

Women
(and other minorities)
in Science and Engineering:
Why the Gap?

a personal perspective

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Starting Points

I believe:

- Women and minorities are equally capable as current faculty of making important contributions to science and engineering fields (see Spelke 2005 review in American Psychologist).
- Diversity strengthens innovation (see Scott Page's book "The Difference") - innovation is good for science.
- Studies show that ALL humans - both men and women - are biased. This is not a finger-pointing exercise.

Starting Points

- Overview of data (% women at each stage from survey of “top 100” departments by Donna Nelson released in November 2007):

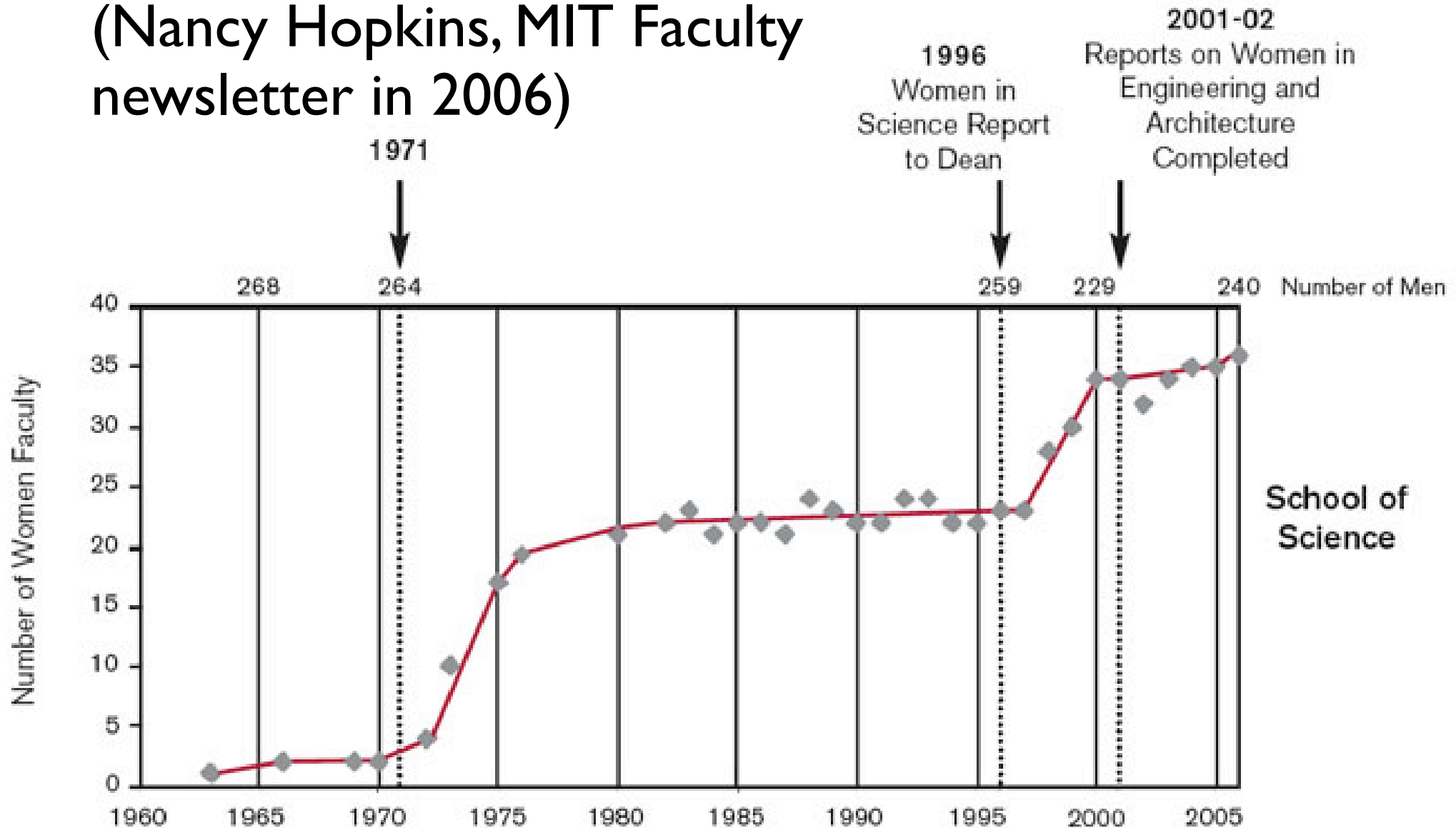
Department	% BS (2005)	% PhD (96-05)	% assist profs	% all profs
Chemistry	51.7	32.4	21.2	13.7
Math	44.9	28.7	26.8	12.9
Physics	21.1	14.3	16.8	9.1
Astronomy	42.4	22.7	25.3	15.8

