

**The Effects of Stereotype Threat/Boost and Personality on a Verbal Reasoning Task**

**By**

**Kelly L. Arnold  
Mary A. Ford and Ursula Goldstein**

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**Abstract**

We induced stereotype threat/boost in 42 introductory level psychology students and measured their stress appraisal, physiological stress response, and performance on a verbal reasoning task.

We predicted that the presence of stereotype threat would lead to the task being perceived as more threatening, heightened physiological stress response, and impaired performance. In contrast, we predicted that the presence of stereotype boost would lead to the task being perceived as more challenging, reduced physiological stress response, and enhanced performance. Ultimately, the data did not support the hypotheses. The small sample size, wide score range, extremely difficult puzzle, and explicitly induced stereotype threat/boost may have contributed to the lack of significant differences in Performance, Appraisal, and Physiological Stress Response. Although our hypotheses were unsupported, we did find a significant main effect for Time on Appraisal and Physiological Stress Response, and a significant difference in the cardiovascular response patterns between men and women. This implies that women are more reactive than men to stressors.

**Honors Thesis Advisor: Dr. Aurora Torres  
Assistant Professor**

Advisor: \_\_\_\_\_ Date: \_\_\_\_\_

Department Chair: \_\_\_\_\_ Date: \_\_\_\_\_

Honors College Director: \_\_\_\_\_ Date: \_\_\_\_\_

### The Effects of Stereotype Threat/Boost and Personality on a Verbal Reasoning Task

Stereotypes may be internalized and used to predict a person's own performance on a particular task. When the stereotype of one's ingroup is negative, a group member may experience uncomfortable pressure and thus a reduction in the ability to perform the task as well (Steele and Aronson, 1995). This reduction in performance may be caused by a lack of free cognitive processing ability (Schmader, & Croft, 2011). With the induction of stereotype threat, individuals may expend mental energy self-regulating performance and trying to stifle negative thoughts and feelings, and will thus have less processing capabilities free to handle the presented task. In a study using female Asian college students, women confronted with the stereotype that women have less math capabilities than men performed worse than women in whom stereotype threat was not induced (Shih & Pittinsky, 1999). In a study by Steele and Aronson (1995), black students performed worse than white students on the verbal section of the GRE after being told that the test was a measure of intelligence, and after being made hyper-aware of their race. The effect of stereotype threat may be moderated by cohort. In a study looking at performance in STEM classes, underclassmen seemed more affected by stereotype threat than upperclassman (Cromley et al., 2013). This implies that personal confidence in a task is more influential than mainstream stereotypes. For example, a woman who has already performed well at physics for three years is less likely to be affected by the statement that women are bad at physics than a woman who has no previous proof of her own successful performance in the discipline.

Stereotypes can also enhance performance. Stereotype boost is the positive pressure experienced by ingroup members of favorably stereotyped groups. In the study by Shih, Pittinsky, & Ambady (1999), Asian women made hyper-aware of their ethnicity experienced a performance boost. This enhancement was assumed to be caused by the internalization of the

popular stereotype that Asians do well at math. Stereotype lift is similar to stereotype boost, but involves internalizing negative stereotypes about an outside group instead of positive stereotypes about one's ingroup. In a study looking at the effects of stereotypes on math performance (Johnson et al., 2012), women performed better after stereotype lift was induced. Performance can also be enhanced by exposure to counter-stereotypes. Contemplating examples of counter-stereotypes, such as a female mathematician, led to enhanced creativity and performance on a divergent thinking task (Gocłowska, Crisp, & Labuschagne, 2012).

Stereotypes may influence the way stressors are approached and tackled. Stress appraisal is the process by which people recognize and analyze stressors (Eschleman et al., 2012). During this process, people recognize a potential stressor, weigh their abilities to cope with the stressor, label the stressor, and then potentially reevaluate the stressor. The presence stereotype threat may lead to a greater level of perceived threat of the stressor (Schmader, & Croft, 2011). This heightened perception of the stressor may be caused by the perceived lack of ability to cope with the stressor. The perception of the stressor as a threat may also lead to an increase in physiological stress responses such as increased heart rate.

