The Influence of Negative Stereotypes and Beliefs on Neuropsychological Test Performance in a Traumatic Brain Injury Population

by

Karen Anne Kit
B.Sc., University of Waterloo, 2000
M.A., University of Victoria, 2004

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Abstract

Objectives: Most researchers have attributed observed cognitive differences between individuals with a traumatic brain injury (TBI) and 'normal' individuals to physiological changes to the brain. Lacking exploration has been the role of social context/environmental variables. One of the variables investigated in the social psychology literature is stereotypes. Research has shown that the presence of stereotypes in testing environments negatively interferes with test performance (called stereotype threat theory). This concept appears relevant to the TBI population given that empirical research has demonstrated that individuals tend to believe that traumatic brain injuries lead to cognitive deficits, as well as the fact that reminders of potential cognitive deficits are oftentimes present in neuropsychological testing settings (e.g., in pre-test instructions, etc.). It is argued that these cues exacerbate pre-existing negative beliefs regarding cognitive functioning for individuals with a mild-moderate TBI, thereby affecting neuropsychological test performance.

Method: The sample consisted of 42 individuals who sustained a mild-to-moderate TBI at least 6 months earlier and 42 age-, gender-, and education-matched healthy adults below the age of 60. The study consisted of ‘reduced threat’ and ‘heightened threat’ conditions. The purpose of the former condition was to reduce negative stereotypes and emphasize the notion of personal control over cognitive abilities. Questionnaires and neuropsychological tests were administered subsequent to the experimental manipulation.

Results: TBI participants endorsed greater levels of anxiety, motivation, and dejection, but reduced feelings of memory self-efficacy compared to the control group. The most pivotal results to the research study revealed that the TBI heightened threat group displayed lower scores on the *Initial Encoding* and *Attention* composite variables (which were comprised of neuropsychological test measures) than the TBI reduced threat group. Furthermore, the head-injured heightened threat condition reported lower memory self-efficacy than the reduced threat condition, and the non-head-injured heightened threat group endorsed a greater degree of *negative beliefs/stereotypes* regarding TBI than the non-head-injured reduced threat group. The construct of memory self-efficacy was found to mediate the relation between threat condition and performance on encoding/attention measures.

Conclusions: The findings highlight the role of negative stereotypes and expectations/beliefs to cognitive test performance in individuals who have sustained a mild/moderate TBI. To date, there have been few attempts to integrate social cognition with neuropsychology. Applying the information gleaned from previous stereotype threat studies to a TBI population bridges this gap and provides a prosperous avenue for future research.

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Thank you as well to my other committee members. Dr. Holly Tuokko's excitement and heartfelt support about the prospect of merging social psychology with neuropsychology under the framework of this dissertation topic further fueled my interest in this research subject. Dr. Julie Rodgers also lended great insight and advice on the 'social psych' sides of things and made me step outside of thinking in a purely 'neuropsych' manner. Additional 'thank you's' to Dr. Jane Milliken and Dr. Wiley Mittenberg who further enhanced and enriched this project with their words of advice and insight.

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Dedication

This dissertation is dedicated to my parents, who always believed in me and my abilities, and who provided me with unconditional love and unwavering support. From an early age, they taught me about dedication and discipline, as well as the importance and great reward that comes from rising to meet challenges. Without knowing it, they were the first to introduce me to the concept of self-efficacy, thus truly paving the way for the essence and scope of this project.

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Introduction

Traumatic brain injury (characterized as an acute trauma to the brain due to contact forces or acceleration/deceleration trauma) is a common neurological disorder that, typically, has accompanying cognitive deficits. In general, researchers have taken a causal view and claimed that traumatic brain injuries (TBI) directly lead to cognitive impairment because of biological/physiological changes to the brain. Indeed, research studies have documented brain abnormalities in individuals with traumatic brain injuries (e.g., Brandstack, Kurki, Tenovuo, & Isoniemi, 2006; Salmond, Chatfield, Menon, Pickard, & Sahakian, 2005) suggesting that the assumption of a causal link may be warranted. Cerebral contusion, and/or diffuse axonal injury are often the result of a TBI. These primary injury mechanisms can cause small blood vessel rupture, faulty axonal transport, and/or areas of bleeding and swelling. The most common areas affected are the ventral and lateral surfaces of the frontal and temporal lobes of the brain (Sohlberg & Mateer, 2001).

Cognitive deficits accompanying these brain changes include difficulties with attention (especially distractibility and selective attention) (e.g., McAvinue, O'Keeffe, McMackin, & Robertson, 2005; Scheid, Walther, Guthke, Preul, & von Cramon, 2006; Ziino & Ponsford, 2006), memory and new learning (e.g., Nolin, 2006; Scheid et al., 2006; Vakil, 2005), working memory (e.g., McAllister, Flashman, Sparling, & Saykin, 2004; Serino et al., 2006; Vanderploeg, Curtiss, & Belanger, 2005), planning (e.g., McDonald, Flashman, & Saykin, 2002), mental flexibility, inhibition (e.g., Leon-Carrion et al., 1998) and insight/awareness into cognitive and emotional deficits and their impact on overall functioning (e.g., Garmoe, Newman, & O’Connell, 2005). As a rule of thumb, increasing severity of injury (as based on injury characteristics) tends to lead to a greater degree of cognitive impairment across multiple domains (e.g., Rapoport, McCauley, Levin, Song, & Feinstein, 2002; Reitan & Wolfson, 2000).

Stereotype Threat and Test Performance

Given the advances in neuro-imaging illustrating brain abnormalities post-TBI, it is easy to assume that organic causes are solely responsible for cognitive deficits. Most researchers have attributed and linked observed cognitive differences between individuals with a TBI and ‘normal’ individuals to biological/physiological changes to the brain. Lacking exploration, however, has been the role of social context and environmental variables. One of the variables considered and investigated in other populations is stereotypes (i.e., a set of widely-shared, consensual positive or negative beliefs about a group of individuals that facilitate how one processes and interprets novel information) (Hamilton & Trolier, 1986). Despite the fact that empirical research has demonstrated that individuals, even those without a history of head injury, appear to believe that traumatic brain injuries lead to cognitive deficits (e.g., Ferguson, Mittenberg, Barone, & Schneider, 1999; Gunstad & Suhr, 2001; Mittenberg, DiGiulio, Perrin & Bass, 1992), the role of stereotypes on test performance in a TBI population has yet to be thoroughly investigated. The ‘stereotype threat effect’, however, has been studied rather extensively in other populations, and this literature will be discussed below.

As a result of the vast number and broad dissemination of stereotypes present in today’s society, stigmatized group members are often aware of stereotypes, even without personally believing or endorsing them. In situations where the stereotype is relevant (e.g., an elderly individual taking a memory test), targeted/stigmatized individuals face the threat of confirming or being judged by the negative stereotype (i.e., stereotype threat). This elicits extra ‘performance pressure’ on the individual, which may interfere with test performance. For African Americans, women, and elderly individuals, widely-known stereotypes exist; African Americans perform poorly in academic environments, women are weak in math, and elderly individuals have failing memories. To demonstrate that stigmatized individuals are negatively affected by stereotypes, researchers have used paradigms comparing the test performance of a group experiencing stereotypic cues against the test performance of a group experiencing minimal stereotypic cues. For example, research on African Americans has most commonly used ‘diagnostic’ versus ‘non-diagnostic’ conditions (Brown & Day, 2006; Davis, Aronson, & Salinas, 2006; Marx & Goff, 2005; Mayer & Hanges, 2003; McFarland, Lev-Arey, & Ziegert, 2003; McKay, Doverspike, Bowen-Hilton & Martin, 2002; McKay, Doverspike, Bowen-Hilton & McKay, 2003; Nguyen, O’Neal & Ryan, 2003; Ployart, Ziegert, & McFarland, 2003; Sawyer & Hollis-Sawyer, 2005; Smith & Hopkins, 2004; Steele & Aronson, 1995). In the former condition, individuals are informed that an upcoming test will be indicative of intelligence level. These pre-test instructions capitalize on the stereotype that African Americans are intellectually inferior to other racial groups. Although most African Americans, as well as many other members of society, do not personally believe this stereotype, the test situation, nevertheless, calls it to mind. Stereotype threat theory argues that once activated, the stereotype elicits fears within targeted individuals that they will confirm the negative stereotype. In stark contrast, Caucasian individuals, as a whole, are not stereotyped to be intellectually inferior to other racial groups. In this way, presenting Caucasian research participants with an intelligence test does not invoke negative stereotypes and therefore threatening feelings do not surface.

In the non-diagnostic condition, information on the purpose of an upcoming test is modified so that individuals are unaware that an intelligence test will be given (e.g., by presenting the test as a measure of perceptual ability, job-skill level, pattern-completion skill level, etc.) By framing pre-test instructions in this way, stereotypes and ensuing threatening feelings are not activated. Thus, in the non-diagnostic condition, African American and Caucasian individuals are thought to experience identical testing environments and, therefore, similar psychological states. As would be expected, it is typically hypothesized that African Americans will perform better in the non-diagnostic condition, in comparison to the diagnostic condition. Indeed, this is often the case (Brown & Day, 2006; Davis et al., 2006; Mayer & Hanges, 2003; McKay et al., 2002; Ployhart et al., 2003; Steele & Aronson, 1995). These data support the idea that stereotypes have negative influences on both internal psychological states and test performance. Caucasian individuals, on the other hand, are often unaffected by the experimental manipulation and perform at the same level on tests regardless of condition (McKay et al., 2002; McFarland et al., 2003) because of the lack of personal relevance of the stereotype. Other experimental manipulations to induce stereotype threat for African Americans include presenting an intelligence test as culturally biased (Blascovich, Spencer, Quinn & Steele, 2001; Major, Spencer, Schmader, Wolfe, & Crocker, 1998), or asking participants to indicate their race on a demographic information sheet prior to completing an evaluative test (Davis et al., 2006; Marx & Goff, 2005; McFarland et al., 2003; Nguyen et al., 2003; Sawyer & Hollis-Sawyer, 2005; Steele & Aronson, 1995).

In addition to demonstrating stereotype threat in African Americans, a wealth of research has focused on the effects of the stereotype ‘women are bad at math’. The most common paradigm for exploring this effect is informing females that an upcoming math test is sensitive to gender differences (i.e., explicitly stating that men out-perform women on the test) (Ben-Zeev, Fein, & Inzlicht, 2005; Brown & Pinel, 2003; Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003; Cadinu, Maass, Lombardo, & Frigerio, 2006; Cadinu, Maass, Rosabianca, & Kiesner, 2005; Ford, Ferguson, Brooks, & Hagadone, 2004; Keller, 2002; Keller & Dauenheimer, 2003; Lesko & Henderlong Corpus, 2006; Quinn & Spencer, 2001; Sekaquaptewa & Thompson, 2003; Smith & White, 2002; Spencer, Steele, & Quinn, 1999; Stangor, Carr, & Kiang, 1998; Walsh, Hickey, & Duffy, 1999). In contrast, participants in control groups are told of the lack of gender differences in mathematical performance. More subtle means to elicit negative stereotype activation include placing women in the gender-minority while doing a math test (Ben-Zeev et al., 2005; Inzlicht & Ben-Zeev, 2003; Schmader & Johns, 2003; Sekaquaptewa & Thompson, 2003), informing women of an upcoming evaluative math/logical intelligence test (Cadinu et al., 2006; Marx & Stapel, 2006; Schmader & Johns, 2003; Smith & White, 2002), making gender-identity salient (by having participants indicate their gender on a demographic questionnaire) (Schmader, 2002; Schmader & Johns, 2003), and notifying women that their math performance will be compared to that of men (Schmader, 2002). All studies found that women in reduced threat conditions, in which stereotype-related cues were minimized, outperformed those in stereotype threat conditions. In fact, some studies found that women in reduced threat conditions performed at levels equivalent to equally qualified men in math test performance (Keller & Dauenheimer, 2003; Lesko & Henderlong Corpus, 2006; Marx & Stapel, 2006; Quinn & Spencer, 2001; Schmader, 2002; Spencer et al., 1999; Walsh et al., 1999). Thus, it may be that women and men are relatively equal in their math abilities but the performance of women is hindered by situational cues.

Another stereotype prevalent in today's society is that older adults have weak memory abilities (e.g., Fingerman & Perlmutter, 1994). Although this may be true for some clinical populations (i.e., individuals with dementia), some researchers would argue that ‘normal’ aging does not, necessarily, equate to deteriorating memory (Petersen, Smith, Kokmen, Ivmik, et al., 1992). Literature on stereotype threat with elderly individuals has supported this theory, to some degree. Typically, stereotype activation is induced in this population by emphasizing the memory component of a test (Chasteen, Bhattacharyya, Horhota, Tam, & Hasher, 2005; Desrichard & Kopetz, 2005; Rahhal, Hasher, & Colcombe, 2001), or suggesting that older individuals need to depend on memory tools, reinforcing stereotypical views of aging and memory (Hess, Auman, Colcombe, & Rahhal, 2003; Hess & Hinson, 2006). Additional studies have employed more implicit means to activate stereotypes. These have included sentence-completion, lexical-decision, and subliminal priming tasks that depict either negative (e.g., dependent, confused, etc.) or positive (e.g., wise, accomplished, etc.) stereotypes about aging (Hess, Hinson, & Statham, 2004; Levy, 1996).

In general, researchers have demonstrated that elderly individuals in reduced threat conditions often outperform those in threat conditions on memory tests (Desrichards & Kopetz, 2005; Hess et al., 2003; Hess et al., 2004; Levy, 1996; Levy, Hausdorff, & Hencke, 2000). Even more interesting, older adults, in non-threat conditions, have been found to perform at levels equivalent to young individuals (Hess et al., 2003; Rahhal et al., 2001). Moreover, Chasteen et al. (2005) demonstrated that participants’ feelings of stereotype threat mediated the relation between age and memory recall performance. This preliminary finding suggests that concerns about negative stereotypes may be a significant determinant of memory differences between younger and older adults. Younger individuals are thought to have excellent memories and thus do not have to contend with negative stereotypes and ensuing threatening feelings. Perhaps if testing situations were altered for older adults, so as to eliminate stereotypic-cues, memory differences between elderly individuals and younger adults would be greatly reduced.

Thus, the general finding across African American, women, and elderly individuals is that, stereotype threat, through various means, can be elicited within the laboratory setting. Conditions that increase stereotype activation (many of which are present in 'real-world' testing environments) decrease performance in comparison to conditions that reduce it. In fact, reducing negative stereotype activation for targeted group members, in a number of studies, equalized performance to the non-stereotyped group. This provides relatively strong evidence that negative stereotypes may be contributing to poorer test performance in selected domains for certain stigmatized populations.

The Mechanism Underlying Stereotype Threat

Following the burgeoning number of studies focused on demonstrating the stereotype threat effect, researchers began to theorize as to the underlying mechanism behind reduced test performance following exposure to negative stereotypes. One of the proposed mechanisms is increased anxiety (Cadinu et al., 2003). When negative stereotypes are activated, stigmatized group members may experience heightened anxiety due to fears of confirming the stereotypes. Anxiety, in turn, interferes with test performance as research, in other domains, has shown (e.g., Dembo & Eaton, 1997). Another possibility in explaining the stereotype threat effect is impaired divided attention (Cadinu et al., 2003). An individual in a stereotype threat situation may be pre-occupied with thoughts of confirming the stereotype, thus reducing the cognitive resources available and allocated towards focusing on task performance. A further theory is that stereotype activation increases evaluation apprehension in the stereotype-relevant domain (Cadinu et al., 2003). Individuals may be greatly concerned about how they will be evaluated and perceived by others based on their performance and thus act more cautiously (i.e., putting forth less effort on test items and reducing the number of items attempted). Related to this idea, negative stereotype activation may remind targeted group members of their stigmatized status and, as such, individuals may feel unable to 'rise above' stereotypes, leading them to reduce their expectations for performance so as to match their groups' typical performance level. Lower expectations, according to Bandura (1989), lessen individuals' motivation and level of effort, thus hindering test outcome.

Despite the robustness of the stereotype threat phenomenon and the profusion of theories that exist to explain it, little data is available to support an unequivocal explanation as to its underlying mechanism. Nevertheless, an overview of the research is provided so as to illustrate the current understanding of the workings behind stereotype threat and its impact on test performance. In the African American population, for example, proposed mediators have included anxiety (Mayer & Hanges, 2003; Ployhart et al., 2003), self-efficacy (Mayer & Hanges, 2003), cognitive interference (i.e., task-irrelevant thoughts) (Mayer & Hanges, 2003), and motivation (Ployhart et al., 2003). Little statistical evidence of mediation has been found for any of these constructs. Research studies have demonstrated, however, that decreased motivation (Ployhart et al., 2003), heightened anxiety (Ployhart et al., 2003), increased blood pressure (Blascovich et al., 2001), evaluation apprehension (Mayer & Hanges, 2003) and self-doubt (Steele & Aronson, 1995) are associated with African Americans' perception of threat and reduced test performance. Although not providing answers as to the underlying mechanism surrounding stereotype threat, these results do suggest that activation of negative stereotypes elicit negative emotions and impact motivation.

Proposed and examined mediators in ‘women and math’ stereotype research have included anxiety (Keller & Dauenheimer, 2003; Schmader, 2002; Spencer et al., 1999), motivation (Brown & Pinel, 2003), effort (Brown & Pinel, 2003; Keller & Dauenheimer, 2003), self-perceived abilities (Brown & Pinel, 2003), performance expectations (Cadinu et al., 2003), regulatory emotions/affective reactions (Keller & Dauenheimer, 2003; Stangor et al., 1998), self-handicapping (Keller, 2002; Keller & Dauenheimer, 2003), thought intrusion (Cadinu et al., 2005; Keller & Dauenheimer, 2003; Oswald & Harvey, 2001), working memory capacity (Schmader & Johns, 2003), evaluation apprehension (Spencer et al., 1999) and self-efficacy (Spencer et al., 1999). Unfortunately, many of these studies were unsuccessful at finding clear evidence for mediation.

Cadinu et al. (2003) did demonstrate, however, that expectations were a partial mediator of performance. Thus, women may under-perform in stereotype threat conditions because of their low expectations for math success. The question remains as to why activation of negative stereotypes leads to diminished performance expectations. One possibility, as previously alluded to, is that women, when confronted with negative stereotypes, re-align their expectations for success to match their groups’ (i.e., women’s) typical math performance level. There are numerous indicators within the ‘real-world’ signifying that women are poor at math (e.g., small representation of women in math-related work fields, lower SAT math scores, etc.) Thus, a woman taking a math test may feel only as capable as her stereotyped group and will, therefore, perform at this level by reducing effort. It is important to note that this is not necessarily a conscious act and women are most likely unaware of these particular thought processes and ensuing actions.

Cadinu et al. (2005) found further evidence for mediation in that, women, in a stereotype threat situation, had many negative thoughts related to mathematics, which in turn, impacted test performance (likely due to reduced working memory capacity). Further support for this theory comes from studies by Schmader and Johns (2003) and Beilock, Rydell, and McConnell (2007). These researchers demonstrated that a reduction in working memory capacity mediated the effect of stereotype threat on women's math performance. This suggests that women may perform poorly on math tests because fears of confirming group stereotypes interfere with attentional resources, causing them to decrease their attention to the task at hand.

Another construct found to mediate the effect of stereotype threat on mathematical performance is dejection (i.e., feelings of frustration, sadness, disappointment, etc.) (Keller & Dauenheimer, 2003). Marx and Stapel (2006), in addition, demonstrated that women, in stereotype threat conditions, experienced greater anxiety and frustration. Likewise, Oswald and Harvey (2001) found that women exposed to negative stereotypes reported feeling less confident and calm, and more embarrassed and preoccupied. Overall, this research evidence suggests that a negative emotional state may mediate the relation between stereotype threat and reduced math performance.

Paralleling the African American and 'women and math' literature, the underlying causal mechanism in stereotype threat has been examined in the elderly population. Anxiety (Chasteen et al., 2005; Hess et al., 2003; Hess et al., 2004; Hess & Hinson, 2006), self-efficacy (Chasteen et al., 2005; Desrichards & Kopetz, 2005), evaluation apprehension (Chasteen et al., 2005; Hess & Hinson, 2006) and performance expectations (Desrichards & Kopetz, 2005) have been investigated as possible mediators. Desrichards and Kopetz (2005) found that performance expectations mediated the relation between stereotype threat and memory test scores and elderly individuals, under stereotype threat conditions, had lowered perceptions of their memory abilities. Like the ‘women and math’ literature, older adults, when confronted with negative memory stereotypes, may re-align their expectations for performance to match their perception of their groups’ typical memory achievement levels thus, in turn, reducing effort and diminishing test outcome.

The available data on mediational effects in the stereotype threat literature is scarce. Due to the possibility that individuals in threat conditions may not consciously recognize the situation as threatening, underlying psychological processes may not be accessible and self-reports measures, as a result, may be ineffective. Methodological issues (e.g., low numbers of research participants) may also preclude finding evidence for mediation. In addition, a host of constructs may be involved in mediational effects and more sophisticated statistical analyses will need to be conducted before evidence for mediation is found. Nevertheless, available data suggests that heightened negative emotions, reduced working memory capacity, and lowered expectations play some role in mediating the effect of stereotype threat on performance.

Interventions in Stereotype Threat Literature

Recent research has moved beyond highlighting stereotype threat’s existence to focusing on methods to best reduce its effect and to improve performance for stigmatized group members. Re-structuring environments so as to decrease stereotypic cues, however, may be an enormous and unrealistic feat as it is difficult to control the infiltration of stereotypes. Even in more controlled contexts (i.e., laboratory settings), numerous stereotypes are oftentimes present (e.g., in advertisements recruiting participants, consent forms, etc.). Therefore, another way to improve test performance, which may be more achievable, is attempting to change individuals' appraisals of well-known stereotypes and beliefs about personal capabilities. In a particularly interesting demonstration of this point, Aronson, Fried, and Good (2002) modified African American students' perceptions of the previously discussed stereotype (i.e., African Americans perform poorly in academic environments) by designing an intervention that emphasized the malleable and expandable nature of intelligence to research participants. Through this intervention, it was hoped that individuals would learn to appraise the stereotype as less threatening by feeling capable of 'rising above' it, instead of 'destined' to confirm it. Moreover, another underlying purpose was to increase positive beliefs about personal capabilities. This harks back to Cavanaugh and Green's (1990) assertions that individuals who endorse an incremental view of intelligence display greater self-efficacy, more positive affect, and attribute performance to level of motivation. Indeed, approximately two months after the study, African Americans exposed to the 'malleable/incremental intelligence' condition continued to believe in the expandable nature of intelligence, reported valuing academics to a greater degree, and obtained higher grades than those in the control condition. These are very promising research findings in that they suggest that even a simple and time-limited intervention in a laboratory setting can translate to change in a real-world academic environment. Furthermore, the data supports the notion that it is possible to modify individuals' appraisals of well-known stereotypes, thus reducing the stereotype threat effect. Good, Aronson, and Inzlicht (2003) similarly encouraged minority adolescents to adhere to the view that intelligence is expandable and malleable, and to attribute academic difficulties to the novelty of the school environment (i.e., transition to junior high school). Female students exposed to this intervention had significantly higher standardized math scores than did females in control conditions, and the gender gap in mathematical performance disappeared. Underlying this intervention is the message that females have the ability to rise above negative stereotypes. A host of additional studies have followed suit and used varying methodologies to examine the interplay between entity/incremental theories and test performance, finding relatively consistent effects. In general, extant research has demonstrated that individuals in acquirable/incremental skill conditions or those that adhere to an incremental view of abilities exhibit reduced anxiety (Martocchio, 1994), increased self-efficacy (Martocchio, 1994), heightened motivation (e.g., Blackwell, Trzeniewski, & Dweck, 2007) and improved academic performance (e.g., Blackwell et al., 2007).

