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### **Does Task Shifting Ability Mediate Gender Based Stereotype Threat Induction?**

Nancy Luddey Torres Calderón

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## Abstract

This study examined whether set shifting mediates the relationship between induction of stereotype threat and performance on organizational selection processes in men and women. Undergraduate students (N=90) were assessed in time in seconds to complete the Trial Making Test (TMT) part B, number of error in TMT-B and performance in a cognitive ability test after being exposed to one of three condition: non-stereotype threat , stereotype threat, and stereotyped threat alleviation. We predicted that females who had Stereotype Threat induced would do worse on the Cognitive Ability math Test (CAT) taken as part of the selection process, that they would take less time set-shifting between different types of stimuli, and would have more errors in doing it than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference will not occur across conditions for males. We found that stereotype threat had no significant effect on females' scores in the CAT. However, females in Stereotype threat condition took significantly less time to set-shift (i.e. speed) between different type of stimuli and had higher number of error when they did it than those in both stereotype threat and stereotype alleviated groups, suggesting that stereotype threatened situations could undermine performance on a task requiring attentional control.

*Key words: Stereotype threat, set shifting, selection, attention control, working memory*

MONTCLAIR STATE UNIVERSITY

Does Task Shifting Ability Mediate Gender Based Stereotype Threat Induction?

by

Nancy Luddey Torres Calderón

A Master's Thesis Submitted to the Faculty of Social Sciences

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For the Degree of

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May 2014

College of Humanities and Social Sciences

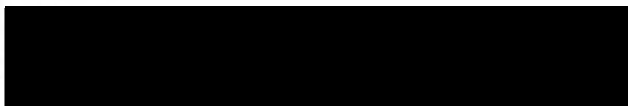
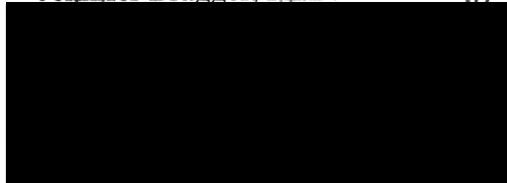
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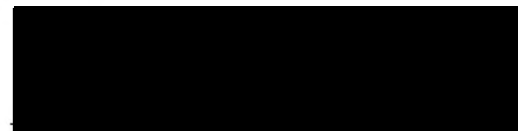
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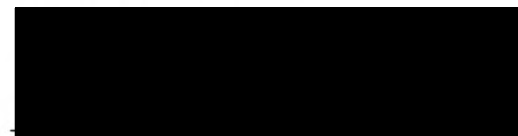


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DOES TASK SHIFTING ABILITY MEDIATE GENDER BASED STEREOTYPE THREAT  
INDUCTION?  
A THESIS

Submitted in partial fulfillment of the requirements  
For the degree of Industrial and Organizational Master

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## Does Task Shifting Ability Mediate Gender Based Stereotype Threat Induction?

Stereotype threat, initially introduced in the field of education, is the threat that test takers or performers feel when they are in situations where a negative stereotype about a group with which they identify is made salient (Steele, 1997). It is a resulting sense that one might be judged in terms of negative stereotypes that are “in the air” (Steele, 1997). Steele, Spencer, and Aronson (2002) have suggested that stereotype threat is accompanied by “concerns about how one will be perceived, doubts about one’s ability, thoughts about the stereotype. . .” (p. 392). Kray, Thompson and Galinsky (2001) define stereotype threat as the “concern and anxiety over confirming, as a self-characteristic, a negative stereotype about one’s group” (p.943).

Research shows that such anxiety can cause negative performance effects in the domain that is negatively stereotyped (Ben-zeevev, Fein & Inzlitch, 2005; Nguyen et. al. 2008; Steele and Aaronson, 1995). Furthermore, research has reliably demonstrated that stereotype threat effects can result in decreased performance and decision-making in a wide array of stereotype-related domains with the research particularly focused on deterioration of performance of women and minorities in response to race and gender-based stereotypes (Schmader & Johns, 2008; Logel, Peach & Spencer, 2011). Some of this research has found ST to cause decrements in memory (Schmader & Johns, 2003), learning (Rydell, Rydell & Boucher, 2010), attention (Inzlitch & Kang, 2010) and self-regulation (Forbes et. al, 2008, Inzlitch et al., 2010). In addition, Inzlitch, Tullet, and Gutsell (2011) found that stereotype threat can impair cognitive processes that then have implications for decision-making and the control of negative or maladaptive impulses. However, while research has begun to investigate the relationships between stereotype threat and attention control and the physiological mechanisms that cause stereotype threat effects, much about how and why these effects occur is still unknown.

Set-shifting is an important executive function that involves the ability to change between a different set of attention foci depending of the demands of the situation (Anderson, 2002; Monsell, 2003). For example, shifting attention between the internal thoughts of trying to manage another's impression of you and the external task of completing a task such as alphabetizing words involves the ability to task or set shift. There is a quite extensive literature on this executive function, and the inability to effectively shift focus of attention has been implicated in the behavioral symptoms of several mental disorders, including Attention Deficit and Hyperactive Disorder (Cepeda, Cepeda & Kramer, 2000; Tamm, Menon, Ringel,& Reiss, 2004), schizophrenia (Pantelis, 1999), Obsessive Compulsive Disorder (Gu et al., 2008), Post Traumatic Stress Disorder (Falconer.2008), and in eating disorders such as anorexia nervosa (Tchanturia, Anderluh, Morris, Rabe-Hesketh, Collier, Sanchez, & Treasure, 2004). Additionally, research has found that acute social stressors elevate cortisol levels can directly reduce the efficiency of this executive function (Kofman, Meiran, Geenberg, Balas, & Cohen, 2006). While research has found that stereotype threat influences performance by affecting attention control and memory (Beilock, 2008; Schmader & Johns, 2003), it has not specifically researched whether the induction of Stereotype Threat influences this particular aspect of attentional control and working memory. Our research purposes to investigate whether the induction of stereotype threat effects the executive function referred to as task or set shifting, and whether influencing this function mediates the reduction of performance in a domain that is stereotyped.

#### *Stereotype threat.*

Stereotype threat, defined as a “social-psychological threat that arises when one is in a situation or doing something for which a negative stereotype about one's group applies” (Steele,

1997, p. 614) can arouse anxiety in the “target”, which can affect performance in the stereotyped domain. Research has found ST to affect performance on many performance related domains including cognitive performance (Richard & Gross, 2000; Inzlicht, et al., 2006, Carr & Steele, 2009), decision-making (Carr & Steele, 2010; Inzlicht & Kang, 2010), negotiation (Kray et al., 2001), and learning (Rydell, et al., 2010). Research has particularly focused on investigating stereotype threat effects on women and minorities in response to race and gender-based stereotypes (Schmader, Johns, & Forbes, 2008; Wright, Thomas, Adler, Ness, Hoge, & Castro, 2005).

*Research History.* The origins of stereotype threat theory lie in two studies published in the 1960s that found that manipulating how a test or a task was presented to test takers influenced how the test takers performed on the tasks and tests. Katz, Epps, and Axelson (1964) found that blacks performed better on an IQ test when they thought they would be compared to other Blacks versus Whites (using national college norms) on the tests, and Katz, Roberts, and Robinson (1965) found Blacks performed better on a difficult digit-symbol task when it was presented as an eye-hand coordination test versus an intelligence test.

