

EXAMINING THE ROLE OF ANXIETY AVOIDANCE
IN THE EFFECT OF STEREOTYPE THREAT ON WORKING MEMORY
CAPACITY

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ABSTRACT

Describing a test as a measure of an ability certain groups are stereotyped to lack can hurt the performance of members of those groups. Steele and his colleagues call this effect *stereotype threat* (1997; Steele & Aronson, 1995; Steele, Spencer, & Aronson, 2002). Now well established, less is known about how stereotype threat reduces performance. The studies described in this dissertation were designed to follow up on past research showing that stereotype threat reduces performance by constraining working memory (Schmader & Johns, 2003). The primary hypothesis is that people experiencing stereotype threat devote cognitive resources that would normally be used for task performance to trying to avoid feelings of anxiety. In the first study, women completed an implicit reaction time measure of anxiety and a measure of working memory capacity under stereotype threat or non-stereotype threat conditions. The implicit measure was described as either related or unrelated to anxiety. The results revealed that women under stereotype threat showed evidence of increased anxiety when the implicit measure was described in neutral terms. However women in this condition showed evidence of anxiety avoidance when it was described as a measure of anxiety. Performance on the implicit measure was also correlated with stereotype threat-induced reductions in working memory. The second study tested whether eliminating the need to avoid feeling anxious would increase working memory. Caucasian and Latino participants completed the same implicit measure and working memory task under conditions that have been shown to create stereotype threat for Latinos. Half the participants were told that anxiety would not harm their performance on an intelligence

test and the remaining participants were not given any information about the effect of anxiety on performance. The results showed that informing Latino participants that anxiety would not harm performance reduced anxiety avoidance on the implicit measure and also improved their working memory. However, anxiety avoidance was not correlated with working memory reductions. The results of these studies provide evidence that anxiety avoidance might be one factor that contributes to the effect of stereotype threat on test performance. Limitations of these studies and suggestions for future research are discussed.

Chapter 1

INTRODUCTION

Standardized tests have become almost as unavoidable as death and taxes.

Students must take them to get into college and graduate school. High school students in Arizona will soon be required to pass the Arizona Instrument to Measure Standards (AIMS) test in order to graduate. Standardized tests are also widely used in employment settings and the military to assess skill sets and vocational aptitudes. Full implementation of the No Child Left Behind act will increase the frequency and importance of standardized testing to unprecedented levels for American public school children.

Nowhere is standardized testing considered more important than in college admissions. The use of standardized tests to evaluate and select prospective students was initially intended to create a merit-based system that would allow talented but economically less privileged students to gain access to the more selective and prestigious universities (Bowen & Bok, 1998). However, research continues to show that members of some groups do not do as well as others on these tests. Despite various social and economic programs designed to neutralize the influence of past inequities, African American and Latino high school students consistently underperform (compared to Whites and Asians) on college entrance exams like the Scholastic Aptitude Test (SAT; Jencks & Phillips, 1998; Roth, Bevier, Bobko, Switzer, & Tyler, 2001) and the General Record Exam (GRE; Whitworth & Barrientos, 1990). Women also tend to underperform

compared to men on the mathematical portion of these types of tests (Benbow, 1988; Hyde, Fennema, & Lamon, 1990; National Center for Education Statistics, 1997).

These performance gaps continue to be a subject of great interest to social scientists. An entire issue of the journal *Psychology, Public Policy and Law* (2005, issue 2) was recently dedicated to the subject of how to interpret group differences on intelligence (and related) tests. Several theories have been offered to explain why members of some groups do not fair as well as others in this domain. As the President of Harvard University, Lawrence Summers, recently found out, one of the more controversial ideas is that certain groups inherently lack the cognitive faculties needed to perform well on tests of intellectual ability. From this perspective, group differences stem from distal genetic influences that predispose some racial and ethnic groups (or men) to outperform others on intellectual tasks (Benbow & Stanley, 1983; Gould, 1996; Herrnstein & Murray, 1994; Rushton & Jensen, 2005). Other theorists have suggested that these performance gaps arise from persistent social and economic discrimination that has beset some groups more than others (e.g., McLoyd, 1998; Ogbu, 1978). Accordingly, minorities and women underperform in certain domains because they have historically been denied access to the educational and economic resources that tend to facilitate academic achievement (Kozol, 1991). A similar suggestion has been made that socialization differences might shape the goals and aspirations of these group members in ways that keep them from performing up to their potential in academic settings (e.g., Eccles, Jacobs, & Harold, 1990; Ogbu, 1981; Tenenbaum & Leaper, 2003).

The social and economic climate for minorities and women has improved significantly in the last 35 years. There is now a sizeable black middle-class and, for the first time, more women than men are attending college. However, performance gaps on standardized tests often remain even after equating for factors such as socio-economic status and academic preparation (Hacker, 1995; Miller, 1995). Although these inequities can account for some of the variance in group performance differences, there is still some aspect of the performance gap that often remains unexplained. One thing that has not changed as quickly for racial minorities and women is the prevalence of negative stereotypes about their intellectual abilities. There is consistent evidence that negative beliefs about members of historically stigmatized groups persist despite a social and legal climate that explicitly discourages the overt expression of such ideas (e.g., Banaji & Greenwald, 1995; Greenwald & Banaji, 1995; McConnell & Leibold, 2001; Sekaquaptewa, Espinoza, Thompson, Vargas, & von Hippel, 2003; Wittenbrink, Judd, & Park, 1997). Could this be an aspect of the performance gap that others theories have not considered?

Steele and his colleagues (Steele, 1997; Steele & Aronson, 1995; Steele et al., 2002) have proposed that the members of groups for which a societal stereotype alleges some type of deficiency can experience additional pressure when they are placed in a situation where their performance or behavior could be interpreted as evidence for the validity of that stereotype. As a result, the apprehension about possibly confirming the stereotype can disrupt the individual's performance and produce a stereotype-consistent outcome. Steele termed this experience of a self-evaluative threat embedded in the

context of a salient group identity *stereotype threat*. According to the theory, the additional concern with confirming a negative stereotype is a situation-specific experience that depends only on knowledge of the stereotype and not the belief that it is true.

In the initial test of this idea, Steele and Aronson (1995) administered African American and Caucasian undergraduates at Stanford University a test composed of some of the more difficult question from the verbal section of the GRE. In one condition designed to mirror standardized testing situations, this test was described as a diagnostic measure of intellectual ability. In a comparison condition, the test was described in non-diagnostic terms as a generic problem solving exercise. According to most explanations of the race gap, altering the description of this test should not have a significant effect on the performance of the African American students; African American students should perform worse than Caucasian students, regardless. However, stereotype threat makes a different prediction. From this perspective the cultural stereotype that African Americans are intellectually inferior makes the experience of completing a test related to this ability different than completing a non-diagnostic problem solving exercise. As a result, the test description should influence the performance of African Americans, but not Whites. Indeed, they found that although African Americans performed worse than their White peers when the test was described as being diagnostic of intellectual ability, they performed nearly equal to White students when the test was framed as a task unrelated to intelligence. In another study, Blacks underperformed relative to Whites when they were merely asked to indicate their race on a demographic survey prior to beginning the test.

These findings have since inspired a substantial body of research designed to test the prevalence of stereotype threat among different group members in other performance situations. For example, Spencer, Steele and Quinn (1999) tested whether the stereotype that women are less talented at math than men could undermine the performance of female participants on a difficult math test. When told that the test had revealed gender differences in the past, women performed worse than men. However, when the same test was described as “gender fair”, women’s performance matched that of men. The effect of stereotype threat on women’s math performance has since been replicated numerous times using a variety of manipulations and populations (e.g., Inzlicht & Ben-Zeev, 2000; Keller & Dauenheimer, 2003; O'Brien & Crandall, 2003; Sekaquaptewa & Tompson, 2003; Shih, Pittinsky, & Ambady, 1999). Research with other socially stigmatized group members has demonstrated that stereotype threat can reduce the intelligence test performance of children from low socioeconomic backgrounds (Croizet & Claire, 1998) and elderly individuals completing a memory test (Hess, Auman, Colcombe, & Rahhal, 2003). There is also evidence that the influence negative intellectual stereotypes can have an additive effect on performance. Gonzales, Blanton, and Williams (2002) found that Latinas were more susceptible to performance decrements on a math test than Latino men and White women. They argued that this effect results from Latinas double-minority status as women from an ethnic group that is stereotyped to lack intellectual ability.

The prospect of confirming a negative stereotype has also been shown to affect the performance of individuals from groups who are not normally considered socially stigmatized or devalued. Aronson and his colleagues (1999) found that White male math

majors performed more poorly on a math test when they were told that their performance would be compared to that of Asian men. Whites have also been found to perform more poorly than Blacks on a motor task when it is described to them as measuring their natural athletic ability (Stone, Lynch, Sjomeling, & Darley, 1999; Stone, 2002). A recent study has shown that Whites appear more racially biased when they think there unconscious attitudes towards African Americans are being measured with a reaction time task (Frantz, Cuddy, Burnett, Ray, & Hart, 2004). The fact that stereotype threat can influence performance regardless of whether someone belongs to a high or low status group attests to the situational nature of this threat.

Beyond establishing the generality of this effect, these and other studies have also explored individual differences that moderate stereotype threat. The results of several studies are generally consistent with Steele's (1997) proposition that a person must see the performance domain as relevant and meaningful to how they view themselves in order to be worried about confirming the stereotype. Thus, stereotype threat is more likely to reduce performance to the degree that the individual is identified with, or sees the domain as important to their sense of self-regard (Aronson et al., 1999; Frantz et al., 2004; Josephs, Newman, Brown, & Beer, 2003; Steele et al., 2002; Stone, 2002). Seeing membership in the negatively stereotyped group as a meaningful source of individual identity can also increase susceptibility to experiencing stereotype threat (Schmader, 2002), as can a predisposition to worry about being evaluated or judged in terms of one's membership in that group (Brown & Lee, 2005; Brown & Pinel, 2003). These studies indicate that not everyone has the same potential to experience stereotype threat when

performing tasks that are relevant to the cultural beliefs about what abilities a group they belong to might lack. At the same time, they also provide important information about factors that can place a person at risk for underperforming in high-stakes testing situations.

Overall, these findings provide consistent evidence that framing a task in terms of a negative stereotype about a social identity that one possesses can interfere with the ability to perform as well at a task as might otherwise be possible. Given the wide-reaching social implications of this effect, understanding the way that stereotype threat reduces performance is paramount. While the body of research establishing the existence of these effects continues to expand to different groups and performance domains, the processes by which stereotype threat reduces performance have remained elusive in most studies. Based on Steele and Aronson's (1995) original formulation, most researchers have focused on trying to identify and describe the nature of the "threat" engendered by this particular concern. The effect of stereotype threat on anxiety, evaluation apprehension, and lowered expectancies are just some of the affective constructs that have been measured as possible mechanisms. However, as will be discussed later in more detail, evidence regarding the phenomenology of stereotype threat and how it works to reduce performance is fairly inconsistent (Ryan & Ryan, 2005; Smith, 2004; Wheeler & Petty, 2001).

One consistent finding has emerged from the research establishing the ubiquity of this phenomenon in intellectual and academic testing situations. Stereotype threat tends to reduce performance on challenging tasks that require high-order cognitive processing to

complete successfully (Steele et al., 2002). Thus, one way stereotype threat might harm performance is by impacting the cognitive resources and skills that individuals might otherwise engage to perform up to their full potential. The purpose of the research reported here is to examine the effect of stereotype threat on one cognitive faculty in particular – working memory capacity. Past research has shown that stereotype threat can reduce working memory capacity (Schmader & Johns, 2003). However, there is no empirical evidence as to how this happens. The specific hypothesis under investigation is that attempts to avoid the anxiety created by stereotype threat consume the cognitive resources that would normally be allocated to task completion. Thus, stereotype threat reduces working memory capacity by inducing anxiety avoidance. Establishing the theoretical and empirical foundation for this hypothesis requires first reviewing research on working memory capacity. This review is followed by a discussion of research examining the experience of stereotype threat, responses to coping with stressful experiences and the effects of emotion regulation on affect and cognitive functioning.

Working Memory Capacity and High-Order Cognition

The ability to perform complex cognitive tasks, like the verbal and quantitative problems found on most standardized achievement tests, is often dependent on the capacity to take in, hold, and integrate information in a flexible and efficient manner. This basic ability is best captured by theory and research on working memory capacity. Baddeley and Hitch (1974) developed the basic theoretical underpinnings for the contemporary view of the working memory concept by integrating basic research on short-term memory and the nature of information processing in learning. The model they

described is composed of an interactive constellation of content-specific memory stores that operate in the service of a central executive process. In their model, working memory consists of a phonological loop that is designed to maintain the accessibility of verbally-based information and a separate visuospatial sketchpad that is used to hold visually-based information in an accessible form. The operation of these two slave systems is coordinated by a central executive processor that works to allocate attention between information held within and between the two memory stores while inhibiting the influence of irrelevant information that could interfere with task performance. Thus, the slave stores hold task-relevant information in an accessible form while the domain-free central executive coordinates the focus of attention and use of information in the stores. Beyond establishing this basic tripartite architecture, Baddeley and Hitch proposed that the capacity of the two memory stores and the executive processor are limited in the amount of information they can hold and the amount of attention that can be allocated to task-specific operations during performance.

Researchers have subsequently elaborated on this tripartite model to derive a variety of specific formulations of working memory based largely on the ideas Baddeley and Hitch (1974) described initially (Miyake & Shah, 1999). These models tend to differ with respect to the specific types of memory stores and the interrelationship between information storage and executive control, as well as whether working memory is domain specific or general. For example, Cowan's (1995) embedded process model describes working memory as a domain general function containing a resource-limited short-term memory store that facilitates access to information activated from long-term memory. In

comparison, Ericsson's (Ericsson & Delaney, 1999; Ericsson & Kintsch, 1995) model of working memory describes a more domain-specific system based solely on semantic and procedural information stored in long-term memory. In spite of such conceptual differences, the basic concept of information activation and maintenance protocols operating in the service of a limited capacity executive process has remained central in the theory of working memory capacity (Feldman-Barrett, Tugade, & Engle, 2004; Miyake & Shah, 1999).

Due to the commonalities inherent in the different models, contemporary research on working memory has focused, in one way or another, on the operation of the executive processes in complex cognitive activities (Miyake et al., 2000). Examination of the role played by the central executive in working memory was facilitated in large part by the research of Daneman and Carpenter (1980). Based on the Baddeley and Hitch model (1974), they developed a task with both information storage and attention allocation demands in order to test the role of working memory in reading comprehension. In this task, participants were asked to read a sentence aloud and memorize a single word that followed the sentence. After a series of sentence and single word combinations, participants were asked to recall as many of the single words as possible from the previous set. Daneman and Carpenter reasoned that the number of words a participant could hold accessible in the face of a competing processing task (i.e. reading sentences) would provide an index of the residual capacity that was available for attention allocation and information processing.

Using this task, Daneman and Carpenter found that performance on several measures of reading comprehension, including the SAT-Verbal, increased as the number of words recalled on the reading span task increased. In comparison, participants' ability to encode and recall words presented without a background processing task did not correlate with reading comprehension. These studies suggested that both the ability to keep information accessible and direct attention between competing tasks were necessary to explain individual differences in a complex skill like reading and comprehending dense prose. More importantly, these were some of the first studies to document the relationship between a dual-process measure of working memory and a specific higher-order cognitive ability.

In subsequent research, Turner and Engle (1989) tested Daneman and Carpenter's (1980) assumption that their findings were due to the fact that the processing task (reading sentences) was related to the domain of interest (reading comprehension). To test the influence of domain-specific processing efficiency (e.g., reading speed), they developed a dual-processing task that required participants to solve arithmetic equations, instead of reading sentences, while memorizing words for later recall. Thus, the processing task (solving equations) was designed to tap into the operation of a general domain-free central executive process. Whereas a domain-specific conceptualization of working memory capacity suggests that the processing task must be related to the target domain in order to predict performance, Turner and Engle found that the arithmetic operation span task predicted reading comprehension just as well as the reading span task used by Daneman and Carpenter. This finding provided important evidence for the

operation of a domain-free central executive process in the execution of complex cognitive tasks that require both information storage and controlled attentional resources. In addition, this study laid the empirical and methodological foundation for subsequent studies to examine the nature of the central executive process and its relationship to higher-order cognitive abilities, like fluid intelligence (Engle, Kane, & Tuholski, 1999a; Engle, Tuholski, Laughlin, & Conway, 1999b).

The general capacity model of working memory, proposed by Engle and his colleagues (Cantor, Engle, & Hamilton, 1991; Engle, 2001, 2002; Engle, Cantor, & Carullo, 1992), has influenced the majority of research on the nature of the central executive process that is captured by dual-processing measures of working memory. Consistent with the original Baddeley and Hitch model, the general capacity model suggests that dual-processing task like the arithmetic operation span task (OSPAN) capture a domain-free but limited ability to control the attention necessary to take in and use task-relevant information while inhibiting the potential influence of task irrelevant information. Thus, working memory capacity is conceptualized as a general ability akin to controlled attention and has specific capacity restraints (Engle, 2001, 2002; Kane, Bleckley, Conway, & Engle, 2001).

Research based on this model has largely been concerned with two concurrent goals: developing and validating measures of working memory that predict performance on complex cognitive tasks and testing specific predictions about the role of attention and resource allocation in completing such tasks. The primary approach to accomplishing these goals has focused almost exclusively on assessing how well individual differences

in performance on dual-processing tasks explain variation in performance on measures of higher-order ability, like the Ravens Advanced Progressive Matrices (Engle et al., 1999b), as well as measures that are thought to capture specific aspects of central executive processing, like Stroop interference (Kane & Engle, 2003). The individual difference approach is based on the assumption that as a general capacity, individual differences in working memory should predict differences in performance on measures that capture variance attributable to high-order cognitive functioning (Kane et al., 2004). Thus, individuals high in working memory capacity should have more attentional resources available for encoding, processing and retrieving information necessary to complete various tasks (Feldman-Barrett et al., 2004).

The empirical evidence produced to test the general processing model has generally supported the predictions suggested by this theoretical conceptualization. For example, Engle and his colleagues (1999b) tested the relationship between short-term memory (STM), performance on the OSPAN measure of working memory capacity (WMC), and fluid intelligence using a structural equations modeling approach. They found that WMC was significantly related to STM, as well as measures of fluid intelligence, but that STM was not related to fluid intelligence directly. Based on this finding, they suggested that it is the operation of central executive processes that drive the relationship between performance on dual-processing WMC tasks and measures of fluid intelligence.

Research comparing individuals high in WMC to individuals low in WMC directly has also provided support for the contention that working memory is a general

and resource-limited capacity involved in the completion of cognitively taxing activities. This research has shown that, compared to individuals low in WMC, high WMC individuals are better at maintaining the activation of task-relevant information (Cantor & Engle, 1993; Kane & Engle, 2003), directing the allocation of attention (Kane et al., 2001), and perform better overall on measures related to general intelligence (Conway, Cowan, Bunting, Theriault, & Minkoff, 2002; Engle et al., 1999a; SuB, Overauer, Wittmann, Wilhelm, & Schulze, 2002). One of the more intriguing findings to emerge from this research relates to the specific capacity to inhibit interference from task-irrelevant information. Research on this particular function of the central executive has shown that individuals high in WMC are less influenced by the potential impact of irrelevant information when completing tasks that demand focus and attention (Conway & Engle, 1994; Conway, Tuholski, Shisler, & Engle, 1999; Kane & Engle, 2000). For example, individuals who are high in WMC are less susceptible to the cocktail party effect (Conway, Cowan, & Bunting, 2001). That is, they are less likely to be distracted by self-relevant information (e.g., someone saying their name) when that information is irrelevant to their current information processing goals (i.e. attending to a conversation). Furthermore, Rosen and Engle (1998) found that individuals who scored high on the OSPAN measure of working memory capacity were better able to minimize the influence of intrusive thoughts while completing a resource demanding task. These findings are generally consistent with the idea that inhibition is a resource-dependent skill (Engle, Conway, Tuholski, & Shisler, 1995) and provide a link between working memory and thought regulation.

The role working memory plays in the ability to resist interference from information outside the realm of immediate task performance is particularly relevant when trying to understand the relationship between psychological stressors and high-order cognitive functioning. Research examining the effect of stress on working memory is often based on the finding that anxiety and worry can provide a source of distracting information (Eysenck, 1992; Sarason, 1984, 1988). Assuming that working memory is a limited capacity, researchers have examined whether environmental and intrapersonal sources of stress are associated with lower levels of working memory because they prime distracting thoughts that consume the residual capacity normally dedicated to task completion. In other words, stress and anxiety activate thoughts that compete for attention and therefore some amount of working memory must be dedicated to controlling the influence of these thoughts when they are irrelevant to the task at hand. Research testing this idea has shown that people who are chronically stressed tend to have lower levels of working memory capacity (Eysenck & Calvo, 1992; Klein & Boals, 2001b). There is also evidence that individuals high in trait anxiety (MacLeod & Donnellan, 1993; Sorg & Whitney, 1992), as well as math anxiety (Ashcraft, 2002; Ashcraft & Kirk, 2001; Miller & Bichsel, 2004) show reduced working memory capacity during high-pressure performance situations.

