

**WE**PAN

Women in  
Engineering  
ProActive  
Network

*Transforming culture  
in engineering education*



# Implicit Bias in Science

## The Power of Automatic, Unintended Mindsets

**Dr. Fred Smyth  
University of Virginia**

# WEPAN 2011-2012 Webinar Series



- **Host: Diane Matt**, Executive Director, WEPAN (Women in Engineering ProActive Network)



- **Moderator: Jenna Carpenter**, Ph.D., Associate Dean; College of Engineering & Science, Louisiana Tech University; Director of Professional Development, WEPAN BOD



- **Presenter: Dr. Fred Smyth**, Department of Psychology, University of Virginia



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# Housekeeping Information

- **The webinar will use Voice Over Internet. If the sound quality is not good, a teleconference line is available:**
  - Phone #: +1 (609) 318-0025
  - Code: 280-707-735
  - Audio Pin: Will appear when you click on the phone icon
- **To be notified of future webinars, sign up for the Knowledge Center newsletter at: <http://wepanknowledgecenter.org>**
- **Survey following the webinar—please respond!**



# How to Ask a Question

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- **Participant microphones are muted for webinar quality.**
- **Type your question in the “Question” space in the webinar control panel.**
- **A presenter will respond as time allows.**

# Who's on the Call Today

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- **We have over 375 registered participants.**
- **Thank you to ASEE WIED, ASEE CMC, ASEE ERM, NAPE Stem Equity Pipeline, PGEList, ADVANCE, and others for helping us spread the word!**
- **The recorded webinar and slides will be posted on the WEPAN Knowledge Center.**

# What's WEPAN? [www.wepan.org](http://www.wepan.org)

- WEPAN's Core Purpose: To propel higher education to increase the number and advance the prominence of diverse communities of women in engineering.
- WEPAN's Core Values: Knowledge of research, statistics, pedagogy, and practice relevant to women in engineering and STEM is a way to drive change.
- WEPAN and Collaboration: Collaboration draws on strengths from many sectors and is key to advancing women in engineering.
- WEPAN and Diversity: Inclusion of diverse communities of women improves the field of engineering itself.
- WEPAN and Leadership: Developing and influencing leadership is pivotal to advancing the success of women in engineering.



# WEPAN Knowledge Center

<http://wepanknowledgecenter.org>

**Goal: Increase the number, scope and effectiveness of initiatives to advance women in engineering.**

- **Catalogued and fully cited resources**

Research, reports, data and statistics, agenda papers, bibliographies, best practices, key programs, and more—1,000+

- **Online Professional Community**

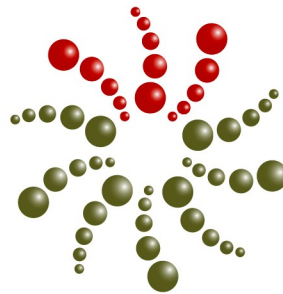
Network, collaborate, identify experts, share information

- **Special online events**

Feature WKC Professional Community and networking opportunities

- **Use** the research, information & data, **Submit** & suggest resources, **Share** the WKC with colleagues





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# Implicit Bias in Science

## The Power of Automatic, Unintended Mindsets

**Dr. Fred Smyth**  
**University of Virginia**





# Implicit Bias in Science

## The Power of Automatic, Unintended Mindsets

Fred Smyth, PhD  
Department of Psychology  
University of Virginia



**Brian Nosek & Fred Smyth**

**Funded by the National Science Foundation**

**REC-0634041**

**[fullpotentialinitiative.org](http://fullpotentialinitiative.org)**

# Who will you bet on?



# Who will you bet on?

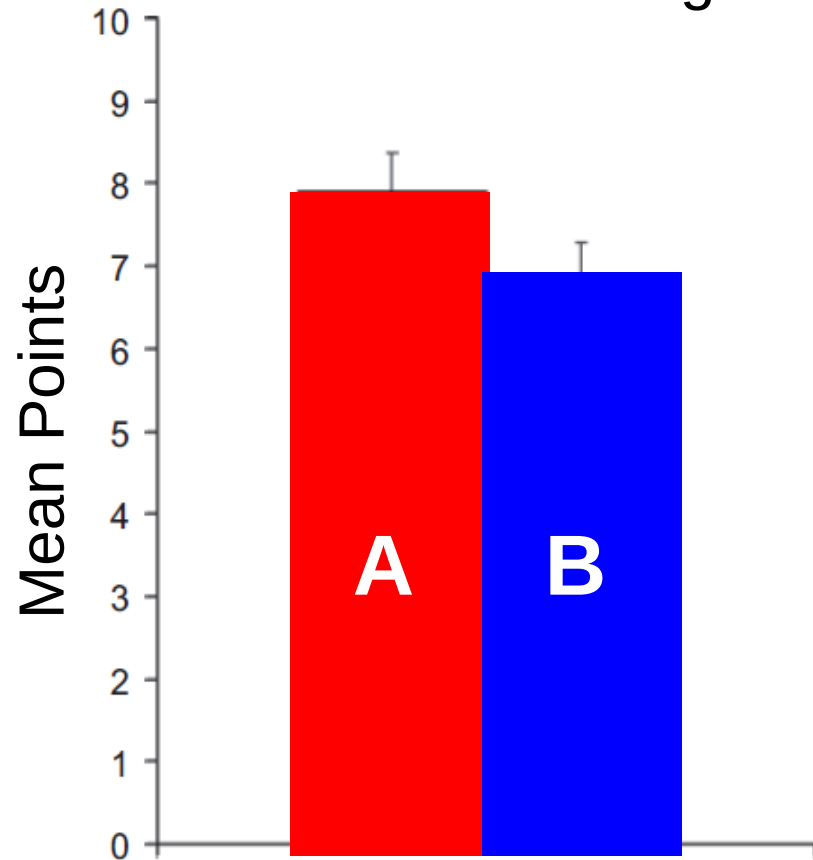


**A**

**B**

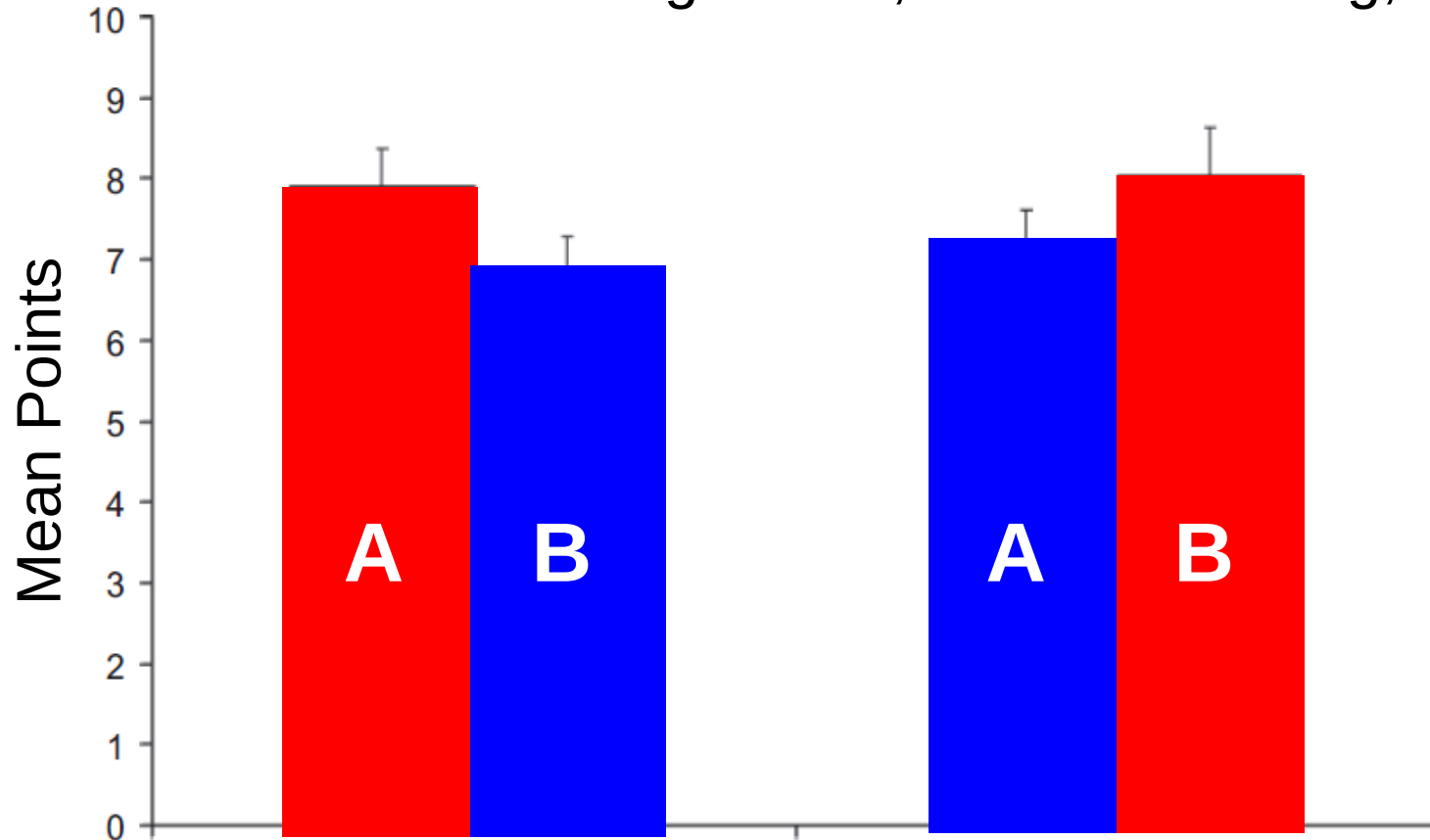
# Competitor A

Hagemann, Strauss & Leing, 2008



# or B if he wears red.

Hagemann, Strauss & Leing, 2008



# Implicit Bias

# Implicit Bias

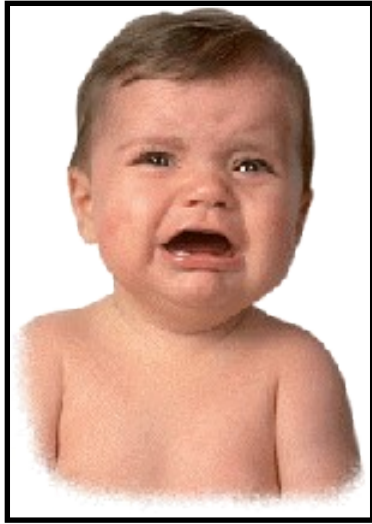
- Beyond awareness and control



# Implicit Bias

- Beyond awareness and control
- 1970s early demonstrations

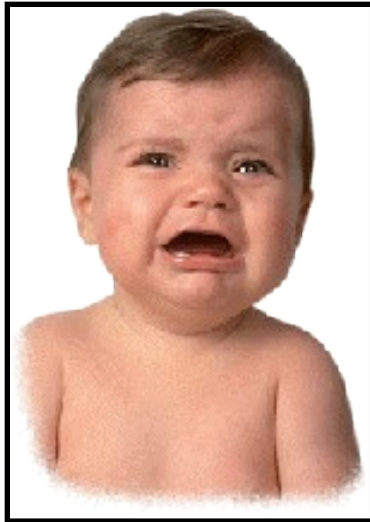
# Feelings



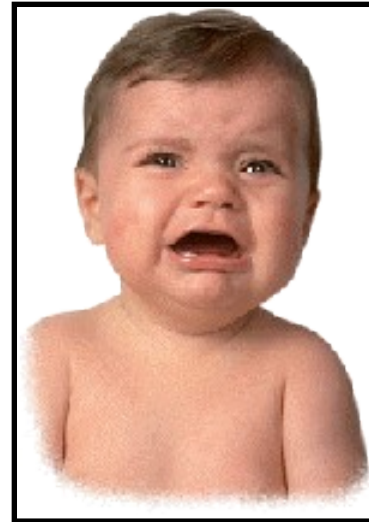
Condry & Condry, 1976

# Feelings

**Debbie**

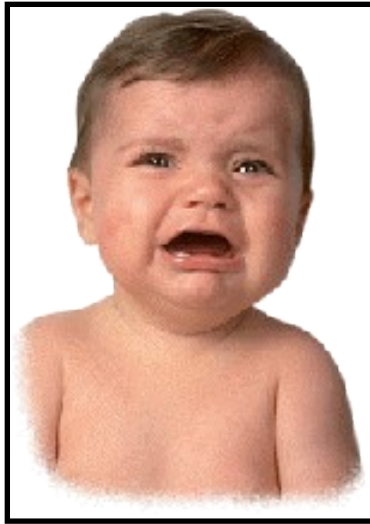


**Danny**



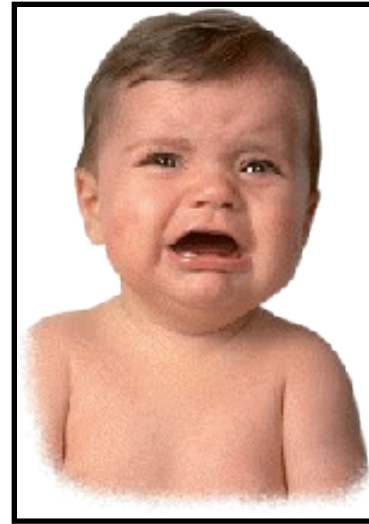
# Feelings

**Debbie**



**“Afraid”**

**Danny**



**“Angry”**

# Implicit Bias

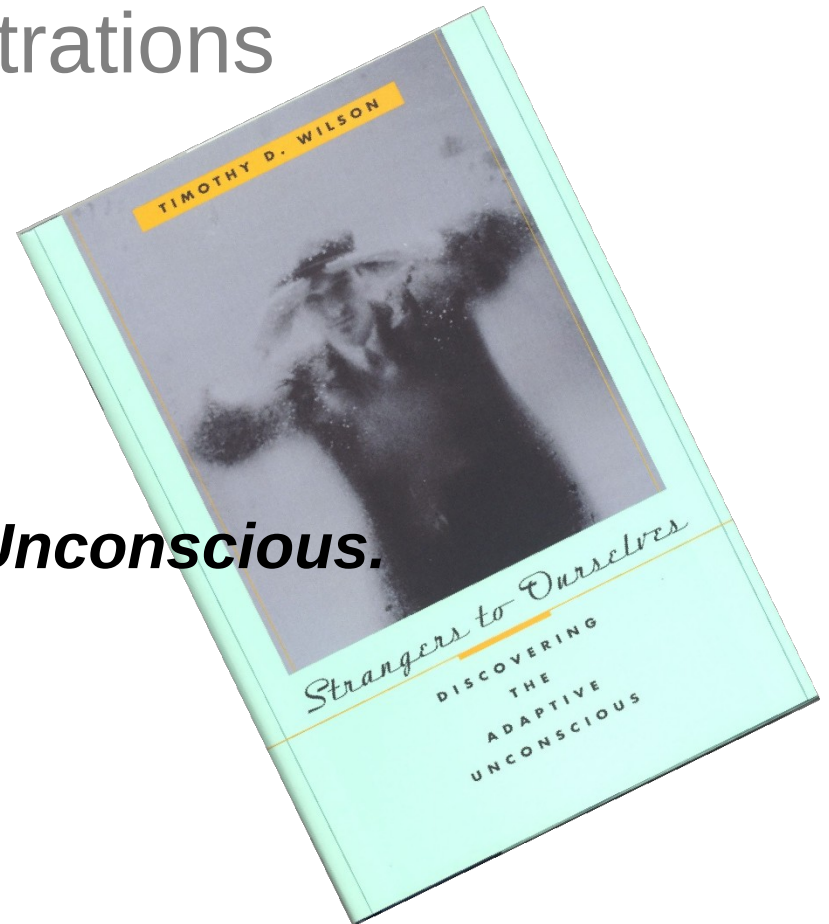
- Beyond awareness and control
- 1970s early demonstrations
- Pervasive