Personality traits may also influence how stressors are appraised. Personality is typically measured along a 5-factor scale referred to as the Big Five (John, Donahue, & Kentle, 1991). The model of personality measures personality along the 5 scales of openness, conscientiousness, extraversion, agreeableness, and neuroticism. Conscientiousness, agreeableness, and openness appear to be positively correlated with "challenging" appraisal and academic achievement (Sorić, Penezić, & Burić, 2013). This may imply that people rated as high in these traits may have been less prone to the internalization of stereotype threat. In contrast, neuroticism and extraversion seem to be positively related with "threatening" appraisal, greater responsivity to the

environment, and less consistent academic achievement (Sorić et al., 2013). Thus people high in extraversion may be more affected by stereotype threat/boost.

Because of this potential heightened sensitivity to the threatening aspects of a stressor (Schmader, & Croft, 2011) as well as the potential underestimation of one's coping abilities, we predicted that the induction of stereotype threat would lead to an increase in the likelihood of the verbal reasoning task being appraised as threatening. Because of this increase in perceived threat, we further predicted that the induction of stereotype threat would lead to an increase in cardiovascular stress response as measured by pulse wave amplitude. In contrast, we predicted that exposure to stereotype boost would lead to a reduction in the perception of the task as being threatening because those participants would have more confidence in their ability to perform the task well. We further predicted that this group would have a reduced cardiovascular stress response as measured by pulse wave amplitude. Because of the performance deficits caused by induced racially based stereotype threat on the verbal section of the GRE (Steele and Aronson, 1995), we predicted that the induction of stereotype threat would lead to impaired performance on a verbal reasoning task (logic puzzle). In contrast, we predicted that performance would be enhanced by the induction of stereotype boost. Lastly we predicted that the big five personality traits would influence performance and appraisal as covariates.

## **Method**

### **Participants**

We recruited a total of 42 right-handed participants from introductory psychology courses. Of these, 65% were women and 68% were of European descent. 38% were liberal arts majors, and 70% had never completed a logic puzzle before this study. 5 participants were eventually excluded because we could not get accurate readings on their pulse wave amplitude

using the BIOPac system. APA guidelines were followed at all times. Minors had to have written permission from a guardian in order to participate. Participants were given class credit for participation.

### **Design**

This design of this study was a three way comparison between Stereotype Threat, Stereotype Boost, and Neutral pretrial speech conditions. Personality traits were used as a covariate. Performance on the puzzle was measured as well as pulse wave amplitude.

### **Materials**

Participants were given a demographics questionnaire in order to determine choice of major and other basic information such as age, sex, race, and GPA. They were also asked to complete the Big Five Inventory, a 44 question inventory of personality along the OCEAN scales. Before the trial, participants were given an example logic puzzle and stress appraisal questionnaire containing likert scales on stress, confidence, and perceived threat/challenge. The primary logic puzzles used were 4 x 4 challenging logic puzzles from logic-puzzles.org. The logic puzzles were changed every week to decrease the likelihood of reactivity. During the trial, a BIOPac MP150 system was used to record pulse wave amplitude. After the trial, participants completed a post-task questionnaire that asked for self-reported stress levels, perceived difficulty, and confidence in performance. A debriefing from was also given that explained the purpose of the study and stated that college major has no effect on reasoning or other mental abilities.

### **Procedure**

Written consent was obtained from each participant at the beginning of each session. Minors had to have written consent from a guardian in order to participate. After obtaining

consent, participants filled out a basic demographics questionnaire and the BFI (Big Five Inventory). The photopleth electrode device was then attached to the middle finger of the left hand of the participants. A 2 minute period spent reading a National Geographic magazine article on meerkats was used to establish a baseline for pulse wave amplitude. After a baseline had been established, participants were given the example puzzle with instructions to look over. They were then exposed to stereotype threat, boost, or neither through casual commentary by the experimenter (i.e. “Your major tends to do well.”). They were next given a short stress appraisal form containing three likert scales assessing stress, perceived challenge/threat, and confidence. After completing the form, they began the primary logic puzzle for which they had 14 min to complete. They were given a 5 min warning. After completing the puzzle, they were given the post-task questionnaire, brought back to baseline over a period of two minutes, debriefed, and released. Pulse wave amplitude was marked at the end of the baseline period, after reading the example puzzle, after the stereotype threat/boost/neutral speech, at the beginning of the puzzle, at the five minute warning mark, and at the end of the puzzle.

