

SIAM DS 2019

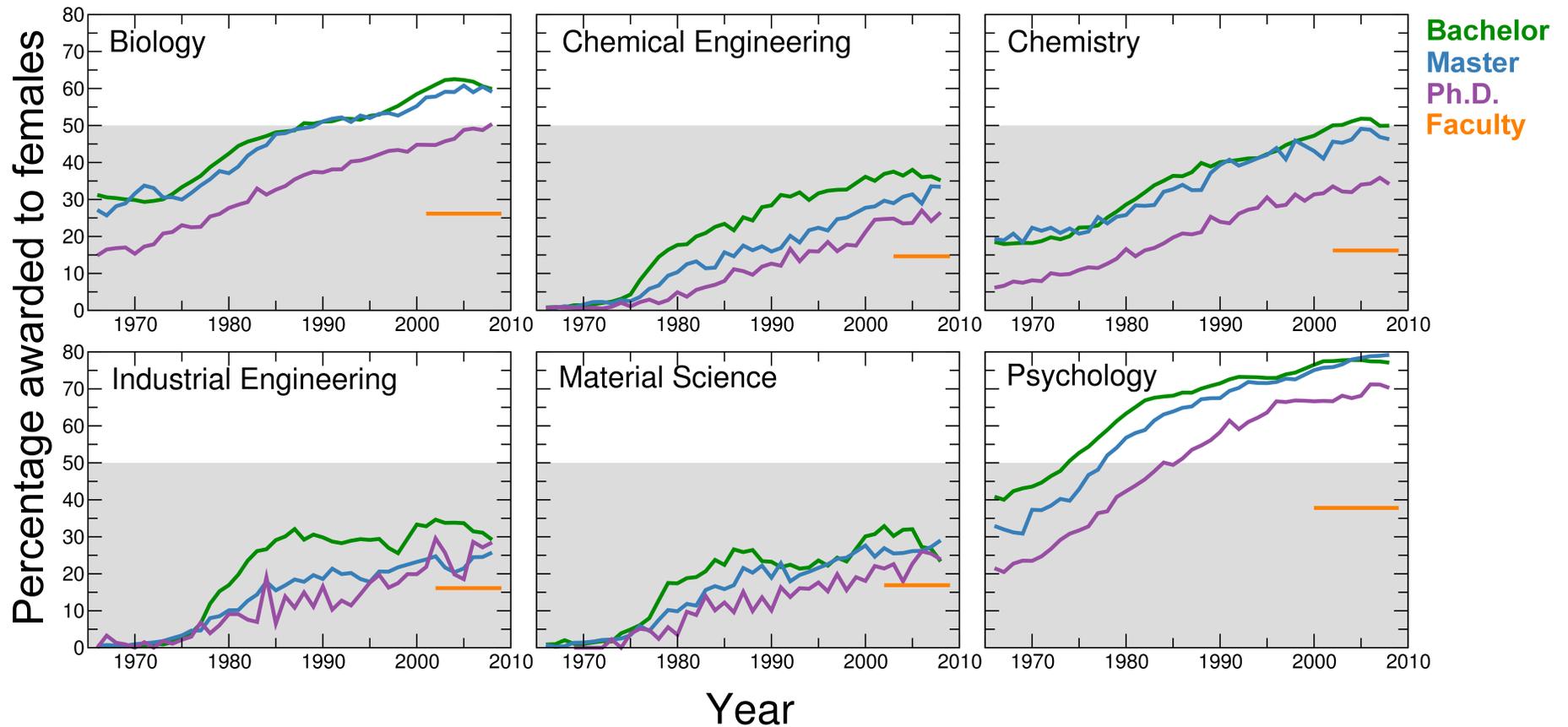
MS137 Modeling Female and Minority Representation in Society

LESSONS FROM A SYSTEMATIC CROSS-INDUSTRY EXPLORATION OF HISTORIC CHANGES IN FEMALE REPRESENTATION

Luís A. Nunes Amaral
Northwestern University

Northwestern | McCORMICK SCHOOL OF
ENGINEERING

Some trends in STEM



The background is a light gray gradient with several thin, white, intersecting lines that create a complex, web-like pattern. The lines are of varying lengths and orientations, some crossing each other to form small, irregular shapes.