Recent research has examined the effect of situational stress on working memory capacity further using experimental methods (Lavric, Rippon, & Gray, 2003). For example, Beilock and Carr (2005) compared the performance of high and low WMC individuals under conditions of low and high performance pressure. As past research

would predict, high WMC participants outperformed low WMC participants on a mathematical task that is working memory dependent when performance pressure was low. However, when pressure was high there were no significant performance differences between the high and low WMC participants on the math problems. Beilock and Carr suggested that pressure reduced the performance of high WMC participants by creating an additional cognitive load that essentially consumed the capacity they would normally dedicate to task performance. As a result, high WMC individuals lost the processing advantage they often have when completing complex cognitive activities (see also Beilock, Kulp, Holt, & Carr, 2004 for converging evidence of this idea).

There is also some evidence that ameliorating a source of worry or distracting thoughts can increase working memory capacity. Drawing on research showing that writing about stressful and traumatic experiences can improve psychological well-being (Pennebaker, 1989, 1997), Klein and Boals (2001a) found that first year college students who wrote about the stresses of college life for 7 weeks showed significant increases in their working memory capacity. Taken together, this research is generally consistent with the proposition that working memory is involved in preventing intrusive or distracting thoughts from interfering with the execution of cognitively demanding tasks. It appears that both environmental and intrapersonal sources of stress and anxiety can inadvertently consume cognitive resources that are often critical for the successful completion of these types of tasks.

How does Stereotype Threat Hurt Test Performance?

The effects of anxiety and pressure on working memory offer one explanation for how stereotype threat might undermine performance on challenging intellectual tests. The added pressure to avoid stereotype confirmation might prime negative thoughts and feelings that compete for resources when completing a challenging test that requires high-order cognitive ability. Studies that have measured the effects of stereotype threat on cognitive processes and functioning have documented several findings that are consistent with this possibility. The most direct evidence that stereotype threat hurts performance by impacting cognitive functioning comes from research by Schmader and Johns (2003), who tested the effects of stereotype threat on working memory capacity. In the first study, women and men completed the OSPAN task under one of two conditions. In the control condition, the task was described as a measure of working memory. In the stereotype threat condition, they described the task as a measure related to mathematical aptitude (“quantitative capacity”) and mentioned that this capacity might be related to gender differences on standardized math tests. Women who completed the OSPAN task when it was described in terms of math ability recalled the significantly fewer words compared to men in this condition, and men and women in the control condition. This result suggests that women’s ability to simultaneously process, hold, and retrieve information was disrupted when they thought their math ability was being assessed. A second study comparing the working memory of Caucasian and Latino students replicated this effect. Latino students showed reduced working memory capacity on the OSPAN when it was described as a measure related to intelligence, an ability they are stereotyped to lack.

In the final study, women completed a short version of the reading span task just before taking a test composed of difficult word problems from the quantitative section of the GRE. In the control condition, the experiment was described as a study of cognitive processes and women completed these tasks in small same-sex groups. In the stereotype threat condition, the experiment was described as a study of math ability and women completed these tasks as the only female in a group with two other men. Women in the stereotype threat condition showed reduced working memory and also were less accurate on the math test compared to women in the control condition. In addition, reductions in working memory capacity mediated the effect of stereotype threat on math performance.

Other work has also shown that stereotype threat can have a negative effect on cognitive functioning. In a subsequent study, Croizet and his colleagues (2004) showed that reductions in heart rate variability – a physiological reaction associated with increased cognitive load (Jorna, 1992) –also mediated the effect of stereotype threat on the test performance of psychology students who thought their intelligence was being compared to the intelligence of engineering students. Quinn and Spencer (2001) tested the complementary hypothesis that stereotype threat disrupts the ability to formulate the problem-solving strategies necessary to answer difficult questions of the sort found on the quantitative section of the GRE. They found that women underperformed compared to men on word problems that required extracting an equation to represent the relationships between the critical variables. However, women and men performed equally when they were presented with theses equations in a purely algebraic form. A second study revealed

that women under stereotype threat were less efficient than men at developing successful strategies for solving the mathematical word problems under time constraints.

These studies offer converging evidence that stereotype threat undermines performance on academic tasks by impacting the cognitive resources that are required to complete these tasks successfully. However, the question remains as to *how* exactly stereotype threat interferes with cognitive functioning. Research on the relationship between working memory impairment and anxiety would suggest distracting thoughts and feelings as a likely source of these cognitive deficits. Stereotype threat researchers have also proposed that increased anxiety and doubt play a role in causing performance decrements (Steele, 1997; Steele et al., 2002). The assertion that reduced performance results from an added pressure or concern about performing well has led many researchers to examine the role of anxiety, evaluation apprehension and distraction in producing stereotype threat effects. However, the results of these studies have been mixed.

Several studies have shown that stereotype threat conditions produce higher levels of self-reported anxiety (Study 2, Schmader & Johns, 2003; Spencer et al., 1999; Stone, Lynch, Sjomeling, & Darley, 1999) and concern about being evaluated (Aronson et al., 1999) that paralleled (but did not correlate with) performance decrements on complex tasks. Only two studies have found that that self-reported anxiety partially mediated the negative effects of stereotype threat on women's math performance (Osborne, 2001; Spencer et al., 1999). Several additional studies have also found evidence suggesting that stereotype threat increases anxiety using approaches that did not depend on self-reports.

For example, Blascovich, Steele, Spencer, and Quinn (2001) found that African Americans showed increases in blood pressure under stereotype threat conditions. Stone et al. (1999) were able to reduce the effects of stereotype threat on performance by providing participants a cue to attribute any tension or discomfort they were feeling to the lighting conditions in the laboratory where the study was being conducted. This arousal misattribution effect has recently been replicated by Ben-Zeev, Fein and Inzlicht (2005), as well as Johns, Schmader and Martens (2005). Research examining the idea that stereotype threat could be harming performance by activating distracting thoughts has shown that thoughts related to the negative stereotype, as well as doubt, are more accessible for participants in stereotype threat situations (Davies, Spencer, Quinn, & Gerhardstein, 2002; Davies, Spencer, & Steele, 2005; Steele & Aronson, 1995; Stone, 2002), and these thoughts are correlated with performance (and related) variables.

It is interesting to note that the more consistent evidence for anxiety and distraction has been produced using either manipulations (e.g., external attribution cues) or relatively indirect measures with low face validity (e.g., word-fragment completions). In comparison, there is very little consistent evidence for the experience of negative affect or distraction when these experiences are measured directly with self-report measures. In a recent review, Smith (2004) noted that the vast majority of studies using strictly self-report questionnaires have failed to find evidence that anxiety is related to poor performance under stereotype threat conditions. One recent study in particular highlights this inconsistency between self-reports and indirect measures. Bosson, Haymovitz, and Pinel (2004) found that participants in the stereotype threat condition did

not indicate increased levels of anxiety on a self-report questionnaire even though analysis of their non-verbal behavior suggested that they were in fact feeling anxious and uncomfortable in the performance situation. More interestingly, it was the non-verbal index of anxiety that mediated poor performance on the critical task.

This apparent dissociation between self-report and more indirect measures could be interpreted in one of two ways. First, it could suggest that stereotype threat is a relatively non-conscious experience (Wheeler & Petty, 2001). Self-report measures of anxiety and distraction might be uncorrelated with indirect measures simply because individuals do not have conscious access to the psychological processes that are undermining their performance (Nisbett & Wilson, 1977). Another possible explanation for the differences between self-report and indirect measures of anxiety-related constructs is that people experiencing stereotype threat are trying to deny or avoid acknowledging the negative thoughts and feelings that are primed when the test they are taking is seen as diagnostic of ability. As a result, they may actually underreport what they are thinking and feeling when asked to describe their experience directly on a self-report questionnaire.

Though it is difficult to disentangle these two explanations completely, there are several pieces of empirical evidence that reduce the plausibility of the idea that stereotype threat effects result from a purely non-conscious process, like mere stereotype activation (Bargh & Chartrand, 1999; Wheeler & Petty, 2001). In addition to providing evidence of increased thought accessibility, research by Steele and Aronson (1995) and Stone (2002), as well as Keller (2002), has shown that participants in stereotype threat conditions are

more likely to claim or create impediments that could explain a poor performance (i.e., self-handicap). Davies et al. (2002) have shown that women experiencing stereotype threat try to avoid stereotype-relevant tasks (i.e., math problems) when given the option to complete stereotype-irrelevant tasks (i.e., verbal analogies) (see also Davies et al., 2005). Similar to Davies et al., Steele and Aronson (Study 3) also found that African Americans were less likely to indicate their racial identity before completing a test described as diagnostic of intellectual ability.

Although these findings are by no means definitive, employing ego-defensive strategies to minimize the stereotype-confirming implications of a less-than-optimal performance suggests that stereotype threatened individuals might have some awareness of the thoughts and feelings that are activated in such situations. It is unclear how non-conscious processes *alone* could explain why targets of stereotype threat would try to create ambiguity about the reason for their underperformance, avoid stereotype-relevant tasks or dissociate their individual performance from their negatively stereotyped social identity. Consequently, it does not seem unreasonable to assume that people experiencing stereotype threat have some perception of the thoughts and feelings that past research would suggest are primed under these conditions. This perspective would be reinforced further if there were a conceptual framework to explain why stereotype threat might make people reticent to acknowledge their experience. In fact, there is a substantial body of theory and research on the psychological aspects coping with stressful experiences that could explain why people experiencing stereotype threat might actually try to deny or avoid what they are actually thinking and feeling. Furthermore, research on emotion

regulation suggests that the act of anxiety avoidance might be effortful enough to consume working memory resources necessary for successful performance on complex cognitive tasks.

Coping with Stress and Emotion Regulation

According to the appraisal-based model of stress and coping proposed by Lazarus and Folkman (1984), attempts to avoid or suppress the negative feelings associated with stressful situations can occur when two levels of subjective construal converge. At the level of primary appraisals, situations that are perceived in terms of a risk to one's sense of self-integrity or loss of self-esteem tend to be seen as threatening and produce feelings of anxiety (Lazarus, 1991, 1999). Secondary appraisals involve assessing one's options for dealing with the situation and the feelings evoked by the primary appraisal of the situation. If an individual perceives that they have the ability to change the situation or avoid a negative outcome, either directly through behavior or indirectly by changing their perception of the situation, they are likely to adopt a problem-focused approach to coping (Folkman & Lazarus, 1985; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Lazarus, 1991). Using this strategy, a college student facing a tough vector calculus mid-term exam might resolve to study at least three hours a day in the week before the exam along with trying to perceive her exam as an opportunity to learn challenging material.

People are more likely to adopt an emotion-focused approach to coping if the threatening situation seems unavoidable or they are uncertain about their ability to control the outcome (Avero, Corace, Endler, & Calvo, 2003; Folkman & Lazarus, 1985; Skinner

& Brewer, 2002). As a result, emotion-focused coping tends to involve attempts to repress or deny the negative thoughts and feelings that are primed by the situation. In comparison to problem-focused coping, a student adopting an emotion-focused coping strategy might try to avoid thinking about the upcoming exam and deny that she is worried about the prospects of doing poorly and losing her academic scholarship.

Research designed to examine the relationship between appraisals and coping indicates that situations perceived as unavoidable self-integrity threats often lead to this type of emotion-focused response (Folkman & Lazarus, 1988; Lazarus, 1991). In complementary research, Twenge and her colleagues (2003) have recently shown that the prospect of social isolation – possibly one of the more fundamental self-threats a person can experience (Baumeister & Leary, 1995) – reduces emotional expressiveness on self-report measures of negative affect. Matheson and Cole (2004) have also shown that perceiving a threat to a particular social identity as a stressor is associated with emotion-focused coping. Together these findings suggest that people experiencing stereotype threat – a situation that both theory and research suggest is ego-threatening (e.g., Martens, Johns, Greenberg, & Schimel, in press) – might be especially likely to deal with their predicament by engaging in emotion-focused coping strategies that involve trying to avoid or deny the negative thoughts and feelings that are primed in such situations. Considering that stereotype threat can increase thoughts of doubt and induce a general focus on avoiding negative outcomes (Seibt & Forster, 2004; Smith, 2004), emotion regulation might be a relatively natural and habitual response when faced with the prospect of confirming a negative group stereotype. Indeed, the inclination to adopt such

a defensive strategy might be encouraged further by a general intuition that anxiety and worry can hurt performance on difficult intellectual tasks (Greenberg, Pyszczynski, & Paisley, 1985; Smith, Snyder, & Handelsman, 1982). So, if excelling in vector calculus is strongly tied to the self-concept of a student, then it follows that she might be highly sensitive to the experience of anxiety and the negative effects it could have on her ability to get an A on the mid-term. Moreover, if she experiences anxiety due to stereotype threat while she is taking her exam, she might be that much more inclined to avoid those anxious thoughts and feelings (Spencer, Iserman, Davies, & Quinn, 2001, as cited in Steele et al., 2002).

The idea that targets of stereotype threat try to regulate their emotional experience by avoiding or denying the feelings associated with threat offers a specific explanation for one of the ways stereotype threat reduces working memory. Research on the effects of emotion regulation has shown that trying to control negative feelings can exact a measurable toll on cognitive functioning (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Butler et al., 2003; Gross & Levenson, 1997; Richards & Gross, 2000). For example, Schmeichel, Vohs and Baumeister (2003) instructed a group of participants to avoid showing any visible signs of emotion while viewing a film containing distressing images. Following this emotion regulation task, the participants were administered a test that contained elaborate logic problems taken from the analytical section of the GRE. Compared to participants who were not given any instructions while viewing the film, participants who had been instructed to avoid expressing any negative emotions performed significantly worse on this test. However, emotional suppression did not

impair performance on a test requiring the use of simple heuristics and general knowledge. Schmeichel et al. suggested that suppression only affected performance on the analytical test because controlling emotional expression depleted the resources necessary to complete a task that depends heavily on high-order cognitive functioning. In addition to depleting the resources required for optimal cognitive functioning, emotion regulation can also have the ironic effects of increasing autonomic arousal (Gross, 1998, 2002; Gross & Levenson, 1993), priming physiological responses associated with perceptions of threat (Mendes, Reis, Seery, & Blascovich, 2003) and reinforcing the emotional state one is trying to change (Wegner, Erber, & Zanakos, 1993).

Drawing direct comparisons between research on emotional suppression and stereotype threat is somewhat difficult given differences in the methods used to study these two phenomena. Participants in emotional suppression research are generally instructed to inhibit the outward expression of the negative feelings that are evoked when viewing disturbing images. Thus, they are not explicitly instructed to regulate their experience of the emotion in the same way someone experiencing stereotype threat might spontaneously try to avoid feeling anxious. Nevertheless, there are a number of interesting parallels between the effects of emotion regulation and stereotype threat on self-reports of emotional experience, physiological reactions, and cognitive functioning. Even though participants in emotion regulation studies are typically instructed only to avoid showing visible signs of distress, they often self-report experiencing less intense emotions than participants not given any instructions to avoid expressing (Gross & Levenson, 1993, 1997). There is also evidence that stereotype threat evokes physiological

arousal patterns similar to those associated with emotional suppression (Ben-Zeev et al., 2005; Blascovich, Spencer, Quinn, & Steele, 2001; Croizet et al., 2004). Research on stereotype threat has also documented an interaction between threat and task difficulty similar to the findings of Schmiechel et al. (2003). In the domain of cognitive tests, stereotype threat tends to reduce performance only on difficult tasks that push the limits of the test-takers' abilities (O'Brien & Crandall, 2003; Quinn & Spencer, 2001; Spencer et al., 1999; Steele, 1997).

The research reviewed thus far leads to a specific hypothesis about how stereotype threat reduces performance on tests of intellectual ability. Considering that, 1) anxiety and worry can reduce working memory capacity, 2) stereotype threat reduces working memory capacity, 3) ego-threats can lead to avoidance or denial of negative thoughts and feelings, 4) people experiencing stereotype threat tend not to report feeling anxious, and 5) emotion regulation can impair high-order cognitive function, stereotype threat might reduce performance on complex cognitive tasks by promoting the avoidance of anxiety-related thoughts and feelings. The ultimate outcome of avoiding anxiety is a reduction in the cognitive resources available to complete intellectual tests that demand a great deal of mental clarity, attention and focus.

THE PRESENT STUDIES

The purpose of this research was to test the idea that individuals experiencing stereotype threat allocate cognitive resources to the process of avoiding the experience of anxiety and negative affect. The question is whether anxiety avoidance is associated with reductions in working memory capacity, which has been shown to mediate the effect of

stereotype threat on performance (Schmader & Johns, 2003). Experiment 1 tested this hypothesis by manipulating stereotype threat among a sample of women in the domain of math ability. The primary prediction was that women would show evidence of anxiety avoidance when the testing situation was framed as related to math ability and women were aware that their anxiety levels were being assessed. It was also expected that as anxiety avoidance increased, working memory would decrease.

To test this hypothesis, an implicit reaction time measure of anxiety (Mathews & MacLeod, 1986; described in detail below) was adapted in order to manipulate whether or not participants thought their anxiety was being assessed before completing a measure of working memory. In one condition, the implicit anxiety measure was described in neutral terms in order to measure participants' anxiety levels without their awareness. It was expected that women under stereotype threat would show evidence of increased anxiety in this condition (compared to control). In a second condition, participants were told that the task was designed to measure how anxious they were feeling and given information about how the task works. If women under stereotype threat are trying to avoid thinking about and feeling anxiety, then they should respond as if they are not anxious when they are given information about the true purpose of the reaction time task. Participants also completed self-report measures of anxiety, doubt, and evaluation apprehension, along with questions designed to assess their primary and secondary appraisals of the performance situation. Based on past research, responses to the anxiety-related questionnaire items were not expected to vary as a function of stereotype threat. The measures of primary and secondary appraisals were exploratory.

The second experiment was designed to demonstrate that eliminating the need to avoid feeling anxious would eliminate evidence of anxiety avoidance and improve working memory. This hypothesis was tested by comparing the performance of Caucasian and Latino students under conditions that have been shown to produce stereotype threat for Latinos in past research (Gonzales et al., 2002; Schmader & Johns, 2003). Participants again completed the reaction time measure of anxiety, followed by the working memory test, while expecting to take a test related to intelligence. In one condition, participants were told that the reaction time task was designed to measure how anxious they were feeling. In a second condition, participants were also told that the task measured anxiety but that past research had shown that increased anxiety was not related to performance on the intelligence test they thought they would be taking. This anxiety reappraisal manipulation was designed to eliminate the motivation to avoid anxiety and improve working memory among Latino participants under stereotype threat. Participants again answered the same self-report questions used in the first study. Results consistent with these hypotheses would support the idea that stereotype threat reduces working memory capacity by increasing the tendency to avoid and deny the negative feelings that are primed by the prospects of taking a diagnostic test in a stereotype-relevant performance domain.

Chapter 2

STUDY 1

Methods

Participants and Design

The participants were 85 Caucasian female psychology students who participated for course credit or \$10. Participants were recruited for participation if they reported in a previous mass survey that they had scored at least 500 on the quantitative section of the SAT (or equivalent converted ACT score) and were aware that women are stereotyped as below average in math ability. Stereotype knowledge was assessed with the question, “Regardless of what you personally believe, what is the stereotype that people have about women’s math ability, in general?” (rated on a 7-point scale where 1 = *well below average*, 4 = *about average* and 7 = *well above average*). Only women who responded 3 or lower on the scale were recruited. Responses to this question were distributed fairly normally (Mean = 3.73, Median = 4) and an average of 44% of women responded 3 or lower in the two semesters when this study was conducted.

Participants were randomly assigned to one of four conditions in a 2 (stereotype threat) X 2 (anxiety measure description) between-subjects factorial design. Data from one woman in the control condition was lost due to a computer malfunction. In addition, data from two women were omitted, one because she failed to follow the instructions on the computer tasks and one because she knew a member of the study personnel. All analyses were conducted on a final sample of 82 women.

Materials and Measures

Dot probe task. Anxiety and anxiety avoidance were measured using the dot probe task (Mathews & MacLeod, 1986). In this task, participants completed a series of trials in which two words are presented on a computer screen simultaneously. One word appears 1.5 cm above the center point of the screen and the other word appears 1.5 cm below the center point. The words remained on the screen for 1 sec and were immediately replaced by a dot that appeared either in the position of the word above the center point or below the center point. Participants were instructed to indicate whether the dot is located in the top-word position or bottom-word position as quickly as possible using the keyboard. The dot disappeared once the participant had made a response or 2000 ms has elapsed.

