

ABSTRACT

Title of Thesis: THE EFFECTS OF COGNITIVE STYLES
AND STEREOTYPE THREAT ON
COGNITIVE TEST PERFORMANCE

Joo Young Park, Master of Science, 2016

Thesis Directed By: Professor, Paul J. Hanges, Psychology
Department

This study examined the difference in cognitive styles between African Americans and Caucasians and how it affected cognitive test scores. This study also sought to detect the interaction of stereotype threat and cognitive style. Study 1 tested whether the cognitive style of field independence/dependence and convergence/divergence mediated the relationship between race and cognitive tests performance. I found support for field independence/dependence as a full mediator; however, I did not find support for convergence/divergence as a mediator. Study 2 sought to replicate Study 1 but add stereotype threat as a possible moderator to the model. I did not find support for the full model but partially replicated the results of Study 1. I discuss the implications of these findings on how to decrease adverse impact on cognitive tests.

THE EFFECTS OF COGNITIVE STYLES AND STEREOTYPE THREAT ON
COGNITIVE TEST PERFORMANCE

by

Joo Young Park

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Advisory Committee:
Professor Paul Hanges, Chair
Professor Michele Gelfand
Professor Jennifer Wessel

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Table 1.

Summary of all the hypotheses and results.

Hypotheses	Study 1	Study 2
H1: African Americans will perform significantly worse than Caucasians on the cognitive test.	Not Supported	Supported
H2: African Americans and Caucasians will significantly differ on field independence with African Americans being lower on field independence than Caucasians.	Supported	Supported
H3: The holistic cognitive style should have a high positive correlation with the field independent cognitive style.	Supported	Not tested
H4: African Americans and Caucasians will significantly differ on convergent/divergent cognitive styles with African Americans being lower on convergence than Caucasians.	Not Supported	Not tested
H5: Those with field independent styles will have higher scores on the RAPM than those with field dependent styles.	Supported	Supported
H6: Those with convergent styles will have higher scores on the RAPM than those with divergent styles.	Not Supported	Not tested
H7: Field independence and Convergence will mediate the relationship between Race and performance on the RAPM.	Partially Supported	Partially Supported
H8: Those in the stereotype threat condition will perceive stereotype threat and will perform worse on the Raven's Advanced Progressive Matrices than those in the no stereotype threat condition.	Not tested	Not Supported
H9: There will be an interaction between field dependent/independent and stereotype threat on RAPM performance. Specifically, the negative effect of stereotype threat will be stronger for the field dependent cognitive style than the field independent cognitive style.	Not tested	Not Supported
H10: There will be an interaction between convergent/divergent cognitive styles and stereotype threat on RAPM performance. Specifically, the negative effect of stereotype threat will be stronger for participants with a divergent cognitive style rather than a convergent cognitive style.	Not tested	Not Supported
H11: There will be a three-way interaction between race, stereotype threat, and field independent/dependent styles. Specifically, African Americans under stereotype threat who are field dependent will have the lowest RAPM scores while African Americans who are field independent will perform better than those who are field dependent but will still	Not tested	Not Supported

perform worse than Whites who are field independent.		
H12: There will be a three-way interaction between race, stereotype threat, and convergent/divergent styles. Specifically, African Americans under stereotype threat who are divergent will have the lowest RAPM scores while African Americans who are convergent will perform better than those who are divergent but will still perform worse than Whites who are convergent.	Not Tested	Not Supported

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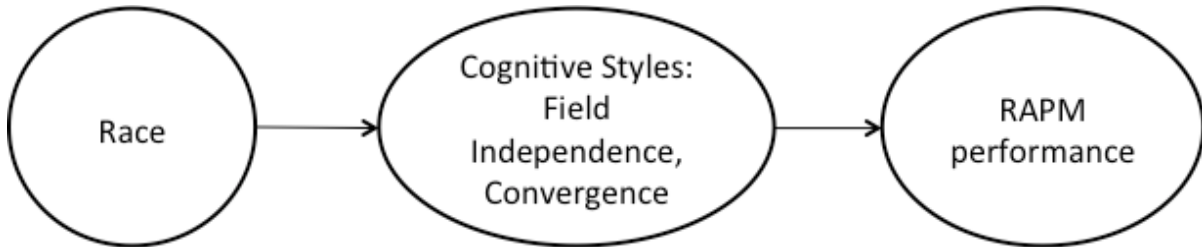


Figure 1. This figure illustrates the hypothesized mediated model for Study 1.

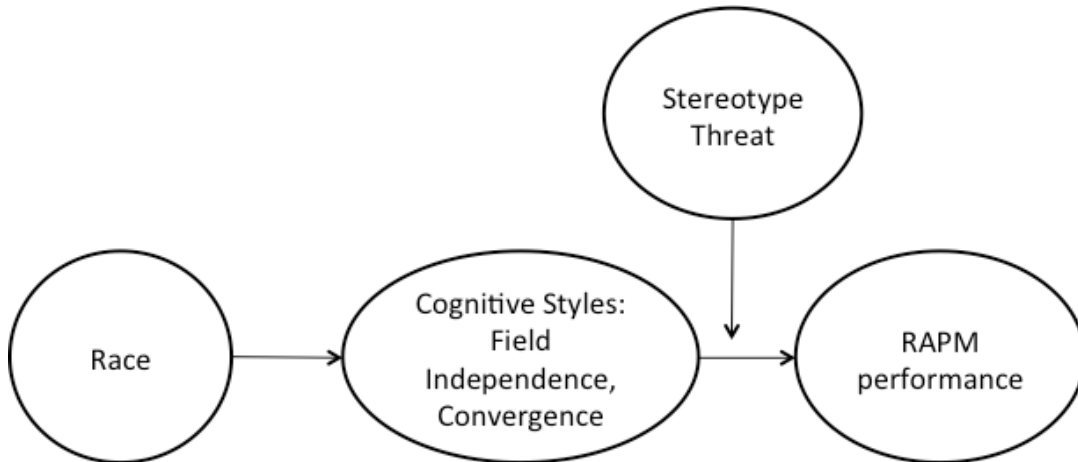


Figure 2. This figure illustrates the full hypothesized model for Study 2.

Chapter 1: Introduction

Meritocracy is a belief that economic benefits and rewards should be based on achievement and competencies, rather than political or familial connections (Young, 1958). American society has sought to make meritocracy a reality by relying on standardized testing as an accurate measure of people's intelligence and aptitude (Hale, 1982). For example, the Scholastic Aptitude test is used for college entrance and the Naglieri Nonverbal Ability Test is widely used to place elementary students into Gifted and Talented programs. Despite their promise, questions about the extent to which tests fulfill this mission without bias have been raised. For example, when assessing intelligence of immigrants and native-born Americans, a disproportionate number of immigrants were found to be mentally deficient in the 1920's (Lemann, 1995); however, subsequent research uncovered that these supposed deficiencies were due to the use of biased testing methods, not because of actual mental deficiencies.

Currently, there are still racial and gender mean differences repeatedly found in academic test scores (Jencks & Phillips, 1998). The average African American scores below 75% of Caucasians on many academic standardized tests (Jencks & Phillips, 1998), which leads to my first hypothesis.

Hypothesis 1: African Americans will perform significantly worse than Caucasians on the cognitive test.

Because of these stark racial gaps, there have been attempts to create "culture free" cognitive ability tests, such as the Raven's Advanced Progressive Matrices (RAPM). The RAPM is a test that assesses cognitive ability based on abstract patterns. Nonetheless, there have still been racial differences found in more visual cognitive tests

like the RAPM between African American and White participants (Brown & Day, 2006). Unfortunately, the overall results of cognitive testing have always appeared to mirror the existing class structure in the United States instead of meritocracy (Lemann, 1995).

Why do these racial and gender gaps exist and why do they persist? Past research has shown that external factors, other than the construct of interest, affect test scores. For example, immigrants were being classified as mentally deficient because they could not read or write English (Lemann, 1995). With the United States becoming increasingly diverse with immigrants from all over the world, it is important to consider all factors that may affect testing results.

There is a history of research on the differential results on cognitive tests based on subgroup differences in the field of Industrial and Organizational psychology, which date back to the 1940's (Hanges, Salmon, & Aiken, 2011). The US Equal Employment Opportunity Commission (EEOC) first introduced the term, Adverse Impact, in 1978 to describe substantial differences in employment decisions based on subgroup differences (Dunleavy, Morris & Howard, 2015). The EEOC prevents discrimination in the hiring process of different groups based on race, color, sex, national origin, religion, disability, or age (40 or older), unless the reason for the selection process is justifiable (Hanges et al., 2011). Adverse impact is usually the first step in claiming discrimination in the selection process and one of the most common ways to determine if adverse impact has occurred is the 4/5ths rule. The 4/5ths rule was established as a quick way to determine whether adverse impact has occurred in the selection process. The rule states that the selection rate for the lowest selection group must not be less than 80% of the highest selection group (Hanges et al., 2011). The uniform guidelines recommend the use of the

4/5ths rules instead of significance testing because of the effect of sample size on significance testing (Hanges et al., 2011).

Because of the legal implications of adverse impact, there has been a focus on what types of test produce the least and highest adverse impact on different subgroups. However, there has generally been a tradeoff; tests with lower adverse impact had lower criterion validity and tests with higher adverse impact and higher criterion validity (Cottrell & Newman, 2015).

Adverse impact occurs in most types of selection measures but has been the highest on cognitive tests between African Americans and Caucasians with an average effect size of $d=1.00$ (Cottrell & Newman, 2015). There are many different hypothesized reasons as to why we observe adverse impact in cognitive tests. I will first start with some of the earliest hypotheses about physical brain structure differences that have been largely debunked.

Broca (1861), concluded that intelligence was correlated with brain size and also made the conclusions that Europeans had larger brains than African Americans, males had larger brains than females, and that the elderly had larger brains than children. Although these conclusions were widely accepted in the 1800s, they have since been largely critiqued (Rushton & Ankney, 1995). Researchers in the late 1900s concluded that Broca's studies may have been affected by unconscious bias (Gould, 1996). The field has largely moved away from the notion that there are physical brain structure differences between different races and genders and has found other reasons for the differences in cognitive test performance. One hypothesis that has been recently been explored by many researchers is the motivational differences in test taking between African Americans and

Caucasians.

