Implicit Attitudes and Stereotypes matter in Math and Science

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Great Circles
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full potential initiative

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fullpotentialinitiative.org

Lawrence Summers & Implicit Bias

"…any of us who think that we can for ourselves judge whether we are biased or not are probably making a serious mistake.

So we all need to think about what we can learn from data about our own unconscious biases and think structurally about what to do about those biases."

National Symposium for the Advancement of Women in Science, April 7, 2005

In Other Words

"…even if most people consciously and honestly believe that interests and achievement should be unconstrained by group membership, unconscious associations may be exacting a toll on the STEM outcomes of stereotyped group members."

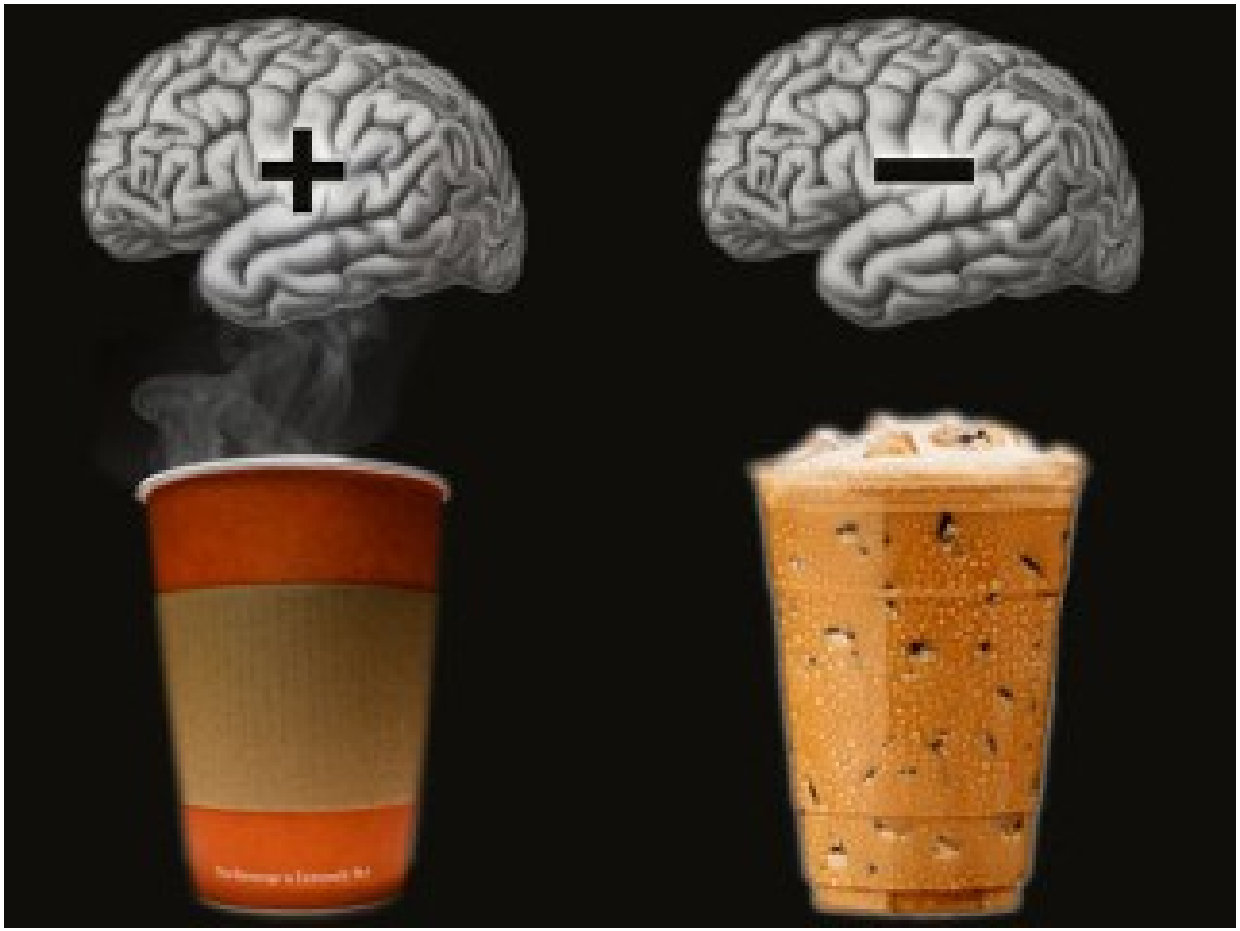
Nosek & Smyth, NSF Proposal (2006)

Take Home

1) Implicit (unconscious) mental processes are fundamental to our perception
2) They are automatic and *relatively* uncontrollable
3) They are related to STEM behavior
4) They can be changed
5) Mindfulness matters

Unconscious Influences on Social Perception

Feeling warm?

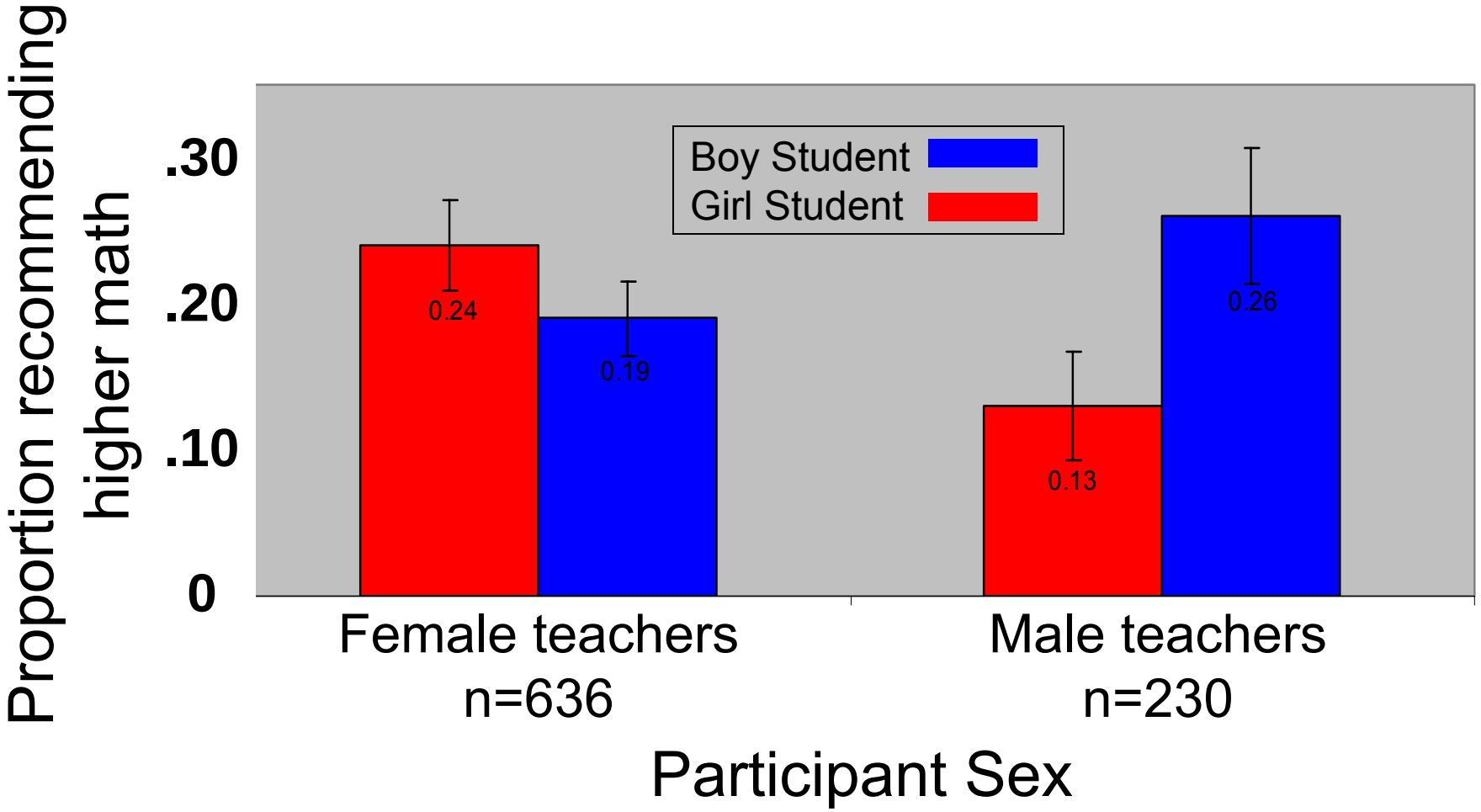


Williams & Bargh, 2008, *Science*

Feeling Romantic?