Further studies have attempted to ameliorate the stereotype threat effect through the application of a variety of research paradigms. For example, a study using African American participants illustrated that these individuals, as a group, performed better on a verbal test when an African American experimenter, versus a Caucasian experimenter, administered the task (Marx & Goff, 2005). Moreover, under these same conditions, the test scores of African Americans did not differ from Caucasian individuals. Although speculative, the African American experimenter may have served as a role model, as he/she was in an authoritative position. This simple intervention may have reinforced the message that African Americans are capable of rising above negative stereotypes, reducing the stereotype threat effect, and allowing individuals to perform to their full potential. Similar forms of methodology, such as providing examples of positive female role models or achievements, have been used in the women/math literature (Marx & Roman, 2002; McIntyre, Paulson, & Lord, 2003; McIntyre, Lord, & Gresky, 2005). In these studies, the typical stereotype threat effect has been demonstrated (i.e., men outperformed women on math tests under threat conditions). However, when female participants were exposed to positive women role models or achievements, they were found to outperform females in control conditions. Moreover, women exposed to interventions performed at the same level as men, even when negative stereotypes were activated (Gresky, Ten & Lord, 2005; Marx & Roman, 2002; McIntyre et al., 2003; McIntyre et al., 2005).

Self-affirmation (i.e., listing positive aspects about oneself) is another intervention used to reduce the stereotype threat effect in females. For example, Schimel, Arndt, Banko, and Cook (2004) and Martens, Johns, Greenberg and Schimel (2006) found that females who self-affirmed when exposed to negative stereotypes performed better on math tests than did females who did not self-affirm. Closely related to this, Ambady, Paik and Steele (2004) and Gresky et al. (2005) demonstrated that women who 'individuated' (i.e., listed both positive and negative aspects about themselves), or listed their various social identities, performed better on math tests when negative stereotypes were present than did females in a control condition. Essential to each of these interventions is restoration of ones' sense of self-worth and an emphasis on the possibility of 'rising above' negative stereotypes, which appears to reduce the negative psychological state that is characteristic of exposure to stereotypes, improving performance in the targeted/stigmatized domain.

Learned Helplessness, Self-Efficacy and Attribution-Focused Interventions

Although stereotype threat theory purports that negative stereotypes are not internalized and do not affect individuals' self-referent beliefs (i.e., beliefs about oneself), arguably this may not be the case. Extending beyond the stereotype threat framework, individuals may internalize negative stereotypes and use them to inform their perceptions of their own abilities, thereby affecting test performance. A large body of literature encompassing varying populations and using diverging theories has verified that self-referent beliefs oftentimes impact test outcome. One branch of research that has indirectly explored this idea has examined the effect of success or failure conditions on subsequent test achievement. Individuals who are informed that they are 'failing' or doing poorly on a particular task display diminished performance on subsequent tests (Douglas & Anisman, 1975; Feather, 1966; Matherly, 1986; Mikulincer, 1988). Failure conditions are thought to induce a state of learned helplessness, whereby individuals feel they have little control over future outcomes (Maier & Seligman, 1976). Similar to this premise, Weiner (1986) constructed the theory of attribution, stating that individuals create causal explanations for experienced outcomes based on the dimensions of locus of causality, stability and controllability. Locus of causality refers to the cause of an event as internal (within a person) or external (outside of an individual). Stability differentiates between causes that fluctuate with time (unstable) or remain steady. Controllability refers to causes that can be volitionally controlled versus those that cannot be changed. This theory is reminiscent of the re-formulated version of learned helplessness (Abramson, Seligman, & Teasdale, 1978; Metalsky, Abramson, Seligman, Semmel, & Peterson, 1982; Peterson & Seligman, 1984) that asserts that negative outcomes are more likely to occur in individuals making internal, stable, and global (i.e., generalizations of causal explanations across situations) attributions for failure. Indeed, numerous empirical studies have consistently reported lower academic grades (Peterson & Barrett, 1987), diminished motivation (Struthers & Perry, 1996), elevated cognitive interference (Stiensmeier-Pelster & Schurmann, 1990), and reduced self-efficacy (Silver, Mitchell & Gist, 1995) in individuals attributing failure to internal, stable, and global factors, in comparison to persons making unstable and external attributions for poor performance.

The mechanism underlying reduced performance on tasks for individuals with a learned helplessness/negative attributional style remains elusive. Social scientists have long been intrigued by the related phenomenon of self-fulfilling prophecy (i.e., the expectation that an event will occur increases the likelihood that it actually does transpire) and offered possible explanations as to its occurrence. These have included 'defensive effort' (i.e., when failure is expected in a given situation, an individual may reduce effort as a means of ego-protection), 'anxiety reduction' (i.e., when failure is expected, an individual is faced with overwhelming anticipatory anxiety and, thus, he/she may act impulsively so as to reduce anxiety, bringing about the feared outcome) and 'anxiety distraction' (i.e., the expectation of failure causes an individual to become pre-occupied with worry about the looming negative consequences to such an extent that that he/she neglects to take appropriate steps to prevent the occurrence of the event itself) (Archibald, 1974). Although the exact mechanism remains unclear, it is fairly apparent that, based on the research evidence, an individual, when placed in a situation where he/she feels little control over his/her abilities and the expected outcome, under-performs on subsequent tests.

Intervention-based research has capitalized on the findings from this body of literature and targeted the goal of improved academic performance through replacement of maladaptive beliefs (e.g., low ability) with more temporary (unstable) and modifiable (controllable) explanations (e.g., insufficient effort or inappropriate study strategies). Not only are individuals found to be amenable to re-attribution conditions (Mikulincer, 2001), academic performance has also been demonstrated to improve as a result of 'adaptive beliefs' intervention conditions (Wilson & Linville, 1985). Van Overwalle and De Metsenaere (1990) found similar findings in that an intervention condition, emphasizing academic failure as related to external causes (i.e., lack of effort, lack of experience, and ineffective study strategies), produced a significant increase in academic outcome, in comparison to a condition that simply taught study strategies. A host of other studies have found comparable effects whereby students in related intervention conditions outperformed those in control conditions on subsequent academic performance (e.g., Brewin & Shapiro, 1985; Hall, Perry, Chipperfield, Clifton, & Haynes, 2006; Noel, Forsyth & Kelley, 1987; Perry & Penner, 1990; Struthers & Perry, 1996), and exhibited elevated expectations (Menec et al., 1994) as well as heightened motivation (Struthers & Perry, 1996).

Bandura's (1986) heralded theory of self-efficacy, that has strong ties to both attribution and learned helplessness models, states that self-efficacious individuals have positive beliefs about their abilities to assemble and exercise the cognitive resources, motivation and courses of action needed to implement control over task demands. Cavanaugh and Green (1990) and Bandura (1989) argue that individuals with high self-efficacy are likely to attribute failure to insufficient effort and heighten motivation in the face of adversity. Implicit to their arguments is also the notion that highly self-efficacious individuals make internal-controllable judgments about performance outcome. Indeed, individuals' attributional style and feelings of control over given situations have an impact on judgments of their ability to effectively execute plans of action, as Lyden, Chaney, Danehower, and Houston (2002) have demonstrated, suggesting a strong linkage between attributional viewpoint, self-efficacy, and performance outcome. More specifically, Stajkovic and Sommer (2000) found that individuals high in self-efficacy attributed performance successes to internal causes whereas individuals low in self-efficacy attributed failure to internal causes. Moreover, a wealth of research has indicated greater academic achievement (e.g., Bandura, 1993; Luszczynska, Gutierrez-Dona & Schwarzer, 2005; Pajares & Miller, 1994; Pintrich & De Groot, 1990; Zimmerman & Bandura, 1994) and enhanced effort/persistence (e.g., Bouffard-Bouchard, 1990; Lent, Brown & Larkin, 1984) in more self-efficacious individuals.

All of the above ideas and theories are especially relevant to targeted/stigmatized individuals when presented with tests in the stereotyped domain. These individuals, in such situations, likely feel that they possess little control over performance outcome (i.e., feel that they are unable to 'rise above' negative stereotypes) and hold negative beliefs about their own cognitive abilities.

Interventions Focused on Modifying Beliefs in the Elderly Population

Researchers in the elderly population have long recognized the relation between self-referent beliefs/self-perceptions and test performance. Studies in the aging literature have found that older adults have lower memory self-efficacy beliefs, feel that their memory has declined, and have a reduced feeling of control over their memory than do younger or middle-aged adults (e.g., Devolder & Pressley, 1992; Dixon & Hultsch, 1983; Hultsch, Hertzog, & Dixon, 1987; Lachman, 1991; Luszcz, 1993). Furthermore, empirical studies have demonstrated a link between these types of beliefs and memory test performance in elderly individuals (e.g., Cavanaugh & Murphy, 1986; Cavanaugh & Poon, 1989; Devolder & Pressley, 1992; Dixon & Hultsch, 1983; Lachman, Steinberg, & Trotter, 1987; Seeman, McAvay, Merrill, Albert & Rodin, 1996). More specifically, research has suggested that older adults with positive self-efficacy beliefs perform better on a variety of everyday and laboratory memory tasks than do elderly individuals with negative self-efficacy beliefs (e.g., Cavanaugh & Poon, 1989; McDonald-Miszczak, Hertzog, & Hultsch, 1995), and that older individuals who attribute positive memory performance to internal, stable and global causes are more likely to perform well on memory tasks (Lachman et al., 1987). In short, the relation between memory beliefs and performance tends to be more robust in older adults than in younger individuals (e.g., Cavanaugh & Poon, 1989), suggesting that self-referent cognitive beliefs may play a substantial role in elderly individuals' memory test performance. Indeed, researchers studying the elderly population have found sizeable amounts of test performance variance accounted for by self-efficacy beliefs (e.g., Berry, West & Dennehey, 1989**;** Cavanaugh & Poon, 1989). Although these studies have typically been correlational in nature, and it is thus difficult to determine the causal direction of this relation, it may be that aging-related declines in memory are, in part, related to changing belief systems.

Recognizing the potentially detrimental role of negative memory beliefs in elderly individuals, researchers have used interventions similar to those employed in learned helplessness/attribution studies, attempting to replace maladaptive self-efficacy beliefs with more adaptive viewpoints. Lachman (1991) proposed that memory performance can be improved for older adults by encouraging individuals to believe that they have control over their memory functioning. Dellefield and McDougall (1996) and Lachman, Weaver, Bandura, Elliott and Lewkowicz (1992) focused their intervention on increasing memory self-efficacy and modifying perceptions and beliefs about memory capacity, control, and stability. Compared to the control group, elderly individuals exposed to the intervention showed increases in memory self-efficacy (Dellefield & McDougall, 1996), had greater feelings of control over their memory (Dellefield & McDougall, 1996; Lachman et al., 1992), and demonstrated improved memory performance (Dellefield & McDougall, 1996). Caprio-Prevette and Fry (1996) used a similar approach, and encouraged individuals to endorse positive and adaptive beliefs about memory capabilities, by reinforcing the message that memory can be viewed as an ability that can be developed and enhanced with practice and effort. Not surprisingly, older individuals in the intervention condition felt more control and stability over their memory beliefs and displayed improved memory performance, in comparison to individuals in a memory-strategy training group. Schmidt, Zwart, Berg and Deelman (1999) incorporated even more of a focus on amelioration of negative stereotypes in their intervention condition through challenging stereotypes about aging and accentuating the cognitive competency of older individuals. Worries about forgetfulness were attenuated post-intervention, especially for individuals initially experiencing memory problems.

Stereotypes, Negative Perceptions and Negative Self-Referent Beliefs Regarding Traumatic Brain Injury

The literature on stereotype threat, attribution, and self-efficacy interventions provide evidence that the presence of stereotypes, and individuals' beliefs about their own abilities, including the belief in their ability to exercise control in a given situation, all impact test performance. For the most part, these ideas have not been applied to a TBI population despite research illustrating that society tends to hold specific and negative ideas regarding the cognitive abilities of individuals who are neurologically-compromised. An innovative study by Turner, Forrester, Mulhern, and Crisp (2005) primed research participants with the social category of 'neuropsychological patient'. More specifically, research participants were asked to imagine a neuropsychological patient and list his/her typical behaviours, lifestyle, and appearance. Subjects in the control condition were asked to imagine a beach scene. Test performance on a measure of executive function was found to be lower in the 'neuropsychologically-primed' condition. Based on these results, the authors reasoned that individuals have expectations as to the types of traits comprising a ‘neuropsychological patient’, temporarily triggering certain styles of behavioural responses, leading to a direct, unconscious negative effect on cognitive abilities.

More specifically, research studies have demonstrated that individuals share a set of common negative beliefs about the effects of a TBI. For example, Mittenberg et al. (1992) and Mulhern and McMillan (2006) found that a large proportion of non head-injured individuals expect concentration difficulties, as well as problems with memory following a head injury. More generally, Ferguson et al. (1999) demonstrated that control participants overestimated the number and frequency of post-concussion symptoms, including cognitive difficulties, following a mild head trauma. Along the same lines, Ferrari et al. (2001) showed that cognitive deficits (e.g., concentration difficulties, emotional disturbances, and thinking/memory problems) resulting from a TBI are thought to be chronic and long-lasting. Moreover, an array of additional research studies have demonstrated that such cognitive difficulties, especially memory deficits, are expected to be severe in nature in that some individuals assume that those who have sustained a head injury are amnesic (forgetting who they are, and lacking the ability to recognize others and recall life events) (e.g., Gouvier, Prestholdt, & Warner, 1988; Guilmette & Paglia, 2004; Hux, Schram & Goeken, 2006), and look and act ‘retarded’ (Gouvier et al., 1988). Thus, it appears that individuals expect prolific, severe and protracted cognitive deficits following a head injury, providing evidence that stereotypes regarding head injury are present in society. Mounting data also indicates that those who have sustained a head injury feel negatively judged by others, perceive themselves to be regarded as ‘crazy’, ‘lazy’, ‘stupid’ and ‘retarded’ (Nochi, 1998), and, in general, feel misunderstood, and misidentified as ‘mentally ill’ or ‘learning disabled’ (Swift and Wilson, 2001).

In addition to head-injured individuals' view that others perceive them in a negative manner, they also appear to hold maladaptive self-referent beliefs. Nochi (1998) theorized that those who experience a TBI face a loss of sense of self. Moore and Stambrook (1995) similarly reasoned that head-injured individuals likely hold an external locus of control and a helpless/hopeless cognitive style (attributing negative outcomes to stable and global causes). Over time, this negative explanatory manner becomes engrained and embedded into a self-limiting and self-defeating belief system. Indeed, Moore, Stambrook and Wilson (1991) found that lower internal locus-of-control beliefs were associated with poorer quality of life in individuals with moderate-to-severe head injury. Additionally, those maintaining negative expectations regarding the outcome of their injury (i.e., anticipate the length of recovery time to be protracted, and believe the consequences of the injury to be severe) tend to be symptomatic for a long period of time (Whittaker, Kemp & House, 2007). Overall, based on the literature reviewed above, it is conceivable that the theories of stereotype threat, learned helplessness, attribution, and self-efficacy are relevant to a TBI population and may be contributing to reduced neuropsychological test performance.

Psychological Factors and Cognitive Test Performance

These theories operate under the over-arching social-cognitive model, whereby social contextual factors are hypothesized to influence individuals' psychological state and overall test performance. It is worth mentioning, at this time, that other psychological constructs have also been investigated with respect to their impact on neuropsychological/cognitive test performance. Anxiety, stress, and depression have been shown to be associated with reduced cognitive performance in non-clinical groups (e.g., Gass & Daniel, 1990; Kizilbash, Vanderploeg, & Curtiss, 2002). Unfortunately, only a few studies investigating the link between psychological constructs and cognitive test performance have been conducted in the TBI population. This small body of research has demonstrated that elevated levels of anxiety, depression and stress are negatively correlated with attention and memory task performance (e.g., Gass, 1996; Ross, Putnam, Gass, Bailey & Adams, 2003; Sherman, Strauss, Slick & Spellacy, 2000). It may be the case that negative stereotypes and self-referent beliefs are impacting test outcome through the mediating influence of the psychological constructs mentioned above, but no research, to date, exists to support this assertion.

The Influence of Stereotypes in Neurological Populations

One group of researchers, however, have acknowledged that individuals with a mild TBI may not be performing to their ‘true’ potential on neuropsychological tests. Keller, Hiltbrunner and Kesselring (2000) employed methodology that prompted mild head-injured participants with the statement ‘could you do better?’ prior to an upcoming divided attention test. It was found that this simple line of encouragement significantly improved head-injured individuals’ level of performance on the cognitive test. While very speculative, this motivating statement may have introduced the notion to head-injured participants that they were capable of better performance, ultimately improving self-efficacy and test outcome.

Another ensemble of researchers have taken this idea a step further and asserted that head-injured individuals may be under-performing in neuropsychological testing settings because of the operation of stereotype threat in this type of environment. Suhr and Gunstad (2002) found that when individuals with a mild TBI had attention called to their head injury, and its potential effects on cognition, they performed worse on memory and intelligence tests in comparison to a group who did not have attention called to their injury. Additionally, they found that the former group rated themselves as putting forth less effort. Thus, based on minor changes to pre-test instructions, group differences on neuropsychological measures emerged. In a follow-up study that adhered to the same design, Suhr and Gunstad (2005) similarly found that individuals in a stereotype threat condition performed worse on memory, psychomotor speed, and attention/working memory tests. However, unlike the previous study, individuals in the threat condition were not found to put forth less effort than individuals in the reduced threat condition. This discrepant finding may be related to the varying neuropsychological tests used in each study. Suhr and Gunstad (2005) failed to include list-learning verbal memory measures in their methodological design. These tests are often viewed as challenging, and therefore individuals completing such tasks may feel that they have exerted great effort leading, potentially, to the findings in the Suhr and Gunstad (2002) study.

Cole, Michailidou, Jerome, and Sumnall (2006) employed almost an almost identical research design to Suhr and Gunstad (2002; 2005) using a population of ecstasy abusers. Although individuals regularly consuming ecstasy are not typically considered a neurological population, an increasing amount of research is documenting cognitive deficits and central nervous system/organic compromise from repeated ecstasy use (e.g., Buchert et al., 2004; Daumann et al., 2005; Gouzoulis-Mayfrank & Daumann, 2006). In this particular stereotype threat/ecstasy study, one group of users was informed of the evidence linking ecstasy use to memory deficits (stereotype threat condition). Others were told that no conclusive evidence purports a link between ecstasy use and memory problems. Like the results from the TBI studies, Cole et al. (2006) found that individuals in the stereotype threat condition performed worse on a memory test.

In short, a paucity of research in the area of stereotype threat and neurological populations has been conducted. Similarly, only a few studies on this phenomenon have been carried out in psychiatric groups. Corrigan and Holtzman (2001) recognized the relevance of this theory to such a population and reasoned that the stereotype threat effect may be contributing to, and exacerbating social cognitive deficits in individuals with schizophrenia in testing environments. There are a number of negative perceptions and stereotypes attached to psychiatric populations, including the idea that such individuals have cognitive deficits (e.g., Farina, Fischer, Boudreau, & Belt, 1996; Fracchia, Canale, Cambria, Ruest, & Sheppard, 1976). An early study by Farina, Gliha, Boudreau, Allen and Sherman (1971) demonstrated that individuals with mental illness performed worse on a cognitive task when they believed others knew of their mental illness, compared to individuals with mental illness who did not disclose their psychiatric background. Although Farina et al. (1971) did not use the term 'stereotype threat' to explain these results, they did argue that individuals with 'mental illness' fear rejection from others, leading to self-handicapping behaviour. Quinn, Kahng, and Crocker (2004) built upon these findings and illustrated that individuals with mental illness (e.g., depression) performed worse on a reasoning test when they revealed their mental illness prior to taking the test, than did individuals who did not disclose their psychiatric condition. The authors reasoned that because mental illness is a concealable stigma, stereotype threat only occurs when one's psychiatric history is exposed to others (and when placed in a testing situation that may elicit negative stereotypes/stigma).

Rationale for Current Study

Although it is clear that the concept of stereotype threat has been applied and studied to at least some degree in neurological populations, there is, overall, a dearth of research in this field. Even Suhr and Gunstad's studies (2002; 2005) are fraught with a number of limitations. Firstly, both failed to include a control group of 'normal' individuals. In this way, it is impossible to compare test performance across groups, and to determine whether a reduction in the number of stereotypic cues leads to equalization of cognitive performance between a TBI and 'normal' group. Moreover, the lack of control group precludes analysis on whether a change in pre-test instructions (i.e., increasing or decreasing stereotypic cues) has any effect on 'normal' individuals. A second limitation of these studies is that non-clinical samples were used. Research participants were undergraduate students and were not partaking in the experiment for clinical reasons. Undergraduate students are likely to be higher functioning than head-injured individuals presenting to clinical settings. Thus, the impact of the stereotype threat effect, in the Suhr and Gunstad (2002; 2005) studies, may actually be an underestimation (as undergraduate students may not view TBI stereotypes as personally relevant, and therefore expectations for performance are not as greatly diminished). A third major limitation in the design of these studies is that head-injured individuals in the control group were unaware that their involvement in the studies was due to their previous head injury. Ultimately, one goal of stereotype threat research should be illustrating 'real-world' methods to reduce the number of stereotypic cues present in laboratory settings. Suhr and Gunstad's (2002; 2005) methodological designs failed to do this, and, as such, their results are limited in their ability to generalize to the 'real-world'. Their findings suggest that an approach to reducing stereotypic cues is to not inform research participants of the study's rationale and/or why they were selected for the study. Due to the general recruitment process for TBI research (i.e., advertising), the face-validity of many neuropsychological tests (i.e. research participants are usually aware when they are being tested for cognitive ability), pre-test instructions (including the consent form), as well as ethical obligations, it is very difficult to design and implement a research project so that participants are unaware of its underlying rationale and/or why they were selected for the study (i.e., due to previous head injury).

Thus, researchers need to begin to explore other methods of reducing the presence of negative stereotypes in laboratory and clinical environments. This study argues that negative stereotypes, present in testing settings, are influencing cognitive/neuropsychological test performance for head-injured individuals. This has far-reaching implications as it suggests that even subtle instructional manipulations create differences in test performance. This idea is somewhat inconsistent with the assumptions and arguments put forth in most empirical studies examining the relation between TBI status and cognitive function. These studies, for the most part, compare a head-injured group to a 'normal' group and attribute differences in cognitive ability to organic causes. They also make the assumption that an identical testing environment exists for individuals with a TBI and control/'normal' individuals, despite the fact that research in the stereotype threat literature has shown this to not be the case for other stigmatized groups. In this way, social-contextual factors are not taken into account and the strength of the relation between TBI, specifically the biological/physiological components to a traumatic brain injury, and cognitive deficits may be exaggerated. A major focus of the present study is to examine the contextual factors potentially contributing to observed cognitive deficits after a TBI.