In a classic 1995 publication, Steele and Aronson published a series of studies that help to explain the traditional findings that African Americans tend to underperform on test such as the GREs or SATs. Subjects were asked to take GRE-like items that were described as either: diagnostic of intellectual ability, as a laboratory tool for studying problem-solving or as both a problem-solving tool and challenge. Diagnostic Blacks significantly underperformed in comparison with non-diagnostic Blacks, and performed significantly worse compared with non-diagnostic-challenge Blacks, and significantly worse in comparison with diagnostic Whites, while non-diagnostic and non-diagnostic-challenge Blacks matched the performance of their

White counterparts, indicating that stereotype threat could be induced through how the test is presented.

Research in the area of stereotype threat has developed over the past 20 years as researchers have realized its implications in society; original studies in the educational field awoke interest to study its possible implications in organizational and other applied social fields (Logel, 2009, Nguyen and Ryan, 2008). Stereotype Threat regarding race, gender and ethnicity have been researched most often (Kirnan et al., 2009; Nguyen & Ryan, 2008; Steele & Aronson, 1995), but there has also been research on stereotype threat and social class (Croizet & Claire, 1998, Croizet & Millet, 2011; Desert, Preaut & Jung, 2009) and age (Buyens, Van Dijk, De Vos, 2009; Levy, 1996); most of the research has focused on cognitive ability as the stereotyped domain (Nguyen and Ryan, 2008). A good deal of research has found stereotype threat affecting women's performance in math and science arenas (Logel, Walton, Spencer, Iserman, Bell & Von Hippel 2009; Shih, Pittinsky, & Ambady, 1999; Spencer, Steele, & Quinn, 1999; Walsh, Hickey, & Duffy, 1999), while some research has found women to be affected by stereotype threat effects in the leadership domain (Davies, Spencer, & Steele, 2005; Knight, Hebl, Foster, & Mannix., 2003) and in organizational negotiation (Kray et. al., 2001, 2004). In their meta-analysis on stereotype threat effects, Nguyen et al (2008) found that the overall mean effect size for race/ethnicity and gender based stereotype threat affects was .26. More recently, researchers of ST have begun investigating the cognitive mechanisms affected by the phenomenon that results in performance decrements.

On the other hand, researchers have also studied how to alleviate stereotype threat effects in threatening situations in an attempt to improve performance. Some studies alleviated stereotype threat by re-stating or reframing the situation as less threatening (Croizet & Claire,

1998; Steele & Aronson, 1995). For instance, Steele and Aronson (1995), study gave GRE verbal questions to Black and White college students, with different introductions. They instructed one group of students that the test measured verbal ability. They told to other group of students that the test did not measured verbal ability, which presumably made the situation less threatening. In the first condition, Blacks scored worse than Whites, in the second condition blacks performed at the same level that Whites introduction. As a result, instructing Black students that the test did not measured verbal ability apparently removed the added pressure of representing their group, decreased arousal, and allowed them to perform better.

In addition, stereotype threat can be alleviated by affirming the stereotype threatened individuals their self-worth by encouraging them to think about their own characteristics, skills, principles or roles that they consider as critical (Schimel, Arndt, Banko, & Cook, 2004). Also, Martens, Johns, Greenberg, and Schimel (2006) found that asking women to self-affirm removed performance impairments that are present when stereotypes about gender differences in mathematics are pointed out. The positive effects of self-affirmation seem to appear for the reason that self-affirmation alleviates psychological threat that arises by the anxiety of confirming stereotypes of bad performance.

#### *Stereotype Threat in the Organizational Contexts.*

As stated above, more recent research on stereotype threat has begun to investigate how it might influence applicant and employee performance in organizational settings (Kirnan et al. 2009; Logel et al., 2009; Schmitt, Gielnik, Zacher, & Klemann, 2013). Given the social nature of the job selection process and the fact that the applicant is expecting to be evaluated, the organization selection process is often considered the first opportunity for stereotype threat to occur in organizational settings. Most of the published research on stereotype threat in



organizational selection has investigated how priming race or mentioning whether a selection test is diagnostic of performance by the test administrator immediately prior to the test affects selection test performance (Kirnan et al., 2009; Nguyan & Ryan, 2008). If the position for which the applicant is applying for, it is one for which there is a stereotyped domain about a group they belong to (e.g. mathematics, science or leadership performance for females), then priming makes their gender more salient in relation to the stereotype domain and their performance will be undermined.

Research suggests stereotype threat may also be manipulated through the amount of employees trust have in their employers. For instance, in one study of African Americans found that employers' advocating for policies that would not support diversity in an organizational setting where there were few minorities had an effect on African American managers where they experienced doubt and distress with the organization (Purdie-Vaughns, Steele, Davies, Dittmann & Crosby, 2008)

In addition, beliefs about workers' age can trigger stereotype threat in older workers. For instance Van Dalen, Henkens, & Schippers (2010) found that older workers are perceived as less productive, less flexible and lacking of willingness to learn about new technologies than their younger colleagues. These ideas suggest that older workers are vulnerable to be exposed to stereotype threat in organizational settings. Von Hippel et al. (2013) demonstrated the relationship between stereotype threat and job attitudes; this relationship was tested among employees of 50 years old and above in the US and Australia, with three different samples. Their research found that older employees' who felt stereotype threatened reported lower job satisfaction.

Additionally, research suggests that favoring males in the workplace can result in stereotype threat inducement for women and minorities in leadership and negotiation arenas (Kray et. al. 2001, 2004, Davies et. al. 2005, Knight et. al. 2003). Several studies have found that when women, minorities, and elders are selected to work in an organization, stereotype threat can affect their job performance, decision-making, and advancement (Buyens, Van Dijk, Dewilde, & De Vos, 2009; Davies et al., 2005; Knight et al. 2003).

*Stereotype threat and gender in organizational settings.*

Like much of the research on stereotype threat in organizational settings we compared the stereotype threatened group against the group that would not be stereotype threatened and the group that would be stereotype alleviated by the same induction in a gender-linked task.

Indeed, organizations have traditionally been considered a more “masculine” context, much of the research on stereotype threat in vocational and organizational settings has focused on women as the victims of stereotype threat (Spencer, Steele & Quinn, 1999; Logel, Peach, & Spencer, 2011). This research on gender and stereotype threat in careers and organizational settings has manipulated or induced stereotype threat in various ways, including through priming gender, by representing women as “tokens” in particular settings, portraying women in more stereotypically feminine ways, and by presenting women as historically less successful in stereotyped domains (Inzlicht & Schmader, 2012). For instance, one study found that women who watched stereotyped commercials showed less interest in math careers (David, Spencer, Quinn & Gerhardstein, 2002). Another study found that women who watched a video with more men than women in a conference showed less desire to participate in the conference than men than women who viewed videos with the same quantity of men and women in the video

(Murphy, Steele, & Gross, 2007). Kray, Thompson, and Galinsky (2001) induced stereotype threat in women in organizational settings by telling participants in the stereotype threat condition that the negotiation exercise was an important indication of managerial negotiation abilities and that gender-relevant traits were predictive of performance. Researchers found that men outperformed women when the negotiation was perceived as diagnostic of ability and when the negotiation was linked to gender-specific traits, demonstrating that stereotype threat confirmation undermines women's performance compared to men.