One of the hypothesized theories is that there is such a big test gap is low test taking motivation from African Americans. Motivation to do well on a test is linked to test performance (Arvey, Strickland, Drauden, & Martin, 1990). However, researchers have found that there are indeed motivational differences between different races. Chan, Schmitt, DeShon, Clause, & Delbridge (1997) found that motivation does mediate the relationship between race and test performance. In addition, Arvey et al. (1990) collected responses to a Test Attitude Survey, which measured test-taking motivation, and found that motivation did indeed mediate the relationship between race and test performance. A more recent study sought to explain the relationship between race, test motivation, and test performance even further by breaking down the motivation into three different types of motivation: valence, instrumentality, and expectancy motivation (VIEMS) (Sanchez, Truxillo, & Bauer, 2000). Valence refers to the test taker's perception of how attractive the outcome of doing well on the test is. Instrumentality refers to whether the test taker believes that performance on the test is linked to a desired outcome while expectancy is the test taker's belief that their effort will lead to the desired performance. Sanchez et al. (2000) found that African Americans reported lower levels of valence than Caucasian participants. The authors also found that VIEMS explained some variance in test scores. These studies show that multiple motivation explanations for the black white test gap but there are still many other explanations being explored as well.

Lastly, I will discuss cultural differences that may affect test performance. A recent study by Cottrell, Newman, and Roisman (2015) linked the cause of adverse impact to factors such as family income, maternal education, learning material at home,

and parenting factors. Parenting is largely influenced by culture and many developmental conditions. The authors suggest that there is a difference in parenting between African Americans and Caucasians and these parenting factors in turn affect cognitive test performance. The authors' final model explains around 80% of the Black-White test gap in children (Cottrell, Newman & Roisman, 2015).

In addition, there has been some research on how different cultures can also influence the kind of cognitive style a person adopts (Anderson, 1988). Therefore differing cognitive styles between different groups may also be possible explanations for subgroup score differences on standardized tests. I will first introduce the current literature on cognitive styles, discuss how this might affect testing, and then explain how stereotype threat may be negatively affecting those with certain cognitive styles to a greater extent.

Chapter 2: Literature Review

A cognitive style refers to the preferred framework people use to acquire knowledge and process information (Cronbach & Snow, 1977). Cognitive styles affect how a person learns, processes, and utilizes information. There are three main factors that affect the cognitive style developed by a child: Child rearing, socialization practices, and sex role development (Anderson, 1988). Because cognitive styles are heavily affected by environmental factors, it is likely that different cultures would produce different cognitive styles. Indeed, many studies have shown differences in cognitive styles across cultures (Witkin, Moore, Goodenough, & Cox, 1977; Anderson, 1988; Ramirez & Price-Williams, 1974; Nisbett & Miyamoto, 2005). Once a cognitive style is developed, it is believed to be relatively stable and persistent (Anderson, 1988).

Because of the large effects that cognitive styles have on an individual's decisions and performance, many different fields have been studying cognitive styles in different contexts since the 1950s (Kozhevnikov, Evans & Kosslyn, 2014). For example, organizational psychologists have been studying cognitive styles decision-making processes, educational psychologists have been studying learning styles in classroom settings, cognitive psychologists have been studying the differences in speed and processing, and neural psychologists have even looked at the difference in neural activity across those with different cognitive styles (Kozhevnikov et al., 2014).

Because many different research areas have studied cognitive styles, the empirical literature is disjointed and difficult to integrate because of a growing panoply of cognitive styles having been identified with no unifying taxonomy available to organize these styles. However, recently, there have been some efforts to organize the different

cognitive style dimensions into a unified taxonomy. Kozhevnikov et al. (2014) proposed a taxonomy that organized the different cognitive styles as a function of (a) level of information processing being affected by the cognitive style and (b) method by which the individual adapts to the external environment. The “level of information processing” factor concerns whether the cognitive style is affecting information processing at the perceptual level, the concept formation level, some higher order cognitive level, or at metacognitive levels. The “method of adapting to the external environment” factor refers to the preferred style that a person uses to adapt to the environment. This factor includes preferred adaptation styles such as: context independence vs. dependency, rule based vs. intuitive, internal vs. external locus of control and integration vs. compartmentalization. With this taxonomy, it is hoped that researchers can identify appropriate cognitive style dimensions for their study as well as synthesize empirical findings into a cohesive database.

For the purposes of this study, I will focus on two different categories of cognitive styles: a) field independence v. field dependence and b) convergent v. divergent cognitive styles. Both are styles that are relevant to the Raven’s cognitive test and are the two most widely studied cognitive styles (Kozhevnikov et al., 2014). As will be discussed shortly, these cognitive styles have also shown racial differences in past studies. I chose these two cognitive styles after examining their location in Kozhevnikov et al. (2014) taxonomy. Field independence/ dependence affects information processing at the perceptual level as well as reflects the context independence/dependence adaptive style. In contrast, convergent/ divergent cognitive style affects information processing at a higher-order cognitive level and reflects the rule based/intuitive adaptive style. These two cognitive

styles, therefore, cover a range of information processing levels as well as tap into two ways that people interact with their environment that have been discussed in the literature on racial differences in testing.

The present study examines how these cognitive styles affect scores on cognitive test performance and how these styles affect a person's susceptibility to perceiving stereotype threat. For this study I will be operationalizing cognitive ability with the RAPM cognitive test. The RAPM is a widely accepted measure of general fluid intelligence that uses non-verbal stimuli and instructs test takers to choose the answer that best fits with the given pattern. The perceptual level (field independent vs. field independent) is critical for the RAPM because this test requires test takers to identify sub patterns within a broader stimulus field to answer the questions correctly. Further, higher order cognitive processes (convergent vs. divergent) are also important when answering the RAPM because the correct solution to each question is dependent on the test taker's ability to find the single correct alternative (i.e., convergence style) as opposed to identifying multiple potential alternatives (i.e., divergent style). I will begin my discussion of these cognitive styles starting with the field independence and dependence cognitive style and discuss evidence from past research regarding cognitive style differences between races.

Field Independence v. Field Dependence

Field independence/dependence cognitive style is the most widely studied cognitive style (Kozhevnikov et al., 2014). Field independent participants perceive elements as discrete from their background and do best on analytic tasks (Witkin et al., 1977). They easily learn material when it is inanimate and impersonal (Anderson, 1988).

The performance of field independent people is usually not affected by other's opinions and they can separate elements from the whole context (Anderson, 1988). In contrast, people with field dependent styles view elements as part of a whole picture and learn material best when it is personal and the information is placed within a larger context (Witkin et al., 1977). In addition, they seek interaction within the context, are perceptive of the whole context, are greatly influenced by the context they are in and whom they interact with and desire more explicit instructions for tests (Anderson, 1988). They perform best on verbal tasks and their performance is affected by the opinions of others (Anderson, 1988). Research has shown that the task performance of field dependent people is enhanced when they receive expressions of confidence from others (Anderson, 1988).

Racial Differences. Generally, it has been found that minorities have more field dependent cognitive styles than majority group members (Anderson, 1988; Rovai, Gallien & Wrighting, 2005). Studies have found that American children with different heritages had different learning styles. For example, Matthews (1973) stated that African Americans have a more difficult time separating their affective self from their cognitive evaluation of reality, whereas Caucasians view this as illogical (Levy-Bruhl, 1966). Using the field independence/dependence language, Levy-Bruhl (1966) indicate that African Americans have a harder time separating things from the context during perceptual processing. Many other researchers confirm this finding (Bonner 2000; Witkin & Moore, 2005). Malloy & Jones (2002) observed that African Americans even solve mathematical problems by analyzing and delving into the big picture of the math problem first. In addition, Ramirez & Price-Williams (1974) found that Mexican American

children tended to be more field dependent while Anglo Americans tended to be more field independent when given a test on field dependency. This leads to my second hypothesis.

Hypothesis 2: African Americans and Caucasians will significantly differ on field independence with African Americans being lower on field independence than Caucasians.

Although different cultures adopt different cognitive styles, the United States tends to use testing methodology that typically is consistent with field independent cognitive styles (Cohen, 1969). People with a field dependent cognitive style might be greatly disadvantaged because their cognitive style conflicts with the cognitive style being unintentionally favored by the test. This is probably especially true with the RAPM exam in that this test requires participants to extract correct patterns from a complex field of patterns. To summarize, current testing methods are potentially unfair to field dependent people. Past research about field independence v. dependence has been promising, but there only been a scarce amount of research on it in more recent years. Additionally, there has been little application of the knowledge that African Americans are indeed more field dependent and lack of research on how exactly it affects cognitive test results. Therefore, it may be important to consider cognitive styles as a possible explanatory factor in the persistent levels of adverse impact that have been found in cognitive tests. Next I will briefly discuss the current research on another very similar cognitive style, holistic v. analytical, and its relationship to the field independent v. dependent cognitive style.

Holistic v. Analytic

The holistic v. analytic cognitive style is similar to the field independent v. dependent literature in that they both fall under the perception level of cognition. Field independence v. dependence cognitive style refers to the attention level and how they selectively attend to certain information within the stimulus. In contrast, the holistic v. analytic cognitive style assesses a slightly different aspect of cognition. Specifically, it measures pattern recognition and differentiates individuals who process stimuli in relation to the part or the whole. There has been a recent interest in the cultural differences that may influence the holistic v. analytic cognitive styles that individuals adopt. I will next discuss the cultural research that has been done in this field.