Although stereotype threat research in other populations has modified the testing situation so as to reduce stereotypic cues, it is difficult to reduce these cues within 'real-world' research and clinical settings for the reasons previously noted. Thus, it can be argued that ‘stereotype threat’ is inherent to the neuropsychological testing setting. As such, it may be more effective to implement interventions at the level of changing maladaptive beliefs. It may be that individuals with a head-injury internalize negative TBI stereotypes and use them to inform their perceptions of their own abilities (i.e., self-referent beliefs), affecting their cognitive performance. Indeed, Kit, Mateer and Graves (2007) found that a TBI group had lower memory self-efficacy beliefs than a ‘normal’ group. It can be easily claimed that stereotypes are not solely forming the basis of these negative self-perceptions/beliefs. Head-injured individuals may have fewer positive beliefs about their memory abilities because their memory has declined as a result of their head injury. Research from the elderly population suggests, however, that this explanation is likely insufficient (e.g., Lineweaver & Hertzog, 1998; McDonald-Miszczak et al., 1995). These researchers’ findings support the idea that individuals often make judgments of memory change not by monitoring actual changes in memory ability, but by accessing implicit theories (i.e. beliefs widely shared within a culture). Indeed, Fingerman and Perlmutter (1994) and Ryan and See (1993) verified that individuals expect a decline in memory ability as one ages. Fingerman and Perlmutter (1994) also reason, based on their findings, that perceptions of memory decline may be exaggerated. In a particularly interesting demonstration of this point, McFarland, Ross and Giltrow (1992) asked individuals to rate themselves across their lifespan on a number of traits. In traits believed to decline with age, elderly individuals evaluated themselves as being higher on the trait in the past, compared with the present. The opposite finding emerged for traits believed to improve with age. Elderly individuals’ retrospective reports were not in agreement with at-present ratings made by a young-adult comparison group. These results provide evidence that self-ratings of cognitive performance and self-referent beliefs regarding cognitive functioning may be guided by implicit theories of aging/cognitive development.

Similarly, research data indicates that individuals with a TBI may underestimate the prevalence of cognitive problems pre-injury and reattribute benign symptoms to their head injury (Mittenberg et al., 1992). Ferguson et al. (1999) demonstrated that mild head-injured individuals reported comparable memory/attention problems and post-concussion symptoms to ‘normal’ controls, and Uomoto and Fann (2004) asserted that mild head-injured individuals overestimate their level of injury severity and residual cognitive impairment. Thus, head-injured individuals’ underestimation of pre-morbid symptom experience, coupled with the lack of objective post-injury symptom increase, suggests an overestimation of pre- to post-injury change. This provides evidence that individuals with TBI may have biased perceptions of their cognitive capabilities, and these perceptions/beliefs are, perhaps, informed and influenced by stereotypes.

Overall, this study argues that negative stereotypes surrounding TBI are influencing self-referent cognitive beliefs, which, in turn, are impacting neuropsychological test performance. Hess (2005) and Hertzog and Dixon (1994) stated that beliefs (which can be conceptualized as schemas stored in memory) can be considered an indirect expression of stereotypes. Moreover, Cavanaugh (2000) and Stewart-Williams (2004) indirectly purport that schemas can become activated and more accessible based on environmental cues. Once a schema has been activated, information that is consistent with that schema is more likely to be noticed. Thus, it is plausible that negative stereotypes within the testing environment are triggering head-injured individuals to feel that they have little control over their performance on neuropsychological tests, to further doubt their own cognitive abilities, and to feel that they may be judged by negative TBI-related stereotypes, or unable to rise above such negative stereotypes.

These ideas will be indirectly explored in the current study through reduction of negative stereotypes and enhancement of adaptive beliefs within the context of a cognitive testing environment (with the assumption that manipulation of these two constructs will improve cognitive test performance for individuals with a TBI). It should be noted that this study is not discounting the role of organic causes to reduced cognitive test performance in head-injured individuals. Instead, it is claiming that contextual and psychological factors (i.e., stereotypes and self-referent beliefs) are also influencing cognitive/neuropsychological test performance for individuals with a mild to moderate TBI.

Although these ideas are closely related to that of stereotype threat theory, they differ in that the latter theory posits that stereotypes are activated due to specific aspects of the situation and are not necessarily internalized. In other words, the underlying premise to the stereotype threat phenomenon is that its effect does not operate through the mediating influence of beliefs. Moreover, this theory states that negative group stereotypes have a detrimental impact on the test performance of stigmatized group members when such individuals are put in the position of potentially confirming or being judged by the stereotype. Slightly different to this idea, it is argued that negative self-referent beliefs for head-injured individuals are heightened in laboratory and clinical environments due to the abundance of stereotypic cues. Individuals with a TBI may feel only as capable as their stigmatized group, and therefore unable to ‘rise above’ negative stereotypes. Furthermore, individuals may re-align their performance expectations to match their perceptions of their groups’ typical performance on cognitive tests. In other words, head-injured individuals may use stereotypes and implicit theories of how TBI affects cognitive functioning to inform their perceptions of their own cognitive capabilities. Head-injured individuals may feel that regardless of the amount of effort exerted they will be unsuccessful on neuropsychological tests, similar to the concept of learned helplessness. As previously alluded to, these assumptions will not be directly tested in the current study. Instead, the focus will be on whether modification of stereotypic cues and negative beliefs will impact neuropsychological/cognitive test performance for TBI individuals. In general, it is hypothesized that by simple manipulation of stereotypic cues and beliefs, through pre-test instructions, individuals' appraisals of stereotypes, self-referent beliefs, and cognitive test performance will change. The purpose of the 'reduced threat' condition, as such, is to reduce negative stereotypes, by indicating that traumatic brain injuries do not necessarily lead to cognitive deficits, and to suggest that individuals have some control over their cognitive test performance. It is predicted, through this manipulation, that individuals with a TBI may feel capable of 'rising above' negative group stereotypes and have a more positive perception of their own cognitive abilities. The anticipated results stemming from this study may have far-reaching implications as it is hoped that these findings will highlight the importance of context to test performance in TBI individuals, potentially informing practice in rehabilitation and neuropsychological testing environments.

Goals and Hypotheses

Hypothesis #1

The main purpose of this study is to investigate whether pre-test instructions (which manipulate stereotype activation and positive/negative beliefs for performance) impact neuropsychological test performance for TBI groups. A profusion of literature examining the stereotype threat phenomenon in other populations suggests that pre-test instructions have a powerful effect on test outcome. Based on this evidence, and preliminary studies of stereotype threat in a TBI population, it is predicted that head-injured individuals in the reduced threat condition will outperform head-injured individuals in the heightened threat condition on memory and attention tests.

Hypothesis #2

A comparison of neuropsychological test performance for control groups across conditions will be conducted. Based on previous stereotype threat research that indicates no difference in test performance across conditions for ‘normal’ individuals, it is predicted that non-head-injured individuals will perform similarly between the two conditions in the current study. This hypothesis is also based on the fact that TBI stereotypes are not personally relevant for ‘normal’ individuals, and thus negative self-referent beliefs do not become activated. Furthermore, the research findings of Kit et al. (2007) suggest that ‘normal’ individuals have fewer negative self-referent beliefs than do head-injured individuals (and thus test performance, for this group, should be equal across conditions).

Hypothesis #3

It is hypothesized that the constructs of expectations, motivation, dejection-related emotions, memory self-efficacy, anxiety, and cognitive interference will differ between the heightened threat and reduced threat conditions for the TBI group. Further analyses will be conducted to determine whether these constructs are acting as mediating variables between stereotype threat condition and neuropsychological test performance for the TBI groups. Both expectations and dejection-related emotions have been shown to act as mediators in the ‘women and math’ stereotype threat literature (e.g., Cadinu et al., 2003;

Keller & Dauenheimer, 2003) thus warranting their investigation in the TBI population. Additionally, one can surmise that due to exposure of negative stereotypes within a neuropsychological testing setting, individuals with a TBI may expect certain outcomes on cognitive measures (i.e., expect to perform poorly on tests of attention, memory, intelligence, etc.). Individuals may re-align and lessen their expectations for performance so as to match their groups' typical performance level. Findings from empirical studies indicate reduced neuropsychological test performance subsequent to experimental manipulations that have directly targeted individuals' test-specific performance expectations (e.g., Fillmore & Vogel-Sprott, 1992; Kvavilashvili & Ellis, 1999).

Furthermore, as previously discussed, the presence of negative stereotypes may elicit a state of 'learned helplessness' for head-injured individuals, in that they may feel that they are unable to 'rise above' negative stereotypes. As such, level of motivation may be affected, supporting the examination of this construct as a mediating variable. Moreover, this study argues that the presence of stereotypes enhances the effects of negative self-referent cognitive beliefs on neuropsychological test performance. Therefore, memory self-efficacy will also be investigated as a potential mediating variable between condition and test performance.

Although there has been little statistical evidence to support anxiety and cognitive interference as mediators in the stereotype threat literature, these constructs have strong theoretical support in TBI research as both heightened anxiety and difficulties with working memory/cognitive interference are often present following a head-injury (e.g., McAvinue, O'Keeffe, McMackin, & Robertson, 2005; Hovland & Raskin, 2000). Thus, they will also be considered as potential mediating variables in the present study.

Ideally, it would be of greatest benefit to examine the simultaneous mediation of the aforementioned constructs (Mayer & Hanges, 2003; Smith, 2004). It may be that stereotype threat influences test scores through several mediators, with only a slight effect on any one variable. Unfortunately, low participant numbers preclude this type of analysis. Moreover, Baron and Kenny (1986) noted that measurement error in the mediator tends to produce an underestimate of its effect. A number of questionnaires that will be used in the current study to measure mediating variables have unknown psychometric properties, signifying another limitation to the mediational analyses.

Hypothesis #4

It is predicted that expectations, motivation, dejection-related emotions, memory self-efficacy, anxiety, and cognitive interference will not differ between the two conditions for the control group.

Hypothesis #5

Only a few studies have assessed and measured individuals' feelings of stereotype threat (i.e., perceiving that one's performance is being judged by or seen as confirming negative stereotypic expectations) under experimental conditions (Marx & Goff, 2005; Mayer & Hanges, 2003; McKay et al., 2002; McKay et al., 2003; Ployhart et al. 2003; Steele & Aronson, 1995). Including this construct within the current study is important in determining whether experimental manipulations are actually inducing such feelings. As previously noted, it is hypothesized that the operational definition and feeling of stereotype threat for a TBI population is likely different than that experienced by other stigmatized groups. As such, including a measure of stereotype threat will help in better understanding the psychological state of head-injured individuals when faced with stereotypic cues. The stereotype threat questionnaire will only be administered to head-injured participants, as this construct is hypothesized to be irrelevant to a non-stigmatized population. A measure of stigma consciousness will also be administered to head-injured participants. Stigma consciousness refers to the expectation that one will be stereotyped, irrespective of one's actual behaviour (Pinel, 1999). Thus, it may be that the heightened threat condition will trigger feelings similar to learned helplessness, which may be better captured by the more general measure of 'stigma consciousness', rather than the more specific measure of stereotype threat. Overall, it is hypothesized that scores on the stereotype threat and stigma consciousness measures will be elevated in the heightened threat condition. In addition, a measure of stereotype endorsement will be administered to both the head-injured and control groups, and it is predicted that both will endorse more negative stereotypes regarding TBI in the heightened threat condition.

Hypothesis #6

Ruthig, Perry, Hall, and Hladkyj (2004) found that high-optimistic students receiving attributional retraining demonstrated improved academic performance. Thus, in the current study, it is predicted that participants with a more pessimistic attitude will be more susceptible to the effects of 'stereotype threat' by showing a stronger decrease in performance in the heightened condition, as compared to participants with a more optimistic attitude. It is also predicted that individuals who are more 'TBI-identified' will be especially susceptible to the effects of 'stereotype threat' by showing a stronger decrease in performance in the heightened threat condition, as compared to participants who are less 'TBI-identified'. Of note, domain identity (i.e., the extent to which individuals place importance on the stereotyped domain) and self-identity (i.e., the extent to which participants view themselves as members of their stereotyped group) have been examined as moderating variables in the stereotype threat research literature (e.g., Cadinu et al., 2003; Davis et al., 2006; Hess et al., 2003; Ployhart et al., 2003). Steele (1997) stated that for stereotype threat to be activated, the threat must be personally salient and meaningful. It is assumed that due to the nature of the recruitment sites (i.e., neuropsychology clinics and rehabilitation settings), as well as the recruitment process (i.e., advertising for individuals with a TBI to participate in a study of attention and memory), many of the potential research participants will be highly 'domain-identified', precluding it as a possible moderating variable.

Method

Recruitment

The final sample consisted of 42 individuals who sustained a mild to moderate TBI and 42 healthy control adults (21 per group), ranging in age from 20 to 59. The ratio of women to men in each group was 4:3 (12 women: 9 men). Over one-third of head-injured participants were recruited through a 'research participant pool'. The participant pool consists of individuals who have previously partaken in other TBI-related studies at the University of Victoria and had expressed interest in future research projects. Approximately 21**%** of head-injured participants were recruited through the Victoria General Hospital Outpatient Neuro-Rehabilitation Unit. Remaining subjects were informed about the study via the Psychology Clinic at the University of Victoria, local brain injury societies, as well as through psychologists and physiotherapists in the Victoria, B.C. area. An on-line newsgroup and flyers posted throughout the Victoria community (in coffee shops, recreation centers, and at the University of Victoria) served as the primary means of recruitment for control subjects. All individuals were compensated with $10.00 for their participation in the study.

TBI Group

Head-injured participants were between the ages of 18-60 and were English-speaking. Time post-injury for brain-injured subjects was at least 6 months. This time frame was chosen due to the spontaneous recovery that can often occur up to six months post-injury (Lezak, Howieson, Loring, Hannay, & Fischer, 2004). Only individuals who sustained their injury after age 16 were included in the present study, as the purpose of the research project is to assess the impact of adult individuals' self-referent beliefs and stereotypes on cognitive performance. It can be assumed that the belief-systems of individuals who sustained their TBI as a child are likely to be different from individuals who had their injury as an adult. In addition, brain maturation begins to decrease in late adolescence (e.g., Huttenlocher, 1984), providing further support for limiting participants to those who sustained their injury after age 16. An upper age limit of 60 was used, as including adults over this age may introduce the confounding variable of age/memory stereotypes and its impact on neuropsychological test performance.

Head-injured participants were restricted to those who sustained a mild-to-moderate TBI. Research indicates that mild head-injured individuals tend to be 'hyper-aware' of their perceived cognitive deficits (Coolidge, Mull, Becker, Stewart, & Segal, 1998; Uomoto & Fann, 2004), experience extensive subjective symptoms (Leininger, Kreutzer, & Hill, 1991; Miller & Donders, 2001; Novack, Daniel, & Long, 1984; Ownsworth, Fleming & Hardwick, 2006), and feel that the head injury has affected their overall quality of life (Uomoto & Fann, 2004). Accordingly, they are likely to be sensitive to stereotypic cues within the testing environment (in contrast to individuals with a severe TBI, who often have reduced insight and awareness into their cognitive and functional difficulties) (e.g., Garmoe et al., 2005; Sawchyn, Mateer, & Braxton-Suffield, 2005).

Information on injury severity was acquired through participant self-report. Medical documentation was not collected due to practical reasons (i.e., the cost and time needed to request documentation from family physicians and emergency room departments). Severity of TBI, for the purposes of the present study, was classified according to the criteria established by the American Congress of Rehabilitation Medicine and by Lezak (1995). These criteria include depth of coma, measured by the Glasgow Coma Scale score (GCS; Teasdale & Jennett, 1974), self-reported duration of post-traumatic amnesia (PTA), and length of loss of consciousness. A mild TBI is defined as involving a traumatic blow to the head or a rapid acceleration/deceleration injury, loss of consciousness (LOC) less than thirty minutes, post-traumatic amnesia (PTA) less than 1 hour, and a Glasgow Coma Scale (GCS) score of 13-15 at injury. Injuries are classified as moderate when GCS scores are 9-12, PTA is greater than an hour, but less than 24 hours, and a loss of consciousness is greater than 30 minutes but less than 6 hours.

A number of research participants expressed uncertainty about their length of post-traumatic amnesia, as is typically the case with head-injured individuals (e.g., Goldstein & Levin, 1995; Gronwall & Wrightson, 1980). In these instances, length of loss of consciousness was used as an index of brain injury severity. For descriptive purposes, subjects were also asked as to whether they had any neuro-imaging (MRI or CT scan) completed, and the findings of such imaging. The results of the CT/MRI scan were reported to be positive by 13 of 29 individuals (7 individuals were in Group 1 and 6 individuals in Group 2). Five participants were unaware of the results of the scan.

Exclusionary criteria included hearing or vision problems (that could potentially interfere with test performance), significant sensory/motor dysfunction (precluding the ability to write with the dominant hand), or additional concomitant neurological conditions (e.g., stroke, multiple sclerosis, brain tumour, dementia, Parkinsons' disease, etc.). A history of substance abuse or psychiatric illness did not serve as exclusion criteria. Given the high prevalence of substance abuse and psychiatric disorders in the TBI population (Taylor, Kreutzer, Demm, & Meade, 2003), restricting the inclusion of such participants would limit the generalizability of the conclusions of this study. Also of note, individuals who had sustained multiple head injuries were included as participants.

One-hundred and ten individuals with TBI were initially contacted and screened for suitability as research subjects. Participants were not accepted into the study for various reasons, including severity of TBI, the fact that they did not suffer a traumatic brain injury (and, instead, had a stroke, cerebral malaria, brain aneurysm, epilepsy, or whiplash injury), lack of interest in participation, failure to meet age criteria (some individuals were older than 60, or sustained their injury before the age of 16), and/or geographical restrictions (a few individuals lived a great distance from the Victoria region). Data from 9 participants was discarded because they failed to accurately remember the experimental manipulation.

Injury characteristics of the remaining 84 participants are presented in Table 1. Mean time post-injury for Group 1 (Reduced Threat) was 6.14 years (*SD* = 3.83 years), ranging from 1 year to 12 years. Mean time post-injury for Group 2 was 5.19 years (*SD* = 3.14), ranging from 1 year to 11 years. Time post-injury and age at injury did not differ significantly between the groups based on separate two-tailed independent-samples t-tests (p >.05). Twenty-seven of the 42 head-injured participants were hospitalized for TBI-related injuries (15 of these individuals were in Group 2). Twenty-nine of the participants underwent rehabilitation (physiotherapy and/or occupational therapy), and 27 had some form of cognitive rehabilitation. These individuals were evenly dispersed across Groups 1 and 2 ($p > 0.05$).

Table 1. Frequency of TBI-related characteristics**.**

Injury-related characteristics	Frequency
Etiology	
Group 1	
Motor-vehicle accident	11
Pedestrian-MVA	1
Cycling accident	1
Assault or fall	3
Sport Injury	2
Logging injury	2
Other	1
Group 2	
Motor-vehicle accident	13
Pedestrian-MVA	2
Cycling accident	0
Assault or fall	2
Sport Injury	1
Logging injury	0
Other	3
Severity	
Group 1	
Mild	16
Moderate	5
Group 2	
Mild	15
Moderate	6
Previous Neuropsychological Testing	
Group 1	16
Group 2	18
Previously Enrolled in Cognitive Rehabilitation Program	
Group 1	13
Group 2	14
Previous TBI	
Group 1	5
Group 2	5

Control Group

The control and TBI group were matched on gender, age, years of education and socioeconomic status, on a case-by-case basis (a discrepancy of 2 years of age and 4 years of education was permitted between matched participants). One-hundred and thirty individuals were initially contacted and screened for suitability as research subjects. Individuals were not accepted into the study if their age and educational level did not match any participant in the head-injured group, if they lived a great distance from the Victoria region, or if they did not meet eligibility criteria for other reasons (e.g., they had a history of neurological conditions). Additionally, a number of other individuals, after learning about study requirements, declined to participate. Data from 2 participants was discarded because they failed to accurately remember the experimental manipulation.

Table 2 lists demographic characteristics of both the TBI and control groups, including mean age, years of education, ratings of depression/anxiety, socioeconomic status (based on family income) and scores on the North American Adult Reading Test (NAART; Blair & Spreen, 1989) (which was used as a measure of pre-morbid intelligence). Table 2 also includes the mean age of injury and the time since injury for TBI groups.

Table 2. Participant demographics.

	TBI				Controls			
	Red. Threat		Height. Threat		Red. Threat		Height. Threat	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	37.95	9.70	38.76	11.92	38.38	11.26	38.71	12.79
Education	15.19	2.25	14.62	2.40	15.62	2.25	14.48	1.69
Income ($)	53000	37430	52000	40987	50952	28619	49047	37670
NAART	111.75	8.40	107.52	8.45	114.89	6.44	114.43	5.83
BSI	29.90	10.04	32.33	15.77	21.19	7.57	24.29	8.25
Years Since TBI	6.14	3.83	5.19	3.14				
Injury Age	31.86	9.26	33.71	11.74				

Note. Red. Threat = Reduced Threat Condition; Height. Threat = Heightened Threat Condition; BSI = Brief Symptom Inventory; NAART = North American Adult Reading Test.

A MANOVA was conducted on the background measures (i.e., age, years of education, SES, NAART scores, and Brief Symptom Inventory Scales (depression and anxiety)) to test for confounds associated with participant assignment to experimental conditions (as each of these constructs is known to potentially affect scores on neuropsychological tests and affective functioning measures). An alpha level of .05 was used for statistical tests. The results of the MANOVA were non-significant [Wilks' Lambda $F(15, 201.9) = 1.679$, $p > 0.05$. Since our interests are univariate in nature, follow-up ANOVAs were conducted. The TBI group endorsed a greater level of depression/anxiety (BSI) [$F(1, 82) = 11.62$, $p < 0.01$] and lower scores on the NAART [$F(1, 81) = 10.32$, $p < 0.01$]. The absence of any other significant effects for the remaining variables indicates that random assignment was successful in controlling for factors that could potentially confound observed condition effects. Follow-up analyses were conducted using BSI and NAART scores as covariates, in addition to analyses without their inclusion. No differences in outcomes were noted, and thus only the latter results are reported (so as to maintain a more parsimonious model). Differences between the two threat conditions for the TBI group were also examined for the variables 'length of time since injury', 'age at injury', 'age' and 'education level', through two tailed independent-samples t-tests. No significant differences were found ($p > 0.05$).

