FALSE AND VERIDICAL MEMORIES AND STEREOTYPE THREAT: A COGNITIVE UNDERSTANDING OF A SOCIAL PHENOMENON

by

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ABSTRACT

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In 1995, Steele and Aronson found that when asked to simply indicate their race prior to a memory test (Study 4) black participants performed significantly worse on a memory test than when not asked to indicate their race. However, their white counterparts did not show a decrease in performance. This effect is often referred to as *stereotype threat*. The effect has been replicated using various tests of general memory and even sporting performance (Beilock & McConnell, 2004). In the cognitive literature memory processes are often broken down into two processes, referred to as *recollection* and *familiarity*. *Recollection* is best understood as an exact replica of the original memory, whereas *familiarity* is a more generalized memory. These processes

can are generally thought to be associated with veridical and false memories. Additionally, memory impairments can lead to lower veridical remembering and increased false remembering (McCabe, Roediger, McDaniel, & Balota, 2009). There is some evidence to suggest that *stereotype threat* may be affecting these processes independently which may lead to differences in false memory formation. However, there has been no direct test of this in the extant literature. Therefore, a well-replicated paradigm that is often used in the cognitive literature to better understand false memory formation was used. The Deese-Roediger-McDermott paradigm, a set of semantically associated word lists, is an excellent paradigm to test the possibility that *stereotype threat* may be affecting veridical and false memories differently (Deese, 1959; Roediger & McDermott, 1995). Although veridical memory was strongly affected by *stereotype threat*, false memory showed no significant effect of the manipulation.

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CHAPTER 1

INTRODUCTION

1.1 Stereotype Threat

Differences in performance on standardized tests related to gender and racial differences have been apparent for some time. For example, males (on average) tend to be more likely to go into math and science than females and have been found to score higher on math portions of standardized tests such as the SAT (Huguet & Régner, 2007; see also NCES, 2004). These differences have not only been confined to academic pursuits, but they are also found in the sports arena (Beilock & McConnell, 2004). Even in a simple golfing putting task, the stereotype that blacks have more natural ability and whites have more sports knowledge can cause a significant decrease in performance. Of course, there are exceptions to any rule and the reasons for why these differences exist are not entirely apparent at this point. Nor are they likely caused by a single factor (i.e. motivation; Smith, Sansone & White, 2007); one factor that has been suggested is *stereotype threat* (Steele & Aronson, 1995; Helms, 2005).

In 1995, Steele and Aronson found through multiple studies that if a test was construed as being a measure of intellectual ability, instead of a simple exercise, a significantly larger drop in score was seen in blacks than in whites in the same setting (Studies 1-3). The researchers also found that simply asking the participants' race prior to testing had a detrimental effect on black participants, but not white (Study 4). Thus,

the concept for *stereotype threat* is that by invoking a negative stereotype (i.e. black's intellectual ability is less than that of other races), performance will decline. Returning to the example about gender differences on math tests, it may be that when some females take a math test they are reminded of the stereotype, consciously or subconsciously, that females are not good at math and perform accordingly. This is thought to occur, in the academic realm, due to increased attention on the stereotype which decreases the amount of available attention, or working memory, that can be used to complete the task. This is a plausible explanation. Cognitive studies of divided attention require participants to perform an additional task as they work through a memory task. For example, a participant may be asked to learn a list of words and then be tested on them. However, while learning the words they are asked to listen for a tone and indicate which ear the tone was presented in. Doing this significantly decreases the participants' available working memory and impairs participants' ability to correctly remember the words. Working memory is used to process and manipulate items in short-term memory. Working memory is the executive functioning that allows the mental juggling required to keep all needed items in conscious awareness. This is similar to the way that a juggler maintains active control over multiple items in the air. Also, just like a juggler, there is a limit to the number of items that can be maintained and this can vary from individual to individual. This is traditionally regarded as 7 plus or minus 2 items (Miller, 1956). In the case of *stereotype threat* it is thought that the threat is similar to the task of listening for the tone. The threat divides attention and

decreases the amount of available working memory which provides participants less to work with.

Because of this, an individual experiencing *stereotype threat* has fewer resources to use to complete a task. This is especially true in the case of a memory task in which participants are trying to maintain a large amount of information that they will shortly need to recall. Additionally, a lack of available working memory can affect a participants' ability to perform reading comprehension. Working memory is key to reading comprehension. One must be able to maintain the entire idea in working memory in order to understand the entire idea and any interactions between variables. For instance, if a participant is reading a long sentence, but does not have the needed amount of available working memory, the information from the beginning of the sentence will no longer be in working memory when they reach the end of the sentence. Without this information the participant will not be able to link the information from the beginning of the sentence with the information from the end of the sentence. This leads to a poor understanding of the concept and, typically, causes the participant to have to re-read the section multiple times to fully understand the concept. This may be familiar to those reading a complicated article late at night when they are tired and distracted, reducing available working memory and causing the re-reading of many sentences and paragraphs to fully understand the concept. This is also extremely important to students working on the reading comprehension portion of a very important test like the SAT or ACT.

In addition to academic effects, other researchers have been interested in areas that are affected by *stereotype threat*. For instance, sports contain many stereotypes that have the potential to affect athlete's performance which can, in turn, change something like the racial make-up of a professional sport (Beilock & McConnell, 2004). Interestingly, although *stereotype threat* hinders athletic performance, it does not seem to do so using the same mechanism as with academic tasks. Although academic tasks show a hindrance from *stereotype threat* attributable to decreased working memory, athletic tasks are hindered by over attention. A skilled athlete's ability does not come from calculating every piece of every move, but instead the skills have become so well-honed that they have become automatic. In fact, over-attention decreases the automaticity and fluidity of the movement and hinders performance. This is thought to be the cause of the decrease in performance during *stereotype threat*. Unlike standard cognitive tasks where participants fair poorly when distracter tasks (tasks diminishing working memory) are used in conjunction with the task, athletes in a threat condition that are given a distracter task (e.g. listen for a tone) perform better than when they are in the threat condition but have no distraction. It is thought that this distraction keeps the athletes from over-attending to the skill and reverts it to the automatic process that it once was. Because of this it is hypothesized that *stereotype threat* causes increased attention to the skill in order to overcome the stereotype. Doing this reduces the automaticity of the movements and causes a decrement in performance. Thus, the idea that *stereotype threat* hurts performance by taking away attentional resources, as is thought with academic tasks, is incomplete.

To resolve this, Schmader, Johns, and Forbes (2008) have proposed a model that describes how *stereotype threat* leads to performance decrements in both the academic and athletic realms. They hypothesize that the threat causes three primary reactions which are interconnected, but distinct (see Figure 1).