# Implicit Bias

- Beyond awareness and control
- 1970s early demonstrations
- Pervasive

***Strangers to Ourselves:  
Discovering the Adaptive Unconscious.***

**Timothy Wilson  
University of Virginia**



# Implicit Bias

- Beyond awareness and control
- 1970s early demonstrations
- Pervasive
- Livelihoods and lives

# Implicit Bias

- Beyond awareness and control
- 1970s early demonstrations
- Pervasive
- Livelihoods and lives



Goldin & Rouse, 2000



# Implicit Bias

- Beyond awareness and control
- 1970s early demonstrations
- Pervasive
- Livelihoods and lives



Goldin & Rouse, 2000



Payne, 2006

# Implicit Bias

- Beyond awareness and control
- 1970s early demonstrations
- Pervasive
- Livelihoods and lives



Goldin & Rouse, 2000

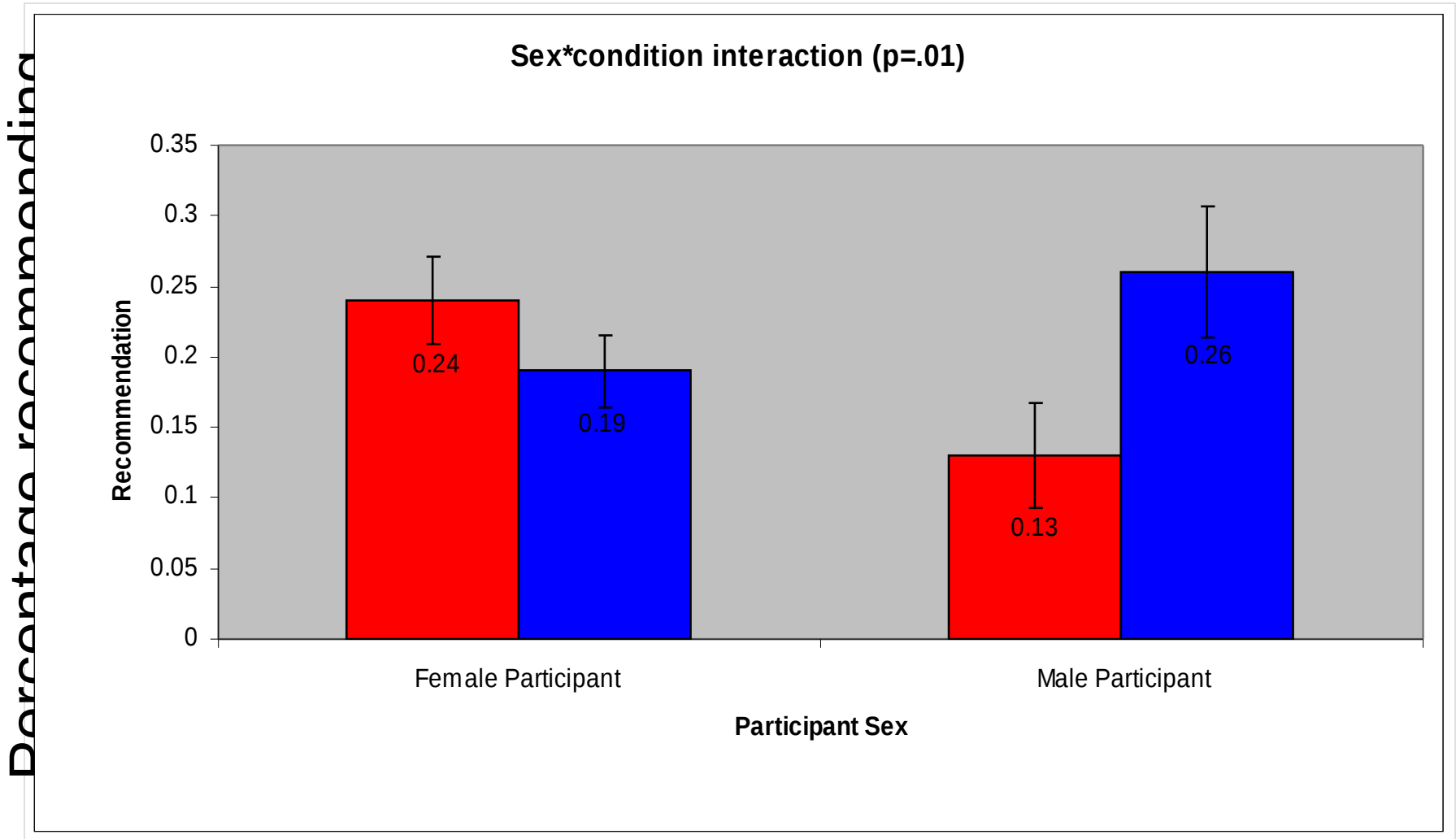


Payne, 2006

# Take Home about Implicit Associations

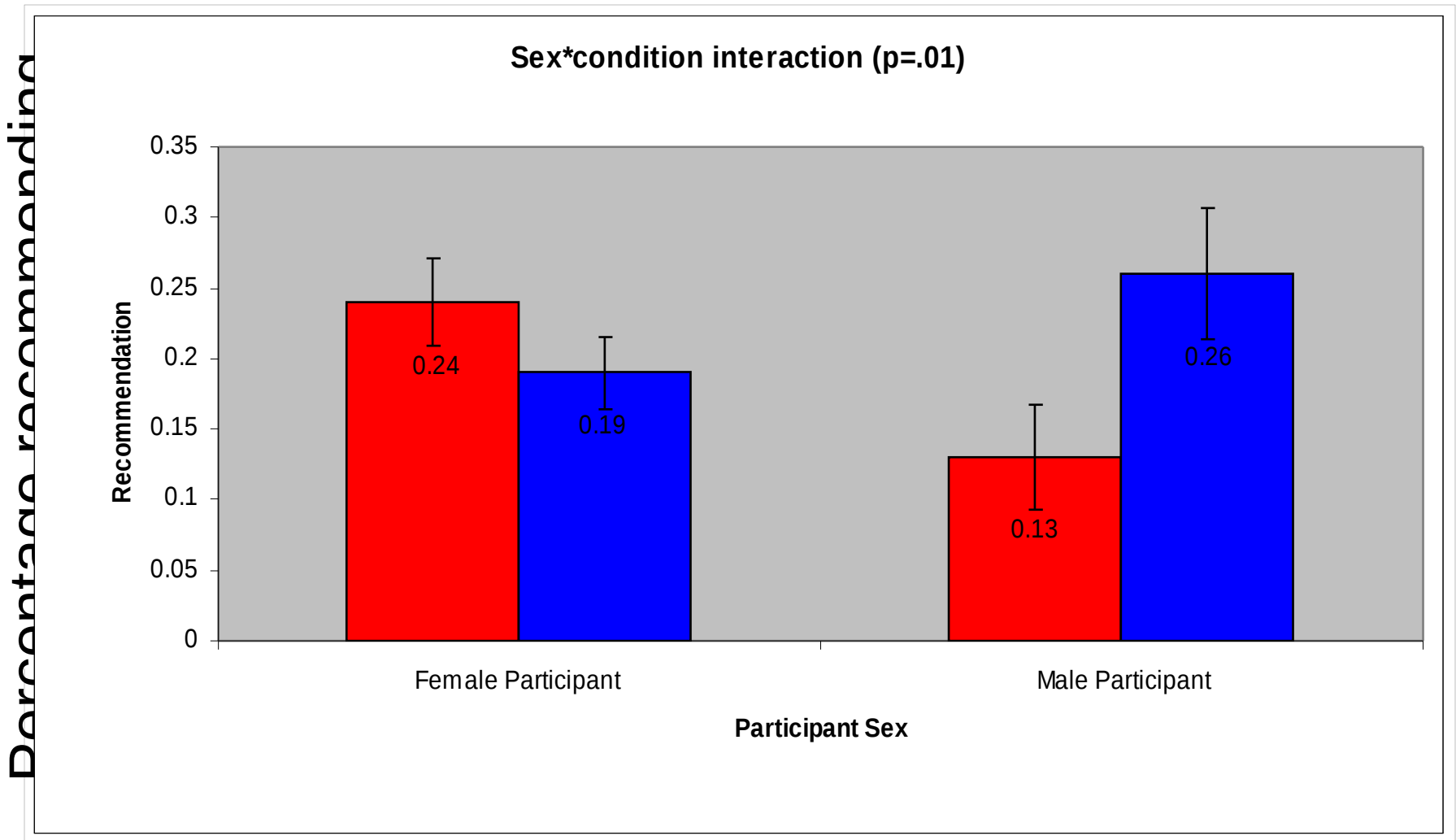
- 1) Humility (we all have 'em)
- 2) Related to STEM outcomes
- 3) Measurable
- 4) Changeable

# Teachers' math placement decisions



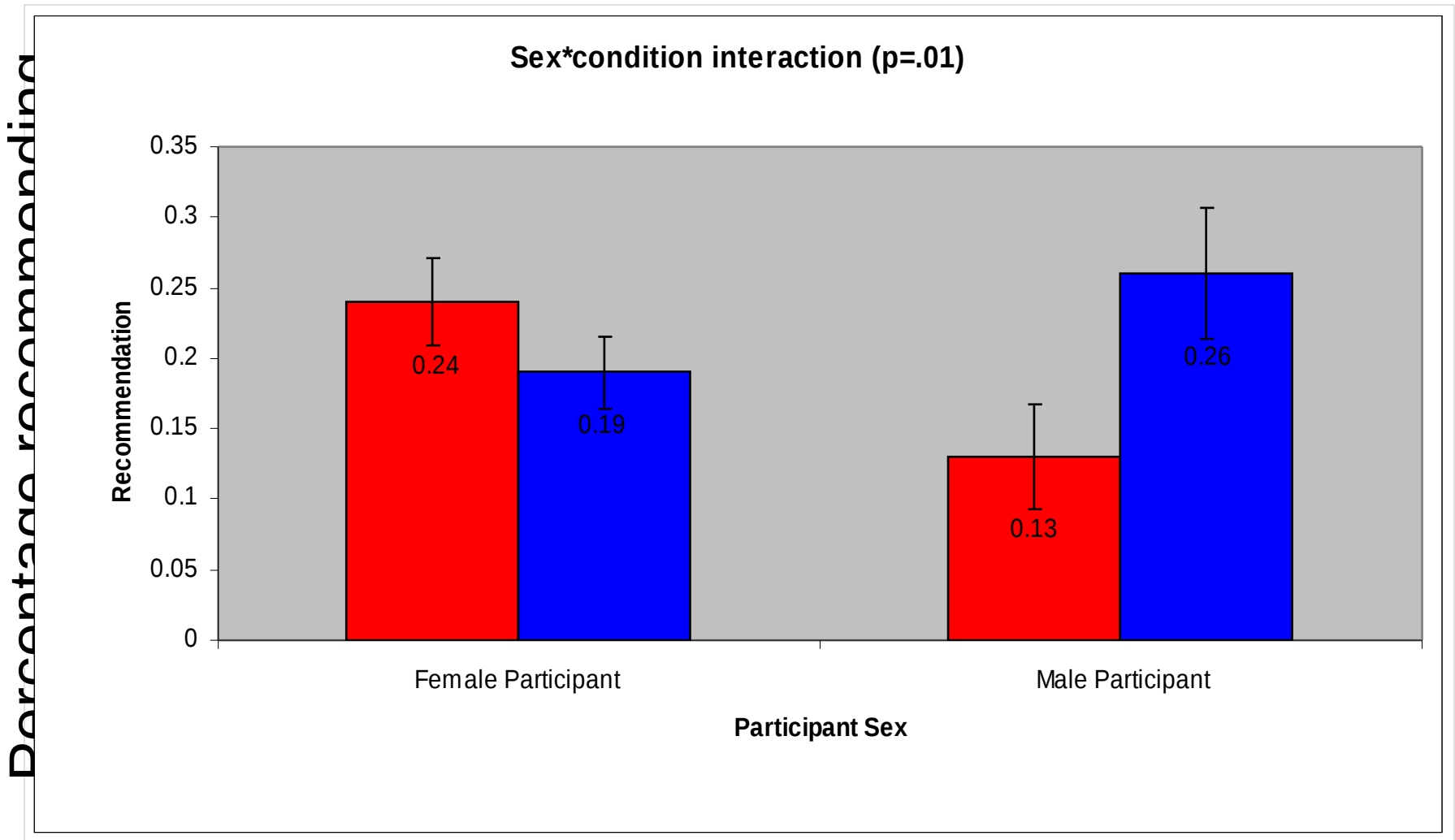
Smyth, Hawkins & Nosek, 2009

# Teachers' math placement decisions



Smyth, Hawkins & Nosek, 2009

# Teachers' math placement decisions



Smyth, Hawkins & Nosek, 2009

# Measuring Implicit Associations (individually)

# Implicit Association Test (IAT)

Greenwald, McGhee & Schwarz, 1998



# Implicit Association Test (IAT)



Giants or Patriots?