Furthermore, Carr and Steele (2010) found that women who experienced severe stereotype threat in business settings displayed great risk aversion. Moreover, von Hippel, Issa, et al., (2011) found that female lawyers who experienced social comparisons with their male counterparts when appraising their career progression and developmental prospects experienced acute stereotype threat measured by identity separation.

In the case of men on the basis of gender stereotype there is limited evidence. For example, Leyens, D' esert, Croizet, and Darcis (2000) found that men who were told that men were not as good as women in processing affective information made more errors in categorizing affective and non-affective words in a verbal decision task than did men who were not stereotyped. Men also have been compared on social sensitivity with women (Koenig & Eagly, 2005)

Thus, research has reliably found that women are stereotyped in the domains of mathematical, leadership, and negotiation ability in organizational settings compared to men, and the research also seems to indicate that women may have a tendency to feel stereotyped in organizational settings in general when underrepresented or reminded of their lack of status

because they have often been discriminated against and underrepresented in this setting (Murphy, Steele & Gross, 2007; Heilman, 1999). In addition, research demonstrates that alleviation can help to improve performance of women in stereotyped threatened situation where they are compared with their male counterparts (Martens et al, 2006; Schimel et al, 2004; Steele et al, 1995).

We therefore propose the following regarding a generalized gender stereotype threat manipulation in an organizational selection context:

Hypothesis 1: We hypothesize that females who had Stereotype Threat induced will do worse on the cognitive ability math test taken as part of the selection test than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference will not occur between conditions for males. In addition, the organizational selection context provides a plausible scenario for assessing subjects' performance on a set-shifting task, which could be presented as a perceptual ability selection tool, in order to determine how stereotype threat induction influences set-shifting ability and its relationship to performance in a stereotyped threatened domain. The following sections develops the rationale for how the physiological ability to set-shifting may be influenced by inducing stereotype threat and might influence performance in threatened domains.

#### *Stereotype Threat and Working Memory.*

Performance losses in stereotype threat situations are likely at least partly the result of anxiety and stress (Steele, 1997). Researchers have long been investigating how exactly stress and anxiety influences performance.

Research suggests that chronic levels of stress and anxiety might be associated with lower levels of working memory capacity (Eysenck & Calvo, 1992). Working memory is defined as a short-term memory system involved in the control, regulation, and active maintenance of a limited quantity of information with direct relevance to the task at hand (Miyake & Shah, 1999a). Working memory is the small amount of information that is kept in an easily retrievable state concurrently (Baddeley, 2007; Klingberg, 2009.). Recent approaches to working memory capacity assume that this cognitive system is highly involved in directing attention to the task at hand while suppressing irrelevant information; for example, intrusive thoughts about what people are thinking about you (Engle, 2001; Rosen & Engle, 1998). Research suggests that anxiety and stress influence levels of working memory. For instance, in one study, participants who score high in trait anxiety or report experiencing more life stress performed worse than less stressed participants on working memory capacity measures (Harris & Cumming, 2003).

Moreover, Petrie et al., 1996 suggest that the goal of suppressing intrusive thoughts is used to regulate emotional responses. Klein et al. (2001) found that thought suppression contends for the working memory processes needed for daily functioning and problem solving. Indeed, stressful events (e.g. ST threat situation) are similar to a secondary task that takes resources from working memory with the primary tasks (e.g. taking a test).

If the capacity of the working memory system to manage task-relevant information is interrupted, performance will be directly affected (Speier, Valacich, & Vessey, 1999; Salvucci, Taatgen, & Borst, 2009). It has been demonstrated that high working memory predicts the ability to sustain the accessibility of task goals (Kane & Engle, 2003) and helps to reduce rumination while completing resource-demanding tasks (Rosen & Engle, 1998). Research suggests that working memory is highly important for efficient thought regulation in situations that place high

demands on attention. Klein and Boals (2001) suggest that individuals with high life stress have lower levels of working memory capacity because they are chronically trying to suppress unwanted negative thoughts and feelings that they have.

Research suggests individuals in stereotype threat situations are trying to suppress negative thoughts about the veracity of the stereotypes, which could increase anxiety, interfere with working memory, and lower performance. Schmader and Johns (2003) tested the relationship between working memory and stereotype threat by triggering negative, salient stereotypes in women and Latinos and then measuring the working memory capacity of stereotyped group members. They found that manipulations of stereotype threat led to lower working memory scores among individuals who were targeted by the stereotype, but had no effect on those who were not targeted by the stereotype. They also found that reductions in working memory capacity observed under stereotype threat influenced the reductions in performance on a standardized test. Their study suggests that members of stereotyped groups underperform on cognitive tests when negative stereotypes have been induced at least partly because this additional information blocks their attentional resources and working memory (Schmader & Johns, 2003). These inner speeches and worries may also have some impact on central executive resources even when the task being performed is no longer related to the stereotype in question (Schmader & Johns, 2003; Carlson, 1997; Miyake & Shah, 1999a). The fact that working memory is implicated in ST and that ST seems to affect working memory by influencing attentional control suggests that specific factors that influence attentional control could be influenced in stereotype threat situations and that these functions are also partially responsible for performance loss when individuals feel stereotype threat.



*Stress, Attentional Control, and Stereotype Threat.* Attentional control is a cognitive function necessary for effective working memory. Attention control was conceptualized by Shallice (1988; Norman & Shallice, 1986) as a “supervisory attention system” that is engaged during conflicts among task goals, external stimuli, and well-learned response schemas. Miyake et al. (1999) used latent-variable analysis to identify three major components of attentional control: 1. Inhibition: “One’s ability to deliberately inhibit dominant, automatic, or prepotent responses when necessary” (p. 57); this involves using attentional control to resist disruption or interference from task-irrelevant stimuli or responses. 2. Updating: “Updating and monitoring of working memory representations” (p. 56) and 3. Shifting: “Shifting back and forth between multiple tasks, operations, or mental sets” (p. 55); this function involves adaptive changes in attentional control based on task demands. While research on stereotype threat has found both working memory and general attention focus and control to be involved in the performance decrements resulting from stereotype threat (Beilock, Jellison, Rydell, McConnell, & Carr; 2006), research has not investigated which specific components of attentional control influence result in reduced performance in ST situations.

*Set Shifting, Working Memory, and Stereotype Threat.*

The ability to change behavioral goals has been referred to by multiple terms including task switching, set shifting, and attention switching. The varieties of terms used to refer to this ability suggest that it may incorporate several component processes, but the way in which these terms differ has never been explicitly stated. The term “set shifting” is typically used when there is a change in attentional set, and a “set” is defined as the property of the stimulus that is relevant in a given trial (Rushworth, Passingham, & Nobre, 2005). Literature on set-shifting is quite extensive, but the term 'set-shifting' is used interchangeably in the literature to refer to several

slightly different capacities to shift foci of attention, and different tools measure different facets of the ability. Wager et al. (2004) identified five different types of set-shifting. Location shifts involve tasks that contrast shifting of spatial locations. Switching involving shifting attention from one relevant dimension of an object to another (e.g., from shape to color) are classified as attribute switches. Switching involving reversal of learned response mappings, where the response sets and the stimuli themselves remain the same, are classed as rule switches, and object switches are those where tasks in which the stimulus set or the relevant object are switched. Finally, tasks for which the critical contrast are either switching between response sets or switching which operations are applied to stimuli are classified as task switches.