Dutton & Aron, 1974, *JPSP*

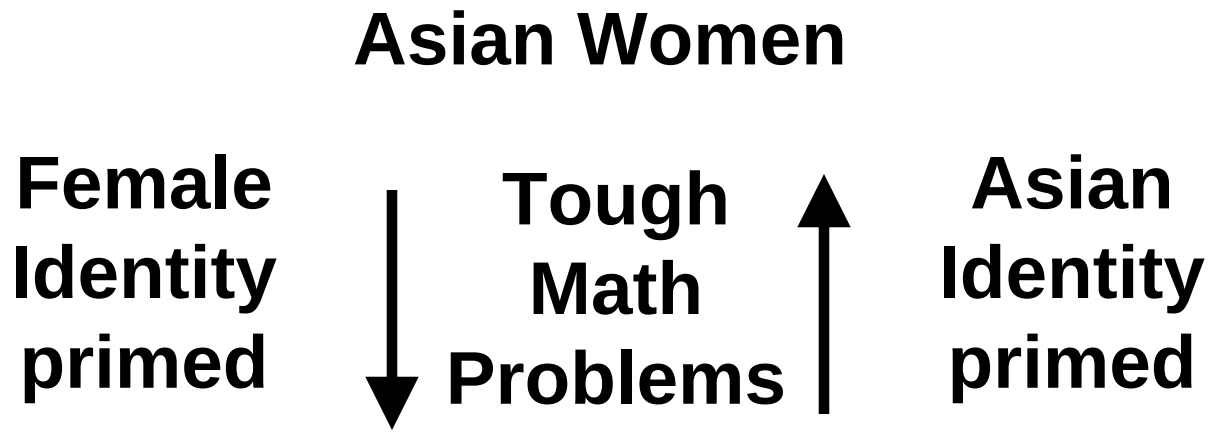
Teachers' math placement decisions vary depending on student's gender



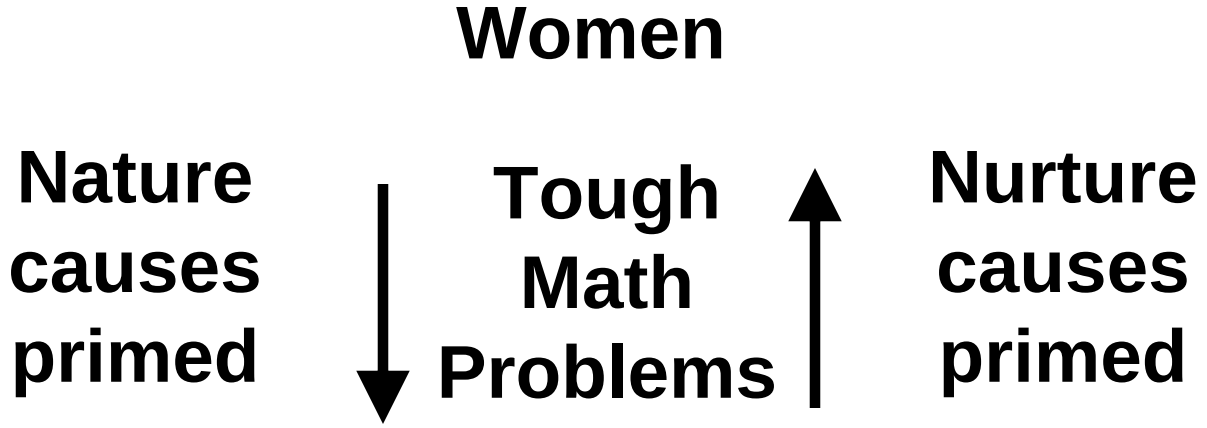
Smyth, Hawkins & Nosek, 2009

Stereotypes affect Math Performance

- If gender is salient in women's minds, concern about fulfilling the stereotype (if they care about doing well) can inhibit performance.
- Identity matters (Shih, Pittinsky, & Ambady,1998)

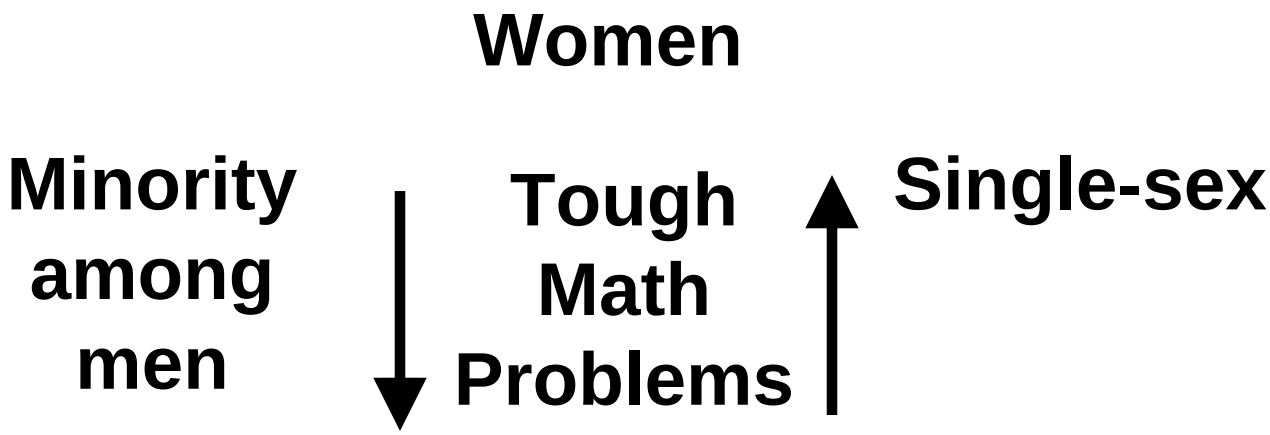


Nature-Nurture beliefs affect Math Performance



Dar-Nimrod & Heine, 2006, *Science*

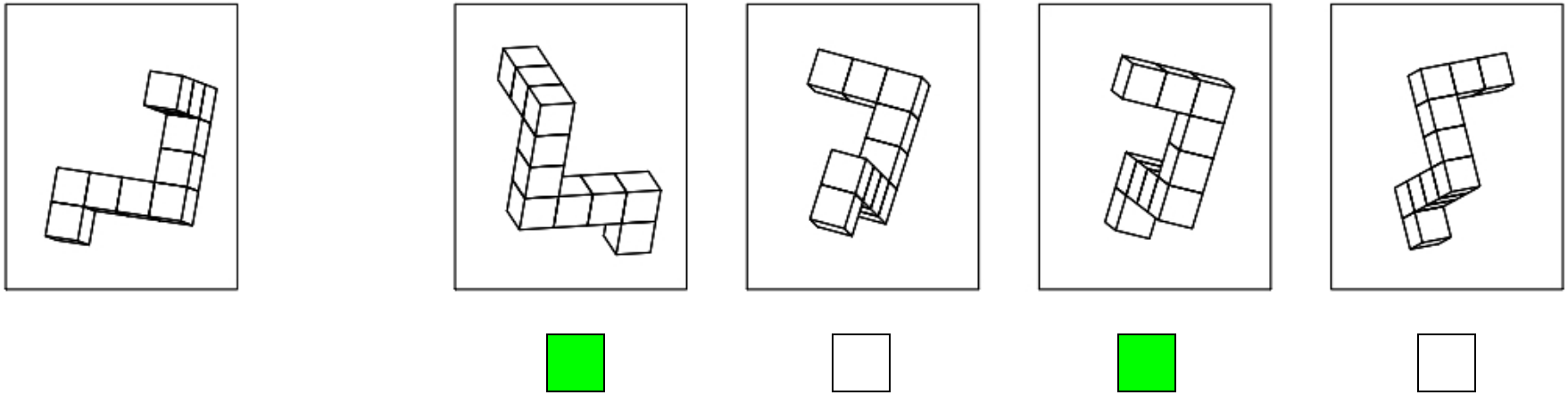
Gender Ratio in Room affects Math Performance