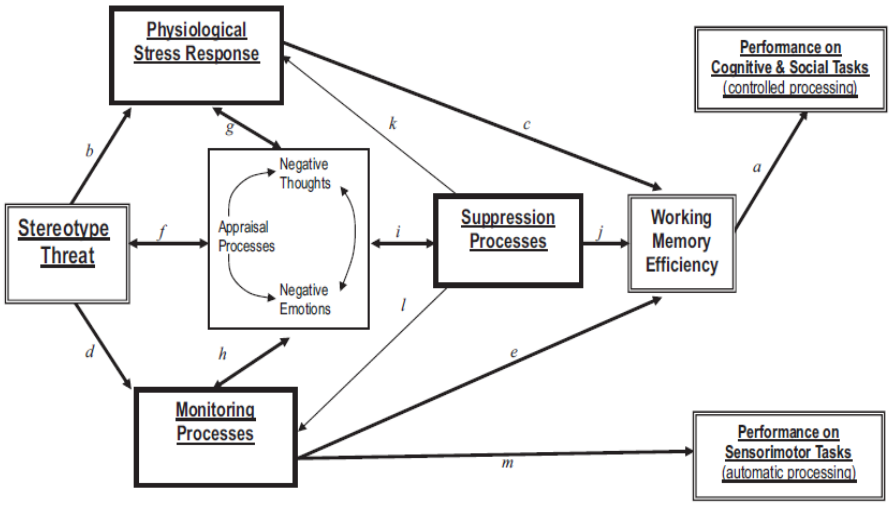

Figure 1. Multi-process model proposed by Schmader, Johns, and Forbes (2008) to explain the causes of Stereotype Threat (from Schmader, Johns, & Forbes, 2008).

First, *stereotype threat* causes physiological responses (e.g. increased heart rate, sweatiness, hypothalamic-adrenal response). It also causes feelings of self-doubt and questioning of the participants' ability which feeds and is fed by the physiological response just mentioned. To overcome this, the participants attempt to suppress these thoughts and feelings. They also increase their attention on the task. All of these require working memory thus decreasing the available amount to be used on the task. In the case of a cognitive task, this suppression is what causes the impairment due to a lack of resources. For athletes, working memory is not required to perform the task, thus it is only the increased attention that impairs their performance. When a distracter task is

used it uses up the available working memory and does not allow enough attentional resources to hinder performance. This is the model that will be used for the present experiment as it describes all data, not just task-specific, and provides testable hypotheses. Now, to better understand how memorial processes work and can be dissociated, a small primer on process models is below.

1.2 Process Models

For obvious reasons *stereotype threat* has become a popular phenomenon to study. However, even with all of the previous research that has been performed, the idea and testing of two differentiable memorial processes has never been studied. Dual-process theories of memory are quite popular in cognitive psychology, but are rarely found in the social literature. For this reason little research can be found in the extant literature relating to what effects *stereotype threat* has on each memorial process. These processes have been described in many ways, which will be elaborated on in the following section, but all seem to carry the idea that there is a process that focuses on a general form of knowledge (e.g. that animal is a dog) and another that focuses on a more exact memory (e.g. that dog's name is Skipper and his owner is the captain of a ship).

A person's ability to recognize previously experienced events may be facilitated by two separate memory processes, recollection and familiarity (Vilberg, Moosavi, & Rugg, 2006; Nemanic, Alvarado, & Bachevalier, 2004; Yonelinas, 2002; Parks & Yonelinas, 2007) or just a single process (Hintzman, 1986). A two-process model believes that recollection occurs when a person gains access to a memory representation

containing exact information (i.e., what, when, where), whereas familiarity occurs when a person gains access to a memory trace that has feature overlap with several other memory traces (Norman & O'Reily, 2003). Moreover, familiarity is often described as being accompanied by a feeling of knowing that you have previously experienced an event, in the absence of an ability to retrieve item-specific details about its previous occurrence (Tulving, 1985). A single-process model states that memory exists on a single continuum and judgments as to whether an item was previously encountered depends on whether or not the memory strength passes a threshold (Hintzman, 1986). For many, this continuum is the amount of familiarity an item evokes when it is recognized or recalled. So, if one sees the word *dog* on a test and is asked *did you see this word during the study session*, they will respond *yes* if they have a strong sense that they know the item and *no* if they feel no familiarity between the item and the study session. Broken down further, different theories hold different views of what causes this sense of familiarity and what is actually stored in memory. These theories have testable predictions that can be studied with various methods.

Some researchers have studied recollection and familiarity by using categorical dot patterns that contain a number of exemplars that are produced by distorting a single prototype (Posner & Keele, 1968; 1970; Reber, Stark, & Squire, 1998). In such experiments, participants study category exemplars, and are later presented with both previously studied exemplars and previously unstudied prototypes on a recognition memory test. This false-memory effect has been accounted for using competing single-process theories. One set of these theories believes that the studied stimuli, *exemplars*,

are encoded at study and at test the overlap of the items creates this false remembering (Cohen & Nosofsky, 2000; Hintzman, 1986). The other set of these theories hold that it is not the *exemplars* that are kept in memory, but the averaged *prototype* of all of the occurrences (Rosch, 1978; Posner & Keele, 1968). This second theory is in line with *schema* theory.

One camp, drawing on early work by Bartlett (1932), believes that in memory a representation of the global idea or framework is stored (see also Bransford & Franks, 1971 and Alba & Hasher, 1983). For example, Bartlett had university students in the United Kingdom listen to Native American folk stories to later be repeated back to the experimenters. He found that when the students were asked to retell the stories they were able to remember the main points (i.e. there was a war), but imparted their native anglo-centric terminology on the stories (e.g. *canoe* became *boat*). Bartlett referred to this as a *schema*. A *schema* is the basic structure or skeleton of a memory. However, it does not contain an exact trace of the memory, causing the memory errors that were observed in the students retelling. Since 1932, other researchers have used this idea to formulate theories about the workings of specific subtypes of *schemas*, such as *scripts* and *frames* (Barsalou & Sewell, 1985 and Minsky, 1975, respectively). *Scripts* are frameworks for how a story unfolds (Schank & Ableson, 1977). The quintessential example of a *script* is the restaurant *script*. If asked, most people can describe the way that a trip to a restaurant will unfold (i.e. *the host/ess will ask us for our smoking preference*, although increasingly less nowadays, *tell us how long the wait, if any, will*

be, etc…). As pointed out by Baddeley (1994), *scripts* and *frames* are subtypes of *schemas* and the terms will be combined with *schemas* for the remainder of this text.

Other researchers have found it necessary to use a model with two processes in order to fully explain the data. These dual-process models, typically, consist of something similar to a *schema* as well as a more specific process. This second process is associated with the features of a memory (i.e. the font of the letters; Reyna & Brainerd, 1995; Tulving, 1985) or the source of the memory (Gallo & Roediger, 2002).