Greenwald, McGhee & Schwarz, 1998

**Giants**

**Patriots**

**Training Phase 1**

**Giants**

**Patriots**

**Left**

**Right**

**Training Phase 1**

Giants

Patriots

Left



Right

Training Phase 1

Giants

Patriots

Left



Right

Training Phase 1

Giants

Patriots

Left



Right

Training Phase 1

Giants

Patriots

Left



Right

Training Phase 1

**Good**

**Left**

**Bad**

**Right**

**Training Phase 2**



**Good**

**Left**



**Bad**

**Right**

**Training Phase 2**

**Good**

**Left**



**Bad**

**Right**

**Training Phase 2**

**Good**

**Left**



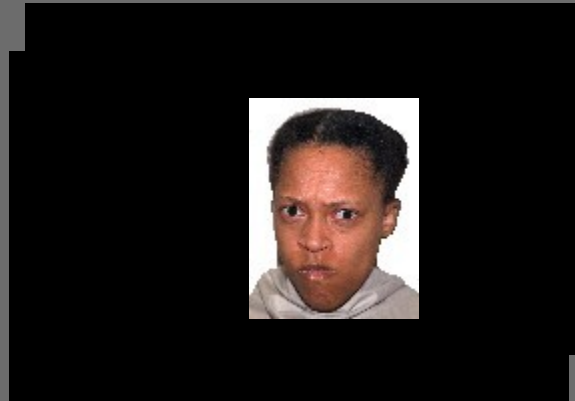
**Bad**

**Right**

**Training Phase 2**

**Good**

**Left**



**Bad**

**Right**

**Training Phase 2**

**Giants**

**Good**

**Left**

**Patriots**

**Bad**

**Right**

**Test Phase 1**

**Giants**

**Good**

**Left**



**Patriots**

**Bad**

**Right**

**Test Phase 1**

Giants

Good

Left



Patriots

Bad

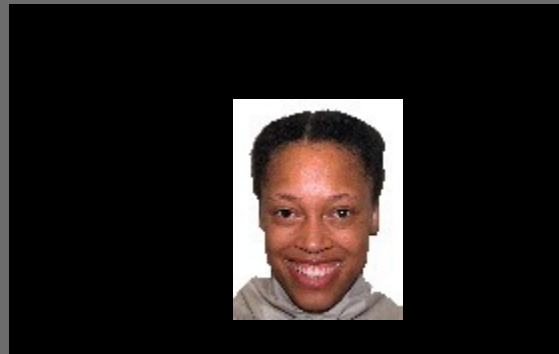
Right

Test Phase 1

**Giants**

**Good**

**Left**



**Patriots**

**Bad**

**Right**

**Test Phase 1**



**Giants**

**Good**

**Left**



**Patriots**

**Bad**

**Right**

**Test Phase 1**

**Patriots**

**Giants**

Left

Right

**Retraining**



**Patriots**

**Good**

**Left**

**Giants**

**Bad**

**Right**

**Test Phase 2**

# Which sorting is easier?

**Giants**

Good

**Patriots**

Bad

OR

**Patriots**

Good

**Giants**

Bad

# Which sorting is easier?

**Giants**

**Patriots**

Good

Bad



**Giants fans**

**Patriots**

**Giants**

Good

Bad



**Patriots fans**

# 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: [Decision 2012 IAT](#).

## Research

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

Visit our brand new website: [Project Implicit Mental Health!](#)



[implicit.harvard.edu/implicit/](http://implicit.harvard.edu/implicit/)

