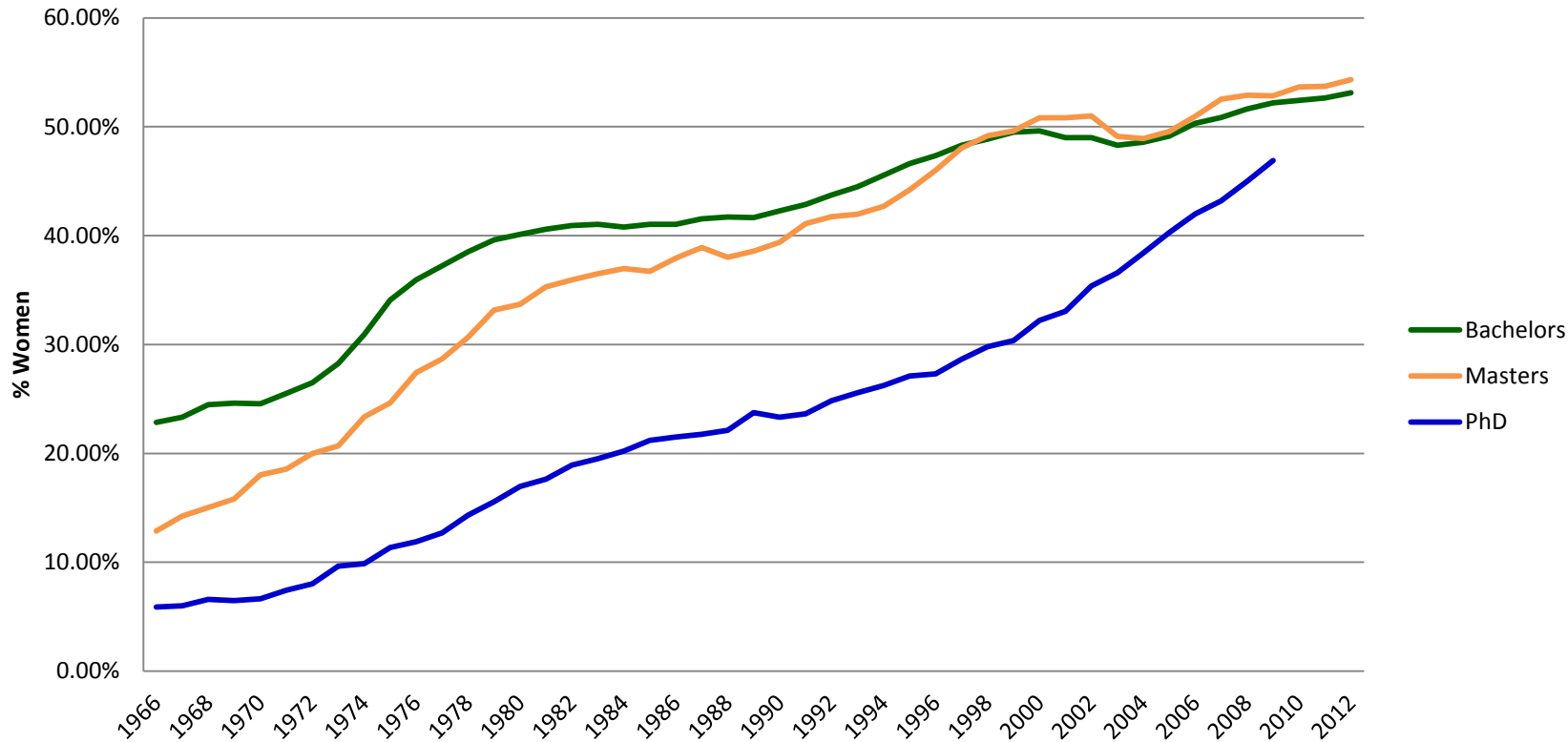


Fostering Inclusive and Diverse Labs, Classrooms and Climates in STEM: Understanding and Minimizing The Role of Implicit Bias

Eve Fine, Ph.D.
Researcher

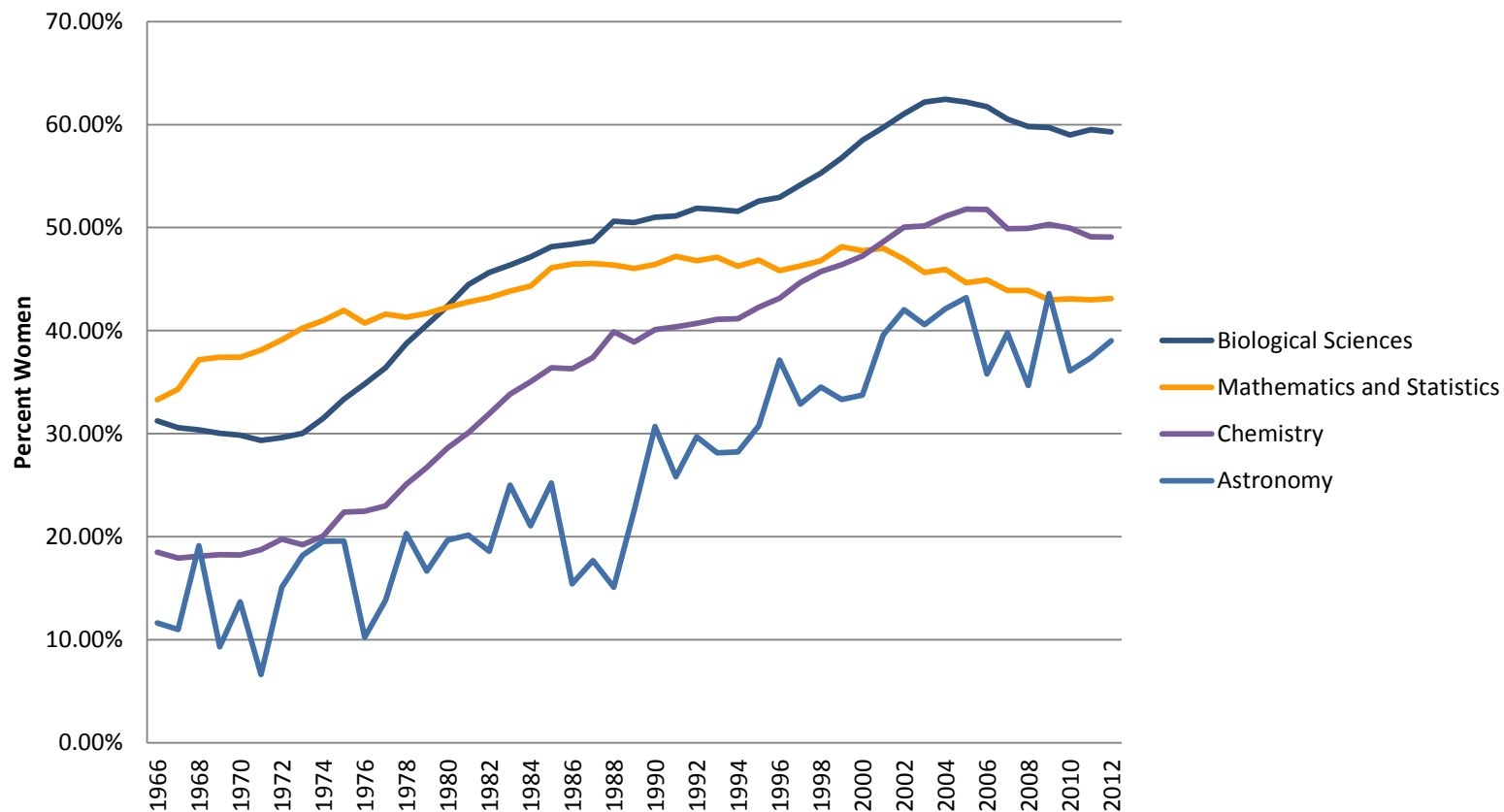
Women in Science & Engineering Leadership Institute

% Women receiving science and engineering degrees, 1966-2010



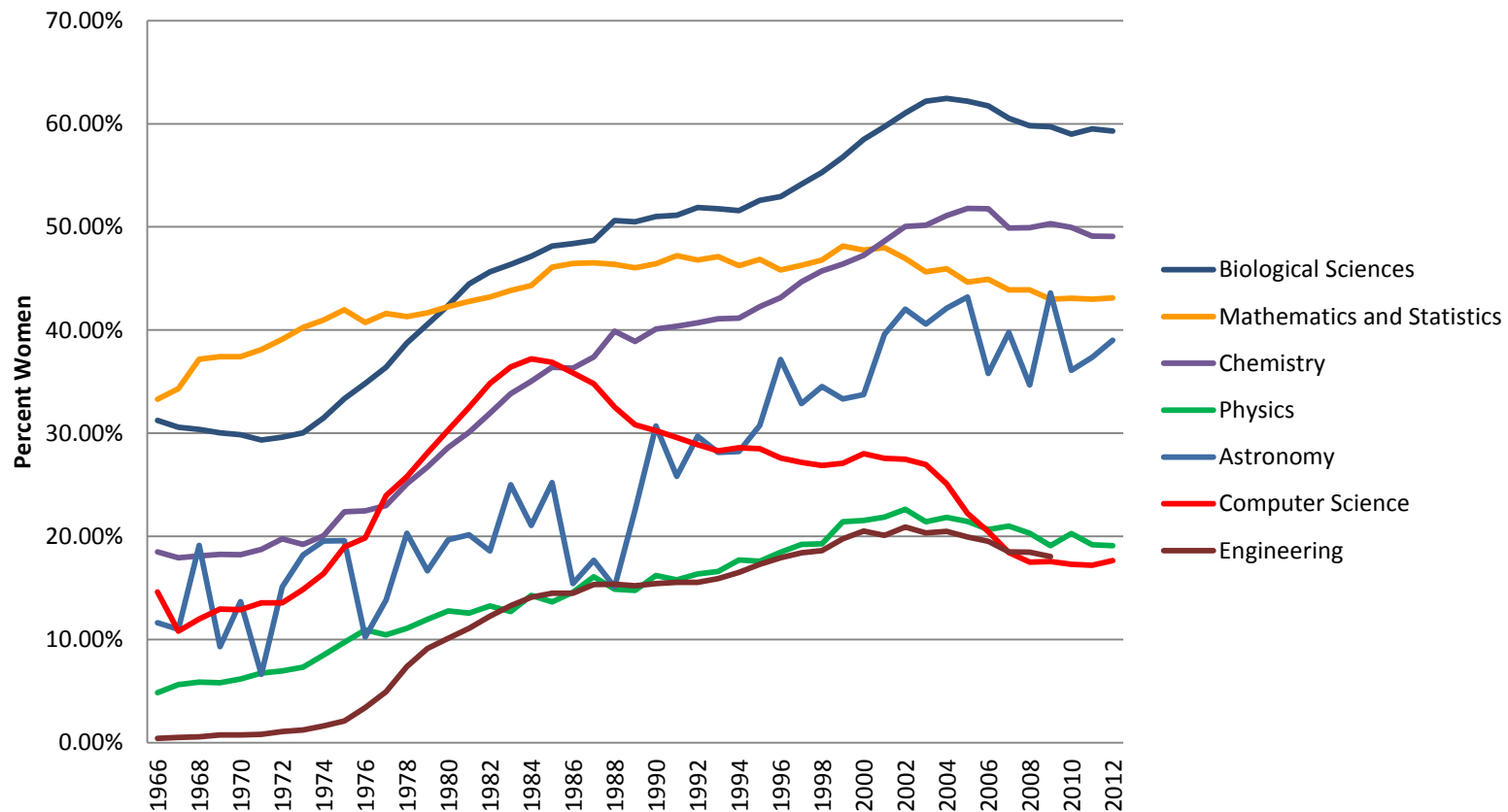
Source: National Science Foundation S&E Degrees