Both behavioral and neuro-scientific investigators have sought to understand how people disengage from one task in order to take on another (Monsell, 2003). Factor analytic studies have widely supported the overall construct of set shifting, and it is widely accepted as one of the more important aspects of executive function and decision-making (Monsell, 2003). Deficits in this ability have found to be associated with various behavioral and mental disorders, including Attention Deficit and Hyperactive Disorder (Cepeda et al., 2000; Tamm et al., 2004), schizophrenia, (Velakoulis, Pantelis, McGorry, Dudgeon, Brewer, Cook, ... & Copolov, 1999), Obsessive Compulsive Disorder (Gu et al., 2008), Post Traumatic Stress Disorder (Falconer, 2008), and in eating disorders such as anorexia nervosa (Tchanturia et al. 2004, ) suggesting that is an important ability and that its malfunction can result in behavioral difficulties and even mental illness.

As noted above, the cognitive ability labeled attentional-, set- or task- shifting is an important component of working memory. The ability to switch sets or tasks rapidly is important for responding flexibly in a changing environment (Miller & Cohen, 2001). As also



discussed above, the ability to efficiently and effectively shift attention is part of a larger network of attentional control abilities. Attentional control theory (ACT) suggests that one of the ways that anxiety disrupts the functioning of the goal-directed attentional system is by inhibiting individuals' ability to effectively switch attention between different tasks or sets. Research has found that stereotype threat influences performance by affecting working memory (Rydell, McConnell, & Beilock, 2009; Beilock, Rydell, & McConnell, 2007) and has begun to suggest the mechanisms through which working memory is influenced. Inzlicht and Kang (2010) found that coping with the perceived threat could directly influence attentional control. According to Schmader et al (2008) the process of engaging in heightened vigilance and attentional switching alone could account for impairments in working memory. The current concept of working memory refers to that type of memory that is used to focus attention on temporarily activated information of interest while inhibiting other information that is irrelevant to the task at hand (Engle, 2001). Thus, working memory capacity includes both the temporary storage of information as well as an attentional capability (Engle, Tuholski, Laughlin, & Conway, 1999), and set-shifting is a component of the attentional control capability. People with higher working memory capacity are better able to suppress task-irrelevant information (Rosen & Engle, 1998) as evidenced by their lower susceptibility to the cocktail party effect (Conway, Cowan, & Bunting, 2001). This effect is in which one can be present to only part of a boisterous setting, and still highly pertinent stimuli such as one's name can swiftly capture attention. This effect allows people to have their attention foci on a single voice and tune off all others while being in a noisy room. This suggests that working memory and set shifting are highly related and that efficient task/set shifting is necessary for effective working memory, and research has supported this relationship (Suvak & Barrett, 2011). Suvak and Barrett state that the anterior insula

interacts with the frontal lobe to regulate executive functions of working memory and attention-switching networks (Corbetta, Patel, & Shulman, 2008), and suggest that control of set-shifting helps to regulate attention between the internal and external world. Switching between sets of response rules requires the ability to retrieve the correct rule set and load it into working memory.

Inzlicht and Kang (2010) found that coping with threat could directly influence attentional control. According to Schmader, Johns, and Forbes, (2008) the process of engaging in heightened vigilance and attention switching alone could account for impairments in working memory. However, though there seems to be agreement that stereotype threat influences performance by interfering with the ability to efficiently focus attention, no research has explicitly investigated whether stereotype threat influences the ability to set shift and whether set-shifting mediates the relationship between stereotype threat and reduced performance in stereotype threat situations.

Research suggests that while ST often reduces performance, that individuals under stereotype threat try to disprove the ST by putting in extra effort to perform well. For instance, some studies by Hoyt and Blascovich (2005; 2010) showed that women who had high leadership self-efficacy improved their identification with leadership after a situation of stereotype threat. Indeed, efficacious women performed better when they were asked to pretend being part of a hiring team, once they were under a stereotype threat situation than women with less leadership efficacy. Individuals under stereotype threat often increase their efforts to perform well and research finds that improved performance can be achieved if the tasks are cognitively simple or the cognitive processes or behaviors have been mastered by the individual (Jamieson & Harkins, 2007).

Research by Jamieson and Harkin (2007) support the suggestion that ST can cause subjects to move faster and try harder to improve performance using an antisaccade task. They tasked subjects to attempt to inhibit an automatic proclivity to look in the direction of a signal that flashes to the left or the right of a fixation point on a screen. To perform successfully in this task, participants must inhibit their dominant saccade to the cue or at least rapidly correct for an automatic saccade in order to pinpoint the target before it disappears from the screen. The researchers found that women under ST were faster to correct their mistake by moving back their look direction rapidly to identify the target on the opposite side of the screen. This display of corrective response emanated from their motivation to do well in order to disprove the stereotype. However, although, stereotype threat increases individual's motivation to do well, this increased drive prompts dominant responses in an automatic way and sometimes those responses are not accurate.

Moreover, under stereotype threat people can be driven not only to do an extra effort to perform well, also to complete the task as fast as they can in order to disconfirm the ST. For instance, in their study Ben-Zeev, Fein and Inzlicht (2005) showed that women wrote their name over and over again faster when expected to take a math test where they were instructed about gender differences (stereotype threat condition) compared to when they did not were stereotype threatened. In sum, research findings suggest those under ST attempt to work faster and correct performance to disconfirm the stereotype, but that performance will suffer if the task is not simple or well learned.

We therefore predict the following:

Hypothesis 2: We hypothesize that females who have had Stereotype Threat induced will take less time set-shifting between different types of stimuli than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference will not occur for males.

Hypothesis 3: We hypothesize that females who have had Stereotype Threat induced will have more errors in set-shifting between different types of stimuli than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference will not occur for males.

Hypothesis 4: We hypothesize that errors in set-shifting will partially mediate the relationship between Stereotype Threat condition and performance on the cognitive ability test in women taken in the last phase of the selection process.

### Methods

#### Participants

We screened 205 individual for this study, only forty-five Caucasian male and 45 Caucasian female subjects, identified with math (i.e. participants who score above to the midpoint in the Math Identification Questionnaire discussed below) who were not classified as suffering from ADHD, OCD, anorexia or schizophrenia (these disorders or mental illnesses have been related with a decrement in set shifting processes as we mentioned before) were recruited for the study through a study recruitment system at Montclair State University. Participants were told we were studying how testing of mathematical ability relates to other types of assessment in predicting job success. We informed participants that they needed to complete a pre-study interest form and if they qualified, they were then invited to attend a specific study session in

Dickson Hall. We did not include Hispanics and African Americans because literature shows that they are susceptible to other forms of Stereotype Threat, which could confound the induction of ST in our study.