# Gender-Science on Project Implicit

**Male**

or

**Liberal Arts**

**Female**

or

**Science**



# Gender-Science on Project Implicit

**Male**

or

**Liberal Arts**

**Female**

or

**Science**

**Female**

or

**Liberal Arts**

**Male**

or

**Science**



# Gender-Science on Project Implicit

**Male**

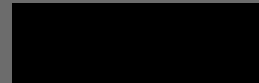
or

Liberal Arts

**Female**

or

Science



**Female**

or

Liberal Arts

Easier for 70%

**Male**

or

Science

# Gender-Science on Project Implicit

**Male**

Easier for 10%

**Female**

or

or

Liberal Arts

Science

**Female**

Easier for 70%

**Male**

or

or

Liberal Arts

Science

# Gender-Science on Project Implicit

**Male**

Easier for 10%

**Female**

or

or

Liberal Arts

Science

No Difference for 20%

**Female**

Easier for 70%

**Male**

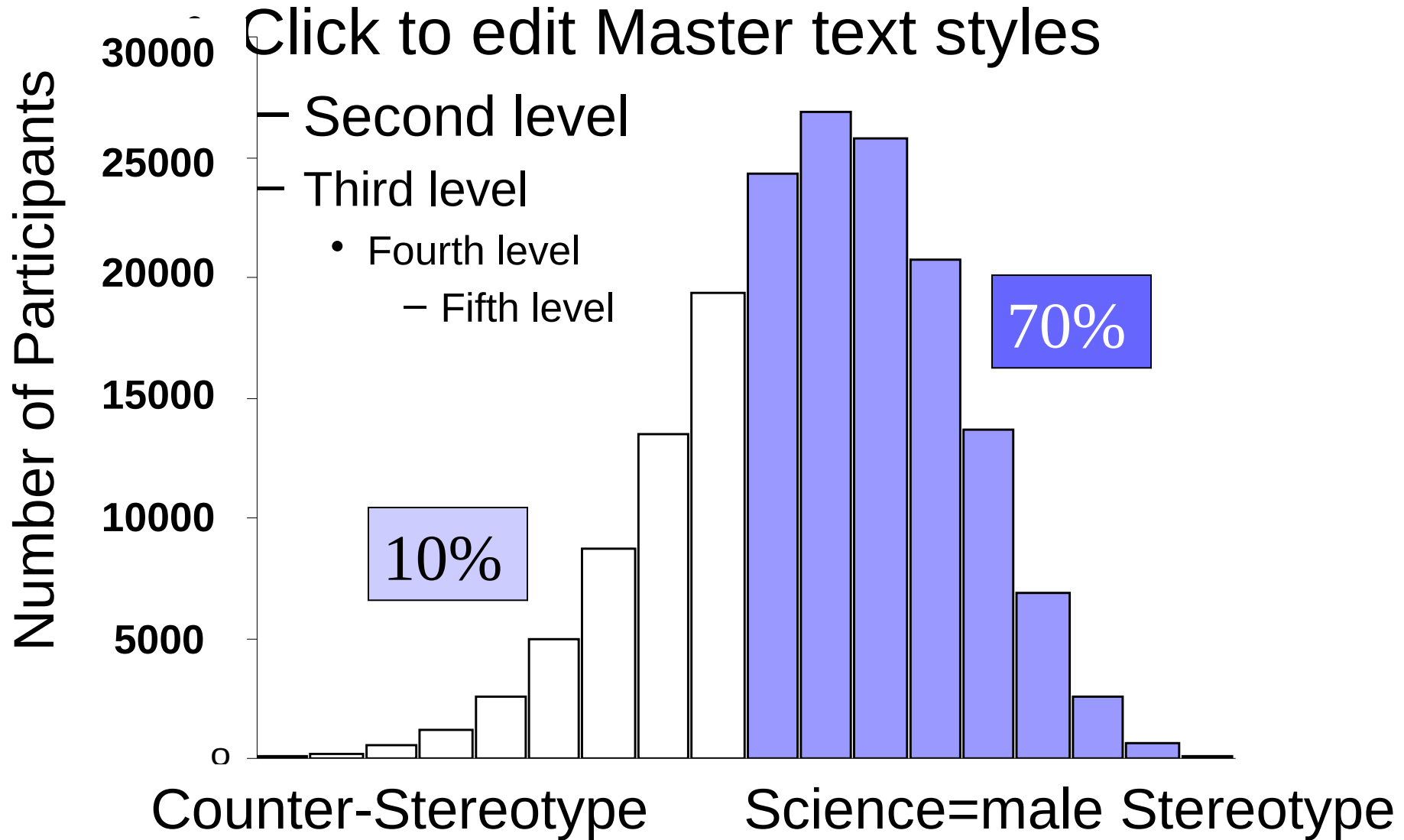
or

or

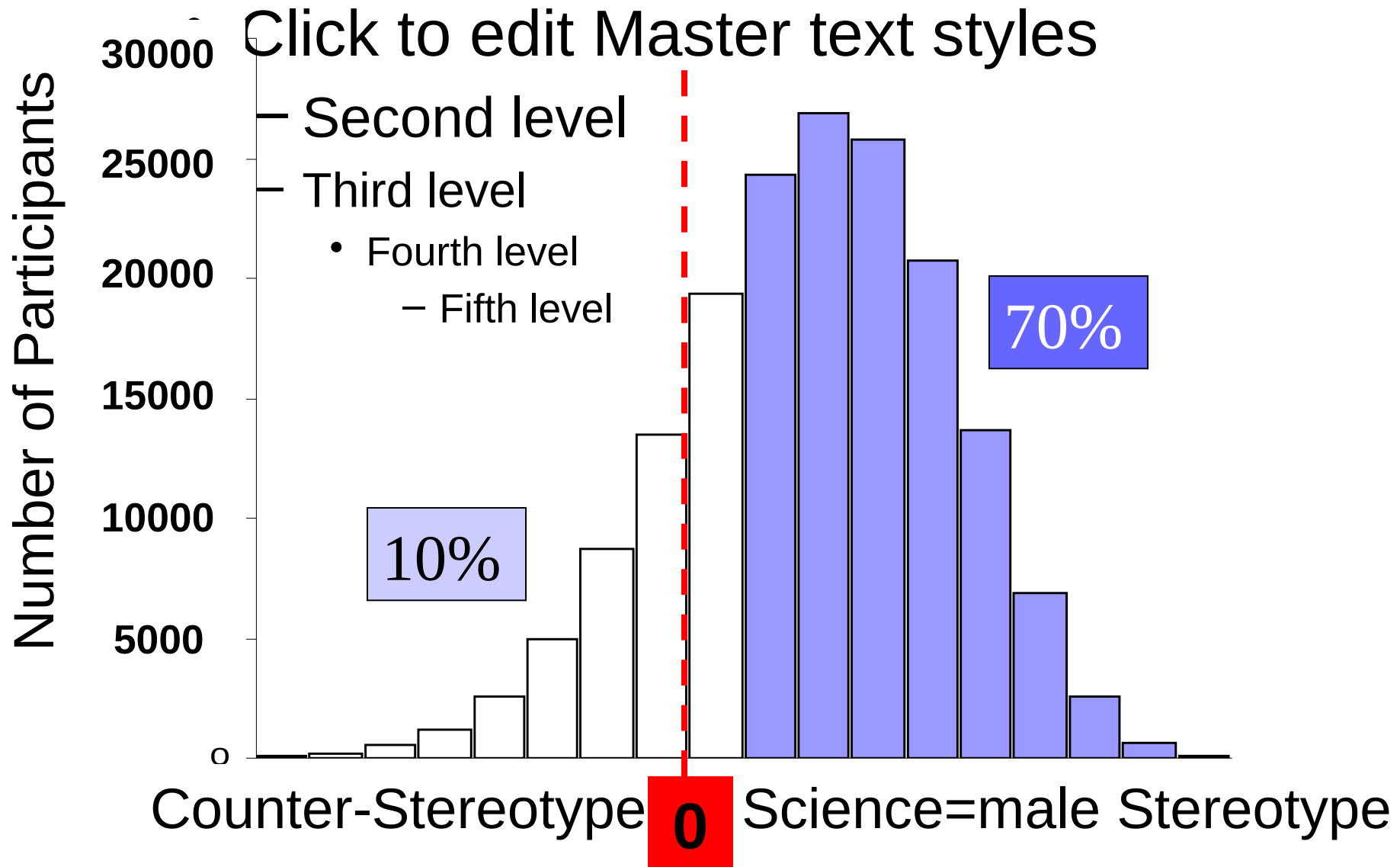
Liberal Arts

Science

# Gender-Science on Project Implicit

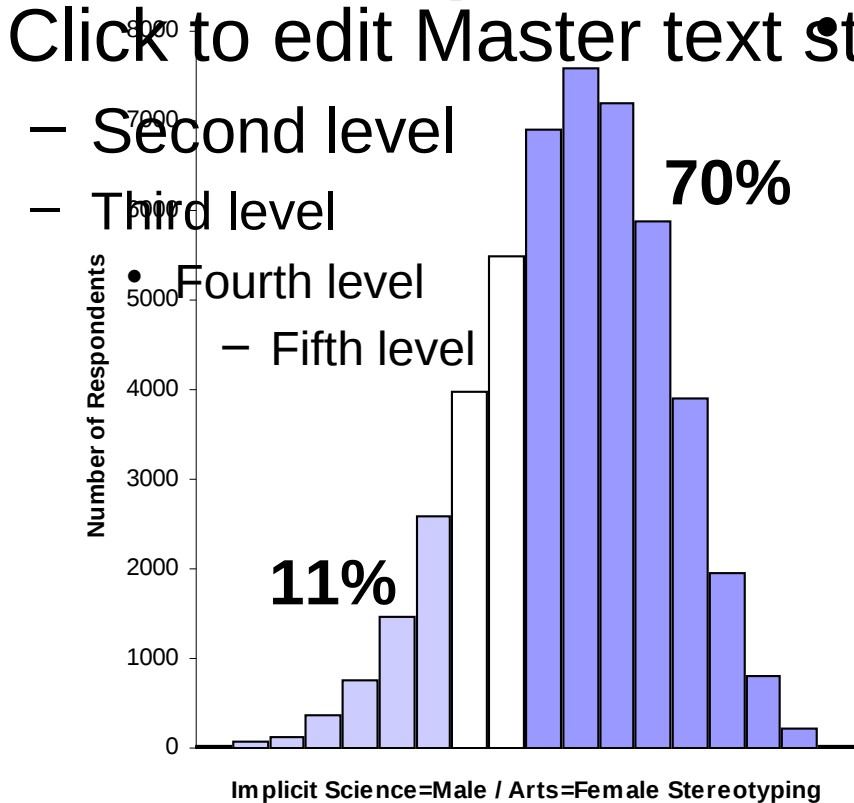


# Gender-Science on Project Implicit

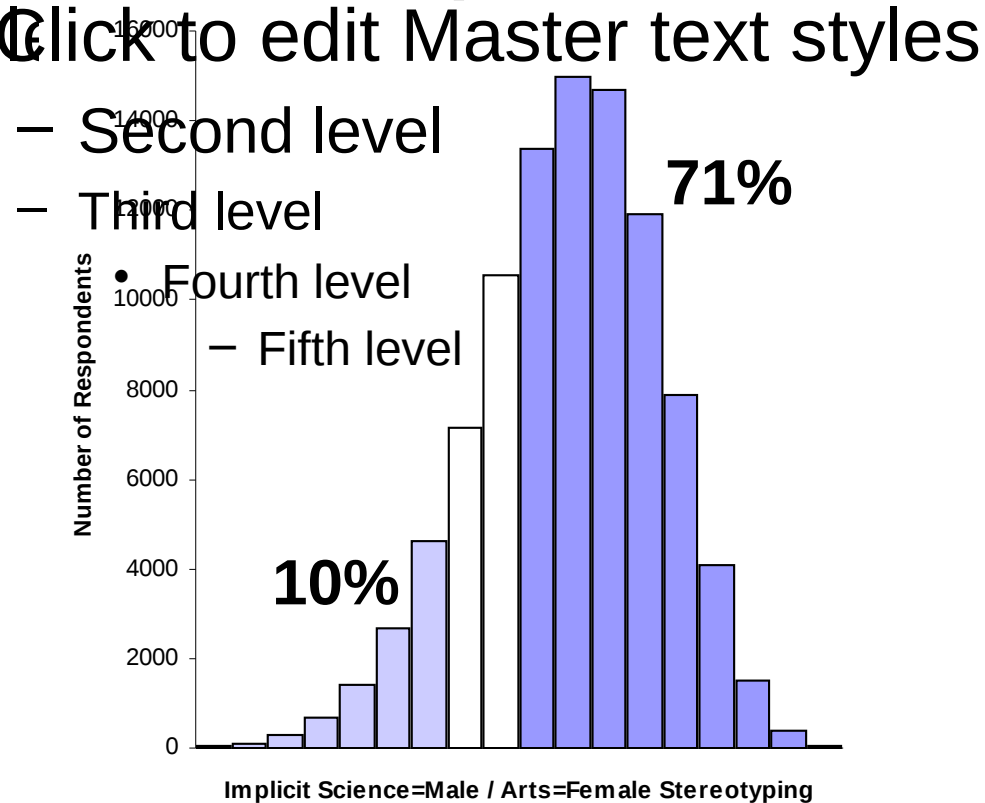


# Same for Men and Women?

## Male Respondents



## Female Respondents



# Academic Identity Matters

Implicit Science=Male

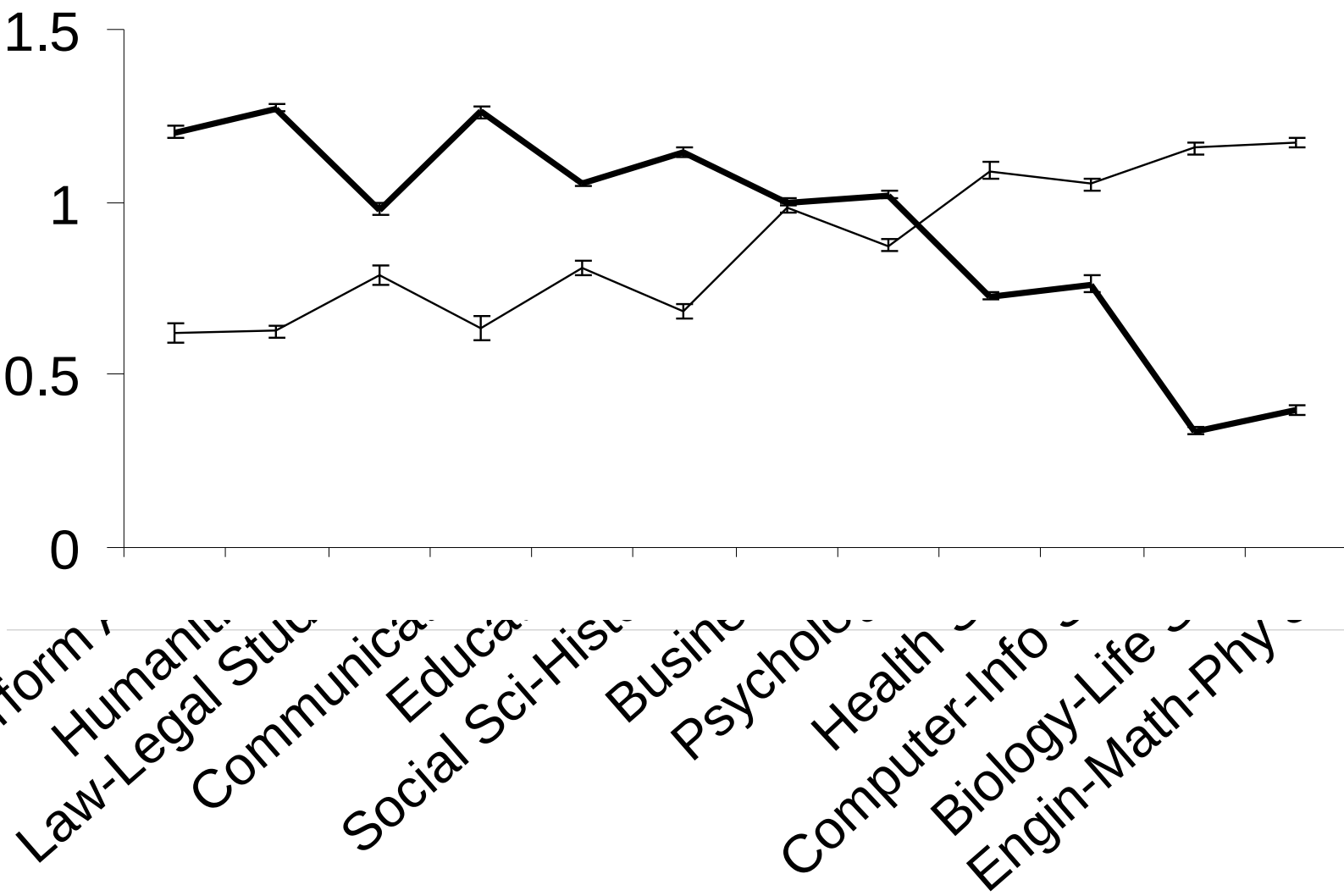
IAT c

1.5  
1  
0.5  
0

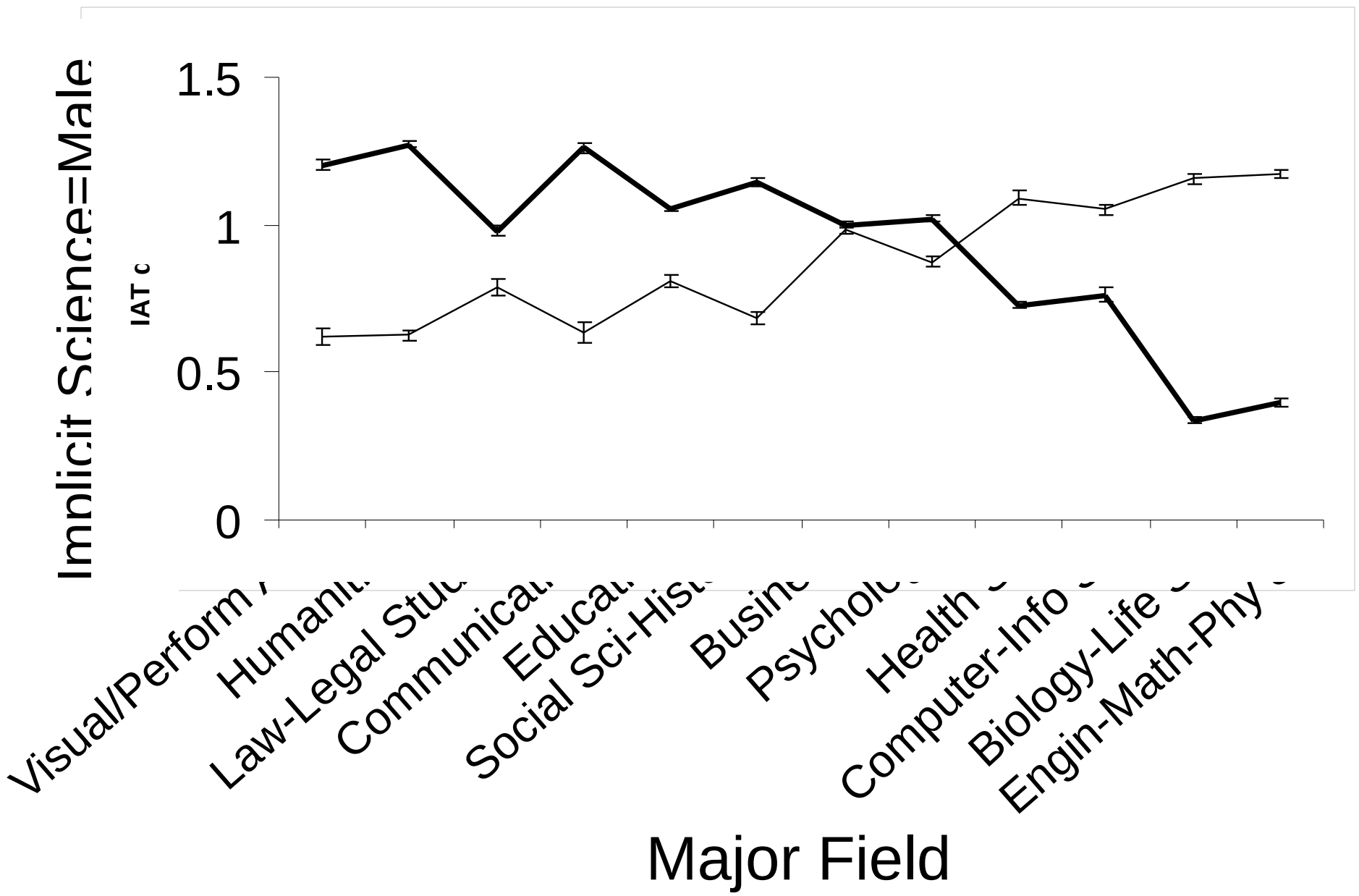
Visual/Perform  
Humanities  
Law-Legal Stud  
Communication  
Education  
Social Sci-Hist  
Business  
Psychology  
Health  
Computer-Info  
Biology-Life  
Engin-Math-Phy