Percent Women - Bachelor's degrees



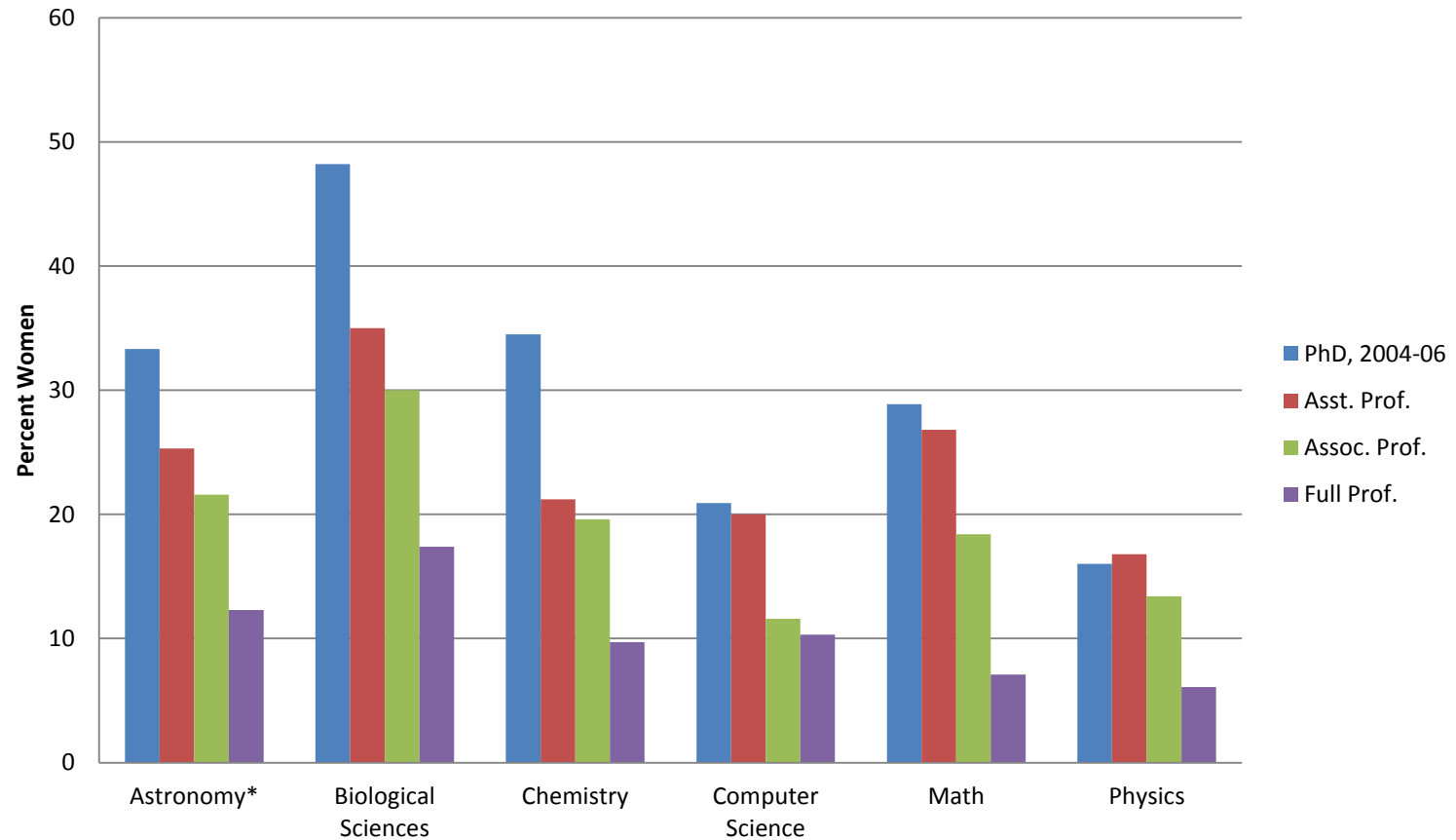
Source: National Science Foundation S&E Degrees

Percent Women - Bachelor's degrees



Source: National Science Foundation S&E Degrees

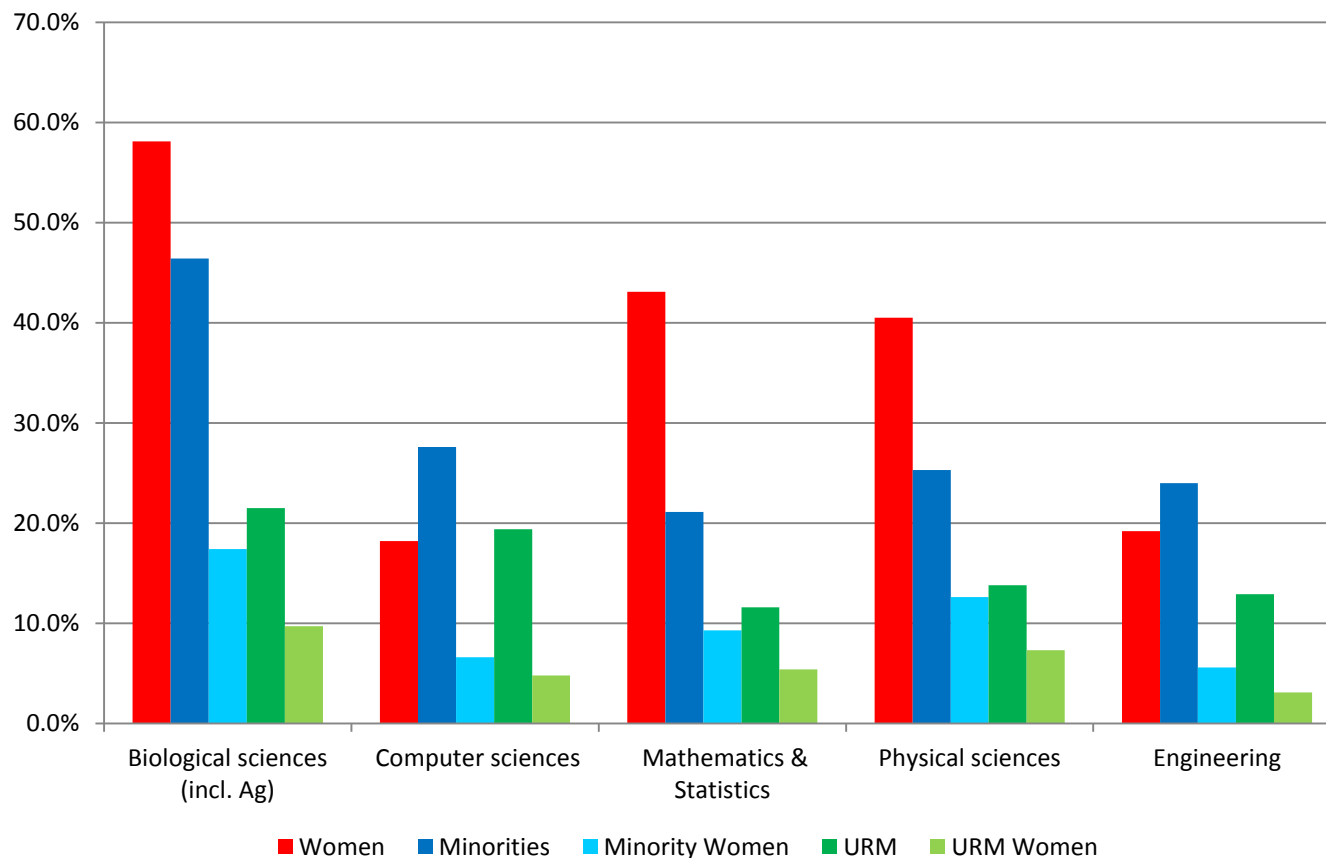
Percent Women PhDs and Faculty, 2007



Source: Faculty Data – Nelson Diversity Surveys, 2007; PhD data – National Science Foundation S&E Degrees

*For all disciplines except Astronomy, the faculty data are for the top 100 departments in each discipline as ranked by NSF on research spending. NSF only ranks 40 Astronomy departments

Selected groups as a percentage of ALL 2012 Bachelor's degrees Selected fields



Minorities = African American, Hispanic, American Indian, Alaskan Native, Asian, and Pacific Islander

URM (Underrepresented Minorities – African American, Hispanic, American Indian, and Alaskan Native.