The frequency of various demographic and health-related variables in each group is detailed in Table 3. Based on chi-square analyses, there was no significant difference in the number of individuals across groups on history of alcohol/drug use, significant medical conditions, psychiatric conditions, ethnicity, or language ($p > .05$). Moreover, the two head-injury groups did not differ in terms of the number of individuals involved in litigation or those on psychoactive medications ($p > 0.05$). Two head-injured participants and one control subject reported English to be their second language (although they stated that they learned English in childhood). Participants were primarily of Caucasian origin. Exceptions included 2 individuals in the TBI group who were of Asian descent and 4 individuals in the control group, who were of Asian and First Nations ethnic backgrounds.

Table 3. Frequency of demographic and health variables per group.

	TBI		Control	
Threat Variable	Red. Threat	Height. Threat	Red. Threat	Height.
Alcohol Abuse Hx	2	1	2	3
Drug Use Hx	10	9	6	5
Psychiatric Hx	9	11	9	7
Use of Psychotropic meds	7	10	2	5
Hx of sig. Medical Conditions	6	6	4	2
Undergone Litigation	14	12		

Note: Red. Threat = Reduced Threat Condition; Height. Threat = Heightened Threat Condition.

Measures

Neuropsychological tests were selected for various reasons. Due to the nature of the recruitment sites, a number of TBI research participants had previously undergone neuropsychological testing. Thus, less frequently used tasks were administered so that practice effects were unlikely to be a confounding issue. Secondly, memory and attention tests were given, as previous research has indicated that individuals tend to believe that traumatic brain injuries lead to attention and memory deficits (e.g., Mittenberg et al., 1992; Ferguson et al., 1999; Gunstad & Suhr, 2001). Furthermore, the selected neuropsychological tests are relatively face-valid in nature, and individuals are likely to realize their underlying purpose (i.e., to measure attention and memory abilities), so that negative TBI stereotypes are more likely to be ‘activated’. As a last point, the Letter-Number Sequencing Test of the WAIS-III was chosen due to Suhr and Gunstad’s (2005) finding of a large difference in performance (*d* = 0.90) between stereotype threat conditions for head-injured individuals.

North American Adult Reading Test (NAART)

The NAART (Blair & Spreen, 1989) is a measure used to estimate pre-morbid intellectual ability, and is supported by research demonstrating a high correlation between reading ability and intelligence (Crawford, Stewart, Cochrane, Parker et al., 1989). This test requires that participants read a list of 61 irregularly spelled words aloud. For the current study, an overall IQ score was calculated, based on the number of errors (i.e., incorrectly pronounced words) and on the equations outlined in Strauss, Sherman & Spreen (2006).

In previous literature, solid ratings of inter-rater reliability and internal consistency have been established, at .99 and .94, respectively. Moderate to high correlations (0.4 to 0.8) have also been reported between performance on the NAART and general intellectual skills (Strauss et al., 2006). Typically, the NAART is not as susceptible to brain injury as other cognitive measures and, in general, is reported to be resistant to neurological disturbances, including TBI (Crawford, Parker & Besson, 1988; Watt & O'Carroll, 1999).

Rey Auditory Verbal Learning Test (RAVLT)

The RAVLT (Rey, 1964) is a measure of verbal learning and memory. A list of 15 unrelated nouns is presented to participants. The list is read aloud, after which subjects try to recall as many items as possible in any order. The list is presented in an invariant order during five consecutive trials. After the last trial, a list of 15 new nouns is read, followed by a free recall test. Participants are subsequently asked to recall words from the previous list, without first hearing them. After a 20-minute delay, they are asked again for the words on the first list.

The RAVLT correlates moderately well with other measures of learning and memory (e.g., Stallings, Boake, & Sherer, 1995) and is sensitive to memory deficits in TBI groups (e.g., Bigler, Rosa, Schultz, Hall, & Harris, 1989; Vakil, Blachstein, Rochberg, & Vardi, 1991).

An alternate version of the test was used in the current study so as to minimize practice effects. The scores analyzed were Trial 1 (immediate recall), List B (immediate recall), and Trial 7 (delayed recall).

WAIS-III Letter Number Sequencing

This test (WAIS-III; Wechsler, 1997) is a measure of working memory and attention. The participant is presented with a random series of letter-number combinations, which must be held in working memory while he/she first recites the numbers in ascending numerical order, followed by the letters alphabetically. As per the standard administration, the test was discontinued after failure on all three sequences containing an identical number of letters/numbers. The dependent variable is the number of trials in which the letter–number string is given accurately. The maximum score achievable is 21. Donders, Tulsky and Zhu (2001) found that the Letter-Number Sequencing test is sensitive to the sequelae of TBI.

Auditory Consonant Trigrams

The Auditory Consonant Trigrams test (Stuss, Stethem, & Pelchat, 1988; Stuss, Stethem, & Poirier, 1987) assesses short-term memory, divided attention, and information-processing capacity (Strauss et al., 2006). Participants are verbally administered a ‘consonant trigram’ at a rate of one letter per second followed immediately by a three-digit random number. Subsequently, the participant is asked to count out loud backwards from a number by three's at delays of 9, 18, or 36 seconds. Participants are then asked to recall the trigram. Dependent measures are the total number of letters correctly recalled at each of 3 delay intervals. The number of items correctly answered on each trial yields a score out of fifteen, for a maximum total of 45.

The Auditory Consonant Trigrams Test has been determined to have sound psychometric properties. Moderate correlations between this test and measures of verbal IQ, executive function, and attention/working memory have been reported (Anil et al., 2003; Boone, Pontón, & Gorsuch, 1998). Stuss, Stethem, Hugenholtz and Richard (1989) found that this task is sensitive to the sequelae of TBI and distinguishes 'normal' from head-injured individuals.

Rivermead Behavioral Memory Test (RBMT) – Prose Recall

The Rivermead Behavioral Memory Test (RBMT) – Prose Recall (Wilson, Cockburn, Baddeley, & Hiorns, 1989), for the purposes of the current study, was used to measure immediate memory recall. Following a brief prose passage read aloud, participants were required to recall words/ideas from the presented story. The maximum score achievable for this test is 21.

Cole et al. (2006) found a large difference in performance between stereotype threat conditions for ecstasy users on the RBMT, and thus this test was chosen for the current study. The RBMT shows moderate correlations with a number of memory measures, including Warrington's Recognition Memory Test, sub-tests of the WMS, recall of the Rey Figure, and the Rey Auditory Verbal Learning Test (Goldstein & Polkey, 1992; Malec, Zweber, & DePompolo, 1990; Wilson et al., 1989). Individuals who have suffered neurological compromise have been shown to have lower scores than normal controls on the RBMT (Koltai, Bowler, & Shore, 1996; Lincoln & Tinson, 1989; Wilson et al., 1989).

Questionnaires

Background History Questionnaire

Background information such as age, health, level of education, family income, ethnicity and injury-related characteristics was collected for screening and descriptive purposes (see Appendix A).

TBI-Identity

The extent to which participants view themselves as members of their stereotyped group, termed self-identity, has been examined as a moderating variable in the stereotype threat research literature. Brown and Pinel (2003) and Schmader (2002) modified a sub-scale of the Collective Self-Esteem Scale (Luhtanen & Crocker, 1992) to assess the perceived importance of gender identity to self-definition. Similarly, participants in the current study were asked to evaluate the perceived importance of TBI identity to self-definition, using the same questionnaire adapted for TBI-identity. The administered questionnaire consists of four items, expressed on a 7-point scale from 1 ('*strongly disagree'*) to 7 ('*strongly agree'*) (see Appendix B). The measure yields a total score out of 28, with higher scores reflecting greater TBI-identification. Previous research (e.g., Brown & Pinel, 2003; Schmader, 2002) with this questionnaire has demonstrated adequate internal consistency (α = .70 - .76).

Brief Symptom Inventory – Depression and Anxiety Subscales

The Brief Symptom Inventory (BSI; Derogatis, 1983) is fifty-three-item short form version of the Symptoms Checklist-90 (SCL-90). Like the SCL-90, the BSI is a measure of psychological distress, yielding scores on nine symptom dimensions, including depression (low affect and mood) and anxiety (feelings of nervousness and tension). The BSI has demonstrated excellent psychometric properties in clinical and non-clinical groups (Derogatis, 1983), including high internal consistency (α= 0.86 for depression and α = 0.80 for anxiety) (Boulet & Boss, 1991; Sinha & Watson, 2007) and good test–retest reliability (r = 0.68 – 0.90).

The BSI requires respondents to indicate their level of distress for particular problems over the last week. Higher scores indicate greater levels of depression/anxiety symptom severity. The depression/anxiety subscales consist of twelve items, expressed on a 7-point scale from 1 (‘*not at all’*) to 7 (‘*extremely*’), yielding a score out of 84 (see Appendix C).

Optimism/Pessimism – Revised Life Orientation Test

The construct of optimism/pessimism was measured through the Revised Life Orientation Test (Scheier, Carver, & Bridges, 1994) (see Appendix D). The questionnaire consists of ten statements (e.g., “in uncertain times, I usually expect the best”) and responses are given on a 5-point Likert-type scale (ranging from *strongly disagree* to *strongly agree*). Four of the items are fillers (items 2, 5, 6, and 8) so as to disguise the underlying purpose of the test. The maximum score attainable on this questionnaire is 30, with higher totals suggesting greater levels of an ‘optimistic-thinking’ style. This questionnaire has demonstrated adequate internal consistency (e.g., Ayyash-Abdo & Alamuddin, 2007; Chang & Bridewell, 1998).

Beck Anxiety Inventory (BAI)

The BAI (Beck, Steer & Brown, 1996) has been used extensively in other stereotype threat research that has investigated the construct of anxiety as a potential mediating variable (e.g., Chasteen et al., 2005; Hess et al., 2003; Hess et al., 2004; Hess & Hinson, 2006; Keller & Dauenheimer, 2003; Mayer & Hanges, 2003; Ployhart et al., 2003; Schmader, 2002; Spencer et al., 1999). The BAI measures the severity and frequency of anxiety symptoms, including somatic, cognitive, and behavioural manifestations. It is comprised of 21 items. The individual chooses from four different responses, based on how he/she has felt over the past week (see Appendix E). For the purposes of this study, the scale yields a total score out of 84, and a high value indicates a greater degree of anxiety.

Measurement of Specific Performance Expectations

Following the procedure used by Desrichards and Kopetz (2005), participants were asked to evaluate their expected performance on upcoming tests. This was done through three items, expressed on a 7-point Likert-type scale from 1 (‘*very poor performance’*) to 7 (‘*very good performance’*) as well as through an additional item, also expressed on a 7-point Likert-type scale from 1 (‘*strongly disagree’*) to 7 (‘*strongly agree’*). The items yield a total score out of 28, with a high value indicating positive expectations for performance. Unfortunately, due to the lack of questionnaires measuring test-specific expectations in psychological research, psychometric properties based on previous studies’ findings are unavailable. The Cronbach’s alpha generated from the current study is .83. (see Appendix F for the items comprising the Expectations questionnaire).

Test Attitude Survey (Motivation Scale)

Rather than using one item to assess test motivation, as has been typically done in previous stereotype threat research (e.g., Brown & Pinel, 2003; Keller & Dauenheimer, 2003), test-taking motivation was evaluated using the Motivation Scale of the Test Attitude Survey (TAS) (Arvey, Strickland, Drauden, & Martin, 1990). Ployhart et al. (2003) used this particular questionnaire as a measure of motivation in their stereotype threat study. The questionnaire was originally designed to measure test-taking motivation in an employment setting. However, all of the questions are relevant and applicable to any test-taking situation and additional studies have used this measure as a means to assess motivation in association with cognitive test performance (e.g., Chan, Schmitt, DeShon, & Clause, 1997). The scale consists of ten items and responses are given on a 7-point Likert-type scale (ranging from *strongly disagree* to *strongly agree*). The Motivation scale of the TAS has high internal consistency ($\alpha = 0.85$) and adequate convergent validity (McCarthy & Goffin, 2003). It has been shortened to six items for the purpose of the current study (see Appendix G), and its associated Cronbach's alpha was found to be .595. The highest score one can attain on this measure is 42, which indicates a high degree of motivation.

Dejection-Related Emotions

Dejection-related emotions have been shown to act as a mediating variable in the 'women and math' stereotype threat literature (e.g., Cadinu et al., 2003; Keller & Dauenheimer, 2003), warranting its investigation in the TBI population. In the current study, dejection-related emotions (e.g., irritable, hostile, distressed, etc.) were assessed through the use of the Positive Affect and Negative Affect Scale (PANAS) (Watson, Clark, and Tellegen, 1988) (see Appendix H). This questionnaire asks participants to rate their present experience of different feelings and emotions on a 5-point Likert-type scale ranging from *very slightly or not at all* (1) to *extremely (5).* The questionnaire consists of 20 items, and the highest score one can attain is 100 (indicating an elevated feeling of dejection). Watson et al. (1988) found this questionnaire to have good internal consistency (α = 0.85 – 0.89).

Memory Self-Efficacy

The Metamemory in Adulthood (MIA) questionnaire provides a measure of self-perceptions of everyday memory functioning (Dixon & Hultsch, 1983b). Studies have shown that two sub-scales from this questionnaire (Capacity and Change) can be used as a marker of memory self-efficacy (MSE) (Hertzog & Dixon, 1994). MSE refers to individuals' sense of mastery in the memory domain (Cavanaugh & Green, 1990). Dissecting this even further, the Capacity scale measures perceptions of memory abilities and the Change scale refers to individuals' perceptions of memory abilities as stable, or subject to long-term decline (Hertzog & Dixon, 1994). The Capacity and Change scales were administered in the current study (see Appendix I). In total, they consist of 32 items, and participants are given five response choices (i.e., *never*, *rarely*, *sometimes*, *often*, *always*). The highest score one can attain on this questionnaire is 160, which indicates lower memory self-efficacy and more negative self-referent cognitive beliefs.

In one of the few studies to examine metamemory in a head-injured population, a modified version of the MIA was developed and used (Kit et al., 2007). An exploratory principal component analysis revealed the same groupings of items to those identified by Hultsch, Hertzog, Dixon, and Davidson (1988). Prior work with the original questionnaire suggests that the scales are internally consistent (α = .85 and .92). This questionnaire has shown good convergent validity with the Memory Functioning Questionnaire (Hertzog, Dixon & Hultsch, 1990).

Cognitive Interference

Following the procedure of Mayer and Hanges (2003), a measure of cognitive interference was used to assess task-irrelevant thoughts (e.g., intrusive thoughts that can occur while an individual is working on a task). Specifically, the Cognitive Interference Questionnaire (CIQ) (Sarason & Stoops, 1978) was used in the current study (see Appendix J). This questionnaire is a 21-item measure in which participants rate the frequency of intrusive thoughts on a scale from 1 (*never*) to 5 (*very often*). An additional item asks respondents to rate the degree of 'mind-wandering' during a specific task on a scale from 1 (*not at all*) to 7 (*very much*). The highest score attainable is 112 (which signifies a high frequency of task-irrelevant thoughts). The alpha for this scale is .90 (Mayer & Hanges, 2003). Empirical research with the CIQ has demonstrated that individuals with elevated test anxiety report greater frequencies of intrusive thoughts than do individuals with low test-anxiety (Sarason, 1984; Sarason & Stoops, 1978).

Stereotype Threat Measure

The measure chosen for this study was modeled after a stereotype threat questionnaire used by Marx and Goff (2005). It was modified for the current study so that statements pertained to TBI. Participants were asked to respond to four statements that were intended to measure the experience of stereotype threat (i.e., the extent to which targeted/stigmatized individuals face the threat of confirming or being judged by a negative stereotype). Respondents answered on a scale from (1) *strongly disagree* to (7) *strongly agree* on four items (see Appendix K). The total score achievable on this questionnaire is 28, which indicates high endorsement of feelings of stereotype threat.

This questionnaire has been shown to have good internal consistency (α = 0.80) (Marx & Goff, 2005). Cronbach's alpha for the current study was found to be .592.

Stigma Consciousness Questionnaire

The measure chosen for this study was modeled after Pinel's 'Stigma Consciousness Questionnaire' (1999), which has been used in other research on stereotype threat (e.g., Brown & Pinel, 2003). Again, like the *Stereotype Threat Measure*, it was modified for the current study so that statements pertained to TBI. Participants were asked to respond to nine statements that were intended to measure their experience of stigma consciousness (i.e., the expectation that one will be stereotyped, irrespective of one's actual behaviour) (see Appendix L). Participants responded on a scale from 1 (*strongly disagree)* to 7 (*strongly agree).* The highest score one can attain on this questionnaire is 63, which indicates a lower degree of stigma consciousness.

Responses to the stigma consciousness questionnaire have proven internally consistent (α= 0.74-0.77) (Brown & Pinel, 2003; Pinel, 1999). Cronbach's alpha for the current study was found to be .728.

Explicit Beliefs/Stereotypes Surrounding TBI

Based on research in the TBI domain (e.g., Mittenberg et al., 1992; Ferguson et al., 1999), it appears that both individuals who have experienced a TBI, as well as those who have not, expect an increase in concentration and memory problems following a head injury (specifically, individuals expect difficulty in remembering names, conversations, and in keeping focus on one's train of thought). Combining the methodology of the aforementioned studies with that of Ford et al. (2004) and Schmader and Johns (2003), participants' endorsement of TBI-related stereotypes were assessed through a single-item measure, which participants rated on a Likert-type scale from 1 to 7, as well as a list of 10 attributes commonly associated with TBI. Participants responded to each of these items on a 7-point Likert-type scale in which ‘1’ signifies *strongly disagree* and ‘7’ indicates *strongly agree* (see Appendix M). The total score attainable on this questionnaire is 77, which indicates a higher degree of endorsement of negative stereotypes regarding TBI.

The items used in this questionnaire were chosen from a 30-item post-concussion symptom checklist employed by Mittenberg et al. (1992). The checklist provides a reliable measure of post-concussion symptoms following head injury and symptom expectations in uninjured individuals (Mittenberg et al, 1992). Responses to this questionnaire were found to be internally consistent (α= 0.89)

Procedure

Pilot Testing for the Experimental Procedure

The tasks were piloted on four graduate students to identify any issues that would indicate the need for task modifications, especially relating to task instructions, experimental manipulation and questionnaire items. No concerns were raised and thus the order of the questionnaires and the experimental manipulation remained identical to that originally proposed.

Test Administration

An initial screening through administration of a portion of the Background History Questionnaire was first conducted over the telephone. Participants were told that the purpose of the study was to assess cognitive and emotional functioning in relation to TBI (control participants were told that their test data was to be used to determine any differences between the two populations). During the telephone screening, head-injured individuals were administered the Brief Symptom Inventory and the TBI-identity scale, and were scheduled for individual testing. Testing was either conducted at a psychology laboratory at the University of Victoria, at a quiet room at a public library, or at participants' homes. The testing session took approximately 1 hour. After the scheduled meeting, participants were thanked for their participation, and were provided with a written summary of the purpose and rationale of the study.

Upon meeting each participant, written consent was obtained. The tests were administered in the order outlined below. Participants first completed the NAART in order to assess pre-morbid intelligence. After completing this test, subjects were administered the Revised Life-Orientation Test. Following this, they were exposed, through random assignment, to one of two conditions (i.e., reduced threat or heightened threat). Participants read the experimental manipulation out-loud. They were then asked whether they understood the material and whether they had any questions about the information.

The wording of each of the experimental manipulations was guided by research findings from interventions used in stereotype threat research and attribution-focused empirical studies. These bodies of research indicate that test performance is enhanced when individuals are encouraged to adopt a more positive view of their capabilities and feel a sense of control over test outcome. These ideas were applied within the 'reduced threat' condition.

Reduced Threat Condition:

> Research has shown that individuals who have had a traumatic brain injury (head injury) usually recover fully after a period of time and perform just as well as

> individuals who have not had a traumatic brain injury on attention/memory tests. Research has also shown that memory and attention abilities are under the personal control of the individual. In other words, memory and attention abilities can improve with effort. The goal of the present study is to confirm the above findings. As such, you will be given a number of attention and memory tests.

Heightened Threat Condition:

> Research has shown that individuals who have had a traumatic brain injury (head injury) do not perform as well as individuals who have not had a traumatic brain injury on tests of memory and attention, even after a period of time. Research has also shown that memory and attention abilities are not under the personal control of the individual. In other words, memory and attention abilities are permanently affected, as a result of a head injury, and cannot improve with effort. The goal of the present study is to confirm the above findings. As such, you will be given a number of attention and memory tests.

It should be noted that this manipulation is fairly subtle in nature. However, research in the ‘women and math’ stereotype threat literature has used a variant of this type of pre-test instruction and found medium to large effect sizes.

Following exposure to either condition, participants were given questionnaires consisting of the Beck Anxiety Inventory, Measure of Performance Expectations, Motivation Scale of the Test Attitude Survey, PANAS, and Memory Self-Efficacy Scale of the MIA. The questionnaires were not presented separately, but instead were collapsed together to resemble a single questionnaire so that participants were less aware of the underlying purpose of each measure. Subjects were informed that the overall function of the questionnaire was to assess mood/emotional functioning and self-perceptions within the context of a testing environment. After completing these measures, participants were asked to recall the experimental manipulation. It is assumed, through these procedures, that individuals actively processed and remembered the information contained in each of the experimental manipulations.

Participants subsequently received the neuropsychological tests. The order of test administration was the RAVLT, followed by Auditory Consonant Trigrams Test, Letter-Number Sequencing, Delayed Portion of the RAVLT, and, finally, the Prose Recall Test of the RBMT. Subsequently, head-injured participants were administered the cognitive interference measure, stereotype threat measure, stigma consciousness scale, and questionnaire of explicit beliefs/stereotypes surrounding TBI (control participants were only administered the cognitive interference and explicit beliefs/stereotypes surrounding TBI measures). Finally, a manipulation check was conducted in that participants were asked, through true-false questions, to recall the pre-test instructions given to them. The manipulation check was designed to assess whether individuals correctly remembered pre-test instructions. This factor is crucial to the predictions regarding the differential effect of pre-test instructions on head-injured individuals' test performance. Data from participants who had difficulty in recalling pre-test instructions was discarded. Following completion of the study, individuals were thanked for their time, and told not to inform future participants about the particulars of the study. Participants were also told that they would receive a summary of the research project once the data had been collected.

Power and Statistical Analyses

Only two studies have investigated the effects of stereotype threat in a TBI population. These studies found large effect sizes (d = 0.84 and d = 0.90) for a number of neuropsychological measures (Suhr & Gunstad, 2002; 2005). Thus, to ensure a minimum power of 0.80 with an alpha level of .05, a sample size of 42 head-injured individuals, and 42 non-head-injured controls was needed (21 per group) to test hypotheses 1, 2, and 3. It is argued that only large effect sizes are of interest for the remaining hypotheses as the current study investigates the applicability of the stereotype threat phenomenon to a research and clinical environment, and thus only clinically meaningful results were desired. As such, no further additional participants were needed.