Why do I care?

- BA in math, Cambridge University
 - ~30% women in math at my college
- PhD in Astronomy and Astrophysics from UCSC
 - ~30% women in the program
- Postdoc at the Institute for Advanced Study
 - ~15% women members in astronomy, <10% women at Tuesday lunch
- Assistant professor at Wesleyan University
 - ~50% women scientists in assistant professor positions when I arrived
 - motherhood (see end of talk)
 - 19 faculty hires in science 2002-2006, 0 women

Why do I care?

- Similar pattern seen at MIT (Nancy Hopkins, MIT Faculty newsletter in 2006)



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- Studies show that ALL humans - both men and women - are biased. This is not a finger-pointing exercise.
- If the spotlight is NOT maintained on issues of diversity, no progress will be made

The BIG QUESTION

- How could we have hired 19 male scientists in a row at Wesleyan when I KNOW that we (ie the faculty) were supportive of women in science and committed to their advancement?

Outline

- What are the problems?
 - stereotype threat
 - unconscious bias
 - society, family and science
- What am I going to do?

Stereotype Threat

Minorities in a group are conscious of (and anxious about): (i) their status; (ii) stereotypes of that minority; (iii) the need to overcome that stereotype; (iv) the need to combat it as a representative of their minority

See Steele, Spencer, Aaronson, Quinn...

- In sports

- black/white athletes hit more/less hoops when reminded of race

- In math tests

- women do worse when reminded of their gender prior to the test (merely recording their gender, or having male instead of female proctors)

➡ an explanation for the 15% gap between women and men's performance on the Physics GRE?