SOURCE: National Science Foundation, National Center for Science and Engineering Statistics, special tabulations of U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, Completions Survey, 2012.

Why do you think it is important to have a diverse faculty and student body in science and engineering; to have better representation of women and minorities in science?

Why Diversity?

- Diverse working groups are more productive, creative, and innovative than homogeneous groups
- Diverse groups engage in a higher level of critical analysis than do homogeneous groups
- Diverse scholars and professionals can invigorate and expand disciplines and fields
- Mentors and role models for all
- Fairness and equity

Why do you think
women and minorities
are underrepresented
in many STEM disciplines –
especially in faculty ranks?

Why the Lack of Representation?

- Bias/discrimination
- Lack of encouragement for women and URM in STEM
- Lack of role models/mentors
- Microaggressions – and/or Negative/chilly climate women and minorities experience as students/faculty
- Societal factors including K-12 schooling, social expectations, career advice
- Women: Difficulty balancing work and family life

Why the Lack of Representation?

What's not on the list:

- Innate/biological differences in intellectual ability
- Lack of interest in science

What is Implicit Bias?

- Tendency of our minds to evaluate individuals based on characteristics (real or imagined) of the group to which they belong
- Depending on the discipline, implicit bias can also be referred to as:
 - Schemas, stereotypes, mental models, cognitive shortcuts, statistical discrimination, unconscious bias, or implicit associations
- Consequences for both the evaluator, and the person being evaluated

What is Implicit Bias?

- A substantial body of evidence demonstrates that most of us routinely rely on unconscious assumptions even though we intend to be fair and believe that we are fair.

Why are we subject to Implicit Bias?: Three Central Ideas

1. Our minds are more than the sum of the conscious parts
 - Implicit processes
2. Unintended thoughts can contradict beliefs
 - Bias as a habitual response
3. Acting consistently with beliefs can require more than good intentions
 - Breaking the bias habit

Shift in Conceptualization of Bias/Prejudice

Old Framework = Prejudice is bad so if I think or act with bias, I am a bad person

New Framework = Prejudiced thoughts and actions are habits that we all have and breaking these habits requires more than good intentions

Why are we subject to Implicit Bias?: Three Central Ideas

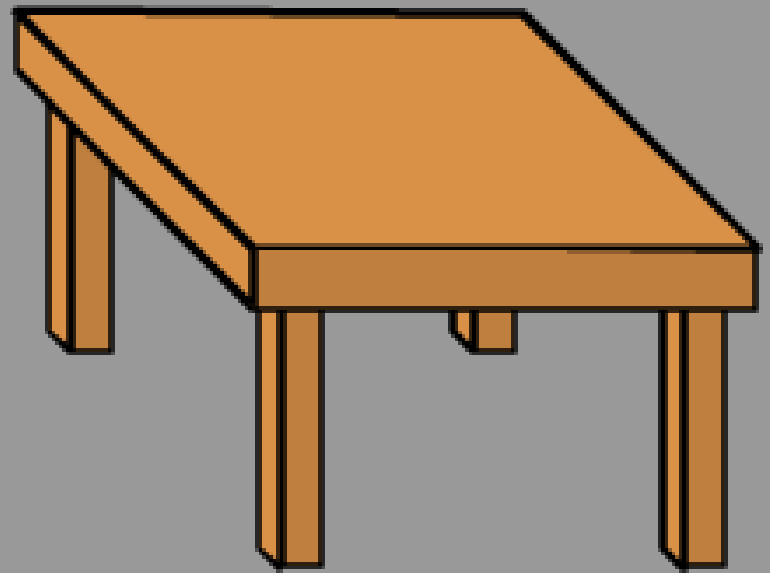
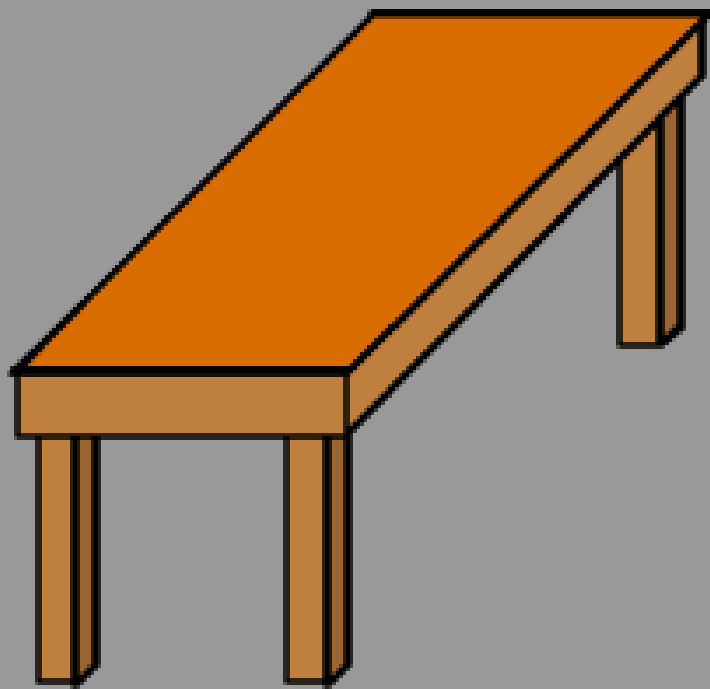
1. Our minds are more than the sum of the conscious parts
 - Implicit processes
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 - Bias as a habitual response
3. Acting consistently with beliefs can require more than good intentions
 - Breaking the bias habit

Prejudice and Habits of Mind

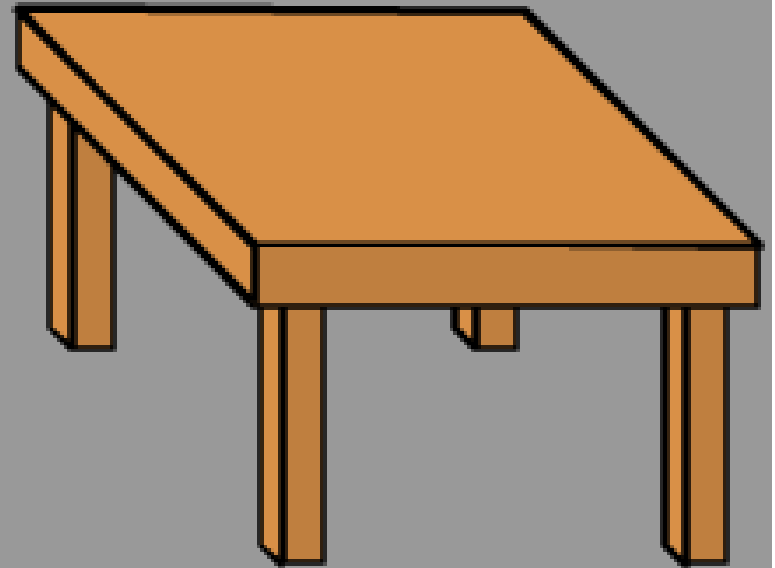
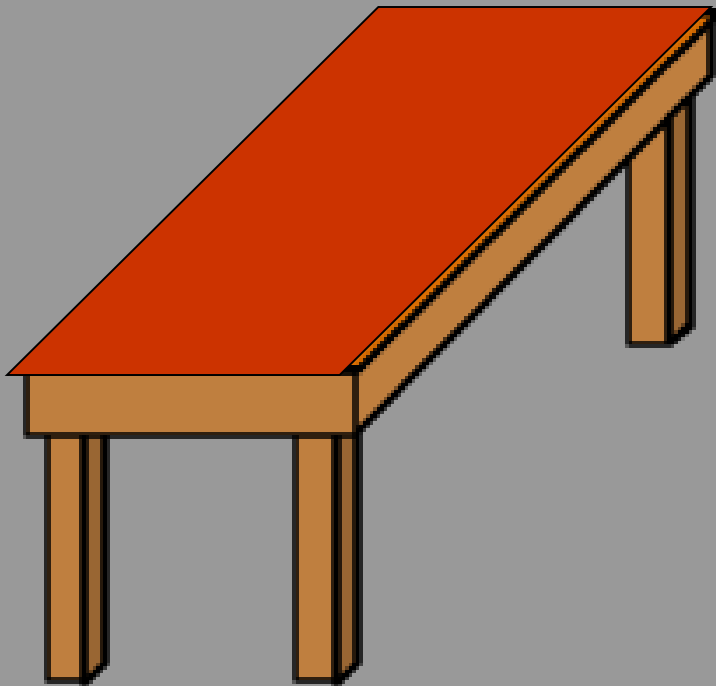
- The human brain works by categorizing people, objects and events around us – this allows us to quickly and efficiently organize and retrieve information.
 - Ordinary mental operations that serve us quite well in most circumstances can fail our intentions
-

Essential Process...