WHAT IS GOING ON?

Women are not good at it

Larry Summers



Why women are poor at science, by Harvard president

The president of [Harvard University](#) has provoked a furore by arguing that men outperform women in maths and sciences because of biological difference, and discrimination is no longer a career barrier for female academics.

Larry Summers

A Harvard spokeswoman declined to comment yesterday, or to release the transcript of Dr Summers's remarks. Richard Freeman, who invited the Harvard president to speak at the conference, said Dr Summers's comments were intended to provoke debate, and some women over-reacted.

"Some people took offence because they were very sensitive," said Dr Freeman, an economist at Harvard and the London School of Economics. "It does not seem to me insane to think that men and women have biological differences."

During Dr Summers's presidency, the number of tenured jobs offered to women has fallen from 36% to 13%. Last year, only four of 32 tenured job openings were offered to women.

James Damore



Possible non-bias causes of the gender gap in tech³

At Google, we're regularly told that implicit (unconscious) and explicit biases are holding women back in tech and leadership. Of course, men and women experience bias, tech, and the workplace differently and we should be cognizant of this, but it's far from the whole story.

On average, men and women biologically differ in many ways. These differences aren't just socially constructed because:

- They're universal across human cultures
- They often have clear biological causes and links to prenatal testosterone
- Biological males that were castrated at birth and raised as females often still identify and act like males
- The underlying traits are highly heritable
- They're exactly what we would predict from an evolutionary psychology perspective

Note, I'm not saying that all men differ from all women in the following ways or that these differences are "just." I'm simply stating that the distribution of preferences and abilities of men and women differ in part due to biological causes and that these differences may explain why we don't see equal representation of women in tech and leadership. Many of these differences are small and there's significant overlap between men and women, so you can't say anything about an individual given these population level distributions.

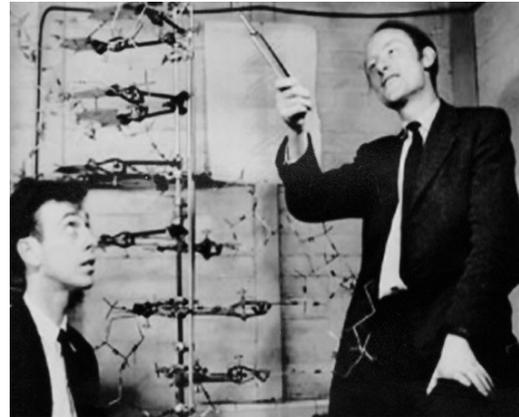
**Women are put off by
competitiveness and
meanness**

The House MD view of science



**Something about not
wearing makeup or smiling
more**

James Watson



DNA scientist James Watson has a remarkably long history of sexist, racist public comments

“People say it would be terrible if we made all girls pretty,” he said in 2003. “I think it would be great.”

By Julia Belluz | [@juliaoftoronto](#) | julia.belluz@voxmedia.com | Jan 15, 2019, 9:40am EST