On the critical trials, one of the words in the pair was a word related to anxiety or threat (e.g. *nervous, anxious, scared*) while the other was a neutral word matched for length and frequency (the anxiety-related words used in present studies are presented in Appendix A). The version of the dot probe task administered in this study contained 20 critical trials that included one anxiety word, and 10 filler trials containing only neutral words. The words were presented in black Courier New font on a light gray background. The position of the dot varied randomly such that it appeared in the same position as the anxiety word for half of the critical trials and in the position of a neutral word for the remaining trials. The position of the anxiety word also varied randomly such that it appeared in the top position for half of the trials and in the bottom position for the remaining trials. Participants indicated the location of the dot by pressing the *C* key if the

dot appeared in the top-word position and the *M* key if the dot appeared in the bottom-word position. Reaction times were recorded starting from the onset of the dot's appearance. In order to assure that participants read the words presented on each trial they were told that they would be given a cued recall test of the words at the end of the experiment (but no test was actually administered).

An index of *attention allocation* to anxiety-related words was computed by subtracting the average reaction time to identify the location of the dot when it appeared in the same location as the anxiety word from the average reaction time for trials when the dot appeared in the same position as the neutral word. Thus, higher positive differences in average reaction time indicate increased vigilance for anxiety-related stimuli. The logic of this index is based on the finding that anxiety tends to increase vigilance toward anxiety- or threat-related stimuli (Broadbent & Broadbent, 1988; MacLeod, Mathews, & Tata, 1986).

Working memory test. Working memory capacity was measured using a version of a dual-processing test called the reading-span task, which has been used extensively by Engle and his colleagues to assess working memory (e.g., (Turner & Engle, 1989). In this task, participants were presented with a sentence and asked to count the number of vowels contained in the words in the sentence. A word was presented after each sentence for later recall. At the end of a series of sentence/word combination trials (i.e., a set) participants were asked to recall as many of the words from the proceeding series as possible. Working memory capacity is indexed as the number of words that participants recall correctly from each sentence/word set.

The task included 12 sets of sentence/word trials each of which included between 4 and 6 sentence/word combinations (i.e., there were four blocks of each set size for a total of 60 sentence/word trials). The sets were presented in random order so participants did not know how many sentences and words they would be required to evaluate and recall at the beginning of each set. The working memory test used in this research contained a total of 60 words that were randomly selected from a pool of one-syllable words used by La Pointe and Engle (1990). The sentences were 10 to 12 words long and contained an average 10.45 vowels. The sentences and words were presented in random order within each set, but the same words and sentences appeared together in each set.

The test was administered on a computer and the participant controlled the presentation of the stimuli with their responses. Participants were instructed to count the vowels quickly and accurately while also remembering the words for later recall. Each set began with the presentation of a sentence to be evaluated. After recording the number of vowels contained in the words in the sentence, participants were presented a to-be-remembered word for 1 second. A blank screen lasting 1 sec separated the presentation of each sentence and word. After presentation of all sentence/word combinations in a set, participants were prompted to recall all of the words in that set. Each set was separated by the prompt “next set,” which was displayed for 3 seconds. The computer recorded the words recalled, the number of vowels counted, and the time participants spent counting the vowels in each sentence.

Procedure

In order to prime and maintain the salience of stereotype threat during the completion of the dot probe and working memory test we adapted procedures used by Inzlicht and Ben-Zeev (2000; see also Schmader & Johns, 2003) to test the effects of solo gender status on women's math performance. Participants in both conditions participated in groups of three people. Women in the stereotype threat condition completed the working memory test in a session conducted by a male experimenter with two other male confederates. Women in the control condition completed the working memory test in a session conducted by a female experimenter along with two other female participants.

Upon entering the lab the participants were seated at adjacent computer workstations, asked to read and sign the consent form and then given a brief overview of the experimental session. In the stereotype threat condition the female participant was seated at the middle workstation so that she was flanked by the two male confederates. The experimenter then explained that the purpose of the study was to administer a test of mathematical aptitude in order to collect normative data on men and women. In the control condition participants were told that the purpose of the study was to administer a problem solving exercise in order to collect normative data on college students. All participants were told that they would complete the problem solving exercise/ math test in two parts, separated by two filler tasks. Participants in both conditions were informed that they would have 10 minutes to work on the first set of problems and that they would receive feedback about their performance on the problem solving/ math test at the end of the experiment, after they had completed both parts of the exercise/ test. The

experimenter then gave the participants scratch paper and instructed them to begin the first problem set, which was presented on the computer. The problems were five multiple-choice word problems taken from the quantitative section of the General Record Exam that had been included in actual GRE tests (1994). The problems selected had been answered correctly by an average of 40% of test takers in past administrations.

After completing the first set of word problems, participants were presented with the dot probe task. In the neutral description condition, the task was identified as a measure of perceptual focus while in the anxiety measure condition the task was identified as a measure of state anxiety. Participants in both conditions were presented with a description of the task and instructions for how to record their responses using the keyboard. In the anxiety-relevant condition participants were also told that, “people who are feeling more anxious should be quicker to identify the location of the dot when it appears in the same position as the anxiety-related word.” Participants were allowed to complete six practice trials that contained only neutral word pairs before the completing the 30 critical trials (20 pairs containing one anxiety-relevant word and 10 neutral filler pairs).

Describing the dot probe task as a measure perceptual focus was designed to reduce the relevance of anxiety for responses on the task, allowing the dot probe task to act as an implicit measure of anxiety in this condition. Thus, participants should be faster to identify the location of the dot when it appears in the same location as the anxiety word if they are feeling anxious or threatened (i.e., higher values should indicate greater implicit anxiety). In contrast, describing the task as a measure of anxiety was designed to

increase the relevance of anxiety for responding on the task, allowing the dot probe task to act as a measure of anxiety avoidance in this condition. Informing participants about the pattern of responses that would indicate increased anxiety should lead those participants who are motivated to avoid anxiety to alter their responses by allocating more attention to neutral as opposed to anxiety-related stimuli. Thus, if participants are trying to avoid anxiety under stereotype threat they should be slower to identify the location of the dot when it appears in the same location as the anxiety word because they are actively attempting to avoid anxiety or threat related thoughts (i.e., lower values should indicate greater anxiety avoidance).

Participants were presented with the working memory task immediately after completing the dot probe task. This task was identified as a filler task in all conditions. As with the dot probe, participants were first given a general overview and allowed to complete a practice set of three sentence/word combinations. They were told that their performance on this task would be based on both how accurately they counted the vowels in the sentences and the number of words they recalled at the end of each set.

After all the participants had completed the working memory task they were asked to complete a brief questionnaire (described below and presented in Appendix B). Once finished with the questionnaire, the experimenter announced that there would not be sufficient time to complete the second set of problems.¹ Participants were then probed for suspicion, debriefed and thanked for their participation.

¹ The second test was not administered given that previous research has established the relationship between working memory and performance (i.e., Schmader & Johns, 2003). In addition, participant fatigue might have undermined performance in all conditions, making it difficult to measure performance differences between conditions.

Self-report Questionnaire

Anxiety and doubt. To assess levels of anxiety, participants rated how much they felt *agitated, anxious, nervous, uneasy, and worried* at the present moment using a 7-point scale anchored by *not at all* (1) and *very much* (7). Using the same scale, participants also rated how much they felt *doubtful, foolish, inferior, insecure, and unsure* as a measure of doubt. The items from each scale were averaged to form an index of self-reported state anxiety ($\alpha = .86$) and self-reported doubt ($\alpha = .91$) where higher numbers indicated more anxiety and doubt, respectively.

Situational appraisals. Participants answered several questions designed to assess their appraisal of the demands of the upcoming problem solving/math test (i.e., primary appraisal) and their ability to cope in the testing situation (i.e., secondary appraisal). To assess primary appraisals participants rated how *difficult* they expected the problems to be on the second set of problems using a 7-point scale from *extremely easy* (1) to *extremely difficult* (7). They next rated how much *pressure* they felt to do well on these problems. To assess secondary appraisals participants rated how much they felt they possessed the *skills* to do well using a 7-point scale anchored by *not at all* (1) and *very much so* (7). Participants also rated their ability to cope with the demands of the upcoming problem set. Finally, they rated how well they expected to perform on the upcoming problem set using a 7-point scale anchored by *extremely poorly* (1) and *extremely well* (7). The exact wording for these items is presented in Appendix b.

Stereotype threat related variables. Participants rated how they expected men and women to do relative to each other (*participant expectation*) and also how they thought

the researcher expected men and women to do relative to each other (*researcher expectation*) on the second task using a 7-point scale anchored by *men will score better than women* (1) and *women will score better than men* (7), with *men and women will score the same* as the midpoint (4).

Participants answered several additional questions designed to assess how concerned they were about the researcher's impression of their ability and performance on the problem solving/math test. Using a 7-point scale anchored by *strongly disagree* (1) and *strongly agree* (7), participants rated how concerned they were that 1) the researcher would think they have less ability if they did not do well on the exercise/test, and 2) the researcher would judge them based on their performance. These two items were internally consistent ($\alpha = .80$) and averaged to form an index of *evaluation apprehension*. Participants also rated how strongly they agreed with the statement that the researcher believed men and women differ in their natural problem solving/mathematical ability.

Importance. Participants rated how *important* their performance was and how much they *cared* about doing well on the problem solving exercise/math test using a 7-point scale, anchored by *strongly disagree* (1) and *strongly agree* (7). Responses to these questions were internally consistent ($\alpha = .93$) and averaged to form an index of importance.

Results

All performance measures were analyzed using a 2(stereotype threat) x 2(anxiety measure description) between-subjects analysis of variance. Descriptive statistics for the performance measures (collapsed across conditions) are displayed in Table 1.

Table 1
Descriptive Statistics for Performance Variables in Study 1.

	Mean	Median	SD	Minimum	Maximum
<i>Dot Probe Task</i>					
Attention allocation index (in milliseconds)	-1.36	-2.20	48.62	-147.40	114.90
Facilitation trials	507	476	119	315	887
Inhibition trials	506	494	119	314	848
Error rates	1.73%	0.00%	3.46%	0.00%	13%
<i>Working Memory Test</i>					
Total words recalled	49.34	51.00	6.30	27	59
Absolute span score	28.73	29.50	12.16	4	55
Vowel counting accuracy	.84	.85	.08	.55	.93
Average time counting vowels (in seconds)	8.25	8.01	2.09	4.92	18.35

Note. *Facilitation* trials are trials when the dot appeared in the same location as the anxiety word.

Inhibition trials are trials when the dot appeared in the opposite position from the anxiety word.

Dot probe

An index representing attention allocation toward anxiety-related words was computed by subtracting the average reaction time on trials when the dot appeared in the same location as the anxiety word from the average reaction time on trials when the dot appeared in the opposite position from the anxiety word. Higher mean differences indicate greater attention toward anxiety-related words (relative to neutral words). Only reaction times for correct responses were included in the computation of the anxiety index. Error rates were not affected by the manipulations and were low overall ($GM = 1.73\%$). A Kolmogorov-Smirnov test indicated that the attention allocation index scores were normally distributed ($Z = .57$).

Analysis of the anxiety index yielded only a significant interaction effect, $F(1, 77) = 6.41, p = .01$.² Simple main effects tests revealed that when the task was described as a measure of perceptual focus women in the stereotype threat condition showed greater attention toward anxiety-related words ($M = 15.68, SD = 33.46$) compared to women in the problem solving condition ($M = -15.28, SD = 50.41$), $F(1, 77) = 4.02, p = .05$ ($d = .72$). This response pattern suggests that women under stereotype threat were experiencing greater levels of anxiety compared to women in the control condition. When the task was described as a measure of anxiety, women under stereotype showed a tendency to shift attention away from anxiety-related words ($M = -16.83, SD = 52.65$) compared to women in the problem solving condition ($M = 6.83, SD = 52.43$), but this difference was only marginal, $F(1, 77) = 2.44, p = .12$ ($d = .45$). Simple main effects analysis within the stereotype threat condition revealed that when the dot probe task was described as a measure of perceptual focus, women directed more attention toward anxiety-related words compared to when the task was described as a measure of anxiety, $F(1, 77) = 5.16, p < .05$ ($d = .73$). This response pattern suggests that women under stereotype threat were attempting to avoid anxiety when they were aware that the dot probe task was a measure of anxiety. Women in the problem solving condition did not show differential attention toward anxiety-related words when the task was described as a

² Analyses involving the dot probe task are 1 degree of freedom lower because one participant did not understand the instructions and failed to respond correctly on any of the critical trials.

measure of perceptual focus compared to when the task was described as a measure of anxiety, $F(1, 77) = 1.84$ ($d = .43$). Figure 1 displays this interaction pattern.³

Working Memory Capacity

Absolute span score. Working memory capacity was analyzed using the number of words recalled taking into account only sets recalled perfectly (called the *absolute span score*). The absolute span score is derived by summing the total number of words from only those sets of words where all the words in the set were recalled correctly. So, if a participant only recalled three words from a four-word set then these three words would not count toward the total score. If, on the other hand, all four words were recalled correctly, all four words would count toward the final score. In this way, the absolute span score is thought to provide a more sensitive measure of working memory capacity (La Pointe & Engle, 1990).

³ In order to decompose the attention allocation pattern further the mean reaction times for facilitation trials (anxiety word and dot in the same location) and inhibition trials (anxiety word and dot in opposite locations) were compared directly in a 2(stereotype threat) X 2(anxiety measure description) X 2(trial type) mixed-factor analysis of variance, with trial type as a within-subjects factor. As would be expected from the analysis of the attention allocation index, this analysis produced only a significant three-way interaction, $F(1, 77) = 6.41$, $p = .01$. No other main effects or interactions were significant, $F_s < 1.2$. Simple main effects analyses suggest that this interaction was driven primarily by the average reaction times on facilitation trials within the neutral (i.e. “perceptual focus”) description condition when participants were under stereotype threat. Participants in the stereotype threat/neutral description condition ($M = 466$, $SD = 93$) were faster to identify the location of the dot when it was in the same location as the anxiety word compared to participants in the problem solving/ neutral description condition ($M = 538$, $SD = 112$), $F(1, 77) = 3.57$, $p = .06$. Participants in the neutral description condition under stereotype threat also showed a tendency to identify the location of the dot faster when it appeared in the same location as the anxiety word compared to when the dot appeared in the opposite condition ($M = 481$, $SD = 102$), but this difference was only marginal, $F(1, 77) = 2.52$, $p = .11$. An exploratory analysis was also conducted on the average reaction time for the 10 neutral filler trials. A 2(stereotype threat) X 2(anxiety measure description) ANOVA produced only a significant main effect of stereotype threat. Women in the stereotype threat condition identified the location of the dot faster ($M = 491$, $SD = 119$) than women in the control condition ($M = 545$, $SD = 122$), $F(1, 77) = 4.00$, $p = .05$. This pattern is consistent with other research demonstrating that stereotype threat increases arousal, which can facilitate responses on tasks that are simple or low in complexity (e.g., Ben-Zeev, Fein, & Inzlicht, in press; O'Brien & Crandall, 2003).

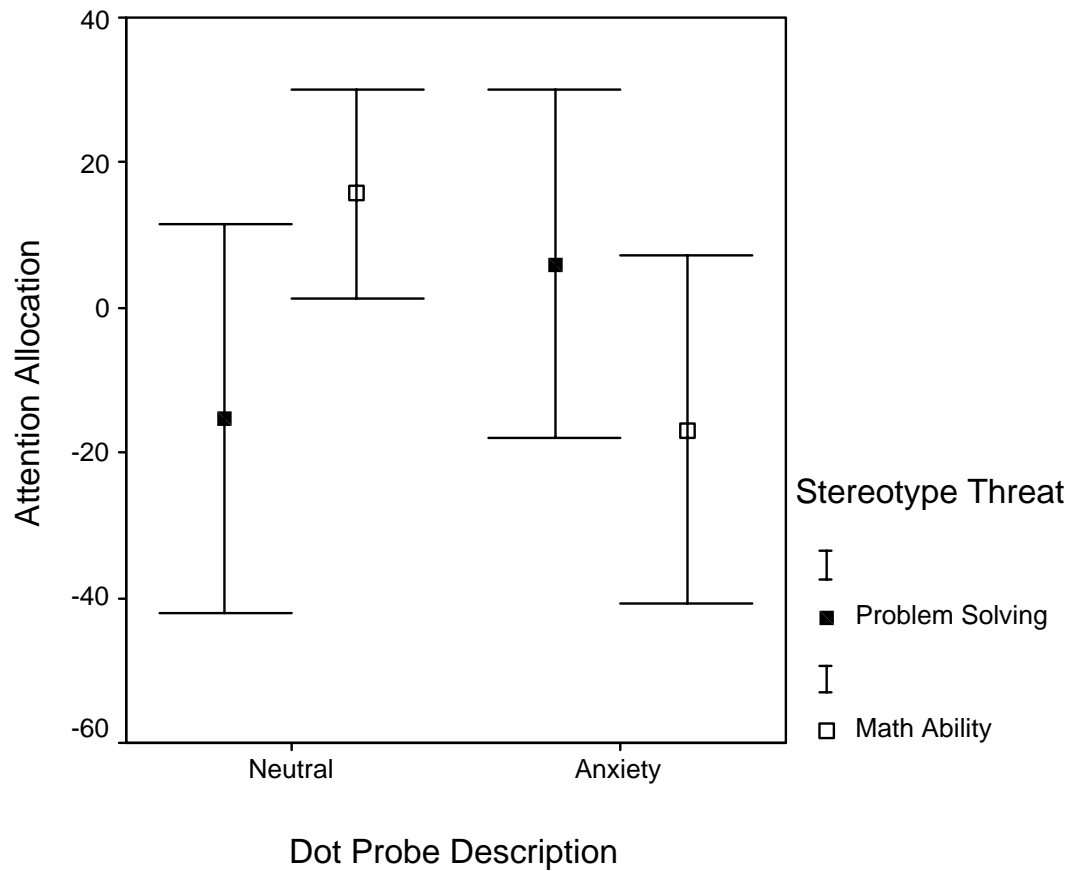


Figure 1. Means and 95% confidence intervals for attention allocation index as a function of the description of the dot probe task and stereotype threat condition.

Analysis of the absolute span score yielded only the predicted main effect of stereotype threat, $F(1, 78) = 10.14, p < .01$. Replicating previous research (Schmader & Johns, 2003), women in the stereotype threat condition ($M = 24.99, SD = 11.46$) recalled fewer words compared to women in the problem solving control condition ($M = 33.21, SD = 11.71$), $d = .71$. Neither the main effect of anxiety measure description nor the interaction were significant, $F_s < 1.3$.

Vowel counting. Although working memory is assessed as a function of the number of words recalled, the accuracy of vowel counting was analyzed to assess whether participants were exerting differential amounts of effort completing the processing component of the task across conditions. As expected, there were no significant effects of stereotype threat or anxiety measure description on percentage of vowels counted correctly ($GM = 83\%$), $F_s < 1.7$. The average amount of time (in seconds) that participants spent counting the vowels in each sentence was also analyzed and did not produce any significant effects of the stereotype threat or anxiety measure manipulation, ($GM = 8.25$), $F_s < 2.0$.

Questionnaire Measures

All questionnaire items (and composites) were analyzed using a 2(stereotype threat) x 2(anxiety measure description) between-subjects analysis of variance. Descriptive statistics for the questionnaire items (collapsed across conditions) are displayed in Table 2.

Stereotype threat. Analysis of extent to which *participants* expected gender differences in performance on the problem solving/math test yielded only a main effect of stereotype threat, $F(1, 78) = 4.83, p < .05$. As expected, women in the stereotype threat condition were more likely to expect men to outperform women on the math test ($M = 3.11, SD = 1.02$) compared to women in the control condition ($M = 3.62, SD = 1.05$). However, these ratings were both significantly lower than the scale mid-point (4 = *men and women will perform equally*) – $t(43) = 5.78, p < .001$ for the stereotype threat

Table 2
Descriptive Statistics for Self-report Questionnaire Items in Study 1.

	Mean	Median	SD	Minimum	Maximum
<i>Stereotype Threat</i>					
Participant expectation of gender differences in performance	3.35	3.00	1.06	1	6
Perception of researcher's performance expectations	3.21	3.00	1.32	1	7
Researcher believes men have more ability than women	4.27	4.00	1.60	1	7
Evaluation apprehension	3.33	3.00	1.49	1	6.50
Self-reported anxiety	2.96	2.80	1.27	1	5.80
Self-reported doubt	2.70	2.40	1.36	1	6.20
<i>Primary Appraisals</i>					
Difficulty	4.96	5.00	1.01	3	7
Pressure to do well	4.66	5.00	1.59	1	7
<i>Secondary Appraisals</i>					
Skills to succeed	4.04	4.00	1.44	1	7
Coping ability	4.65	5.00	1.13	2	7
Overall performance expectation	3.55	4.00	1.28	1	7
Importance of performance	3.74	4.00	1.57	1	7

Note. All items were rated on 1-7 scales.

condition and $t(37) = 2.16, p < .05$ for the control condition – suggesting that women in both conditions expected gender differences to some extent.