Brainerd and Reyna's Fuzzy-Trace Theory (1995) consists of two memorial traces. One of these is the *gist* trace which is similar to a *schema*, except that it does not use a reconstructive process in remembering, but is in fact a trace of the semantic, or meaning, component. The other trace is the *verbatim* trace. The *verbatim* trace is a veridical representation of the surface level features (i.e. the actual picture rather than what the picture means).

The activation/monitoring framework (Gallo & Roediger, 2002) is a combination of a spreading activation account (Collins & Loftus, 1975) and a source monitoring perspective (Johnson, Lindsay, & Hashtroudi, 1993). Spreading activation states that memory is made up of a number of nodes (items) that are connected to each other and these connections have various strengths, represented graphically as distances. When one item (I will use the "dog" example again) is activated, its activation spreads to the closest nodes (e.g. "cat") which spreads to its closest nodes and so on, each time diminishing in the amount of activation passed on. It is easy to think of this spread as a ripple in a pond. The monitoring portion of this framework is used to account for why

some memories with a large spread of activation fail to produce false memories (remembering that you saw "cat" when you really saw "dog") and others with a small amount of spread do. According to the framework, a source monitor determines the source of a memory when it is reactivated. In many cases this is not overly important. For instance, remembering that it was your mother who taught you that 2+2=4 instead of your first grade teacher probably has little consequence on your later life. However, remembering that the lyrics to a song are from someone else's song instead of one that you wrote yourself could have very important legal consequences (Bright Tunes Music v. Harrisongs Music). Together, activation explains how items are stored and connected in the mind and the source monitor provides checks and balances of sorts.

Many other dual-process theories, in some shape or form, believe the decision made about an items' presence or absence on a studied list is composed of *recollection* and *familiarity*. *Recollection* is similar to the *verbatim* trace in Fuzzy-Trace Theory. It is a more exacting representation of the item and the surrounding events. It contains source details as well, such as where, when, and what did the stimulus look like (similar to the information used by the source monitor of the Activation/Monitoring framework). *Familiarity*, on the other hand, is a more general sense of knowing an item. Wittgenstein (1958) pointed out the distinction of remembering something versus knowing it. Tulving (1985) dissociated *recollection* and *familiarity* with the *remember/know* paradigm. In this paradigm, participants must make one of three choices, *remember/know/new*, about an item on a recognition memory task. The participants are instructed to answer *remember* if they were able to recall specific

details about an item, know if they only had a high sense of *familiarity*, but no accompanying details, and *new* if they believed that the item was not previously studied. The judgment of *remember*, therefore, is made up of both recollection and familiarity, whereas the know judgment is made up only of *familiarity*. By subtracting the *know* judgments from the *remember* judgments, a measure of pure recollection is fashioned.

For example, returning to Posner and Keele's experiment (1968) using dot patterns, correctly recognizing that a previously studied exemplar is old can be based on either recollection or familiarity. However, incorrectly judging a previously unstudied prototype as having been presented at study is a familiarity-based memory error. A familiarity-based memory error occurs when a participant experiences a feeling of familiarity for a previously unstudied item and misattributes the feeling to the item having been studied. This also means that they did not have a strong enough recollective memory for the event to discount it as false.

Slotnick and Schacter (2004) used categorical lists of abstract shapes, as opposed to dot patterns, in an attempt to better understand the neural signature that accompanies recollection of previously studied events and false recognition of previously unstudied shapes (see also, Slotnick, Moo, Segal, & Hart, 2003). As with the dot patterns, their lists of abstract shapes were composed of exemplars and prototypes. Slotnick and Schacter used old-new judgments to measure recognition memory. These researchers contrasted brain activation measured for old-hits (previously seen items, judged old), which was taken as a measure of recollection, to old-misses (previously

seen items, judged new), which was used as a measure of familiarity, in an attempt to provide a neural estimate of brain activation that accompanies recollection. The researchers argued that this contrast provided a measure of brain activation that accompanies recollection of previously studied items. They observed the largest differences in the early visual processing fields, consistent with previous research (Reber et al., 1998; Henson, Hornberger, & Rugg, 2005, for orthographically processed words). Inconsistent with previous research these investigators did not observe differences in late visual processing fields (as increased activation was observed for both item types). Based on their findings, Slotnick and Schacter concluded that recollection is accompanied by increased activation in early visual processing areas, whereas familiarity is accompanied by increased activation in late visual processing areas. Thus these processes are dissociable even between neural substrates.

There are a few studies that have touched on the subject of the effects of *stereotype threat* on different pieces of memory, seemingly unintentionally. The first goes back to the original example of gender differences on math tests. A study by Huguet and Régner (2007) found that by merely telling students that a task measured mathematical ability increased negative effects on females' performance and judgment of task difficulty. This effect disappeared when female students were in an all-girl environment due to a decrease in *stereotype threat* without males present. Given that math is a rule-based system that deals more with a general way to do something (i.e. knowing how to add) rather than an exact representation of each situation (i.e. knowing every combination of numbers to add together and their respective sums), this can be

looked at as evidence for affecting a specific process. So, at least in this instance, *stereotype threat* is affecting the more general process.

Additionally, other researchers have found that not only do black participants show a decrease in performance on a multiple-choice test when in a *stereotype threat* condition than when in a non-threat condition, the black participants also find the test to be more biased (Edwards & Arthur, 2007). It should be noted that although multiple-choice tests do not rely entirely on the general process, it is the dominant process. These same researchers, in the same set of experiments, also saw no decrease in performance between the threat and non-threat conditions when the test format was changed to fill-in-the-blank. This test format was judged as being less biased than the multiple-choice test. Traditionally, fill-in-the-blank test formats are thought to use a larger amount of the more specific process than the general process. This is because a participant must produce the answer rather than simply recognize it.

1.3 Theory Testing

Based on the Schmader et al model and the previously mentioned findings, it is likely that *stereotype threat* is affecting the two memorial processes differently. To test this theory, a Deese-Roediger-McDermott (DRM) task was given to participants both in a *stereotype threat* condition and a *non-threat* condition. The DRM paradigm consists of lists of fifteen semantically related words. All lists have a semantically primed, but not presented, prototype (Deese, 1959; Roediger & McDermott, 1995; see Appendix I). This is a standard method used by cognitive psychologists to tease apart the two

memorial processes to produce purer measures than multiple choice tests or fill in the blank tests.

