to social class:

    The intellectual underperformance of students from low socioeconimic backgrounds.

    Personality and Social Psychology Bulletin, 24(6), 588-594.

Davies, P. G., Spencer, S. J., Quinn, D. M., & Gerhardstein, R. (2002). Consuming images: How

    television commercials that elicit stereotype threat can restrain women academically and

    professionally. *Personality and Social Psychology Bulletin, 28*(12), 1615-1628.

Dweck, C. S. (1986). Motivational processes affecting learning. *American Psychologist, 41*(10),

    1040-1048.

Esses, V. M., Haddock, G., & Zanna, M. P. (1994). The role of mood in the expression of

    intergroup stereotypes. In J. M. Olson (Ed.), *The psychology of prejudice: The ontario*

    symposium, vol. 7. (pp. 77-101). Hillsdale, NJ England: Lawrence Erlbaum Associates, Inc.

Farina, A., Gliha, D., Bourdreau, L. A., Ale, J. G., & Sherman, M. (1971). Mental illness and the

    impact of believing others know about it. *Journal of Abnormal Psychology, 77*(1), 1-5.

Frasure-Smit, N., LespQance, F., & Talajic, M. (1993). Depression following myocardial

    infarction: Impact on 6-month survival. *Journal of the American Medical Association, 270*,

    1819-1825.

Garden, N., & Sullivan, K. A. (2010). An examination of the base rates of post-concussion

    symptoms: The influence of demographics and depression. *Psychology Press,17*(1), 1-7.

Gunstad, J., & Suhr, J. A. (2001). 'Expectation as etiology' versus 'the good old days':

    Postconcussion syndrome symptom reporting in athletes, headache sufferers, and depressed

    individuals. *Journal of the International Neuropsychological Society, 7*(3), 323-333.

Gunstad, J., & Suhr, J. A. (2004). Cognitive factors in postconcussion syndrome symptom

    report. *Archives of Clinical Neuropsychology, 19*(3), 391-405.

Hahn, R. A. (1997). The nocebo phenomenon: Concept, evidence, and implications for public

    health. *Preventive Medicine, 26*(5), 607-611.

Hahn, R. A. (1999). Expectations of sickness: Concept and evidence of the nocebo phenomenon.

    In I. Kirsch (Ed.), *How expectancies shape experience.* (pp. 333-356). Washington, DC US:

    American Psychological Association.

Hamilton, D. L., & Sherman, J. W. (1994) Stereotypes. In R. S. Wyer, Jr., & T. K. Srull (Eds.),

    Handbook of social cognition, Vol.1: Basic processes (2nd ed., pp. 1–68). Hillsdale, NJ:

    Erlbaum.

Hoge, C. W., Goldberg, H. M., & Castro, C. A. (2009). *Care of war veterans with mild traumatic*

    brain injury — flawed perspectives

Iverson, G. L. (2005). Outcome from mild traumatic brain injury. *Current Opinion in Psychiatry, 18*(3),

    301-317.

Iverson, G. L., & Lange, R. T. (2003). Examination of "postconcussion-like" symptoms in a

    healthy sample. *Applied Neuropsychology, 10*(3), 137-144.

Iverson, G. L., & Mccracken, L. M. (1997). Postconcussive symptoms in persons with chronic

    pain. *Brain Injury, 11*(11), 783-790.

Iverson, G. L., Lange, R. T., Brooks, B. L., & Rennison, V. L. (2010). [Image omitted] "Good

    old days" bias following mild traumatic brain injury. *Clinical Neuropsychologist, 24*(1), 17-

    37.

Jewett, D. L., Fein, G., & Greenberg, M. H. (1990). A double-blind study of symptom

    provocation to determine food sensitivity. *New England Journal of Medicine, 323*(7), 429-

    433.

Katz, I., Roberts, S. O., & Robinson, J. M. (1965). Effects of task difficulty, race of

    administrator, and instructions on digit-symbol performance of negroes. *Journal of*

    Personality and Social Psychology, 2(1), 53-59.

Kennedy, W. P. (1961). The nocebo reaction. *Medical World*, *91*, 203-205.

King, P. (2010). *The hits that are changing football.* Retrieved from

    http://sportsillustrated.cnn.com/vault/article/magazine/MAG1176374/index.htm

Kinkela, J. H. (2008). *Diagnosis threat in mild traumatic brain injury.* (Unpublished doctoral

    dissertation). Ohio University, Ohio.

Kit, K.A. (2009). *The influence of negative stereotypes and beliefs on neuropsychological test*

    performance in a traumatic brain injury population. (Unpublished doctoral dissertation).

    University of Victoria, Canada.