Analysis of extent to which participants thought the *researcher* expected gender differences in performance on the problem solving/math test only produced the expected main effect of stereotype threat, $F(1, 78) = 20.08, p < .01$. Women in the stereotype threat were more likely to think the researcher expected men to outperform women on the math test ($M = 2.68, SD = .88$) compared to women in the control condition ($M = 3.87, SD =$

1.48). Only the ratings of the researcher's expectations in the stereotype threat condition were lower than the scale mid-point, $t(43) = 9.90, p < .01$.

Analysis of the extent to which the participants thought the researcher believed that men and women differ in their natural problem solving/mathematical ability and the *evaluation apprehension* composite did not produce any significant main effects or interaction, $F_s < 1.5$.

Self-reported anxiety and doubt. Analysis of the self-reported anxiety and doubt measures did not yield any significant main effects or interaction, $F_s < 1.0$. Overall self-reported anxiety ($GM = 2.96, SD = 1.27$) and doubt ($GM = 2.70, SD = 1.36$) were relatively low.

Cognitive appraisals. Analysis of the primary appraisal items – the *difficulty* of the second problem set and how much *pressure* they felt to perform well – did not produce any significant main effects or interaction, $F_s < 1.8$.

Analysis of the secondary appraisal of the extent to which participants thought they had the skills to succeed on the second problem set produced only a significant interaction, $F(1, 78) = 4.63, p < .05$. Simple main effects analysis indicated that women in the stereotype threat condition rated their skills lower when the dot probe task was described as a measure of anxiety ($M = 3.43, SD = 1.43$) compared to when the dot probe was described as a measure of perceptual focus ($M = 4.26, SD = 1.48$), $F(1, 78) = 3.85, p = .05$. In the control condition, describing the dot probe as a measure of anxiety did not influence skill ratings ($M = 4.45, SD = 1.44$) compared to when the dot probe task was described as a measure of perceptual focus ($M = 3.94, SD = 1.48$), $F(1, 78) = 1.26$.

Analysis of the secondary appraisal of the extent to which participants thought they had the ability to cope with the demands of the upcoming problem set produced a only significant main effect of stereotype threat, $F(1, 78) = 5.81, p < .05$. Women in the stereotype threat condition ($M = 4.92, SD = 1.09$) rated their ability to cope higher than women in the control condition ($M = 4.33, SD = 1.09$).

Expectancy. Analysis of how *well* participants thought they would perform overall on the upcoming problem set did not produce any significant main effects or interaction, $F_s < 2.0$

Importance. Analysis of how important participants felt it was to do well on the problem solving/math test did not produce any significant main effects or interaction, $F_s < 1.2$.

Within-cell Correlations

The primary goal of this study is to test whether attempts to avoid anxiety are related to working memory capacity reductions under stereotype threat. The central predictions are that, under stereotype threat, working memory should decrease as attention to anxiety-related stimuli increases when the dot probe task was described as a measure of perceptual focus. In other words, increases in implicit anxiety should be negatively correlated with working memory capacity. In contrast, working memory should decrease as attention to anxiety-related stimuli decreases when the dot probe task was described as a measure of state anxiety and participants were under stereotype threat. That is, anxiety avoidance should be positively correlated with working memory. The attention allocation index should be uncorrelated with working memory in the control

condition, regardless of the way the dot probe task was described. Mediation hypotheses of this sort are most often tested using the regression procedure described by Baron and Kenny (1986). However, this procedure is not appropriate in the current situation because the proposed mediator and the predictor variable are uncorrelated overall ($r = .05$) and also uncorrelated in the two control conditions ($r = -.09$).

In order to test this hypothesis, correlations were computed between the attention allocation index derived from the dot probe task and working memory separately within each of the four conditions. Within-cell correlations support the predictions. Under stereotype threat, working memory was negatively correlated with attention allocation when the dot probe task was described as a measure of perceptual focus, $r(23) = -.42$, $p = .05$, but positively correlated with working memory when the dot probe was described as a measure of state anxiety, $r(21) = .54$, $p = .01$. In the control condition, working memory was uncorrelated with attention allocation when the dot probe was described as a measure of perceptual focus, $r(16) = .05$, and state anxiety, $r(21) = -.13$. The relationship between working memory and attention allocation in the stereotype threat conditions is depicted in Figure 2.

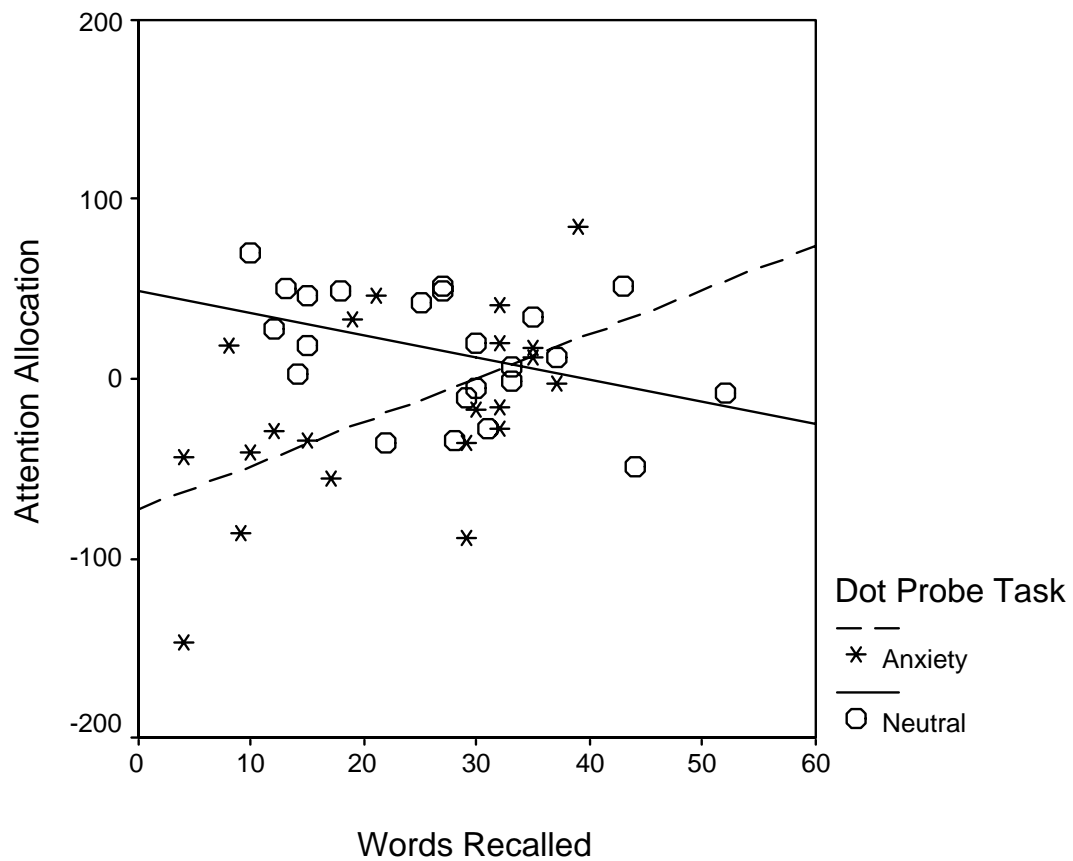


Figure 2. Scatterplot depicting the relationship between attention allocation in the dot probe task and words recalled on the working memory test as a function of the description of the dot probe task in the stereotype threat condition.

Discussion

The results of this first study provide initial support for the hypothesis that attempts to avoid anxiety and negative affect contribute to the effect of stereotype threat on working memory capacity. Women completing an implicit dot probe measure of anxiety under stereotype threat exhibited different response patterns depending on the description of the task and their reaction times to anxiety related stimuli were correlated with decreases in working memory capacity. When the dot probe task was described in

neutral terms as a measure of perceptual focus, women under stereotype threat tended to direct more attention toward anxiety-related words. This response pattern is consistent with past research showing that people who feel anxious attend more to threat and anxiety-related stimuli (e.g., Fox, Russo, Bowles, & Dutton, 2001; Mogg & Bradley, 1998), as well as more recent work showing evidence of anxiety and arousal under stereotype threat using indirect measures (Ben-Zeev et al., 2005; Bosson et al., 2004; O'Brien & Crandall, 2003). Furthermore, as attention toward anxiety-related words increased, the number of words recalled on the working memory measure decreased suggesting that there might be a direct effect of anxiety on reduced working memory capacity. In comparison, when the dot probe task was described as a measure of anxiety, women under stereotype threat showed a tendency to direct attention away from anxiety-related words, suggesting that they were attempting to avoid anxiety-relevant stimuli. A correlational analysis confirmed that working memory decreased as women shifted their attention away the anxiety words in this condition. This pattern of results indicates that women under stereotype threat might have tried to regulate their experience of anxiety (i.e., by avoiding anxiety related stimuli), but their efforts placed additional demands on working memory. These results also suggest that women have some awareness of the anxiety they are experiencing and the goal to avoid it. If anxiety avoidance was a purely non-conscious response then women should have directed attention away from the anxiety words regardless of how the dot probe task was described.

Unlike the implicit measure of anxiety, self-reported anxiety and doubt did not differ as a function of the stereotype threat manipulation. Women reported relatively low

and equal levels of anxiety in both the problem solving and math test condition. The lack of differences in self-reported anxiety are not surprising given that previous studies have often shown what appears to be a dissociation between direct and indirect measures designed to elucidate the psychological experience of stereotype threat (Bosson et al., 2004; Steele et al., 2002; Wheeler & Petty, 2001). Indeed, the lack of differences in self-reported anxiety and doubt are consistent with the idea that participants experiencing stereotype threat are motivated to appear less anxious to themselves and others who might evaluate their performance.

There were also no condition differences on the self-reported measures of evaluation apprehension or primary situational appraisals (i.e., pressure and difficulty). Ratings for these items were near the mid-point in all conditions. The stereotype threat manipulation did influence other self-report measures, however. Women in the stereotype threat condition were more likely to expect men to outperform women on the math test. Participants also reported that they thought the experimenter expected gender differences in math performance, but not problem solving performance. Stereotype threat also affected secondary appraisals of coping ability and skills, although not in a consistent manner. Women in the stereotype threat condition reported higher coping ability even though they were less certain they had the skills to succeed on the math test when the dot probe task was described as a measure of anxiety. The higher coping ratings might have resulted from a certain amount of defensive bolstering under threat (Blanton, Pelham, DeHart, & Carvallo, 2001). Alternatively, the general language of this question might have captured women's perception that they were coping with the situation by trying to

control their reactions and avoid feeling anxious. However, it is not clear how to explain why participants rated their skills lower when the dot probe task was described as a measure of anxiety.

The influence of stereotype threat on the secondary appraisal items and not the primary appraisal items might suggest that stereotype threat influences performance through perceptions of one's ability to cope but not the perception of the testing situation itself. However, the general nature of the primary appraisal questions might have rendered them too insensitive to specific perception of stereotype threat. In other words, there might have been a conceptual mismatch between the specific threat posed by confirming a negative stereotype and the general feelings of performing a difficult task in a high-pressure situation. Such mismatches can produce conceptual asymmetries that reduce measurement accuracy (Wittmann, 1988; Wittmann & SuB, 1999). In this sense, the manipulation check questions about the experimenter's expectations might be the more accurate index for capturing participants' primary appraisals of the situation. Overall, it appears that framing the study in terms of math ability did have a measurable influence on women's perceptions of the experimental situation. Although they did not report elevated levels of anxiety or evaluation apprehension, the stereotype threat related questions confirmed that gender was salient for women in the stereotype threat condition.

Chapter 3

STUDY 2

Study 1 represents an important step in understanding exactly how stereotype threat works to undermine the cognitive functioning of negatively stereotyped group members in threatening intellectual situations. It appears that the prospect of confirming a negative stereotype might impact cognitive resources by encouraging attempts to regulate negative affect and avoid the feelings of anxiety that stereotype threat creates. If this is the case, then eliminating the need to avoid anxiety should reduce the negative effect of stereotype threat on working memory. Several studies have shown that cuing people to reappraise the source of their anxiety can eliminate stereotype threat in testing situations (Ben-Zeev et al., 2005; Johns et al., 2005). However, these studies have not examined how reappraisal works to improve performance. The primary goal of the second study was to test whether directly encouraging threatened participants to reappraise anxiety as irrelevant to performance on a diagnostic test would improve working memory. This study examines another form of reappraisal and focuses on a potential mediator; anxiety avoidance.

The second study was also designed to provide evidence that the role of anxiety avoidance is not limited to women in the domain of math ability. Previous research by Schmader and Johns (2003) has demonstrated that Latinos also experience working memory reductions under stereotype threat conditions, which suggests that working memory deficits are not specific to women. However, the results of the first study could

be limited to women in the math domain given that women are stereotyped as being more emotional than men (Davies et al., 2005). Women might be more likely to avoid anxiety under stereotype threat because experiencing and reporting anxiety could be seen as another path to confirming a negative gender stereotype. Though not linked directly, the stereotype about women's emotionality could be seen as another side of the same math stereotype coin (Pronin, Steele, & Ross, 2004; Seymour & Hewitt, 1997). Being more prone to emotionality implies that women lack the ability to think rationally and logically – abilities that are generally associated with mathematical reasoning.

However, it also seems likely that anxiety avoidance might be employed by other stigmatized groups. To the degree that members of negatively stereotyped groups appraise stereotype-relevant testing situations as ego-threatening, they are more likely to adopt an emotion-focused coping strategy, regardless of gender (Lazarus, 1991, 1999). Furthermore, perusing the self-help section at a local bookstore would seem to indicate that the concern with feeling anxious while completing an intellectual task is not unique to women taking math tests. To confirm this intuition, we recently asked a group of male and female undergraduates to rate how they think anxiety affects performance on intellectual tests using a 7-point scale where 1 = *anxiety hurts performance*, 4 = *anxiety does not influence performance* and 7 = *anxiety helps performance*. Overall, participants rated anxiety as significantly lower than the scale mid-point ($M = 2.94$, $SD = 1.50$), $t(30) = 3.94$, $p < .01$, suggesting they generally see anxiety as harmful to performance. There were no significant differences between ratings of men ($M = 3.10$, $SD = 1.10$) and women ($M = 2.86$, $SD = 1.68$), $t(29) < .50$, on this question.

Also, if anxiety avoidance was specific to women in the math domain then the lack of increases in self-reported anxiety under stereotype threat should only be seen in studies focusing on gender and math. However, it is noteworthy that past research examining the role of self-reported anxiety in stereotype threat has failed to find a relationship among negatively stereotyped group members other than women taking a math test (e.g., (Aronson et al., 1999; Bosson et al., 2004; Hess et al., 2003; Smith, 2004; Steele & Aronson, 1995). Although interpreting null findings can be problematic, the lack of anxiety effects among other stereotyped groups is consistent with the notion that anxiety avoidance could be working to impede the performance of various group members under stereotype threat. Taken together, it seems unlikely that only women experiencing stereotype threat will be motivated to regulate negative affect and avoid feeling anxious.

In order to address the degree to which the effects of Study 1 generalize to other stigmatized groups, the second study examined whether Latinos under stereotype threat would also exhibit evidence of anxiety avoidance. Furthermore, this study tested whether eliminating the need to avoid anxiety would ameliorate the negative effect of stereotype threat on working memory capacity. To test this idea, Latino and Caucasian students completed the dot probe task framed as an anxiety measure (to allow for a measure of anxiety avoidance) and the working memory test while expecting to take a test related to general intelligence. This description was designed to prime stereotype threat for Latino participants (but not among Whites) based on the cultural stereotype that Latinos are less intelligent than Whites (Gonzales et al., 2002). In order to manipulate the relevance of

anxiety for performance, half of the participants were informed that past research had shown that anxiety does not hurt performance on the intelligence test they expected to complete. The remaining participants were not provided any information about the possible effect of anxiety on performance. Based on the first study, Latino participants not given any information about the relationship between anxiety and performance were expected to show evidence of anxiety avoidance (i.e., direct attention away from anxiety-related words on the dot probe task) and reduced working memory capacity. In comparison, informing Latinos that anxiety would not harm performance was expected to eliminate anxiety avoidance and improve working memory under threat. The anxiety instructions were not expected to have an effect on anxiety avoidance or working memory of White participants. After completing the dot probe and working memory test, participants made self-reports about their anxiety, doubt, evaluation apprehension and primary and secondary appraisals of the situation.

Methods

Participants and Design

The participants were 34 Latino (22 women and 12 men) and 47 Caucasian (28 women and 19 men) undergraduates who participated for course credit or \$10. Participants were recruited based only on their self-reported ethnicity (collected in a previous mass survey) and assigned to one of two conditions in a 2 (ethnicity) X 2 (effect of anxiety) between subjects factorial design.⁴ Data from one Latino participant was

⁴ This study originally included a non-stereotype threat comparison condition. However, this condition was dropped due to difficulties recruiting a sufficient number of Latino participants during the time this research was conducted.

omitted because a computer error resulted in lost data. Data from 2 Latino and 3 Caucasian participants were omitted because they failed to follow the instructions on the computer tasks. All analyses were conducted on a final sample of 31 Latinos and 44 Caucasians.

Procedure

Two Caucasian female experimenters conducted the sessions in mixed ethnic groups ranging from two to four participants. There was always at least one Latino participant and one Caucasian participant in each session but the ratio of Latinos to Caucasians varied randomly from session to session.⁵ Participants completed the study in individual rooms. After reading and signing the consent form, the female experimenter then instructed them to listen to, and read along with, a pre-recorded description of the study broadcast on an intercom system and displayed on the computer monitor. This study description was delivered by a male who identified himself as a researcher in the psychology department and served as the stereotype threat prime. He explained that the purpose of the experiment was to administer a measure related to general intelligence in order to study the cognitive processes that influence group differences in performance on intelligence tests. He did not explicitly state the groups of interest or mention the nature of the performance differences under investigation. He explained further that the test would be administered in two parts, with a measure of anxiety (i.e., the dot probe task)

⁵ The ratio of Latinos to Caucasians varied from session to session due to the failure of some participants to show up for their scheduled time. The proportion of Latinos to Caucasians tended to be higher in the no information condition (45% Latinos, 55% Caucasians) compared to the anxiety reappraisal condition (41% Latinos, 59% Caucasians), $t(73) = 1.65$, $p = .10$. However, it is important to note that the proportion of Latinos to Caucasians remained below 50%, which is generally conducive to creating stereotype threat (Inzlicht & Ben-Zeev, 2000; Steele et al., 2002).

and a filler task (i.e. the working memory test) between the two halves of the test. In the no information condition participants were told only that another purpose of the study was to assess the relationship between anxiety and performance on the intelligence measure. In the anxiety reappraisal condition participants were told that past research had established that anxiety does not affect performance on the types of problems they would be completing and that feeling anxious might actually facilitate their performance. In this way, anxiety was primed for both groups of participants, but only one group was told that anxiety would not debilitate their performance.

In order to reinforce the stereotype threat manipulation and bolster the cover story, participants in both conditions were informed that they would have 10 minutes to work on the first set of problems and that they would receive feedback about their performance on both parts of the test at the end of the experiment. The female experimenter then gave the participants scratch paper and instructed them to begin the first problem set, which was presented on the computer. The problems were four multiple-choice problems taken from the analytical reasoning section of the General Record Exam; these problems had been answered correctly by an average of 33% of test takers in past administrations.

After completing the first set of analytical reasoning problems, participants were presented with the dot probe task. The task was identified as a measure of state anxiety in both conditions and all participants were told that, “people who are feeling more anxious should be quicker to identify the location of the dot when it appears in the same position as the anxiety-related word.” Participants were allowed to complete six practice trials that

contained only neutral word pairs before the completing the critical trials. Because the dot probe task was described as an anxiety measure in all conditions, the 10 neutral filler trials were omitted from the task for this study. Thus, participants completed only 20 critical trials that included one anxiety-related word and one neutral word. As in the anxiety condition in Study 1, this measure served as an index of anxiety avoidance.

Participants completed the same working memory task used in the first experiment immediately after finishing the dot probe task. This task was identified as a filler task in all conditions. Participants were given a general overview of the task and allowed to complete a set of practice trials before beginning the task. They were informed that their performance on this task would be based on both how accurately they counted the vowels in the sentences and the number of words they recalled at the end of each set.

Once they finished the working memory task participants completed a brief questionnaire (described below and presented in Appendix C) and were then told there would not be sufficient time to complete the second set of problems (Footnote 1 explains the rationale for not administering the second test). Participants were then debriefed and thanked for their participation.

Self-report Questionnaire

Anxiety information manipulation check. Participants answered two questions as a check that they understood the information conveyed regarding the effect of anxiety on performance. The two questions were, “According to the *researcher*, how does anxiety affect performance on intellectual tests?”, and “How do *you* think anxiety affects performance on intellectual tests?” Participants responded on a 7-point scale where 1 =

anxiety hurts performance, 4 = *anxiety does not influence performance* and 7 = *anxiety helps performance*.