Major Field

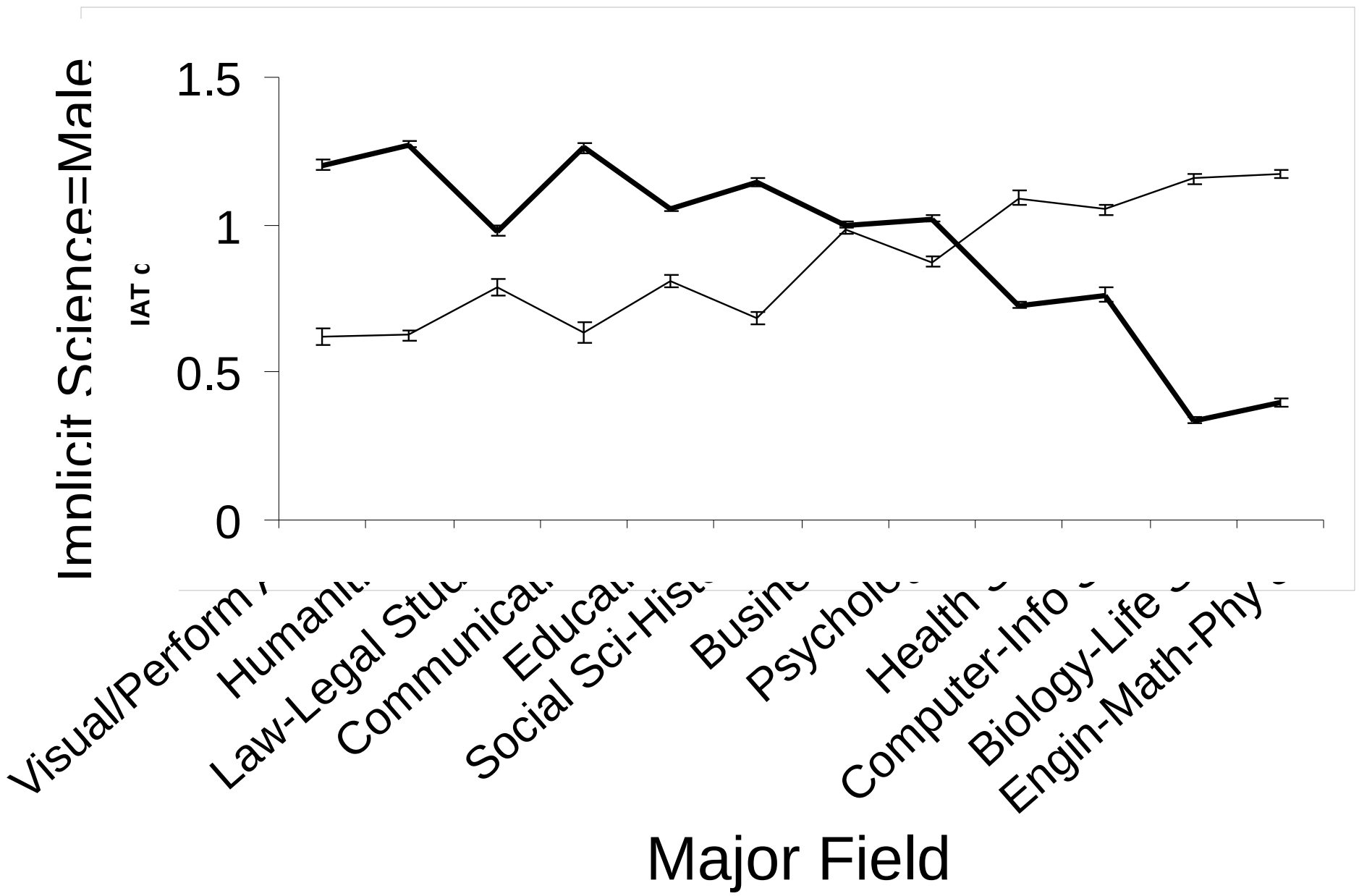
Smyth, Greenwald & Nosek, 2012



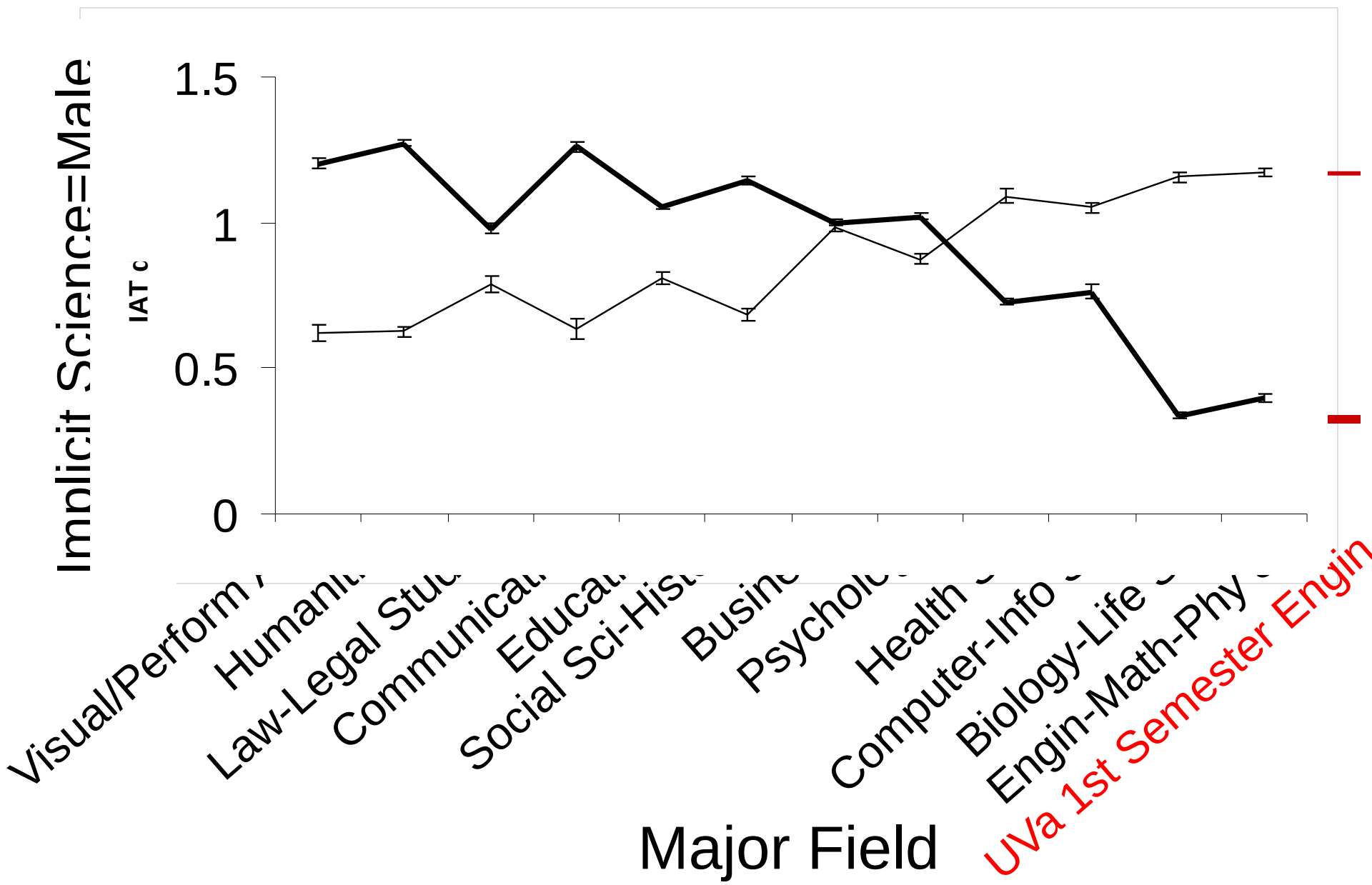




Smyth, Greenwald & Nosek, 2012



Smyth, Greenwald & Nosek, 2012



Smyth, Greenwald & Nosek, 2012

# Environment Matters

# International Variation



Nosek, Smyth, et al., 2009, *PNAS*

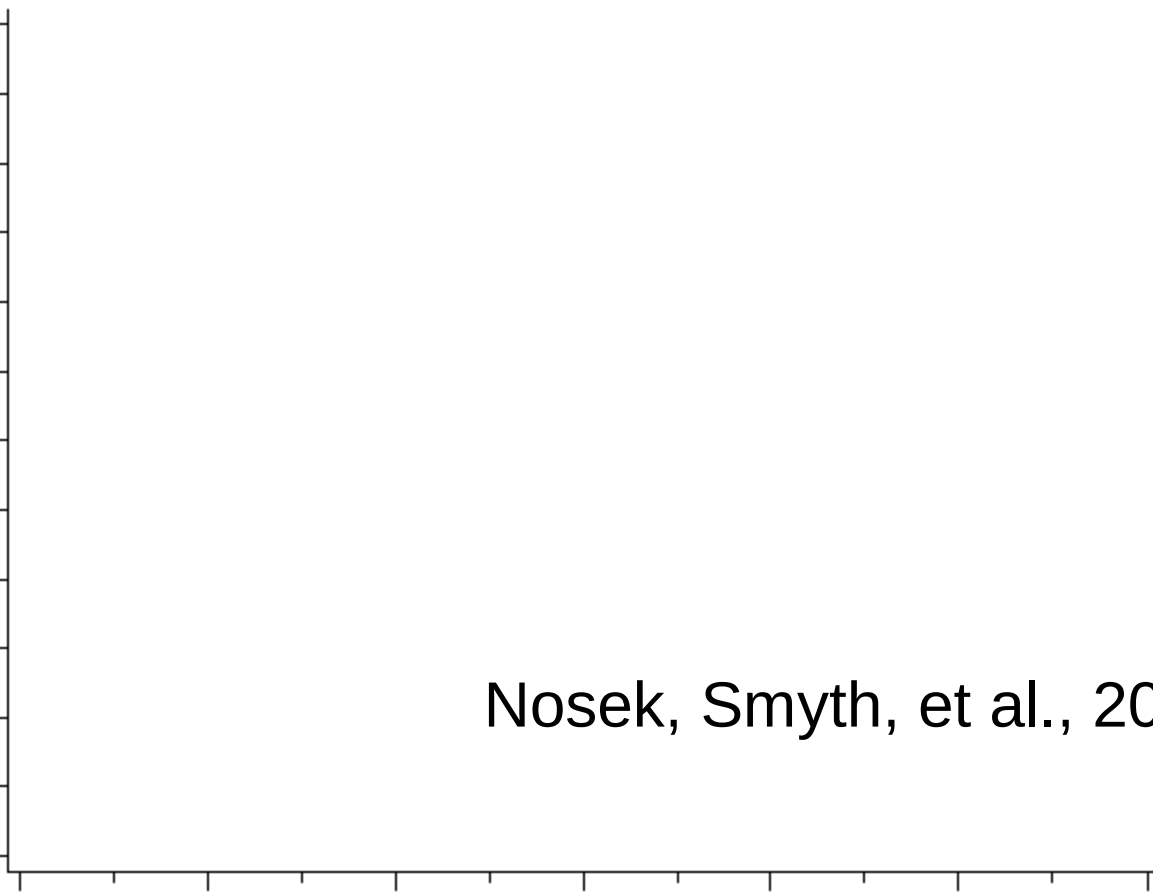
# 8th-grade TIMSS Gender Gap

Nosek, Smyth, et al., 2009, *PNAS*

# 8th-grade TIMSS Gender Gap

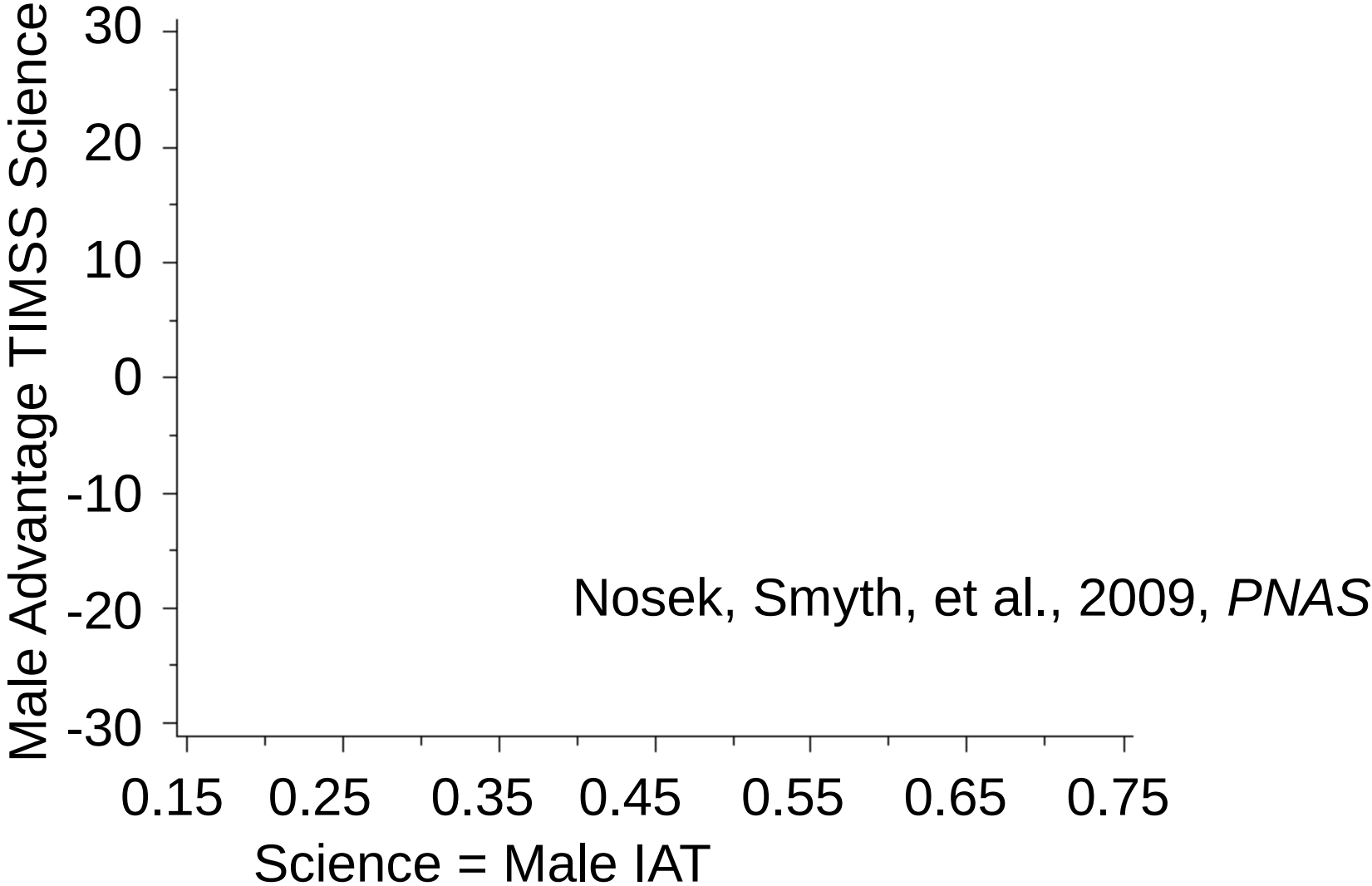
Male Advantage TIMSS Science

30  
20  
10  
0  
-10  
-20  
-30



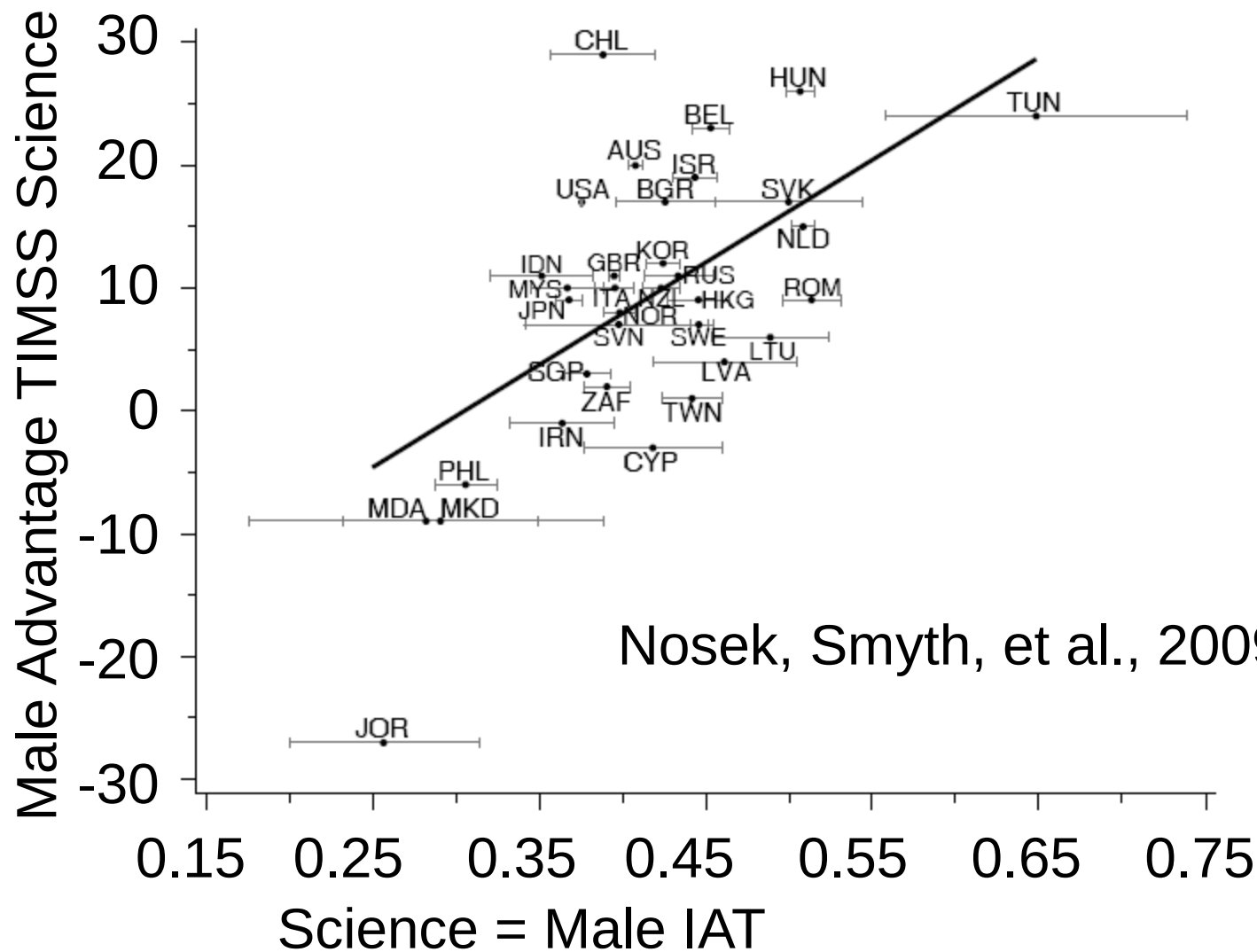
Nosek, Smyth, et al., 2009, *PNAS*

# 8th-grade TIMSS Gender Gap



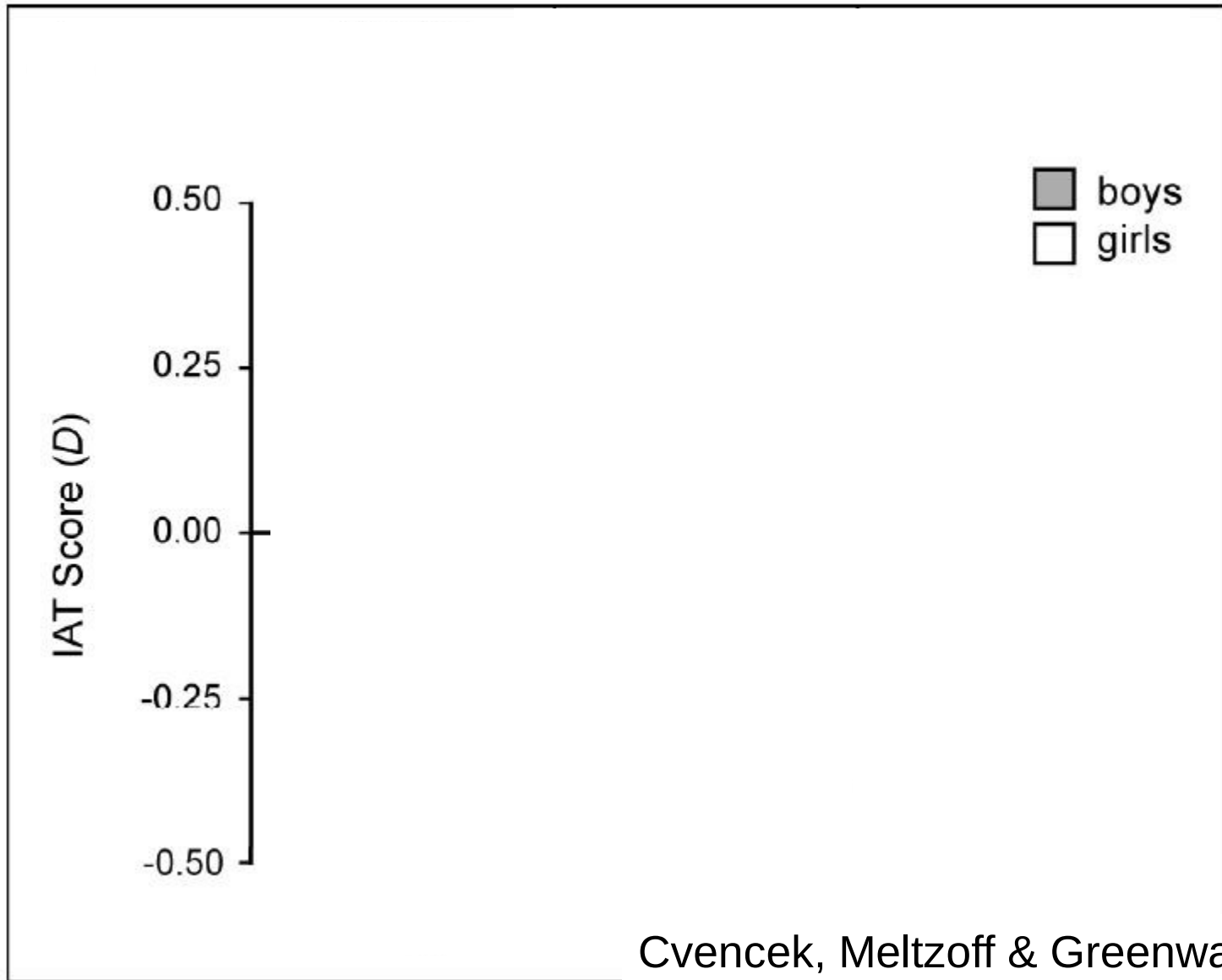


# Greater 8th-grade Boys' Advantage correlated with greater country-level implicit bias, $r = .60$

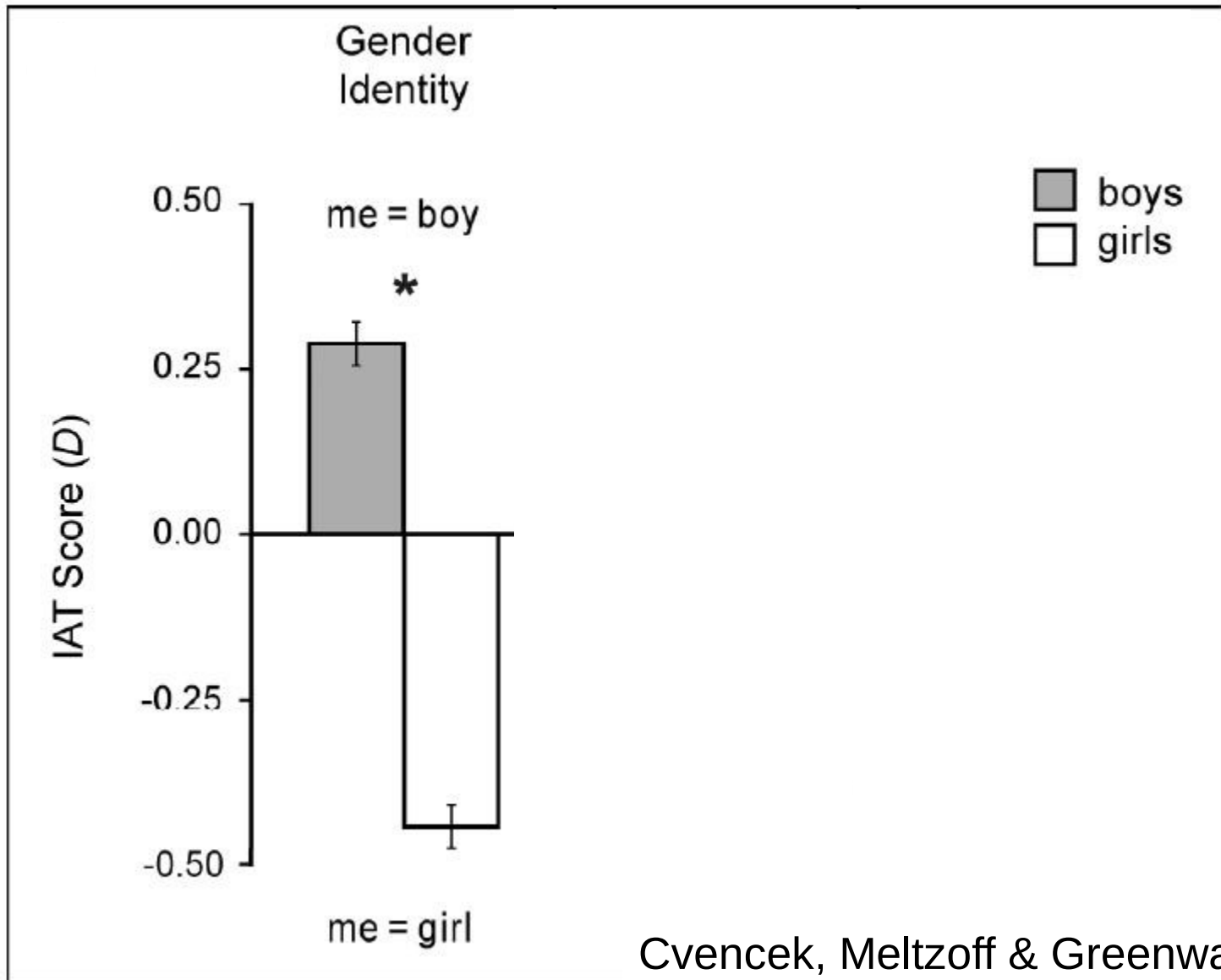


Nosek, Smyth, et al., 2009, *PNAS*

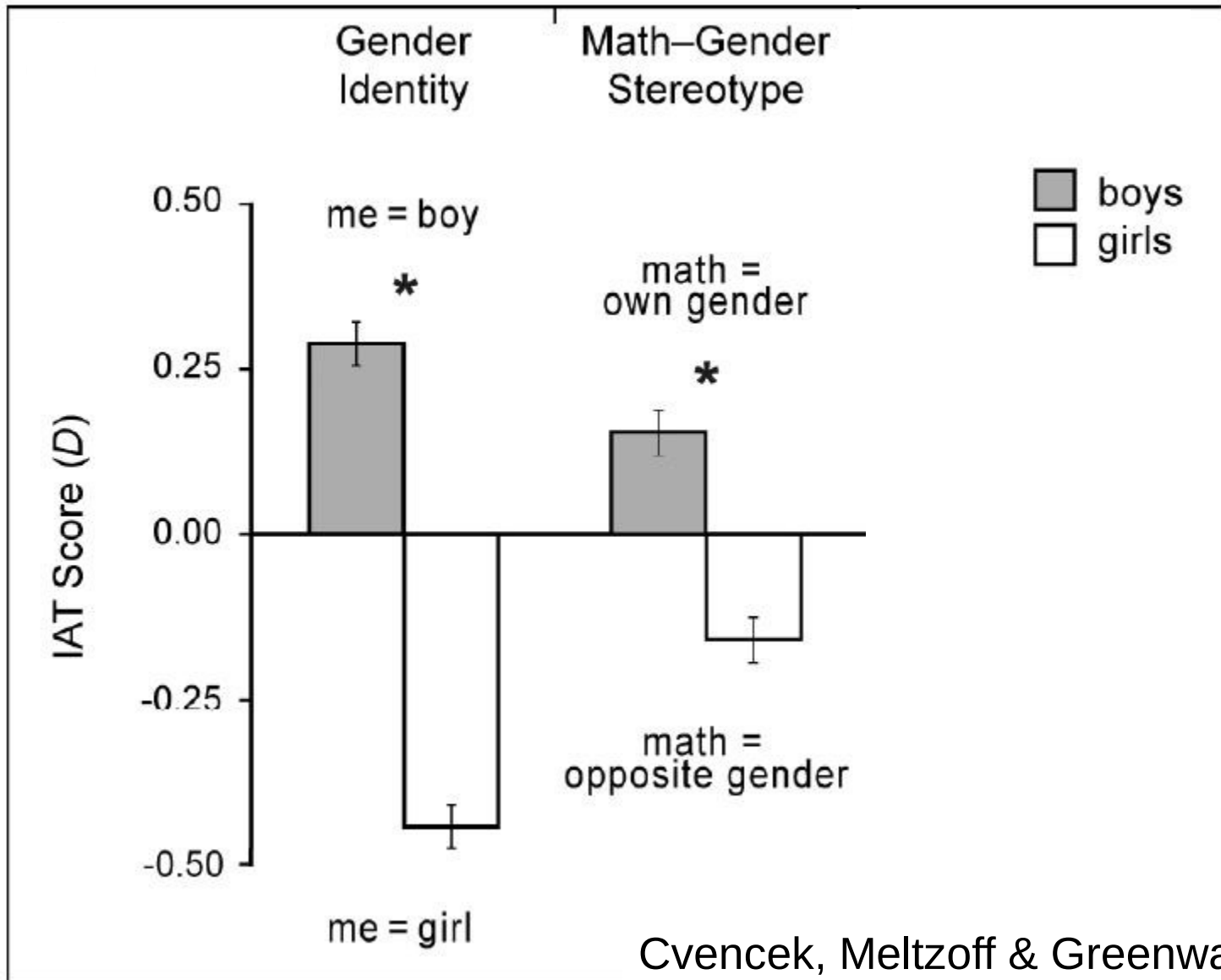
# Elementary School



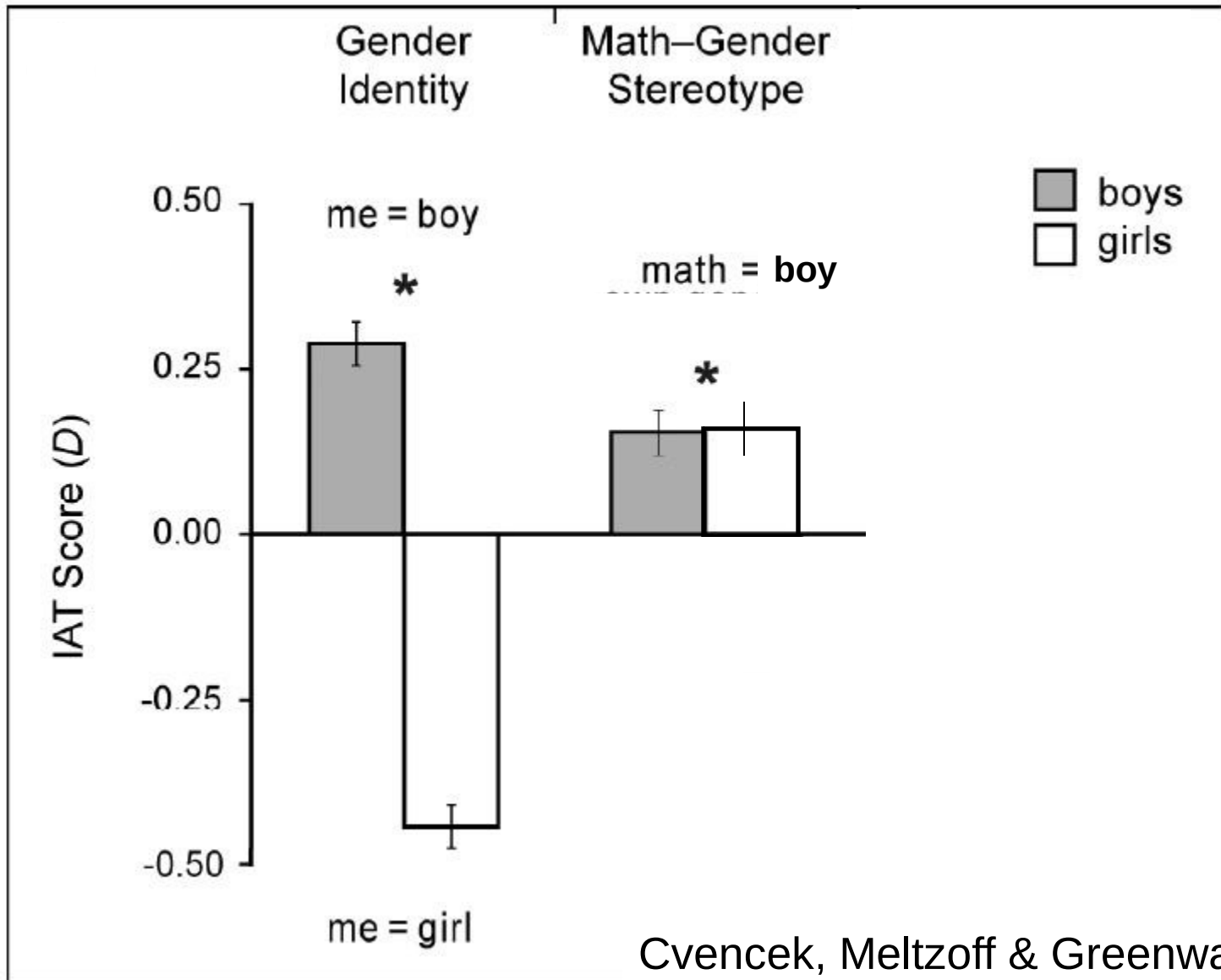
# Elementary School



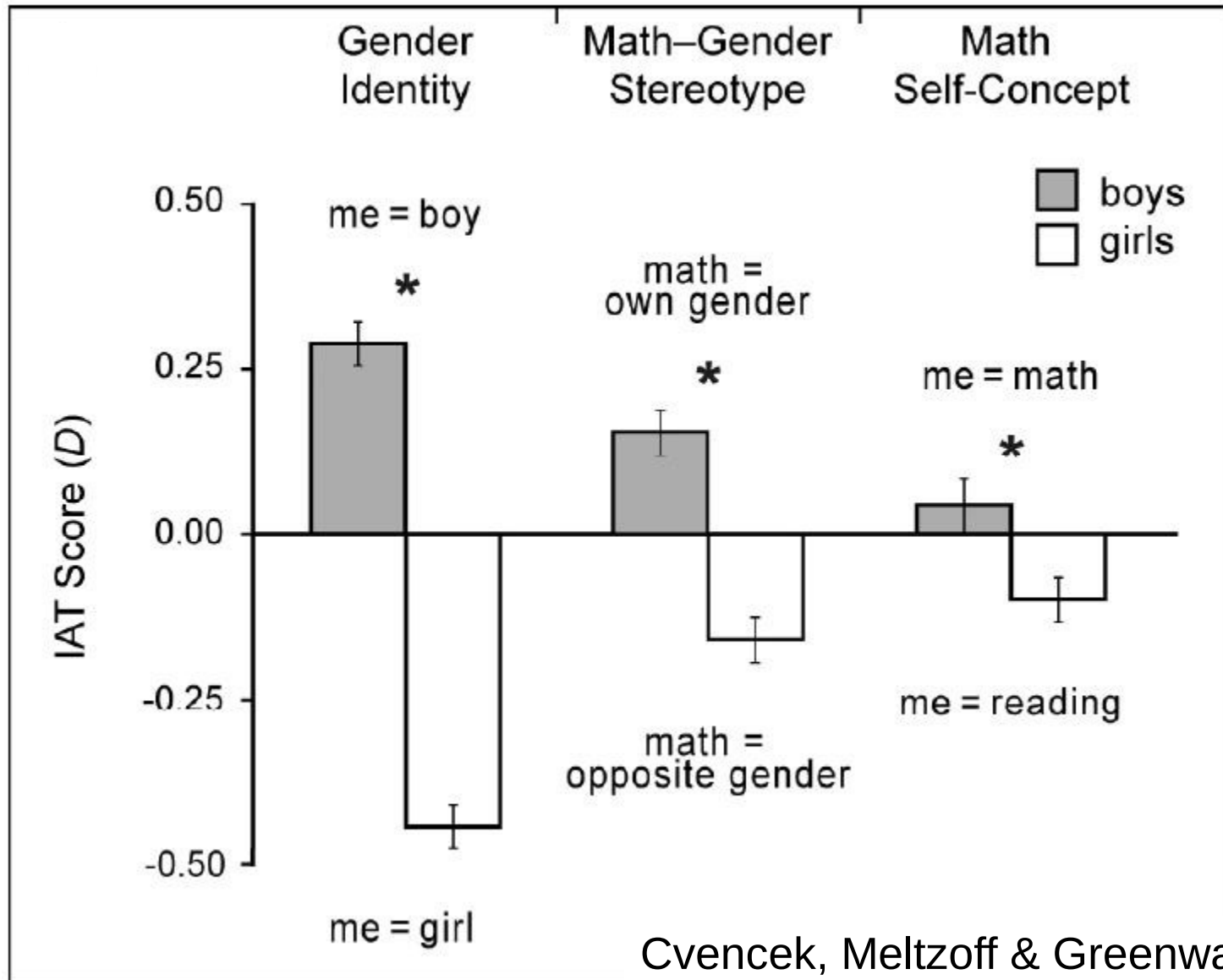
# Elementary School



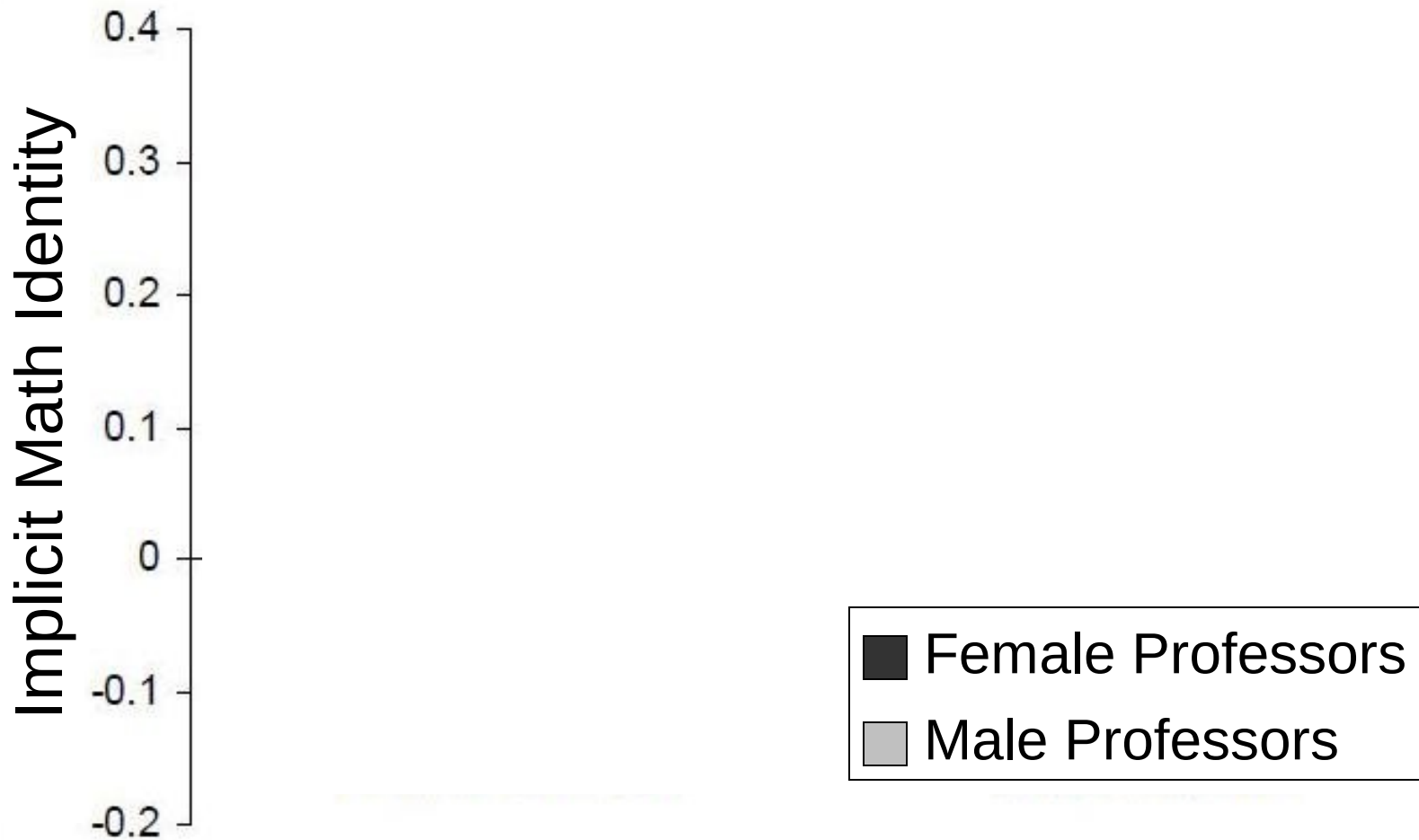
# Elementary School



# Elementary School

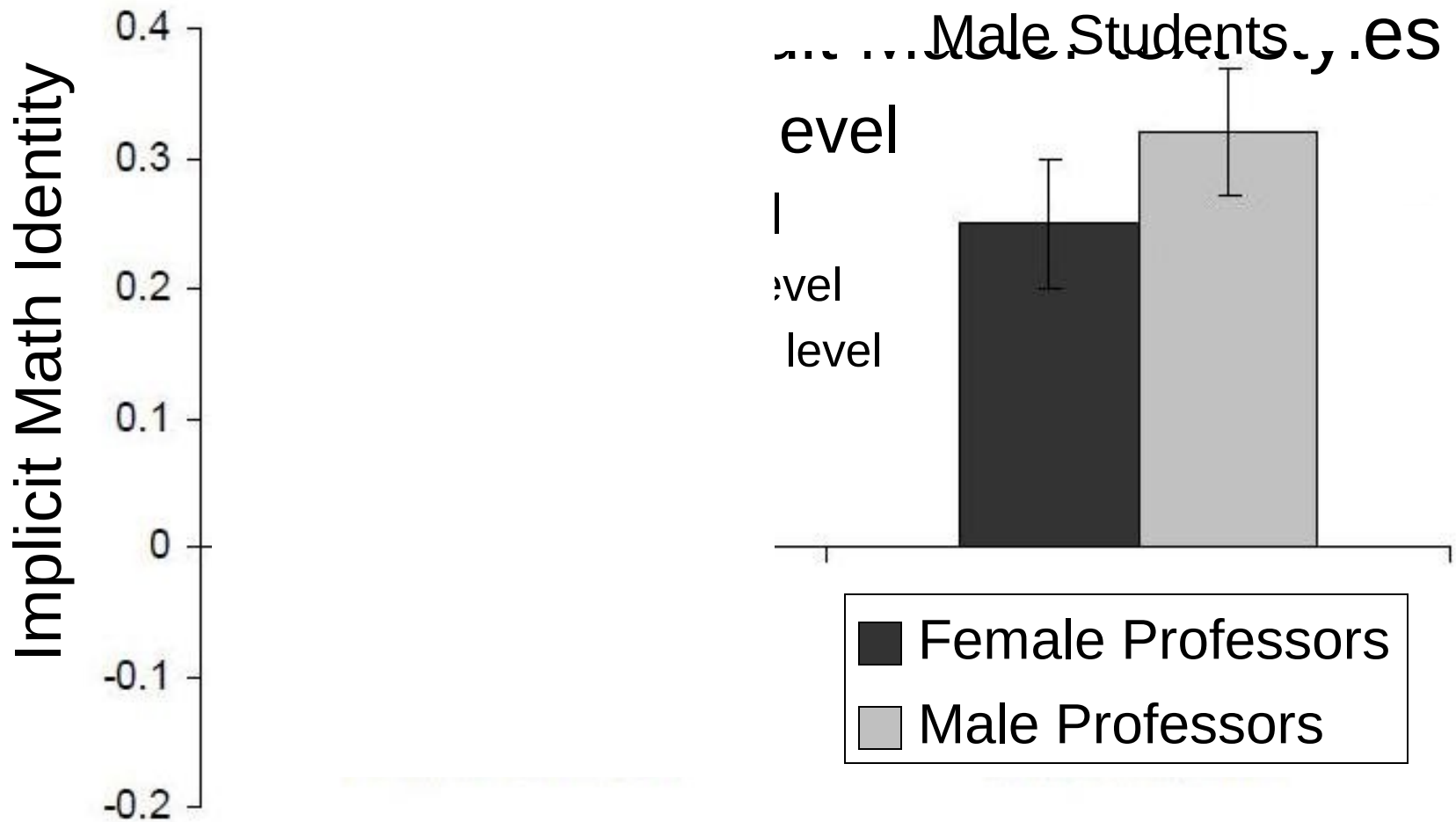


# Professor's Gender affects Calculus Students' Implicit Math Self-Concept



Stout, Dasgupta et al., 2010

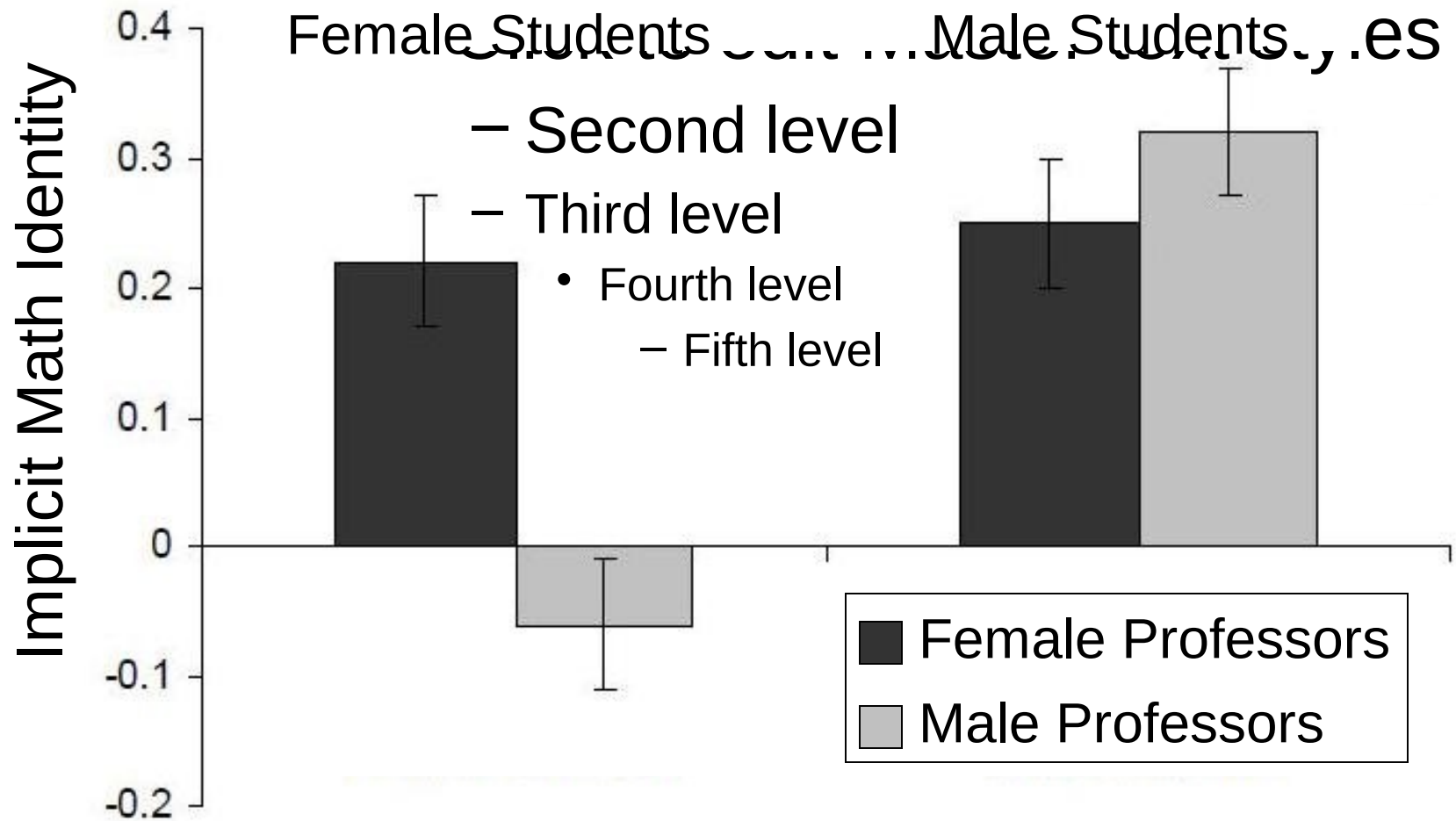