Inzlicht & Ben-Zeev, 2000

Stereotype Threat for Differential Equations Students with a Female Professor

Vandenberg-Kuse Mental Rotation Test

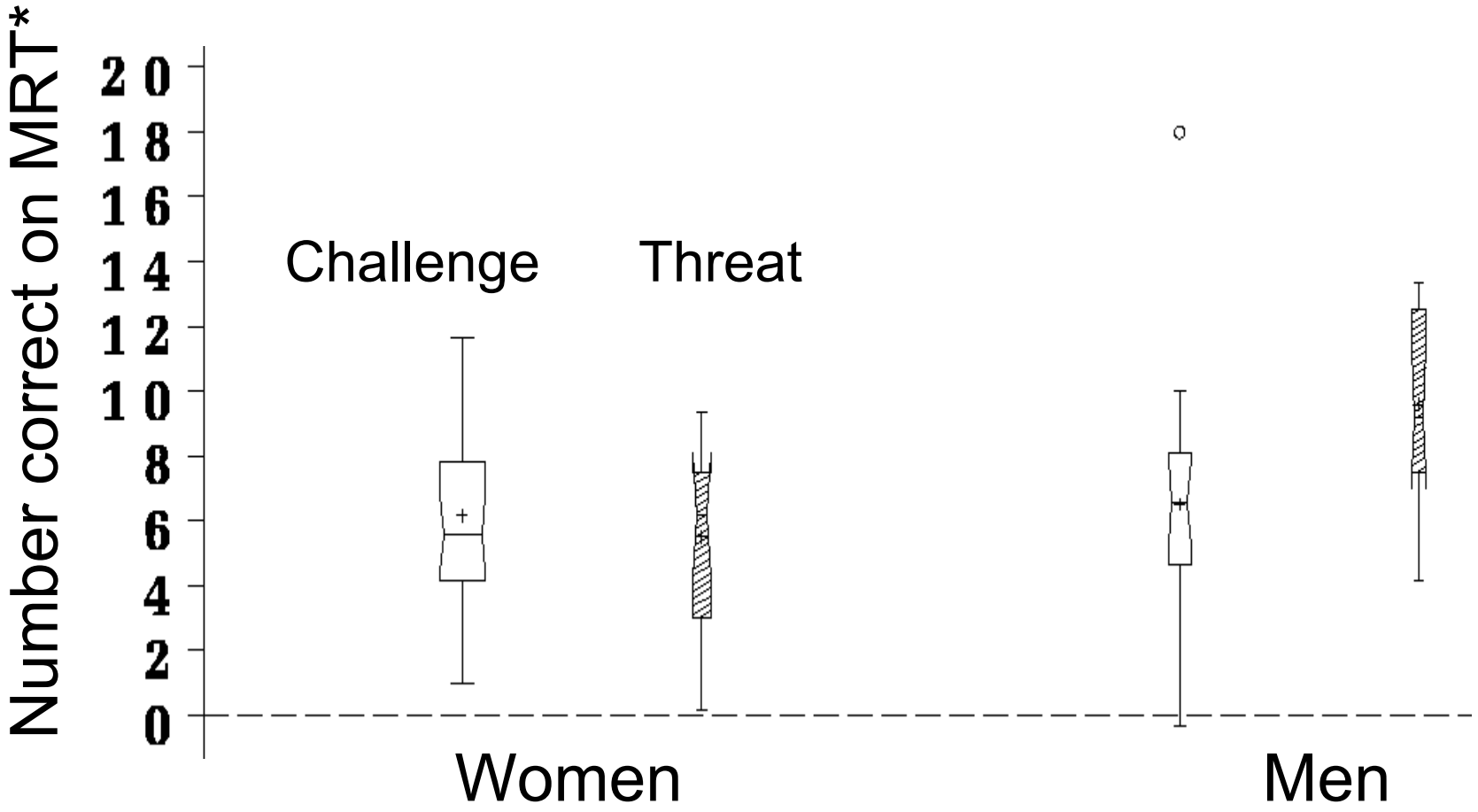


Smyth & Mitrea, 2009

Challenge or Threat Manipulation

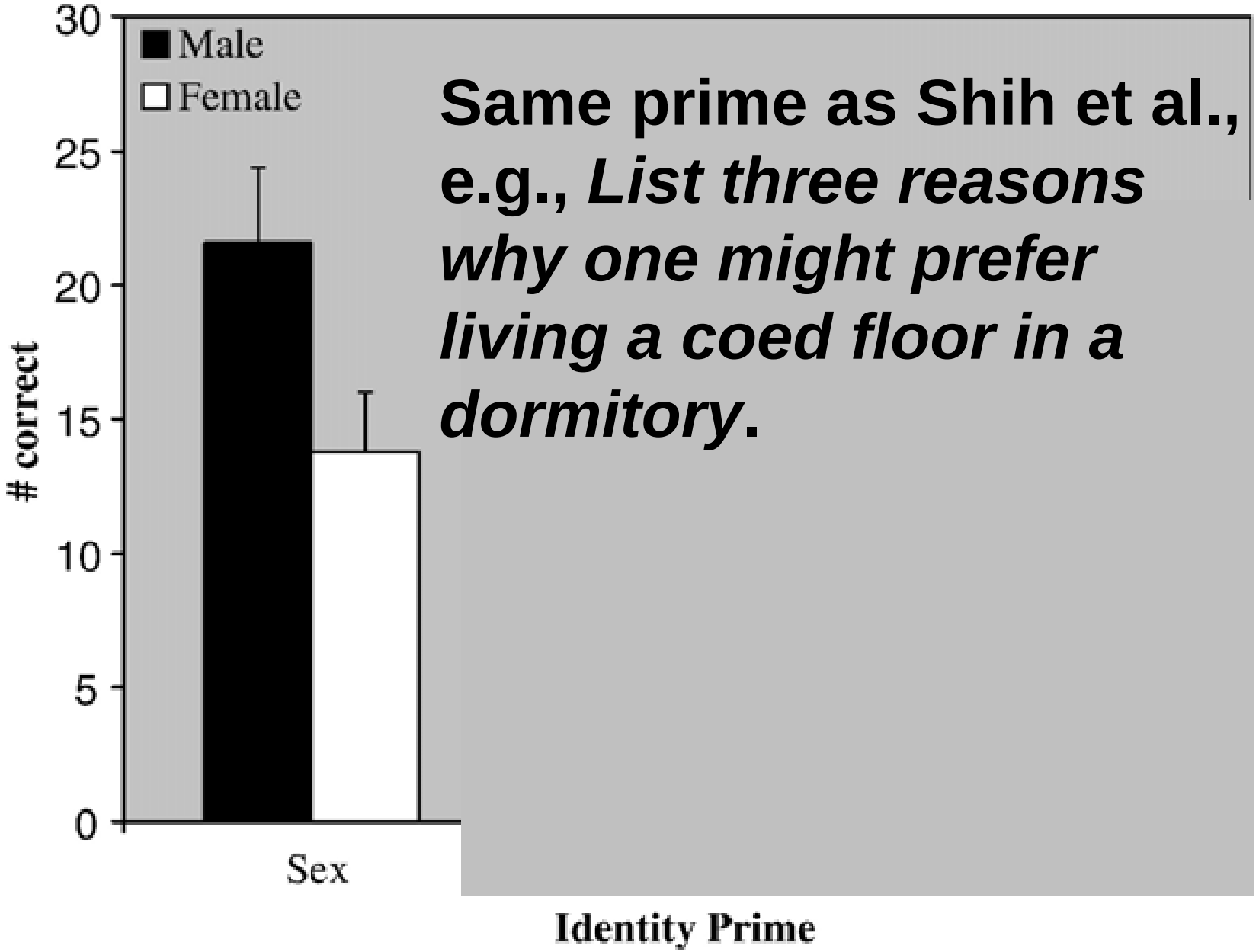
- This is the Spatial Visualization Challenge.
- **This is the Spatial Intelligence Test.**
- It's a good way to exercise your brain, and research shows that working hard at it builds new brain connections.
- **High scores have been shown to relate to achievement in high level math and science.**
- We are trying to learn how people get better at it and how this may relate to getting better at differential equations.
- **We are examining whether the typical finding of a male advantage applies for differential equations students and whether this skill is specifically related to learning in differential equations.**
- Please do your best!

