

Gender in STEM: Trends, Paradoxes, and Job Talks

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Outline

- **Surprising patterns in women's participation in CS & STEM**
 - Time
 - Different countries
 - Socioeconomic levels
- **My gender-STEM projects**
 - Job talks: interruptions & introductions
 - Career assessment tools, faculty hiring, book project...
- **Suggestions for what individuals can do**

Women's Under-representation in STEM

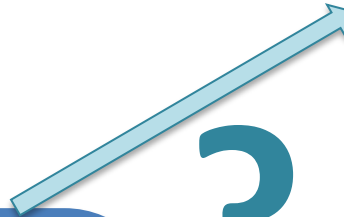
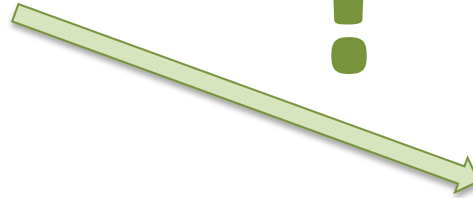
BIOLOGICAL FACTORS

Strength

Height

Psychological factors

Reproductive needs...



Aptitudes

Preferences



**Job
Choice**

SOCIAL FACTORS

Parental
Influence

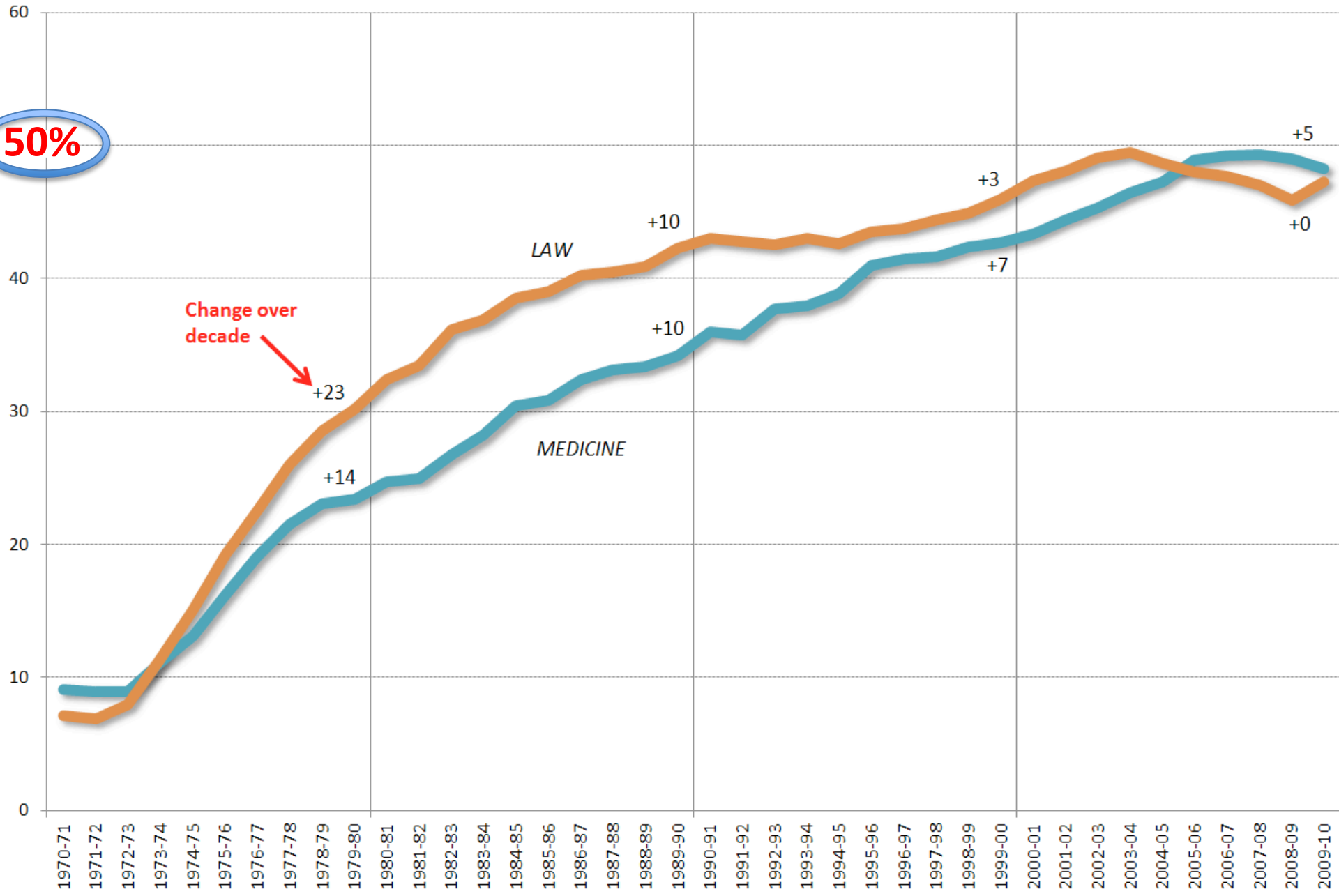
Advertisements

Societal
Expectations

Discrimination

Role models...