Initially, the background literature led to the consideration that *stereotype-threat* was affecting the more general, or familiarity-based, type of memory more so than the more feature-based, recollective type of memory. Surprisingly, this was not the case. Black participants in the *stereotype-threat* condition showed a significant decrease, relative to their *non-threat* counterparts, in terms of veridical memory which relies on more recollective memorial processes than false memories. However, no mean difference was found in the number of falsely recalled lures between the groups. In addition, no significant correlation of false memories with cognitive interference measures (a measure related to how strongly *stereotype threat* was affecting the participant) was found, but the correlation for veridical memories to this measure was significant. This is more in-line with the effects of aging on memory (McCabe et al, 2009). In aging, which sees a decrease in overall working memory as well, veridical memories decrease while false memories are stable or even increase.

The Schmader et al theory provides some insight into the effect of *stereotype threat* on the memorial processes and to the results that were found. First, since the threat taxes working memory that would otherwise be used for the task, it will reduce the number of items that will be held in working memory at any time. This will partially disrupt the formation of a generalized memory, but only in so much as the items are weakly associated. Thus, if the items are strongly associated (like those in this study), a smaller number of them will be needed to cause an association and will not amount to a

decrease in false memories, but will decrease the overall number of items stored in veridical memory and later recalled. This may minimally decrease the overall strength of the association, but given the decrease in veridical memories, participants will have less to use to discount the false memory. Given this understanding of the mechanisms behind *stereotype threat* as well as false memories, an overall decrease in the number of correctly recalled items is in line with the theory for those African Americans in the *stereotype threat* condition compared to those in the *non-threat* condition. Additionally, the number of falsely recalled lures remaining the same is also in accord with the theory. These follow the theoretical models for a dual-process model of memory as well as Schmader et al's model of *stereotype threat*.

This is the beginning to fully understand the underlying memorial processes involved in *stereotype threat* and how those processes interact with the mechanisms set forth by Schmader et al. This will aid in the reduction of this effect. Although, inoculation to *stereotype threat* can inhibit its effects, this is only useful for individuals that have been inoculated (e.g. had *stereotype threat* explained; Johns, Schmader & Martens, 2005). Further, all inoculations are not equally effective (Nguyen and Ryan, 2008). By better understanding the processes, exams can be produced that do not fall prey to the effects of *stereotype threat*. Doing this negates the need for inoculation and levels the playing field for test-takers.

CHAPTER 2

METHODS

2.1 Design

Participants completed all tasks in separate rooms to reduce the influence that the group makeup has on the participant's performance. Half of the participants began with instructions explaining that this is a test of intellectual ability and that the research is to examine individual differences in verbal intelligence. They then answered a set of demographic questions, including the question asking them to indicate their race. This is known as the stereotype condition as it involves the introduction of *stereotype threat*. The other half of the participants began with the study/test session and were told that this is a simple task related to word memorability and how participants remember words, but not that the number of words was not the focus. This study/test session consisted of viewing 19 lists of semantically associated words (see Appendix I), one at a time, and completing a recollective memory test. This is known as the *non-threat* condition because the threat is not introduced and should have no effect on the outcome of the memory test. The same procedure for the study test/session was used in the *stereotype threat* condition following the demographic questionnaire. Those participants in the *non-threat* condition completed the questionnaire following the study/test session.

Additionally, a series of questionnaires relating to self-efficacy, cognitive interference, task engagement, performance self-evaluation, and feelings of test bias

were given to participants in both conditions. In the *non-threat* condition, participants completed the demographic questionnaire after all other questionnaires. Participants were also asked to provide their GPA and SAT scores to be used as covariates, as has been previously done (Steele & Aronson, 1995). In some cases, such as transfers from community colleges and military personnel, no SAT score was available. In these instances, if available, ACT was substituted and equated to an SAT score using the concordance scale available from *The ACT* (www.act.org/aap/concordance/index.html, 2010). This was done for seven participants. Nine participants had no SAT or ACT scores to draw on or were unable to recall the scores (one participant) and were not included in any analysis using SAT as a covariate. All participants were debriefed at the end of the session (Appendix E).

2.2 Participants

97 undergraduate students participated for course credit. Data from 4 participants was unusable due to computer malfunctions (2), incorrect ethnicity (1, Hispanic), and unforeseen circumstances (1, fire alarm). Data from these participants was excluded from all analyses. Therefore, 93 participants (26 white (non-Hispanic) & 21 African American in the non-stereotype condition; 26 white (non-Hispanic) & 20 African American in the stereotype condition) provided usable data.

2.3 Experimental Stimuli

Nineteen lists of fifteen semantically associated words from those normed by Stadler and colleagues (1999) as well as lists normed by Gallo and Reodiger (2002) per

participant were used (see Appendix A). Each list contains a semantic lure. This lure was only used during the test session.

Participants in the threat condition were asked to fill out a demographic form prior to the study/test procedure (Appendix E). Participants in the non-threat condition received this form after the study/test procedure.

Following the study/test task participants were asked to fill out a few short questionnaires to measure self-efficacy (Appendix C; Steele & Aronson, 1995; Heatherton & Polivy, 1991), memory self-efficacy (Appendix D; Zelinski & Gilewski, 2004), task engagement (Appendix B; Steele & Aronson, 1995), cognitive interference (Appendix B; Saranson, 1978), performance self-evaluation (Appendix B; Steele & Aronson, 1995), and how biased they felt the test was (Appendix B; Steele & Aronson, 1995). The self-efficacy measure (Appendix C) provided an overall score as well as sub-measures for Performance self-esteem, Social self-esteem, and Appearance self-esteem. In the non-threat condition, these preceded the demographic form. The task engagement measure asked participants to choose the purpose of the experiment. The options were as follows:

A) Provide a genuine test of my abilities in order to examine personal factors involved in verbal ability. (*stereotype threat*)
B) Provide a challenging test in order to examine factors involved in solving verbal problems. (*non-threat*)
C) Present you with unfamiliar verbal problems to measure verbal learning. (distracter)

These provided a verifiable method to confirm that participants understood the instructions and that participants in each condition received instructions that differentiated the groups.

CHAPTER 3

RESULTS

3.1 Manipulation Check

A Chi-squared analysis of the purpose chosen for participants in each condition (*non-threat* and *stereotype threat*) revealed that participants in the *non-threat* condition chose B as the purpose of the experiment (30) significantly more than the other choices (A=9, C=6) and participants in the Threat condition chose A as the purpose of the experiment (34) significantly more than the other choices (B=9, C=3), χ^2 (2,89) = 26.835, p<.001. Thus, participants were correctly able to distinguish which condition they were in. Two participants failed to answer this question and were not included in this analysis.

3.2 Memory Measures

Next, a 2 (group: African American vs. white) X 2 (stereotype threat: present vs. absent) MANOVA, was performed for Veridical Memory, False Memory, Current Thoughts-Performance.

No significant differences for any of the dependent variables were present for the main effect of ethnicity. No significant differences for any of the dependent variables were found for the main effect of threat condition.