# Professor's Gender affects Calculus Students' Implicit Math Self-Concept



Stout, Dasgupta et al., 2010



# Professor's Gender affects Calculus Students' Implicit Math Self-Concept



Stout, Dasgupta et al., 2010

# Stereotype Inoculation Model

“Inoculation” by contact with successful female role models bolsters STEM self-concept, attitude, self-efficacy and goals.

Dasgupta, 2012

Stout, Dasgupta et al., 2010

# Costs of Implicit Bias?

# Costs of Implicit Bias?

*Jenny went home to cook dinner...*

Logel et al., 2009

# Costs of Implicit Bias?

*Jenny went home to cook dinner...*

1-Egalitarian to 5-Sexist

Logel et al., 2009

# Costs of Implicit Bias?

*Jenny went home to cook dinner...*

1-Egalitarian to 5-Sexist

*...for her husband.*

Logel et al., 2009

# Costs of Implicit Bias?

*Jenny went home to cook dinner...*

1-Egalitarian to 5-Sexist

*...for her husband.*

*...naked.*

Logel et al., 2009

# Costs of Implicit Bias?

*Jenny went home to cook dinner...*

1-Egalitarian to 5-Sexist

*...for her husband.*

*...naked.*

*...because Tim cooked dinner last night.*

Logel et al., 2009



# Costs of Implicit Bias?

*Jenny went home to cook dinner...*

1-Egalitarian to 5-Sexist

*...for her husband.*

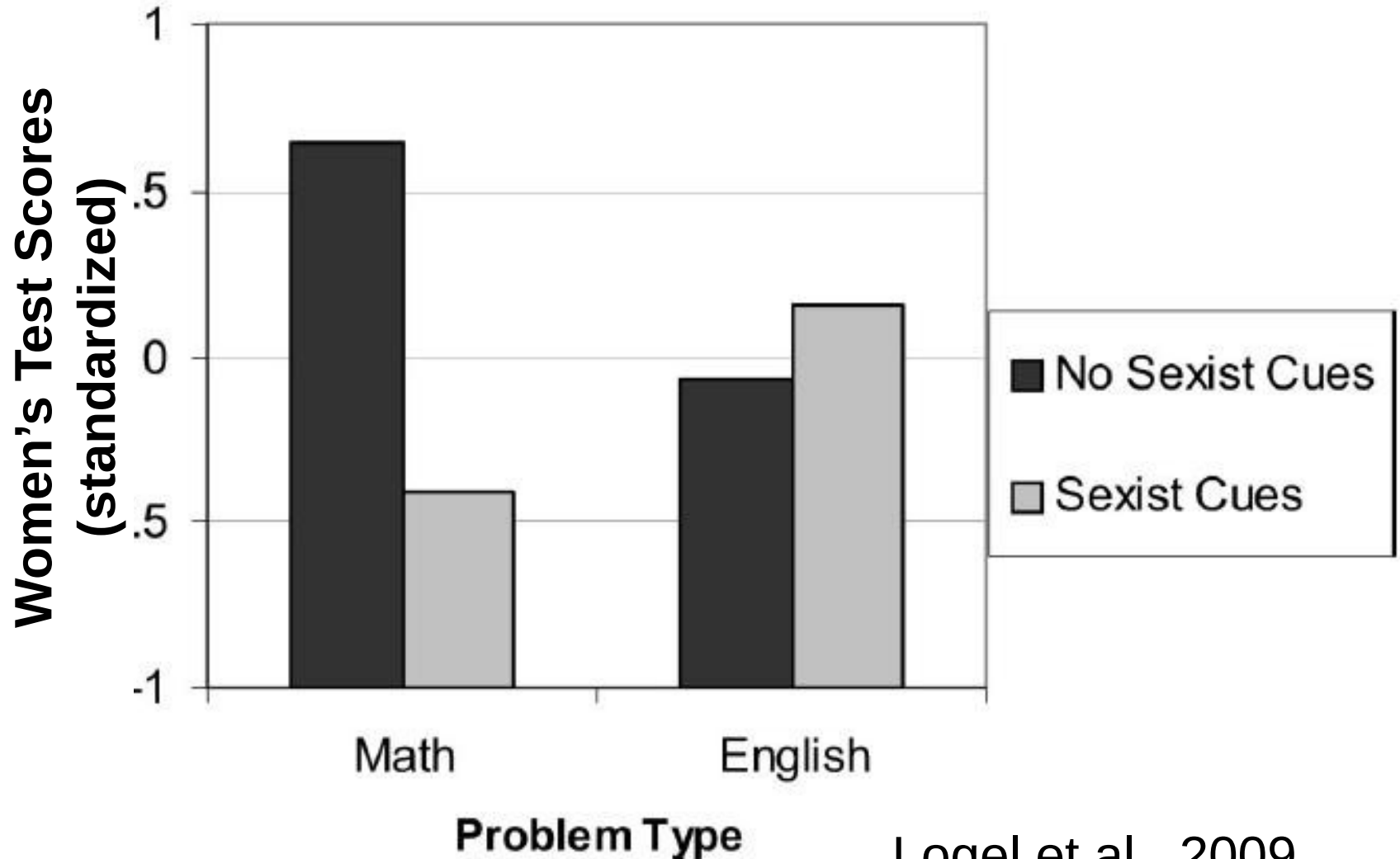
*...naked.*

*...because Tim cooked dinner last night.*

*...after work.*

Logel et al., 2009

# Costs of Implicit Bias?



Logel et al., 2009

# What to do?

- 1) Education, measurement and evaluation.