Cultural differences. There has been a particular focus on the difference between Western and East Asian cultures in the holistic v. analytical literature. Nisbett and Miyamoto (2005) state that those from western cultures focus on the salient object, use and pick out rules to organize their environment, and pay less attention to the context while the opposite is true for eastern cultures. A possible explanation for this difference is that East Asian cultures are more collectivistic and need to pay more attention to the context more because of how interdependent their society is (Nisbett & Masuda, 2003). The opposite is true for western cultures. Western cultures are highly independent and individualistic and researchers have observed that starting as young as age 5, western children start to ignore the context and focus only on salient objects. As reviewed, the perception level, both the pattern recognition and attention level, of cognition is highly influenced and shaped by the cultural environment. Because both constructs assess the degree to whether an individual processes stimuli in relation to the part and whole, I

expect the holistic v. analytic cognitive style to have a high positive correlation with the field independence v. dependence cognitive style, which leads to my second hypothesis.

Hypothesis 3: The holistic cognitive style should have a high positive correlation with the field independent cognitive style.

I hypothesize that the pattern recognition level and the attention level should be associated with each other, therefore resulting in a high correlation. Next I will discuss the current research on another cognitive style that also affects test results, convergent and divergent cognitive styles.

Convergence v. Divergence

Convergent and divergent styles deal with whether a person makes decisions in an analytical or intuitive basis. An individual with a convergent style makes decisions following a classic “rational” process in which all alternatives are weighed before arriving at a final deductive decision (Kozhevnikov, Evans, & Kosslyn, 2014). In contrast, individuals with a divergent style use a more intuitive process and arrive at decisions that can be described as more inductive than deductive. In addition, convergent styles desire more logical and formal materials whereas divergent styles favor more creative and imaginative materials (Kozhevnikov, Evans, & Kosslyn, 2014).

Racial Differences. Currently, there are not many empirical articles that directly show racial differences in convergent/divergent cognitive style preference. However, there are previous studies that have shown that Mexican American and African Americans performed better on tests that look at the flexibility of ideas and creative thinking than Caucasians (Price-Williams & Ramirez, 1977; Willis, 1989). For example, Price-Williams and Ramirez (1977) found that African American and Mexican American

children performed better than Caucasians on the Unusual Uses Test, which measures fluency and flexibility in thinking. In a more recent study, Outtz, Goldstein, & Ferreter (2006) found that African Americans outperformed Caucasian participants when the video-based situational judgment test was formatted to have a divergent response format rather than a typical convergent response format. Because divergent cognitive styles deal with being more creative and flexible, I hypothesize that there will be racial differences in convergent vs. divergent cognitive styles. Specifically that African American will more likely have a divergent cognitive style, while Caucasians will more likely have a convergent cognitive style.

Hypothesis 4: African Americans and Caucasians will significantly differ on convergent/divergent cognitive styles with African Americans being lower on convergence than Caucasians.

Because these two cognitive styles (field independence/dependence and convergence/ divergence) seem to differ by race, it is important to determine whether these different cognitive styles affect performance on standardized tests and consider ways to reduce this effect. Since the format of the RAPM is more catered towards field independent and convergent style, I believe that people with more field independent and convergent styles will score better on the RAPM. Furthermore, I hypothesize that the two cognitive styles, field independence and convergence, will mediate the relationship between race and performance on the RAPM. The hypothesized model is shown in Figure 1.

Hypothesis 5: Those with field independent styles will have higher scores on the RAPM than those with field dependent styles.

Hypothesis 6: Those with convergent styles will have higher scores on the RAPM than those with divergent styles.

Hypothesis 7: Field independence and Convergence will mediate the relationship between Race and performance on the RAPM.

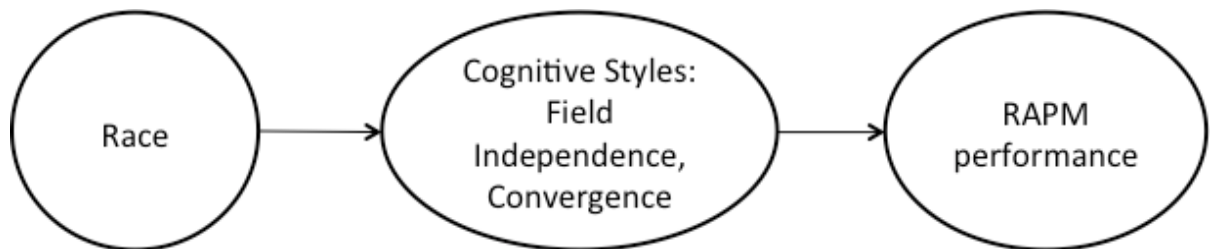


Figure 1. This figure illustrates the hypothesized mediated model for Study 1.

Now that I have examined how cognitive styles may differentially affect RAPM scores, I will discuss how different cognitive styles may affect susceptibility to stereotype threat. I will begin with a discussion of the background of stereotype threat and then explain how this topic integrates with cognitive styles.

Stereotype Threat

As explained before, stereotype threat has been introduced as a possible explanation of the gap in racial differences and gender differences in test performance. Stereotype threat is when individuals perform poorly because of their fear of confirming a negative stereotype about a subgroup that they belong to (Steele & Aronson, 1995). Steele and Aronson (1998) showed that when a negative stereotype was made more salient to participants, participants performed worse on the task and were anxious about confirming a negative stereotype.

There are numerous requirements identified by Ryan & Sackett (2013) that need to be present for the stereotype threat to manifest. First, the stereotype must be consistent (i.e., the same stereotype has to be known by multiple people) and the individual must be aware that the stereotype exists. Second, the subject must believe that the assessment is diagnostic of an individual's ability on the construct of interest. Third, the individual must know what the assessment is testing and assume that it is relevant to the situation they are in. Fourth, the task must be difficult and challenge the individual. Fifth, the individual must care about the ability being assessed and it must be a skill that is important for the person's self-concept (Steele & Aronson, 1995). For example, Aronson et al. (1999) found that motivation to do well on a specific test is necessary for the stereotype threat theory to work. If a test is measuring cognitive ability, then stereotype threat will affect those who believe being intelligent is important for their self-concept to do well on a cognitive test. Therefore, it is crucial to measure the importance of the domain to the individual beforehand to ensure the stereotype threat mechanism is activated. And lastly, the individual must identify with the subgroup being stereotyped (Ryan & Sackett, 2013).

Steele and Aronson (1995) showed that African Americans performed worse than Caucasian participants when African Americans were under stereotype threat. In the first study, participants in the stereotype threat condition were told that the test was a measure of their intellectual abilities and were presented with verbal GRE questions. This activated the stereotype that African Americans underperform on intellectual ability tests. Participants in the non-stereotype threat condition were told that the test was not diagnostic of their intellectual abilities. Results showed that African Americans

performed significantly worse on the verbal ability test than Whites when under the stereotype threat condition. However, African Americans performed equally as well as the Whites when the participants were not in the stereotype threat condition. The stereotype threat also held true for women's math performance. In a similar study, Spencer, Steele and Quinn (1998) tested this by inducing the stereotype threat that women do worse on the math test. The authors found that women under stereotype threat performed significantly worse on the math test.

Meta-analysis of stereotype threat research has indicated that the effect is robust; the effects have shown that stereotype threat has a sizeable effect on test performance across multiple settings for many different groups of people (Nguyen & Ryan, 2008). African Americans do significantly worse when under stereotype threat during cognitive ability tests while women do significantly worse when under stereotype threat during math ability tests (Aronson, Lustina, Good, Keuough, Steele, & Brown, 1999; Johns, Schmader, & Martens, 2005; Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti, 2003; Davies, Spencer, Quinn, & Gerhardstein, 2002; Schmader & Johns, 2003). These studies have many implications for test takers, especially for minority groups and female groups who have traditionally underperformed on standardized tests in the past. One implication of this research is about the importance of creating a stereotype threat free environment for minorities to show their true potential in assessment settings. It will be important to avoid prompting stereotype threats for minorities, but in order to do so, it is important to understand exactly why the stereotype threat is occurring.

Interestingly, stereotype threat is not only limited to minority groups. Caucasian males have been shown to underperform under stereotype threat as well (Aronson et al.,

1998). Researchers showed that when Caucasian males were told that their math scores were being compared to Asian males (a group stereotyped to excel at math) math scores, Caucasian males performed significantly worse (Aronson et al., 1998). Consequently, it is important to think about ways to detect when an individual is under stereotype threat and how we can alter the context and the test itself to make sure that certain subgroups do not have an unfair disadvantage on important testing measures. Furthermore, it is important to note which type of stereotype threat cue is used in the methodology because the type of stereotype threat cue has implications on the results of the study. In the following section, I will describe the three different types of stereotype threat cues typically used in stereotype threat research and which of these three cues is most effective in activating stereotype threat.

Type of Stereotype Threat. There are different techniques used to induce stereotype threat in current literature usually ranging from subtle to blatant stereotype threat. Subtle stereotype threats can be implemented by simply priming the individual's race. Often this is done by simply by priming the participant's race or gender before the experiment starts (Anderson, 2001; Dinella, 2004; Oswald & Harvey, 2000; Schmader & Johns, 2003; Spicer, 1999). Subtle stereotype threats can also be activated by stating what the test is intended to measure (Steele & Aronson, 1995; Martin, 2004; Marx & Stapel, 2006; Ployhart et al., 2003). For example, in Steele & Aronson (1995), the researcher mentioned that the test measures intelligence and they found that this subtle manipulation was sufficient to activate the stereotype that African Americans traditionally perform worse on intelligence testing. However, some researchers were not able to see the stereotype threat effect using subtle manipulation (Oswald & Harvey, 2000). Other

researchers prefer a stronger manipulation, such as the researcher conveying the message that the test has shown racial differences, but not stating the direction of that difference; the participants usually interpret the direction. This is called the moderately explicit cue. For example, Edwards (2004) used moderately explicit cues by stating that there have been racial differences on an ability test and saw performance decrements. Brown & Pinel (2003) and Rosenthal & Crisp (2006) also used moderately explicit cues to induce stereotype threat and observed the stereotype threat effect.