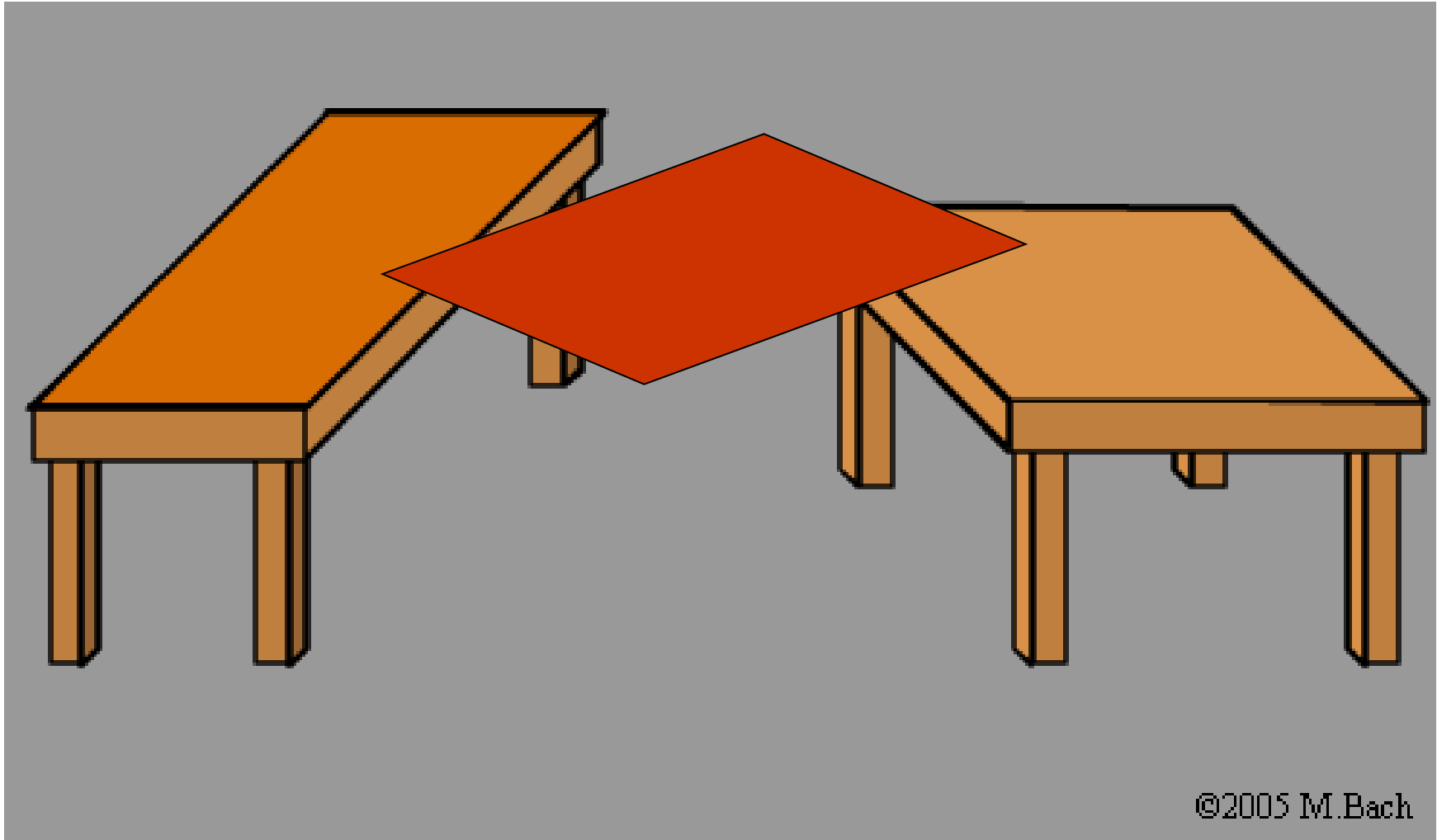
- Translation of the world outside to a mental experience inside
 - Guided by our experience and expectations
 - Affects our perceptions, judgments, and behavior
- This translation process is not infallible
 - A variety of *habits of mind*, born out of experience, can separate our experience from reality



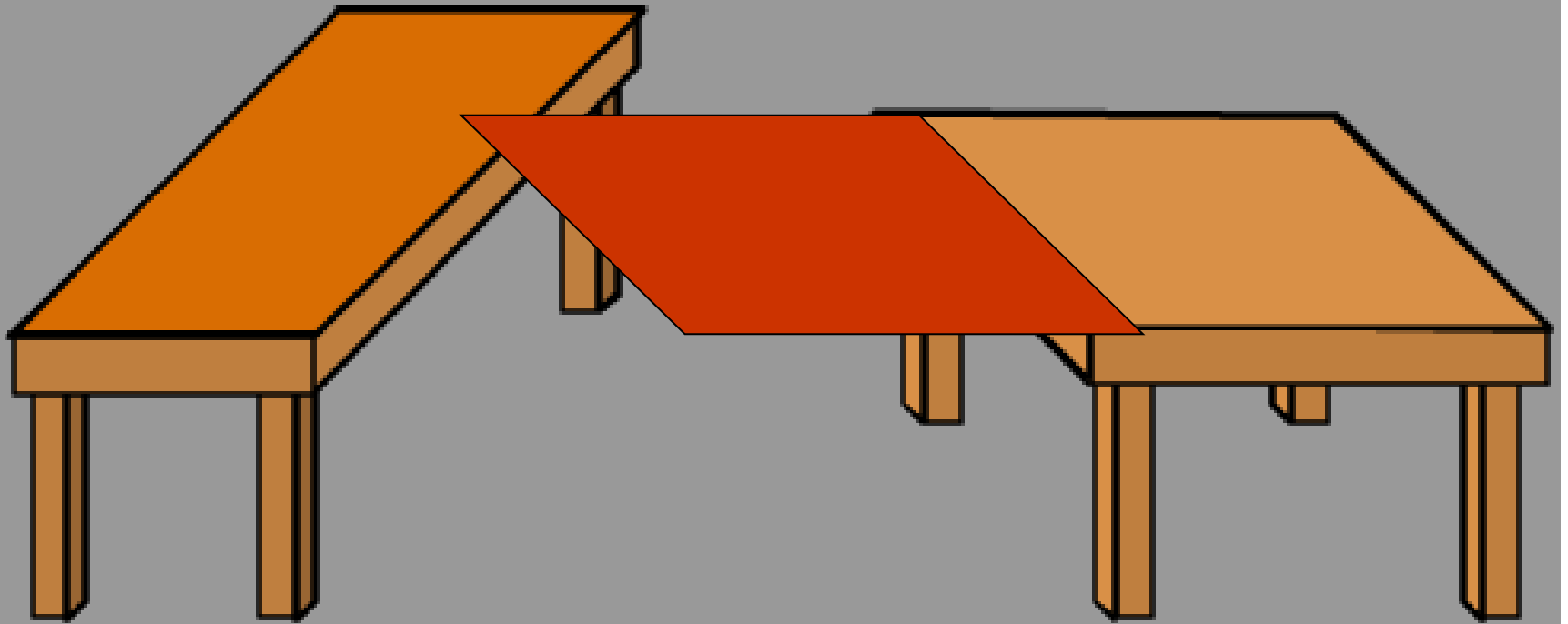
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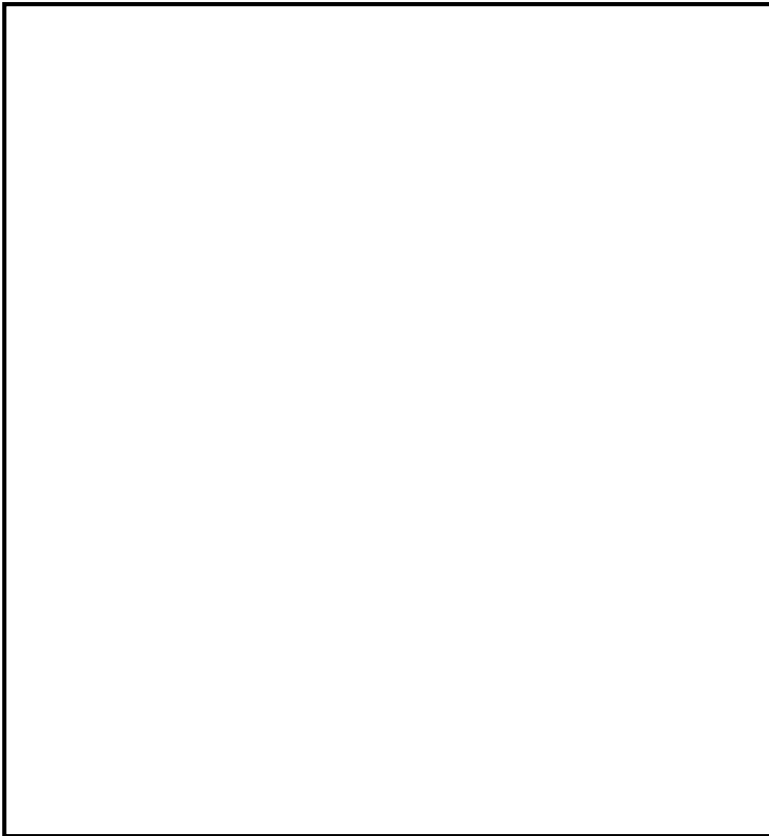
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Stroop Color Naming Task

Compatible Trials



Stroop Color Naming Task

Compatible Trials

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Stroop Color Naming Task

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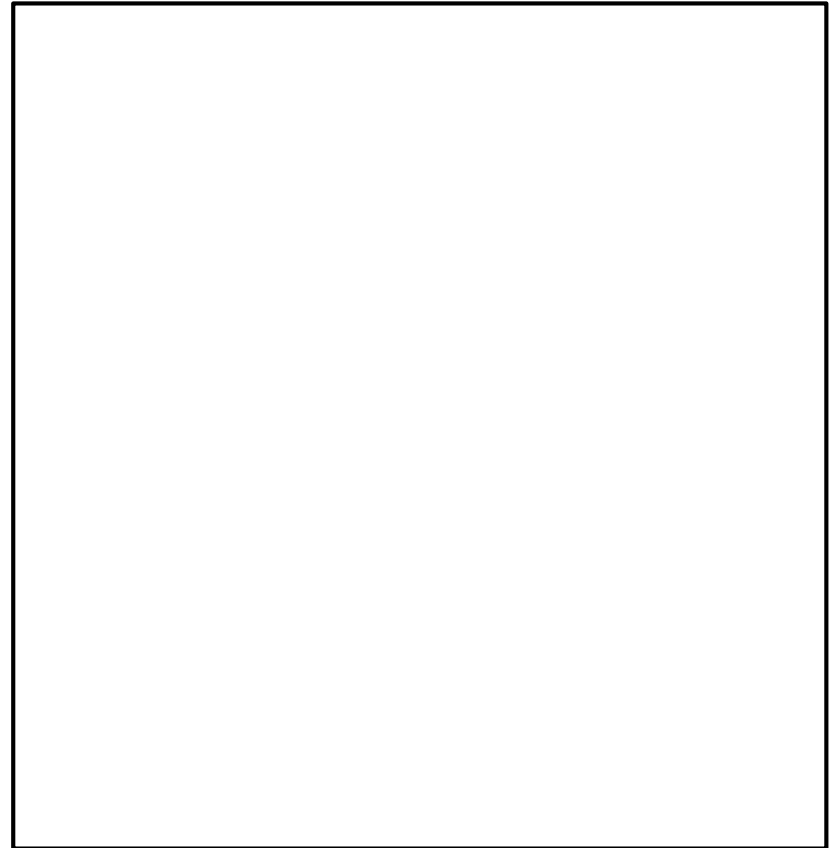
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Measuring Unconscious Bias:
Gender-and-Science IAT