# Restructure decision-making process



Goldin & Rouse, 2000

# Protect against known biases



Hagemann, Strauss & Leing, 2008

# What to do?

- 1) Education, measurement and evaluation.
- 2) Longitudinal research! Collaboration!

# What to do?

- 1) Education, measurement and evaluation.
- 2) Longitudinal research! Collaboration!
- 3) Strengthen the associations we want.

# MIT's Women's Initiative



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## Women's Initiative

The MIT Women's Initiative program seeks to increase the number of women enrolled in engineering majors by educating middle and high school girls nationwide through presentations made by MIT women students. Click on our Sponsors link to learn more!



# What to do?

- 1) Education, measurement and evaluation.
- 2) Longitudinal research! Collaboration!
- 3) Strengthen the associations we want.
- 4) Promote “mind-is-muscle” mindset.

# Promote Mind-is-Muscle Mindset

Carol Dweck

# Mind-is-Muscle Mindset

## Carol Dweck

- *Why do beliefs about intelligence influence learning success?*
- *Is math a gift? Beliefs that put females at risk.*
- *Mindset.* (Random House, 2006)

# What to do?

- 1) Education, measurement and evaluation.
- 2) Longitudinal research! Collaboration!
- 3) Strengthen the associations we want.
- 4) Promote “mind-is-muscle” mindset.
- 5) Promote “challenge-is-normative” mindset