The interaction effect of threat condition by ethnicity showed a significant difference for veridical memory and a moderately significant difference for false

memory, $F(1,82)=10.144$, $p<.01$ and $F(1,82)=3.326$, $p=.072$, respectively (see Figures 2 and 3).

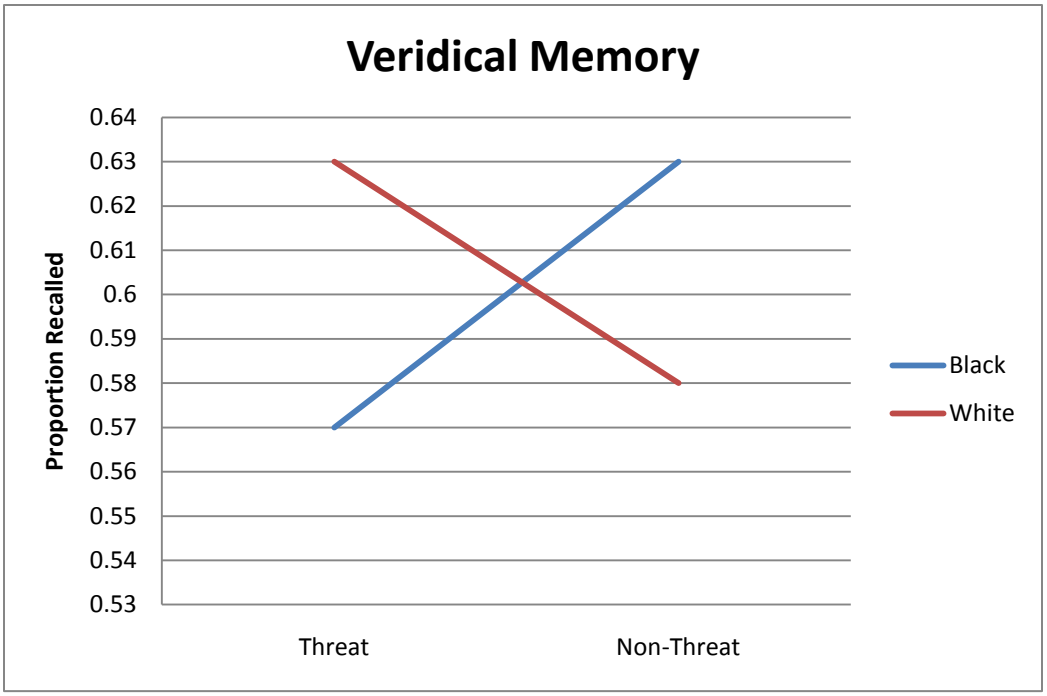

Figure 2. Proportion of correctly recalled list words (veridical memories).

An ANCOVA using SAT as a covariate indicated that there was a significant interaction with respect to false memory, $F(1,82)=3.936$, $p=.051$. Post-hoc analyses of veridical memories revealed moderately significant differences between blacks in the threat condition ($M=.57$, $SD=.062$) with those in the non-threat condition ($M=.63$, $SD=.058$), $t(39)=1.919$, $p=.062$. Significant differences were also present between whites in the threat condition ($M=.63$, $SD=.073$) and those in the non-threat condition ($M=.58$, $SD=.099$), $t(50)=2.232$, $p<.05$.

Post-hoc analyses of false memories revealed no significant difference for blacks in the threat condition ($M=.27$, $SD=.198$) with those in the non-threat condition

(*M*=.30, *SD*=.154), *t*<1. However, significant differences were present between whites in the threat condition (*M*=.33, *SD*=.196) and those in the non-threat condition (*M*=.21, *SD*=.169), *t*(50)=2.351, *p*<.05.

The interaction effect of threat condition by ethnicity showed a significant difference for performance self-efficacy as measured by the Current Thoughts-Performance subscale, *F*(1,82)=12.318, *p*<.001 (see Figure 3).

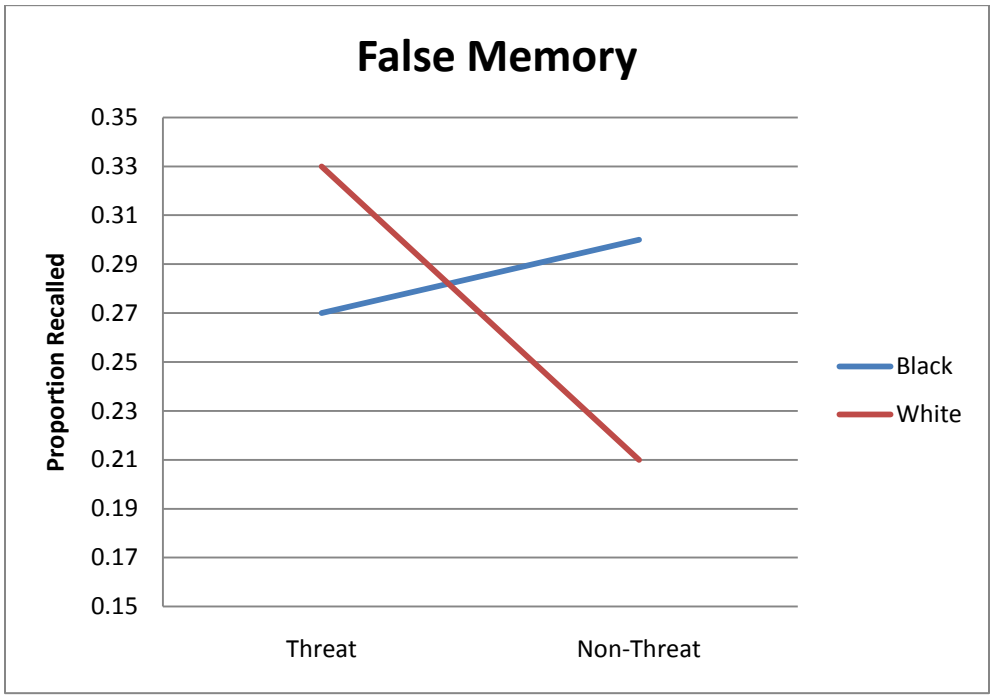

Figure 3. Proportion of falsely recalled critical lures (false memories).

Post-hoc analyses revealed significant differences between blacks in the threat condition (*M*=.94, *SD*=5.247) with blacks in the non-threat condition (*M*=5.18, *SD*=2.767), *t*(39)=2.038, *p*<.05. Moderately significant differences were also present between whites in the threat condition (*M*=4.46, *SD*=2.956) and those in the non-threat condition (*M*=2.13, *SD*=5.203), *t*(50)=1.957, *p*=.056.