<https://implicit.harvard.edu>

Logic of the IAT

- IAT provides a measure of the strength of associations between mental categories such as “male and female” and attributes such as “science and humanities” disciplines
- Strength of association between each category and attribute is reflected in the time it takes to respond to the stimuli while trying to respond rapidly
- Trial Types

Congruent Trials

Say “LEFT” for

Science

OR

Men

Say “RIGHT” for

Humanities

OR

Women

Incongruent Trials

Say “LEFT” for

Science

OR

Women

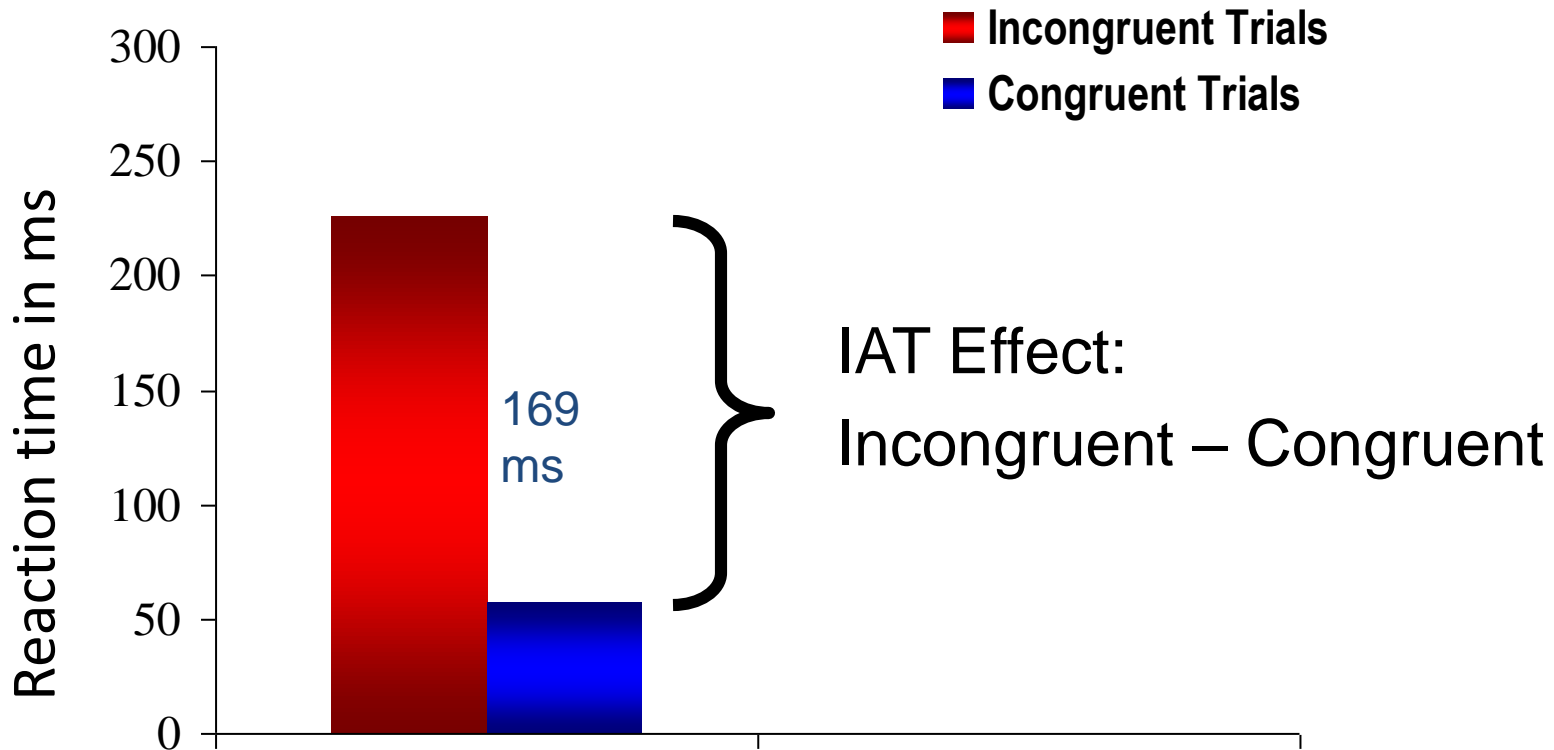
Say “RIGHT” for

Humanities

OR

Men

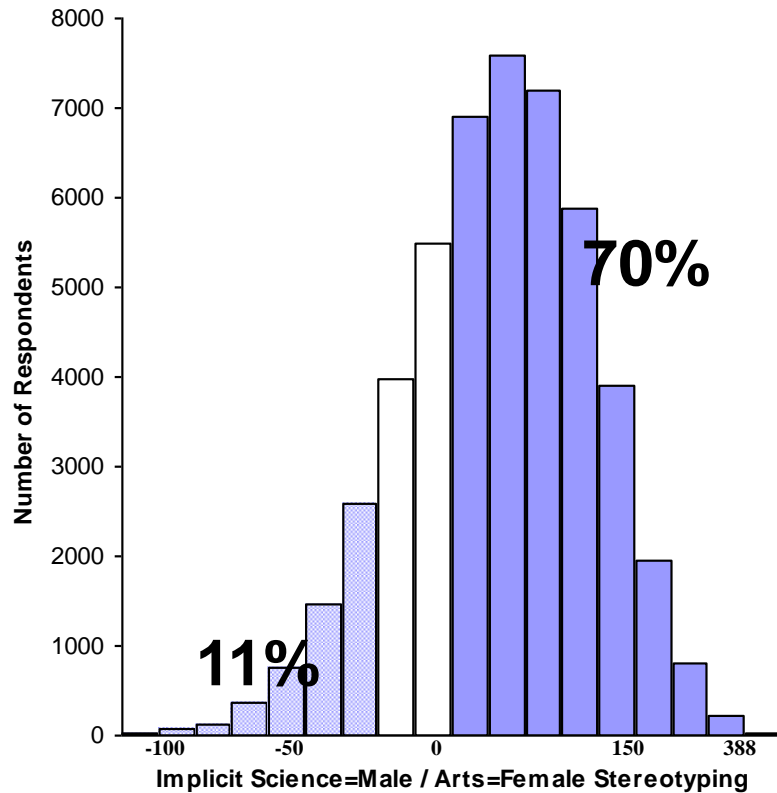
IAT Effect



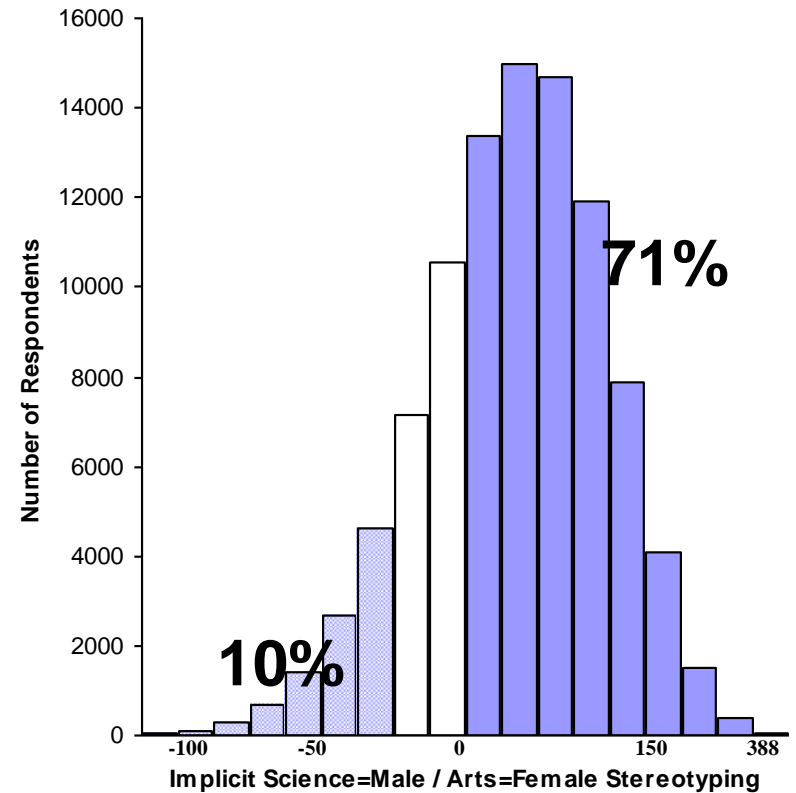
The larger the difference, the greater the bias in associating men with science and women with humanities

Implicit Gender-Science Stereotypes

Male Respondents



Female Respondents



Expectancy Bias

Expecting certain behaviors or characteristics in individuals based on stereotypes about the social category to which they belong

Stereotypes about men?

Men

- Strong
 - Decisive
 - Independent
 - Don't ask for directions
 - Logical
 - Lack emotions
 - Love sports
 - Good at math
-

Stereotypes about women?

Men

- Strong
- Decisive
- Independent
- Don't ask for directions
 - Logical
- Lack emotions
- Love sports
- Good at math

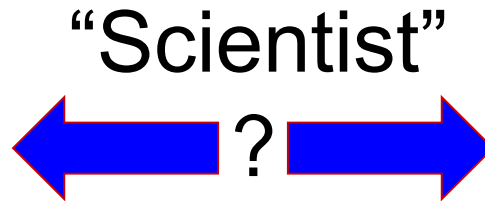
Women

- Nurturing
 - Nice
 - Supportive
 - Helpful
 - Sympathetic
 - Verbal
 - Social
 - Creative
-

Stereotypes about scientists?
Stereotypes about engineers?