Kit, K. A., Tuokko, H. A., & Mateer, C. A. (2008). A review of the stereotype threat literature and its

    application in a neurological population. *Neuropsychology Review, 18*(2), 132-148.

Lancman, M. E., Asconapé, J. J., Craven, W. J., & Howard, G. (1994). Predictive value of induction of

  psychogenic seizures by suggestion. *Annals of Neurology, 35*(3), 359-361.

Leininger, B. E., Kreutzer, J. S., & Hilla, M. R. (1991). Comparison of minor and severe head

  injury emotional sequelae using the MMPI. *Brain Injury, 5*(2), 199-205.

Livingston, B. (2010). *NFL has yet to prove any real sympathy for concussion victims*. Retrieved

  from

  http://www.cleveland.com/livingston/index.ssf/2010/10/nfl_has_yet_to_prove_any_real.html

Lubit, R. H. (2010). *Postconcussive syndrome*. Retrieved from

  http://emedicine.medscape.com/article/292326-overview

Luparello, T., Lyons, H. A., Bleecker, E. R., & McFadden, E. R. (1968). Influences of suggestion on

  airway reactivity in asthmatic subjects. *Psychosomatic Medicine, 30*(6), 819-825.

Mittenberg, W., DiGiulio, D. V., Perrin, S., & Bass, A. E. (1992). Symptoms following mild

  head injury: Expectation as aetiology. *Journal of Neurology, Neurosurgery & Psychiatry,*

  55(3), 200-204.

Mittenberg, W., Tremont, G., Zielinski, R. E., Fichera, S., & Rayls, K. R. (1996). Cognitive-

  behavioral prevention of postconcussion syndrome. *Archives of Clinical Neuropsychology,*

  11(2), 139-145.

Myers, M. G., Cairns, J. A., & Singer, J. (1987). The consent form as a possible cause of side

  effects. *Clinical Pharmacology and Therapy, 42*, 250-253.

Nguyen, H. D., & Ryan, A. M. (2008). Does stereotype threat affect test performance of

  minorities and women? A meta-analysis of experimental evidence. *Journal of Applied*

  Psychology, 93(6), 1314-1334.

Ozen, L. J., & Fernandes, M. A. (2011). Effects of "Diagnosis threat" on cognitive and affective

    functioning long after mild head injury. *Journal of the International Neuropsychological*

    Society, 17(2), 219-229.

Schweiger, A., & Parducci, A. (1981). Nocebo: The psychologic induction of pain. *Pavlovian*

    Journal of Biological Science, *16*, 140- 143.

Seibt, B., & Förster, J. (2004). Stereotype threat and performance: How self-stereotypes influence

    processing by inducing regulatory foci. *Journal of Personality & Social Psychology, 87*(1), 38-

    56.

Shyr, L. (2011). *Lasting Impact*. Retrieved from

    http://ngm.nationalgeographic.com/2011/02/big-idea/concussions-text

Sosin, J.E., Sniezek, D.J., & Thurman, D.M. (1996). Incidence of mild and moderate brain injury

    in the united states, 1991. *Brain Injury, 10*(1), 47-54.

Spencer, S. J., Steele, C. M., & Quinn, D.M. (1999). Stereotype threat and women's math

    performance. *Journal of Experimental Social Psychology, 35*(1), 4-28.

Steele, C. M. (1997). A threat in the air. *American Psychologist, 52*(6), 613-629.

Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of

    african americans. *Journal of Personality and Social Psychology, 69*(5), 797-811.

Suhr, J. A., & Gunstad, J. (2002). 'Diagnosis threat': The effect of negative expectations on

    cognitive performance in head injury. *Journal of Clinical and Experimental*

    Neuropsychology, 24(4), 448-457.

Suhr, J. A., & Gunstad, J. (2005). Further exploration of the effect of 'diagnosis threat' on

    cognitive performance in individuals with mild head injury. *Journal of the International*

    Neuropsychological Society, 11(1), 23-29.

The Washington Times (n.d.).. *Topic – sports illustrated.* Retrieved from

    http://www.washingtontimes.com/topics/sports-illustrated/

Thurman, D.J. (2001). The epidemiology and economics of head trauma. In L. Miller & R.

    Hayes (Eds.), *Head trauma: Basic, preclinical, and clinical directions* (pp. 327–348). New

    York: John Wiley & Sons.

Whittaker, R., Kemp, S., & House, A. (2007). Illness perceptions and outcome in mild head

    injury: A longitudinal study. *Journal of Neurology, Neurosurgery & Psychiatry, 78*(6), 644-

    646.

WordPress.org (n.d). *National Geographic Magazine.* Retrieved from

    http://wordpress.org/showcase/national-geographic-magazine/