Pearson's correlations for all covariates with veridical and false memories were performed. The proportion of correctly recalled list items was negatively correlated with the amount of cognitive interference experienced, difficulty rating, and bias rating, r= -.320, p<.01, r= -.256, p<.05, r= -.230, p<.05, respectively. This was also positively correlated with participants' estimate of their percentage correct, how they felt they compared to others, and the Performance self-esteem measures on the Current Thoughts questionnaire, r= .439, p<.01, r= .245, p<.05, r= .280, p<.01, respectively.

CHAPTER 4

DISCUSSION

Previous research has contended, and validated, that the introduction of a negative stereotype can cause a threat which leads to physiological and psychological changes (Schmader et al, 2008). These changes can lead to decreased performance in the area that is threatened (i.e. memory or sports). Research into human memory has led to the belief, by many, that memory is composed of two separable processes (recollection and familiarity) which can lead to differing amounts of false and veridical memories depending on the strength or weakness of each (Roediger & McDermott, 1995; Reyna & Brainerd 1995). These processes can be affected by decreased working memory which can lead to a unique pattern of veridical and false memories (McCabe et al, 2009). Therefore, it seemed to reason that *stereotype threat* would independently affect veridical and false memories.

The current results follow the previous research on *stereotype threat* (Steele & Aronson, 1995); such that blacks in the threat condition underperformed those in the non-threat condition in their ability to correctly recall words that were presented during the study portion (see Figure 2). Furthermore, their ability to recall list words was negatively correlated with the amount of cognitive interference they reported following the test, a measure associated with *stereotype threat*. Therefore, it can be concluded that stereotype threat has a significant effect on veridical memory.

In contrast to veridical memory, blacks in both conditions falsely recalled a similar number of lures, no significant difference was present. No correlation between the number of falsely recalled lures and the amount of cognitive interference experienced was found either. For these items, *stereotype threat* failed to affect the overall proportion of falsely recalled words. This result paired with the previously mentioned negative effect on veridical memories can lead to the conclusion that *stereotype threat* affects only veridical memories, not false memories.

Given the underlying components that lead to false memories (strong sense of familiarity based on the general idea of the memories in the absence of strong enough recollection to discount the false memory) it could also be argued that it is not as simple as this conclusion. Rather than processes underlying false memories being unaffected, it is possible that they are simply affected at a similar rate as those that lead to veridical recall (a strong recollection for the item or a strong enough sense of familiarity to cause the participant to output the item). If these processes were affected at a similar rate, this could lead to the decrease in veridical memories, since both recollection and familiarity would be mildly diminished, as well as no significant change for false memories. Although familiarity would be decreased which would normally cause a smaller amount of falsely recalled lures, with the decrease of recollection as well (which is necessary to discount the false memories as false), it is possible for false memories to remain unchanged between the groups.

This theory, however, is unable to explain the results of the white participants. Surprisingly, whites in the *non-threat* condition recalled fewer study items than those in

the *stereotype threat* condition. They also provided significantly fewer false lures than their *stereotype threat* counterparts. For these participants, whose boost in performance from the *non-threat* to *threat* condition will be discussed later, the proportion of falsely recalled lures mirrored the directionality of the veridical items. This is unlike those black participants who were truly experiencing *stereotype threat*. This leads to the conclusion that *stereotype threat* is primarily affecting the processes underlying veridical memories while not affecting those underlying false memories.

4.1 Whites Underperform When Not Threatened

Traditionally, whites show no significant difference between the conditions in an experiment such as this (Steele & Aronson, 1995). They are typically the control group because they are unaffected by *stereotype threat* due to the lack of negative stereotypes. The white participants in this experiment did not follow the tradition. Rather, they showed a decreased overall performance in the *non-threat* condition compared to the *threat* condition, which is the opposite of the blacks. This may be attributable to the population of whites that took part in this study.

The majority of the participants in this study, 80 of the usable participants, participated during the last two weeks of the spring semester. The other 13 participants participated during summer school. This non-traditional group is usually less-motivated than those participating in studies earlier in the semester, hence they wait until the end to complete their credits. Also, many of these studies take place at universities with a history of high achievement that requires a much more motivated student. This does not mean that the University of Texas at Arlington does not have high achieving

individuals. It does, however, have a much more diverse and normalized population from which to draw.

In addition to *stereotype threat* another phenomenon exists which is known as *stereotype boost*. As its name implies, *stereotype boost* leads to increased performance in the presence of a positive stereotype (Shih, Ambady, Richeson, Fujita, & Gray, 2002). For example, the notion that men excel in math and whites outperform other groups (blacks and Hispanics) in academics. When whites are reminded of this stereotype just before a test, it can boost their performance rather than hinder it. The effect is not as pronounced as *stereotype threat*. However, as mentioned in the previous paragraph, these studies are usually performed on campuses with very high achievers. The small effect may simply be a ceiling effect in those instances. In contrast, this study had a more diverse population of participants who had waited until the end of the semester to complete their requirement. Thus, without the presence of anything to motivate them, they underperformed. Then when they were provided with a small challenge and a *stereotype boost*, their performance was enhanced. This explains why the pattern of results for false memories in whites did not follow the pattern for blacks. They were not experiencing *stereotype threat*, instead they were experiencing motivation and a boost in self-confidence as evidenced by the increased self-esteem in the realm of performance as measured by the Current Thoughts questionnaire. Blacks, who were experiencing *stereotype threat*, however, showed a significant decrease with respect to this subscale from the *non-threat* condition to the *threat* condition (see Figure 4).