Men

- Strong
- Decisive
- Independent
- Don't ask for directions
 - Logical
- Lack emotions
- Love sports
- Good at math

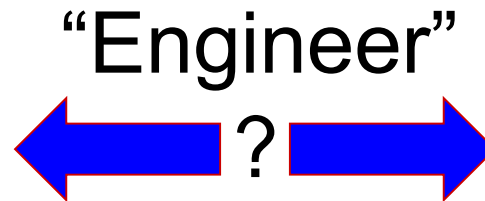


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-

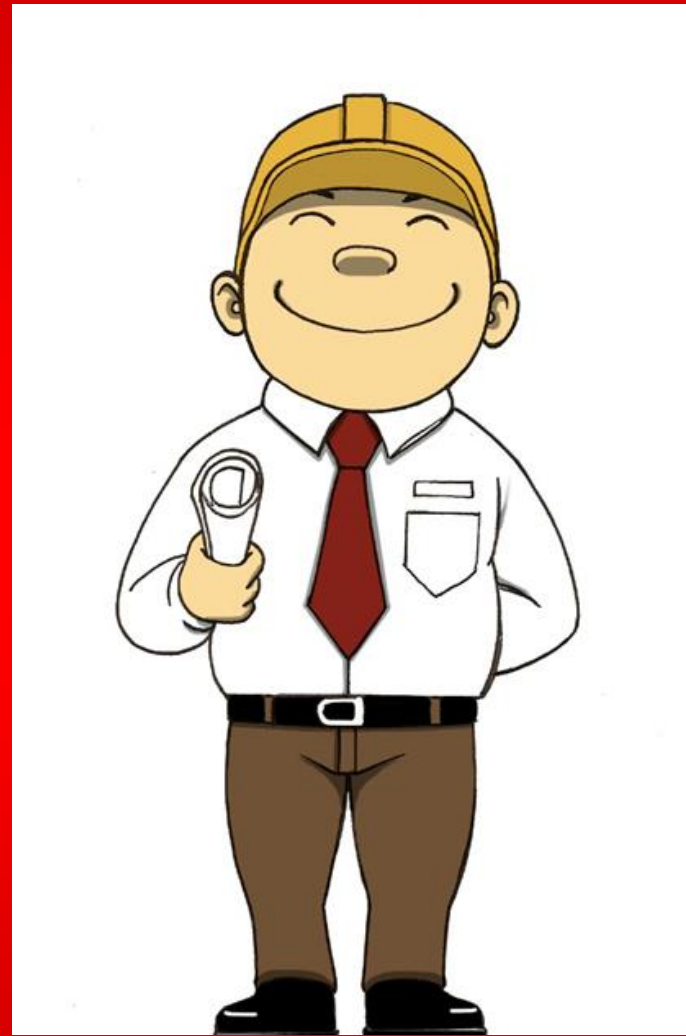
Men

- Strong
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- Don't ask for directions
 - Logical
- Lack emotions
- Love sports
- Good at math



Women

- Nurturing
 - Nice
 - Supportive
 - Helpful
 - Sympathetic
 - Verbal
 - Social
 - Creative
-



How does this affect students?

- Parents/teachers/counselors provide help, mentoring, and advice based on assumptions of students' interests & abilities -- may steer women and URM away from “male” or “intellectually challenging” fields
- Students “choose” jobs that conform to the stereotypes of their group
- Evaluators view credentials in ways that conform to gender/racial/ethnic expectations

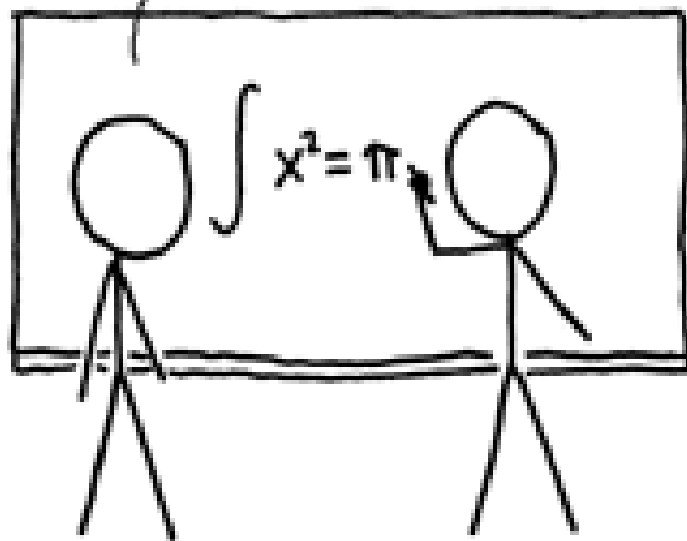
Influence of Unconscious Bias on Women in Stem

- Stereotype Threat
- Role Congruity/Incongruity
- Microaggressions/Interactions

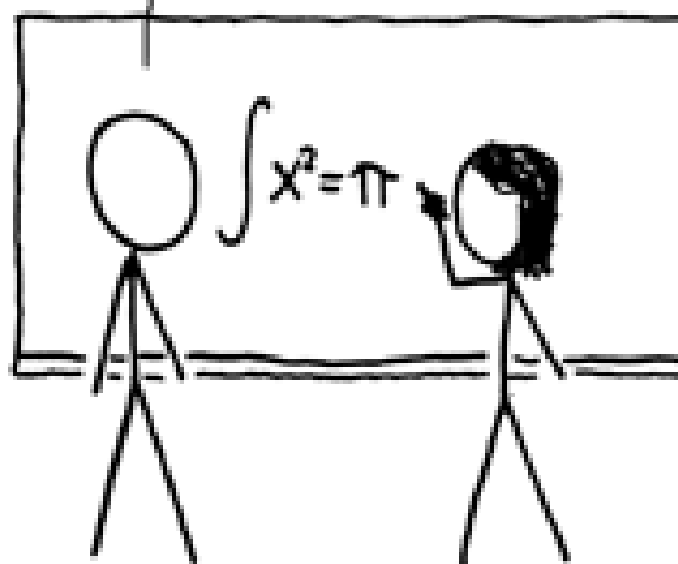
Stereotype Threat

Members of negatively stereotyped groups may underperform when reminded of their group membership

WOW, YOU
SUCK AT MATH.



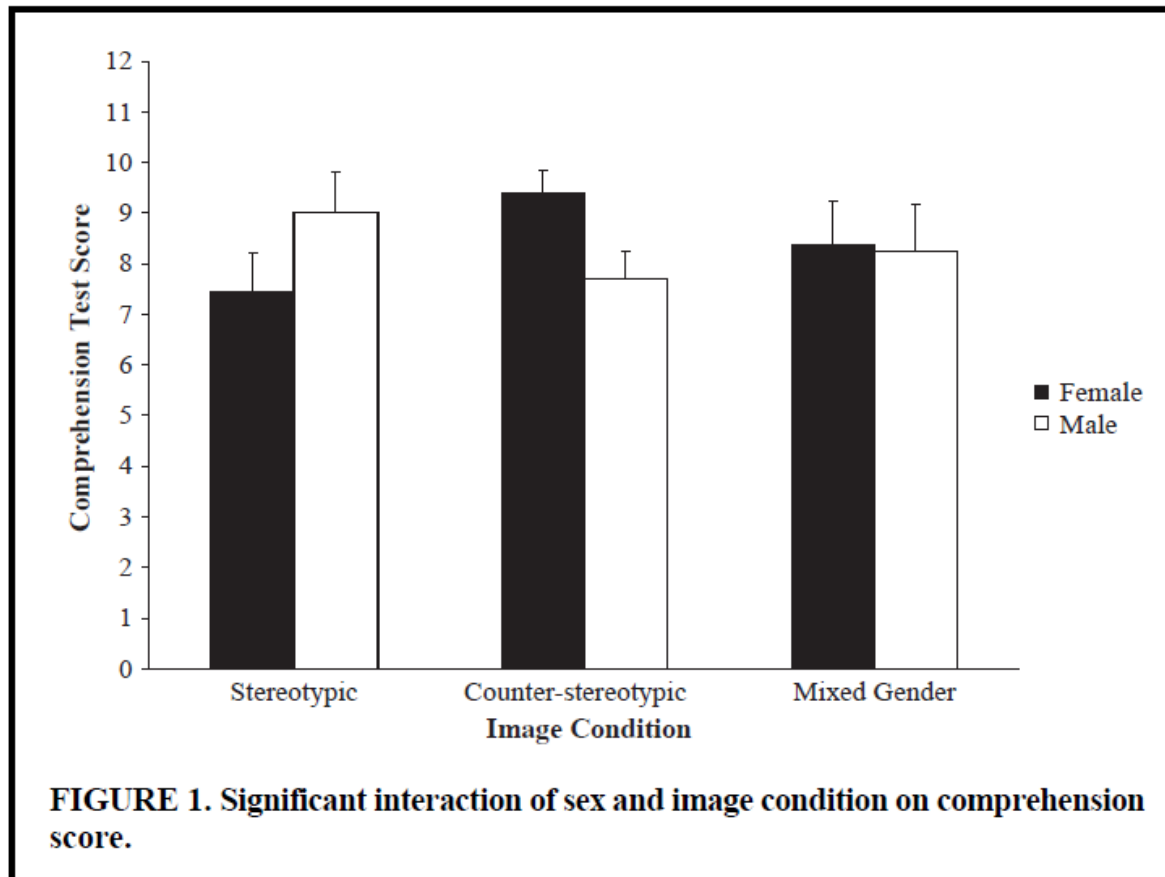
WOW, GIRLS
SUCK AT MATH.