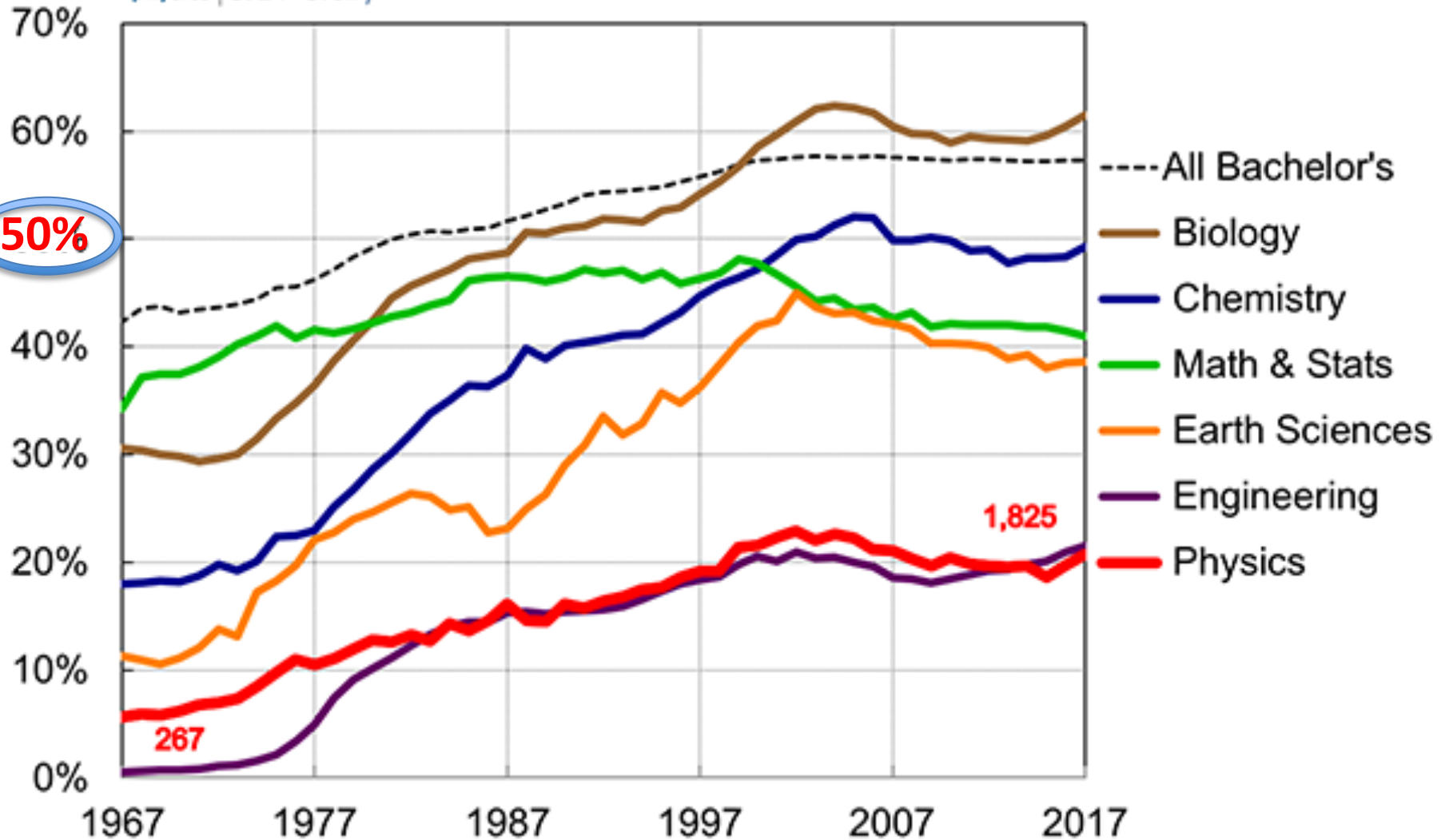
Law & Medical degrees: % women, 1971-2010



STEM B.S. degrees: % women, 1967-2017

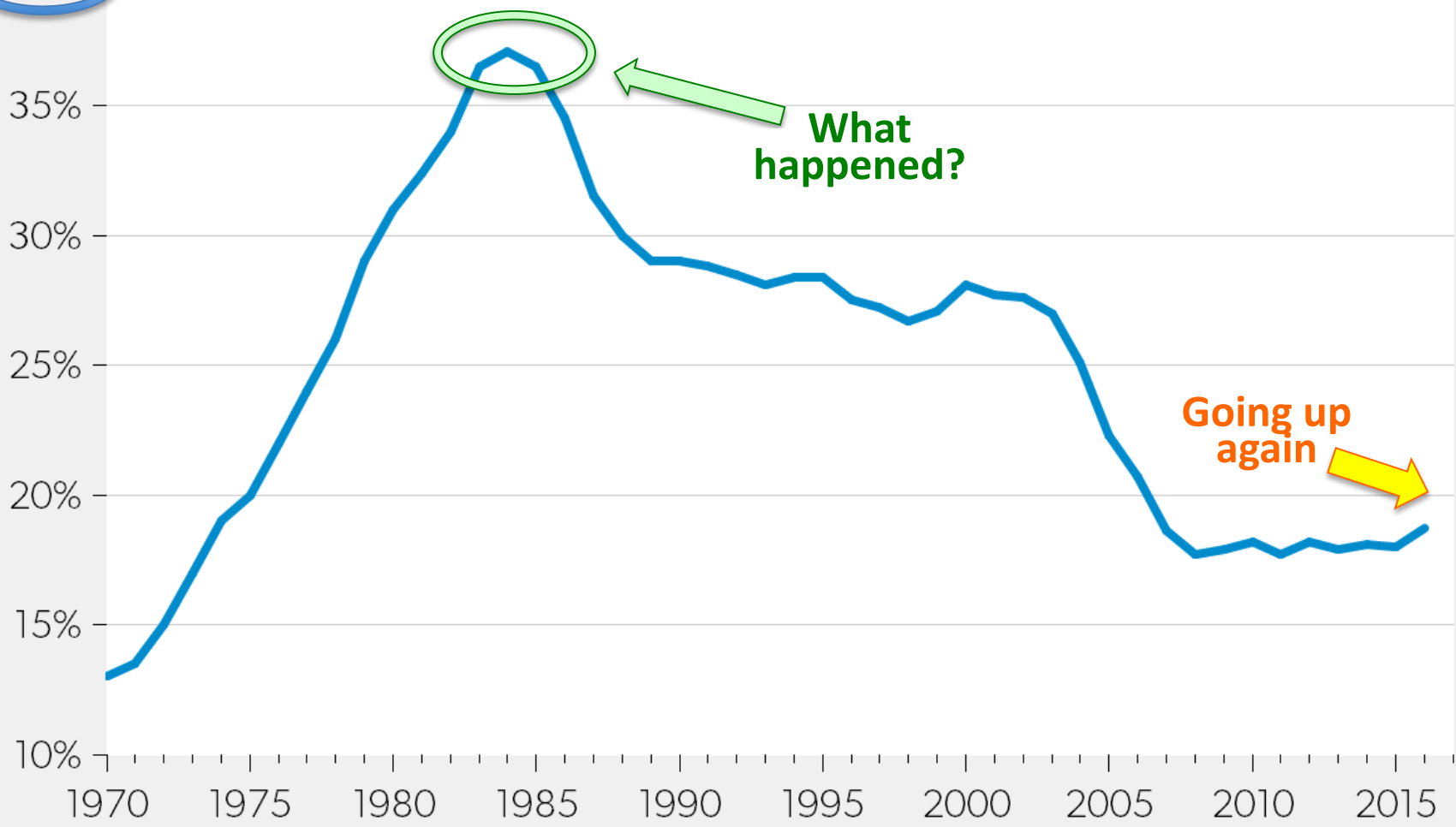


Bachelor's Degrees Earned by Women



Female Share of Bachelor's Degrees in Computer Science, 1970-2016

40%



Source: US Department of Education

Why? Hypothesis 1. Personal computers arrived in the home... went to sons not daughters

*Clive Thompson, "The Secret History of Women in Coding,"
New York Times Magazine, February 2019*