### Procedure

Subjects who responded to the recruitment message received a link to a consent form and a short prescreening survey that asked them if they have been diagnosed with ADHD, OCD, schizophrenia, or anorexia. Also, the initial survey asked them about their gender, ethnicity, SAT scores, major in college, GPA and future goals. Additionally, the survey included a five-item Math Identification Questionnaire (Brown & Josephs, 2000), a 7-point Likert questionnaire measuring the importance individuals place on their mathematical abilities (e.g., “Doing well on math-related). We administered the MIQ scale to control for differences in identification with the stereotyped domain, something known to predict susceptibility to stereotype threat. Subjects who score below the midpoint on the Math Identification Questionnaire or that have been diagnosed with ADHD, OCD, schizophrenia and anorexia were thanked and told that they do not need to come for the “selection process” at this particular time (students were not made aware of their scores). Students who score above the midpoint were given directions as to when and where to come to complete the selection process. Subjects were also asked in the survey to complete questions about how they react to tests in a 4-point Likert questionnaire measuring their test anxiety (e.g., “I feel distressed and uneasy before test”).

When subjects arrived to the in-person portion of the study, they were told again that they were there to complete a selection battery to determine their suitability for a career as a consultant in fields of mathematics or computers. They were told that there were 5 stages in the

process but that they were required to complete three of them (i.e. a writing assessment, a perceptual assessment and a numerical ability assessment). Subjects were given directions before each subsequent stage on how to complete each assessment and told how they would be timed for each stage of the selection process. The “writing assessment” involved the manipulation of the independent variable of stereotype induction. The “perceptual assessment” (the Trail Making Test) assessed the mediating variables of set-shifting speed and accuracy. The “numerical assessment” was a cognitive ability test that served as a measure of stereotype threat as gender based stereotype threat in the mathematical ability domain. At the end of the study we handed subjects a short survey that was a manipulation check and when they finished we thanked them for their participation and handed them the full disclosure consent that told the real purpose of the study.

*Math Identification Questionnaire - MIQ* (Brown & Josephs, 2000). The MIQ was a screening measure that was intended to screen out subjects who were not identified with mathematics as individuals must be identified in the stereotype threatened domain for their performance to be influenced. The MIQ is a 5-item questionnaire that evaluates the importance of mathematics to subjects. Participants rate the scope to which they come to an agreement with the statements on the MIQ using 7-point Likert scales anchored with strongly disagree (1) and strongly agree (7). Sample items are, “my math abilities are very important to me,” and “Math abilities are not important to my success in school.” (reverse scored). The MIQ has been used in previous research to screen out participants with low scores, who are not likely to be concerned with their performance on an inconsequential math test in a psychology study (Brown & Josephs, 1999). Only participants who scored above the median (3.5) were eligible for this study. We administered the MIQ to control for variances in identification with the stereotyped domain, this



is known to predict sensitivity to stereotype threat (Aronson et al., 1999; Inzlicht & Kang, 2010).

*Independent Variables.*

*Gender.* Gender was a non-manipulated independent variable in this research study. We balanced the number of males and females subjects in the study to compare cognitive ability scores and trial making between males and females in the 3 different stereotype threat conditions. Males served as a non-stereotyped control group as males are not traditionally stereotyped in mathematical, or organizational domains.

*Stereotype Threat Manipulation.* The manipulation of the stereotype threat variable occurred in the “written assessment” in what subjects were told was the first stage of the selection process. Subjects were randomly assigned to one of three different conditions; the stereotype threat condition, the non-stereotype threat condition, and the stereotype threat alleviation condition. We induced gender-based Stereotype Threat using Inzlicht & Kang’s (2010) methodology for inducing ST in the writing assessment by asking participants to recall and write about a time when they experienced a negative experience because of their gender a process that Inzlicht & Kang (2010) suggested can be resource depleting. Research has shown that vividly recalling an experience of prejudice would provoke psychological effects linked to the actual experience of the specific situation (Ackerman, Goldstein, Shapiro, & Bargh, 2009; Inzlicht & Kang, 2010). Subjects in the non-stereotype threat condition were asked to recall and write about a negative experience in general. Subjects in the ‘alleviating ST condition’ were asked to allocate part of their time to writing a negative outcome due to their gender, and then to spend part of the time writing about how this experience helped them to grow and realize that

they could overcome being stereotyped and discriminated against. Participants were asked to write about this experience and given 20 minutes to complete these stories.

*Manipulation Checks.* We evaluated the manipulation of the independent variables through questions that asked about whether the interviewer asked or remarked on the demographic characteristics of the interviewee with questions such as “during the selection process, did the interviewer acknowledge your gender” and through questions asking about the face validity of the math test (i.e. DAT) subjects were asked to complete.

### *Measures*

#### *Dependent variables*

*The Trail Making Test –TMT* is an instrument used in neuropsychological assessment as an indicator of task or set shifting ( Horton, 1979; Reitan, 1992; Strauss, Sherman, & Spreen, 2006; Wager et. al. 2004; Roberts, Tchanturia, & Treasure, 2010; Tenconi,, Santonastaso, Degortes, Bosello, Titton, Mapelli, & Favaro, 2010). Specifically the TMT part B is a measure of cognitive flexibility, also known as “set-shifting” or “task-set switching. Several studies have supported that set-shifting is key executive abilities essential to complete successfully part B (Lamberty et al., 1994 ; O’Donnell et al., 1994 ; Lezak, Howieson, & Loring, 2004; Spikman et al., 2001; arbutnott, , & frank, 2000). Indeed, TMT assesses “sustained attention” and “set maintenance,” set shifting (Sanchez-Cubillo, Perianez, Adrover-Roig, Rodriguez-Sanchez, Rios-Lago, Tirapu & Barcelo, 2009). Moreover, great deal of research significant correlation between TMT-B and Wisconsin Card Sorting Test (a neuropsychological test of set shifting) this supports the idea that the TMT-B measures “attentional set-shifting” or “task-set



switching,” ( Kortte et al., 2002; Ríos et al., 2004 ; Chaytor et al., 2006; Langenecker et al., 2007 ; Spikman et al., 2001; Sanchez-Cubillo et al, 2009).

In the Trail Making Test subjects must draw lines connecting in ascending order 25 circles containing numbers (1 to 13) and letters (A-L); the subject draws lines to connect the circles in an ascending order, with an additional task of alternating between the numbers and letters (i.e., 1, A, 2, B, 3, C). The subject was instructed to connect the circles as quickly as possible. We timed the subject as he or she connected the circles; the total score was the time in seconds spent to finish each part (Reitan, 1986). In administering the TMT, errors were defined as any incorrect line that reaches its target as defined by Ashendorf, L Jefferson, O'Connor, Chaisson, Green, and Stern (2008). While pointing out errors is generally done on the TMT-B participants in this study were not told by the test-administrator so that errors made could be considered as part of the ability to set shift.

After completing the writing assessment that involved the manipulation of the independent variable of stereotype induction, subjects were asked to complete this test as the second stage of the job selection process. The trail making test (TMT) was introduced to the subjects as a “perceptual assessment”.