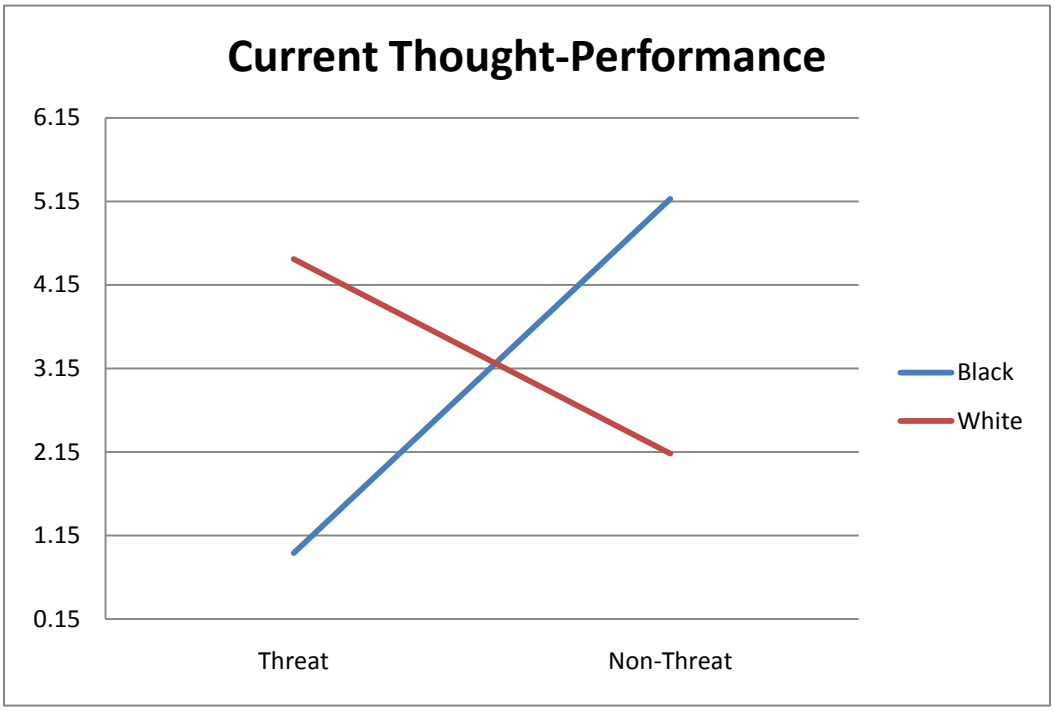

Figure 4. Current thoughts questionnaire: Performance subscale.

4.2 General Discussion

To sum up, no evidence from this experiment indicates that *stereotype threat* affects false memories. On the contrary, the evidence that *stereotype threat* does not affect false memories is much stronger. This includes a lack of mean differences, lack of correlation to measures related to *stereotype threat*, and a differing pattern of results between the two ethnic groups that are affected by two different phenomena. This does not prove that recollection and familiarity are being affected differently by *stereotype threat*. It merely indicates that this may be the case. Additional studies that are more focused on parsing recollection and familiarity are needed to fully determine how each process is affected.

Once this is determined, this information can be used to further reduce the race gap that is currently present in standardized testing (e.g. SAT, ACT, and the GRE). By understanding the processes that are affected as well as those that are not, standardized tests can be developed which do not fall prey to the effects of *stereotype threat*. Others have used inoculation (teaching students about *stereotype threat*) to reduce the effect and narrow the race gap (Johns, Schmader & Martens, 2005). Although this is a step in the right direction, two problems exist with the use of inoculation. First, it only works on those who are inoculated. This leaves a large number of students vulnerable. Second, not all inoculation is equally affective (Nguyen and Ryan, 2008). So, a student getting ready for college that is fortunate enough to understand *stereotype threat* may not be as prepared as another student that received better inoculation. We are then once again back to measuring factors other than academic ability. This is not the best solution. The solution is to further understand *stereotype threat* and the processes it affects to enhance our measures.

APPENDIX A

EXAMPLES OF CRITICAL TARGETS WITH LIST ITEMS 1 TO 15 (FROM STADLER ET AL, 1999 AS WELL AS GALLO AND ROEDIGER, 2002)

Citizen: United States, Man, Person, American, Country, Alien, People, Vote, Me, Patriot, Flag, Foreigner, France, Immigrant, Member.

City: Tow, Crowded, State, Capital, Streets, Subway, Square, New York, Village, Metropolis, Big, Chicago, Suburb, Sharp.

Foot: Shoe, Hand, Toe, Kick, Sandals, Soccer, Yard, Step, Ankle, Arm, Boot, Inch, Sock, Knee, Mouth.

Health: Sickness, Good, Happiness, Wealth, Ill, Doctor, Service, Strong, Hospital, Disease, Body, Vigor, Center, Pain, Robust.

Lamp: Light, Shade, Table, Bulb, Post, Black, Cord, Desk, Bright, Lighter, Read, On, Bed, Burn, Stand.

Needle: Thread, Pin, Eye, Sewing, Hole, Point, Prick, Thimble, Haystack, Thorn, Hurt, Injection, Syringe, Cloth, Knitting.

Pen: Pencil, Write, Fountain, Leak, Quill, Felt, Bic, Scribble, Crayon, Cross, Tip, Marker, Ink, Cap, Letter.

Rubber: Elastic, Bounce, Gloves, Tire, Ball, Eraser, Springy, Foam, Galoshes, Soles, Latex, Glue, Flexible, Resilient, Stretch.

Smoke: Cigarette, Puff, Blaze, Billows, Pollution, Ashes, Cigar, Chimney, Cough, Tobacco, Stink, Match, Lungs, Flames, Stain.

Stove: Hot, Heat, Pipe, Cook, Warm, Fire, Oven, Wood, Kitchen, Lid, Coal, Gas, Iron, Range, Furnace.

Trash: Garbage, Waste, Can, Refuse, Sewage, Dirt, Junk, Rubbish, Paper, Scraps, Pile, Dump, Landfill, Debris, Litter.

Window: Door, Glass, Pace, Shade, Ledge, Sill, House, Open, Curtain, Frame, View, Breeze, Sash, Screen, Shutter.

Sleep: Bed, Rest, Awake, Tired, Dream, Wake, Snooze, Blanket, Doze, Slumber, Snore, Nap, Peace, Yawn, Drowsy.

Smell: Nose, Breathe, Sniff, Aroma, Hear, See, Nostril, Whiff, Scent, Reek, Stench, Fragrance, Perfume, Salts, Rose.

Doctor: Nurse, Sick, Lawyer, Medicine, Health, Hospital, Dentist, Physician, Ill, Patient, Office, Stethoscope, Surgeon, Clinic, Cure.

Sweet: Sour, Candy, Sugar, Bitter, Good, Taste, Tooth, Nice, Honey, Soda, Chocolate, Heart, Cake, Tart, Pie.

Chair: Table, Sit, Legs, Seat, Couch, Desk, Recliner, Sofa, Wood, Cushion, Swivel, Stool, Sitting, Rocking, Bench.

Soft: Hard, Light, Pillow, Plush, Loud, Cotton, Fur, Touch, Fluffy, Feather, Furry, Downy, Kitten, Skin, Tender.

Cup: Mug, Saucer, Tea, Measuring, Coaster, Lid, Handle, Coffee, Straw, Goblet, Soup, Stein, Drink, Plastic, Sip.

Cold: Hot, Snow, Warm, Winter, Ice, Wet, Frigid, Chilly, Heat, Weather, Freeze, Air, Shiver, Arctic, Frost.

APPENDIX B

COGNITIVE INTERFERENCE QUESTIONNAIRE/ENGAGEMENT CHECK (FROM SARANSON, 1978; STEELE & ARONSON, 1995)

We are interested in learning about the kinds of thoughts that go through people's heads 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 circling the appropriate number provided.

I thought about how poorly I was doing.