No Threat Effect for Women; Boost for Men



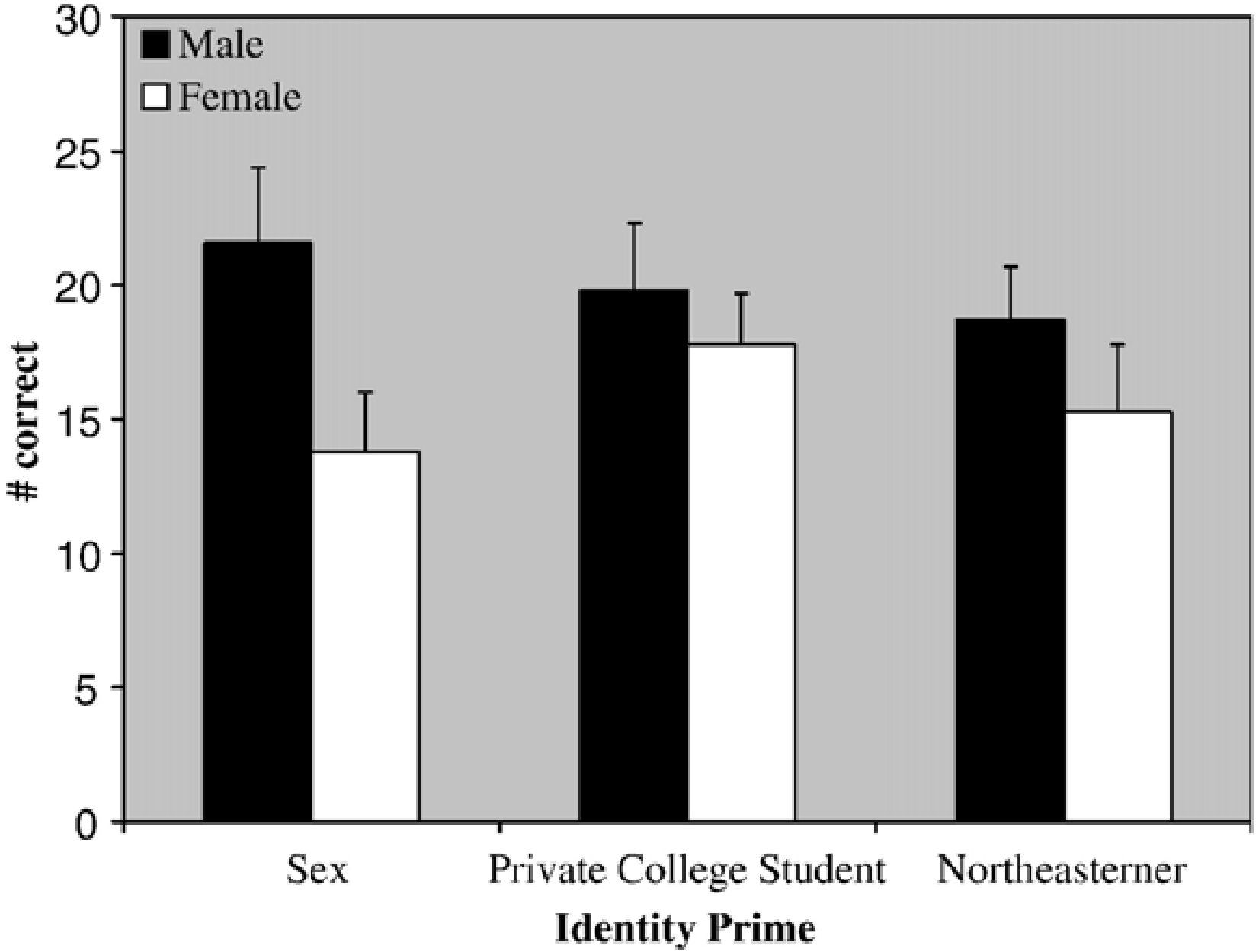
Smyth & Mitrea, 2009

Other Stereotype Threat effects on Vandenberg-Kuse MRT



Same prime as Shih et al., e.g., *List three reasons why one might prefer living a coed floor in a dormitory*.

McGlone & Aronson, 2006



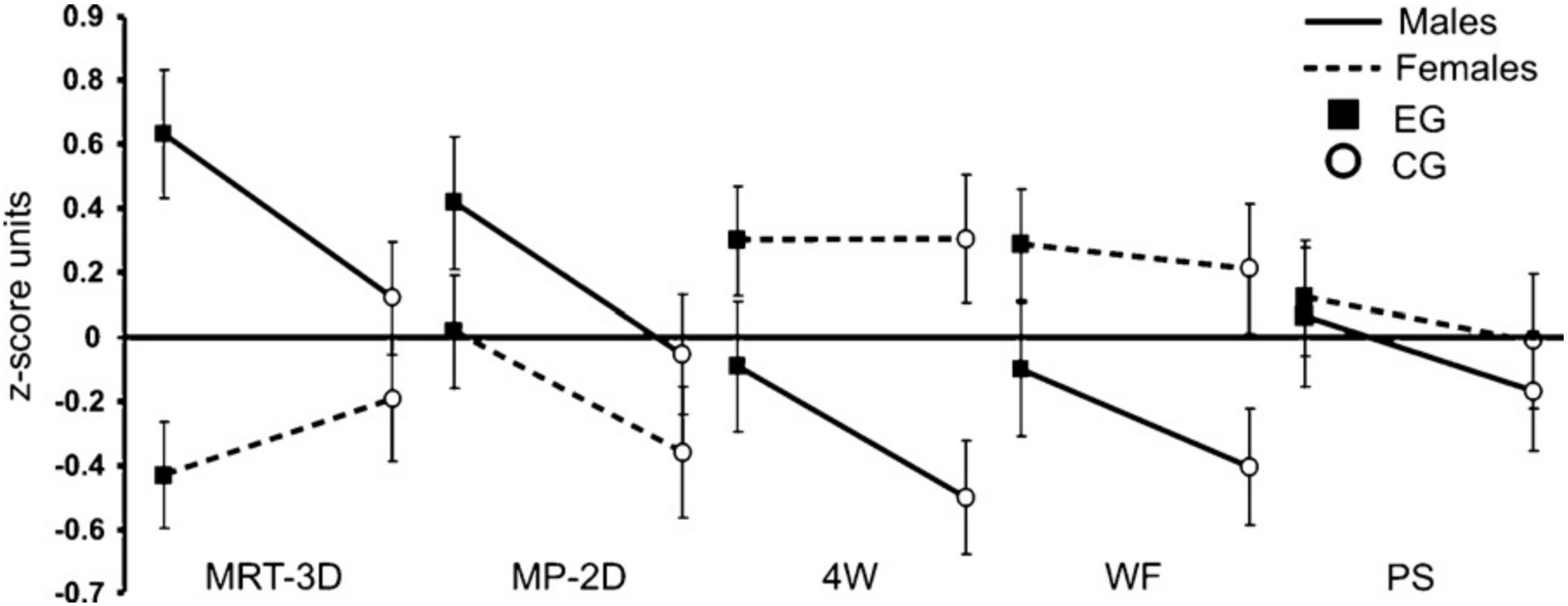
McGlone & Aronson, 2006

German college students, mixed gender groups

Threat Condition Prime: imagine being about to meet a person who you've never met and estimate the probability that the person is male or female based on various facts about them, e.g., "*is able to understand concepts in physics*."

Control Condition: …estimate probability that the person is "North American" or "European"

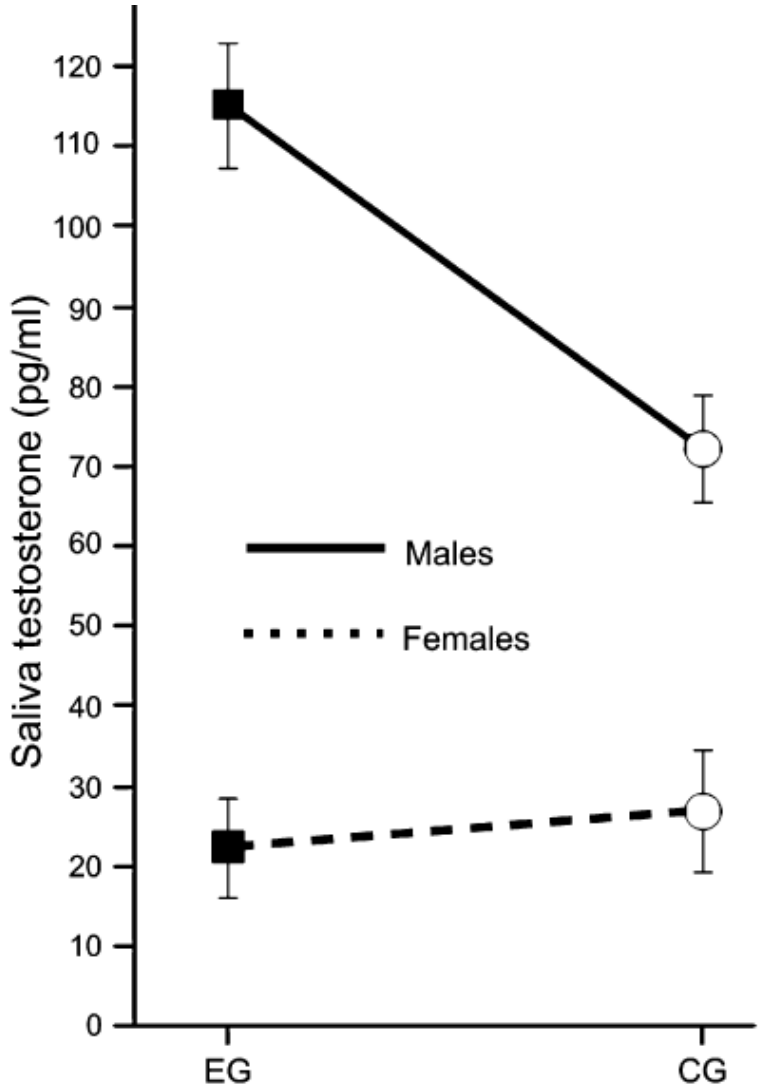
Hausmann et al., 2009



Mental Rotation **Verbal Fluency**

Hausmann et al., 2009

Threat increased males' testosterone



Hausmann et al., 2009

Measuring Implicit Associations

Implicit Association Test (IAT)