Manipulation Checks

Three items were used to assess whether the stereotype threat manipulation was salient to participants. Subjects answered the following three true/false questions: ‘I was told that research has shown clear differences in neuropsychological/cognitive test scores between individuals with a head injury/traumatic brain injury and those without a head injury/traumatic brain injury’; ‘I was told that research has shown no differences in neuropsychological/cognitive test scores between individuals with a head injury/traumatic brain injury and those without a head injury/traumatic brain injury; and ‘I was also told that cognitive/neuropsychological abilities can improve with the amount of effort expended.’ A probe for suspicion was also used in that participants were asked ‘What do you feel this study was about?’ If a participant disclosed that he/she was aware of the manipulation used within this research project, his/her data was discarded. Although no individuals suspected another purpose to the study other than the goals provided by the experimenter, 9 individuals (5 head-injured, and 4 non-head-injured) failed to accurately recall the underlying message to the experimental manipulation, and thus their data were discarded.

Results

Data Screening

Data screening procedures did not identify any missing data. To detect univariate outliers, criteria similar to that defined by Tabachnick and Fidell (1996) were used (standard deviation of z +/- 3.00 from the group mean for each test). Four univariate outliers were detected and subsequently discarded (including the measures of RAVLT-List B, LNS, and RBMT) so as to ensure a homogenous sample. Using a conservative alpha level of .01, no distribution of scores deviated significantly from normality based on the Shapiro-Wilks test. The homogeneity of variance assumption was also satisfied for all measures based on the Levene statistic. Thus, parametric tests were carried out.

Main Analyses

The primary interest was in the impact of the stereotype threat manipulation on (a) neuropsychological test performance, (b) emotional functioning, (c) perceptions of stereotype threat/learned helplessness and (d) stereotypes surrounding TBI. The influence of head-injury status and stereotype condition on the dependent variables was examined using General Linear Model-based ANOVAs, with head-injury status (head-injured or non-head-injured) and stereotype condition (reduced threat or heightened threat) as between participant factors.

Performance on Neuropsychological Tests

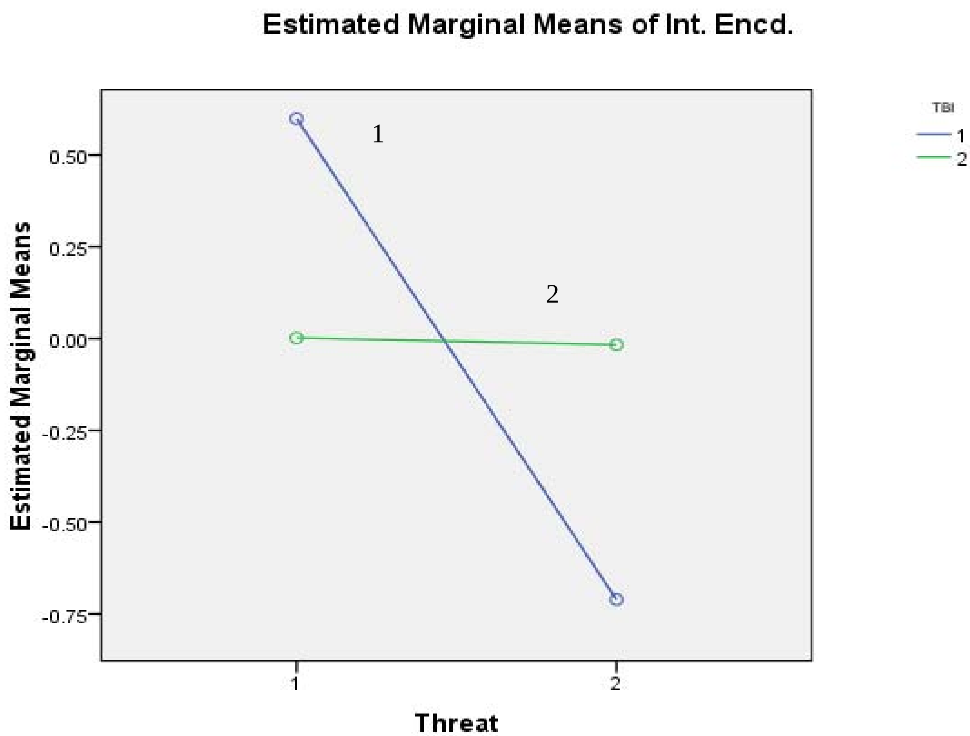
The main point that this study addressed was whether experimental condition (i.e., heightened or reduced threat) influenced participants' neuropsychological test scores (see Table 4 for a breakdown of scores on neuropsychological test measures). A high degree of correlation ($r = .464$, $p < 0.01$) was noted between the total score of the Auditory Consonant Trigrams Test (ACT) and the Letter-Number Sequencing task (LNS), both of which are a measure of working memory (e.g., Strauss, Sherman & Spreen, 2006). For these reasons, the measures were collapsed into a composite variable termed *Attention*. Similarly, a high correlation was noted between Trial 1 of the RAVLT and RBMT total score ($r = .363$, $p < 0.01$) thus warranting their combination into a composite variable termed *Initial Encoding*. *Delayed Recall* was a further composite variable, formulated by collapsing Trials 6 and 7 of the RAVLT, as well as the Total RAVLT score (the sum of words provided across all trials), which were all found to be highly correlated (Trial 6 and 7: $r = .889$, $p < 0.01$; Trial 6 and Total: $r = .777$, $p < 0.01$; Trial 7 and Total: $r = .781$, $p < 0.01$). Calculating composite variables provided a reduction in the number of neuropsychological test measures, thus increasing the power of statistical analyses when Type I error rate was controlled.

ANOVAs were performed, using Initial Encoding, Attention, and Delayed Recall as dependent measures. No significant main effects or interactions were found. However, the analysis yielded a marginally significant interaction for the Initial Encoding variable, ($F(1,80) = 3.495$, $p = 0.065$, $\eta_p^2 = 0.042$)). In looking at Figure 1, it appears that the Threat Condition had a differential effect on the TBI and Control group. As indicated in the hypothesis, planned pairwise comparisons were subsequently conducted. Simple effects were examined by t-test, which showed that the head-injured reduced threat group outperformed the head-injured heightened threat group on the Initial Encoding variable, $t(40) = 2.503$, $p = 0.016$.

Table 4. Scores across the four conditions for neuropsychological test measures.

	Experimental Condition			
	Reduced Threat		Heightened Threat	
Measure	TBI (*n* = 21)	Non-TBI (*n* = 21)	TBI (*n* = 21)	NonTBI (*n* = 21)
ACT-Total	27.00+/-6.07	29.76+/-5.85	25.05+/-7.95	27.62+/-7.68
LNS-Total	11.48+/-2.18	11.14+/-2.39	10.50+/-2.31	11.19+/-2.75
RAVLT-Trial 1	7.76+/-2.05	7.05+/-2.11	6.48+/-1.94	7.29+/-1.74
RBMT-Total	8.62+/-3.53	7.93+/-2.92	6.69+/-2.45	7.90+/-2.50
RAVLT-Trial 6	10.48+/-2.79	11.57+/-2.40	10.62+/-3.15	11.05+/-2.36
RAVLT-Trial 7	10.33+/-2.92	11.10+/-2.55	11.05+/-3.34	11.14+/-2.59
RAVLT-Total	53.05+/-8.67	53.00+/-8.51	50.90+/-10.00	52.95+/-8.18

Figure 1. Interaction effect across the two conditions for the Initial Encoding measure.

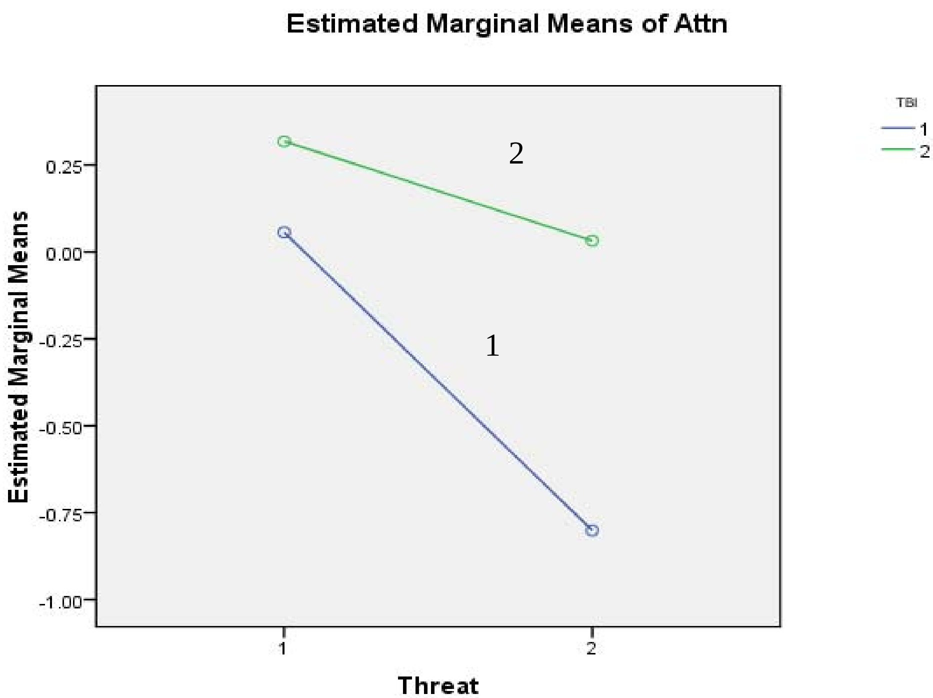


Note: TBI1 = Head-injured group; TBI2 = Control group. Threat1 = Reduced Threat; Threat2 = Heightened Threat.

No differences were noted across conditions for the control group, $t(40) = .041$, $p > 0.05$, consistent with the original hypotheses.

Although a significant effect was not found for the interaction term for the Attention variable, ($F(1,80) = 0.664$, $p > 0.05$, $\eta_p^2 = 0.008$)), inspection of the graph depicted in Figure 2 suggests that differences may exist between the TBI groups across conditions. Indeed, the head-injured reduced threat group outperformed the head-injured heightened threat group on the Attention variable, $t(40) = 1.801$, $p = 0.079$, as evidenced by a marginally significant effect. No differences were noted across conditions for the control group, $t(40) = .0.556$, $p > 0.05$.

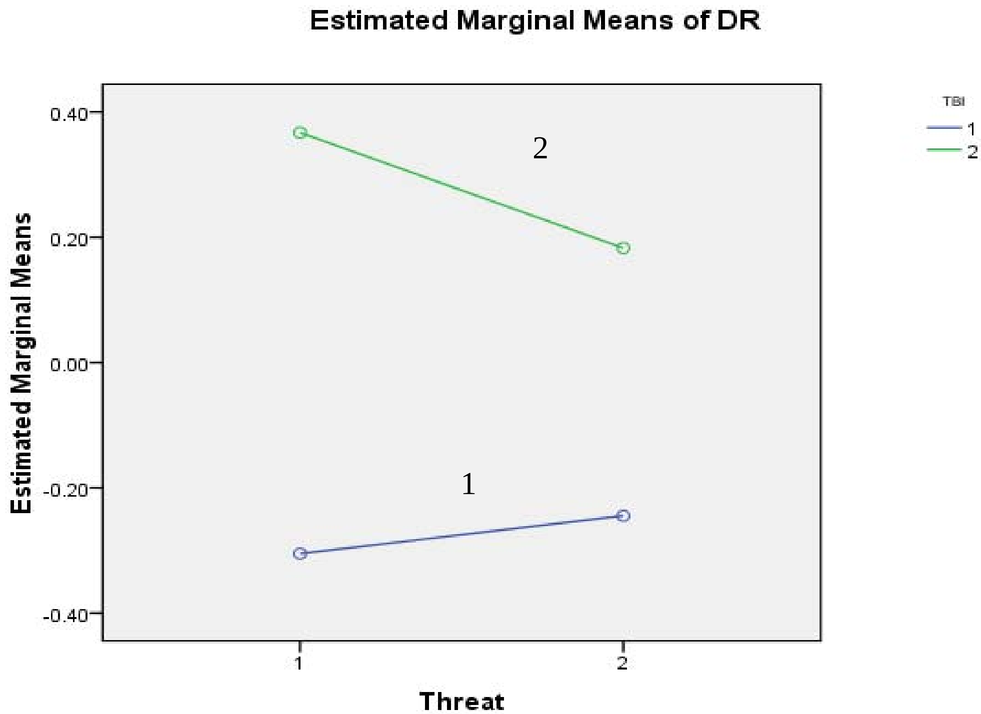
Figure 2. Interaction effect across the two conditions for the Attention measure.



Note: TBI1 = Head-injured group; TBI2 = Control group. Threat1 = Reduced Threat; Threat2 = Heightened Threat.

No significant effects were documented for the Delayed Recall variable, as illustrated in Figure 3, and substantiated by follow-up planned comparisons. The TBI group performed similarly on this measure across conditions ($t(40) = -.065$, $p > 0$ .05)), as did the control group ($t(40) = .228$, $p > 0.05$)). Also, in comparing head-injury groups' neuropsychological test performance to that of the control group, across all conditions, no significant differences were found ($p > 0.05$).

Figure 3. Interaction effect across the two conditions for the Delayed Recall measure.



Note: TBI1 = Head-injured group; TBI2 = Control group. Threat1 = Reduced Threat; Threat2 = Heightened Threat.

In addition to statistical significance, the possibility of clinical significance was examined. Clinically impaired performance (as defined by borderline scores on three or more of the abovementioned measures (i.e., whether task performance fell greater than 1.5 standard deviations below the mean, based on published norms for the task)) indicated that 43% of heightened threat head-injured participants, and 14% of reduced threat head-injured participants exhibited impaired performance. Chi-squared analyses indicated that this represented a significant difference between groups ($p < 0.05$).

Table 5. Main and interaction effects across the two conditions for neuropsychological composite variables.

	Experimental Condition			
	Reduced Threat		Heightened Threat	
Composite Variable	TBI (n = 21)	Non-TBI (n = 21)	TBI (n = 21)	Non-TBI (n = 21)
Attention	.06+/-1.43	.23+/-1.37	-.80+/-1.65	.03+/-1.89
Initial Encoding	.60+/-1.88	.10+/-1.64	-.71+/-1.48	-.02+/-1.22
Delayed Recall	-.31+/-2.77	.26+/-2.67	-.24+/-3.25	.18+/-2.59

Note. The data provided in the table are the mean and standard deviations for each of the groups on the measures listed. Values are mean and standard deviation z-scores.

Emotional functioning, Perceptions of Stereotype Threat/Learned Helplessness and Stereotypes Surrounding TBI

A secondary aim of the study was to determine whether measures of emotional functioning and self-perception (i.e., anxiety, expectations, motivation, dejection-related emotions, memory self-efficacy, cognitive interference, stereotype threat, stigma consciousness, and beliefs about TBI) varied in accordance with stereotype threat condition and head-injury status. The ANOVAs conducted yielded a significant head-injury status main effect, [$F(1, 79) = 23.11$, $p < 0.01$, $\eta_p^2 = .226$] for the BAI, with the TBI group endorsing a higher level of anxiety ($M = 35.48$; $SD = 8.75$) than the control group ($M = 27.44$, $SD = 6.02$). Significant effects were also found for: 1. the Motivation variable, [$F(1,78) = 15.62$, $p < 0.001$, $\eta_p^2 = .167$] in that the head-injured group reported a higher level of motivation ($M = 36.05$, $SD = 4.40$) than the control group ($M = 31.83$, $SD = 5.15$); 2. the Memory Self-Efficacy construct, [$F(1, 80) = 87.66$, $p < 0.001$, $\eta_p^2 = .523$] (the control group endorsed a greater degree of memory self-efficacy ($M = 80.31$, $SD =$

16.54; reverse-scored) than the TBI group (*M* = 112.24, *SD* = 15.31); 3. and the PANAS variable, [$F(1, 79) = 8.98$, $p < 0.01$, $\eta_p^2 = .102$], with TBI participants endorsing a greater degree of dejection (*M* = 43.62, *SD* = 9.48) than non-head-injured participants (*M* = 38.20, *SD* = 6.51). Moreover, a significant difference was found for the Explicit Beliefs/Stereotypes Surrounding TBI measure across the threat conditions, [$F(1, 76) = 7.724$, $p < 0.01$, $\eta_p^2 = .092$], in that the heightened threat condition endorsed elevated perceptions of negative beliefs regarding TBI. A marginally significant main effect for threat condition was also found for the MSE variable, $F(1,77) = 2.95$, $p = 0.09$, with the heightened threat condition reporting lower feelings of memory self-efficacy. No other significant main effects were found.

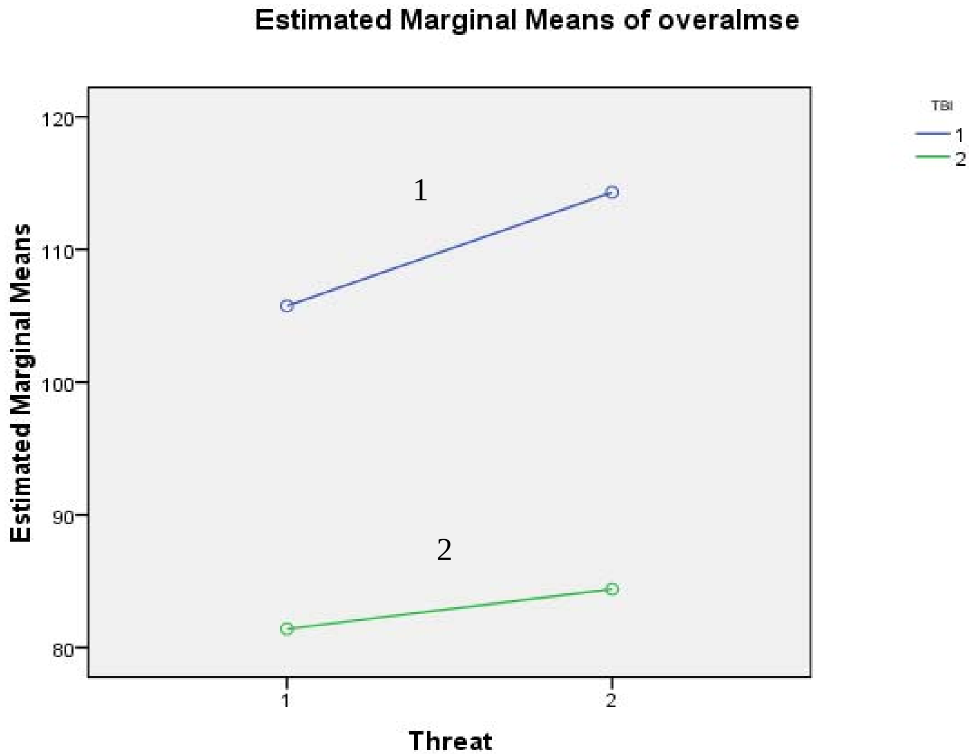
Following up on the abovementioned results, planned pairwise contrasts indicated that the head-injured heightened threat condition endorsed lower Memory Self-Efficacy than the head-injured reduced threat condition, $t(40) = -2.38$, $p < 0.05$ (see Figure 4. Note: the variable of MSE is reverse-scored). Simple effects testing also revealed that the non-head-injured heightened threat group reported a greater degree of negative beliefs/stereotypes regarding TBI than the non-head-injured reduced threat group, $t(39) = -3.193$, $p < 0.01$ (see Figure 5). No other significant effects between the two threat conditions for the TBI or control groups were found.

Table 6. Main and interaction effects across the two conditions for affective measures.

	Experimental Condition			
	Reduced Threat		Heightened Threat	
Measure	TBI (*n* = 21)	Non-TBI (*n* = 21)	TBI (*n* = 21)	Non-TBI (*n* = 21)
Anxiety*	35.57+/-8.98	26.60+/-5.64	35.38+/-8.74	28.40+/-6.51
Expectations	18.57+/-5.31	20.55+/-4.80	17.71+/-4.18	19.86+/-3.90
Motivation*	35.75+/-4.08	31.79+/-4.26	36.33+/-4.78	32.29+/-5.71
Dejection*	42.86+/-11.18	37.30+/-8.43	44.38+/-7.61	39.05+/-4.07
MSE*[1]	106.90+/-14.14	78.50+/-19.60	117.57+/-14.87	82.76+/-13.51
Cog. Interference	41.90+/-8.25	42.95+/-12.48	42.24+/-9.56	40.52+/-10.06
Stereotype Threat	15.33+/-5.34		16.10+/-4.50	
Stigma Cons.	36.71+/-10.52		38.57+/-7.67	
Beliefs re: TBI[2]	53.14+/-11.03	49.55+/-11.04	56.67+/-10.96	59.40+/-8.14

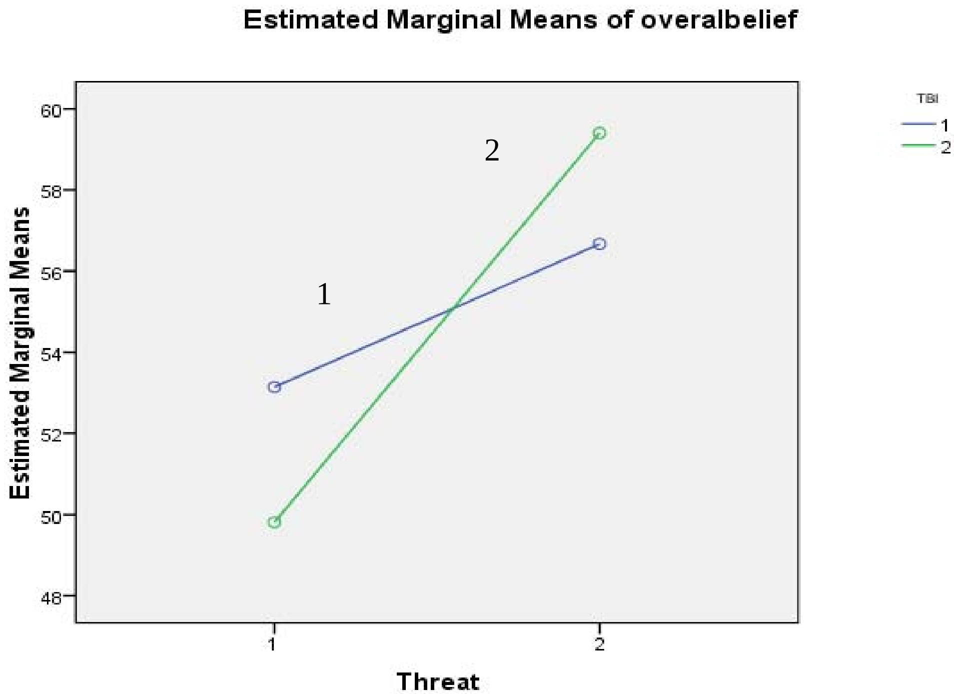
Note. The data provided in the table are the mean and standard deviations for each of the groups on the measures listed. The Memory Self-Efficacy (MSE) variable is reverse-scored (and thus a higher value indicates a lower score of memory self-efficacy). * = main effect; [1] = TBI-RT > TBI-HT; [2] = Non-TBI-RT < Non-TBI-HT

Figure 4. Interaction effect across the two conditions for the Memory Self-Efficacy measure.



Note: TBI1 = Head-injured group; TBI2 = Control group. Threat1 = Reduced Threat; Threat2 = Heightened Threat. The Memory Self-Efficacy (MSE) variable is reverse-scored (and thus a higher value indicates a lower score of memory self-efficacy).