Lastly, blatant stereotype threat cue is created by the researcher directly stating that the targeted group has performed worse in previous studies. Cadinu, Maass, Frigerio, Impagliazzo, & Latinotti (2003) told African American and Hispanic participants that the test is a measure of cognitive ability and that their respective race has traditionally underperformed on the test. Conversely, Schneeberger & Williams (2003) used blatant stereotype cues to state that women did significantly worse on math testing, but did not find the stereotype threat effect. Interestingly, some studies using blatant stereotype threat manipulation have not supported the effect. Blatant stereotype threat cues have been shown to cause the “stereotype reactance” effect. Stereotype reactance occurs when the participants react against the blatant stereotype by consciously trying to react against the stereotype and not putting in any effort (Nguyen & Ryan, 2008). Nguyen and Ryan (2008) hypothesize that the stereotype threat effect may only work on a subconscious level. Therefore blatant stereotype threat creates inconsistent results because some people do perform worse, some are able to perform better despite the distracted thought, and some do not put in any effort (Levy, 2006).

Nguyen and Ryan's (2008) conducted a meta-analysis of past empirical stereotype threat research. They explicitly examined whether the strength of the stereotype threat manipulation potentially moderates the strength of the findings. Their results showed that the severity of the stereotype threat manipulation affected the magnitude of the stereotype threat effect. Moderately explicit stereotype threats created the largest stereotype threat effect for minorities, $d_s = .64$, where minorities presented with moderately explicit stereotype threats performed significantly worse (Nguyen & Ryan, 2008). The blatant stereotype threat cue had the second largest effect ($d_s = .41$) and the subtle cue ($d_s = .22$) had the smallest effect size. Nguyen & Ryan (2008) has suggested that moderately explicit stereotype threat cues have the largest effect size. Consequently, moderately explicit cues will be used in the present study so the effect is not too subtle that it goes undetected and not too blatant to cause reactance.

In summary, the negative effects of stereotype threat on task performance have been well established in past research using a moderately explicit cue. Researchers have used different methods and different groups of participants to test stereotype threat and have shown that the effect holds across situations, which leads to my fifth hypothesis. I will now discuss how people with certain cognitive styles may be more susceptible to stereotype threat.

Hypothesis 8: Those in the stereotype threat condition will perceive stereotype threat and will perform worse on the Raven's Advanced Progressive Matrices than those in the no stereotype threat condition.

Stereotype Threat & Cognitive Style

As discussed before, African Americans tend to have more field dependent and divergent cognitive styles while most standardized tests are geared towards field independent and convergent cognitive styles. As mentioned earlier, those with field dependent styles are very aware of the context they are in and seek interaction with others and do better when authority figures express confidence in them (Anderson, 1988). Because field dependent styles are more aware of their context and desire more approval and confidence from authority figures (Anderson, 1998), they may be more susceptible to stereotype threat because they fear letting the authority figures down and may have even more anxiety than field independent people, who are more unaware of their context and do not seek approval or confidence. Thus my next hypothesis is:

Hypothesis 9: There will be an interaction between field dependent/independent and stereotype threat on RAPM performance. Specifically, the negative effect of stereotype threat will be stronger for the field dependent cognitive style than the field independent cognitive style.

Moreover, those who have more divergent cognitive styles will also be aware that the RAPM is geared towards more convergent cognitive styles because of the format of the test. Because they know the test is less suitable for their style, they will also be more susceptible to stereotype threat as well.

Hypothesis 10: There will be an interaction between convergent/divergent cognitive styles and stereotype threat on RAPM performance. Specifically,

the negative effect of stereotype threat will be stronger for participants with a divergent cognitive style rather than a convergent cognitive style.

Next, I also hypothesize that there will be a three-way interaction between race, cognitive style and stereotype threat to influence test performance. Participants who have both of the less advantageous factors, such as being a minority and having the less common cognitive style may influence greater perceived stereotype threat. However, those with one of the advantageous factor, such as either being White or having the common cognitive style, may serve as a protective factor and lead to less perceived stereotype threat.

Hypothesis 11: There will be a three-way interaction between race, stereotype threat, and field independent/dependent styles. Specifically, African Americans under stereotype threat who are field dependent will have the lowest RAPM scores while African Americans who are field independent will perform better than those who are field dependent but will still perform worse than Whites who are field independent.

Hypothesis 12: There will be a three-way interaction between race, stereotype threat, and convergent/divergent styles. Specifically, African Americans under stereotype threat who are divergent will have the lowest RAPM scores while African Americans who are convergent will perform better than those who are divergent but will still perform worse than Whites who are convergent.

In conclusion, African Americans with more divergent and field independent cognitive styles may be even more vulnerable to stereotype threat and perceive greater

stereotype threat, which may result in poor performance on cognitive testing. Cognitive styles may be a possible explanation as to why people perform worse. The full model that I am proposing is presented in Figure 1. The hypotheses will be tested with the design in the following section.

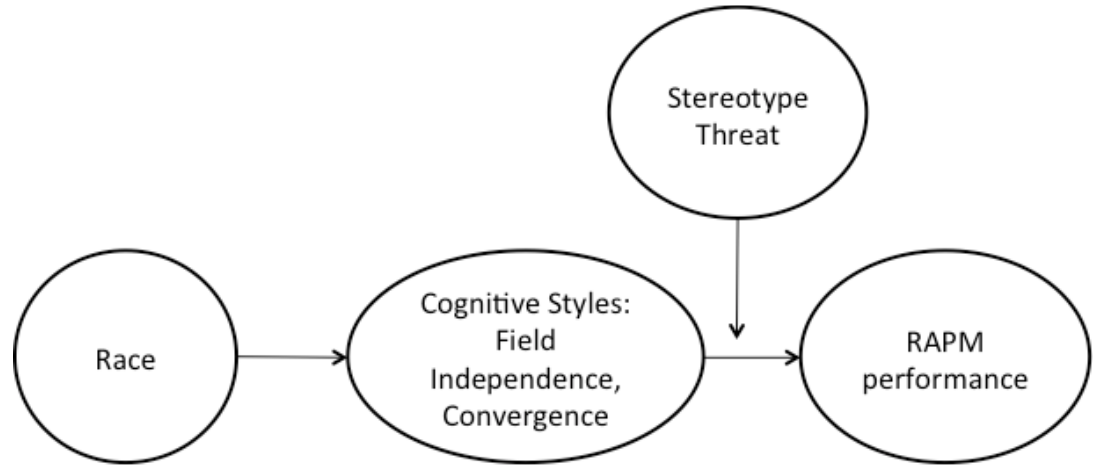


Figure 2. This figure illustrates the full hypothesized model for Study 2.

Chapter 3: Study 1

Study 1 tested the first mediation model from figure 1. The purpose of this study was to establish that African Americans do indeed differ on field independence/dependence and convergence/divergence and that this affects their cognitive test score.

Methods

Subjects. For the purposes of this study, the sample was limited to Caucasian and African-American female participants over the age of 18 years old. Participation was limited to female students in order control for differences that may be observed for cognitive styles and cognitive test scores between male and female participants. A total of 111 student participants met the study criteria. These participants were recruited through the participant pool for course credit at a large public mid-Atlantic University. The final sample consisted of 34 (30.6%) African American and 77 (69.4%) Caucasian participants. The age range for the sample was 18 to 34 with a mean age of 19 years old.

Measures. *Field Independence/Dependence.* The short form of the Witkin's Embedded Figures Test adapted by Jackson (1955) was used in this study. The test includes 12 items with a 36-minute time limit used in the original Witkin's Embedded figures test. The short form has a .99 correlation with the original test, which includes 24 items. This measure is shown in Appendix A. Participants were timed on how long they took to complete the problems. The participants' field independence score was calculated by dividing the number of problems they solve correctly by the number of minutes they took to solve the problems. Lower scores meant that the participant was more field independent and higher scores meant that the participant was more field dependent.

Convergence/Divergence Cognitive Style. This cognitive style was measured by using the convergence/divergence test created by Al-Naeme (1991). The test is a 25-minute test comprised of six mini tests, which tests whether a participant is more convergent oriented or divergent oriented. These assessments tested whether the participant could come up with as many creative answers as possible to the proposed problems. Example problems are shown in the Appendix B.

Raven's Advanced Progressive Matrices (RAPM). The Raven's Advanced Progressive Matrices (RAPM) will be used to measure cognitive ability. The RAPM is a measure of fluid intelligence developed in 1939 by John C. Raven. The RAPM is an adaptation from the original standard progressive matrices. The RAPM is used for adults that are above average intelligence and includes 48 questions that must be completed in 45 minutes. The RAPM will be used instead of the original standard progressive matrices in order to have more variance in the scores and because the sample we are using are college students. In addition, the short form will be used for study 2, which includes all 12 questions from set 1 and 12 questions from set two for a total of 24 questions. Example matrices are shown in Appendix C.

Analysis-Holism Cognitive Style. I used the Analysis-Holism scale developed by Choi, Koo and Choi (2007). This scale was developed as a measure of whether an individual has more holistic or analytic thinking tendency. There were four subscales in this scale, which include Causality, Attitude Toward Contradictions, Perception of Change and Locus of Attention. The scale had a total of 24 questions and had a Cronbach's alpha of .74.

Demographic Questionnaire. The demographic questionnaire asked basic demographic questions such as race, age, familiarity with the tests, college GPA, high school GPA, SAT scores mother and father education and household income. All demographic survey questions are included in Appendix D.

Procedures. Before coming to the lab, participants completed an online survey assessing the degree to which they are convergent or divergent thinkers. They also completed the Analysis-Holism scale to assess whether they tend to think holistically or analytically. Demographic information was collected after participants completed both of these scales. The entire online component took approximately 30 minutes to complete and participants received course credit for completing this survey.

I randomly selected individuals to participate in the lab portion of the study from the online database. Only those individuals that completed the online survey and were either Caucasian or African-American were invited to the lab study. Once they got to the lab, participants completed a measure of field independence/dependence. They were told that the field independence/dependence measure assessed perceptual acuity. After answering a practice problem, they were instructed to solve the problems as quickly and as accurately as possible.