**Boy gets pre-college experience with coding,
better prepared for intro CS course**



**Girl worries about relative lack of preparation?
Course moves at a faster pace?**

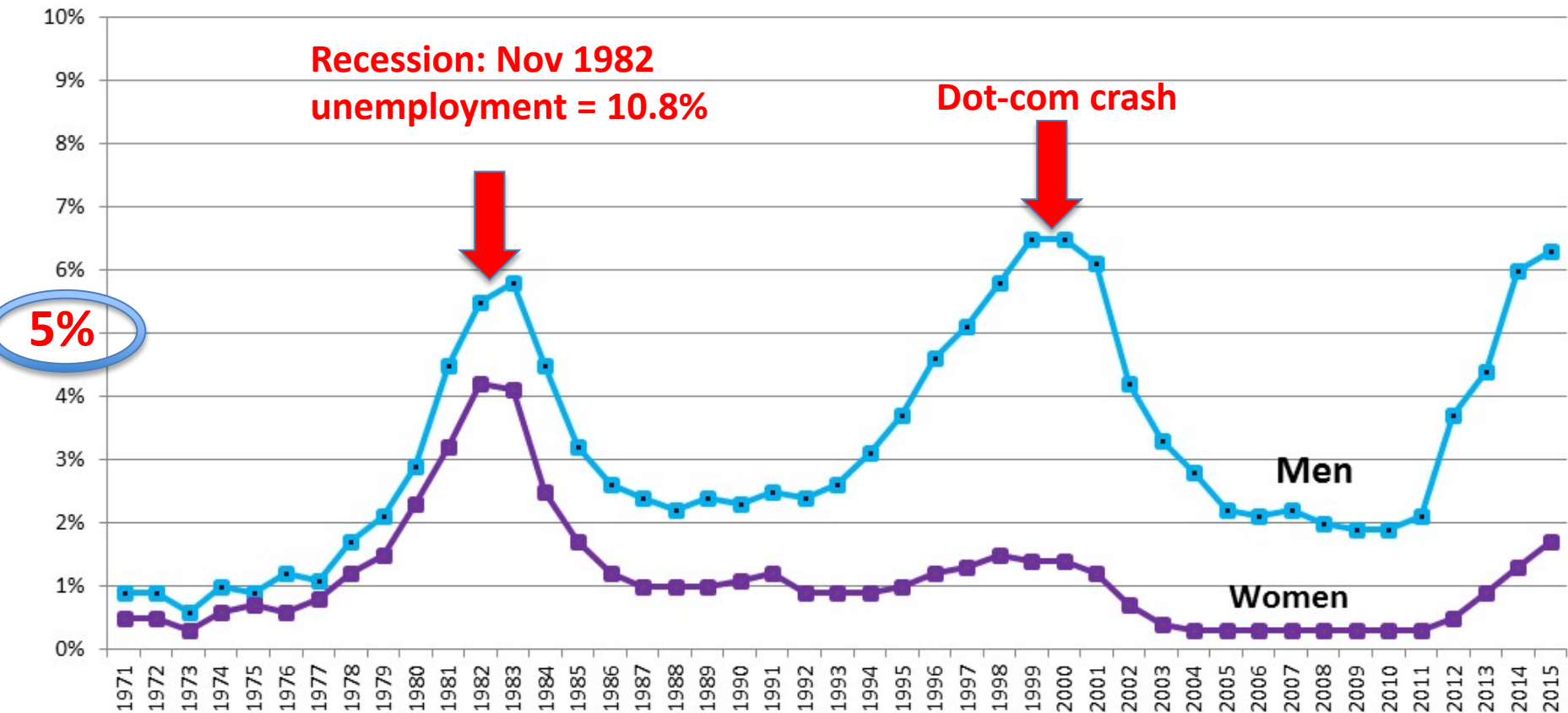


Girl leaves CS

Why? Hypothesis 2. Women react more strongly to downturns

Stuart Reges, "Why Women Don't Code," Quillette, June 2018

Proportion of entering students who plan to major in CS, by gender, 1971 - 2015



Source: Cooperative Institutional Research Program Freshman Survey, Higher Education Research Institute, UCLA

Linda Sax, "Expanding the Pipeline: Characteristics of Male and Female Prospective Computer Science Majors – Examining Four Decades of Changes," Computing Research News, Feb 2017

Why? Hypothesis 3. Hollywood

Clive Thompson, "The Secret History of Women in Coding," New York Times Magazine, February 2019

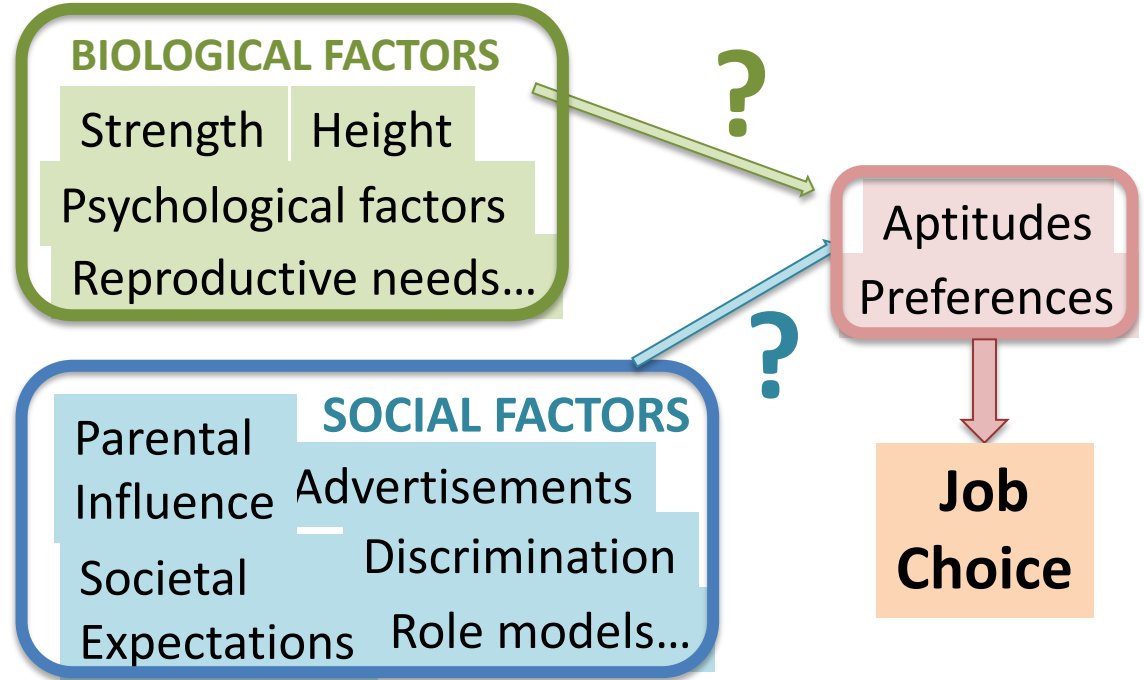
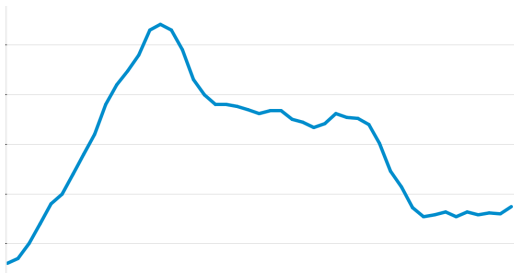
Tron	1982
WarGames	1983
Revenge of the Nerds	1984
Weird Science	1985
Back to the Future	1985