Figure 5. Interaction effect across the two conditions for the Explicit Beliefs/Stereotypes Surrounding TBI measure.



Note: TBI1 = Head-injured group; TBI2 = Control group. Threat1 = Reduced Threat; Threat2 = Heightened Threat.

Mediational Analyses

To examine mediation, three conditions, as proposed by Baron and Kenny (1986), need to be present. Firstly, a significant relationship must exist between the independent and dependent variables. Secondly, the independent variable must be significantly related to the mediator. Thirdly, the mediator must affect the dependent variable when it is regressed on the independent variable and mediator. Mediation exists if the impact of the independent variable on the dependent variable is reduced after controlling the mediator. The current statistical analyses were conducted in a regression format among the head-injured participants, as it is only among these individuals that the stereotype threat phenomenon presumably operates. Based on the results previously mentioned, memory self-efficacy (MSE) was examined as a potential mediator between Threat Condition and Initial Encoding and Threat Condition and Attention. Regression analyses showed that Threat Condition and Initial Encoding were related ($F(1,40) = 6.265$, $p < 0.05$) and that Threat condition was significantly associated with the MSE variable of the MIA, ($F(1,40) = 5.675$, $p < 0.05$). When the dependent variable (i.e. Initial Encoding) was simultaneously regressed on both the independent variable (i.e. Threat Condition) and on the mediator (i.e, Memory Self-Efficacy), MSE was significantly related to Initial Encoding, and the previously significant relationship between Stereotype Threat Condition and Initial Encoding was reduced to non-significance (see Table 7). Examination of the mediation effects revealed that MSE fully mediated the relationship between Threat Condition and Initial Encoding. That is, the direct effect of Threat Condition on Initial Encoding, while controlling for the effect of Memory Self-Efficacy, was not significant. This was corroborated by the significant mediation effect as measured by the Sobel (1982) test (which assesses the indirect effect of the independent variable on the dependent variable through the mediator. The test can be interpreted as an index of the strength of the mediation). Overall, according to the Baron and Kenny (1986) procedure, the Memory Self-Efficacy variable of the MIA mediated the relation between Stereotype Threat Condition and Initial Encoding. Identical results were found for the Attention variable, although, as indicated previously, only a marginally significant relationship was documented between Threat Condition and the Attention construct. Nevertheless, the mediational statistical results are outlined in Table 7.

Table 7. Summary of regression results: testing the mediating effects of Memory Self-Efficacy on the relationship between Threat condition for the TBI groups and Initial Encoding/Attention.

Equation	ß	SE ß	Beta	t	F	R^2	Sobel Test
1. Threat Condition ->							
Initial Encoding[1]	-.655	.262	-.368	-2.503	6.265**	.135	
2. Threat Condition ->							
Memory Self-Efficacy[2]	5.333	2.239	.352	2.382	5.675**	.124	
3. Threat Condition and							
Memory Self-Efficacy->Initial Encoding[3]					8.246**	.297	z=1.90**
Threat Condition	-.385	.255	-.216	-1.509			
Memory Self-Efficacy	-.051	.017	-.430	-2.996***			
1. Threat Condition ->							
Attention[1]	-.428	.238	-.274	-1.801	3.245*	.075	
2. Threat Condition ->							
Memory Self-Efficacy[2]	5.333	2.239	.352	2.382	5.675**	.124	
3. Threat Condition and							
Memory Self-Efficacy->Attention[3]					4.396**	.184	z=1.83**
Threat Condition	-.234	.242	-.150	-.968			
Memory Self-Efficacy	-.036	.016	-.353	-2.282**			

Note. [1]df = 1,40; [2]df = 1,40; [3]df = 2,39; *$p < 0.08$, ** $p < 0.05$, ***$p < 0.01$

Moderation Analyses

It was predicted that head-injured participants with a more pessimistic attitude, and who were more ‘TBI-identified’ would be especially susceptible to the effects of ‘stereotype threat’, by showing a stronger decrease in performance in the heightened threat condition. Thus, the goal of the analysis was to determine whether Optimism/Pessimism and TBI-Identity moderated the effect of threat condition on neuropsychological test scores. To test this proposition, a moderated multiple regression analysis was conducted (Stone-Romero & Anderson, 1994) in which the Initial Encoding, Attention, and Delayed Recall scores were regressed separately on TBI-Identification and Optimism/Pessimism in Step 1, followed by their multiplicative term in Step 2.

Table 8. Moderated multiple regression analyses of the effects of TBI-identification & optimism/pessmism and threat condition on neuropsychological test scores of head-injured individuals.

Variable	*B*	*SE B*	ß	*p*
Initial Encoding				
Step 1				
TBI-Identification	.144	.272	.080	.600
Threat Condition	-.681	.268	-.382	.016
Step 2				
TBI-Id.XThreat Cdtn.	.232	.277	.127	.408
Attention				
Step 1				
TBI-Identification	-.100	.247	-.063	.689
Threat Condition	-.410	.244	-.262	.101
Step 2				
TBI-Id.XThreat Cdtn.	-.304	.250	-.189	.231
Delayed Recall				
Step 1				
TBI-Identification	.256	.484	.086	.600
Threat Condition	-.016	.479	-.005	.974
Step 2				
TBI-Id.XThreat Cdtn.	.150	.498	.049	.765
Initial Encoding				
Step 1				
Optimism/Pessimism	.113	.268	.063	.676
Threat Condition	-.652	.264	-.367	.016
Step 2				
Opt/Pess.XThreat Cdtn.	-.363	.266	-.202	.180
Attention				
Step 1				
Optimism/Pessimism	.361	.237	.228	.136
Threat Condition	-.420	.234	-.269	.079
Step 2				
Opt/PessXThreat Cdtn.	.153	.240	.097	.527
Delayed Recall				
Step 1				
Optimism/Pessimism	-.035	.478	-.012	.942
Threat Condition	.029	.472	.010	.951
Step 2				
Opt/PessXThreat Cdtn.	-.073	.487	-.025	.881

The results reported in Table 8 show that TBI-Identification and Optimism/Pessimism failed to moderate the Threat Condition/neuropsychological test score relationship, as indicated by the non-significant interaction terms.

The failure to find a significant interaction between threat condition and TBI-Identity/Optimism-Pessimism in predicting neuropsychological test performance is likely to have resulted from insufficient power, given the small number of participants. Thus, a less stringent test of the moderation hypothesis was performed. A series of simple regression analyses, in which neuropsychological test scores were regressed on TBI-Identity and Optimism/Pessimism scores for each threat condition, were conducted. No significant effects emerged, as outlined in Table 9.

Table 9. Simple regression analyses of the effects of TBI-Identity and Optimism/Pessimsism scores on neuropsychological test performance of TBI participants.

Variable	R^2	*B*	*SE B*	ß	*p*
Initial Encoding					
Height. Threat condition (*N*=21) TBI-Identity	0.064	0.060	0.053	.254	.267
Red. Threat condition (*N*=21) TBI-Identity	0.001	-0.007	0.058	-.027	.907
Attention					
Height. Threat condition (*N*=21) TBI-Identity	0.063	-.457	.405	-.251	.273
Red. Threat condition (*N*=21) TBI-Identity	0.013	0.15	.301	.114	.624
Delayed Recall					
Height. Threat condition (*N*=21) TBI-Identity	0.014	0.063	.119	.120	.604
Red. Threat condition (*N*=21) TBI-Identity	0.003	0.019	0.086	0.052	.824
Initial Encoding					
Height. Threat condition (*N*=21) Optimism/Pessimism	0.035	-.056	0.068	-.186	.420
Red. Threat condition (*N*=21) Optimism/Pessimism	0.061	0.086	0.077	.248	.279
Attention					
Height. Threat condition (*N*=21) Optimism/Pessimism	.095	.529	.375	.308	.174
Red. Threat condition (*N*=21) Optimism/Pessimism	0.028	.223	.304	.166	.472
Delayed Recall					
Height. Threat condition (*N*=21) Optimism/Pessimism	0.001	-.023	.152	-.034	.883
Red. Threat condition (*N*=21) Optimism/Pessimism	0.000	0.006	.117	0.012	.959

Discussion

The contribution of social-contextual and psychological factors to neuropsychological test performance in individuals who have sustained a TBI remains relatively unexplored. The underlying assertion to this research study is that negative stereotypes, abundant within neuropsychological testing environments, influence head-injured individuals' beliefs about their cognitive capabilities. This is in contrast to the core assumption in much of the extant research literature on TBI, in which cognitive differences observed between head-injured and 'normal' individuals on neuropsychological tests are attributed and linked to biological/physiological changes to the brain. Although the concept of 'stereotype threat' has been applied and studied at least to some degree in neurological populations, only two studies have examined this notion in a TBI group (Suhr & Gunstad, 2002; Suhr & Gunstad, 2005). However, each were fraught with a number of limitations, including failure to incorporate a control group of 'normal' individuals into experimental designs, the use of non-clinical samples (TBI research participants were high-functioning undergraduate students), and an unawareness, on behalf of research subjects, that their involvement in the study was due to a previous head injury. A major objective of stereotype threat research should be illustrating 'real-world' methods to reduce the number of stereotypic cues present in laboratory settings. The current study attempted to achieve this goal. It was hypothesized that cognitive test performance, appraisals of stereotypes, self-referent cognitive beliefs, and emotional status would be modified following simple experimental manipulation of stereotypic cues and beliefs, especially for head-injured individuals who were 'TBI-Identified' and held a pessimistic attitude. The hypotheses were tested through a methodological design consisting of four groups: (1) TBI Reduced Threat Group, (2) TBI Heightened Threat

Group, (3) Non-TBI Reduced Threat Group, and (4) Non-TBI Heightened Threat Group. The TBI and control groups were matched on age, gender, education and socio-economic status, thus ruling out potential contribution of these factors to differential group performance. Prior to analyzing performance on the outcome measures, the TBI and control groups were compared on scores on the Brief Symptom Inventory and the NAART. The results indicated that the TBI groups scored significantly higher than the control groups on the BSI and displayed lower NAART scores. Inclusion of these variables as covariates did not alter the results, and thus they were not co-varied out in the presented analyses.

Overall, the results provided some support for the abovementioned hypotheses. Looking at the main effects, it was found that the TBI group endorsed greater levels of anxiety, motivation, and dejection, but reduced feelings of memory self-efficacy compared to the control group. No differences were found between the TBI and control groups on the constructs of test-performance expectations, cognitive interference, or beliefs about TBI. The most pivotal results to the research study revealed that the TBI Heightened Threat group displayed lower scores on the *Initial Encoding* and *Attention* composite variables (although the effect was only marginally significant for the latter construct) than the TBI Reduced Threat group (no difference was found for the *Delayed Recall* variable). Consistent with hypotheses, no differences on neuropsychological or affective/self-perception variables were revealed for the non-TBI group. In trying to understand and appreciate the mechanism underlying the demonstrated stereotype threat effect, a number of affective functioning variables were included in the experimental design. Interestingly, the constructs of test-performance expectations, motivation, dejection-related emotions, anxiety, cognitive interference, stereotype threat and stigma consciousness were not found to differ between the TBI Heightened Threat and Reduced Threat groups. However, the TBI Reduced Threat group endorsed an elevated perception of memory self-efficacy compared to the Heightened Threat group, and this variable mediated the relation between Threat Condition and the *Initial Encoding/Attention* variables. In keeping with the original hypotheses, no differences on affective functioning measures were found between the two non-TBI conditions. Other secondary hypotheses were also supported, in that testing for main effects revealed that the Heightened Threat group endorsed more negative beliefs about TBI than did the Reduced Threat group. Exploring this result further, simple effects testing demonstrated that participants in the Non-TBI Heightened Threat condition endorsed more negative stereotypes/beliefs than did the Non-TBI Reduced Threat condition, but no differences on stereotype endorsement were revealed for the TBI groups. The abovementioned results will be discussed below.

Differences between TBI and Non-TBI Groups on Affective Functioning Measures

Not surprisingly, both TBI groups endorsed greater levels of anxiety, as measured by the BAI, than non-TBI groups. There may be several explanations for this finding. Firstly, consideration of the instructions of the BAI is needed, as this questionnaire asks research participants to rate symptoms of anxiety over the past week, including the current day. Previous research literature has noted elevated anxiety symptoms in individuals who have sustained a TBI (e.g., Anson & Ponsford, 2006; Draper, Ponsford, & Schonberger, 2007; O'Connor, Colantonio, & Polatajko, 2005), and the current finding may be a reflection of greater generalized anxiety for head-injured individuals. This increased anxiety may be a result of the adjustment process that often occurs following TBI, as well as biological/physiological changes to the brain that frequently cause heightened anxiety levels (Crowe, 2008). Moreover, a handful of researchers have remarked on the overlap between anxiety and PCS symptoms (e.g., Szymanski & Linn, 1992). Head-injured participants in the current study, for the most part, were recruited from hospitals, brain injury societies, or psychologists' offices, and were a number of years post-injury. As such, it can be assumed that many of the participants were experiencing post-concussion symptoms, which may mimic the anxiety symptoms endorsed on the BAI. A further explanation as to the current findings may relate to the timing of the BAI questionnaire, as it was administered at the beginning of the experimental session. Non-head-injured individuals may have had few concerns or anxieties regarding participation in the study, and may have felt indifferent regarding their performance on memory/attention tests. On the other hand, TBI participants may have been particularly anxious during the testing session, knowing that neuropsychological tests were to be administered. Attention and memory difficulties are often reported following a TBI (e.g., McAvinue et al., 2005; Nolin, 2006), and head-injured individuals may have been concerned about their performance on the upcoming attention/memory tests, potentially elevating their scores on the BAI.

Related to this, results revealed that TBI groups endorsed a greater level of motivation to perform well on the neuropsychological tests. As alluded to above, head-injured individuals participating in the study may have been particularly invested in their performance on the memory/attention tests, as they may have chosen to partake in the research experiment to assess their current cognitive capabilities. Although speculative, control individuals drive to participate in the study may have been less tied to a personal desire to evaluate cognitive abilities, and instead linked to a variety of extraneous reasons (e.g., financial gain, motivation to aid and help in research, curiosity regarding scientific discovery and psychological research, etc.) Perhaps if another control group were used, outside of ‘normal’ individuals (e.g., individuals who had not sustained a TBI, but had memory/attention complaints), a different result with respect to level of motivation between the TBI and non-TBI groups would have emerged. Extrapolating beyond the current study, prior and future research should be cognizant of the type of control group incorporated into their methodological design. Although researchers in the TBI field have long recognized that individuals’ level of motivation has an impact on neuropsychological test results, most have only acknowledged organic motivational deficits (e.g., Evans, 2008) or level of effort as it relates to litigation/compensation-seeking (e.g., Lynch, 2004). Using a slightly different slant, Bernstein and de Ruiter (2000) found, through experimental manipulation of motivation, differential neuropsychological test performance emerged for TBI and control groups. More specifically, experimentally-induced ‘motivation’ elevated the control groups’ performance, but did not affect test outcome for the TBI group. Although these results can be interpreted in a number of ways, one possible explanation may be that the control group may not necessarily perform to the best of their ability (perhaps due to a slight indifference to their performance on cognitive tasks), in contrast to the TBI group. Unfortunately, the present study relied solely on self-reported level of motivation, and more objective measures of effort/motivation were not integrated into the experimental design. If the current results are taken at face-value, however, they suggest that control and TBI groups may be approaching neuropsychological tests, in an experimental context, with a varying mindset. Head-injured individuals may be more motivated to perform well on cognitive tests and put forth a greater level of effort than non-head-injured individuals. This result is very preliminary in nature, but it calls into question whether a comparison of head-injured groups' neuropsychological test performance to non-head-injured groups' test performance, as is typically done in TBI research literature, is the best method with which to base conclusions about head-injured individuals' cognitive abilities.

Interestingly, although individuals who have sustained a TBI may be very motivated to perform well on neuropsychological tests in an experimental context, the results also suggest that they may experience increased feelings of dejection when faced with such tasks. Researchers and theorists alike have acknowledged the existence of dejection-related feelings (e.g., distress, irritability, and frustration) in individuals post-TBI (e.g., Kreutzer, Seel & Gourley, 2001) but only a dearth of studies have examined this construct within a neuropsychological testing environment (e.g., Gasquoine, 1997; Stulemeijer, Andriessen, Brauer, Vos & van der werf, 2007). What can be surmised from the current study results is that head-injured individuals, although motivated to perform well on attention/memory tests may, at the same time, feel overwhelmed with the prospect of engaging in such tasks and expect to do poorly, leading to heightened feelings of frustration and dejection.

In addition to differential endorsement of anxiety, motivation, and dejection-related emotions between head-injured and non-head-injured groups, results further revealed that the latter group endorsed more positive feelings about their memory abilities, in keeping with the findings of Kit et al. (2007). This outcome is consistent with the underlying assumption of the current study, in that head-injured individuals have less positive beliefs about their memory abilities, which may lead to under-performance on neuropsychological tests.

Contrary to the original hypotheses, on the other hand, were the lack of significant findings for the ‘expectations’ and ‘cognitive interference’ variables. A plethora of reasons may be responsible. With regard to the former variable, a likely explanation may be related to the fact that a large number of head-injured individuals (90%) had undergone previous neuropsychological testing. As such, a high proportion of participants were likely aware of the nature and type of tests that were to be administered. In this way, they may have used their previous performance on neuropsychological tests as an anchor point for their current responses regarding their test-performance-expectations. Control individuals may have approached the Expectations questionnaire in a different manner, as few had undergone any previous neuropsychological testing. Most control participants’ responses tended to be ‘middle-of-the-road’ (i.e., responding in the middle of the Likert-type scale). Their seeming ambivalence to the questionnaire may be a reflection of their unawareness of the nature of neuropsychological tests, leading them to have difficulty in forming a strong opinion as to how they were likely to perform. If control individuals had experienced an equivalent amount of previous exposure to neuropsychological tests as had head-injured research participants, the hypothesized effect of differential endorsement of test-performance-expectations may have emerged. Lack of experience with neuropsychological tests for control participants may have also contributed to the insignificant findings for the Cognitive Interference variable. Due to the unfamiliarity of cognitive testing, control participants may have been bombarded with an elevated number of interfering thoughts, factoring into their heightened score on this measure. Other possible explanations for the equivalent endorsement of cognitive interfering thoughts for the TBI and Non-TBI groups may relate to level of motivation (head-injured individuals were more motivated to perform well on the tests, and thus were focused on test items), working memory ability (head-injured individuals may have had to direct more of their cognitive resources to test items, exceeding their working memory capability, and thus had few cognitive resources available to ponder extraneous thoughts), and/or the content of the Cognitive Interference questionnaire (perhaps if more items were related to test-environment-specific-concerns, rather than non-test-setting-concerns, a different result would have occurred).

Overall, what is clear from the abovementioned results is that head-injured individuals undergoing neuropsychological testing may experience a more varying affective state than non-head-injured individuals, including heightened anxiety, increased feelings of frustration/dejection, negative perceptions of memory abilities, and increased motivation. Caution needs to be exercised when interpreting and comparing neuropsychological test results of head-injured to ‘normal’ individuals. An abundance of research in other populations has pointed to fluctuating scores on cognitive tests as a result of varying affective states (e.g., Gass & Daniel, 1990; Kizilbash et al., 2002), and thus, based on the current study’s results, an underestimation or overestimation of head-injured individuals’ cognitive abilities may be occurring.

Differences between Threat Conditions for TBI Groups on Neuropsychological Measures

Paramount to this study’s design, over and above exploring affective states in head-injured and non-head-injured groups, is investigating whether the experimental manipulation differentially affected scores on the memory/attention tests for the two TBI conditions. Indeed, the most robust effect was found for the *Initial Encoding* composite variable, in that the TBI Heightened Threat group displayed a lower score on this measure than the TBI Reduced Threat group. The *Initial Encoding* variable consists of Trial 1 of the RAVLT and Immediate Recall of the RBMT. Immediate recall measures may be especially sensitive to the experimental manipulation as success on such tasks is typically dependent upon some form or strategy of active encoding and retrieval. Strategy use is also of key importance for superior performance on the Auditory Consonant Trigrams test. Thus, scores on the *Initial Encoding* and *Attention* composite variables may be particularly affected by the threat manipulation due to the effortful processing that is required for their success. In other words, the Reduced Threat manipulation may have served as a ‘motivator’, and individuals in this condition may have felt more likely to be successful on the upcoming tasks, and employed more strategies, although not necessarily consciously, to actively encode and retrieve the information. In comparison, less active/effortful processing is required for successful performance on the *Delayed Recall* composite variable (consisting of Trials 6, 7 and the Total score of the RAVLT). It can be assumed that by Trials 6 and 7, the word list on the RAVLT has been consolidated for many of the research participants. Scores on these trials are less dependent upon active encoding strategies, and rote memory can be relied on to a greater degree, due to the test’s repetitious nature. Thus, scores are more likely to be a reflection of one’s information processing capacity. Psychological factors such as effort and motivation are less likely to be instrumental in achieving high scores on these measures. In a slight variant of this explanation, the tests comprising the *Delayed Recall* composite variable may have been less cognitively engaging in nature, due to their lack of novelty. Thus, although the Reduced Threat manipulation may have elicited an effort-focused approach, research participants may have tired of the word list, essentially ‘washing out’ threat effects. Another ‘order effect’ that may have contributed to the null result of the *Delayed Recall* variable is that the tasks encompassing this composite score were administered in the latter portion of the testing battery. Participants may have been judging and gauging their upcoming performance on the remaining neuropsychological tests by using their estimated previous performance on the already administered tasks, instead of basing their expectations for upcoming performance on the threat manipulation.

The above explanations are in accordance with theories postulated by a number of researchers in learning/self-regulation literature. Seibt and Forster (2004) argue that negative stereotypes tend to invoke a more cautious style of responding. In a slight reworking of this same idea, Dweck (1986) stated that individuals afflicted with a 'helpless pattern of responding' are challenge-avoidant and display little perseverance in the face of difficulty. On the flip side, Seibt and Forster (2004) maintain that positive stereotypes induce an 'explorative processing style' or a promotion focus/state of eagerness. This 'mastery-oriented' pattern, by Dweck's (1986) account, is characterized by a greater degree of effort and perseverance in the face of obstacles. Although very speculative, the Reduced Threat experimental manipulation may have elicited a mastery-oriented/explorative processing style, in that individuals may have been motivated to put forth enhanced effort, although not necessarily consciously. Level of effort may have contributed to improved performance on the *Initial Encoding* and *Attention* composite scores for the reasons previously cited.

Of additional note, no differences between TBI and control groups were found on neuropsychological test scores. At first glance, this is rather surprising in nature in that a plethora of research has documented differences in performance between head-injured and non-head-injured groups across numerous cognitive domains (e.g., McAllister, Flashman, Sparling, & Saykin, 2004; McAvinue, O'Keeffe, McMackin, & Robertson, 2005; Nolin, 2006; Leon-Carrion et al., 1998; McDonald, Flashman, & Saykin, 2002).