(Greenwald, McGhee & Schwartz, 1998)

Colts

Bears

Good

Bad

Colts **Bears**

Good **Bad**

Colts

Bad

Bears

Good

Male **Female**

Science **Liberal Arts**

Literature

licit.harvard.edu/implicit/

Project Implicit

Tools Help

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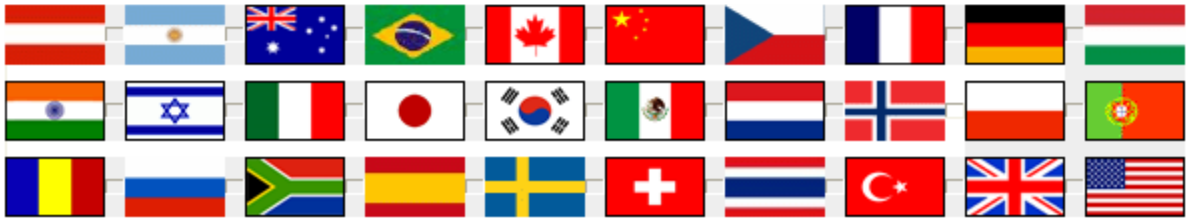
Project Implicit®

Demonstration

The demonstration site for the Implicit Association Test. Click this button to learn more about implicit associations and try out some sample tasks. Or, go directly to our featured task:
U.S. Election 2008.

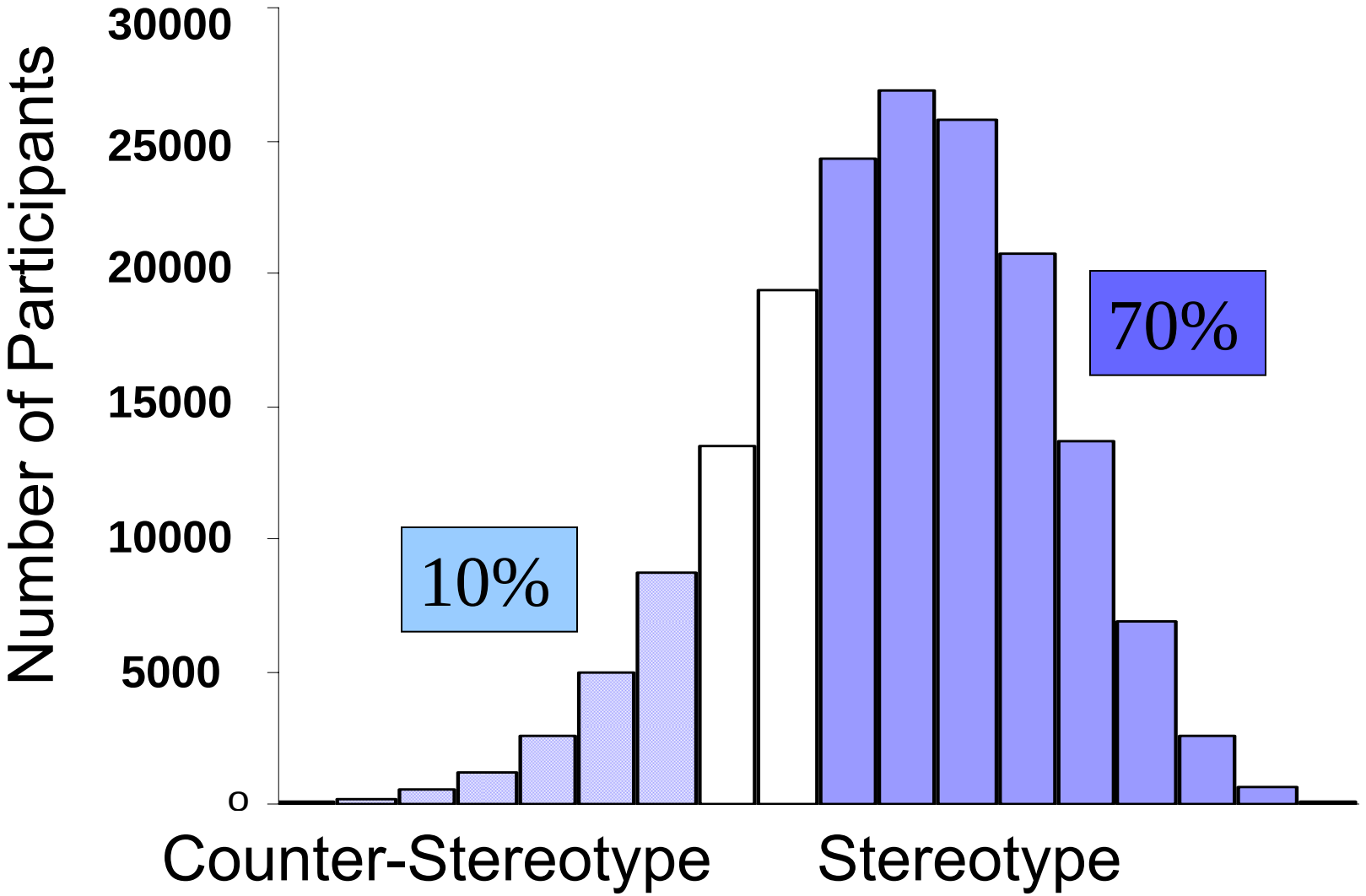
Research

The research site for Project Implicit. Click this button to participate in on-going research measuring implicit associations for a variety of topics.



