Performing a working memory task prior to GRE eliminates stereotype fit effects

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Research Overview

Stereotypes activate regulatory focus states, which interact with environmental reward structures. Advantageous pairings have been shown to benefit math test performance (Grimm et al., 2009). We examined whether completing math or reading working memory tasks prior to answering GRE math problems would influence stereotype fit effects.

Introduction

Regulatory Focus

- A motivational mechanism that tunes sensitivity to gains and losses in the environment (Higgins, 1997)
  - Promotion focus increases sensitivity to gains
  - Prevention focus increases sensitivity to losses

Regulatory Fit

- Regulatory fit exists when there is a match between focus and environment (Maddox, Markman, & Baldwin, 2007; Maddox, Baldwin, & Markman, 2006; Grimm, Markman, Maddox, & Baldwin, 2009)

	Gains	Losses
Men/Promotion Focus	Match	Mismatch
Women/Prevention Focus	Mismatch	Match

- A regulatory fit influences task performance differently depending on the type of task being performed (Grimm et al., 2008; Maddox & Markman, 2010). Prior work has demonstrated that a regulatory match produces more cognitive flexibility (Grimm et al., 2008; 2009)
- If the task requires cognitive flexibility, like the verbal GRE, math GRE, or rule-based classification, then a regulatory match produces better performance than a regulatory mismatch

Stereotype Threat

- Negative task-relevant stereotypes lead to performance decrements (Steele & Aronson, 1995)
  - For example, women tend to underperform compared to men on math tests (Spencer et al., 1999)
- Positive and negative stereotypes activate different motivational states (Seibt & Forster, 2004)
  - Positive stereotype induces a promotion focus
  - Negative stereotype induces a prevention focus
- Early work by Schmader and Johns (2003) suggests that activating negative stereotypes reduces working memory capacity (Baddeley & Hitch, 1974) and working memory mediates stereotype threat effects. They used a vowel counting task.

Research Questions

- We expect to replicate prior work and find stereotype threat and fit effects
  - Men will perform better than women and better when gaining points
  - Women will perform better when losing points
- What is the impact of collecting WM data prior to the math task?
  - We expect to replicate Schmader and Johns
- What is the impact of priming stereotypes and inducing focus on WM? That is, does stereotype threat lead to reductions in WM or are stereotype fit effects present?
  - We expect to find stereotype fit effects in post-math WM measures

Experiment Overview

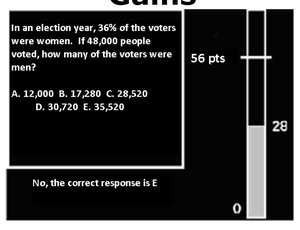
Participants

- 240 TCNJ undergraduates (119 Males and 121 Females) participated for course credit

Procedure

- **First Working Memory Task: Participants completed the OSPAN or RSPAN**
  - The Operation Span Working Memory Task (OSPAN; Allport, Antonis, & Reynolds, 1972) measures working memory with math problems. The task presents an answer to a math problem and asks participants to decide if the answers are correct or not. Then it presents a letter for two seconds for the participants to remember. After presenting multiple math problems and letters, the participants must recall the letters presented.
  - The Reading Span Working Memory Task (RSPAN; Daneman, & Carpenter, 1980) has the same structure but uses sentences instead of math problems.
- **Chronic Stereotype: Participants identified their gender as either "male" or "female"**
  - Men have a positive math stereotype
  - Women have a negative math stereotype
- **GRE Math Problem Task Reward Structure: Gains or Losses**
  - Completed 20 multiple-choice GRE math problems presented on a computer screen with five possible answers. They were given scratch paper but were not permitted to use a calculator.
  - After their answer was chosen, participants received immediate feedback of either "Correct" or "No, the correct response is ___" and tracked their progress using a point meter on the screen.

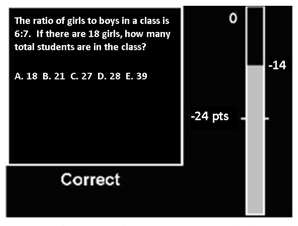
Gains



Gain points on every trial.

Gain more points for correct responses (3 points) than for incorrect responses (1 point).

Losses



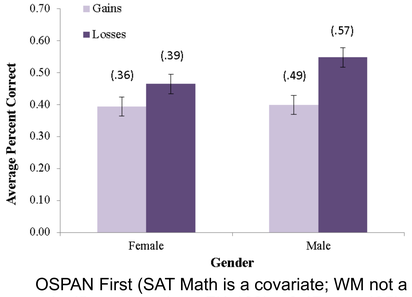
Lose points on every trial.