Anxiety and doubt. Participants rated how much they felt *agitated*, *anxious*, *nervous*, *uneasy*, and *worried* at the present moment using a 7-point scale anchored by *not at all* (1) and *very much* (7). For doubt, participants used the same scale to rate how much they felt *doubtful*, *foolish*, *inferior*, *insecure*, and *unsure*. The items from each scale were averaged to form an index of self-reported state anxiety ($\alpha = .86$) and self-reported doubt ($\alpha = .90$) where higher numbers indicated more anxiety and doubt, respectively.

Situational appraisals. To assess primary appraisals participants rated how *difficult* they expected the problems in the second set to be and how much *pressure* they felt to do well on these problems. For secondary appraisals participants rated how much they felt they possessed the *skills* to do well on these problems and their ability to *cope* with the demands of the test. Participants then rated how well they expected to perform overall. The exact wording, scales, and anchors used for these items are presented in Appendix C.

Stereotype threat related items. Participants rated how concerned they were that the researcher would judge people of their race/ethnicity, as whole, based on their performance on the test. They also rated how concerned they were that the researcher would think they have less ability if they did not do well on the test, and judge them based on their performance. These last two items were internally consistent ($\alpha = .92$) and averaged to form an index of *evaluation apprehension*.

Importance. Participants rated how *important* their performance was and how much they *cared* about doing well on the problem solving exercise/math test using a 7-point scale, anchored by *strongly disagree* (1) and *strongly agree* (7). Responses to these questions were internally consistent ($\alpha = .94$) and averaged to form an index of importance.

Results

Based on the results of the first study and the a priori predictions for the second, the attention allocation index and the number of words recalled on the working memory task were analyzed using a set of orthogonal contrasts (Tabachnick & Fidell, 2001). The first contrast tested the primary prediction that Latinos in the no information condition would show evidence of anxiety avoidance and the lowest working memory capacity compared to Latinos in the anxiety reappraisal condition and Caucasians in both conditions. To test this prediction, Latinos in the no information condition were assigned a weight of -3 and a weight of 1 was assigned to the remaining three conditions. The second contrast, which was of little theoretical interest, compared the performance of Caucasians in the no information condition (weighted 2) to Caucasians and Latinos in the anxiety reappraisal condition (each weighted -1). The third contrast tested the simple main effect of ethnicity within the anxiety reappraisal condition. In this condition, Caucasians were assigned a weight of 1 and Latinos a weight of -1, with the remaining condition weighted zero. Descriptive statistics for the performance measures (collapsed across conditions) are displayed in Table 3.

Table 3
Descriptive Statistics for Performance Variables in Experiment 2.

	Mean	Median	SD	Minimum	Maximum
<i>Dot Probe Task</i>					
Attention allocation index (in milliseconds)	13.40	7.40	56.00	-136.30	208.30
Facilitation trials	520	495	116	359	904
Inhibition trials	533	516	122	365	873
Error rates	1.67%	0.00%	3.00%	0.00%	15%
<i>Working Memory Test</i>					
Total words recalled	51.23	53.00	6.45	26	60
Absolute span score	33.13	34.00	14.11	0	60
Vowel counting accuracy	.84	.87	.10	.45	.93
Average time counting vowels (in seconds)	7.73	7.45	1.96	3.49	12.78

Note. *Facilitation* trials are trials when the dot appeared in the same location as the anxiety word.

Inhibition trials are trials when the dot appeared in the opposite position from the anxiety word.

Dot probe

Attention allocation toward anxiety-related words was computed by subtracting the average reaction time on trials when the dot appeared in the same location as the anxiety word from the average reaction time on trials when the dot appeared in the opposite position from the anxiety word. Only reaction times for correct responses were included in the computation of the anxiety index. Error rates were not affected by the manipulation and were low overall ($GM = 1.62\%$). The Kolmogorov-Smirnov test indicated that the attention allocation index scores were normally distributed ($Z = 1.08$).

The pattern of means for the attention allocation index (Figure 3) generally fits the prediction that Latinos in the no information condition would exhibit the lowest attention allocation scores compared to Caucasians and compared to Latinos in the

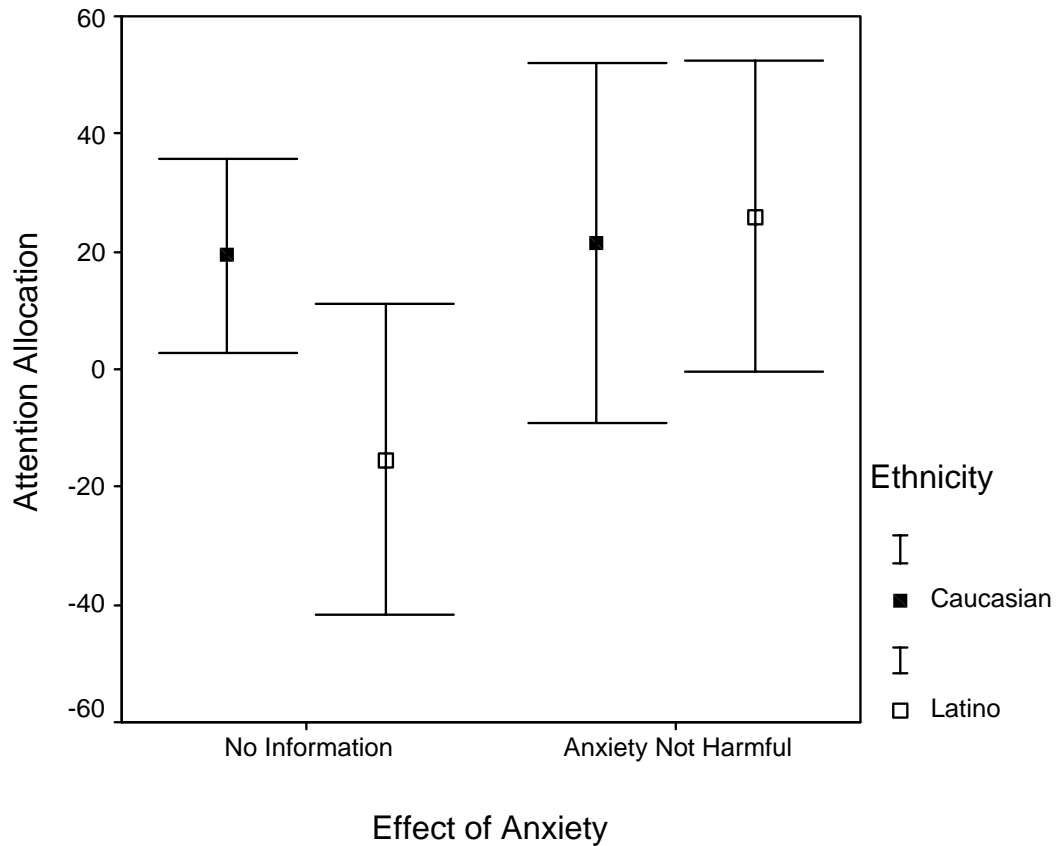


Figure 3. Means and 95% confidence intervals for attention allocation on the dot probe task as a function of anxiety reappraisal manipulation and participant ethnicity.

anxiety reappraisal condition. Results of the first contrast confirmed that Latinos in the no information condition ($M = -15.33$, $SD = 51.42$) directed less attention to anxiety-related words compared to participants in the other three conditions ($M = 21.83$, $SD = 54.87$), $t(73) = 2.47$, $p < .05$ ($d = .70$).⁶ Analysis of the contrast residuals revealed that they did not vary by condition, $F(3, 71) < 1.0$, which indicates that this contrast provides a good

⁶Analysis of variance on the attention allocation index produced a marginal interaction $F(1, 71) = 2.31$, $p = .13$. However, examination of the residuals plot (displayed in Appendix D; computed by subtracting the two relevant main effect means from each participant's attention allocation score and then adding the grand mean) revealed a cross-over pattern, which is the hallmark of an interaction effect according to Rosnow and Rosenthal (1989, 1995).

description of the variation in attention allocation, (Abelson & Prentice, 1997; Levin & Neumann, 1999). This response pattern suggests that Latinos were attempting to avoid anxiety when no information was provided about the effect of anxiety on performance, but providing the instruction that anxiety would not be bad for performance appeared to prevent Latinos from engaging in anxiety avoidance. Results of the second contrast confirmed that the attention allocation of Caucasians in the no information condition ($M = 19.37$, $SD = 35.03$) did not differ from the attention allocation of both Latinos and Caucasians in the anxiety reappraisal condition ($M = 23.12$, $SD = 63.27$), $t(73) < .05$. The third contrast indicated that there was no difference between the attention allocation of Latinos ($M = 26.01$, $SD = 45.36$) and Caucasians ($M = 21.43$, $SD = 75.55$) in the anxiety reappraisal condition, $t(73) < .05$. Inspection of the 95% confidence intervals displayed in Figure 3 also reveals that Latinos in the no information condition allocated significantly less attention to anxiety words than Latinos in the reappraisal condition. The results of these analyses support the prediction that telling participants that anxiety does not harm performance reduces attempts among Latinos to avoid anxiety while under stereotype threat.

Working Memory Capacity

Absolute span score. The pattern of means for the number of words recalled on the working memory task (Figure 5) also fits the prediction that Latinos in the no information condition recall fewer words compared to Caucasians in the no information condition and compared to Latinos in the anxiety reappraisal condition. The first contrast confirmed that Latinos in the no information condition ($M = 27.06$, $SD = 14.77$) recalled

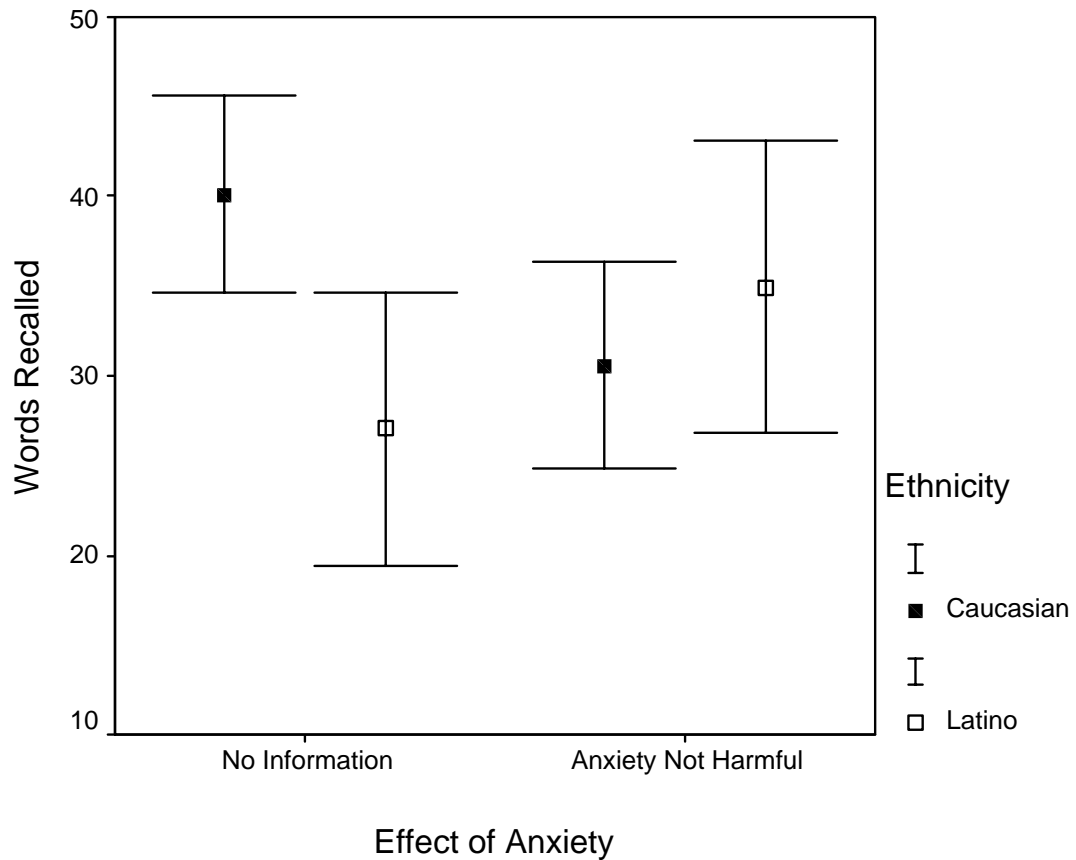


Figure 5. Means and 95% confidence intervals for words recalled as a function of anxiety reappraisal manipulation and participant ethnicity.

significantly fewer words compared to participants in the other three conditions ($M = 34.91$, $SD = 13.53$), $t(73) = 2.18$, $p < .05$ ($d = .55$).⁷ The contrast residuals did not vary across conditions, $F(3, 71) < 1.9$, suggesting that this contrast pattern describes the variation in word recall sufficiently. The second contrast indicated that Caucasians in the no information condition ($M = 40.10$, $SD = 11.68$) tended to recall more words compared to Latinos and Caucasians in the anxiety reappraisal condition ($M = 32.18$, $SD = 13.77$), $t(73) = 1.95$, $p = .06$ ($d = .62$). Examination of the box plots suggests that this effect

might be driven by unexpectedly low word recall scores by Whites in the anxiety reappraisal condition. The third contrast indicated that word recall for Latinos and Caucasians in the anxiety reappraisal condition ($M = 34.93$, $SD = 14.09$) not differ significantly from one another ($M = 30.58$, $SD = 13.62$), $t(73) < .10$ ($d = .31$). Inspection of the 95% confidence intervals displayed in Figure 5 reveals that Latinos in the no information condition tended to recall fewer words than Latinos in the reappraisal condition, but this difference was only marginal. The results of these analyses generally support the prediction that reducing the need to avoid anxiety would reduce the negative effects of stereotype threat on working memory.

Vowel counting. Vowel counting accuracy was analyzed using a 2(ethnicity) X 2(effect of anxiety) analysis of variance. Although no effects were predicted, this analysis produced a significant interaction, $F(1, 71) = 8.00$, $p < .01$. Simple main effects analysis revealed that Latinos in the no information condition ($M = .79$, $SD = .13$) were less accurate compared to Caucasians in the no information condition ($M = .87$, $SD = .09$), $F(1, 71) = 6.40$, $p = .01$, and compared to Latinos in the anxiety reappraisal condition ($M = .88$, $SD = .13$), $F(1, 71) = 6.73$, $p = .01$. There was no difference between the vowel counting accuracy of Caucasians in the no information condition and Caucasians in the anxiety reappraisal condition ($M = .83$, $SD = .08$), $F(1, 71) = 1.70$.

The lower vowel counting accuracy of Latinos in the no information could indicate that they were exerting less effort on this portion of the task. If this were the case, the average amount of time participants spent counting vowels should reveal a

⁷Analysis of variance on the number of words recalled produced only a significant interaction $F(1, 71) =$

pattern similar to vowel counting accuracy (i.e., less time spent counting vowels).

Analysis of the average amount of time (in seconds) that participants spent counting the vowels in each sentence did not produce any significant main effects of interaction, ($GM = 7.73$), $F_s < 1.0$, however. In addition, vowel counting accuracy was not correlated with time spent counting vowels, $r(75) = .05$. These results suggest that stereotype threat reduced performance of Latinos on the vowel counting portion of the working memory task by reducing cognitive resources and not by simply undermining motivation.

Questionnaire Measures

All questionnaire items (and composites) were analyzed using a 2(ethnicity) x 2(effect of anxiety) between-subjects analysis of variance. Descriptive statistics for the questionnaire items (collapsed across conditions) are displayed in Table 4.

Manipulation checks. Analysis of the question about how the researcher thought anxiety would affect performance produced only the expected main effect of the anxiety information manipulation, $F(1, 70) = 78.24$, $p < .01$. Participants who were told that anxiety would not hurt performance indicated that the researcher thought anxiety would be more likely to help performance ($M = 5.53$, $SD = 1.64$) compared to participants who were not given any information about the effect of anxiety on performance ($M = 2.29$, $SD = 1.37$), $d = 2.14$. Participants' ratings in each condition were also significantly different from the midpoint of the scale (4 = *anxiety does not influence performance*), $t_s > 5.50$, $p_s < .01$.

Table 4
Descriptive Statistics for Self-report Questionnaire Items in Experiment 2.

	Mean	Median	SD	Minimum	Maximum
<i>Manipulation Checks</i>					
How does the <u>researcher</u> think anxiety affects performance	3.94	4.00	2.22	1	7
How do <u>you</u> think anxiety affects performance	2.89	2.00	1.71	1	7
<i>Stereotype Threat Related</i>					
Researcher will judge my race/ethnicity based on my performance	2.21	1.00	1.77	1	7
Evaluation apprehension	3.06	3.00	1.75	1	7
Self-reported anxiety	2.95	2.80	1.38	1	6.60
Self-reported doubt	2.49	2.20	1.34	1	6.20
<i>Primary Appraisals</i>					
Difficulty	4.51	5.00	1.21	1	7
Pressure to do well	4.72	5.00	1.71	1	7
<i>Secondary Appraisals</i>					
Skills to succeed	5.19	5.00	1.37	1	7
Coping ability	4.97	5.00	1.23	2	7
Overall performance Expectation	4.61	5.00	1.25	1	7
Importance of performance	3.90	4.00	1.68	1	6.50

Note. All items were rated on 1-7 scales.

Analysis of how participants thought anxiety would affect their performance produced only the expected main effect of the anxiety information manipulation, $F(1, 71) = 19.91, p < .01$. Participants who were told that anxiety would not hurt performance indicated that they thought anxiety would be less likely to hurt performance ($M = 3.75, SD = 1.72$) compared to participants who were not given any information about the effect of anxiety on performance ($M = 2.14, SD = 1.36$), $d = 1.04$. Only the responses of

participants in the no information condition were significantly different from the scale midpoint, $t(36) = 8.36, p < .01$. These results confirm that participants were attentive to the anxiety information manipulation and suggest that this information influenced their perceptions of how anxiety might affect performance.

Stereotype threat. Analysis of extent to which participants were concerned that the researcher would judge people of their race/ethnicity based on their performance produced only a main effect of ethnicity, $F(1, 71) = 21.38, p < .01$. Latinos expressed more concern that the researcher would make ethnic-based attributions based on their individual performance ($M = 3.19, SD = 1.99$) compared to Caucasian students ($M = 1.52, SD = 1.19$).

Evaluation apprehension. Analysis of the *evaluation apprehension* composite did not produce any significant main effects or interaction, $F < 1.0$.

Self-reported anxiety. Analysis of the self-reported anxiety composite did not reveal any significant main effects or interaction, $F_s < 1.7$. Analysis of doubt produced only a main effect of the anxiety information manipulation, $F(1, 71) = 4.84, p < .05$. Participants who were told that anxiety would not harm their performance expressed less doubt ($M = 2.16, SD = 1.04$) compared to participants who were not given any information about the effect of anxiety ($M = 2.83, SD = 1.54$).

Cognitive appraisals. Analysis of the primary appraisal items – the *difficulty* of the second problem set and how much *pressure* they felt to perform well – did not produce any significant main effects or interaction, $F_s < 1.0$.

For secondary appraisals, the extent to which participants thought they had the *skills* to succeed on the test did not produce any significant main effects or interaction, $F_s < 1.0$. Analysis of the extent to which participants thought they had the ability to *cope* with the demands of the test produced a only significant main effect of anxiety information, $F(1, 71) = 4.60, p < .05$. Participants in the no information condition rated their coping ability lower ($M = 4.65, SD = 1.27$) compared to participants in the anxiety reappraisal condition ($M = 5.29, SD = 1.11$).

Expectancy. Analysis of how *well* participants thought they would perform overall on the intelligence test did not produce any significant main effects or interaction, $F_s < 1.7$

Importance. Analysis of how important participants felt it was to do well on the test did not produce any significant main effects or interaction, $F_s < 2.0$.

Within-cell Correlations

This study, like the first, was designed to test whether attempts to avoid anxiety are related to working memory capacity reductions under stereotype threat. The central prediction is that the working memory of Latinos under stereotype threat should decrease to the extent that attention is shifted away from anxiety-related stimuli but only when no information was provided about the effect of anxiety on performance. This would replicate the results of the first study. There were no specific predictions for the relationship between working memory and attention allocation for Latinos in the anxiety reappraisal condition and Caucasians in both conditions. As in the first study, the regression-based mediation analyses described by Baron and Kenny (1986) are not

appropriate for testing this prediction because the proposed mediator (attention allocation) and the predictor variable (working memory) were uncorrelated overall ($r = .06$) but were expected to correlate differently by condition.