Never		A Few Times		Very Often
1	2	3	4	5

I wondered what the experimenter would think of me.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about how I should work more carefully.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about how much time I had left.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about how others have done on this task.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about the difficulty of the problems.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about my level of ability.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about the purpose of the experiment.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about how I would feel if I were told how I performed.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about how often I got confused.

Never		A Few Times		Very Often
1	2	3	4	5

I thought about things completely unrelated to the experiment.

Never		A Few Times		Very Often
1	2	3	4	5

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.*

Not At All						Very Much
1	2	3	4	5	6	7

Please circle the number on the following scale which best represents the degree to which you felt that the task was **DIFFICULT**.

Not At All														Very Much
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

Please circle the number on the following scale which best represents the degree to which you felt that the task was **BIASED**.

Not At All														Very Much
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

What percentage of the words do you think you correctly answered? _____

How would you say your performance on this task was in relation to other students at UTA?

Much Worse														Much Better
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

The purpose of this experiment was to:

D) Provide a genuine test of my abilities in order to examine personal factors involved in verbal ability.
E) Provide a challenging test in order to examine factors involved in solving verbal problems.
F) Present you with unfamiliar verbal problems to measure verbal learning.

APPENDIX C

CURRENT THOUGHTS QUESTIONNAIRE (FROM STEELE & ARONSON, 1995 AND HEATHERTON & POLIVY, 1991)

This is a questionnaire designed to measure what you are thinking at this moment. There is, of course, no wrong answer for any statement. The best answer is what you feel is true of yourself at this moment. Be sure to answer all of the items, even if you are not certain of the best answer. Again, answer these questions as they are true for you **RIGHT NOW**.

I feel confident about my abilities.

Not at All		Somewhat		Extremely
1	2	3	4	5

I am worried about whether I am regarded as a success or failure.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel satisfied with the way my body looks right now.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel frustrated or rattled about my performance.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel that I am having trouble understanding things that I read.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel that others respect and admire me.

Not at All		Somewhat		Extremely
1	2	3	4	5

I am dissatisfied with my weight.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel self-conscious.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel as smart as others.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel displeased with myself.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel good about myself.

Not at All		Somewhat		Extremely
1	2	3	4	5

I am pleased with my appearance right now.

Not at All		Somewhat		Extremely
1	2	3	4	5

I am worried about what other people think of me.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel confident that I understand things.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel inferior to other at this moment.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel unattractive.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel concerned about the impression I am making.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel that I have less scholastic ability right now than others.

Not at All		Somewhat		Extremely
1	2	3	4	5

I feel like I am not doing well.

Not at All		Somewhat		Extremely
1	2	3	4	5

I am worried about looking foolish.

Not at All		Somewhat		Extremely
1	2	3	4	5

APPENDIX D

FREQUENCY OF FORGETTING-10 SCALE (FROM ZELINSKI & GILEWSKI, 2004)

This is a questionnaire about how you remember information. There are no right or wrong answers. Circle a number between 1 and 7 that best reflects your judgment about your memory. Think carefully about your responses and try to be as realistic as possible when you make them. Please answer all questions.

General frequency of forgetting

How would you rate your memory in terms of the kinds of problems that you have?

Major Problems			Some Minor Problems			No Problems
1	2	3	4	5	6	7

How often do these present a problem for you?

	Always			Sometimes			Never
Names	1	2	3	4	5	6	7
Faces	1	2	3	4	5	6	7
Where you put something	1	2	3	4	5	6	7
Directions to places	1	2	3	4	5	6	7
Beginning to do something and forgetting what you were doing	1	2	3	4	5	6	7

As you are reading a novel, how often do you have trouble remembering what you have read…

	Always			Sometimes			Never
The paragraph just before the one you are currently reading	1	2	3	4	5	6	7
The sentence before the one you are currently reading	1	2	3	4	5	6	7

How well you remember things which occurred…

	Very Bad			Fair			Very Good
Between one and five years ago is	1	2	3	4	5	6	7
The sentence before the one you are currently reading	1	2	3	4	5	6	7

APPENDIX E

DEMOGRAPHIC QUESTIONNAIRE

The following are standard demographic questions. Please fill in or check off whichever applies to you in the following:

Gender: Male _____ Female _____

Ethnicity: White _____ African American _____ Hispanic (Not White) _____ Asian _____ Pacific Islander _____ Native American/Alaskan Native _____ Other _____

Age: _____

GPA: _____

SAT Score: _____

APPENDIX F

DEBRIEFING FORM

The primary purpose of this study is to better understand the effects of *Stereotype Threat* on veridical and false memories. *Stereotype Threat* occurs in a situation where a group member is at risk of fulfilling a negative stereotype about one's group (Steele and Aronson, 1995). This causes that person to focus more mental resources on the stereotype which takes away resources from the task. This can result in reduced performance compared to when the person did not think about the stereotype. Additionally, this study is aimed at determining how this affects veridical and false memories differently.

To do this, half of the white and half of the African American participants are randomly selected to be in either the *Stereotype Threat* condition or the *No Threat* condition. Then the participants receive semantically associated lists of words to remember. They are then given a memory test for those words. Their overall performance gives the researchers a better understanding of how *Stereotype Threat* affects veridical memory. Also, since the words were semantically related (e.g. *bed, rest, pillow…)* they have been known to cause participants to falsely remember the semantic associate (e.g. *sleep*). This relies on additional processes. Therefore, how participants misremember these semantic associates allows the researchers to better understand these other processes.

The information from this study will lead to a better understanding of not only when *Stereotype Threat* occurs, but also how it differently affects processes in memory. Understanding this can lead to the production of exams that do not fall prey to this phenomenon and, therefore, will level the playing field, so to speak, to give an accurate measure of one's abilities. To accomplish these goals you were either told that you were doing a simple laboratory task that did not measure ability or you were led to believe that this was a test of mental ability to measure racial differences. To maintain the integrity of the experiment the control participants were not told that the goals of this task were to examine racial differences. Because of this, you may withdraw from the study at any time (as was noted in the consent form) and you may withdraw the use of your data. If you do this your data will not be used in any scientific publications. I have been given the above information and fully understand my rights.

_____	_____	_____	_____
Participant name (Printed)	Date	Researcher (Printed)	Date

_____	_____
Participant Signature	Researcher Signature

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BIOGRAPHICAL INFORMATION

As an undergraduate John worked under Drs. Valerie F. Reyna and Charles Brainerd. In addition to memory research, this research also focused on human decision making, particularly the reduction of risky decision making in adolescents. John Biggan completed his Bachelor's degree in August of 2005, studying Psychology and Theatre. He immediately began graduate work focusing on Human Learning & Memory as well as Cognitive Neuroscience. His intentions are to complete his PhD under the supervision of Dr. Heekyeong Park. Following this he plans to pursue a career that involves research into the cognitive aspects of human aging.