After the completion of the embedded figures test, participants were then asked to complete the RAPM measure of cognitive ability. All participants were given the RAPM instructions and were told that the test was another measure of perceptual acuity. They were then given the traditional example RAPM problems and then asked to complete the RAPM within 45 minutes. After the RAPM, participants completed the demographic questionnaire, and were then debriefed.

Analyses

I will use the Baron and Kenny (1986) approach to test my hypothesized mediation model. The Baron and Kenny approach tests each path in the model and includes four steps. These steps are explained in the results below. However, the Baron and Kenny approach does not test the indirect effect or the amount of mediation. To test this indirect effect, I will use the Sobel test (1982). The Sobel test assesses whether there is a significant reduction in the effect of the independent variable on the dependent variable when the mediator is included in the model.

Results

For the first step, I first ran an independent t-test to verify that there was a difference in RAPM scores between African Americans and Caucasians (H1). Surprisingly, there was no significant difference between African Americans ($M= 31.88$, $SD= 6.11$) and Caucasians ($M=33.70$, $SD= 6.48$), $d= .29$, $t(109) = 1.39$, $p>.05$ in my sample with a power of .28. While this was surprising given the robustness with which racial differences on cognitive ability tests have been found previously, I went ahead with my mediation analysis because recent researchers report that this first step is not necessary step when establishing mediation (Mackinnon, Fairchild, & Fritz, 2007).

The next step was to test whether there was a significant difference in field independence and dependence between Caucasians and African Americans, which was my second hypothesis. I ran an independent t-test and found that Caucasians were more field independent ($M=0.82$, $SD=0.46$) than African Americans ($M=1.22$, $SD=.67$), $t(109) = 3.60$, $p<.001$, $d = .74$ confirming Hypothesis 2.

Hypothesis 5 predicted that field independence would be related to performance on the RAPM. Consistent with this hypothesis and confirming step 3, field independence predicted performance on the RAPM, ($B = 5.41$, $t(109)=5.65$, $p<.01$), and explained 23% of the variance in RAPM scores. To test step 4, I ran a multiple regression with race and field independence both predicting RAPM scores. Field independence was a significant predictor in the model, $B=5.50$, $t(108)= 5.41$, $p<.001$, even when controlling for race.

To follow up, I ran the Sobel test with a bootstrap of 1000 samples using the process macro developed by Hayes (2013) to test for indirect and direct effects. The Sobel normal test theory was significant ($z'= 2.18$, $p<.01$) and the direct pathway of race on RAPM performance was not significant ($z=0.36$, $p>.05$) showing that there was a full mediation effect.

I also sought to test another cognitive style, convergence v. divergence, as a potential mediator to the relationship between race and performance on the RAPM. Hypothesis 4 predicted that there would be a significant difference in convergence and divergence scores between African Americans. However, there was no significant difference between African Americans and Caucasians in convergence and divergence score, $t(109)=.30$, $p>.05$.

Hypothesis 3 predicted that holistic v. analytic cognitive style would be related to field independence and dependence. However, holistic v. analytic did not significantly correlate with field independence $r=.03$, $p>.05$.

Discussion

The results of this study show that Study 1 supported the proposed model when field independence and dependence was used as the mediator between race and RAPM

performance, supporting Hypothesis 7. Hypothesis 2 was supported; race predicted field independence, with Caucasians more likely to be field independent and African Americans likely to be more field dependent. In addition, Hypothesis 5 was supported, as I was able to find that the cognitive style of field independence was a good predictor of performance on the RAPM; participants higher in field independence performed better on the RAPM. These results indicate that it may be important to consider how to make cognitive tests more suited for field dependent styles in order to reduce adverse impact.

Unfortunately, the cognitive style of convergence/divergence did not show the expected results and did not show any differences in scores between African Americans and Caucasians. Therefore, none of the hypotheses related to convergence and divergence was supported. One possible explanation for the null results is that because the convergence/divergence asked the participants to name as many answers as possible for each mini-test before moving on, participants may have felt unmotivated to put in effort towards the tests and may have wanted to end the tests earlier by not answering the questions. In addition, there was a time lapse between taking the convergence/divergence questionnaire since it was collected online and taking the Raven's, which was taken in the lab. The time differential issue is discussed further below.

Lastly holistic v. analytic also did not show the expected correlation with field independence v. dependence. Despite Hypothesis 3, which predicted that the holistic/analytic cognitive style would be related to the field Independence/dependence cognitive style, we did not support this hypothesis. This may be attributable to the fact that the holistic/ analytic cognitive style scale was a self-report measure in which the questions were focused on how interconnected individuals view the world. It is possible

that participants misrepresented themselves (either deliberately or not deliberately) as they responded to this self-report measure. It is possible that cognitive style and how an individual processes information may be something that individuals do not think of and are potentially unaware of. Thus, the meaningfulness of measuring this construct with a self-report measure may introduce more noise than useful information. Another possibility is that the time differential between when the holistic/analytic scale was collected (i.e., online survey) versus when the field independence/dependence scale was collected (i.e., lab study) may have been too long for the temporal stability of the holistic/analytic scale. While the cognitive style constructs are believed to be stable across time once participants have reached adulthood, the manifestation of these constructs (i.e., scale scores) may not be. In other words, the delay between online assessment and lab study may have exceeded the holistic/analytic test-retest reliability to expect a sizeable relationship with field independence/dependence.

Study 1 had a number of limitations that should be noted. First, the variability of participants in terms of their intelligence was restricted. All of the participants were college students and it seems reasonable to expect that the selection for college will reduce the variability of cognitive ability seen in my sample. Indeed, the selection criteria used to get into college (e.g., SAT, ACT) is often used as a substitute measure of cognitive ability in studies. As has been documented, range restriction introduces a conservative bias in a study (Cohen, Cohen, West, & Aiken, 2002).

Another limitation was the number of African American participants in this study. Despite the fact that I recruited Caucasians and African Americans for this study, the participation rate of African-Americans was substantially lower than the participation rate

of Caucasians. This created an uneven sample size and made it difficult to find that African Americans underperformed on the RAPM. In the next study, I address both of these issues by using monetary compensation to increase participation. First, recruiting participants via monetary compensation opens up the participant pool to non-students, which may help expand the range of the results for the cognitive ability test. Second, the added monetary incentive may increase the recruitment of African American participants by expanding the participant pool to all majors in the university and even to the broader community.

Chapter 4: Study 2

Study 2 sought to replicate and extend Study 1. In particular, this study added the stereotype threat manipulation to test Model 2. As discussed previously, the results of Study 1 are limited due to the insufficient number of African American participants and range restriction on the main dependent variable (i.e., cognitive ability). Therefore, in this study, I recruited participants through the paid participant pool and the course credit participant pool. Participants recruited through the paid pool received \$7.00 for their participation in the study. I tested whether the different pools significantly affected the results of this study. Lastly, the convergence v. divergence cognitive style did not exhibit any significant results in Study 1; this variable was removed from Study 2. All other Study 1 procedures remained the same. Study 2 is a generalized randomized block research design (Kirk, 1982) with one between subjects factor (Stereotype Threat) and one blocking factor (Race).

Methods

Subjects. A total of 108 individuals participated in this study. In terms of race, there were 45 (42 percent of the total sample size) African American female and 63 Caucasian female participants (58 percent of the total sample size). The mean participant age was 21 with an age range of 18 to 45.

Procedures. Participants came into the lab and completed the field independence/dependence measure. I followed the same procedure as in Study 1. Participants were then randomly assigned to the either the stereotype threat condition or the control condition. All participants were given the RAPM instructions and the

traditional RAPM example problem. The short form of the RAPM was utilized in study 2 to decrease participant fatigue. After the RAPM, participants completed the demographic questionnaire, the holistic v. analytic questionnaire, and then were debriefed.

Stereotype threat Manipulation. As indicated before, stereotype threat has been manipulated in numerous ways in the literature. Following the Nguyen and Ryan (2008) meta-analysis, I decided to use a moderately explicit stereotype threat manipulation. Specifically, this involved differentially highlighting the saliency of race differences on the Ravens without specifying the direction of the race differences (Nguyen & Ryan, 2008). The Nguyen and Ryan (2008) meta-analysis showed that this type of stereotype threat has the largest effect size for minorities. Specifically, participants in the stereotype threat condition read:

The following is a measure of cognitive ability and has previously shown differences in scores as a function of race.

As shown above, the instructions indicate that the test assesses cognitive ability, a type of test widely known to produce racial differences, and states that previous research with this test has shown that it produces score differences as a function of race. However, the statement does not indicate the direction of the race effect.

Participants in the control condition were told the test is assessing perceptual acuity, a test not known to produce racial differences, and states that there are no score differences as a function of race. Specifically, the following information will be provided:

The following is a test of perceptual acuity and has previously shown that there are no differences in scores as a function of race.

Results

As expected, there was a difference in RAPM test scores between the two samples. The first student sample has a higher mean RAPM score and standard deviation for both African Americans ($M= 19.88$ $SD=6.10$) and Caucasians ($M= 21.70$ $SD=6.48$) than the second sample, which includes non-students (African Americans: $M=17.82$ $SD=3.56$, Caucasians: $M=19.81$ $SD=2.71$).

The Baron and Kenny (1986) four-step approach was used again to test the mediation hypothesized. The first step was to conduct a simple regression analysis to see whether race predicted performance on the RAPM. Consistent with Hypothesis 1, African American ($M= 7.82$ $SD=3.56$) performed significantly worse than Caucasians ($M=19.81$ $SD=2.71$) on the RAPM in Study 2, $B=1.99$, $p<.01$, $d=.65$.

I next tested the interaction of race and the stereotype threat condition to see whether African Americans in the stereotype threat condition performed the worst (H8). Unfortunately, there was no significant interaction with African Americans in the stereotype threat condition ($M=17.87$, $SD=3.47$) not performing worse than African Americans in the non-stereotype threat condition ($M=17.77$, $SD= 3.74$), $d=.01$, $F(1,104) = .007$, $p>.05$. In addition, I tested hypotheses 11 and 12 and tested the interaction of race, stereotype threat and cognitive styles and found no effect, $p>.05$. Hypotheses 11 and 12 were also not supported. Because the stereotype threat manipulation was not effective, I removed stereotype threat from the model and tested the first mediation model again.