### **Statistics**

Data were analyzed using SPSS. An ANOVA was run to see if Stereotype Speech Type led to differences in Performance, Appraisal, and Physiological Stress Response as measured by pulse wave amplitude. Personality traits were used individually as covariates.

### **Results**

There was no main effect found for Stereotype Speech Type on Appraisal or Performance (see Table 1). Personality did not seem to be related to Appraisal ( $p > .05$ ) (See Figure 1) or Performance ( $p > .05$ ) (see Figure 2). However there was a main effect for Time on Appraisal ( $F(2,42) = 5.120, p = .029, \eta^2 = 0.116$ ) and Physiological Stress Response ( $F(1,42) = 5, p =$

.031,  $\eta^2 = 0.114$ ). There was also a difference in the cardiovascular response patterns of men and women (see Figure 3). Men tended to have a quadratic pattern ( $p < .050$ ), whereas women tended to display a cubic pattern ( $p < .005$ ).

### **Discussion**

All hypotheses were unsupported by the data. There were no significant differences in Performance, Appraisal, or Physiological Stress response for the three stereotype speech conditions (Threat, Boost, Neutral). Furthermore, personality did not seem to attenuate the effects of stereotype threat/boost, but considering the complexity of personality's affect on cognition (Sorić et al., 2013), the lack of a significant difference with such a small sample size is not shocking. There was a significant main effect for Time on Appraisal which indicated that the participants perceived the puzzle as more threatening after actually being faced with it. There was also a significant main effect for Time on Physiological Stress Response which indicated that the participants did experience cardiovascular changes in reaction to the puzzle. Lastly, we found a difference in the cardiovascular response patterns of women and men. Women tended to have a cubic response pattern whereas men tended to have a quadratic pattern of response.

The men tended to have the greatest change in pulse wave amplitude immediately following the stereotype (Threat, Boost, Neutral) speech. This spike may have occurred because the participants were anticipating starting the task. After this spike, the men tended to slowly return back to baseline without any other drastic changes in pulse wave amplitude. The women also displayed the same spike after the stereotype speech, but they had a second spike at the five minute warning and then continued to move further away from baseline through to the end of the puzzle. This difference in pattern may have occurred because women tend to be more responsive

to negative stimuli (Ordaz & Luna, 2012) and thus were more affected by the time pressure created by the five minute warning.

Neither stereotype threat/boost or personality seemed to have any relationship to Performance, Appraisal, or Physiological Stress Response. This may have been due to the nature of the logic puzzles chosen. They were extremely difficult with a wide range of possible scores. This manifested in low mean Performance scores with large SE for each group. A lack of significant difference in Appraisal may have been due to the way the likert scales were anchored. Participants were asked how challenging/threatening the task seemed, and this may have led to the scales measuring word choice instead of outright appraisal. Lastly, we explicitly induced stereotype threat/boost which may explain the lack of significant difference in the findings. A previous study by Shih and colleagues (2002) showed that only implicitly induced stereotype threat/boost had any significant impact on performance and appraisal.

A major limitation of this study was the type of task chosen. The logic puzzle provided a huge range in scores which may have resulted in insignificance. A second limitation of the study was that the stereotype threat/boost is not widely known or recognized. This may have led to the stereotype threat/boost not being internalized and manifested in Performance, Appraisal, and Physiological Stress Response. Lastly, the sessions were run individually in a lab setting. This may have meant that the participants were already uncomfortable by the set up and may have been suspicious of the commentary by the researchers (most participants were current psychology course students) and were thus not able to be truly affected by the stereotype threat/boost speeches. Lastly, we had a fairly small sample which may account for the lack of significance. Future studies should try to use a more natural setup such as a classroom in order



to improve ecological validity. Stereotype threat/boost should also be induced implicitly (Shih et al., 2002) in keeping with the findings of previous research.