2016



Many Sociocultural Effects

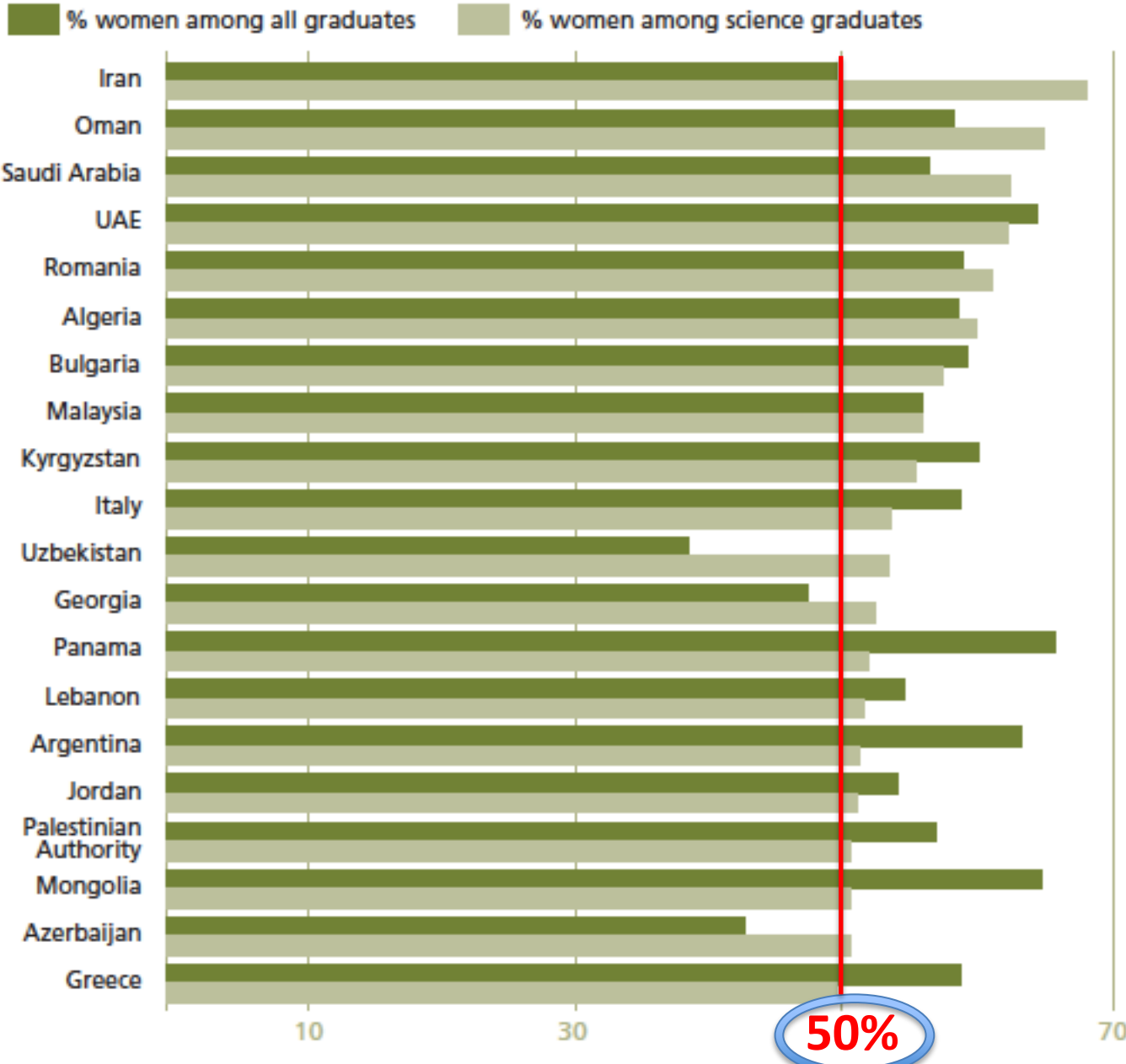
Powerful social & economic changes in the early 80's



Science Education in Other Countries

In more than 20 countries, women earn the majority of STEM bachelor's degrees

Where women earn the majority of science degrees



- Iran
- Oman
- Saudi Arabia
- UAE
- Romania
- Algeria
- Bulgaria
- Malaysia
- Kyrgyzstan
- Italy
- Uzbekistan
- Georgia
- Panama
- Lebanon
- Argentina...

Maria Charles, "What Gender is Science?" Contexts, Vol 10, May 2011

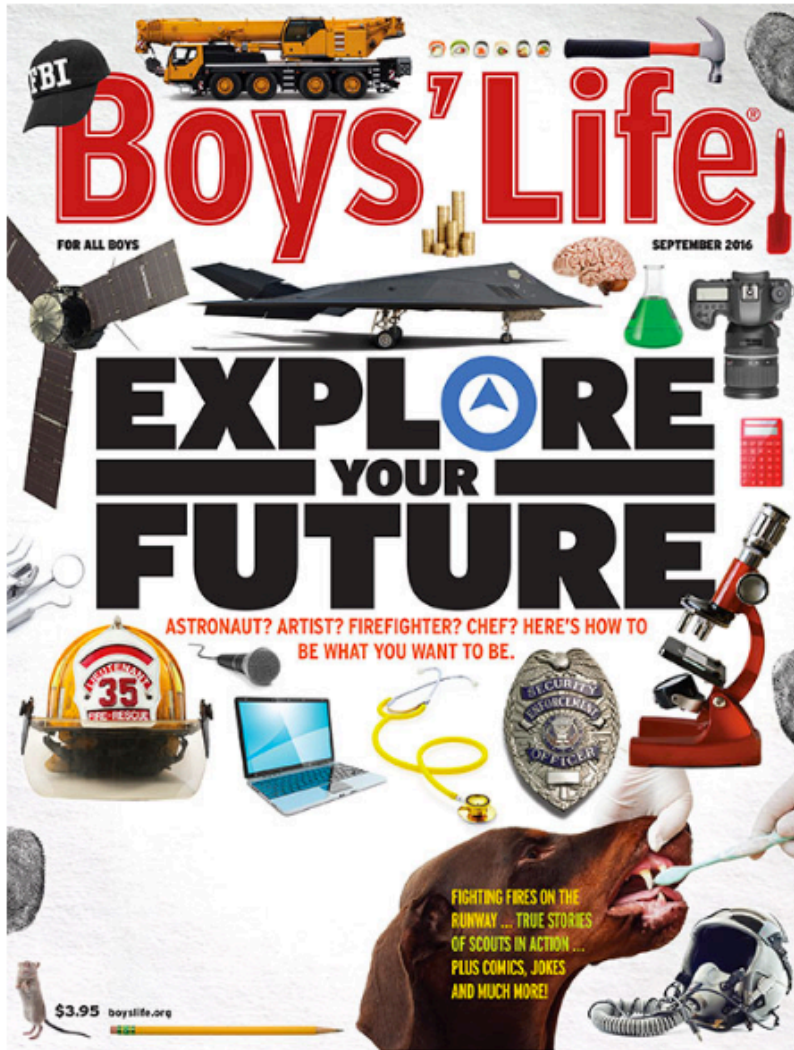
Why do *wealthy* countries have *fewer* women in STEM?