*DAT “Differential Aptitude Tests for Personnel and Career Assessment.* After completing the perceptual activity (TMT) subjects were asked to complete a math test as the third stage of the job selection process. We selected the Differential Aptitude Tests for Personnel Selection (DAT) as the test to be administered to subjects as the measure of performance in a stereotype threatened domain. The DAT had been adapted and validated for personnel selection and it widely used in personnel selection (NCS Pearson inc., 1996). The Differential Aptitude

Tests for Personnel Selection and Career Assessment (DAT for PCA) developed and published by The Psychological Corporation (Omizo, 1980; Wilson & Wright, 1993). The DAT for PCA has a number of tests that were created and validated to either be used all together or as a battery of tests. Each test can be used individually or with other parts of the DAT for PCA. On this study we used a shortened version of the numeric reasoning section of the DAT, which is marketed as more general aptitude assessment. We used only this subtest because we considered that females are prone to suffer from stereotype threat in the area of mathematical reasoning and the position we were selecting for required this skill. The DAT for PCA is a timed test, which is important because research has found stereotype threat effects to be stronger under time constraints. The numeric reasoning section of the DAT for PCA has a time limit of 30 minutes. We shortened the test by eliminating several items from the mathematical reasoning and reduced the time limit to 20 minutes. This test is extensively recognized as having acceptable reliability and validity (Omizo, 1980; Wilson & Wright, 1993) and is frequently used as a personnel selection test (Pearson manual guide). Individuals had a total of 24 items and 20 minutes to complete and so scores on the test could range from 0 to 24. We used the Level 2 Version of the test which is reported by the Psychological Corporation to require a 17 score to show numerical ability, Level 2 is a more difficult version of this test, which research shows, is necessary to induce stereotype threat effect.

## Results

Table 1

*Means: overall means for Overall Numeric on the Cognitive Ability Test (DAT), Seconds to Complete the Trail Making Test Part B (TMT-B), Number of Errors in the Trail Making Test Part B*

		<i>DAT M (SD)</i>	<i>Time in Seconds to Complete TM- TB M (SD)</i>	<i># Error TMT-B M (SD)</i>
Gender	Female	13.13 (3.72)	47.81 (16.01)	.82 (1.63)
	Male	15.15 (4.28)	49.98 (15.18)	1.13 (2.03)
Condition	Non-stereotyped condition	13.60 (4.44)	52.38 (13.27)	.33 (9.22)
	Stereotyped condition	14.37 (3.92)	46.30 (17.47)	1.40 (2.40)
	Stereotyped +alleviation	14.47 (4.05)	48.03 (15.52)	1.20 (1.75)

Table 2

*Means: overall means by gender and condition on the Cognitive Ability Test (DAT), Seconds to Complete the Trail Making Test Part B (TMT-B), Number of Errors in the Trail Making Test Part B*

Gender	Condition	DAT M (SD)	Time in Seconds to Complete TM- TB M (SD)	# Error TMT-B M (SD)
Female	Non-stereotyped condition	13.00 (4.16)	52.39 (12.82)	.33 (1.05)
	Stereotyped condition	13.53 (3.50)	43.87 (18.08)	1.67 (2.35)
	Stereotyped +alleviation	12.87 (3.70)	47.20 (16.59)	.47 (.74)
Male	Non-stereotyped condition	14.20 (4.78)	52.37 (14.15)	.33 (.816)
	Stereotyped condition	15.20 (4.26)	48.73 (17.11)	1.13 (2.50)
	Stereotyped +alleviation	16.07 (3.84)	48.86 (14.90)	1.93 (2.15)

### *Manipulation checks*

A chi-square test of goodness-of-fit was performed to determine whether participants in the different conditions (i.e. non-stereotype threatened, stereotype threatened and stereotyped alleviated) were differently acknowledged about their gender by the interviewer (i.e. stereotype manipulation). Participants in ST condition found that their gender was acknowledged more during the selection process, by the interviewer than participants from other conditions,  $X^2(6) = 12.5$ ,  $p = .025$ , one tailed.

### *Mean differences in the MIQ:*

In the screening survey we asked participants to rate their math identification with questions such as “My math abilities are very important to me” and if “I took an IQ test of my math abilities (a test of my natural math abilities, on which studying really would not help) and I did poorly on this test, I would be very bothered”. Females rated their math identification higher ( $M = 5.50$ ;  $SD = .44$ ) than males ( $M = 5.26$ ,  $SD = .70$ ). However, we ran a t-test and found that these differences in math identification were not significant ( $t(88) = -1.93$ ,  $p = 0.28$ , one tailed)

### *Mean Differences*

*Mean differences in the numerical Cognitive Ability Test Scores.* Means and standard deviations for the numerical portion of the DAT Cognitive Ability Test by gender and stereotype condition are reported in Table 1 and 2. Male participants scored higher on the numerical portion of the Cognitive Ability Test (CAT) than did female participants, with male subjects having a mean score of 15.15 correct out of a possible 24 items, and female participants having a mean score of 13.13. This mean differences were significant ( $t(88) = 2.39$ ,  $p = .001$  one tailed, Cohen's  $d = .50$ ).

As can be seen in Table 2, with respect to the stereotype condition, participants that were stereotype alleviated scored highest on the numerical section of the CAT with means of 14.47. Participants were in the stereotyped condition the next highest with an average score of 14.37 on the numerical section of the CAT. Participants who were on the non-stereotype condition scored lowest on the numeric section of the CAT ( $M=13.60$ ).

*Mean differences in TMT-B.* As can be seen in Table 1, females completed the Trail-Making Test Part B faster than males with a mean score of 47.82 seconds and 49.98 seconds respectively; this differences were not significant ( $t(88)=0.659$ ,  $p=.256$  one tailed, Cohen's  $d=-0.14$ ). Moreover, participants that were stereotyped completed the TMT-B faster ( $M=46.30$  seconds) than participants that were stereotype alleviated ( $M=48.03$  second) ( $t(58)=-0.405$ ,  $p=.34$  one tailed, Cohen's  $d=-0.10$ ) and those that were not stereotyped ( $M=52.38$  seconds) ( $t(58)=1.151$ ,  $p=.067$  one tailed Cohen's  $d=-0.39$ ).

*Mean differences in number of errors (accuracy) in TMT-B.* Table 1 shows that overall females had less error in TMT-B ( $M=.82$ ) than males ( $M=1.13$ ). This differences were not significant  $t(88)=.802$ ,  $p=.212$  one tailed, Cohen's  $d=-0.16$ . With reference to the stereotype conditions, participants in the non-stereotyped condition had less error in the TMT-B ( $M=.33$ ) than participants in the stereotyped + alleviation condition ( $M=1.20$ ) and the stereotyped condition ( $M=1.40$ ). These differences were significant, the former  $t(58)=1.167$ ,  $p=.01$  one tailed, Cohen's  $d=-0.13$ ; the later  $t(58)=-2.271$ ,  $p=.013$ , Cohen's  $d=-0.16$ . Means and standard deviations reported on Table 2 show the number of errors in the TMT-B by gender and stereotype condition.

### *Hypothesis Testing*

*Hypothesis 1:* Hypothesis one predicted that females who had Stereotype Threat induced would do worse on the cognitive ability math test taken as part of the selection test than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference would not occur between conditions for males. As can be seen in Table 2, females under the stereotype condition scored .53 points higher on the Cognitive Ability Test ( $M=13.53$ ) than females in the non-stereotyped condition ( $M=13.00$ ), and this difference is not significant ( $t(28)=-.38, p=0.35$ , one tailed, Cohen's  $d= .14$ ). Females in the stereotype condition scored only .66 higher on the CAT scores ( $M=13.53$ ) than females in the stereotype alleviation condition ( $M=12.87$ ) and the means are not significant different ( $t(28) =.507, p=0.31$ , one tailed, Cohen's  $d= .19$ ) providing no support to Hypothesis 1.