Ultimately, the data did not support the hypotheses. The small sample size, wide score range, extremely difficult puzzle, and explicitly induced stereotype threat/boost may have contributed to the lack of significant differences in Performance, Appraisal, and Physiological Stress Response. Future studies should utilize a larger sample size, more natural environment, and implicitly induced stereotype threat/boost in order to be better able to see relationships between stereotype threat/boost and personality on appraisal, physiological stress, and performance on a verbal reasoning task. Although our hypotheses were unsupported, we did find a significant main effect for time on Appraisal and Physiological Stress Response, and a significant difference in the cardiovascular response patterns between men and women. This implies that women are more reactive than men to stressors.

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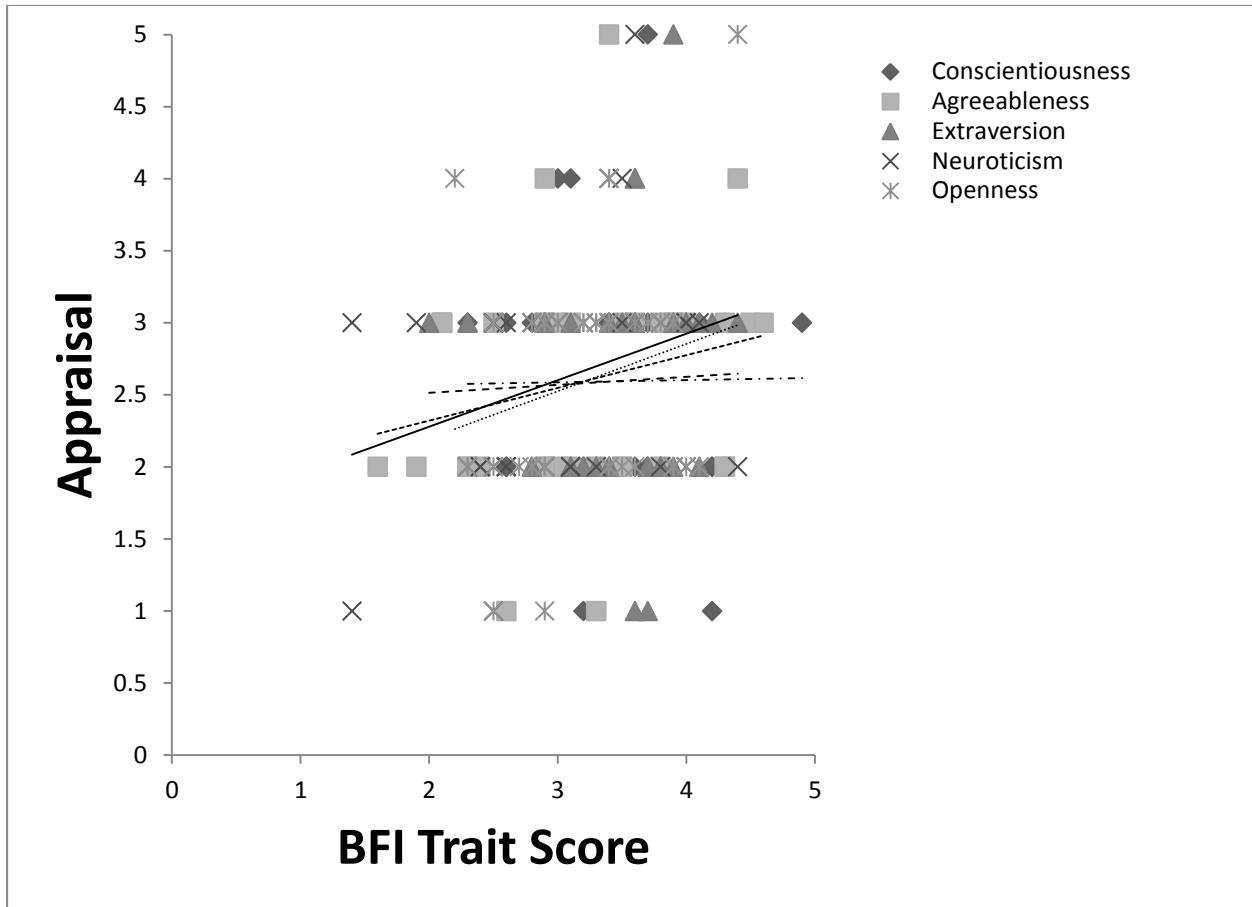
Table 1