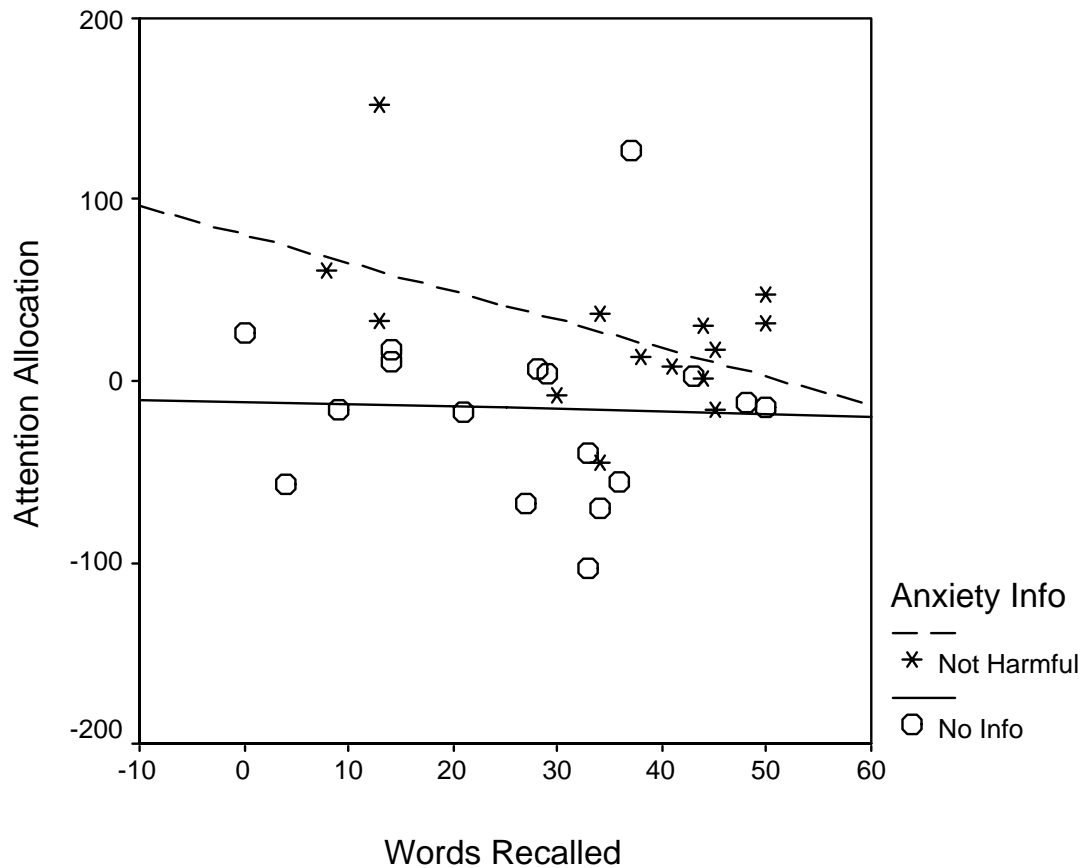


Figure 6. Scatterplot depicting the relationship between attention allocation in the dot probe task and words recalled on the working memory test for Latino participants as a function of information about the effect of anxiety on performance.

Correlations were computed between the attention allocation index and working memory separately for Latino and Caucasian participants within each of the two anxiety information conditions. Unexpectedly, for Latino participants, working memory was not correlated with attention allocation on the dot probe task when no information was given

about the effect of anxiety on performance, $r(17) = -.04$, but tended to correlate negatively with working memory when anxiety was described as not harmful, $r(14) = -.49$, $p = .08$. For Caucasian participants working memory was positively correlated with attention allocation when no information was given about the effect of anxiety, $r(20) = .46$, $p < .05$, and uncorrelated when anxiety was described as not harmful, $r(24) = .03$. Figure 6 depicts the relationship between working memory and attention allocation for Latinos as a function of the information that was provided about the effect of anxiety on performance.

Discussion

The results of the second study provide some additional support for the idea that attempting to avoid anxiety contributes to the negative effect of stereotype threat on working memory capacity. As with women in the first study, Latinos completing the dot probe measure and working memory test under stereotype threat showed evidence of anxiety avoidance and reduced cognitive capacity. This effect was qualified, however, by whether participants were given information about the likely effect of anxiety on performance. When Latinos were told that anxiety would not harm performance – thus making it irrelevant to the upcoming intelligence test – there was no evidence that they were attempting to direct attention away from anxiety-related words. The anxiety information manipulation also tended to reduce the effect of stereotype threat on the working memory performance of Latinos. Although the anxiety information manipulation influenced the attention allocation and working memory in the predicted manner the relationship between these two measures was inconsistent with the results of the first

study. The attention allocation index was not correlated with the working memory performance of Latinos in the no information condition but was negatively correlated with working memory in the anxiety reappraisal condition.

The lack of correlation between attention allocation and working memory in the no information condition fails to replicate the results of the first study. Though difficult to interpret, this finding might suggest that a significant minority of the Latino participants were not affected by the stereotype threat manipulation. If so, some participants either might not have been anxious or were not trying to avoid any anxiety they were experiencing. As a result, both increased and decreased attention to anxiety words would have covaried with higher working memory scores and attenuated the expected correlation. This might have occurred because Latino participants were not selected based on their self-reported stereotype knowledge along with the more subtle nature of the stereotype threat prime used in this study. Participants were told that the researcher was interested in group differences on intelligence tests but not told what groups were being compared. Indeed, even though Latinos in both conditions were more likely to think the researcher would judge their performance in light of their ethnic identity (compared to Caucasians), their average rating for this item was slightly lower in the no information condition ($M = 2.82$) than in the reappraisal condition ($M = 3.64$), $d = .43$.

If the stereotype threat prime did not impact all the Latino participants equally, this might also explain the negative correlation between attention allocation and working memory in the anxiety reappraisal condition. The reappraisal manipulation could have increased the working memory of stereotype threatened Latino participants who would

have otherwise been trying to avoid anxiety but left the working memory of non-threatened Latino unaffected. In other words, the more the reappraisal manipulation actually reduced the concern of stereotype threatened Latinos about feeling anxious, the less they attended to the anxiety words and the better their performance on the working memory measure. Consistent with this idea, the results from the self-report measures showed that the anxiety reappraisal manipulation did reduce self-reported doubt and increased perceptions of coping ability.

The performance of Caucasian participants on the dot probe measure and working memory task also produced some interesting findings. Caucasians in the no information condition exhibited an attention allocation pattern consistent with increased anxiety, as well as the highest average performance on the working memory task. Unexpectedly, their working memory performance positively correlated with attention to anxiety-related words. This might suggest that anxiety had a different meaning for Caucasian participants in this condition. Because there is no stereotype alleging intellectual inferiority, perhaps the general concern about doing well on an intelligence test, which most students would likely feel, was experienced more as a state of motivational arousal than an aversive state of negative affect to be avoided. Thus, Caucasian participants might have been feeling anxious but without the prospects of confirming a negative stereotype hanging over them this anxiety translated into a motivation to approach success, as opposed to avoid failure (e.g., Raffety, Smith, & Ptacek, 1997). For example, Seibt and Forster (2004) recently found that conditions representing stereotype threat for one group can induce a focus on approaching positive outcomes for members of a group who are not the target of a

negative stereotype in that performance situation. This idea is also consistent with the stereotype lift effect (Walton & Cohen, 2003). Non-stereotyped group members tend to show enhanced performance in conditions that undermine the performance of negatively stereotyped group members. Walton and Cohen propose that this effect results from an enhanced sense of efficacy that is afforded by comparing oneself to a negatively stereotyped outgroup.

The tendency for Caucasian participants in the anxiety reappraisal condition to show lower working memory capacity than Caucasians in the no information condition was also unexpected. Providing information that anxiety would influence performance might have inadvertently eliminated their ability to translate the experience of arousal or tension into a source of motivation. However, this seems unlikely given that they were told explicitly that anxiety might actually improve performance. Presumably, this information should have made it easier to translate anxiety into a motivation to do well. Another possibility is that this information undermined their ability to use anxiety as an explanation in the case that they did not perform well (e.g., Smith et al., 1982). By not being able to claim increased anxiety as a handicap, Caucasians in this condition might have been deprived of a self-protective buffer that would have otherwise helped their performance. Clearly, these explanations are speculative and additional research is needed to test them directly.

Like the first study, and previous stereotype threat research, the self-report measures present a mixed picture. Self-reported anxiety did not differ as a function of ethnicity or the anxiety reappraisal manipulation even though telling participants that

anxiety would not harm performance did influence their perceptions of the effects of anxiety. Participants in both conditions reported relatively low and equal levels of anxiety. There were also no condition differences on the self-reported measures of evaluation apprehension, primary situational appraisals (i.e., *pressure* and *difficulty*) or performance expectancies. Ratings for evaluation apprehension were below the mid-point (4) and primary appraisals were slightly above the mid-point. Participants did not appear excessively concerned with being evaluated by the researcher but did perceive that the intelligence test would be moderately difficult and felt some pressure to perform well. Their performance expectations were modest.

The anxiety reappraisal manipulation did, however, influence participant's self-reported doubt and perceptions of their coping ability in a meaningful way. Although ratings of doubt were low overall (2.5 on a 7-point scale), the reappraisal manipulation led to a slight (but significant) decrease in the amount of doubt they expressed. Learning that anxiety would not likely harm performance also led participants to rate their coping abilities higher compared to when no information was provided about the effects of anxiety. Overall, the self-report measures did provide some hints that Caucasian and Latino participants perceived the testing situation differently, and also that reappraisal manipulation influenced their perceptions. However, the most consistent information about participants' experience came from the dot probe and working memory tasks.

Chapter 4

GENERAL DISCUSSION

Stereotype threat theory has generated a substantial body of research since Steele and Aronson (1995) first proposed and tested it. This research has consistently demonstrated that placing members of negatively stereotyped groups in situations where their behavior could somehow conform to the stereotype can disrupt cognitive functioning and lower test performance. However, studies that have attempted to identify the process responsible for performance decrements in testing situations have been much less consistent. While some studies have found evidence that stereotype threat hurts performance by increasing anxiety, most have not. The present studies were conducted to test the hypothesis that stereotype threat reduces performance because individuals expend cognitive resources trying to avoid the anxious thoughts and feelings that are primed in such situations. Thus, stereotype threat reduces performance by diverting resources that would normally enhance performance to the process of regulating one's emotional experience in an intellectually threatening situation.

The results of both studies provide initial evidence that trying to avoiding anxious thoughts and feelings might be one process by which the concern about confirming a stereotype can sap the resources needed to perform well on challenging tests. Women and Latinos under stereotype threat showed evidence of avoiding anxiety-related stimuli and this response occurred in parallel with reduced working memory capacity. The first study showed that anxiety avoidance was correlated with lower working memory capacity for

women. The second study provided complementary evidence that describing anxiety as irrelevant to performance reduced anxiety avoidance and increased the working memory capacity of Latinos. These findings represent an important advance in understanding how negative intellectual stereotypes can work to undermine the performance of people who worry about being reduced to those widely-held beliefs.

Both studies were generally consistent with each other and the hypotheses they were designed to test. The most noteworthy inconsistency that arose between Study 1 and 2 was the relationship between the anxiety avoidance and working memory. Working memory decreased as anxiety avoidance increased in the critical condition of Study 1 (i.e., anxiety-relevant) but not in the critical condition of the second (i.e., no information). As discussed above, the lower strength of the manipulation used in Study 2 might have made it more difficult to capture this relationship in the no information condition. However, the failure of working memory to decrease as anxiety avoidance increased could also suggest that women are in fact more likely than Latinos to adopt an emotion-focused coping strategy. Steele et al. (2002) have suggested that the processes that mediate stereotype threat might differ by both group and performance domain. The stereotype that women are more emotional, which implies they are less rational, could make a unique contribution to the effect of stereotype threat on women's math performance. This might be similar to the additive effect of double-minority status that Gonzales et al. (2002) demonstrated. Instead of two negatively stereotyped social identities, Caucasian women face the burden of two negative stereotypes that are relevant to math ability (a concern about having lower ability and a concern about being more

emotional). However, the anxiety reappraisal manipulation clearly improved the working memory of Latinos, which suggests that some sort of affective mechanism was at work when they were not given this information. Taken together, the results of both studies provide more evidence for the anxiety avoidance hypothesis than against it. Additional research is needed to test whether anxiety avoidance is a general strategy used by different groups in different performance domains or specific to women taking a math test.

Like past research, there was no evidence that a stereotype threat prime led to higher levels of self-reported anxiety. This null finding by itself is fairly unremarkable. However, Study 1 did provide evidence that participants under stereotype threat were in fact feeling more anxious. Women who thought they would be taking a difficult math test allocated more attention to anxiety-related stimuli on the dot probe task when they were unaware that this response pattern was suggestive of increased anxiety. More importantly, as working memory decreased attention to anxiety words increased. This dissociation between self-reported affect and increased attention to threat-relevant stimuli again raises an interesting question about the results of these studies: How conscious is the process of anxiety avoidance? This is a difficult question to answer because neither study was designed to address this issue directly. However, both studies do provide some evidence to suggest that anxiety avoidance might be more of a conscious than a non-conscious activity.

The most direct evidence against a purely non-conscious explanation comes from the finding that women in Study 1 exhibited anxiety avoidance only when they were told

that the dot probe task was designed to measure anxiety. Presumably, if anxiety avoidance was operating outside of conscious awareness then participants should have been directing attention away from anxiety words regardless of the way the task was described. The fact that explicitly telling Latinos that anxiety was unlikely to hurt their performance eliminated anxiety avoidance and improved working memory shows that it is possible to inhibit this potentially disruptive response. If avoidance was completely unconscious then such information should not have completely eliminated unconscious attempts to avoid anxiety (Bargh & Chartrand, 1999; Shah & Kruglanski, 2002).

However, it still might be the case that learning the dot probe task is designed to measure anxiety primed an unconscious goal to avoid any threatening stimuli, which was simply overridden by the explicit reappraisal manipulation. According to the auto-motive theory of social behavior, goals can become automated if they are pursued repeatedly in similar situations (Bargh, Gollwitzer, Lee-chai, Barndollar, & Troetschel, 2001). Indeed, there is accumulating evidence that even subtle environmental cues can activate goals that guide behavior (including attention) outside of awareness (Moskowitz, 2002; Shah, 2005).

Perhaps more relevant is the finding that asking people to contemplate their own mortality – the ultimate self-threat – automatically instigates attempts to keep death-related thoughts out of consciousness (Arndt, Greenberg, Solomon, Pyszczynski, & Simon, 1997). If an individual is consistently dealing with stereotype threat by trying to avoid or deny feeling anxious then avoidance might become a relatively automatic and unconscious reaction.

Recent research by Payne and his colleagues (2001; Payne, Lambert, & Jacoby, 2002) might offer one approach for assessing the degree to which responses on the dot probe task are driven by automatic goals. They have adapted the process dissociation technique (Jacoby, Toth, & Yonelinas, 1993) to study how controlled and automatic processes contribute to the tendency to misperceive a tool as a weapon when it is preceded by an African American face. In this procedure, participants are briefly presented White or African American faces (200 ms), which are replaced immediately with an equally brief photo of either a common tool (e.g., hammer) or weapon (e.g., handgun). The final screen displays a visual mask until participants make a response indicating whether the second photo depicted a tool or a weapon. Because this task contains trials that pit potentially automatic reactions (Blacks = violent; therefore, tool = gun) against controlled reactions (I'm not prejudiced; was that a gun?), response times and error rates can be used to derive sensitivity indexes that capture each type of process independently (see Payne, 2001 for specific equations). The dot probe task would be well suited to this approach because it contains both congruent trials (i.e., dot and anxiety word in same location) that should facilitate automatic responses and incongruent trials (i.e., dot and anxiety word in opposite location) that require controlled responses. Changing the parameters of this task (e.g., stimulus presentation tasks) so that it parallels the procedures used by Payne might make the dot probe amenable to a process dissociation analysis. This could provide important evidence regarding the relative contribution of conscious and non-conscious processes in producing performance decrements.

Related to the issue of conscious awareness, the question also arises as to whether participants' responses on the dot probe task were motivated more by a concern with not appearing anxious to the researcher or a concern with simply not feeling anxious. Although the current studies do not provide any direct evidence to address this issue, responses to the evaluation apprehension questions could be interpreted (cautiously) as an indication of how concerned participants were about the researcher's perceptions of them. If stereotype threat generally made women and Latinos more concerned about the impressions they were making during the study then they might have been more likely to express apprehension about being judged on these items. However, responses on these questions did not differ as a function of the primary manipulations in either study. Thus, participants under stereotype threat appeared just as concerned with how the research would evaluate them as participants not under stereotype threat.

The data most relevant for addressing this question comes from research by Inzlicht and Ben-Zeev (2003). In their studies, women underperformed on a math test even when they were reassured that their results would not be seen by the experimenter or anyone else. This finding is consistent with the idea that stereotype threat is primarily a self-threat that is derived from a salient social identity (Marx, Stapel, & Muller, 2005; Steele, 1997). If stereotype threat were purely a concern with public evaluation, then the possibility of confirming a negative stereotype should only disrupt performance when others can evaluate one's performance. Inzlicht and Ben-Zeev's findings indicate that this is not necessarily the case. However, avoiding anxiety in a testing situation might stem

from a concern with appearing calm that is functionally independent of the concern with performing poorly.

Claiming that impression management concerns do not contribute to anxiety avoidance motivations at some level seems a fairly untenable position to adopt on this issue. It just might be that impression management is not the most immediate concern for people experiencing stereotype threat. For example, Fredrickson and her colleagues (Fredrickson, Roberts, Noll, Quinn, & Twenge, 1998) showed that women who viewed themselves wearing a swimsuit in private performed much worse on a subsequent math test compared to women who viewed themselves in a baggy sweater or men who viewed themselves in a pair of swim shorts. They argued that wearing a swimsuit undermined women's performance because it created a disruptive state of self-objectification; women were primed to view themselves through the lens of a society that tends to devalue them as objects devoid of intellect. In a sense, the public aspect of stereotype threat might take a form similar to self-objectification. To the degree that people overestimate how much they are attended to by others (Gilovich, Medvec, & Savitsky, 2000), targets of negative stereotypes might be especially sensitive to the idea that their performance will somehow reduce them to an object of ridicule and disdain in the eyes of others (Fribley, Blackstone, & Scherbaum, 1990; Mendoza-Denton, Purdie, Downey, & Davis, 2002; Pinel, 1999). From this perspective, impression management concerns would represent a distal mechanism in the effect of stereotype threat on performance. Thus, the desire to avoid anxiety would most likely stem from the immediate goal to avoid doing poorly, as opposed to the more distal goal to avoid becoming a social caricature. If this is the case

then threatened individuals might try to avoid anxiety even in completely private performance situations. Future research should test this idea directly. However, the theoretical benefits of disentangling public concerns from private concerns could be relatively small compared to the difficulty of designing the critical studies this would require (Tetlock & Manstead, 1985).

Implications

Several researchers have recently proposed that stereotype threat research would benefit from the development of a well-articulated model that could help identify potential processes to examine more closely (Marx et al., 2005; Ryan & Ryan, 2005; Smith, 2004). Based on past research showing that stereotype threat reduces the cognitive resources necessary for optimal performance on intellectual tests (e.g., Quinn & Spencer, 2001; Schmader & Johns, 2003), the present studies represent an important step toward this goal by moving up the mediational chain to examine exactly how stereotype threat impacts cognitive functioning. The results offer some specific evidence regarding how stereotype threat produces its pernicious effect in the academic domain that can contribute to the development of a process model.

In addition, these studies might help explain the difficulty researchers have so far encountered using self-reports to understand the experience of stereotype threat. It appears that stereotype threat promotes a coping response that might actually make it difficult to measure certain process variables in a direct and explicit manner. Accordingly, researchers might exercise caution in relying solely on self-report measures to assess the psychological experience of stereotype threatened individuals. The hope is

that a better understanding of stereotype threat will assist researchers identify (or develop) the appropriate measurement strategy to examine more specific mechanisms that translate the effect of stereotype threat into poor performance. In this way, the studies reported here represent both a theoretical and methodological advance for this area of research.

These studies could also facilitate model development by providing the empirical foundation to make conceptual links between stereotype threat and several related phenomena. Most obvious is the link that one can draw between stereotype threat and research on coping with stressful experiences (e.g., Folkman & Lazarus, 1988; Lazarus, 1999). General research on the ways individuals react to and deal with potentially threatening situations has benefited tremendously from the application of appraisal-based models of stress and coping (e.g., Blascovich & Tomaka, 1995). As an explanation for a specific response to a social identity threat, research on stereotype threat could also benefit from explicitly considering the ways primary and secondary appraisals contribute to the phenomenon (Steele et al., 2002). While there are several findings in the literature that imply appraisals play a role in the effect of stereotype threat on performance (Ben-Zeev et al., 2005; Ford, Ferguson, Brooks, & Hagadone, 2004; Johns et al., 2005), researchers have yet to examine these factors explicitly and directly.