Maria Charles, "What Gender is Science? Contexts, Vol 10, May 2011

- 1. Personal economic security & national development more central concerns in developing societies**
 - Affluent people can study subjects that don't lead to secure or high-paying jobs.
- 2. College viewed as identity construction and self-realization:**
 - Expressing your essential male/female selves, rather than career preparation, economic betterment
- 3. More high school choices:**
 - Art, drama, languages... Girls can opt out of STEM
- 4. More college choices created for girls:**
 - Home economics, early childhood education, gender studies

5. Consumerism:

- Sell more toys if boys/girls play with different stuff



Why do *wealthy* countries have *fewer* women in STEM?

Maria Charles, "What Gender is Science? Contexts, Vol 10, May 2011

6. "Follow your passion"

- Many 18-year-olds don't know their passion
- *What does society expect me to be passionate about?*
- Becomes a stereotypical gendered choice

7. Self-reinforcing:

- Fewer opportunities to socialize with other girls in STEM clubs
- Believing in difference can produce difference (e.g., stereotype threat)

Why do many *conservative* Muslim countries have *more* women in STEM?

1. Single-sex education:

- More girls enjoy STEM when no pressure to appear feminine
- No need to “dumb down”

2. Military, religious, political jobs:

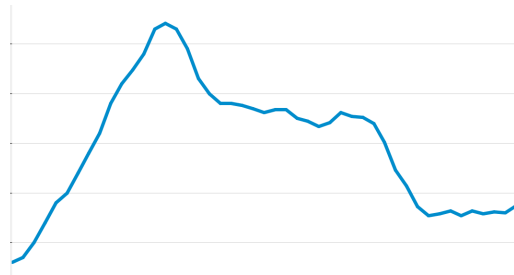
- Only for men in some countries, leaving more STEM jobs for women

3. Appropriate environments for women:

- Chemistry lab vs. courtroom

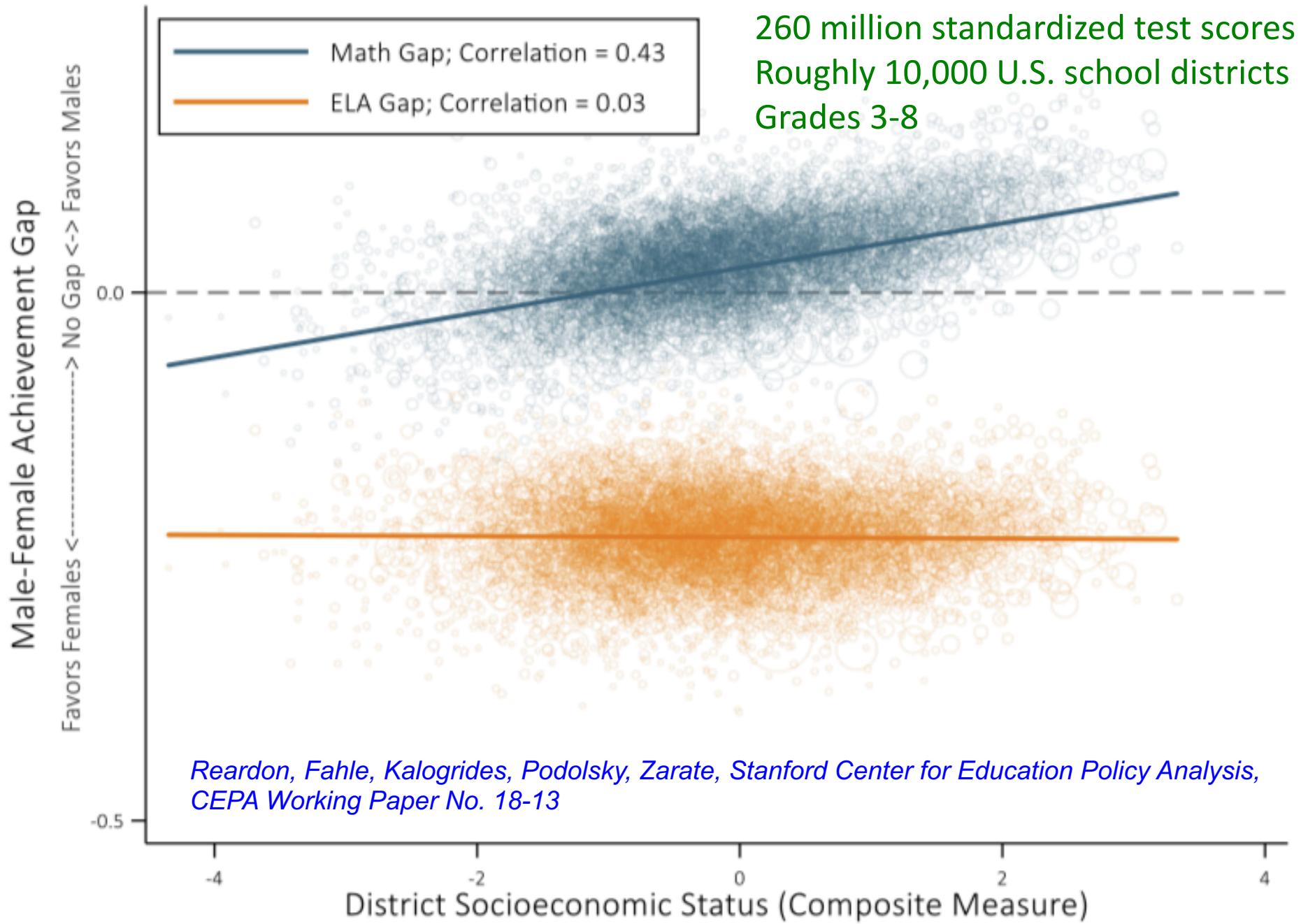
Two counter-intuitive patterns so far...