# Challenge-is-Normative Mindset

## Geoffrey Cohen

- Identity, Belonging, and Achievement
  - Cohen & Garcia (2008). *Current Directions in Psychological Science*
- Reducing the Gender Achievement Gap in College Science
  - Miyake...Cohen et al. (2010). *Science*

# Lawrence Summers & Implicit Bias

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

# 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.

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

# Lawrence Summers & Implicit Bias

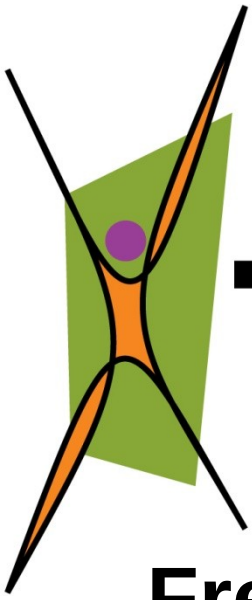
“...any of us who think that we can for ourselves judge whether we are biased or not are probably making a serious mistake.

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



# Thank you



**fpi**

**full potential initiative**

**Fred Smyth, PhD**

**fsmyth@virginia.edu**

**fullpotentialinitiative.org**

**Funded by the National Science Foundation**

**REC-0634041**

# Questions?

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- **Remember:**
  - **Type your question in the “Question” space in the webinar control panel.**
  - **The presenter will respond as time allows.**

# Thank You!



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- We will E-mail the link to the recorded webinar to you—share with your colleagues!
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**[www.wepanknowledgecenter.org](http://www.wepanknowledgecenter.org)**