Step two of the Baron and Kenny approach was to test whether race predicted field independence and dependence. Hypothesis 2 predicted that African Americans would be more field dependent than Caucasians. As in Study 1, this hypothesis was

confirmed in Study 2. Caucasians ($M=0.66$, $SD= .33$) performed significantly worse on the embedded figures test than African Americans ($M=1.00$, $SD= 0.66$) meaning that Caucasians were more field independent than African Americans, $t(106)=3.59$ $p<.01$ $d=.71$.

Hypothesis 5 and step 3 of the Baron and Kenny approach was to test whether RAPM performance would be higher for field independent than field dependent participants. Consistent with this hypothesis, the degree of field independence was significantly positively related to cognitive ability ($B =1.92$, $t(106)=3.35$, $p<.001$). For the last step of the Baron and Kenny Approach, I tested whether the effect of field independence and race together on RAPM scores with a multiple regression analysis. Consistent with the mediation analysis, field independence significantly added to the prediction of RAPM scores ($B=1.45$, $t(105)=2.45$, $p<.05$) over and above the contribution of race. Unexpectedly, race still remained a significant predictor in the model, $B=1.48$, $t(105)= 2.37$, $p<.05$, even after field independence was added to the model. This implies that there might be a partial mediation model for the effect of race on RAPM through field independence/dependence.

To finish our test of the mediation effect (H7), I conducted the Sobel test again to test the significance of the indirect pathway. The bootstrapping method was used with 1000 bootstrap samples. Results of this test suggest that the association between race and performance on the RAPM is significantly mediated by field independence ($z'=1.97$, $p<.05$). Yet, because race remained significant when testing the direct effect of race on RAPM performance, field independence is a partial mediator ($z=1.48$, $p<.05$). Thus, there

was only partial support for Hypothesis 7. All of hypotheses, including results regarding whether each hypothesis was supported or not, are provided in table 1 below.

I next controlled different variables to make sure that another variable was not driving the mediation effect. I first controlled for SES and found that SES was not significant $B=0.09$, $t(104)=.84$, $p>.05$. Next, I controlled for whether the participants got paid or whether they did it for class credit and this was not significant as well, $B=0.12$, $t(104)=1.24$, $p>.05$.

Table 1

Summary of all the hypotheses and results

Hypotheses	Study 1	Study 2
H1: African Americans will perform significantly worse than Caucasians on the cognitive test.	Not Supported	Supported
H2: African Americans and Caucasians will significantly differ on field independence with African Americans being lower on field independence than Caucasians.	Supported	Supported
H3: The holistic cognitive style should have a high positive correlation with the field independent cognitive style.	Supported	Not tested
H4: African Americans and Caucasians will significantly differ on convergent/divergent cognitive styles with African Americans being lower on convergence than Caucasians.	Not Supported	Not tested
H5: Those with field independent styles will have higher scores on the RAPM than those with field dependent styles.	Supported	Supported
H6: Those with convergent styles will have higher scores on the RAPM than those with divergent styles.	Not Supported	Not tested
H7: Field independence and Convergence will mediate the relationship between Race and performance on the RAPM.	Partially Supported	Partially Supported
H8: Those in the stereotype threat condition will perceive stereotype threat and will perform worse on the Raven's Advanced Progressive Matrices than those in the no stereotype threat condition.	Not tested	Not Supported
H9: There will be an interaction between field	Not tested	Not Supported

dependent/independent and stereotype threat on RAPM performance. Specifically, the negative effect of stereotype threat will be stronger for the field dependent cognitive style than the field independent cognitive style.		
H10: There will be an interaction between convergent/divergent cognitive styles and stereotype threat on RAPM performance. Specifically, the negative effect of stereotype threat will be stronger for participants with a divergent cognitive style rather than a convergent cognitive style.	Not tested	Not Supported
H11: <i>There will be a three-way interaction between race, stereotype threat, and field independent/dependent styles. Specifically, African Americans under stereotype threat who are field dependent will have the lowest RAPM scores while African Americans who are field independent will perform better than those who are field dependent but will still perform worse than Whites who are field independent.</i> <i>Hypothesis 12: There will be a three-way interaction between race, stereotype threat, and convergent/divergent styles. Specifically, African Americans under stereotype threat who are divergent will have the lowest RAPM scores while African Americans who are convergent will perform better than those who are divergent but will still perform worse than Whites who are convergent.</i>	Not tested	Not Supported
H12: <i>There will be a three-way interaction between race, stereotype threat, and convergent/divergent styles. Specifically, African Americans under stereotype threat who are divergent will have the lowest RAPM scores while African Americans who are convergent will perform better than those who are divergent but will still perform worse than Whites who are convergent.</i>	Not Tested	Not Supported

Discussion

Study 2 showed promising results. Hypothesis 1 was supported; African Americans scored significantly lower on the RAPM. Moreover, Hypotheses 2, 5, and 7, were supported and field independence/dependence was a significant mediator. Though

field independence/ dependence was a partial mediator in study 2 as opposed to a full mediator, this study still showed that field independence/dependence may be a good explanatory variable across different samples.

However, Hypotheses 8, 9, 10 were not supported because the stereotype threat manipulation was not effective. As stated before, there are several conditions that must be present in order for the stereotype threat manipulation to be successful. Although I tried my best to account for those conditions, there are some conditions that may have not been met. One condition that may have not been met is the participants' motivation to do well on the cognitive test. This study was taken for either credit or monetary compensation but there were no real implications or consequences if they did not do well on any of the tasks. I suspect because of the lack of consequences or feedback and the anonymous nature of the study, participants did not find the situation threatening, despite the moderately explicit cue given. Another limitation with the stereotype threat was that there were no stereotype threat manipulation checks. This limits the conclusions that stereotype threat was actually manipulated. In addition, the wording of the manipulation may have been a bit too complex. It is not clear whether the participants understood what a perceptual acuity test may have meant and whether this was not threatening to the participants in the non-stereotype threat condition.

Lastly, Another limitation was that Study 2 showed that field independence/dependence was only a partial mediator and race still remained a significant predictor of RAPM performance even when field independence/dependence was controlled for. This means that there are still other explanatory variables

unaccounted for. Possible directions for future studies are discussed in the general discussion.

Chapter 5: General Discussion

Overall, there is support that there are indeed subgroup differences in test scores. Study 1 did not support the finding that there are subgroup differences but there was a particularly small subject pool for the African American participants. In addition, Study 1 found that field independence and dependence mediated the relationship between race and cognitive test performance. However, there was no support for the convergent and divergent cognitive style.

Study 2 added stereotype threat to the original model from Study 1. Study 2 did indeed find differences in cognitive test score between African Americans and Caucasians. African Americans performed significantly worse on the cognitive test than Caucasians. In addition, we were able to replicate the findings that field independence and dependence mediate the relationship between race and cognitive test performance. However, the stereotype threat manipulation was not effective and did not interact with the cognitive style or race. Yet another limitation with the two samples is that both samples only used female participants. We only recruited female participants because the psychology pool at the university is for the vast majority female. We wanted to control for gender because of the differences in stereotypes for men and women on cognitive ability tests. Nonetheless, this may be a limitation because there are recent meta-analyses that show that females actually outperform males in almost every subject, including science and math subjects (Voyer & Voyer, 2014). Therefore, many of the female college students may already have high confidence in their academic abilities and may not believe stereotypes about their cognitive ability.

Previous studies support the claim that racial groups may differ in terms of cognitive styles and these differences may potentially account for subgroup differences on these tests due to an inadvertent misalignment between participant cognitive style and test construction. This study supports this claim. Mediation was supported in both studies although the extent of the mediation was different for each study; the first study supported a full mediation, while the second study only supported a partial mediation. These studies show that there may be a systematic difference in field independence and dependence between African Americans and Caucasians and this may explain why African Americans underperform on cognitive tests. This is one of the first studies to show this mediation effect of the field independence/dependence cognitive style.

Cognitive test performance is widely used for many important decisions and is extremely important for future career success (Murphy, Cronin & Tam, 2003). As stated before, cognitive test performance can determine whether you obtain more advanced education by being accepted into a gifted and talented school or a reputable college. Furthermore, many forms of cognitive testing are used for employment purposes. For example, the FAA uses a cognitive ability test to select applicants to train to become Air Traffic Controllers (Pierce, Broach, Byrne & Bleckley, 2014). It is clear that cognitive test performance has a large impact on many opportunities gained throughout the lifespan. Therefore, it is crucial to have cognitive testing be as fair as possible to all and to investigate why there may be subgroup differences in cognitive test performance. Although field independence/dependence may be one reason that there may be subgroup differences, other possible mediating variables may be an avenue for future research. In addition to the two cognitive styles that I investigated, it may be interesting to further

explore other cognitive styles and whether there may be a racial difference at other levels of cognitive processing. For example, there may be differences at the memory level of cognitive processing as well. It would be interesting to see if there are any racial differences in the analytic-verbal v. visual-analog cognitive style at the memory processing level. Past research has shown that subgroup differences are lower for tests with a visual stimuli, although there is still a small effect (Ployhart, 2008). Therefore it may be interesting to assess whether a visual analog cognitive style will also mediate the relationship between race and cognitive test performance.

This study is a humble beginning to reduce adverse impact in cognitive testing. The results from these studies implicate that by catering test formats to more field dependent cognitive styles, adverse impact may be reduced. Possible next steps may be to also consider and examine in what ways tests can be adapted for those who are more field dependent. There is some research already in the past that those who are more field dependent prefer certain styles of teaching (Ibarra, 2001). Ibarra (2001) notes that those with field dependent cognitive styles enjoy positive reinforcement and prefer content that is more personal and has defined goals. Even changing instruction format to have clearer instructions and goals and adding in positive reinforcement for field dependent learners during cognitive tests may be an interesting empirical study to pursue.