Lose fewer points for correct responses (-1 point) than for incorrect responses (-3 points).

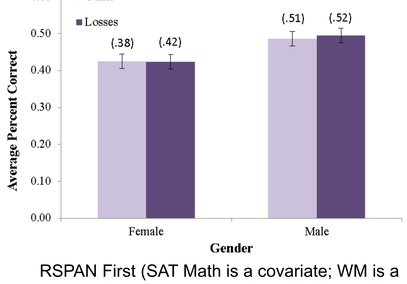
- **Second Working Memory Task: Participants completed the OSPAN or RSPAN**

Results: Collecting WM data prior to math test

- **There is a male advantage in both the OSPAN (Male = 48.0; Female = 34.8) and RSPAN (Male = 36.5; Female = 30.3), $p_s < .025$, prior to the GRE math test**
- **Individuals with high WM capacity perform better on GRE as compared to low capacity**
- **Using absolute WM score (number of items recalled from correctly recalled sets) and Math SAT scores as covariates in the model, we find math stereotype threat effects ($p_s < .01$) but not stereotype fit effects as predicted ($p_s > .2$) [means without covariates in parentheses]**



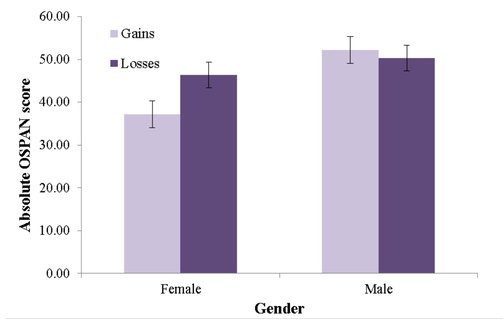
OSPAN First (SAT Math is a covariate; WM not a significant covariate, $F(1,109) = 0.47$, $p = .495$)



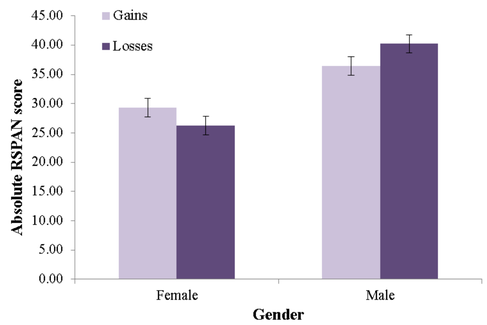
RSPAN First (SAT Math is a covariate; WM is a significant covariate, $F(1,119) = 19.45$, $p < .001$)

Results: Impact of Stereotype threat/fit on WM

- **Examined the influence of the stereotype fit states created during the math test on WM capacity post test**

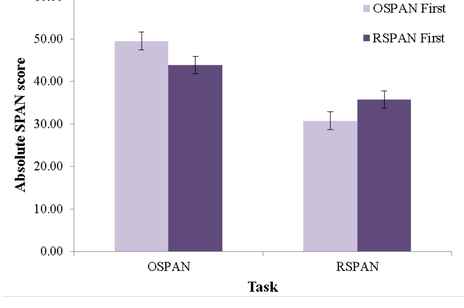


OSPAN (SAT Math is not a covariate ($p = .640$); main effect of gender ($p = .003$) and marginally significant interaction ($p = .083$)



RSPAN (SAT Math is a covariate ($p = .001$); main effect of gender ($p = .002$)

- **There was a three way interaction between Gender, Reward, and WM task ($F(1,222) = 3.64$, $p = .058$).**
- **Evidence that stereotype fit effects extend into other tasks**
  - **When math task accuracy is entered as a covariate, it is a significant covariate only for the OSPAN (which also drops the p-value associated with the interaction to $p = .056$).**
- **Scores improved on the second WM task as a function of which task was completed first, but there was no four-way interaction with Reward and Gender.**



Concluding Remarks

- **Reduction in stereotype threat effects when RSPAN as compared to OSPAN is used to assess WM prior to a math test: WM is a covariate for math test accuracy only when first assessed by the RSPAN**
- **The OSPAN appears to have induced a prevention focus for all participants, which overrode math stereotypes.**
- **There does not appear to be a processing benefit of performing a WM task that matched the math test.**
- **Stereotype fit effects are present for WM assessed after the math test, but only for the OSPAN. For the RSPAN, the effects are in the predicted direction but not significant.**
- **Further research could examine what characteristics of the OSPAN and RSPAN put participants in a regulatory focus states.**

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