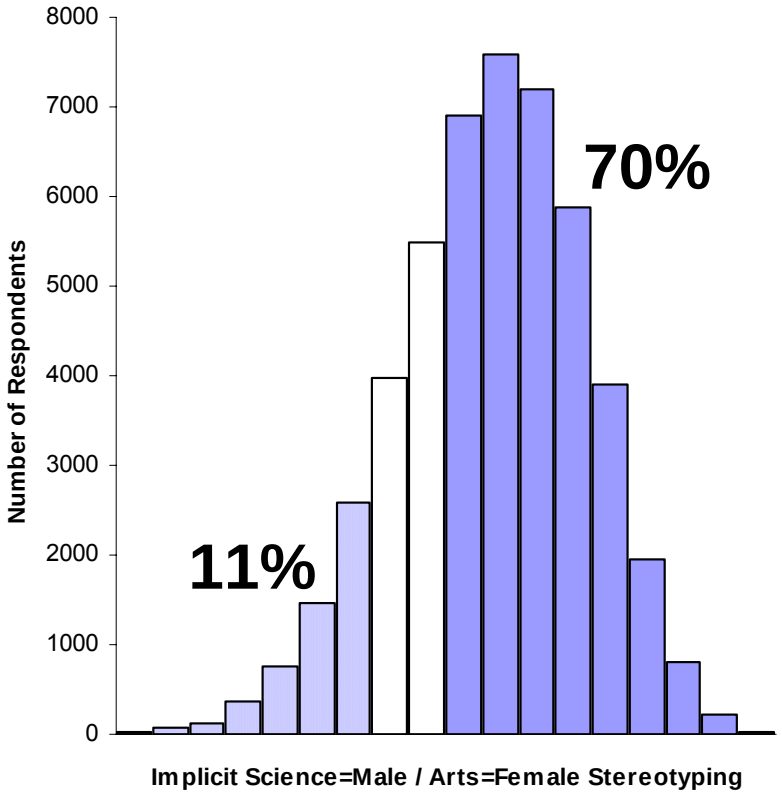
Internet

Implicit Gender-Science Stereotyping at Project Implicit

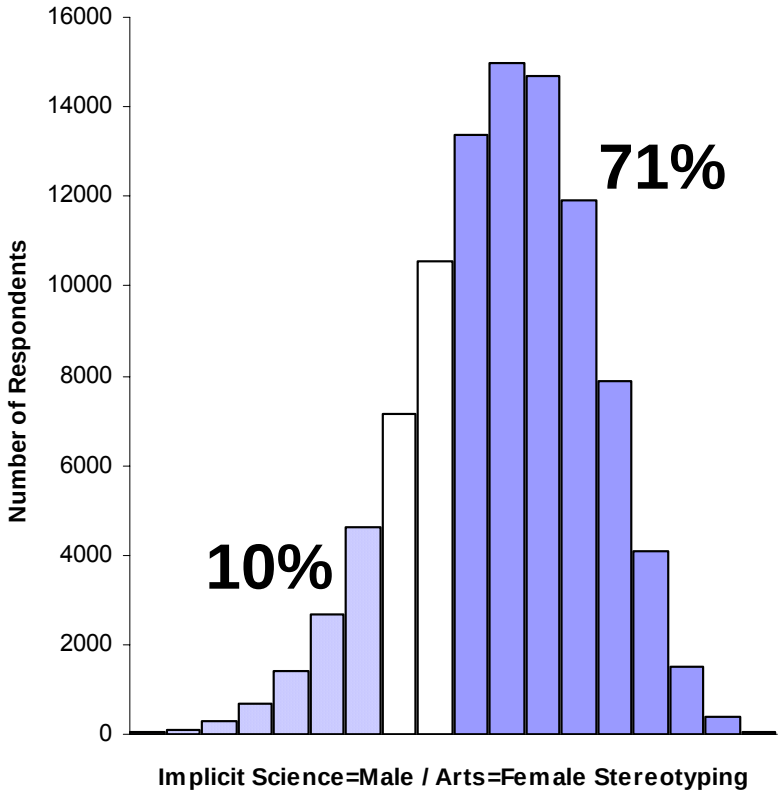


Same for Men and Women

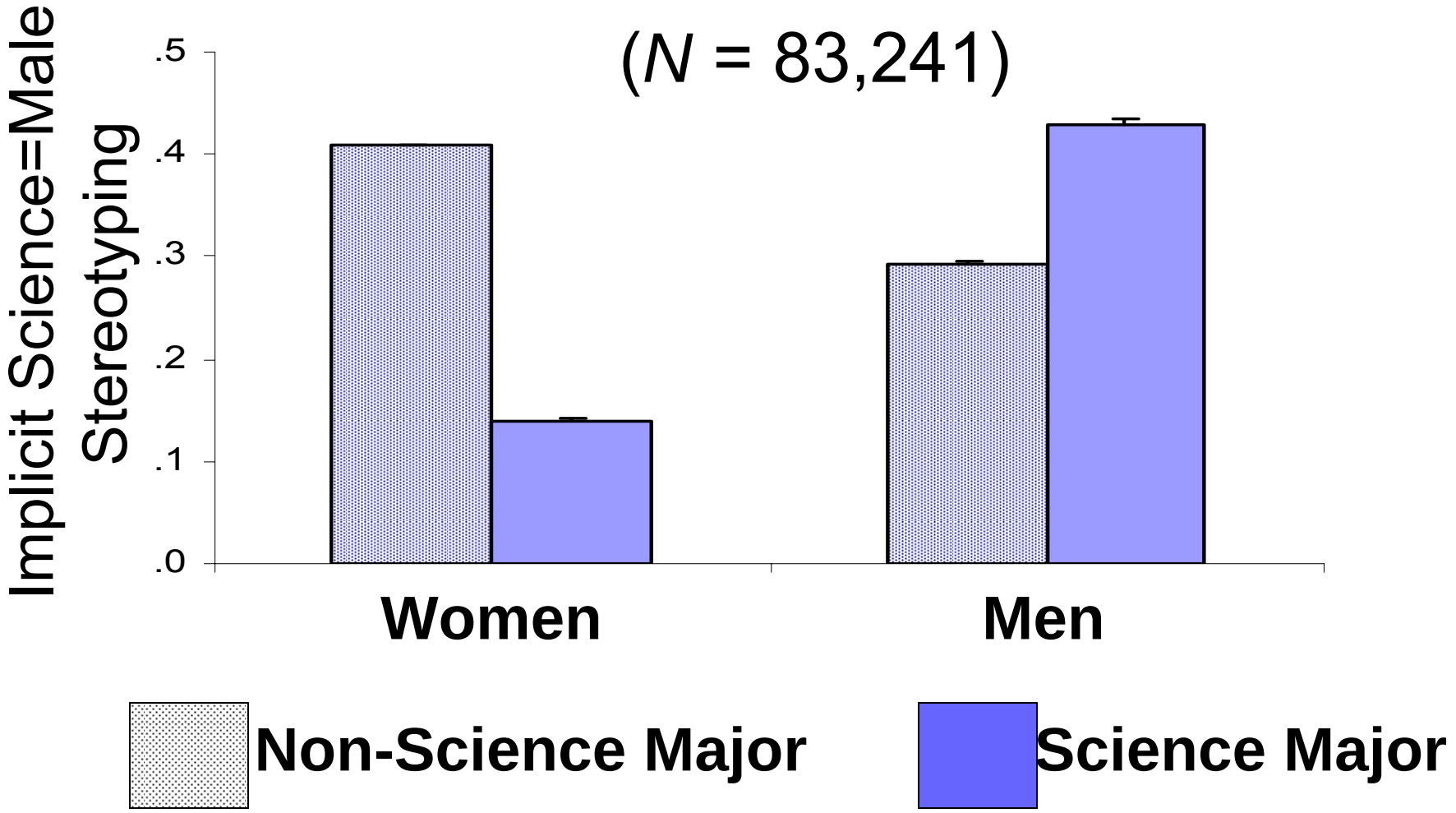
Male Respondents

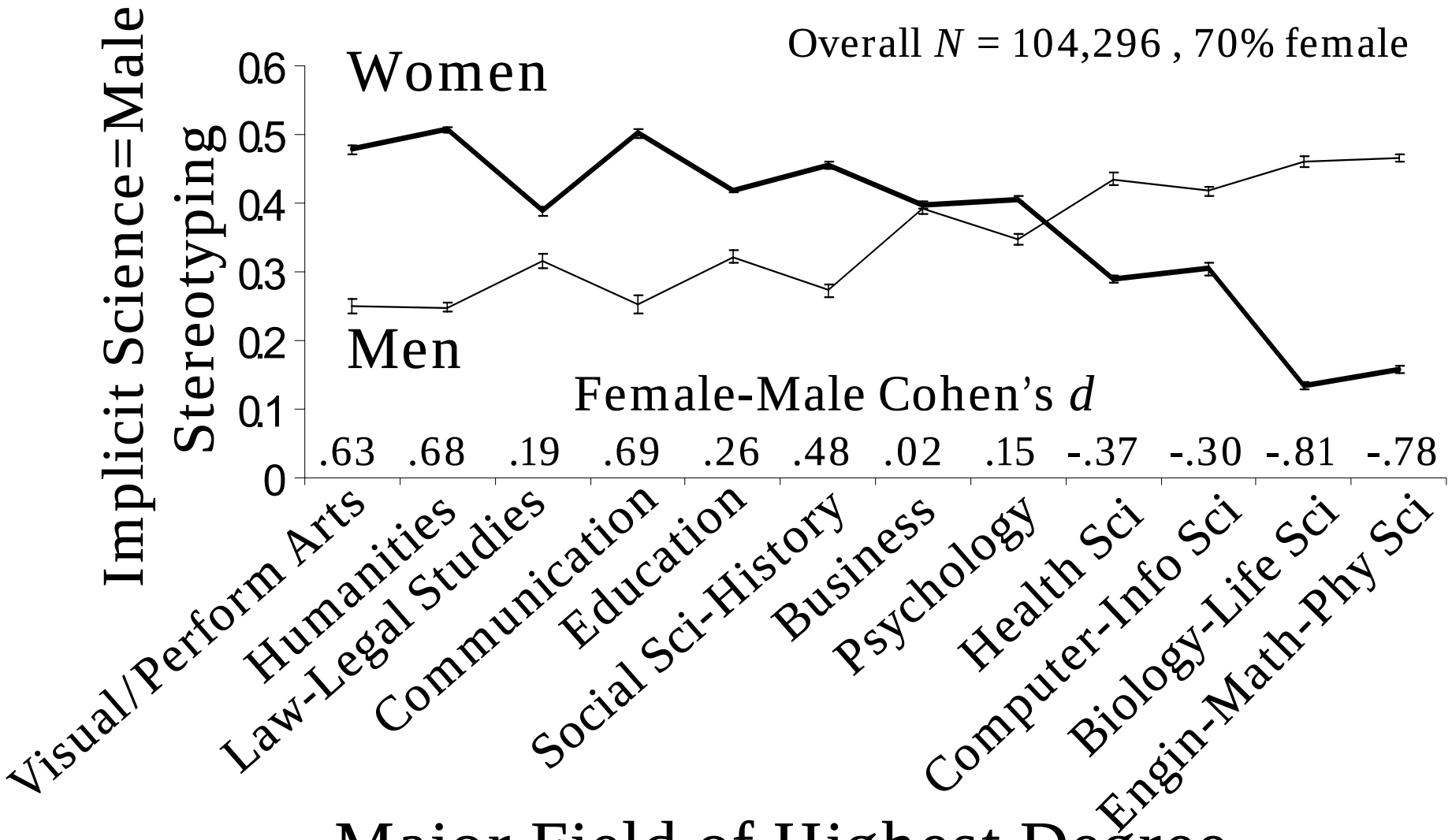


Female Respondents