However, the nature of the sample may have contributed to the null effects. The current study focused on individuals who had sustained a mild to moderate TBI, as compared to a severe TBI, and the former type of injury is known to have less drastic cognitive repercussions (e.g., Reitan & Wolfson, 2000). Moreover, another reason for the lack of significant difference between groups may relate to the fact that this study was advertised as research examining cognitive functioning. A number of control participants may have be motivated to partake in the study because they had specific attention/memory concerns and were curious about their own performance on neuropsychological tests. Thus, they may not have been representative of the general population. Indeed, a relatively high proportion of control individuals had a significant psychiatric history or a history of drug abuse, both of which are known to affect cognitive test scores (e.g., Carlin & Trupin, 1977; van Gorp, Altshuler, Theberge, Wilkins & Dixon, 1998). Finally, methodological issues may have played a role in equivalent neuropsychological test performance for control and TBI groups. Specifically, as outlined in the *Results* section, the scores across cognitive tests were collapsed into composite variables. Although each of the tests used in the current study are known to be sensitive to detection of cognitive weaknesses in TBI (e.g., Bigler et al., 1989; Donders et al., 2001; Koltai et al., 1996; Stuss et al., 1989), overall sensitivity may have been reduced through the combination of test scores.

Differences between Threat Conditions for TBI Groups on Affective Functioning Measures

In agreement with the findings noted above, stereotype threat research, for the most part, has documented significant effects for test performance across threat conditions. Less robust and striking, however, have been findings for measures of emotional functioning; stereotype threat and attribution-related literature is laden with inconsistencies. With respect to the construct of anxiety, studies demonstrating null effects (e.g., Chasteen et al., 2005; Hess et al., 2003; Hess et al., 2004; Hess & Hinson, 2006; Keller & Dauenheimer, 2003; Mayer & Hanges, 2003; Nguyen et al., 2003; Oswald & Harvey, 2001; Schmader, 2002; Schmader & Johns, 2003; Spencer et al., 1999; Steele & Aronson, 1995) have greatly outnumbered those finding increased anxiety under threat conditions (Inzlicht & Ben-Zeev, 2003; Marx and Stapel, 2006; Ployhart et al., 2003; Spencer et al., 1999). The results from the current study are in keeping with the former set of results, in that no differences between TBI groups were found on the Beck Anxiety Inventory (BAI). A number of reasons may be responsible for such findings. Firstly, the instructions for the BAI prompt participants to rate their level of anxiety over the previous week. It is conceivable that even if individuals in the Heightened Threat condition were feeling particularly anxious as a result of the experimental manipulation, their responses may have been underrated, because of the requirement to generalize anxiety levels over the last seven days. Additionally, the BAI probes for physiological components of anxiety (e.g., ‘feeling hot’, ‘dizzy’ or ‘lightheaded’). The threat manipulation may have induced a more subtle anxiety response, not eliciting perceptible biological symptoms. As Bosson, Haymovitz and Pinel (2004) purport, even when covert behavioural measures indicate that individuals are experiencing increased anxiety, self-report measures may not show evidence of elevated anxiety. Instead, a more ruminative anxiety reaction may have resulted from the manipulation, which would likely go undetected by the BAI. A further explanation of the results may relate to timing issues. The questionnaire was administered post-threat manipulation, but prior to presentation of neuropsychological tests. The potential anxiety reaction to the experimental manipulation may have occurred only once participants had begun facing the challenges of the cognitive tasks.

Additionally, number of years post-injury may serve as a supplementary reason for the lack of significant BAI results. Due to the number of elapsed years between injury and time of testing for many of the research participants, individuals had likely acknowledged and accepted their cognitive strengths and weaknesses. Thus, they may have remained relatively unaffected by the manipulation, even discarding it, at least at a conscious level. Overall, the failure of the manipulation to affect the pre-test self-report of anxiety should not be taken as definitive evidence that participants were not, in fact, experiencing increased anxiety. Future research will need to incorporate behavioural measures of anxiety or perhaps use a more sensitive self-report questionnaire to determine if individuals experience anxiety as a direct result of the activation of negative self-stereotypes.

In addition, null effects for the current study were demonstrated for the Expectations variable, in contrast to other stereotype threat research (Cadinu et al., 2003; Desrichards and Kopetz, 2005). The nature of the measure employed may be culpable for such findings. Cadinu et al. (2003), for example, asked individuals to rate their performance relative to the stereotyped and non-stereotyped group. In the current study, however, individuals were not asked to rate their expected performance relative to others. This is incongruent with the underlying communication of the stereotype threat manipulation, which directly makes a comparison between head-injured and non-head-injured individuals. The lack of specificity of this particular questionnaire may have been confusing for the TBI group. Individuals may have been unsure as to whether they were to make a social comparison (rating their performance relative to others) and, if so, whether this comparison was to be in relation to head-injured or ‘normal’ individuals. Participants’ ‘middle-of-the-road’ responses across conditions may reflect their lack of clarity on this issue. Perhaps if more detailed and specific instructions had been outlined on the questionnaire, different results across threat conditions for the TBI-groups would have emerged. Another potential contributing factor to the lack of significant results may relate to the fact that a large percentage of head-injured individuals had previously undergone neuropsychological testing. It is likely that many of these individuals received relatively ‘low’ scores on memory and attention tasks. Although the Reduced Threat manipulation may have temporarily increased individuals’ expectations for current test performance, their previous negative test results may have largely influenced how they responded to items on this questionnaire.

Fewer stereotype threat studies have included motivation measures in their experimental design. In those studies that have included this construct, many have noted no change in motivation level, in response to a threat manipulation (Brown & Pinel, 2003; Keller & Dauenheimer, 2003; Nguyen et al., 2003). Only one study has documented significant effects with respect to motivation across threat conditions (e.g., Ployhart et al., 2003). The measure used in this study was almost identical to the questionnaire administered in the current study, except the former included a few additional items. Interestingly, no effects for the motivation variable materialized in this dissertation. A number of reasons may be responsible. Firstly, many head-injured participants were recruited through rehabilitation centers, suggesting that they were invested in their recovery and, in general, motivated individuals. Ratings on the motivation questionnaire support this postulation, as head-injured individuals tended to present as highly motivated. Thus, the current questionnaire may not have been sensitive enough to detect subtle differences in motivation level occurring between the two conditions, as near-ceiling levels were documented. Impression management may also have contributed to the insignificant findings for the motivation variable. Participants may have felt that regardless of their internal level of motivation, they wanted to present as highly-motivated (i.e., participants may have felt they wanted to portray an image of someone who was invested and interested in participating in the study) so as to make a positive impression, essentially diminishing any difference between groups. A third possible explanation as to the non-significant findings may relate, in part, to the order of administration of questionnaires/neuropsychological tests. Participants' affective reactions to the experimental manipulation may have occurred when engaged in the neuropsychological tasks. In other words, their level of motivation and effort, especially in the Heightened Threat condition, may have started to dwindle when confronted with the cognitive tests, and not immediately proceeding the experimental manipulation (i.e., at the time the motivation questionnaire was administered).

This same line of reasoning applies to the non-significant effects for the dejection measure. Head-injured participants may have been cued and reminded of the experimental manipulation once they had begun the cognitive testing portion of the study. The period of time elapsed between the experimental manipulation and the completion of the dejection questionnaire may have led to muted affective reactions. Moreover, in examining individuals' item responses to the dejection measure, it appears that, as a whole, participants were endorsing feelings of excitement and alertness at the time of questionnaire completion. This may be related to the fact that the motivation measure was administered immediately prior to the dejection questionnaire, and the former may have acted as a motivational tool (due to the nature of the items), causing participants to be especially keen and engaged in the testing process. Thus, order effects may have diminished the strength of the experimental manipulation.

Becoming increasingly apparent is the lack of significant findings for the affective constructs in this dissertation. This also holds true for the cognitive interference questionnaire. Specific reasons as to why this may be the case echo the conjectures stated in the *Differences between TBI and Non-TBI Groups on Affective Functioning Measures* section. Head-injured participants appeared highly motivated to perform well on the tests. In addition, as suggested by previous results, TBI individuals had to direct much of their cognitive resources to test items, due to the tasks' challenging nature. It may be that their focus on test items allowed little extra time to deliberate over extraneous thoughts, and thus the cognitive interference measure was not sensitive enough to detect subtle differences in affective reactions between groups. Additionally, in examining items on this questionnaire, it appears that head-injured participants endorsed a greater number of thoughts related to a ruminative performance anxiety state (e.g., 'I thought about my level of ability'). Perhaps if more items of this nature were included on this measure (many items, instead, pertained to thoughts unrelated to performance), differences between groups would have been documented. An even more superior method may be using an open-ended questionnaire (i.e., 'write down anything that comes to your mind') to measure cognitive-interfering thoughts. Indeed, Beilock et al. (2007), Cadinu et al. (2005), and Oswald & Harvey (2001) found significant differences between stereotype threat conditions employing this method.

Insignificant effects were also revealed for the Stereotype Threat and Stigma Consciousness measures. One plausible explanation for the findings of the former construct may be related to the questionnaire administered in the current study, in that it was a modified version of a measure used by Marx and Goff (2005), and items were re-worded so that statements pertained to TBI. Although adequate psychometric properties have been documented for the original questionnaire, the modified version had a Cronbach's alpha level of .59, which may have interfered with uncovering significant test results. Additionally, as previously alluded to, head-injured participants may have used the underlying messages inherent in the experimental manipulation to inform their perceptions of their own capabilities and expectations for their upcoming test performance. Less importance may have been placed on confirming or being judged by negative stereotypes, which comprised the focus of the Stereotype Threat questionnaire. In other words, participants may have had little concern about the impact of their performance on the 'reputation' of other head-injured individuals, as well as minimal distress regarding how they were to be viewed by others. Indeed, anecdotal evidence suggests that this questionnaire was irrelevant to the experimental design. Many participants expressed confusion around the statements contained in this measure, and explicitly stated that they did not tend to 'worry' about the abovementioned issues. The inclusion of a stereotype threat measure is a relatively novel addition to stereotype threat research, and thus an ideal questionnaire has likely yet to be constructed. Moreover, the experience of 'stereotype threat' for head-injured participants is, perhaps, quite unlike the psychological state of African Americans and women under threat conditions, where much of the stereotype research has been concentrated. Therefore it may be ill-advised to simply modify wording in a stereotype threat measure designed for African Americans for use in a head-injury population.

The inclusion of a stigma consciousness questionnaire to stereotype threat research is also relatively unexplored territory. Only Pinel (1999) and Brown & Pinel (2003) have integrated this construct into their experimental design. It was hypothesized that the Stigma Consciousness questionnaire employed in this dissertation might capture the state of learned helplessness, thought to be present for head-injured participants in the Heightened Threat condition. Although the items on the said questionnaire appear to relate to the concept of learned helplessness, there is no research that has attempted to validate this claim. Thus, the abovementioned hypothesis was exploratory in nature and failed to be supported. Upon closer inspection, the items on the administered questionnaire ask participants to rate whether they feel they are stereotyped in society. Perhaps if a more test-specific stigma consciousness measure were used, so that participants were not forced to generalize their experience beyond the testing environment, different results would have surfaced. Moreover, the original hypothesis asserted that the Heightened Threat condition would cause head-injured individuals to feel that regardless of the amount of effort exerted, they would be unsuccessful on neuropsychological tests. Given that no items on the Stigma Consciousness questionnaire actually asked about feelings of learned helplessness in relation to cognitive test performance, it appears unsurprising, in hindsight, that no significant effects were documented.

Memory Self-Efficacy

In contrast to the abovementioned null effects, a significant and robust difference was found between the Reduced and Heightened Threat groups for the memory self-efficacy construct. Memory self-efficacy, which refers to beliefs about one’s ability to use memory effectively, is a sub-component of metamemory (defined as one’s knowledge, awareness, and beliefs about the functioning of one’s own memory) (Hultsch, Hertzog, & Dixon, 1987). Both can be subsumed under the category of self-schemas. The concept of self-schema within the discipline of psychology has morphed over the years from its original conception within cognitive psychology, to a theory widely used in cognitive behaviour therapy (Greenberg & Beck, 1990). In general, it is tantamount to the idea of a broadly-connected network of self-referent beliefs. Self-schemas impinge upon individuals' perceptions of self, may guide information processing about oneself, and have a strong relation to behaviour (e.g., Markus, 1977). Unfortunately, self-schemas have rarely been examined within a TBI population, despite the many anecdotal reports of head-injured individuals indicating a perceived shift in sense of identity following a TBI. One reason for this omission may be the plethora of research that has pointed towards reduced self-awareness in individuals with head injury (e.g., Garmoe et al., 2005; Knight, Harnett, &Titov, 2005; Sbordone, Seyranian, & Ruff, 1998), suggesting that investigation of self-perception may be futile within this population. Another potential explanation may be related to the type of methodology that is required for the study of such concepts. Qualitative analysis is likely the ideal mode in which to examine perceptions about self, due to its allowance of open-ended responses. However, this type of research is often difficult and cumbersome to undertake.

Thus, the investigation of self-schemas and self-referent beliefs, as applied to a TBI population, remains relatively unexplored and elusive. The current study found that the Reduced Threat TBI group endorsed greater feelings of memory self-efficacy (i.e., had more positive perceptions about their memory abilities, and felt their memory had changed to a lesser extent), in comparison to the Heightened Threat TBI group. This is a provocative and relatively startling finding, given the simplistic nature of the experimental manipulation. A host of other studies have demonstrated no change in self-efficacy under stereotype threat conditions (Brown and Pinel, 2003; Brutus and Ryan, 1998; Chaasten et al., 2005; Mayer & Hanges, 2003, Nguyen et al., 2003; Spencer et al., 1999). The differing effects may be related to a number of possible explanations, including diverse populations, varying experimental manipulations, and assorted measures of self-efficacy.

Interestingly, the memory self-efficacy construct was the only affective functioning/self-perception variable found to differ between the two conditions for TBI groups in this dissertation. One contributing factor lies in the fact that the Metamemory in Adulthood (MIA) questionnaire has been used extensively in research studies in the elderly population, and is known to have sound psychometric properties. As a general rule of thumb, the questionnaires employed to measure the other studied constructs in the current study have been used less widely and may be insensitive to subtle differences between groups. Another possible reason for the contrasting significant/null effects across the administered measures may be related to the MIA's focus on self-perception, versus affective state. Emotional functioning may be difficult to detect through self-report questionnaires, as individuals may struggle with perceiving slight changes in their internal emotional states. Items on the MIA questionnaire, on the other hand, require individuals to reflect upon their previous experiences across a variety of memory situations. As suggested by Ross (1989), individuals typically think about and re-construct past behaviour by invoking implicit theories (i.e., a fundamental set of schematic beliefs regarding the nature of attributes in a specific reference population), and not, necessarily, by monitoring actual experiences. Cavanaugh, Feldman, and Hertzog (1998) aptly described this same notion in a slightly different light, arguing that responses to memory-questionnaire items are often constructed 'on-line', and thus susceptible to environmental variables, with little reliance on previously stored self-referent beliefs. Nisbett and Wilson (1977) similarly maintained that because individuals have difficulty in accessing their own cognitive processes, when required to make determinations of personal ability level in a certain domain, their judgments typically reflect socially conditioned beliefs. Thus, responses to memory questionnaire items are likely based on the intertwined variables of self-knowledge, implicit theories about memory, general affect, and response constructions (Cavanaugh et al., 1998), and may reflect little about actual monitoring of memory performance (Bielak, Hultsch, Levy-Ajzenkopf, MacDonald, Hunter & Strauss, 2007). Extrapolating from these postulations, individuals in the Reduced Threat condition, when completing the MIA questionnaire, may have based their responses on the implicit theory that cognitive capabilities return to normal after a TBI, in direct accordance with the underlying message in the experimental manipulation. Thus, they may have been more likely to recall recent memory successes than recent memory failures, and may have felt an increased sense of control over their memory functioning, potentially inflating MSE ratings.

Of course, it is difficult to surmise whether positive self-referent beliefs were enhanced in the Reduced Threat condition, or lessened in the Heightened Threat condition, given the lack of control group. Ideally, a third group receiving no pre-test instructions should have been added to the methodological design. Tentativeness and caution is also needed in discussing whether participants incorporated the ideas presented in the experimental manipulation into their self-referent beliefs or self-schemas. Individuals may not have internalized the underlying message of each of the threat conditions, and instead, modified their responses to questionnaire items only as a form of impression management. In other words, individuals may have felt 'pressure' to respond to items on the MIA measure in such a way that matched the views expressed in the manipulation so as to present in a favorable manner to the experimenter. Additionally, the MIA questionnaire may not necessarily reflect perceptions of memory self-efficacy but instead be a ‘rough’ measurement of self-confidence/self-regard, and the manipulation may have simply induced a more hopeful and optimistic psychological state for participants in the Reduced Threat condition.

Thus, continuing to remain provisional is whether individuals’ self-referent cognitive beliefs were actually changed by the experimental conditions. The manipulation was designed with the idea in mind that self-schemas/self-referent beliefs would be activated and potentially modified, as a result of the threat condition. The study results suggest that divergent psychological processes occurred between the two threat conditions, leading to disparate cognitive test performance. But, again, it is difficult to state with more than a modicum of certainty that individuals actually shifted in their memory self-efficacy beliefs. However, putting these doubts aside, if the study results are taken purely at face-value, they suggest that beliefs about cognitive capabilities for TBI individuals can be altered, at least temporarily, through simple pre-test instructions (focusing on highlighting/minimizing stereotypes regarding head injury as well as emphasizing/de-emphasizing individuals’ ability to exercise control over their cognitive functioning). This is consistent with theorists’ claims that varying self-referent beliefs are activated by environmental cues (Cavanaugh, 2000; Stewart-Williams, 2004) and are amenable to change (Mikulincer, 2001).

Taking this a step further, mediational findings from the current study indicate that neuropsychological test results for head-injured individuals, by the same token, are also amenable to change, and appear to be influenced by self-referent cognitive beliefs (specifically, memory self-efficacy). In short, results indicate that reducing stereotypes/emphasizing personal control over cognitive functioning is associated with more positive beliefs about one’s ability to use memory effectively, leading to enhanced neuropsychological test performance. These findings are in direct accordance with the primary assertion of this dissertation. Memory self-efficacy and an internal locus of control have been previously documented as powerful determiners of affective functioning, gainful employment, and overall life satisfaction for head-injured individuals (Cicerone & Azulay, 2007; Kit et al., 2007; Lubusko, Moore, Stambrook, and Gill, 1994; Moore et al., 1991) and it is thus relatively unsurprising that cognitive test performance is also seemingly impacted by individuals' self-referent beliefs. The construct of general self-efficacy has been long recognized as an enhancer of motivation and performance attainments (Bandura & Locke, 2003). Individuals in the Reduced Threat condition, as originally hypothesized, may have felt a sense of control over their cognitive functioning and perceived that increased effort would be rewarded through improved test performance. On the flip side, individuals in the Heightened Threat condition may have felt that even if more effort were applied, it would be futile, in that they would be unsuccessful on cognitive tests. Therefore they may have reduced effort, albeit subconsciously, as a means of ego-protection, or because of the psychological state of learned helplessness. Of course, various other constructs, in addition to level of effort and motivation, may have contributed to the strong relation between memory self-efficacy and neuropsychological test performance (e.g., anxiety, level of affect, etc). For example, individuals in the Heightened Threat condition may have been hyper-vigilant and subsequently consumed by any lapses in attention/memory on cognitive tests, interfering with future test performance. Overall, a host of constructs were likely involved in mediational effects. Due to the lack of findings for other affective/self-perception constructs, it is difficult to make any definitive statements with regard to the psychological processes responsible for reduced neuropsychological test performance in the TBI Heightened Threat group. Likely, a string of variables is involved in the mechanism underlying the stereotype threat effect, and more sophisticated data analyses will need to be conducted before this pathway can be illuminated.

The Moderating Influence of Optimism/Pessimism and TBI-Identity

Although the results of the mediational analyses prove intriguing, less remarkable are findings from the moderational analyses. At the study's onset, it was predicted that participants with a pessimistic attitude would be more susceptible to the effects of 'stereotype threat' by showing a stronger decrease in performance in the Heightened Threat condition, as compared to participants with a more optimistic attitude. This hypothesis was based on Ruthig et al.'s (2004) work that found that high-optimistic students receiving attributional retraining demonstrated improved academic performance. In the current study, the large majority of participants endorsed items suggesting an elevated level of optimism. In many ways, this is an unexpected finding, given that head-injured individuals are posited to hold a more external locus of control. Likely as a result of the little observed variation across participants' scores, no significant effects were found for the aforementioned hypothesis. Similarly, null findings were documented for the moderation analyses conducted with respect to the TBI-Identity measure. Originally, it was predicted that individuals who were 'TBI-identified' would be more susceptible to the effects of 'stereotype threat' by showing a stronger decrease in performance in the Heightened Threat condition, as compared to participants less 'TBI-identified'. Although an adequate spread in participants' responses was noted, potentially weak psychometric properties may have factored into the non-significant effects. More specifically, the Identity measure used in the current study was modified from a Gender

Identity questionnaire. Thus, the items may not have been overly relevant to a TBI population.

Negative Stereotypes

Although secondary to the abovementioned study results, another significant effect emerged in looking at individuals' endorsement of negative beliefs/stereotypes regarding TBI. In inspecting participants' answers to questionnaire items, both head-injured and non-head-injured participants' responses, for the most part, except for the Heightened Threat control group, were slightly above the middle-point of a Likert-type scale (indicating that participants appear to believe that mild head injuries cause minor attention/memory difficulties in day-to-day life). Moreover, the non-head-injured Heightened Threat group reported a greater degree of negative beliefs regarding TBI than the non-head-injured Reduced Threat group. In contrast, no significant effects were found for this variable across the two head-injured groups. This discrepancy in results is not necessarily unexpected. A large body of research purports that stereotype change can occur through a variety of mechanisms, including the presentation of disconfirming evidence (e.g., Hewstone, Johnston & Aird, 1992; Queller & Smith, 2002; Richards & Hewstone, 2001; Weber & Crocker, 1983), as is the case in the current study. Non-head-injured individuals, as supported by the present results, are likely more susceptible and open to stereotype change via persuasion, given their lack of familiarity with the effects and cognitive implications of a traumatic brain injury. The fact that stereotype change did not occur for the TBI group is likely a reflection of head-injured individuals' relatively firm ideas on the repercussions of head injury, as informed by personal experience. What is very interesting is that although head-injured individuals appeared to not shift in their beliefs about the cognitive consequences of a head injury as a result of the experimental manipulation, they did alter their responses to questionnaire items when asked about personal cognitive capabilities in response to the experimental condition. Thus, it is plausible that although the manipulation may have done little to alter head-injured individuals' general beliefs about the effects of TBI, it may have caused them to feel that they had control over their performance on neuropsychological tests, and were capable of rising above negative stereotypes.