Both of the present studies represent some of the first stereotype threat studies to test hypotheses derived explicitly from appraisal-based models of coping. Study 2 in particular suggests that it is not mere stereotype-derived anxiety that undermines performance but the way that anxiety is interpreted. Even though Latinos were concerned

that they would be evaluated based on their ethnicity, encouraging them to reinterpret anxiety as irrelevant to performance reduced doubt and increased their working memory capacity. These findings suggest that stereotype threat might influence coping responses by affecting the perceptions of one's ability to deal with the stress of the situation.

Additional research is needed, however, to examine this finding more closely. Given the possible difficulties of measuring secondary appraisals with self-report, it might be productive to test whether individual differences in coping styles (e.g., problem focused vs. emotion focused) moderate both the perception and experience of stereotype threat. Physiological indicators of stress, like cortisol levels, could also provide converging evidence of appraisal patterns and help link cognitive to affective processes (e.g., Matheson & Cole, 2004).

These studies might also provide a link to more general research on the nature of self-regulation. Similar to research on the executive function of working memory, evidence has accrued suggesting self-control is an effortful process that depends on the availability of limited resources (Baumeister et al., 1998; Muraven, Baumeister, & Tice, 1998). Studies testing this idea have shown that engaging in various forms of self-control, like inhibiting emotional expression, can drain the resources necessary for adaptive functioning in other situations that require some amount of active cognition (Schmeichel et al., 2003). Applying this model could suggest novel approaches to measuring the effects of stereotype threat on cognitive functioning. For example, if people experiencing stereotype threat are expending additional resources to self-regulate (i.e., avoid and deny feeling anxious) then they might have more difficulty performing subsequent behaviors

that also require executive control, like speaking in public (Vohs, Baumeister, & Ciarocco, 2005). This idea could also have important implications for academic achievement. The effect of stereotype threat on one test could essentially spill over to reduce performance on another, inherently non-threatening test. For example, if a woman experiences stereotype threat while completing the quantitative section of a college entrance exam then her performance on subsequent sections of the test could be compromised. Considering that 10 points on the SAT could mean the difference between obtaining an academic scholarship or having to work during college, even a small spill-over effect could have dramatic consequences for a student's undergraduate achievement potential. Beyond simply reducing the time available to study, juggling school and work could increase the number of stressors in a student's life and elevate her risk for experiencing mental and physical health problems during college.

Understanding the way stereotype threat reduces performances probably has the most significant implications for constructing academic situations that allow targets of negative stereotypes to perform up their full potential. The second study suggests that providing stereotype targets explicit opportunities to reappraise their anxiety might offer one approach to reducing stereotype threat. However, this type of intervention might be difficult to implement in real-world testing situations. At a more general level, the results of these studies suggest that teaching stereotype vulnerable students about more constructive ways to cope with stressors like stereotype threat could benefit their test performance. Information of this sort could be included in "Wise schooling" interventions that Steele and his colleagues have developed (see Steele, 1997 for a

description). If emotion-focused coping responses emerge from an underlying sense of doubt about one's ability to perform well, anxiety avoidance tendencies might also be reduced by the presence of confidence-building situational cues. Consistent with this idea, research by Marx and his colleagues (Marx & Roman, 2002; Marx et al., 2005) suggests that the presence of female instructors and graduate students in quantitative fields might provide a useful buffer for women taking math and engineering courses by offering positive, counter-stereotypic role models. Ingroup role models could ease doubt by providing important reminders that membership in a negatively stereotyped group does not necessarily limit one's potential for academic and professional achievement in the threatening domain (Davies et al., 2005).

Conclusions

The research presented here was designed to contribute to our understanding of the ways that stigmatized social identities can influence performance in academic situations. Following past research, the primary question was how the concern with confirming a negative intellectual stereotype can lead targets of these stereotypes to underperform on challenging tests. The results of two studies provide evidence that performing under the specter of a negative stereotype diverts cognitive resources to avoiding the negative feelings that arise when one is faced with the possibility of social devaluation. Indeed, Shelby Steele presaged this hypothesis when he offered the following observation about the experience of racial identity in academic settings:

To admit that one is made anxious in integrated situations about the myth of racial inferiority is difficult for young blacks. It seems like admitting that one *is* racially

inferior. And so, most often, the students will deny harboring those feelings. This is where some of the pangs of racial tension begin, because denial always involves distortion.

(1989, p. 51)

Providing empirical support for this idea represents an important advance in understanding exactly how persistent social beliefs work to undermine the talents and abilities of students who are members of stigmatized groups. Although these findings advance our theoretical knowledge, the ultimate hope that these studies contribute to the broader efforts aimed at developing strategies to assure that all members of society are afforded the opportunity to reach their full potential in whatever domain they choose.

APPENDIX A

Word Pairs Presented During the Critical Trials of the Dot Probe Task

<u>Attention Allocation Trial Word Pairs</u>		<u>Filler Trial Neutral Word Pairs</u>	
<u>Anxiety Words</u>	<u>Neutral Words</u>		
TENSE	BACKS	ATTIRE	SOAKED
UPSET	BLANK	AVOCADO	OFFHAND
FOOLISH	CHANNEL	BOTTLES	IMPORTS
STRESS	CITIES	EARS	LAWN
PATHETIC	CLEANERS	GEOMETRIC	CONTENDER
WORRIED	CONTEXT	HUNTING	PROCURE
INSECURE	DOORWAYS	KEYHOLE	DEFROST
WARY	FOLD	TOMATOES	OVERTIME
AGITATED	FOOTHILL	MARCHING	POTATOES
UNSURE	HELMET	MUSEUM	BRANCH
UNEASY	NEARBY		
FEAR	NOTE		
NERVOUS	OUTCOME		
DOUBTFUL	OVERSEAS		
SCARED	PLANET		
FAILURE	PROJECT		
EDGY	RINK		
INFERIOR	SHEARING		
ANXIOUS	SIGNALS		
THREAT	VARIED		

APPENDIX B

*Self-report Questionnaire Items for Study 1*Primary Appraisal Items

How difficult do you expect the problems to be on the [exercise\ test] you are about to take?

1	2	3	4	5	6	7
Extremely Easy						Extremely difficult

How much pressure do you feel to do well on these types of problems?

1	2	3	4	5	6	7
None at all						Very much

Secondary Appraisal Items

Do you feel like you have the skills to succeed on the upcoming [problem solving exercise\ math test]?

1	2	3	4	5	6	7
Not at all						Very much so

How able are you to cope with the demands of the upcoming [problem solving exercise\ math test]?

1	2	3	4	5	6	7
Not at all						Extremely well

Performance Expectation

Overall, how do you think you will do on the upcoming [problem solving exercise\ math test]?

1	2	3	4	5	6	7
Extremely Poorly						Extremely well

Stereotype Threat Related

How would you expect men and women will do on this [exercise\ test] test relative to each other?

1	2	3	4	5	6	7
Men will score better than women			Men and women will score the same			Women will score better than men

APPENDIX B (continued)

Self-report Questionnaire Items for Study 1

How do you think the researcher expects men and women to do on this [exercise\ test] relative to each other?

1	2	3	4	5	6	7
Men will score better than women			Men and women will score the same			Women will score better than men

The researcher believes that men and women differ in their natural [problem solving\ mathematical ability].

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

Evaluation Apprehension Items

I am concerned that the researcher will think I have less ability if I did not do well on this [exercise\ test].

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

I am concerned that the researcher will judge me based on my performance on the [exercise\ test].

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

Importance

Doing well on this [exercise\ test] is very important to me.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

I care a great deal about my performance on this [exercise\ test].

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

APPENDIX C

*Self-report Questionnaire Items for Study 2*Anxiety Effect Manipulation Checks

According to the researcher, how does anxiety affect performance on intellectual tests?

1	2	3	4	5	6	7
Anxiety hurts performance			Anxiety does not influence performance			Anxiety helps performance

How do you think anxiety affects performance on intellectual tests?

1	2	3	4	5	6	7
Anxiety hurts performance			Anxiety does not influence performance			Anxiety helps performance

Primary Appraisal Items

How difficult do you expect the problems to be on the test you are about to take?

1	2	3	4	5	6	7
Extremely easy						Extremely difficult

How much pressure do you feel to do well on tests of intellectual ability?

1	2	3	4	5	6	7
None at all						Very much

Secondary Appraisal Items

Do you feel like you have the skills to succeed on the upcoming test?

1	2	3	4	5	6	7
Not at all						Very much so

How well are you able to cope with the demands of the upcoming test?

1	2	3	4	5	6	7
Not at all						Extremely well

Performance Expectation

Overall, how do you think you will do on the upcoming test?

1	2	3	4	5	6	7
Extremely poorly						Extremely well

APPENDIX C (continued)

*Self-report Questionnaire Items Study 2*Stereotype Threat Related

I am concerned that the researcher will judge people of my race/ethnicity based on my performance on this test.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

Evaluation Apprehension Items

I am concerned that the researcher will think I have less ability if I did not do well on this test.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

I am concerned that the researcher will judge me based on my performance on the test.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

Importance

Doing well on this test is very important to me.

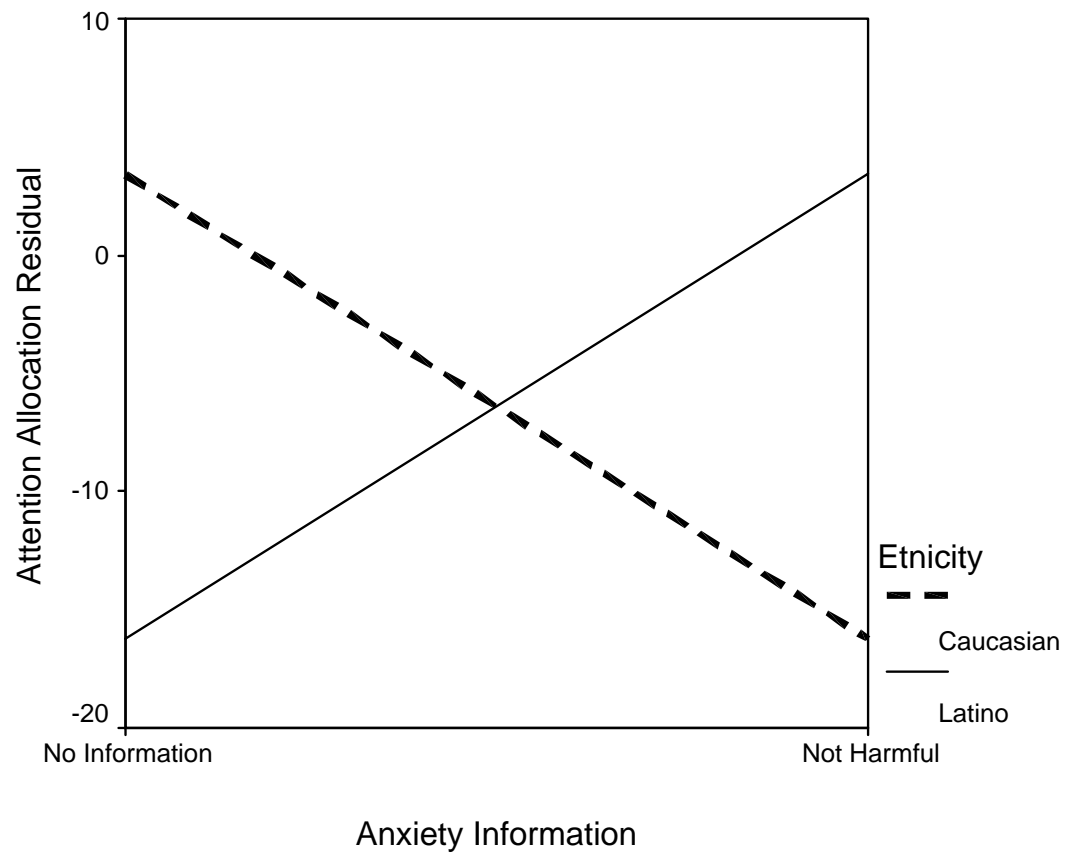
1	2	3	4	5	6	7
Strongly Disagree						Strongly agree

I care a great deal about my performance on this test.

1	2	3	4	5	6	7
Strongly disagree						Strongly agree

APPENDIX D

Figure 4 depicting the residual scores for the attention allocation index plotted as a function of participant ethnicity and anxiety information.



REFERENCES

- Abelson, R. P., & Prentice, D. A. (1997). Contrast tests of interaction hypotheses. *Psychological Methods*, 2(4), 315-328.
- Arndt, J., Greenberg, J., Solomon, S., Pyszczynski, T., & Simon, L. (1997). Suppression, accessibility of death-related thoughts, and cultural worldview defense: Exploring the psychodynamics of terror. *Journal of Personality and Social Psychology*, 73, 5-18.
- Aronson, J., Lustina, M. J., Good, C., Keough, K., Steele, C. M., & Brown, J. (1999). When white men can't do math: Necessary and sufficient factors in stereotype threat. *Journal of Experimental Social psychology*, 35, 29-46.
- Ashcraft, M. H. (2002). Math anxiety: Personal, educational, and cognitive consequences. *Current Directions in Psychological Science*, 11, 181-185.
- Ashcraft, M. H., & Kirk, E. P. (2001). The relationship among working memory, math anxiety and performance. *Journal of Experimental Psychology: General*, 130, 224-237.
- Avero, P., Corace, K. M., Endler, N. S., & Calvo, M. G. (2003). Coping styles and threat processing. *Personality and Individual Differences*, 35, 843-861.
- Banaji, M. R., & Greenwald, A. G. (1995). Implicit gender stereotyping in judgments of fame. *Journal of Personality and Social Psychology*, 68, 181-198.
- Bargh, J. A., & Chartrand, T. L. (1999). The unbearable automaticity of being. *American Psychologist*, 54, 462-479.

Bargh, J. A., Gollwitzer, P. M., Lee-chai, A., Barndollar, K., & Troetschel, R. (2001).

The automated will: Nonconscious activation and pursuit of behavioral goals.

Journal of Personality and Social Psychology, 81, 1014-1027.

Baron, R. B., & Kenny, D. A. (1986). The moderator-mediator variable distinction in

social psychological research: Conceptual, strategic, and statistical considerations.

Journal of Personality and Social Psychology, 51, 1173-1182.

Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is

the active self a limited resource? *Journal of Personality and Social Psychology*,

74, 1252-1256.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal

attachments as a fundamental human motivation. *Psychological Bulletin*, 117,

497-529.

Beilock, S. L., & Carr, T. H. (2005). When high-powered people fail: Working memory

and "choking under pressure" in math. *Psychological Science*.

Beilock, S. L., Kulp, C. A., Holt, L. E., & Carr, T. H. (2004). More on the fragility of

performance: Choking under pressure in mathematical problem solving. *Journal*

of Experimental Psychology: General, 133, 584-600.

Ben-Zeev, T., Fein, S., & Inzlicht, M. (2005). Arousal and stereotype threat. *Journal of*

Experimental Social psychology, 41, 174-181.

Ben-Zeev, T., Fein, S., & Inzlicht, M. (in press). Arousal and stereotype threat. *Journal of*

Experimental Social psychology.

- Benbow, C. P. (1988). Sex differences in mathematical reasoning ability in intellectually talented preadolescents: Their nature, effects and possible causes. *Behavioral and Brain Sciences, 11*, 169-232.
- Benbow, C. P., & Stanley, J. C. (1983). Sex differences in mathematical reasoning ability: More facts. *Science, 222*, 1029-1031.
- Blanton, H., Pelham, B. W., DeHart, T., & Carvallo, M. (2001). Over-confidence as dissonance reduction. *Journal of Experimental Social psychology, 37*, 373-385.
- Blascovich, J., Spencer, S. J., Quinn, D., & Steele, C. M. (2001). African americans and high blood pressure: The role of stereotype threat. *Psychological Science, 12*, 225-229.
- Blascovich, J., & Tomaka, J. (1995). The biopsychosocial model of arousal regulation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 28, pp. 1-51). New York: Academic Press.
- Bosson, J. K., Haymovitz, E. L., & Pinel, E. C. (2004). When saying and doing diverge: The effects of stereotype threat on self-reported versus non-verbal anxiety. *Journal of Experimental Social psychology, 40*, 247-255.
- Bowen, W. G., & Bok, D. (1998). *The shape of the river: Long-term consequences of considering race in college and university admissions*.
- Broadbent, D., & Broadbent, M. (1988). Anxiety and attentional bias: State and trait. *Cognition and Emotion, 2*, 165-183.
- Brown, R. P., & Lee, M. N. (2005). Stigma consciousness and the race gap in college academic achievement. *Self and Identity, 4*, 149-157.

- Brown, R. P., & Pinel, E. C. (2003). Stigma on my mind: Individual differences in the experience of stereotype threat. *Journal of Experimental Social psychology, 39*, 626-633.
- Butler, E. A., Egloff, B., Wilhelm, F. H., Smith, N. C., Erickson, E. A., & Gross, J. J. (2003). The social consequences of expressive suppression. *Emotion, 3*, 48-67.
- Cantor, J., & Engle, R. W. (1993). Working-memory capacity as long-term memory activation: An individual-differences approach. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 19*, 1101-1114.
- Cantor, J., Engle, R. W., & Hamilton, G. (1991). Short-term memory, working memory, and verbal abilities: How do they relate? *Intelligence, 15*, 229-246.
- Conway, A. R. A., Cowan, N., & Bunting, M. F. (2001). The cocktail party phenomenon revisited: The importance of working memory capacity. *Psychonomic Bulletin and Review, 8*, 331-335.
- Conway, A. R. A., Cowan, N., Bunting, M. F., Theriault, D., & Minkoff, S. (2002). A latent variable analysis of working memory capacity, short-term memory capacity, processing speed, and general fluid intelligence. *Intelligence, 30*, 163-183.
- Conway, A. R. A., & Engle, R. W. (1994). Working memory and retrieval: A resource-dependent inhibition model. *Journal of Experimental Psychology: General, 123*, 354-373.

- Conway, A. R. A., Tuholski, S. W., Shisler, R. J., & Engle, R. W. (1999). The effect of memory load on negative priming: An individual differences investigation. *Memory & Cognition*, 27, 1042-1050.
- Cowan, N. (1995). *Attention and memory: An integrated framework*. New York: Oxford University Press.
- Croizet, J. C., & Claire, T. (1998). Extending the concept of stereotype threat to social class: The intellectual underperformance of students from low socioeconomic backgrounds. *Personality and Social Psychology Bulletin*, 24, 588-594.
- Croizet, J. C., Despres, G., Gauzins, M., Huguot, P., & Leyens, J. (2004). Stereotype threat undermines performance by triggering a disruptive mental load. *Personality and Social Psychology Bulletin*, 30, 721-731.
- Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior*, 19, 450-466.
- Davies, P. G., Spencer, S. J., Quinn, D., & Gerhardstein, R. (2002). Consuming images: How television commercials that elicit stereotype threat can restrain women academically and professionally. *Personality and Social Psychology Bulletin*, 28, 1615-1628.
- Davies, P. G., Spencer, S. J., & Steele, C. M. (2005). Clearing the air: Identity safety moderates the effects of stereotype threat on women's leadership aspirations. *Journal of Personality and Social Psychology*, 88, 276-287.

- Eccles, J. S., Jacobs, J. E., & Harold, R. D. (1990). Gender role stereotypes, expectancy effects, and parents' socialization of gender differences. *Journal of Social Issues*, 46, 183-201.
- Engle, R. W. (2001). What is working memory capacity? In H. L. Roediger & J. S. Nairne (Eds.), *The nature of remembering: Essays in honor of Robert G. Crowder* (pp. 297-314). Washington, DC: American Psychological Association.
- Engle, R. W. (2002). Working memory capacity as executive attention. *Current Directions in Psychological Science*, 19-23.
- Engle, R. W., Cantor, J., & Carullo, J. J. (1992). Individual differences in working memory and comprehension: A test of four hypotheses. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 18, 972-992.
- Engle, R. W., Conway, A. R. A., Tuholski, S. W., & Shisler, R. J. (1995). A resource account of inhibition. *Psychological Science*, 6, 122-125.
- Engle, R. W., Kane, M. J., & Tuholski, S. W. (1999a). Individual differences in working memory capacity and what they tell us about controlled attention, general fluid intelligence and functions of the prefrontal cortex. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control* (pp. 102-134). Cambridge: Cambridge University Press.
- Engle, R. W., Tuholski, S. W., Laughlin, J. E., & Conway, A. R. A. (1999b). Working memory, short-term memory, and general fluid intelligence: A latent variable approach. *Journal of Experimental Psychology: General*, 128, 309-331.