Stereotype Threat: Images in science textbooks

- 81 9th- and 10th grade students (29 male, 52 female) – never taken a chemistry course
- Read a section of a chemistry text under 3 conditions:
 - Only male scientists pictured (stereotypic)
 - Only female scientists pictures (counter-stereotypic)
 - Both male and female scientists pictured

Stereotype Threat: Images in science textbooks



Good, J.J., J.A. Woodzicka, & L.C. Wingfield. (2010). The Effects of Gender Stereotypic and Counter-Stereotypic Textbook Images on Science Performance. *Journal of Social Psychology* 150(2), 132-147.

Stereotype Threat When Choosing Major

- 39 undergraduate students, non-declared major
- Entered room in two conditions:
 - Stereotypical computer science objects
 - Non-stereotypical objects
- Filled out a career assessment questionnaire – included measuring level of interest in taking a course or majoring in computer science

Classroom Environments

Stereotypical room

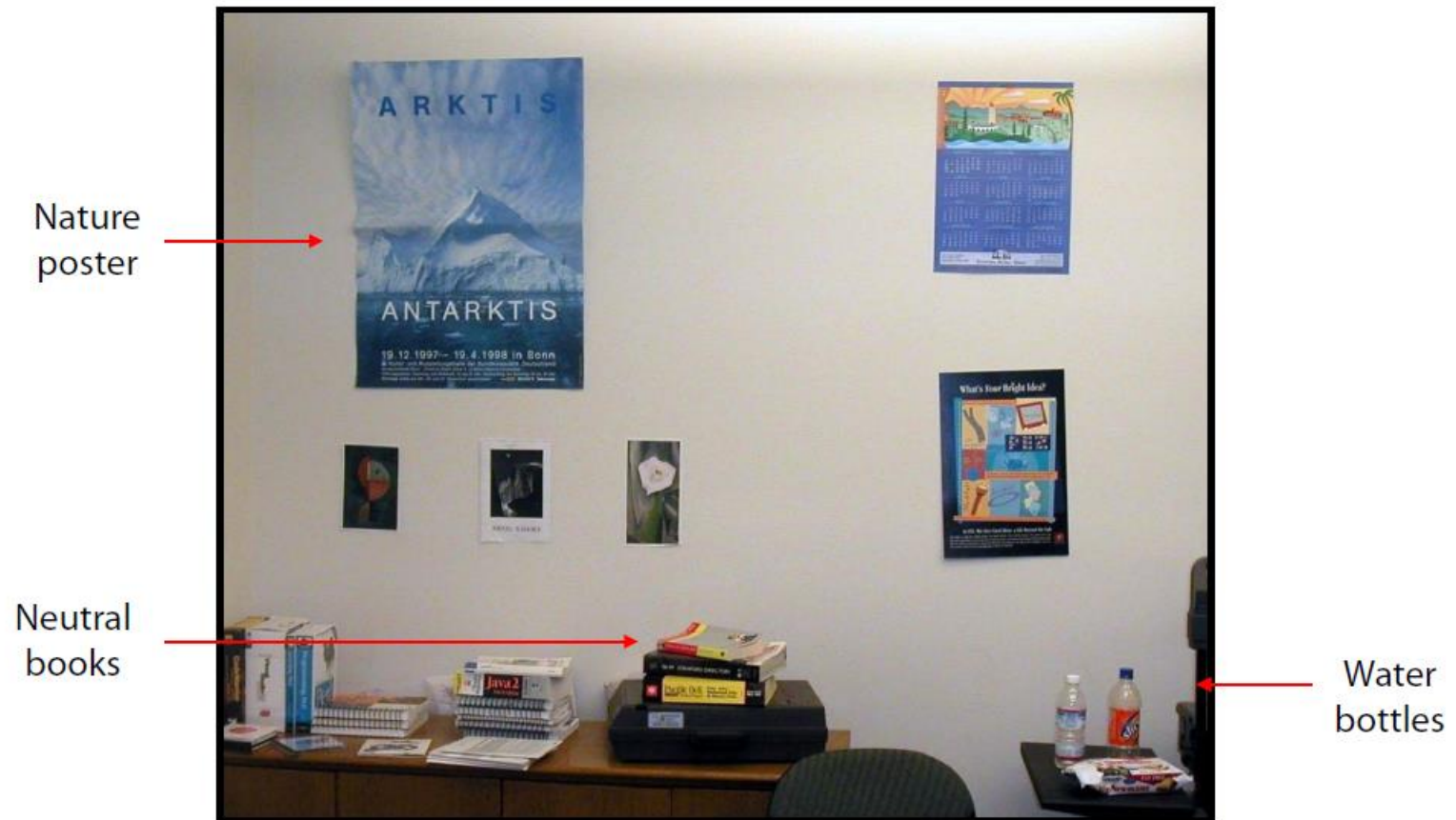


Cheryan, Plaut, Davies & Steele, *Journal of Personality & Social Psychology*, 2009

Images used with permission of Dr. Sapna Cheryan

Classroom Environments

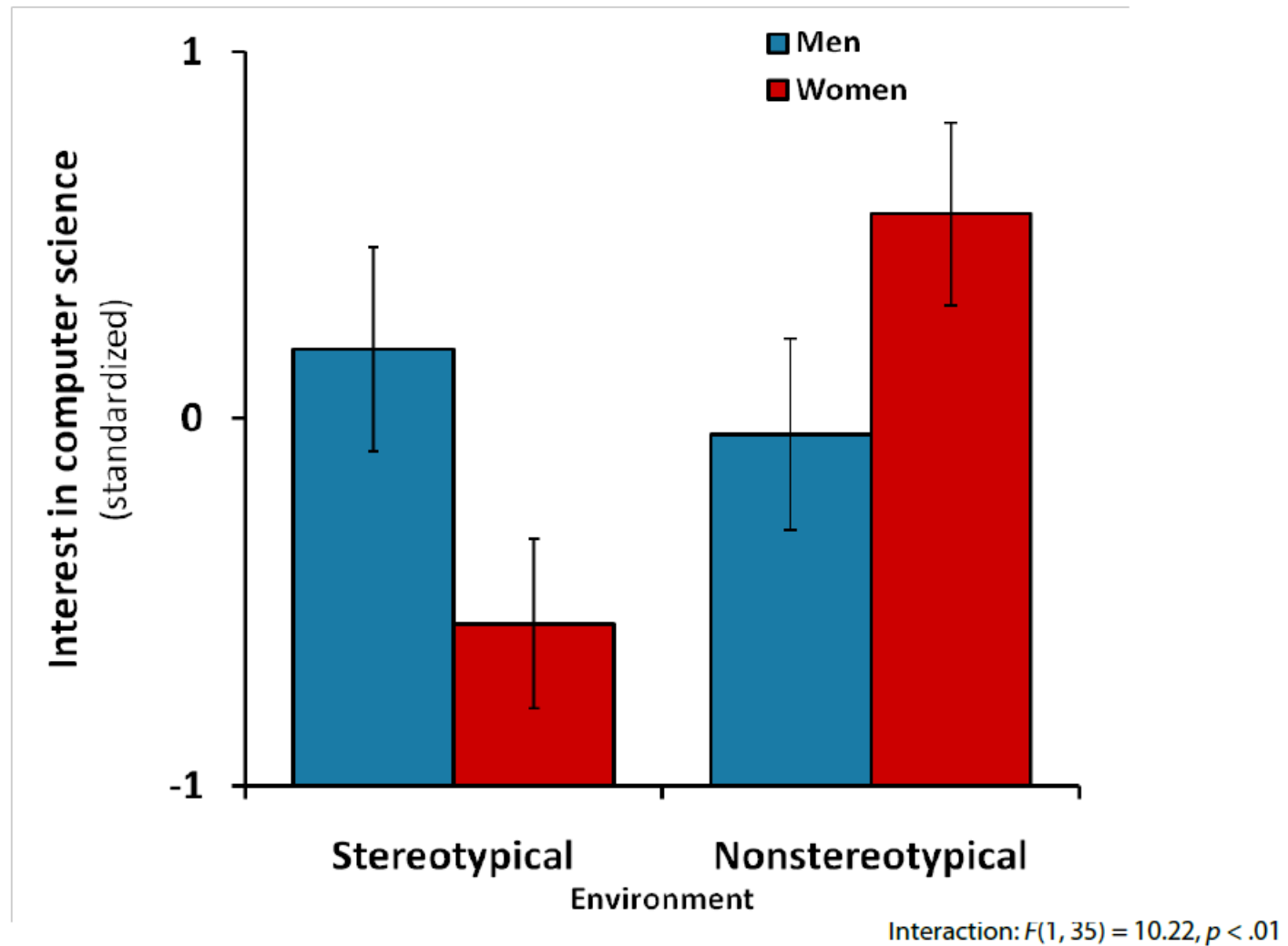
Non-stereotypical room



Cheryan, Plaut, Davies & Steele, *Journal of Personality & Social Psychology*, 2009

Images used with permission of Dr. Sapna Cheryan

Environment influences women's interest in CS



Role Congruity/Incongruity

The fit (or lack of fit) between gender norms and workplace roles

Hiring a Lab Manager

- 127 faculty from Physics, Chemistry and Biology departments
- Evaluated an application from an undergraduate science student for an entry-level Lab Manager.
 - Competence
 - Hireability
 - Likability
 - Starting Salary
 - Willingness to Provide Mentoring
- Application randomly assigned name “Jennifer” or “John”

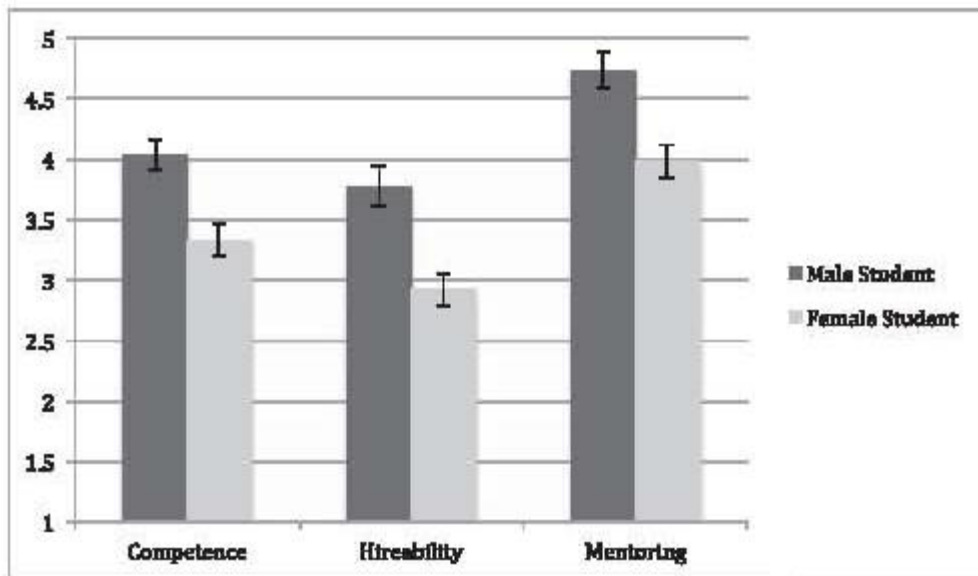


Fig. 1. Competence, hireability, and mentoring by student (collapsed across faculty gender). All student gender differences ($P < 0.001$). Scales range from 1 to 7, with higher numbers representing extent of each variable. Error bars represent SEs. $n_{\text{male student condition}} = 64$.