Moreover, there were many limitations of this study that may need to be further explained in future studies. Although this study shows that field independence and dependence may mediate the relationship between race and test performance, this study was only done with African Americans and Caucasians. There are previous studies that show that East Asian cultures are more field dependent as discussed before. However,

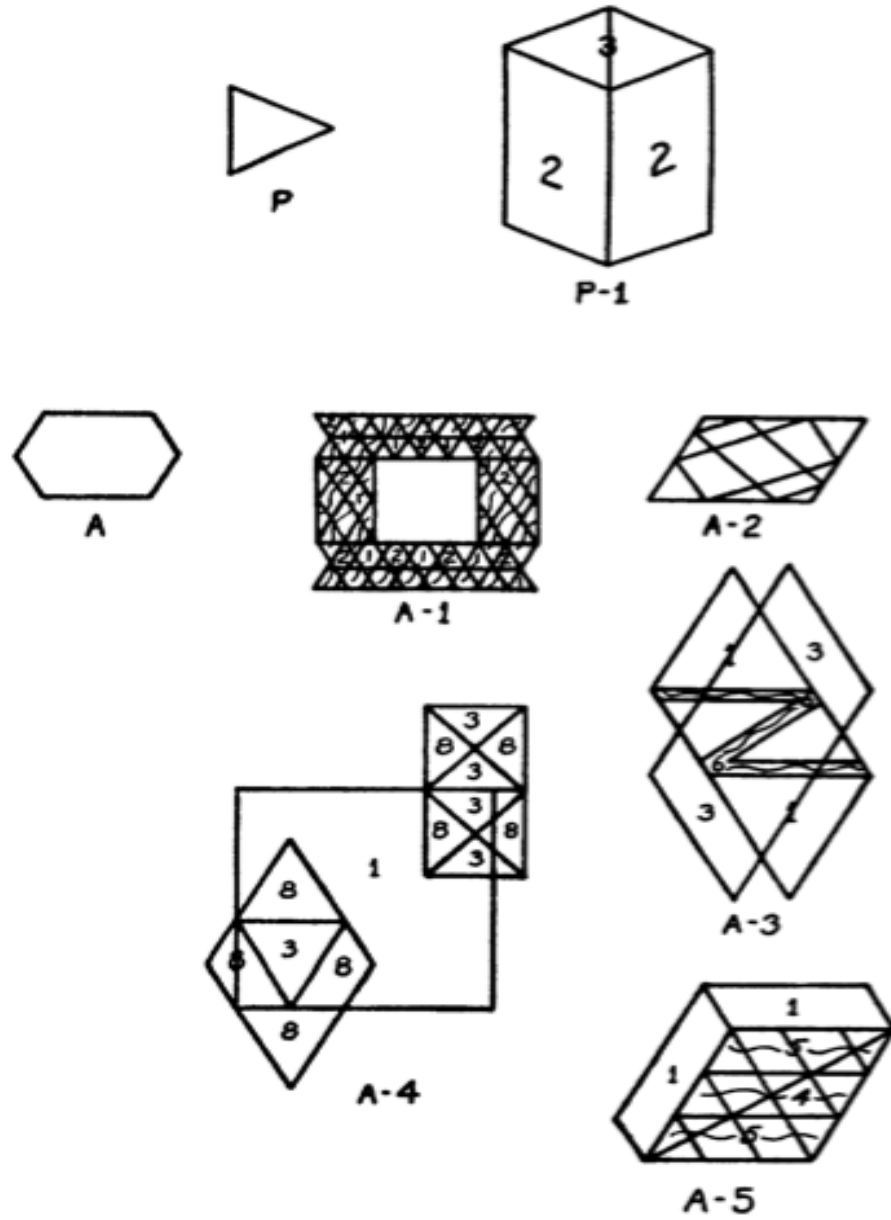
East Asian individuals score higher than Caucasian participants in standardized tests (Jensen, 1998). Although testing familiarity did not have an effect on the African American and Caucasian participants, I suspect that testing familiarity may have an effect on Asian participants because of the emphasis on test taking in East Asian cultures. This may be another research area that may need to be explored further.

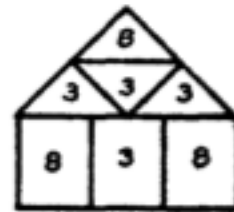
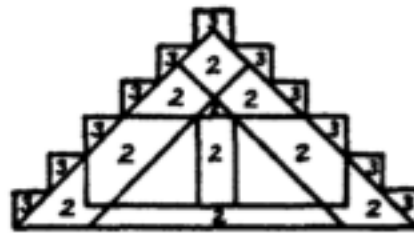
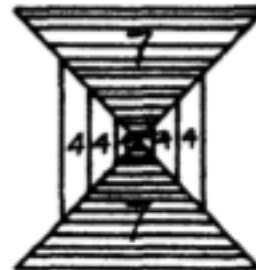
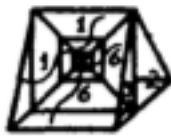
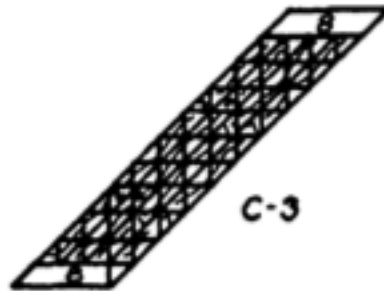
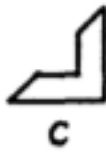
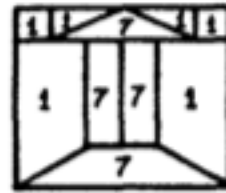
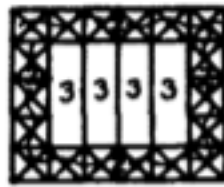
Appendices
Appendix A

FIG 1 SIMPLE AND COMPLEX FIGURES USED IN THE
EMBEDDED-FIGURES TEST

The simple figures are designated by a letter, the complex figures are designated by a letter and a number, the letter corresponding to that of the simple figure which it contains. Figures P and P-1 are the practice figures.

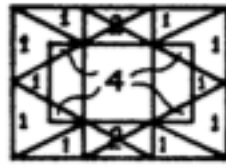
The specific colors used in each complex figure are represented by numbers, and wherever necessary the area covered by a given color is indicated by wavy lines radiating from the number. Figure A-2 remained uncolored. The colors to which the numbers refer are as follows: 1—red, 2—blue, 3—orange, 4—yellow, 5—brown, 6—dark green, 7—light green, 8—black.







E



E-1



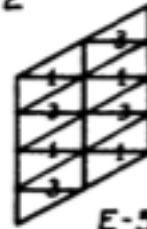
E-2



E-3



E-4



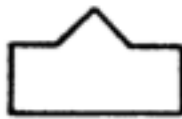
E-5



F



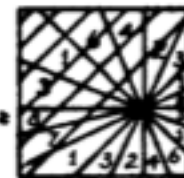
F-1



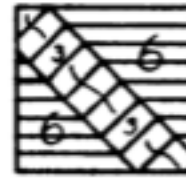
G



G-1



G-2



G-3



H



H-1

Appendix B

((THE CONVERGENT / DIVERGENT TEST))

NAME:

SEX:

MATRICULATION NO.:

DATE OF BIRTH:

These are some tests to measure the way you think. There is no limit to the responses you can give and your answers will not affect any part of your course.

TEST 1

When you are writing, it is often necessary to think of several different words having the same meaning or similar meanings, so that you do not have to repeat one word again and again. In this test you will be asked to think of words having meanings which are the same as or similar to a given word. The given words will be ones that are well known to you.

For example:

If the word were **short** you would write at least some of the words written below:

Short: brief abbreviated concise compact little
 limited deficient abrupt petite crisp

Now try the following words. You probably will not be able to fill in all the spaces, but write as many as you can think of.

1- Strong:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

2- Dark:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

3- Clear:

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

5 Minutes

TEST 2

In this test you will be asked to write as many sentences as you can. Each sentence should contain the four special words mentioned and any other words you choose:

For example:

TAKE FEW LAND LITTLE

- 1- Few crops take little land.
- 2- A few little boats take supplies to land.
- 3- Take a few little boys with you to see the green land.

All the four words are used in each sentence. The words must be used in the form that is given; for example, you cannot use "taking" instead of "take". Notice that the sentences may be of any length. All sentences must differ from one another by more than merely one or two changed words, such as different pronouns or adjectives.

Now try the following words. Remember to number each new sentence as was done in the example above.

1- WRITE WORDS LONG OFTEN

2- SISTER MAN YEAR CATCH

5 Minutes

TEST 4

This is a test to see how many things you can think of that are alike in some way.

For example:

What things are always red or that are red more often than any other colour? You may use one word or several words to describe each thing.

tomatoes bricks watermelon

Go ahead and write all the things that are round or that are round more often than any other shape.

-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----

3 Minutes

TEST 5

This is a test of your ability to think rapidly of as many words as you can that begin with one letter and end with another.

For example:

The words in the following list all begin with S and end with N.

sun spin stain solution

Now try thinking of words beginning with G and ending with T. Write them on the lines below. Names of people or places are not allowed.

-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----
-----	-----	-----	-----

3 Minutes

TEST 6

This is a test to see how many ideas you can think of about a topic. Be sure to list all the ideas you can about a topic whether or not they seem important to you. **You are not limited to one word.** Instead you may use a word or a phrase to express each idea.