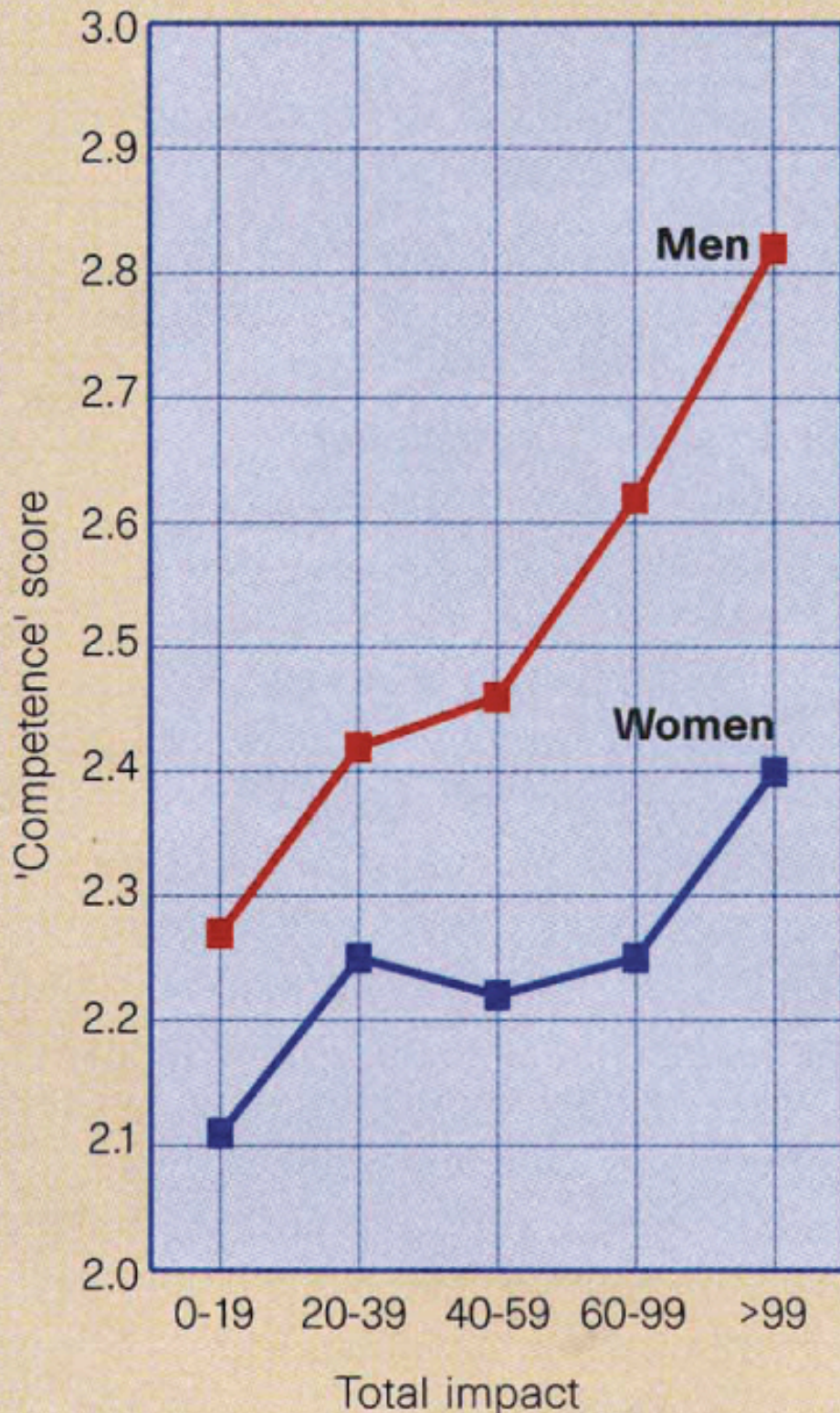
- asians do better when reminded of their race

Unconscious Bias

Weneras & Wold (1997) commentary in Nature:

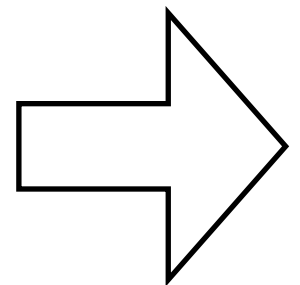
- looked at prestigious postdocs awarded in 1995 by the Swedish Medical Research council
 - 52/62 female/male applicants, 4/16 female/male awards. Why?
 - applications peer-reviewed, each application assigned score (0-4) for “scientific competence”, “
 - women scored systematically lower than men in all three, particularly for “scientific competence”
- to objectively evaluate a scientists “impact” on the field
 - authors assigned their own score from number of publication, number of 1st author publications, citations for each, and taking account prestige of journal

Unconscious Bias



- Only the group of women with impact scores greater than 100 were peer-reviewed to be as competent as any of the groups of men
- Note: no error bars on plot BUT differences must be significant otherwise you would have 50/50 success rate

➡ question your own evaluation of any scientist's "competence"



Unconscious Bias

- Biases in evaluation

- Moving to “blind” auditions for orchestras increased percentage of women’s chances of getting beyond first round by 50%
- Evaluators gave systematically lower job performance scores to women if under time pressure (Martell, 1991)