- Ericsson, K. A., & Delaney, P. F. (1999). Long-term working memory as an alternative to capacity models of working memory in everyday skilled performance. In A. Miyake & P. Shah (Eds.), *Models of working memory: Mechanisms of active maintenance and executive control*. Cambridge, UK: Cambridge University Press.
- Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. *Psychological Review*, 102, 211-245.
- Eysenck, M. W. (1992). *Anxiety: The cognitive perspective*. Hove, UK: Lawrence Erlbaum.
- Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition and Emotion*, 6, 409-434.
- Feldman-Barrett, L., Tugade, M. M., & Engle, R. W. (2004). Individual differences in working memory capacity and dual-process theories of the mind. *Psychological Bulletin*, 130, 553-573.
- Folkman, S., & Lazarus, R. S. (1985). If it changes it must be a process: Study of emotion and coping during three stages of a college examination. *Journal of Personality and Social Psychology*, 48, 150-170.
- Folkman, S., & Lazarus, R. S. (1988). The relationship between coping and emotion: Implications for theory and research. *Social Science Med.*, 26(3), 309-317.
- Folkman, S., Lazarus, R. S., Dunkel-Schetter, C., DeLongis, A., & Gruen, R. J. (1986). Dynamics of a stressful encounter: Cognitive appraisal, coping and encounter outcomes. *Journal of Personality and Social Psychology*, 50, 992-1003.

- Ford, T. E., Ferguson, M. A., Brooks, J. L., & Hagadone, K. M. (2004). Coping sense of humor reduces the effects of stereotype threat on women's math performance. *Personality and Social Psychology Bulletin*, 30, 643-653.
- Fox, E., Russo, R., Bowles, R., & Dutton, K. (2001). Do threatening stimuli draw or hold visual attention in subclinical anxiety. *Journal of Experimental Psychology: General*, 130, 681-700.
- Frable, D. E., Blackstone, T., & Scherbaum, C. (1990). Marginal and mindful: Deviants in social interactions. *Journal of Personality and Social Psychology*, 59, 140-149.
- Frantz, C. M., Cuddy, A. J. C., Burnett, M., Ray, H., & Hart, A. (2004). A threat in the computer: The race implicit association test as a stereotype threat experience. *Personality and Social Psychology Bulletin*, 30, 1611-1624.
- Fredrickson, B. L., Roberts, T. A., Noll, S. M., Quinn, D., & Twenge, J. M. (1998). That swimsuit becomes you: Sex differences in self-objectification, restrained eating and math performance. *Journal of Personality and Social Psychology*, 75, 269-284.
- Gilovich, T., Medvec, V. H., & Savitsky, K. (2000). The spotlight effect in social judgment: An egocentric bias in estimates of the salience of one's own actions and appearance. *Journal of Personality and Social Psychology*, 78, 211-222.
- Gonzales, P. M., Blanton, H., & Williams, K. J. (2002). The effects of stereotype threat and double-minority status on the test performance of latino women. *Personality and Social Psychology Bulletin*, 28, 659-670.
- Gould, S. J. (1996). *The mismeasure of man* (2nd ed.). New York: Norton.

- Greenberg, J., Pyszczynski, T., & Paisley, C. (1985). Effect of incentives on use of test anxiety as an anticipatory attributional defense: Playing it cool when the stakes are high. *Journal of Personality and Social Psychology*, 47, 1136-1145.
- Greenwald, A. G., & Banaji, M. R. (1995). Implicit social cognition: Attitudes, self-esteem and stereotypes. *Psychological Review*, 102, 4-27.
- Gross, J. J. (1998). Antecedent- and response-focused emotion regulation: Divergent consequences for experience, expression, and physiology. *Journal of Personality and Social Psychology*, 74, 224-237.
- Gross, J. J. (2002). Emotion regulation: Affective, cognitive and social consequences. *Psychophysiology*, 39, 281-291.
- Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology*, 64, 97-986.
- Gross, J. J., & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting negative and positive emotions. *Journal of Personality and Social Psychology*, 106, 95-103.
- Hacker, A. (1995). *Two nations: Black and white, separate, hostile, unequal*. New York: Ballantine.
- Herrnstein, R. J., & Murray, C. (1994). *The bell curve*. New York: Free Press.
- Hess, T. M., Auman, C., Colcombe, S. J., & Rahhal, T. A. (2003). The impact of stereotype threat on age differences in memory performance. *Journal of Gerontology*, 58, 3-11.

- Hyde, J. S., Fennema, E., & Lamon, S. J. (1990). Gender differences in mathematics performance: A meta-analysis. *Psychological Bulletin*, 107(2), 139-155.
- Inzlicht, M., & Ben-Zeev, T. (2000). A threatening intellectual environment: Why women are susceptible to experience problem-solving deficits in the presence of men. *Psychological Science*, 11, 365-371.
- Inzlicht, M., & Ben-Zeev, T. (2003). Do high-achieving female students underperform in private? The implications of threatening environments on intellectual processing. *Journal of Educational Psychology*, 95, 796-805.
- Jacoby, L. L., Toth, J. P., & Yonelinas, A. P. (1993). Separating conscious and unconscious influences on memory: Measuring recollection. *Journal of Experimental Psychology: General*, 122, 139-154.
- Jencks, & Phillips. (1998). *The black-white test score gap*. Washington, DC: Brookings Institute Press.
- Johns, M., Schmader, T., & Martens, A. (2005). Knowing is half the battle: Teaching stereotype threat as a means of improving women's math performance. *Psychological Science*, 16, 175-179.
- Jorna, P. G. (1992). Spectral analysis of heart rate and psychological state: A review of its validity as a workload index. *Biological Psychology*, 34, 237-257.
- Josephs, R. A., Newman, M. L., Brown, R. P., & Beer, J. M. (2003). Status, testosterone, and human intellectual performance: Stereotype threat as status concern. *Psychological Science*, 14, 158-163.

- Kane, M. J., Bleckley, M. K., Conway, A. R. A., & Engle, R. W. (2001). A controlled-attention view of working-memory capacity. *Journal of Experimental Psychology: General, 130*, 169-183.
- Kane, M. J., & Engle, R. W. (2000). Working-memory capacity, proactive interference, and divided attention: Limits on long-term memory retrieval. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 26*, 336-358.
- Kane, M. J., & Engle, R. W. (2003). Working-memory capacity and the control of attention: The contributions of goal neglect, response competition, and task set to stroop interference. *Journal of Experimental Psychology: General, 132*, 47-70.
- Kane, M. J., Hambrick, D. Z., Tuholski, S. W., Wilhelm, O., Payne, T. W., & Engle, R. W. (2004). The generality of working memory capacity: A latent-variable approach to verbal and visuospatial memory span and reasoning. *Journal of Experimental Psychology: General, 133*, 189-217.
- Keller, J. (2002). Blatant stereotype threat and women's math performance: Self-handicapping as a strategic means to cope with obtrusive negative performance expectations. *Sex Roles, 47*, 193-198.
- Keller, J., & Dauenheimer, D. (2003). Stereotype threat in the classroom: Dejection mediates the disrupting threat effect on women's math performance. *Personality and Social Psychology Bulletin, 29*, 371-381.
- Klein, K., & Boals, A. (2001a). Expressive writing can increase working memory capacity. *Journal of Experimental Psychology: General, 130*, 520-533.

- Klein, K., & Boals, A. (2001b). The relationship of life event stress and working memory capacity. *Applied Cognitive Psychology, 15*, 565-579.
- Kozol, J. (1991). *Savage inequalities: Children in america's schools*. New York: Crown.
- La Pointe, L. B., & Engle, R. W. (1990). Simple and complex word spans as measures of working memory capacity. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 61*(6), 1118-1133.
- Lavric, A., Rippon, G., & Gray, J. R. (2003). Threat-evoked anxiety disrupts spatial working memory performance: An attentional account. *Cognitive Therapy and Research, 27*, 489-504.
- Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.
- Lazarus, R. S. (1999). *Stress and emotion: A new synthesis*. New York: Springer.
- Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.
- Levin, J. R., & Neumann, E. (1999). Testing for predicted patterns: When interest in the whole is greater than in some of its parts. *Psychological Methods, 4*, 44-57.
- MacLeod, C., & Donnellan, A. M. (1993). Individual differences in anxiety and the restriction of working memory capacity. *Personality and Individual Differences, 15*, 163-173.
- MacLeod, C., Mathews, A., & Tata, P. (1986). Attentional bias in emotional disorders. *Journal of Abnormal Psychology, 95*, 15-20.

- Martens, A., Johns, M., Greenberg, J., & Schimel, J. (in press). Combating stereotype threat: The effect of self-affirmation on women's intellectual performance. *Journal of Experimental Social Psychology*.
- Marx, D. M., & Roman, J. S. (2002). Female role models: Protecting women's math test performance. *Personality and Social Psychology Bulletin*, 28, 1183-1193.
- Marx, D. M., Stapel, D. A., & Muller, D. (2005). We can do it: The interplay of construal orientation and social comparisons under threat. *Journal of Personality and Social Psychology*, 88, 432-446.
- Matheson, K., & Cole, B. M. (2004). Coping with a threatened group identity: Psychosocial and neuroendocrine responses. *Journal of Experimental Social Psychology*, 40, 777-786.
- Mathews, A., & MacLeod, C. (1986). Discrimination of threat cues without awareness in anxiety states. *Journal of Abnormal Psychology*, 95, 131-138.
- McConnell, A. R., & Leibold, J. M. (2001). Relations among the implicit association test, discriminatory behavior, and explicit measures of racial prejudice. *Journal of Experimental Social psychology*, 37, 435-517.
- McLoyd, V. (1998). Socioeconomic disadvantage and child development. *American Psychologist*, 53, 185-204.
- Mendes, W. B., Reis, H. T., Seery, M. D., & Blascovich, J. (2003). Cardiovascular correlates of emotional expression and suppression: Do content and gender context matter? *Journal of Personality and Social Psychology*, 84, 771-792.

- Mendoza-Denton, R., Purdie, V., Downey, G., & Davis, A. (2002). Sensitivity to status-based rejection: Implications for african americans. *Journal of Personality and Social Psychology*, 83, 896-918.
- Miller, H., & Bichsel, J. (2004). Anxiety, working memory, gender, and math performance. *Personality and Individual Differences*, 37, 591-606.
- Miller, L. S. (1995). *An american imperative: Accelerating minority educational advancement*. New Haven, CT: Yale University Press.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognition Psychology*, 41, 49-100.
- Miyake, A., & Shah, P. (1999). *Models of working memory: Mechanisms of active maintenance and executive control*. Cambridge, UK: Cambridge University Press.
- Mogg, K., & Bradley, B. P. (1998). A cognitive-motivational view analysis of anxiety. *Behaviour Research and Therapy*, 36, 809-848.
- Moskowitz, G. B. (2002). Preconscious effects of temporary goals on attention. *Journal of Experimental Social psychology*, 38, 397-404.
- Muraven, M., Baumeister, R. F., & Tice, D. M. (1998). Self-control as limited resource: Regulatory depletion patterns. *Journal of Personality and Social Psychology*, 74, 774-789.
- Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports of mental processes. *Psychological Review*, 84, 231-259.

- O'Brien, L. T., & Crandall, C. S. (2003). Stereotype threat and arousal: Effects on women's math performance. *Personality and Social Psychology Bulletin*, 29, 782-789.
- Ogbu, J. U. (1978). *Minority education and caste: The american system in cross-cultural perspective*. San Diego: Academic Press.
- Ogbu, J. U. (1981). Origins of human competence: A cultural-ecological perspective. *Child Development*, 52, 413-429.
- Osborne, J. W. (2001). Testing stereotype threat: Does anxiety explain race and sex differences in achievement? *Contemporary Educational Psychology*, 26, 291-310.
- Payne, B. K. (2001). Prejudice and perception: The role of automatic and controlled processes in misperceiving a weapon. *Journal of Personality and Social Psychology*, 81, 181-192.
- Payne, B. K., Lambert, A. J., & Jacoby, L. L. (2002). Best laid plans: Effects of goals on accessibility bias and cognitive control in race-based misperceptions of weapons. *Journal of Experimental Social psychology*, 38, 384-396.
- Pennebaker, J. W. (1989). Confession, inhibition and disease. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 22, pp. 211-244). Orlando, FL: Academic Press.
- Pennebaker, J. W. (1997). Writing about emotional experiences as a therapeutic experience. *Psychological Science*, 8, 162-166.
- Pinel, E. C. (1999). Stigma consciousness: The psychological legacy of social stereotypes. *Journal of Personality and Social Psychology*, 76, 114-128.

- Pronin, E., Steele, C. M., & Ross, L. (2004). Identity bifurcation in response to stereotype threat: Women and mathematics. *Journal of Experimental Social psychology, 40*, 152-168.
- Quinn, D., & Spencer, S. J. (2001). The interference of stereotype threat with women's generation of mathematical problem-solving strategies. *Journal of Social Issues, 57*, 55-71.
- Raffety, B. D., Smith, R. E., & Ptacek, J. T. (1997). Facilitating and debilitating trait anxiety, situational anxiety, and coping with an anticipated stressor: A process analysis. *Journal of Personality and Social Psychology, 72*, 892-906.
- Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. *Journal of Personality and Social Psychology, 79*, 410-424.
- Rosen, V. M., & Engle, R. W. (1998). Working memory capacity and suppression. *Journal of Memory and Language, 39*, 194-201.
- Rosnow, R. L., & Rosenthal, R. (1989). Definition and interpretation of interaction effects. *Psychological Bulletin, 105*, 143-146.
- Rosnow, R. L., & Rosenthal, R. (1995). "some things you learn aren't so": Cohen's paradox, asch's paradigm, and the interpretation of interaction. *Psychological Science, 6*, 3-9.
- Roth, P. L., Bevier, C. A., Bobko, P., Switzer, F. S., & Tyler, P. (2001). Ethnic group differences in cognitive ability in employment and educational settings: A meta-analysis. *Personnel Psychology, 54*, 297-330.

- Rushton, J. P., & Jensen, A. R. (2005). Thirty years of research on race differences in cognitive ability. *Psychology, Public Policy and Law*, 11, 235-294.
- Ryan, K. E., & Ryan, A. M. (2005). Psychological processes underlying stereotype threat and standardized math test performance. *Educational Psychologist*, 40, 53-63.
- Sarason, I. G. (1984). Stress, anxiety, cognitive interference: Reactions to tests. *Journal of Personality and Social Psychology*, 46, 929-938.
- Sarason, I. G. (1988). Anxiety, self-preoccupation and attention. *Anxiety Research*, 1, 3-7.
- Schmader, T. (2002). Gender identification moderates stereotype threat effects on women's math performance. *Journal of Experimental Social Psychology*, 38, 194-201.
- Schmader, T., & Johns, M. (2003). Converging evidence that stereotype threat reduces working memory capacity. *Journal of Personality and Social Psychology*, 85, 440-452.
- Schmeichel, B. J., Vohs, K. D., & Baumeister, R. F. (2003). Intellectual performance and ego depletion: Role of the self in logical reasoning and other information processing. *Journal of Personality and Social Psychology*, 85, 33-46.
- Seibt, B., & Forster, J. (2004). Stereotype threat and performance: How self-stereotypes influence processing by inducing regulatory foci. *Journal of Personality and Social Psychology*, 87, 38-56.

- Sekaquaptewa, D., Espinoza, P., Thompson, M., Vargas, P., & von Hippel, W. (2003). Stereotypic explanatory bias: Implicit stereotyping as a predictor of discrimination. *Journal of Experimental Social psychology*, 39, 75-82.
- Sekaquaptewa, D., & Thompson, M. (2003). Solo status, stereotype threat and performance expectancies: Their effects on women's performance. *Journal of Experimental Social psychology*, 39, 68-74.
- Service, E. T. (1994). *Gre: Practicing to take the general test* (9th ed.). Princeton, NJ: Pantheon Book.
- Seymour, E., & Hewitt, N. M. (1997). *Talking about learning: Why students leave the sciences*. Boulder, CO: Westview Press.
- Shah, J. Y. (2005). The automatic pursuit and management of goals. *Current Directions in Psychological Science*, 14, 10-13.
- Shah, J. Y., & Kruglanski, A. W. (2002). Priming against your will: How accessible alternative affect goal pursuit. *Journal of Experimental Social psychology*, 38, 368-383.
- Shih, M., Pittinsky, T. L., & Ambady, N. (1999). Stereotype susceptibility: Identity salience and shifts in quantitative performance. *Psychological Science*, 10, 80-83.
- Skinner, N., & Brewer, N. (2002). The dynamics of threat and challenge appraisals prior to stressful achievement events. *Journal of Personality and Social Psychology*, 83, 678-692.

- Smith, J. L. (2004). Understanding the process of stereotype threat: A review of mediational variables and new performance goal directions. *Educational Psychology Review, 16*, 177-206.
- Smith, T. W., Snyder, C. R., & Handelsman, M. M. (1982). On the self-serving function of the academic wooden leg: Test anxiety as a self-handicapping strategy. *Journal of Personality and Social Psychology, 42*, 314-321.
- Sorg, B. A., & Whitney, P. (1992). The effect of trait and situational stress on working memory capacity. *Journal of Research in Personality, 26*, 235-241.
- Spencer, S., Iserman, E., Davies, P. G., & Quinn, D. (2001). The perils of avoiding negative thoughts: Thought suppression as a mediator of stereotype threat: University of Waterloo.
- Spencer, S. J., Steele, C. M., & Quinn, D. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social psychology, 35*, 4-28.
- Statistics, N. C. f. E. (1997). *Findings from the condition of education 1997: Women in mathematics and science* (No. 97-982). Washington, DC: U.S. Government Printing Offices.
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identities and performance. *American Psychologist, 52*, 613-629.
- Steele, C. M., & Aronson, J. (1995). Stereotype threat and the intellectual test performance of african americans. *Journal of Personality and Social Psychology, 69*, 797-811.

- Steele, C. M., Spencer, S. J., & Aronson, J. (2002). Contending with group image: The psychology of stereotype and social identity threat. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (Vol. 34, pp. 379-440). San Diego, CA: Academic Press.
- Steele, S. (1989, Feb). The recoloring of campus life: Student racism, academic pluralism, and the end of a dream. *Harper's*, 47-44.
- Stone, J. (2002). Battling doubt by avoiding practice: The effects of stereotype threat on self-handicapping in white athletes. *Personality and Social Psychology Bulletin*, 28, 1667-1678.
- Stone, J., Lynch, C. I., Sjomeling, M., & Darley, J. M. (1999). Stereotype threat effects on black and white athletic performance. *Journal of Personality and Social Psychology*, 77, 1213-1227.
- SuB, H.-M., Overauer, K., Wittmann, W. W., Wilhelm, O., & Schulze, R. (2002). Working-memory capacity explains reasoning ability - and a little bit more. *Intelligence*, 30, 261-288.
- Tabachnick, B. G., & Fidell, L. S. (2001). *Computer-assisted research design and analysis*. Boston: Allyn and Bacon.
- Tenenbaum, H. R., & Leaper, C. (2003). Parent-child conversations about science: The socialization of gender inequities? *Developmental Psychology*, 39, 34-47.
- Tetlock, P. E., & Manstead, A. S. (1985). Impression management versus intrapsychic explanations in social psychology: A useful dichotomy? *Psychological Review*, 92, 59-77.

- Turner, M. L., & Engle, R. W. (1989). Is working memory task dependent. *Journal of Memory and Language*, 28, 127-154.
- Twenge, J. M., Cantese, K. R., & Baumeister, R. F. (2003). Social exclusion and the deconstructed state: Time perception, meaninglessness, lethargy, lack of emotion, and self-awareness. *Journal of Personality and Social Psychology*, 85, 409-423.
- Vohs, K. D., Baumeister, R. F., & Ciarocco, N. J. (2005). Self-regulation and self-presentation: Regulatory resource depletion impairs impression management and effortful self-presentation depletes regulatory resources. *Journal of Personality and Social Psychology*, 88, 632-657.
- Walton, G. M., & Cohen, G. L. (2003). Stereotype lift. *Journal of Experimental Social Psychology*, 39, 456-467.
- Wegner, D. M., Erber, R., & Zanakos, S. (1993). Ironic processes in the mental control of mood and mood-related thought. *Journal of Personality and Social Psychology*, 65, 1093-1104.
- Wheeler, S. C., & Petty, R. E. (2001). The effects of stereotype activation on behavior: A review of possible mechanisms. *Psychological Bulletin*, 127, 797-826.
- Whitworth, R. H., & Barrientos, G. A. (1990). Comparison of hispanic and anglo graduate record examination scores and academic performance. *Journal of Psychoeducational Assessment*, 8, 128-132.
- Wittenbrink, B., Judd, C. M., & Park, B. (1997). Evidence for racial prejudice at the implicit level and its relationship with questionnaire measures. *Journal of Personality and Social Psychology*, 72, 262-274.

Wittmann, W. W. (1988). Multivariate reliability theory: Principles of symmetry and successful validation strategies. In J. R. Nesselroad & R. B. Cattell (Eds.), *Handbook of multivariate experimental psychology* (pp. 505-560). New York: Plenum.

Wittmann, W. W., & SuB, H.-M. (1999). Investigating the path between working memory, intelligence, knowledge, and complex problem-solving performances via brunswik symmetry. In P. L. Ackerman, P. C. Kyllonen & R. D. Roberts (Eds.), *Learning and individual differences: Process, trait, and content determinants* (pp. 77-104). Washington, D. C.: American Psychological Association.