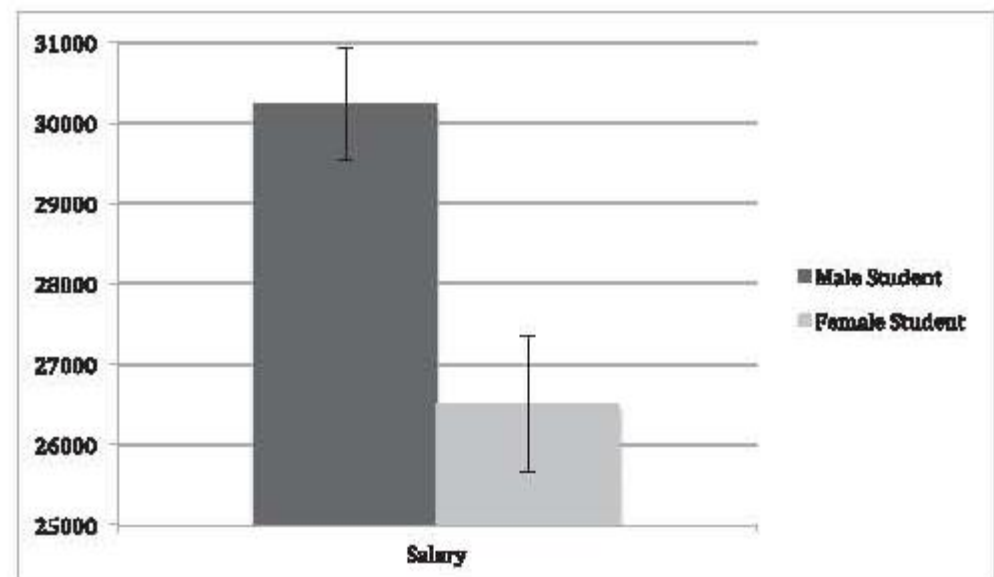


Fig. 2. Salary conferral by student gender condition (collapsed across faculty gender). The student gender difference is significant ($P < 0.01$). The scale ranges from \$15,000 to \$50,000. Error bars represent SEs. $n_{\text{male student condition}} = 63$, $n_{\text{female student condition}} = 64$.

Hiring a Lab Manager

Mentoring Questions – How likely are you to:

- Encourage the applicant to stay in the field if s/he was considering changing majors?
- Encourage the applicant to continue to focus on research if s/he was considering switching focus to teaching?
- Give the applicant extra help if s/he was having trouble mastering a difficult concept?

Microaggressions/Interactions

“Brief and commonplace daily verbal, behavioral, and environmental indignities, whether intentional or unintentional, that communicate hostile, derogatory, or negative racial, gender, sexual orientation, and religious slights and insults to the target person or group.”

D.W. Sue. (2010). *Microaggressions in Everyday Life: Race, Gender, and Sexual Orientation*. Hoboken, NJ: John Wiley & Sons.

Climate experienced by women in STEM

- Women students, especially when they are underrepresented in the classroom may experience unwelcoming climates that can include:
 - sexist language
 - stereotypic or disparaging views of women
 - differential treatment from professors
 - sexual harassment.

E.J. Whitt, M.I. Edison, E.T. Pascarella, A. Nora, & P.T. Terenzini. (1999). Women's Perception of a "Chilly Climate" and Cognitive Outcomes in College: Additional Evidence. *Journal of College Student Development* 40 (2), 163-177; E. Seymour & N.M. Hewitt. (1997). *Talking About Leaving: Why Undergraduates Leave the Sciences*. Boulder, CO: Westview Press;

Climate experienced by minorities in STEM

- Minority students, encounter daily inequities, both large and small, that include:
 - Low expectations and marginalization by faculty
 - Tokenism (often the only representative of their group)
 - Perceived double standards – must work harder to prove competency
 - Lack of respect from others in the academic community
 - Isolation from their cultural community, exclusion from academic communities
 - Absence of supportive role models/mentors

Climate experienced by minorities in STEM - Examples

- So I've had someone look me in the face and basically say that the reason why I've gotten the fellowships I've gotten is because I'm Black. So I've had to deal with that. – *Austin, mechanical engineering*
- I was trying to talk to [a professor] about his research and his response was, "Well, I didn't think your kind would be interested in this kind of research." And I stopped and asked myself do I really want to go into this or not? So, of course, me being the way I am, I just decided I'd challenge him. "What do you mean my kind?" And I think a lot of it comes from ignorance – and I don't even think he thought about what he said. – *Brandon, applied physics*
- I had a teacher call me "one of you" before. He was like, "I've never taught one of you before." And I was like, "You've never taught a student before? Never taught a softball player?" [I was] trying to figure out what he meant by, "one of you." And he finally came out and said, "I've never had a black student before." It was just very, very uncomfortable. I know he didn't mean anything like, negative by it. – *Jasmine, computer science*

*Strategies to Increase the
Representation of Women in STEM
Strategies to Reduce the Influence of
Unconscious Bias*

Strategies to Reduce the Influence of Implicit Bias

- Personal actions
- Actions in the lab or classroom

Personal Actions

Strategies that DO NOT WORK:

- Suppress bias and assumptions from one's mind (or try to)
 - Studies demonstrating Stereotype Rebound effect
 - Nira Liberman and Jens Förster, "Expression After Suppression: A Motivational Explanation of Postsuppression Rebound," *Journal of Personality & Social Psychology* 79 (2000): 190-203
 - C. N. Macrae, Galen V. Bodenhausen, Alan B. Milne, and Jolanda Jetten, "Out of Mind but Back in Sight: Stereotypes on the Rebound." *Journal of Personality & Social Psychology* 67 (1994): 808-817
- Belief in personal objectivity
 - Leads to biased evaluations of women
 - Uhlmann & Cohen,

STRATEGY 1 - Stereotype Replacement

Steps to take...	Examples
<p>Recognize when you have stereotypic thoughts. Recognize stereotypic portrayals in society.</p>	<ul style="list-style-type: none">• <i>Women students are less interested in engineering than in social science</i>• <i>Portrayal of females as poor at math</i>
<p>Challenge the fairness of the portrayal and replace it with a non-stereotypic response.</p>	<ul style="list-style-type: none">• <i>I know many successful women engineers</i>• <i>Research does not support a gender difference in math performance once we control for the number of math courses taken</i>

STRATEGY 2. Counter-Stereotype Imaging

Steps to take...	Examples
Help regulate your response by imagining a counter-stereotype woman in detail.	<ul style="list-style-type: none">• <i>Imagine an astronaut, engineer, CEO who is also a woman</i>• <i>Think about specific positive counter-stereotypical individuals you know</i>

STRATEGY 3. Individuating (vs. generalizing)

Steps to take...	Examples
Avoid making a snap decision based on a stereotype.	<ul style="list-style-type: none">• <i>Make gender less salient than being a scientist, physician, or engineer</i>
Obtain more information on specific qualifications, past experiences, etc., before making a decision.	

STRATEGY 4. Perspective-Taking

Steps to take...	Examples
<p>Adopt the perspective (in the first person) of a member of the stigmatized group.</p>	<p><i>Imagine what it would be like to...</i></p> <ul style="list-style-type: none">• <i>Have your abilities called into question</i>• <i>Be viewed as less committed to your career than colleagues with similar training and effort</i>• <i>Not be offered opportunities because of assumptions about family responsibilities or about your research interests</i>

STRATEGY 5. Increasing Opportunities for Contact

Steps to take...	Examples
Seek out opportunities for professional interaction with counter-stereotypic women	<ul style="list-style-type: none">• <i>Attend meetings or gatherings of minority-serving groups at your professional meetings</i>• <i>Ensure guest teachers or speakers to the class or department are diverse</i>

Actions to Take in the Classroom

- Address the “confidence gap”
 - Realize that stereotype threat may be at play when underrepresented persons downplay their achievements. Do not take statements of doubt in abilities at face value.
- Ensure equal opportunity in the classroom
 - Create a system to call on all students equally, for example, a deck of cards with names that can be selected at random.
- Avoid creating “tokens”
 - To the extent possible, ensure that women or URM students are not “tokens” in a lab or study group. Assign at least 2 women or 2 minorities to a group if you can.
- Monitor images
 - Ensure that artwork, pictures, photographs convey inclusive messages.
 - Ensure assignments provide inclusive examples and problems.

Breaking the Prejudice Habit

- Not necessarily easy
- With effort (awareness, motivation, and a sustained commitment), prejudice is a habit that can be broken
 - Can expect that you may slip up
 - Stay committed
- Strategies we provided are powerful tools to combat implicit biases
 - Implicit responses can be brought into line with explicit beliefs