1. CS has a different trend from math, engineering fields, everything else...



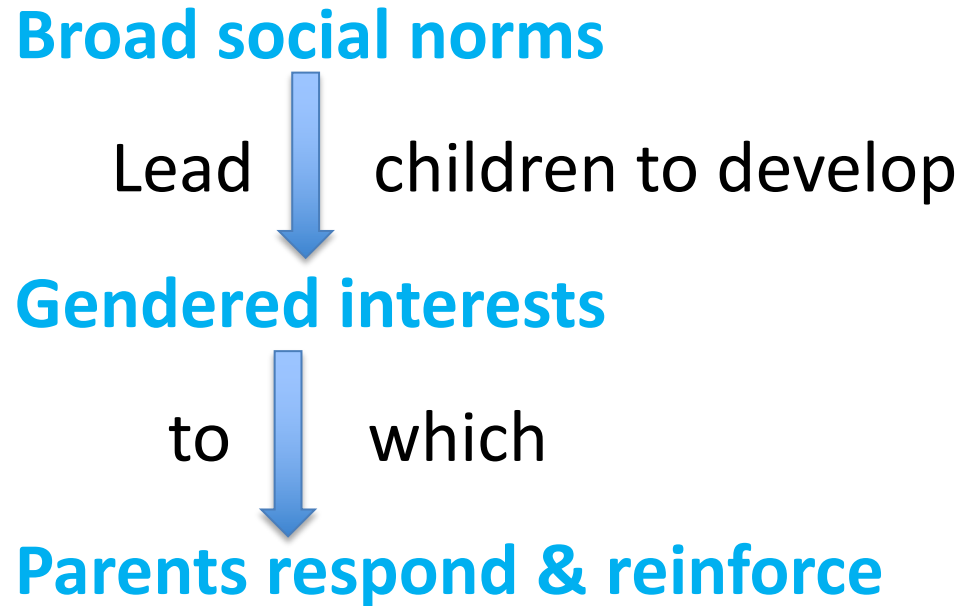
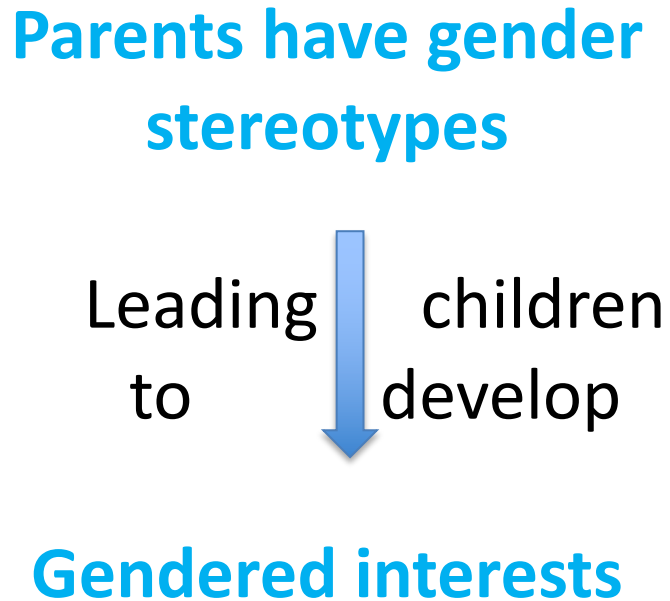
2. Developing countries and, in particular, conservative Muslim countries, have more women in STEM

U.S. Math/ELA patterns by socioeconomic level



Why? Hypothesis 1. Parents invest time/money resources in their children in gendered ways

CEPA Working Paper No. 18-13



Either way, greater investments from affluent families can lead to greater gender differences in children's interests, identities, and skills

Why? Hypothesis 2. Different returns on educational investments

CEPA Working Paper No. 18-13

Wealthy families: Men earn more than women

Leading  to

Higher expected return on education for boys

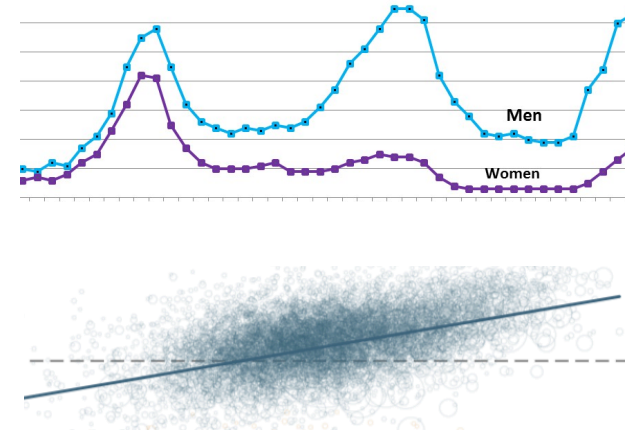
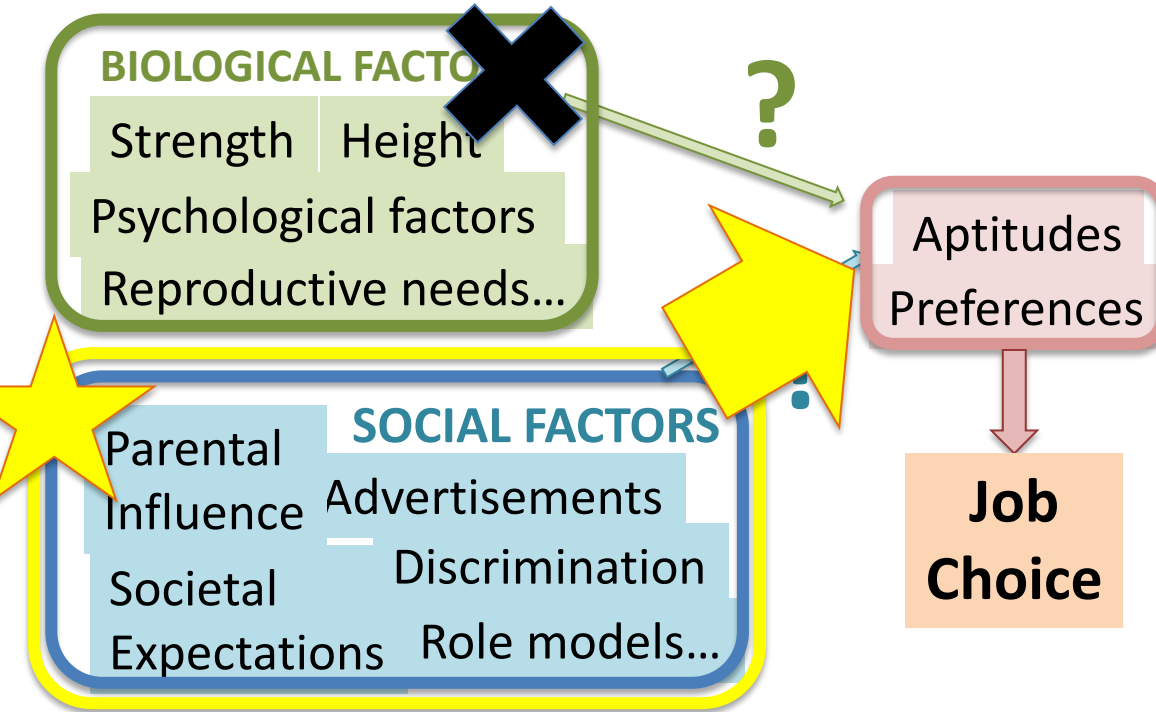
Lower SES conditions (especially single-mom families)



Higher expected return on education for girls

- **Sons of high-status fathers tend to achieve higher educational attainment than daughters**
- **Among low SES families, boys have lower academic & economic outcomes than girls**

Why Learn about Causes of Under-representation?