But…important variation with identity



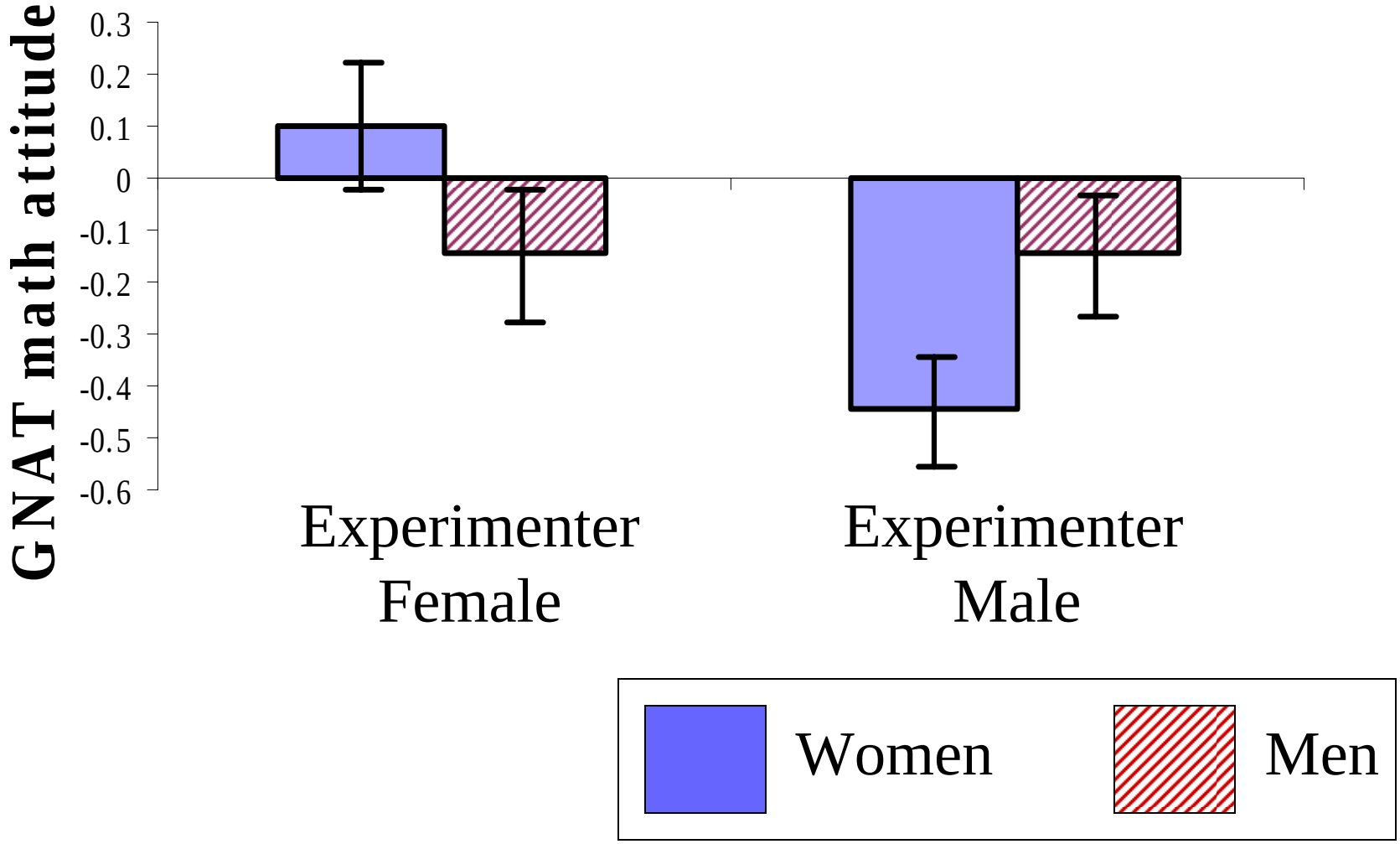


Major Field of Highest Degree

(ascending order by an independent ranking of the science requirement of the major)

Smyth, Greenwald & Nosek, 2009

Environment Matters



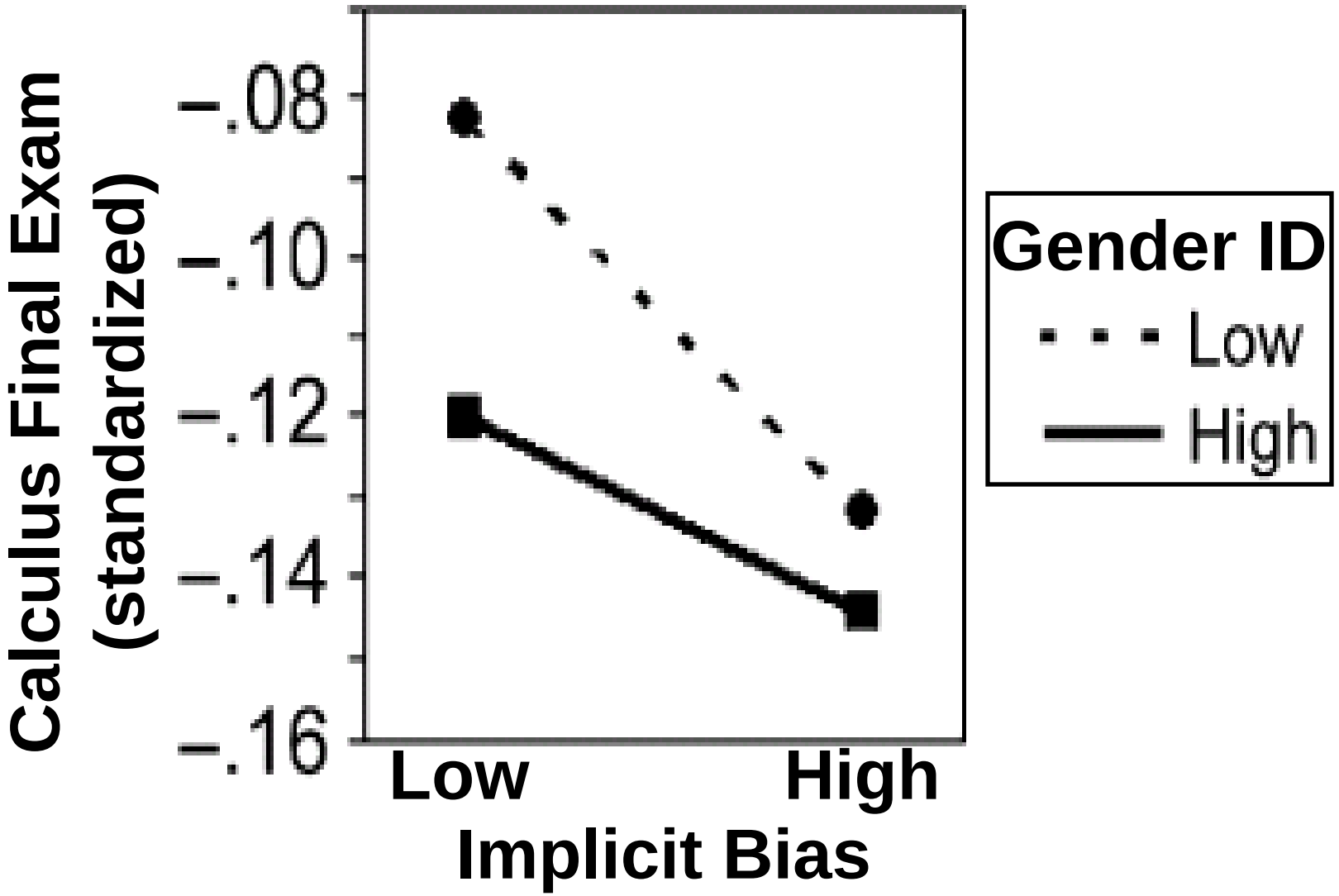
(Nosek & Banaji, 2002)