*Hypothesis 2:* Hypothesis two predicted that females who have had Stereotype Threat induced would take less time set-shifting between different types of stimuli than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference would not occur for males. Females in the stereotype condition took less time set shifting ( $M=43.87$ ) than females in the non-stereotype condition ( $M=52.39$ ). Because the small sample we are using  $p<.10$  instead of the standard  $p< .05$ . This mean differences is significant ( $t(28) = 1.48, p=.07$ , one tailed, Cohen's  $d= .56$ ). Females in the stereotype condition took less time set shifting ( $M=43.87$ ) than females in the stereotype alleviation condition ( $M=47.20$ ), however, this difference was not significant ( $t(28) =.507, p=.31$ , one tailed, Cohen's  $d= .19$ ) providing partial support to Hypothesis 2.



The t-tests comparing males in the stereotype condition to those in the non-stereotype condition and the one comparing males in the stereotype condition to those in the stereotype alleviation condition were not significant. In the stereotype condition males took less time set-shifting between different types of stimuli ( $M=48.73$ ) than males in the non-stereotype condition ( $M=53.37$ ). However, mean differences were not significant ( $t(28) = .64, p = .26$ , one tailed, Cohen's  $d = .24$ ). Males took less time set-shifting between different stimuli on the stereotype condition ( $M=48.73$ ) than males on the stereotype alleviation condition ( $M=48.86$ ), but differences were not significant, providing more support for Hypothesis 2.

*Hypothesis 3:* Hypothesis 3 predicted that females who have had Stereotype Threat induced would make more errors in set-shifting between different types of stimuli than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated, but that this difference would not occur between stereotype threat conditions for males. Females in the stereotype condition had significantly more error in set shifting between different types of stimuli than females in the stereotyped alleviation condition ( $t(28) = -2.00, p = .035$ , one tailed, Cohen's  $d = -.75$ ) and significantly more error than females in the non-stereotype condition ( $t(28) = 1.88, p = .03$ , one tailed, Cohen's  $d = .71$ ). Results of the two independent t-test shows that there was not significant differences in error in set shifting between males in the stereotype condition males in the non-stereotyped condition ( $t(28) = -1.27, p = .12$  one tailed) and males in the stereotype alleviation condition ( $t(28) = -.94, p = .18$  one tailed, Cohen's  $d = .35$ ). H3 is therefore supported.

*Hypothesis 4:* Hypothesis four predicted that errors in set-shifting were partially mediated by the relationship between Stereotype Threat condition and performance on the cognitive ability test taken in the last phase of the selection process. However, in our study Stereotype threat



induction did not influence scores on the CAT we could not assess whether errors in set shifting mediated this ability; hence hypothesis 4 was not supported.

### Discussion

The purpose of this study was to investigate whether the induction of Stereotype Threat influenced task or set shifting, and whether influencing this function mediated the reduction of stereotype threatened cognitive ability performance. We found that when females were stereotype threatened because of their gender they set shifted faster than females that were not stereotyped or stereotyped but also alleviated and that those females who were Stereotype Threatened had more errors in set-shifting between different types of stimuli than those who did not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated. We also found that these differences did not occur between conditions for males, who for whom mathematical ability and organization performance are not stereotyped threatened domains.

On the other hand, we did not find support for our prediction that female who had Stereotype Threat induced would do worse on the cognitive ability math test taken as part of the selection test than those who do not have Stereotype Threat induced or who have ST induced but also have Stereotype Threat alleviated.

#### *Theoretical implications*

Our study is the first study to find that inducing ST can influence set shifting speed and errors. We found that women who were stereotype threatened completed the set shifting task (marginally) faster than those who were not stereotyped, but made more errors in doing so and that this difference did not occur for male subjects who were not under stereotype threatened conditions. Our findings support Inzlicht and Kang's (2010) suggestion that coping with

stereotype threat could influence attentional control and their findings that stereotype threatened situations could harm performance on a task requiring attentional control (e.g. TMT-B) (Inzlicht, Mackay & Aronson, 2006). Schmader et al (2008) suggested that process of engaging in high vigilance and attentional shifting alone could account for impairments in working memory. The current concept of working memory refers to that type of memory that is used to focus attention on temporarily activated information of interest while inhibiting other information that is irrelevant to the task at hand (Engle, 2001). This suggests that working memory and set shifting are linked and that accurate task/set shifting is critical for effective working memory and vice-versa, (Suvak & Barrett, 2011). Our results go beyond Inzlicht et. al (2010; 2006) by providing initial evidence to further explain the neuropsychological process of stereotype threat by finding that task shifting speed and error are influenced under stereotype threatened conditions. Hence, individuals experiencing stereotype threatening situations shift between stimuli rapidly but they also do it inaccurately. Our results support the idea, as Inzlicht et al., (2010) suggested, that task/set shifting takes resources from working memory and that this can impede performance. In fact, our results support that actuated stereotypes consume executive functioning (Inzlicht et. al, 2006).

The fact that women, who were under stereotype conditions, took less time to complete the set shifting task but made more errors, is consistent with suggestions by Jamieron et al. (2007) that threatened participants produce work faster because they are attempting to disprove the stereotype, but produce incorrect responses, which displays a failure to inhibit prepotent/dominant responses. Our findings are also consistent with consistent with Schmader, et. al.'s (2008) findings that stereotyped individuals show impaired working memory

However, our research differs from previous research on stereotype threat in that we did not find females under ST conditions differed from those not under ST on the cognitive ability test (e.g. DAT) taken after completion of the set shifting task (Logel, Walton, Spencer, Iserman, Bell & Von Hippel 2009; Shih, Pittinsky, & Ambady, 1999; Spencer, Steele, & Quinn, 1999; Walsh, Hickey, & Duffy, 1999). We are not quite sure why we did not find differences on the CAT.

One possible explanation for lack of significant differences on the DAT was the organizational selection context. Our research investigated ST in an organizational selection scenario. Subjects believed that scores on the test would be used to indicate their “fit” for a career of interest. Our results support Sackett and collaborators (2003) that found that performance deficits associated with stereotype threat are not significant in selection processes because applicants are greatly motivated and incentives exist to do well (Cullen, Hardison, & Sackett, 2004; Cullen, Waters, & Sackett, 2006; Sackett, 2003; Sackett et al., 2001). Indeed, Sackett (2003) has suggested that other studies ST using personnel selection simulations also have failed in finding a negative effect of ST because participants were either focused on obtaining a desirable job, gaining a financial reward, or both (Mayer & Hanges, 2003; McFarland, Lev-Arey, & Ziegert, 2003; Nguyen, O'Neal, & Ryan, 2003; Ployhart, Ziegert, & McFarland, 2003). Sackett (2003) suggested that studies finding the above, involving realistic elements of life, direct attentional resources away from concerns about the stereotyped domain, the attention is forwarded to test performance instead, therefore the effect of stereotype threat is reduced or eliminated (Kalokerinos, von Hippel, & Zacher, 2014)