Limitations of the Present Study

Slightly obscuring the results of this dissertation are an array of factors, including: (1) the nature of the sample, (2) methodological shortcomings, and (3) theoretical issues not necessarily considered at the study's onset. With regard to the TBI sample, individuals, for the most part, were recruited through a research participant pool as well as an Outpatient Neuro-Rehabilitation Unit. As such, they may have been particularly motivated to improve their cognitive skills compared to the general TBI population and overly susceptible to the experimental manipulation. Additionally, and as mentioned earlier, a large majority of participants had previously undergone neuropsychological testing, and thus may have been differentially affected by the intervention (perhaps using their previous performance on tests to guide their responses to questionnaire items). Moreover, individuals with TBI recruited for the current study were in the chronic stage post-injury. Thus, in light of the latter two points, the study results cannot be generalized to head-injured individuals inexperienced in taking neuropsychological tests as well as individuals in the acute stage post-TBI (less than 6 months).

With regard to methodological limitations, and as previously discussed, a couple of the questionnaires used in the current study were psychometrically and theoretically weak, due to the fact that they were originally designed for a non-head-injured population, and thus may have lacked relevance for individuals with TBI. The lack of counterbalancing in the current study also creates some difficulty in interpreting the found effects. For example, no significant results were uncovered for the Delayed Recall composite variable. This may have simply been a consequence of the timing of the Delayed Recall measures, as they were administered during the end portion of the neuropsychological testing. Perhaps by the time these measures were given, the threat effect had ‘worn off’. Moreover, because the questionnaires were administered in the identical sequence to each participant, order effects may have impacted responses to questionnaire items. Other methodological limitations include the low number of research participants (which may have precluded finding significant effects for the secondary hypotheses), and failure to obtain supporting objective medical documentation of TBI severity (which would have provided a more valid and reliable indicator of injury severity, rather than exclusive reliance on participants’ self-report). Furthermore, as alluded to in the *Introduction* section, the constructs of self-awareness, locus of control and attitudes towards TBI may have influenced the impact of the threat manipulation, and perhaps measures of these variables should have been included in the methodological design. More specifically, a locus of control questionnaire would have been interesting to administer both pre- and post-manipulation, so as to ascertain whether participants shifted in their control beliefs, as assumed previously in this dissertation. Additional measures that, in hindsight, should have also been incorporated as part of the questionnaire battery, are those of working memory and evaluation apprehension, as discussed in *The Mechanism Underlying Stereotype Threat* section of the *Introduction*. These constructs would likely have been relevant to the TBI population, in light of the ideas raised throughout the body of this dissertation. As a last point regarding methodological concerns, the test administrator, under ideal conditions, would have been blind to the experimental manipulation.

In addition to methodological issues, theoretical constraints to the current study include the melding of conjectures from both stereotype threat and attribution theory into the underlying message of the experimental manipulation. As a result, it is difficult to boldly make the statement that stereotype threat is relevant to a TBI population, as perhaps the varying results across the two conditions was more due to participants latching onto ideas presented from attribution theory. Another thorny issue is determining whether the Reduced Threat condition improved neuropsychological test performance, or whether performance decreased as a result of the Heightened Threat condition. Preferably, a TBI-control group should have been added to the methodological design so as to shed light on this matter. Finally, it is conceivable that differences on affective measures across the head-injured and non-head-injured groups emerged simply because individuals who have sustained a TBI may be more susceptible to other experiential influences not investigated in this dissertation (e.g., amount of sleep, attention, stress, etc.).

Clinical Implications and Future Research Directions

Despite these limitations, it appears that situational context may be a factor in determining cognitive performance for individuals with TBI. Indeed, in the current sample, nearly one-half of head-injured persons exposed to threat conditions exhibited clinically-impaired test performance, as defined by borderline performance on three or more tasks. Researchers are thus beginning to acknowledge and examine the impact of psychological factors on cognitive test performance. The current study demonstrated that individuals who have had a TBI appear to have a pronounced reaction to the testing environment and are seemingly more anxious, experience elevated feelings of dejection, and have a decreased perception of memory self-efficacy, as compared to a control group. Investigators need to be mindful of this divergent psychological state when designing research studies and take extra precautions to protect against the amplification of stereotype threat by examining the optimal manner in which to present research studies to participants. By minimizing exposure to negative stereotypes, a more valid measure of actual cognitive deficits in a TBI group may emerge. Cognitive deficits in a TBI population may thus be exaggerated in past research, since the influence of stereotype threat, and more broadly, social contextual factors, and their impact on neuropsychological test performance have not been accounted for or considered. The study results also call into question the typical practice of comparing head-injured individuals' test performance to non-clinical population norms within a clinical setting. As Lezak (1995) stated, neuropsychological tests measure both brain function and behavior. Based on the above findings as well as Lezak's (1995) postulations, it appears that individuals with a mild to moderate TBI may not be performing to their 'true' potential, or actual 'organic ability level,' on neuropsychological measures, and that test results may be heavily influenced by one's present psychological state.

Head-injured individuals' anxious and dejected psychological state harks back to the theories of Hovland and Raskin (2000) and Kay, Newman, Cavallo, Ezrachi, and Resnick (1992), who posit that a loss of sense of self often occurs following head injury. Moore and Stambrook (1995) similarly reason that due to the accompanying cognitive, behavioural, emotional, and interpersonal symptoms subsequent to sustaining a TBI, 'learned helplessness' is inevitable. A multitude of theorists and researchers are beginning to target these maladaptive/negative self-referent beliefs through cognitive-behavioural techniques and therapy (Cicerone, 1991; Ferguson & Mittenberg, 1996; Miller & Mittenberg, 1998), with the goal of reducing the number and duration of post-concussive syndrome (PCS) symptoms, and promising effects have been found (Mittenberg, Tremont, Zielinski, Fichera, & Rayls, 1996). The targeting of negative self-referent beliefs, through potentially endorsing a more positive perception of one's cognitive ability level, as well as emphasizing the idea of personal control over one's cognitive capabilities, may also be beneficial in helping to improve neuropsychological test performance, and, more broadly, overall cognitive abilities. When interacting with patients, clinicians should reinforce the idea of maximal effort, and attempt to ward off disparaging and self-defeating attitudes. Although this idea is rather intuitive in nature, this study is one of the first to empirically demonstrate the importance and relevance of such notions to the testing environment. Clinicians and researchers may also want to consider exploring ways in which to maximize effort level and reduce the number of stereotypic cues present within a clinical setting, as head-injured individuals appear to be sensitive to explicit, as well as possibly implicit, messages present within a neuropsychological testing environment. This could be achieved, for example, by using techniques to restore individuals' sense of self-worth (e.g., through self-affirmation, individuation, and positive role models), or by modifying individuals' perceptions of stereotypes (i.e., emphasizing the message of 'rising above' negative stereotypes, and/or providing a more accurate and realistic description of typical cognitive difficulties observed after a mild to moderate TBI). In general, the results of this dissertation suggest the head-injured individuals are likely amenable to intervention techniques similar to those employed in the elderly population. These rehabilitative programs have included specific approaches aimed at altering perceptions and beliefs about memory capacities, stability of memory skills, personal control over cognitive abilities, and feelings of anxiety related to test performance. These studies have found significant changes in memory self-efficacy, as well as memory performance (Caprio-Prevette & Fry, 1996; Dellefield and McDougall, 1996; Lachman, 1991, Lachman et al., 1992). Thus, future research within the head-injury domain can examine whether using parallel interventions results in similar effects for individuals with a TBI.

Although the results of this dissertation are very preliminary, they hint at the notion and raise awareness that social-contextual variables within a testing environment have an impact on head-injured individuals' psychological state. In turn, neuropsychological test performance appears to be influenced by individuals' self-referent beliefs. This research area, as applied to a TBI population is a novel enterprise. Future studies in this realm would be aided by using physiological measures (e.g., blood pressure readings) as an adjunct to self-report questionnaires. Alternatively, Levy (1996) and Montepare and Clements (2001) used a reaction time test to examine the internalization of negative stereotypes and this too, may be an innovative method so as to look directly at whether individuals are shifting in their self-referent cognitive beliefs, unclouded by the issue of impression management. On the whole, a more general measure of self-referent beliefs, extending beyond beliefs limited to personal cognitive capabilities, should be added to future research designs so as to better ascertain the link between the presence of stereotypes and ensuing belief-modification. Additionally, researchers may want to consider using more open-ended self-report measures as a tool to accessing individuals' thoughts/emotions within the testing environment. Although self-report measures are the most likely means of obtaining individuals' perceptions of threat, a measurement challenge is that these feelings may not be consciously accessible.

Finally, future research studies may want to amend participant characteristics. For example, including individuals with a shorter length of time post-injury, those with more severe TBIs, those with varying levels of self-awareness, as well as individuals who have not undergone previous neuropsychological testing would likely alter the study results, and further illuminate the impact of stereotype threat within a head-injured population.

As well as demonstrating the stereotype threat effect, an understanding of its underlying mechanism is essential. It will be important to use more sophisticated data analyses, methodological designs, as well as an increased number of research participants in order to identify the mechanism within this population. Inclusion of measures of effort and further neuropsychological tests may additionally aid in uncovering and elucidating the stereotype threat phenomenon. Building upon this idea, another research avenue is designing more sensitive measures of effort to be used in clinical testing settings. At present, the tests employed to gauge effort are not overly sensitive, given that they are typically utilized to detect malingering. The dissertation results suggest that individuals' self-referent beliefs impinge upon level of motivation/effort, albeit subconsciously, and thus it is important to determine if decreased effort is contributing to diminished neuropsychological test scores. Furthermore, future studies could focus on understanding stigmatized individuals' views and appraisals of stereotype threat. Stereotype exposure for African Americans and women may elicit worries of confirming negative stereotypes about their group. In a slightly different view, an individual from a TBI population may feel less concerned about how their performance will impact others' perception of their group, but may be fearful of conforming to their groups' negative stereotype, and being judged by it. Other related potential lines of investigation stemming from the current study include examining the concepts of learned helplessness and locus of control/attribution within the TBI population.

Overall, research avenues that have both research and clinical implications appear to be plentiful within this area. Stereotype threat is a relatively new theory, derived from social psychology, and despite the abundance of studies in this domain over the last ten years, few have moved outside of racial and gender groups to explore the consequences of stereotype threat for other populations. Furthermore, there have been few attempts to date that integrate social psychological theories, and more specifically those concerning social cognition, with neuropsychology. As proposed in this dissertation, applying the information gleaned from previous stereotype threat studies to a TBI population bridges this gap and provides an exciting and likely prosperous avenue for future research.

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Appendix A: Background History Questionnaire

ID No. ___________
Age _______
Marital Status __________
Highest level of education _________
Family Income________

Have you had more than one brain injury? Yes No If Yes, please describe

How long ago was your brain injury?

Please describe the cause of your brain injury.

Were you hospitalized at the time of your brain injury?

Were you at least 16 years old at time of injury? Yes No

Do you have any difficulty with reading? Yes No

Do you speak English as your native language? Yes No

Have any significant hearing or vision problems? Yes No

Have any significant sensory or motor problems? Yes No

Have you ever had any neuropsychological testing? Yes No If Yes, when?

Details regarding brain injury: (if you have had more than one brain injury, please answer about your most severe brain injury)

Did you experience a loss of consciousness? Yes No If Yes, for how long?

Did you experience confusion or memory loss after your brain injury? Yes No If Yes, for how long?

Do you know what your Glasgow Coma Scale Score was? Yes No If Yes, what was it?

Did you have a CT scan or MRI done? Yes No If Yes, what were the results?

Do you…

Have any history of significant medical conditions	Yes	No	If Yes, then what?
Have any history of major psychiatric disorders or mental health problems (including depression, anxiety) prior to your injury, or currently?	Yes	No	If Yes, what?
Have any history of alcohol abuse prior to your injury, or currently?	Yes	No	

Please list any street drug (including marijuana) you currently used, or have used in the past. Also indicate the frequency of use.

Please list any medications you currently take.

Were/are you involved in litigation related to your injury?	Yes	No

Appendix B: Collective Self-Esteem Scale – Identity Sub-scale

Having a TBI is an important part of my self-image.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

Having a TBI is unimportant to my sense of what kind of person I am.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

Having a TBI is an important reflection of who I am.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

Having a TBI has very little to do with how I feel about myself.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

Appendix C: Brief Symptom Inventory (Depression and Anxiety sub-scales)

The following is a list of statements. Please read each one and indicate your level of distress for each statement over the last week.

Feeling like you have no interest in things

I——I——I——I——I——I——I
Not at all Extremely

Nervousness or shakiness inside

I——I——I——I——I——I——I
Not at all Extremely

Feeling lonely

I——I——I——I——I——I——I
Not at all Extremely

Feeling tense or keyed up

I——I——I——I——I——I——I
Not at all Extremely

Feeling blue

I——I——I——I——I——I——I
Not at all Extremely

Suddenly scared for no reason

I——I——I——I——I——I——I
Not at all Extremely

Feeling of worthlessness

I——I——I——I——I——I——I
Not at all Extremely

Spells of terror or panic

I——I——I——I——I——I——I
Not at all Extremely

Feeling hopeless about the future

I——I——I——I——I——I——I
Not at all Extremely

Feeling so restless you could not sit still

I——I——I——I——I——I——I
Not at all Extremely

Thoughts of ending your life

I——I——I——I——I——I——I
Not at all Extremely

Feeling fearful

I——I——I——I——I——I——I
Not at all Extremely

Appendix D: Revised Life-Orientation Scale

In uncertain times I usually expect the best.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

It's easy for me to relax.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

If something can go wrong for me, it will.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

I'm always optimistic about my future.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

I enjoy my friends a lot.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

It's important for me to keep busy.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

I hardly ever expect things to go my way.

I———I———I———I———I———I———I
Strongly Disagree | Strongly agree

I don't get upset too easily.

I———I———I———I———I———I———I
Strongly Disagree Strongly agree

I rarely count on good things to happen to me.

I———I———I———I———I———I———I
Strongly Disagree Strongly agree

Overall, I expect more good things to happen to me than bad.

I———I———I———I———I———I———I
Strongly Disagree Strongly agree

Appendix E: BAI

Below is a list of common symptoms of anxiety. Please carefully read each item in the list. Indicate how much you have bothered by each symptom during the PAST WEEK, INCLUDING TODAY, by placing an X in the corresponding space in the column next to each symptom.

	NOT AT ALL	MILDLY It did not bother me much.	MODERATELY It was very unpleasant but I could stand it.	SEVERELY I could barely barely stand it.
1. Numbness or tingling				
2. Feeling hot.				
3. Wobbliness in legs.				
4. Unable to relax.				
5. Fear of the worst happening.				
6. Dizzy or lightheaded.				
7. Heart pounding or racing				
8. Unsteady				
9. Terrified				
10. Nervous				
11. Feelings of choking				
12. Hands trembling.				
13. Shaky.				
14. Fear of losing control.				
15. Difficulty breathing.				
16. Fear of dying.				
17. Scared.				
18. Indigestion or discomfort in abdomen.				
19. Faint				
20. Face flushed.				
21. Sweating (not due to heat).				

Appendix F: Measurement of Specific Performance Expectations

Please rate your expected performance on the upcoming tests.

I———I———I———I———I———I———I

Very Poor Performance	Very Good Performance

I expect to do very well on the upcoming tests.

I———I———I———I———I———I———I

Strongly disagree	Strongly agree

I expect that I will do poorly on the upcoming tests.

I———I———I———I———I———I———I

Strongly disagree	Strongly agree

I expect to have little difficulty on the upcoming tests.

I———I———I———I———I———I———I

Strongly disagree	Strongly agree

Appendix G: Test Attitude Survey (Motivation Scale)

Doing well on this test (or these tests) is important to me.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

I want to do well on this test or tests.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

I will try my best on this test or tests.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

I am extremely motivated to do well on this test or tests.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

I just don't care how I do on this test or tests.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

I'm not going to put much effort into this test or tests.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

Appendix H: PANAS

This scale consists of a number of words that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now, that is, at the present moment. Use the following scale to record your answers.

1	2	3	4	5
very slightly or not at all	a little	moderately	quite a bit	extremely

__ interested
__ distressed
__ excited
__ upset
__ strong
__ guilty
__ scared
__ hostile
__ enthusiastic
__ proud

__ irritable
__ alert
__ ashamed
__ inspired
__ nervous
__ determined
__ attentive
__ jittery
__ active
__ afraid

Appendix I: Metamemory in Adulthood Questionnaire (Capacity & Change scales)

I remember things as well as always.
a) never b) rarely c)sometimes d) often e) always

I am less efficient at remembering things now than I used to be.
a) never b) rarely c)sometimes d) often e) always

It is more difficult to remember things clearly than it used to be.
a) never b) rarely c)sometimes d) often e) always

I am just as good at remembering as I ever was.
a) never b) rarely c)sometimes d) often e) always

I am much worse at remembering the content of news articles and broadcasts than I used to be.
a) never b) rarely c)sometimes d) often e) always

I am much worse at remembering titles of books, films, or plays than I used to be.
a) never b) rarely c)sometimes d) often e) always

I remember my dreams much less now than I used to.
a) never b) rarely c)sometimes d) often e) always

I misplace things more frequently than I used to.
a) never b) rarely c)sometimes d) often e) always

I tend to forget where I put things more frequently than I used to.
a) never b) rarely c)sometimes d) often e) always

I now forget many more appointments than I used to.
a) never b) rarely c)sometimes d) often e) always

My memory for important events is better than it used to be.
a) never b) rarely c)sometimes d) often e) always

My memory for phone numbers has declined.
a) never b) rarely c)sometimes d) often e) always

My memory for dates is not as good as it once was.
a) never b) rarely c)sometimes d) often e) always

My memory for names is not as good as it once was.
a) never b) rarely c)sometimes d) often e) always

My memory is not as good as it once was.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering names.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering birthdates.
a) never b) rarely c)sometimes d) often e) always

I have no trouble keeping track of my appointments.
a) never b) rarely c)sometimes d) often e) always

I am poor at remembering trivia.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering the order that events occurred.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering conversations I have had.
a) never b) rarely c)sometimes d) often e) always

I often forget who was with me at events I have attended.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering the places I have been.
a) never b) rarely c)sometimes d) often e) always

I have no trouble remembering where I have put things.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering things like recipes.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering titles of books, films, or plays.
a) never b) rarely c)sometimes d) often e) always

I have no trouble remembering lyrics of songs.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering names of musical selections.
a) never b) rarely c)sometimes d) often e) always

After I have read a book I have no difficulty remembering factual information from it.
a) never b) rarely c)sometimes d) often e) always

I am good at remembering the content of news articles and broadcasts.
a) never b) rarely c)sometimes d) often e) always

Remembering the plots of stories and novels is easy for me.

a) never b) rarely c)sometimes d) often e) always

I am usually able to remember exactly where I read or heard a specific thing.
a) never b) rarely c)sometimes d) often e) always

Appendix J: Cognitive Interference Questionnaire

Instructions: This questionnaire concerns the kinds of thoughts that go through people's heads at particular times, for example, while they are working on a task. The following is a list of thoughts, some of which you might have had *while doing the task on which you have just worked.*

Please indicate approximately how often each thought occurred to you while working on it by placing the appropriate number in the blank provided to the left of each question.
1 = Never
2 = Once
3 = A few times
4 = Often
5 = Very often

1. I thought about how poorly I was doing. ___
2. I thought about what the experimenter would think of me. ___
3. I thought about how I should work more carefully. ___
4. I thought about how much time I had left. ___
5. I thought about how others have done on this task. ___
6. I thought about the difficulty of the problems. ___
7. I thought about my level of ability. ___
8. I thought about the purpose of the experiment. ___
9. I thought about how I would feel if I were told how I performed. ___
10. I thought about how often I got confused. ___
11. I thought about other activities (e.g., assignments, work). ___
12. I thought about members of my family. ___
13. I thought about friends. ___
14. I thought about something that made me feel guilty. ___
15. I thought about personal worries. ___
16. I thought about something that made me feel tense. ___
17.1 thought about something that made me feel angry. ___
18. I thought about something that happened earlier today. ___
19. I thought about something that happened in the recent past (last few days, but not today). ___
20. I thought about something that happened in the distant past. ___
21. I thought about something that might happen in the future. ___

Please circle the number on the following scale which best represents the degree to which you felt your mind wandered *during the task you have just completed.*

1 2 3 4 5 6 7
Not at all Very Much

Appendix K: Stereotype Threat Measure

I worry that my ability to perform well on standardized tests is affected by my traumatic brain injury/head injury.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

I worry that if I perform poorly on this test, the experimenter will attribute my poor performance to my traumatic brain injury/head injury.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

I worry that people's evaluations of me will be affected by my traumatic brain injury/head injury.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

I worry that, because I know the stereotype about head-injured individuals and cognitive ability, my anxiety about confirming the stereotype will negatively influence how I perform on cognitive/neuropsychological tests.

I———I———I———I———I———I———I
Strongly disagree — Strongly agree

Appendix L: Stigma Consciousness Questionnaire

Stereotypes about traumatic brain injury have not affected me personally.

I——I——I——I——I——I——I
Strongly disagree … Strongly agree

I never worry that others will view my behavior as being stereotypic of traumatic brain injury.

I——I——I——I——I——I——I
Strongly disagree … Strongly agree

When interacting with others, I feel like they interpret all my behaviors in terms of the fact that I have had a traumatic brain injury.

I——I——I——I——I——I——I
Strongly disagree … Strongly agree

Most people do not judge individuals who have sustained a traumatic brain injury on the basis of their traumatic brain injury.

I——I——I——I——I——I——I
Strongly disagree … Strongly agree

The fact that I have had a traumatic brain injury does not influence how others act with me.

I——I——I——I——I——I——I
Strongly disagree … Strongly agree

I almost never think about the fact that I have had a traumatic brain injury when I interact with others.

I——I——I——I——I——I——I
Strongly disagree … Strongly agree

The fact that I have had a traumatic brain injury does not influence how people act with me.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

Most people have a lot more negative thoughts about individuals who have had a traumatic brain injury than they actually express.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

I often think that people are unfairly accused of having negative thoughts about individuals who have had a traumatic brain injury.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

Most people have a problem viewing individuals who have had a traumatic brain injury as equals.

I——I——I——I——I——I——I
Strongly disagree — Strongly agree

Appendix M: Explicit Beliefs/Stereotypes Surrounding TBI

To what extent do you think there are differences in performance levels between individuals who have sustained a traumatic brain injury and those who have not, on tests of memory and attention?

I——I——I——I——I——I——I
Not at all Very much

Please rate the following items on a scale from 1 (hardly ever) to 7 (often):

Individuals who have sustained a traumatic brain injury:

Experience concentration difficulty

I——I——I——I——I——I——I
Hardly ever Often

Have trouble thinking

I——I——I——I——I——I——I
Hardly ever Often

Forget where their car was parked

I——I——I——I——I——I——I
Hardly ever Often

Lose car keys

I——I——I——I——I——I——I
Hardly ever Often

Forget directions

I——I——I——I——I——I——I
Hardly ever Often

Forget why they entered a room

I——I——I——I——I——I——I
Hardly ever Often

Forget content of daily conversations

I——I——I——I——I——I——I
Hardly ever Often

Forget groceries

I——I——I——I——I——I——I
Hardly ever Often

Get lost when driving

I——I——I——I——I——I——I
Hardly ever Often

Forget store locations in shopping centre

I——I——I——I——I——I——I
Hardly ever Often