*Performance and Appraisal as Affected by Stereotype Threat/Boost*

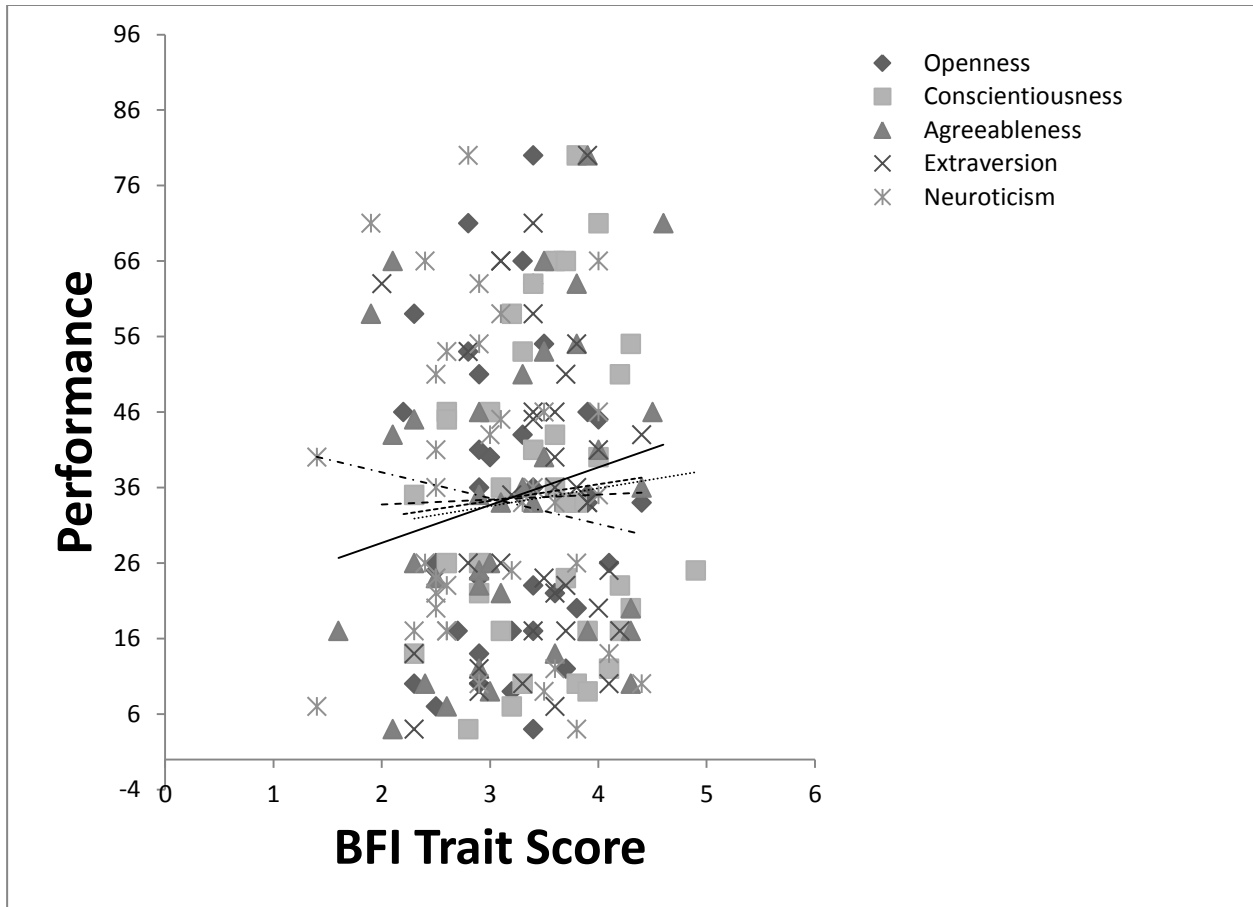
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Stereotype	Performance		Appraisal	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Threat	36.3	18.9	2.5	1.1
Boost	25.8	16.7	2.8	.55
Neutral	41.9	22.0	2.4	.76