It is possible, however, that another explanation more aptly explains the lack of differences in scores on the CAT. Kalokerinos, et. al. (2014) suggest that stereotype threat

effects can be “acute” or “chronic” with multiple incidents of “acute” ST in a particular setting (e.g. one organization) eventually resulting in chronic stereotype threat. In our study the CAT in not taken immediately after the writing exercise -methodology introduced by Inzlicht et. al (2010) that triggered the ST. In our study the set-shifting task occurred between the ST threat induction and completing the Cognitive Ability Test making the induction of ST more “distal” as opposed to “proximal”. It could be that having another task in between the ST induction and the 2<sup>nd</sup> (cognitive ability) assessment of performance reduced the influence of this acute measure of ST.. Indeed, to date, research on stereotype threat in organizational selection has investigated how mentioning whether a selection test is diagnostic of performance by the test administrator immediately prior to the test affects selection test performance (Kirman et. al. 2009; Nguyen & Ryan, 2008). In these proximal tasks the effect of the ST is acute compared with distal tasks. Even though research has suggested that stereotype threat can be triggered by reminding people that are prone to be the targets of negative stereotypes, little research has investigated how transitory the feelings of stereotype threat are especially in a new or different contexts such as the case with our study (Kalokerinos, von Hippel, & Zacher, 2014). Indeed, Kalokerinos et al (2014) suggested that further research is required in order to conclude whether these intense reminders and/or manipulations bring lasting or merely transitory experiences of stereotype threat. Moreover, Inzlicht and Kang (2010) suggested that stereotype threat does not always result in performance deficits in the stereotyped domain, that a person under ST threat can perform at the same level as a non-threatened person but would need to expend more energy and effort to do so (Inzlicht, Aronson, Good & Mackay, 2006). Perhaps stereotyped women were able to “practice” on the more proximal set-shifting task resulting in improved performance on the more distal Cognitive Ability Test.

### *Practical implications*

Research, including our study, demonstrates that in organizational contexts, especially in selection processes, stereotype threat is a phenomenon that can affect executive control and performance of participants. Our results suggest that stereotype threat effects tax working memory and causes individuals to work more quickly to disprove stereotype threat effects yet this seems to result in higher occurrence of error, showing impairments in set shifting abilities.

The stress of being judged according to a stereotype threat results in errors of set shifting which cause problems in attention control. We did not find that this reduction in ability to effectively set shift influenced performance on the cognitive ability test following assessment of set shifting.

Impairments in set shifting are often present in behavioral and mental disorders , including ADHD (Cepeda et al., 2000; Tamm et al., 2004), schizophrenia, Velakoulis, Pantelis, McGorry, Dudgeon, Brewer, Cook, ... & Copolov, 1999), OCD (Gu et al., 2008), Post Traumatic Stress Disorder (Falconer,2008), and in eating disorders such as anorexia nervosa (Fascino et al, 2002, Tchanturia et al. 2004 ), suggesting that is an important ability of the executive function and that its malfunction can result in behavioral difficulties and even mental illness. When set shifting is impaired in terms of speed and errors people can show behavior disorders and even mental illness. For example, Mahurin and colleagues (2006) assessed TMT errors and time to complete it among patients with schizophrenia and depression and healthy people. They found that healthy participants completed the TMT more rapidly than the patients with depression and schizophrenia. Moreover, elevated error rates were only observed in patients with schizophrenia.

We have demonstrated that, at least for a short period of time, individuals under condition of stereotype threat make more errors in the ability to set shift than those not under ST conditions. It could also be that individuals who have difficulty set shifting are more susceptible to stereotype threat. Given that there are individual differences in attentional control (Inzlicht et al, 2006), working memory (Engle, Kane, & Tuholski, 1999) and set shifting (Rogers, Grasby, Brooks, & Robbins, 2000; Friedman, Miyake, Young, DeFries, Corley, & Hewitt, 2008) and that research has found these processes to be affected by Stereotype Threat. It is likely that such individual differences are likely to determine how susceptible a person is to stereotype threat.

### *Limitations*

Despite the contributions of our research, there are several limitations that should be taken into account when interpreting these findings. The sample size in the present study is not large, which could have influenced our ability to detect important differences. Some of analyses demonstrated medium effect sizes, as measured by Cohen's *d*, yet were still not statistically significant because of our lack of power (small sample).

In addition, we found theoretical disagreement on how to truly measure set shifting using the Trail Making Test. There is general agreement that the TMT is a valid measures of set shifting, but disagreement on how to statistically derive the measure. Arbuthnott and Frank (2000) studied the relationship between TMT scores and a theoretically 'real; measure of set shifting (i.e. Cognitive flexibility); their analysis showed specific association between B:A (e.g. the ratio of speed in completing the Trail Making Test Part B to the speed in completing the Trail Making Test Part A) and the ability to inhibit versus alternate between task-sets. Many other researchers have suggested that cognitive flexibility, could be assessed as a key executive ability in the performance of part B (Chaytor et al., 2006 ; Kortte et al., 2002 ; Lamberty et al., 1994 ;



Langenecker et al., 2007 ; O'Donnell et al., 1994 ; Ríos et al., 2004 ; Spikman et al., 2001 ). On the other hand, Sanchez- Cubillo et. al, (2009) suggested that TMT-A requires essentially visuo-perceptual abilities, TMT-B assess as firstly factor working memory and secondarily factor task/set-switching ability. Thus, they recommended that B-A reduces visuo-perceptual and working memory loads, providing an accurate indicator of executive control abilities, but not necessarily specifically set or task shifting. We decided to use the Trail Making Test Part B for two reasons 1) It was the most agreed upon and used derivation of set shifting in the Trail Making Test and 2) By doing so we could assess both set shifting speed and errors as other research has done (Mahurin et al, 2006)

#### *Future directions*

While there is a great deal of research on the “proximal” effects of acute stereotype threat effects, as noted by Kalokerinos, et al (2014) there has been little research on acute stereotype threat effects and its possible distal causes. Our research emphasizes the need to study both proximal and distal sources of stereotype threat and to investigate both acute and chronic stereotype threat effect. Future research should investigate the both proximal and distal sources of ST in social and organizational settings and how they influence both acute and chronic outcomes.

Second, given the evidence indicating that Stereotype threat has an effect on working memory and attentional control in general (Inzlicht et al, 2006) and set-shifting in particular, future research should investigate how these effects interact with other neurological dysfunctions and mental illnesses to determine whether individuals with certain disabilities are more susceptible to stereotype threat. For instance, individuals with ADHD, eating disorders,

OCD and schizophrenia could have a high risk to feel that by their diagnosis and their behaviors, they could confirm negative stereotypes about their group. Thus, their academic performance and/or academic commitment could be undermined not only because of their neurological impairment but also for an additional factor, stereotype threat.

Third, there is a need for more research focusing on the strategies used by stereotype threatened individuals when their set-shifting becomes inefficient. We found that when stereotype threat is induced subjects seemed to increase effort or motivation to maintain task performance as indicated by set shifting speed. Future research should investigate other adaptive strategies those under stereotype threat condition undertake and the efficiency of these strategies.

*Conclusions.* There were some limitations of the current research but this study provides continued support for the premise that stereotype threat influences working memory and attentional control. It is also the first study to investigate how stereotype threat influences the specific ability to set shift and one of the first studies to specifically investigate the process of *how* stereotype threat influences working memory. Future research should further investigate these findings in order to shed light on stereotype as the dynamic and multi-faceted phenomenon that it is.



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