Extraordinarily complex set of causes:

- Social/cultural/economic/religious/etc

We can do something about many of these

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My roles & projects

- **Co-Director, Center for Research on Gender in STEMM**
 - <http://crg-stemm.ucsd.edu>
 - **Research on engineering job talks**
 - Research on career assessment tools
- **Faculty Equity Advisor, Jacobs School of Engineering (7 years)**
 - Faculty search committee training
 - Mentoring
- **Community involvement**
 - Book project, talks at schools
 - Volunteer with Girl Scouts
 - Many presentations in the community

Gender Gap in Engineering Faculty: Many Causes

Not much studied: The Interview Day

- **1-hour research seminar** open to faculty, students
 - Questions & interruptions **Job Talk**
 - Introductions
- Many contexts studied: Corporations, press briefings, parent-child, fictional TV, supreme court,...

How would you define an Interruption?

- Simultaneous speech more than two syllables before the end of someone's sentence
- Interrupting in midst of incomplete grammatical unit
 - It's raining outside so I am going to leave.
 - It's raining outside ...
 - It's...

→ Didn't raise your hand; didn't get acknowledged by the speaker



Definitions of Interruptions

Presenter is Presenting:

Raise hand, get
acknowledged

– **ACKNOWLEDGED QUESTION**

Otherwise

– **INTERRUPTION**

Presenter is Answering a Question:

Wait until presenter finishes
answer, ask another
question without raising
hand

– **FOLLOW-UP QUESTION**

Otherwise (speech overlap)

– **INTERRUPTION**



First Data Set: Video recordings of job talks

- 140 videos
- 91 men, 49 women
- Range of seniority:
 - PhD students: 44
 - 1-2 years out: 26
 - 3-6 years out: 40
 - 7-21 years out: 30
- 2 large public R1 schools
- Multiple departments
 - EE, CS, ME, BioEng
- Data analysis from pre-Q&A portion

Activity	Duration
Presenting	10:03
Question (Acknowledged)	00:07
Answer	00:12
Presenting	03:53
Question (Interruption)	00:03
Answer	00:06

Results (excluding Bioengineering)

Dependent Variables	Men	Women
Interruptions	3.77	4.95
Ack. Questions	5.49	5.39
Follow-ups	4.83	6.66
Total Questions	14.1	17

- Gender effect:
 - Women get 3 more questions, on average
 - Women experience more talks with zero questions
 - Conditioned on getting any questions, women get 6 more questions than men, on average
- Seniority effect
- Department effect: Some depts much more aggressive (Bioengineering is very different, almost no questions)

Is it Bad to get More Questions?

- Could be a sign of audience interest
- No outcome information (offers, hires)
- More questions correlated with speaker having to rush:
 - “There’s not much time left; I will rush through this”
 - “I’m going to skip to the end”

Preliminary research: Analyses of Introductions

- 85 Introductions transcribed
- No difference in first/last name use
- Research awards:
 - Counting irrelevant statements in intro:
 - Things that wouldn't be found in the CV
 - Women: 41 %
 - Men: 14 %

	Listed in CV	Mentioned in Intro
Men	78%	52%
Women	73%	27%

My Own Story of an Irrelevance...

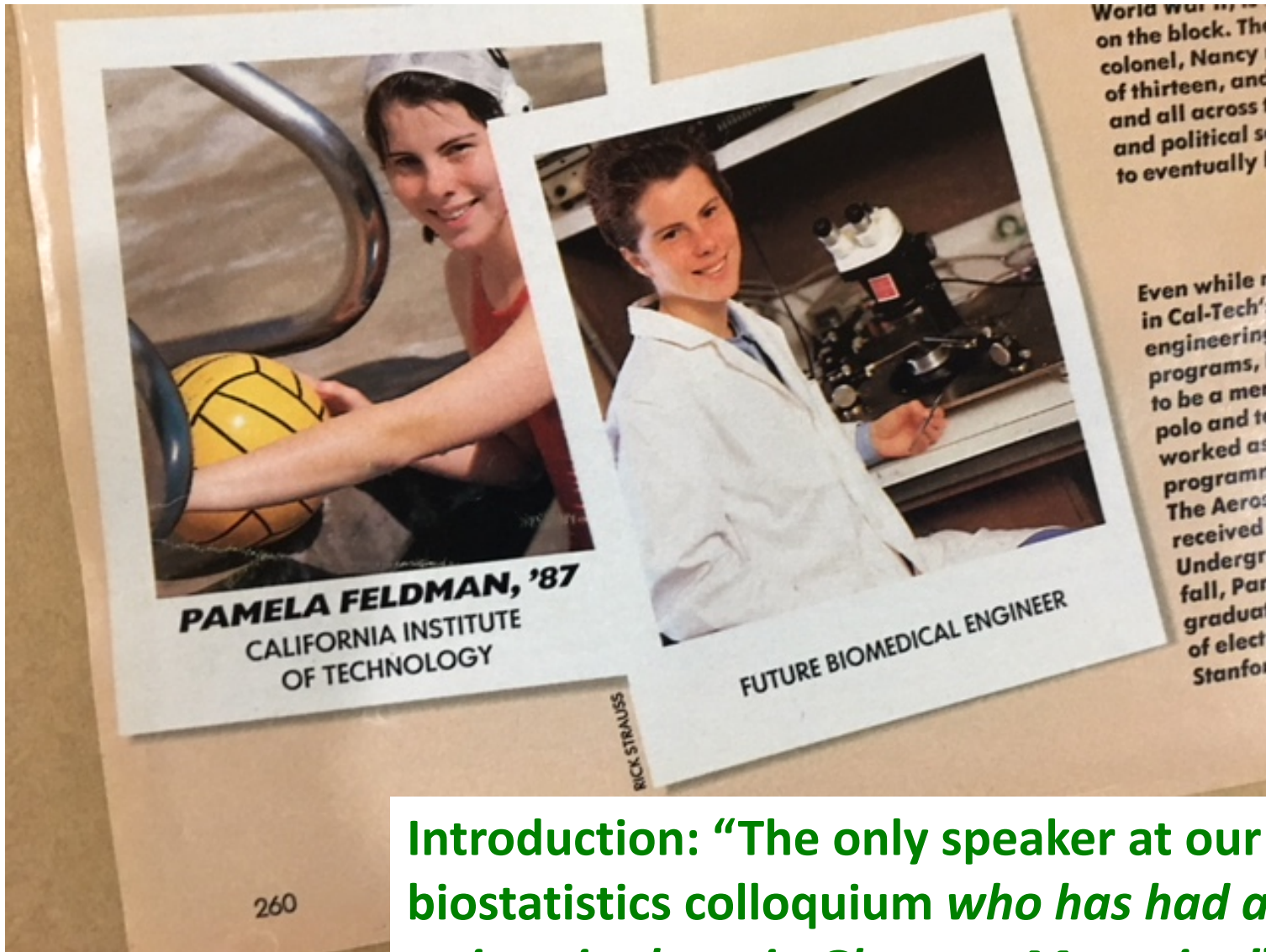
- Stanford Biostatistics Colloquium, mid-90s
- But going back some years...