For example:

"A train journey", examples are given below of ideas about a topic like this.

number of miles catching the train the train stations people in the train

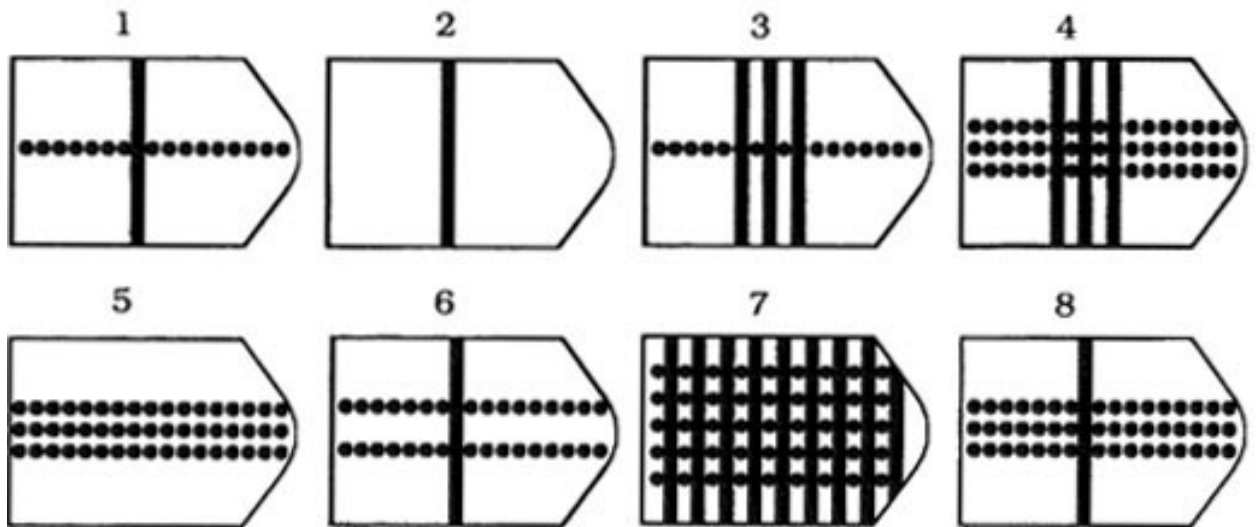
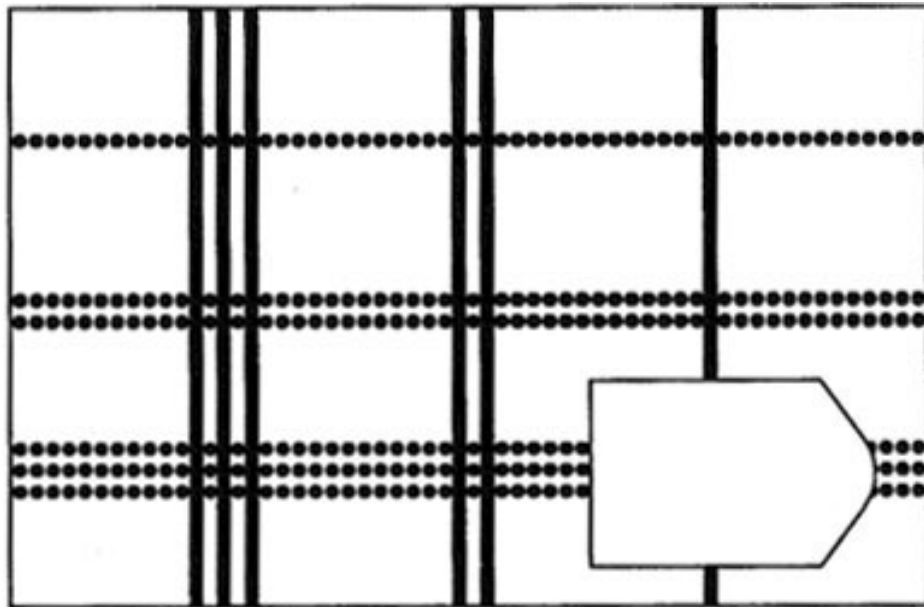
Now list all the ideas you can about "crossing the stream".

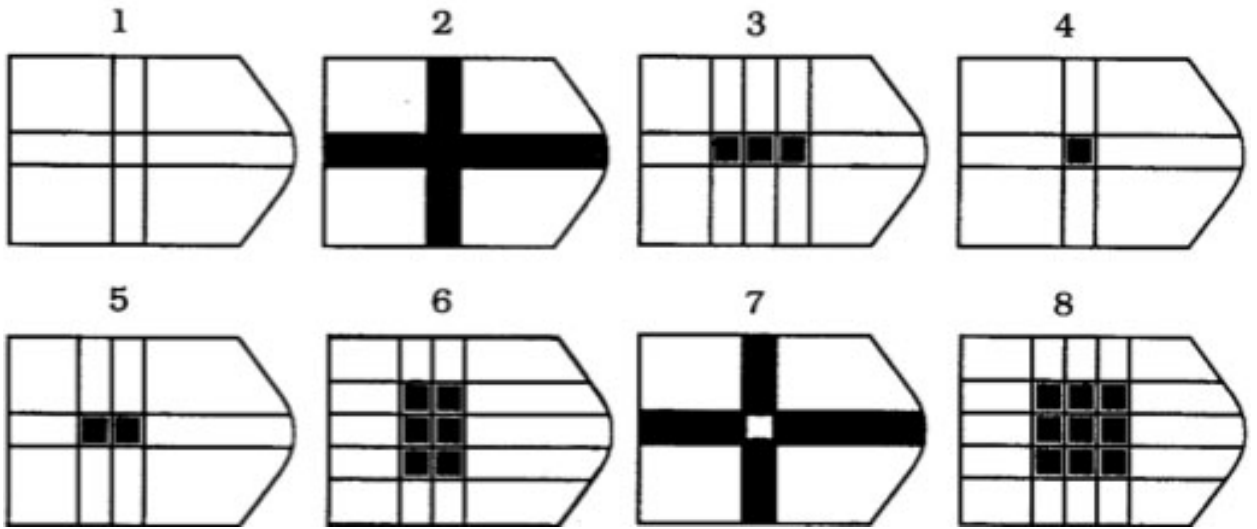
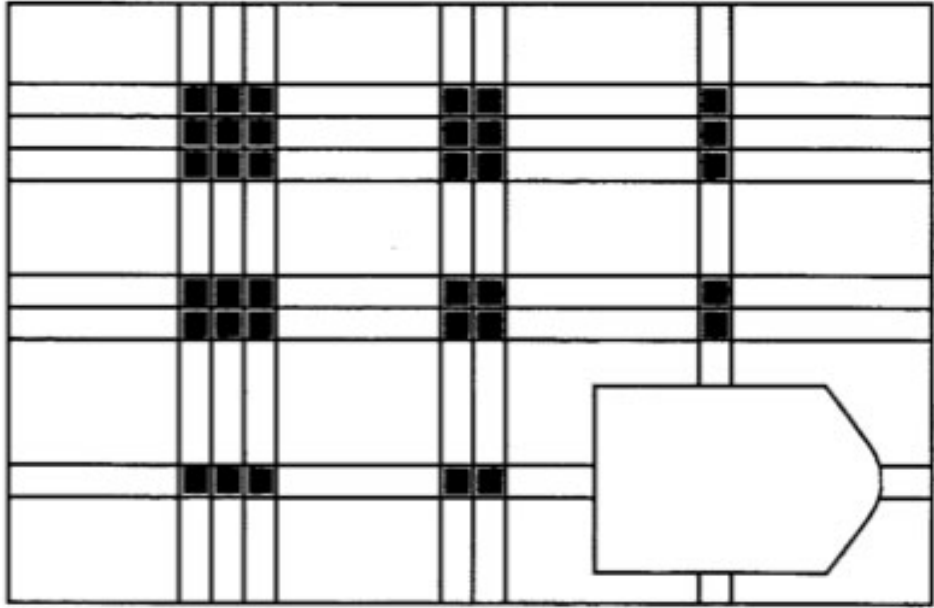
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4 Minutes

END OF TESTS

Appendix C





Appendix D

Demographic Questionnaire

Participant ID

1. What is your current college GPA? (This question does not apply to Freshmen)

2. What was your High School GPA?

3. What was your SAT score? Please state whether it is out of 1600 or 2400 (Please estimate if you don't remember).

_____/_____

4. Please rate the extent to which an anxious mood (Worries, anticipation of the worst, fearful anticipation, irritability) is currently present (Please circle one).

1	2	3	4
Mild	Moderate	Severe	Very Severe

5. Please rate the extent to which feelings of tension (fatigability, startle response, moved to tears easily, trembling, feelings of restlessness, inability

1	2	3	4
Mild	Moderate	Severe	Very Severe

to relax) are

currently present (Please circle one).

6. Please rate the extent to which you are familiar with testing situations and environments

1	2	3	4	5
Very	Somewhat	Neither	Somewhat	Very familiar

unfamiliar	unfamiliar	unfamiliar nor familiar	familiar	
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Question 4. What is the highest degree your mother has earned?

- High school diploma or equivalency (GED)
- Associate degree (junior college)
- Bachelor's degree
- Master's degree
- Doctorate
- Professional (MD, JD, DDS, etc.)
- Other specify
- None of the above (less than high school)
- Do not know

Question 5. What is the highest degree your father has earned?

- High school diploma or equivalency (GED)
- Associate degree (junior college)
- Bachelor's degree
- Master's degree
- Doctorate
- Professional (MD, JD, DDS, etc.)
- Other specify
- None of the above (less than high school)
- Do not know

Question 6. Which of these categories best describes your total combined family income for the past 12 months?

This should include income (before taxes) from all sources, wages, rent from properties, social security, disability and/or veteran's benefits, unemployment benefits, workman's compensation, help from relatives (including child payments and alimony), and so on.

- Less than \$5,000
- \$5,000 through \$11,999
- \$12,000 through \$15,999
- \$16,000 through \$24,999
- \$25,000 through \$34,999
- \$35,000 through \$49,999
- \$50,000 through \$74,999
- \$75,000 through \$99,999
- \$100,000 and greater
- Don't know
- No response

Think of this ladder as representing where people stand in the United States.

At the **top** of the ladder are the people who are the best off – those who have the most money, the most education and the most respected jobs. At the **bottom** are the people who are the worst off – who have the least money, least education, and the least respected jobs or no job. The higher up you are on this ladder, the closer you are to the people at the very top; the lower you are, the closer you are to the people at the very bottom.

Where would you place yourself on this ladder?

Please place a large "X" on the rung where you think you stand at this time in your life, relative to other people in the United States.



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