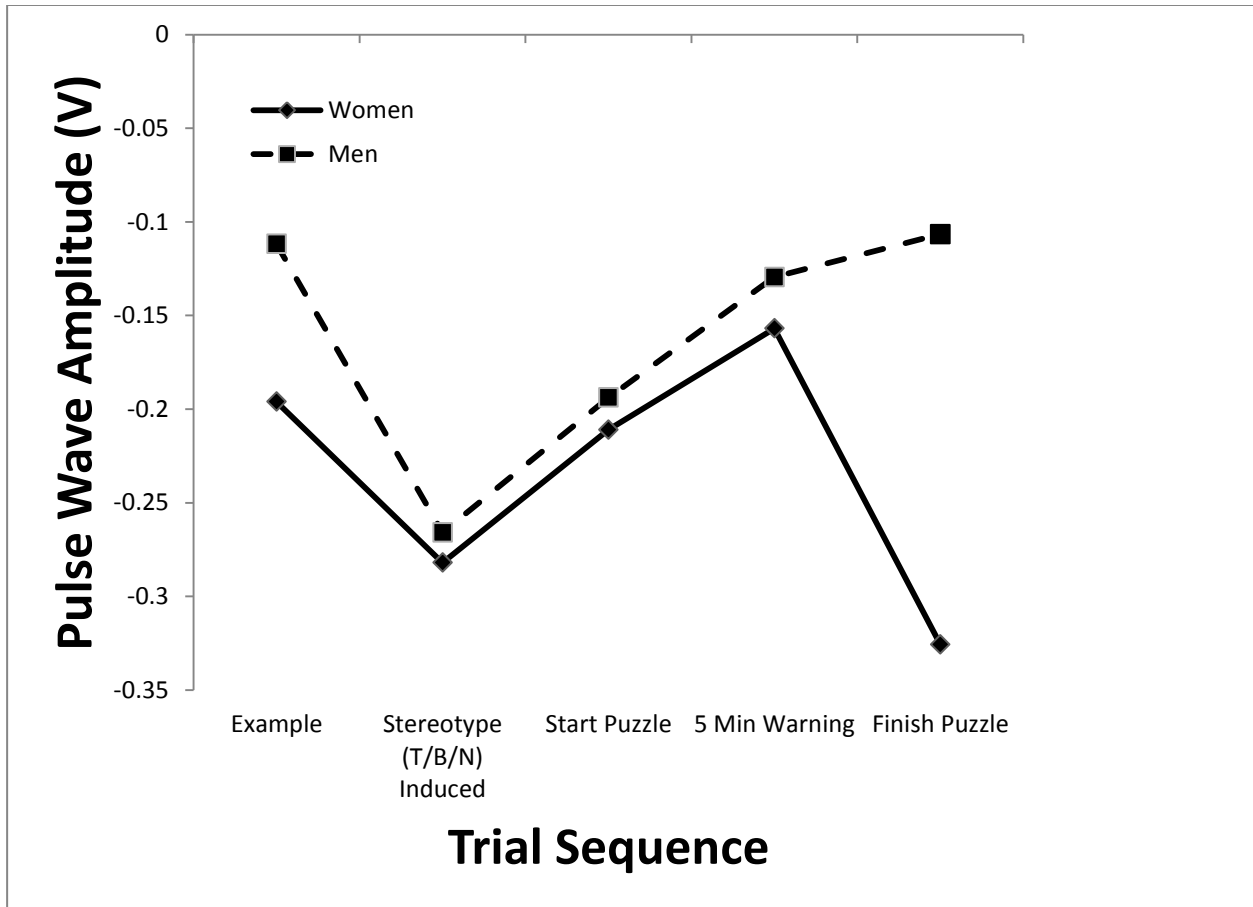
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*Figure 1.* There were no significant relationships between personality traits as measured by the BFI and Appraisal.



*Figure 2.* There were no significant relationships between personality traits as measured by the BFI and Performance.



*Figure 3.* Men tended to display a quadratic pattern of physiological response whereas women tended to display a cubic pattern of physiological response.