TOP TEN COLLEGE WOMEN '87

Student leaders, outstanding scholars and community activists all, our Top Ten College Women for 1987 plan to become leaders in politics, business, medicine and science. Here we show how they got there themselves now *and* in the future. Read on to see how they got where they are today, and where they expect to be in years ahead. For information on next year's college contest, turn to page 152.

GO SOFT
SENSUOUS!

Glamour, August 1987



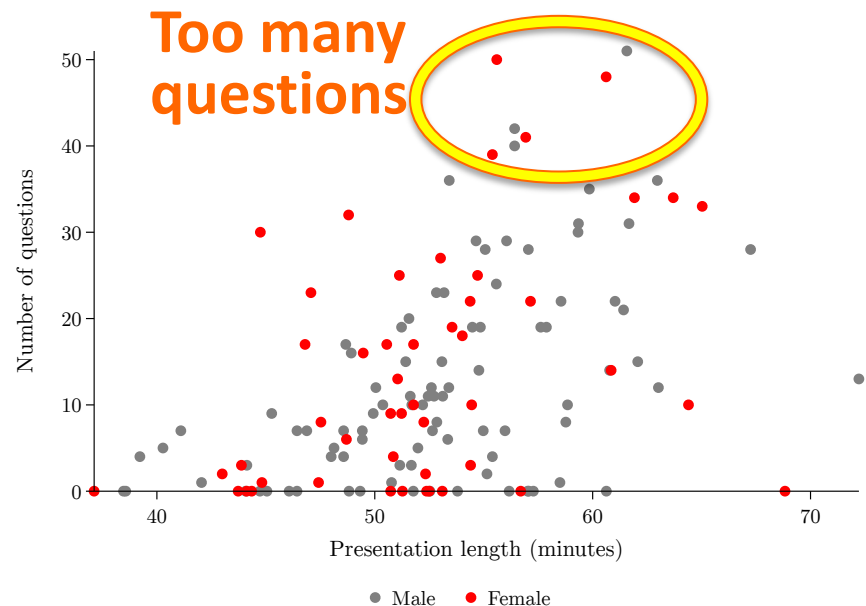
Introduction: “The only speaker at our biostatistics colloquium *who has had a swimsuit photo in Glamour Magazine!*”

Suggestions for Engineering Departments

- Standardize strongly positive introductions for all faculty candidates
- If questions get out of hand:
 - Ask audience to hold remaining questions for the end
 - Most natural for introducer to say this
 - But any faculty member in audience can step in



- **Engineering should have a less aggressive culture!**



Career Assessment Tools (CATs)

- CATs are questionnaires that attempt to ascertain a person's interests and aptitudes, and that suggest possible careers.
- Taken by 3000+ undergrads at UCSD each year

O*NET Interest Profiler



Progress:



1	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Build kitchen cabinets
2	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Lay brick or tile
3	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Develop a new medicine
4	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Study ways to reduce water pollution
5	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Write books or plays
6	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Play a musical instrument
7	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Teach an individual an exercise routine

Question: Do CATs suggest engineering as a career to women as much as they do to men?

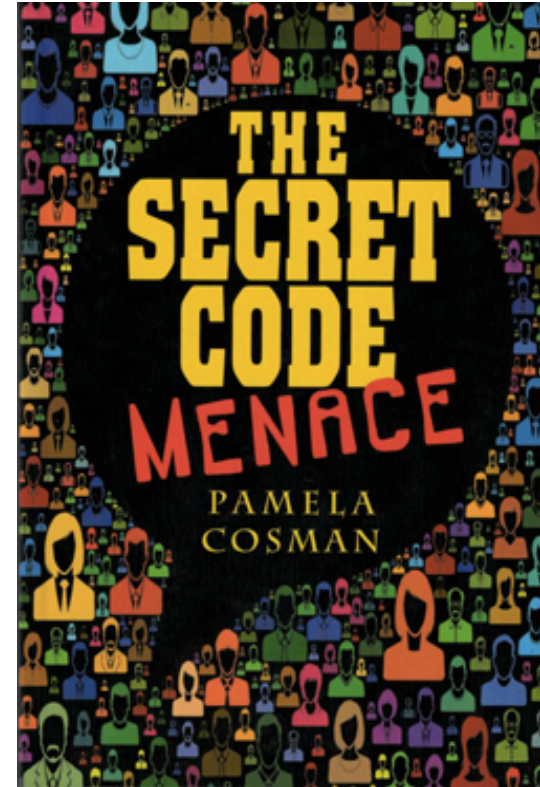
- 121 engineering students
 - 53% women, 18% underrepresented minorities (URM)

	O*Net	
	Male	Female
At least one engineering occupation recommended	66%	40%
Median rank 1st engr occupation recommended (top=1)	7	>20

- After controlling for GPA & satisfaction with major:
O*Net less likely to recommend Eng major to women

Outreach Projects

- Girl Scouts, Splash, school talks
- Children's book (ages 9-11) that teaches a little about Electrical Engineering (error correction coding) through fiction
- *My attempt at social engineering:*
Both lead characters = girls
- *Publisher's idea of social reality:*
Don't even think about it.



“Girls are willing to read about boys but boys are not willing to read about girls”

Delancey → Daniel

Some Assorted Recommendations

1. Do not say “Follow your passion”
 - Instead say “Nurture an interest”
2. Women: Never say “*I hated math... I could never understand it*”
 - Even if it’s true, don’t say it
 - Believing in difference can actually produce difference
 - Find something else to be self-deprecatory about
3. Men: Suggest item #2 to the women in your life
4. Encourage children to:
 - Draw
 - Work with their hands
 - Play games that involve fitting things into places
 - Play with construction toys

More Assorted Recommendations

5. Teach children that intellectual skills can be acquired
 - Praise children for *effort* not innate brilliance
 - Talented and gifted programs should send the message that they value growth and learning
6. Portray challenges, effort and mistakes as highly valued
7. Expose girls to successful role models
8. Encourage girls to join robotics clubs, Girls Who Code, math clubs, etc.
9. Pre-screen media regarding portrayals of women scientists

Last Thoughts

- The “Gender of Science” is a cultural construct that varies across
 - time
 - nations
 - socioeconomic levels
- When talking to scientists and engineers about sociology, data is important
- U.S. needs more computer scientists!
- Many things individuals can do to help