Women in College Calculus

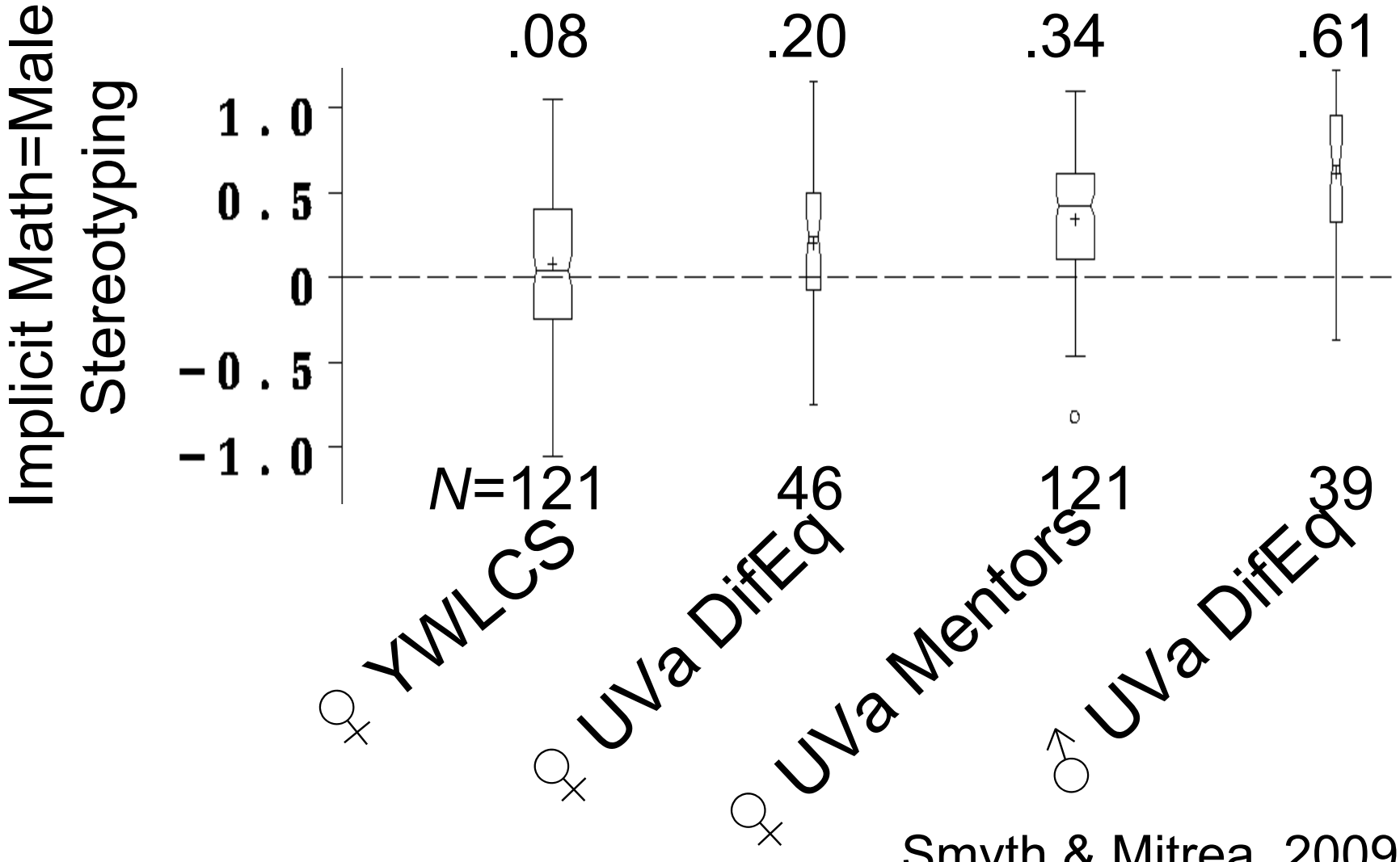
- Weaker implicit math=male bias to start…
- Predicted stronger calculus performance at finish…
- …when “centrality of gender” low.
- e.g., “Being a woman is an important part of my self image.”

Kiefer and Sekaquaptewa (2007)

Low implicit bias and low gender ID predicted higher calculus performance

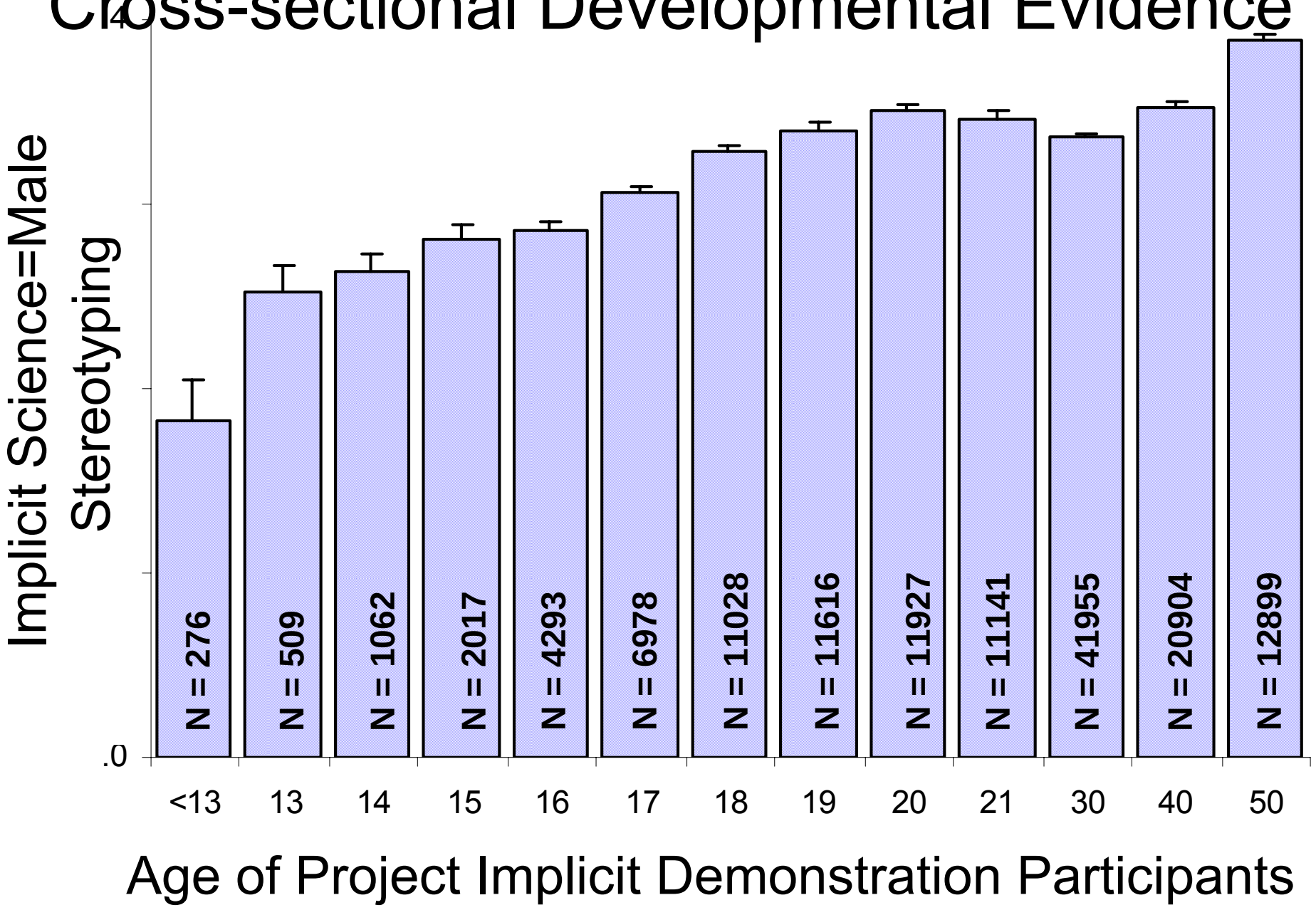


Implicit Math=Male Bias by Group



Smyth & Mitrea, 2009

Cross-sectional Developmental Evidence



Undoing?

- “Re-doing”
- Counter-stereotypical associations
- We are “wired” to develop automatic associations but our explicit values matter
- Education and self monitoring
- Adopt and teach a “malleability mindset” about ability

Open Doors

- “Malleability mindset” about ability
- Conscious structuring of personal and organizational environments

- Hands-on!
- Positive emotion

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Thank you