➡ reviewers of applicants to grad school/postdocs/faculty should spend at least 5 minutes on every application

- Asked to assign success at a task due to “luck” or “skill” more women than men were systematically judged by both women and men to be “lucky” (Deaux & Emswiller, 1974)

➡ reviewers should question their own evaluation of a candidate

➡ reviewers should question any letter-writer’s evaluation

Unconscious Bias

- Biases in selection

- A study of front covers of Time Magazine found that when one person was chosen to represent a topic, it was invariably the stereotype, but if many were chosen there was usually diversity (Valerie Purdie - Yale)
- ➡ Move as much as possible to “cluster-hiring”, rather than the traditional mode of filling one-job-at-a-time. Even hiring 2 people at once makes a difference.

Unconscious Bias

- A study comparing recommendations by both women and men (Trix & Psenka, 2003) for 300 successful applicants to a medical school found letters written for women candidates
 - were shorter
 - raised more doubts
 - talked about them as teachers/students rather than researchers/professionals
- ➡ writers should carefully review their own letters for these characteristics
- ➡ reviewers should question their own evaluation of a candidate
- ➡ reviewers should question any letter-writer's evaluation

Unconscious Bias

- A study comparing evaluations by both women and men of a resume randomly assigned a male/female name found
 - both men and women rated the resume lower if it was from a woman (Steinpreis, Anders & Ritzke, 1999).
 - ➡ reviewers should question their own evaluation of a candidate
 - the effect is increased if there are fewer women in the pool (Heilman, 1980)
 - ➡ search committees should ensure their applicant pool and their short list is diverse as possible - interview at least 2 women!

other minorities in science
face the same barriers

scale of problem is an order
of magnitude worse

My personal plan

- **Maintain awareness**
 - at Columbia: bring up these issues on all committees
 - outside Columbia: give this talk
 - always be aware I'm human and that I'm part of the problem
- **On any admission committee, take time to**
 - make sure applicant pool contains significant fraction of women
 - read each application carefully
 - question the letter-writer's descriptions
 - question my own judgement
 - include more than one woman candidate on the short list
 - question my own reaction to the candidates' visits

Social Pressure

Study of scientists and engineers outside academia (Xie & Shauman, 2003)

- More female than male scientists are married to scientists
 - women are more likely to face “dual-career” issues
 - women are often the younger (and hence more junior) partner in these marriages
- Once a woman has children, compared to a man with children, she is less likely to
 - pursue a career in science
 - be employed
 - move
 - be promoted

Social Pressure

- Mason & Goulden (2002) followed more than 160,000 PhD recipients up to the age of 76:
 - There is a 24% gap in the tenure rate between men (77%) and women (53%) in science who became parents within 5 years of gaining a PhD.
 - 50% of tenured women in the sciences, but only 30% of men are childless 14 years after receiving a PhD
 - Tenured women are twice as likely as tenured men to be single
- Mason & Goulden (2004): ladder-rank faculty in the University of California system (4400 respondents) found that women (ages 30-50) with children
 - spent an average of 4.5 hours/week less on professional duties
 - 18 hours/week more on household and care-giving duties

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- **Work on more realistic career paths for families to encourage women to stay in the field.**

Ending Points

- Anecdotes from Ben Barres, transgendered physicist, in 2006 Nature article “Does Gender Matter?”:
 - As an undergrad at the Massachusetts Institute of Technology (MIT), I was the only person in a large class of nearly all men to solve a hard maths problem, only to be told by the professor that my boyfriend must have solved it for me. I was not given any credit.
 - I am still disappointed about the prestigious fellowship competition I later lost to a male contemporary when I was a PhD student, even though the Harvard dean who had read both applications assured me that my application was much stronger (I had published six high-impact papers whereas my male competitor had published only one).
 - Shortly after I changed sex, a faculty member was heard to say "Ben Barres gave a great seminar today, but then his work is much better than his sister's."

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