The **FEBS**
Journal

Commentary |  [Free Access](#) |

Science, narcissism and the quest for visibility

Bruno Lemaitre



**CAN DATA HELP US
SELECT FROM AMONG
THESE HYPOTHESES?**

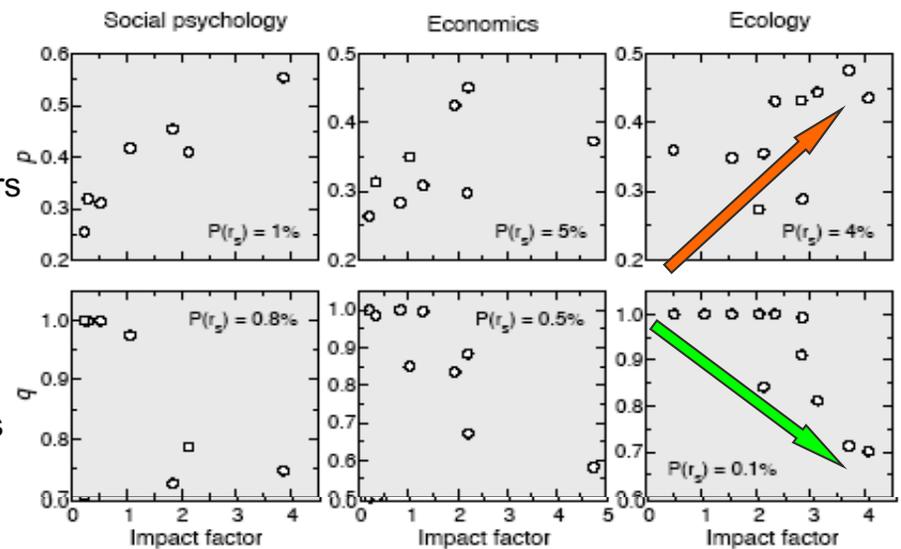
Role of collaboration

Team Assembly Mechanisms Determine Collaboration Network Structure and Team Performance

Roger Guimerà,^{1*} Brian Uzzi,^{2*} Jarrett Spiro,³
Luís A. Nunes Amaral^{1†}

Increasing
experience of
team members

Decreasing
probability of
repeating
collaborations



Role of mentorship

nature Vol 465|3 June 2010|doi:10.1038/nature09040

LETTERS

The role of mentorship in protégé performance

R. Dean Malmgren^{1,2}, Julio M. Ottino^{1,3} & Luís A. Nunes Amaral^{1,3,4}

k is total number of proteges from Math Genealogy

	k < 3	3 ≤ k < 10	K ≥ 10
1 st third of career	37% larger	---	29% larger
2 nd third of career	37% larger	---	---
3 rd third of career	37% larger	---	31% smaller

Role of bias

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OPEN ACCESS PEER-REVIEWED RESEARCH ARTICLE

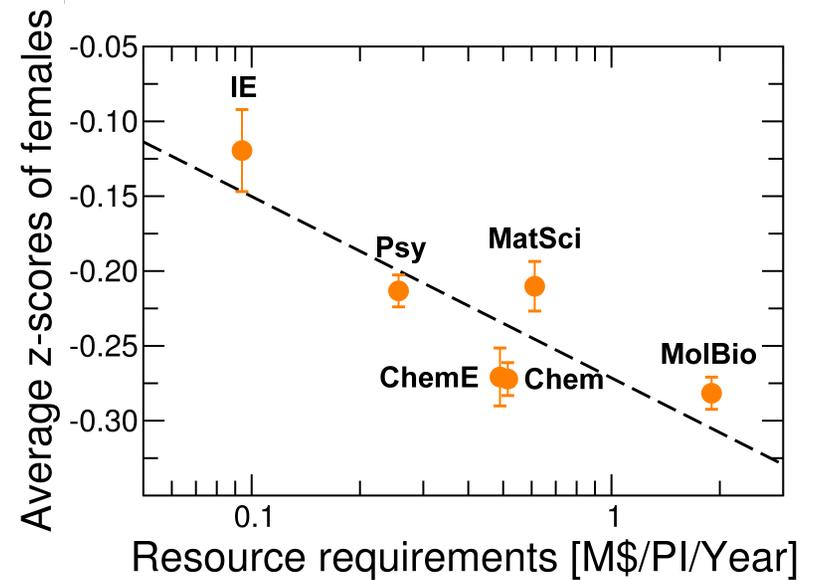
6,360	6	29	83
VIEWS	CITATIONS	SAVES	SHARES

The Possible Role of Resource Requirements and Academic Career-Choice Risk on Gender Differences in Publication Rate and Impact

Jordi Duch, Xiao Han T. Zeng, Marta Sales-Pardo, Filippo Radicchi, Shayna Otis, Teresa K. Woodruff, Luís A. Nunes Amaral

Published: December 12, 2012 • DOI: 10.1371/journal.pone.0051332

Average number of yearly publications
vs.
Resources



Role of bias

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OPEN ACCESS PEER-REVIEWED RESEARCH ARTICLE

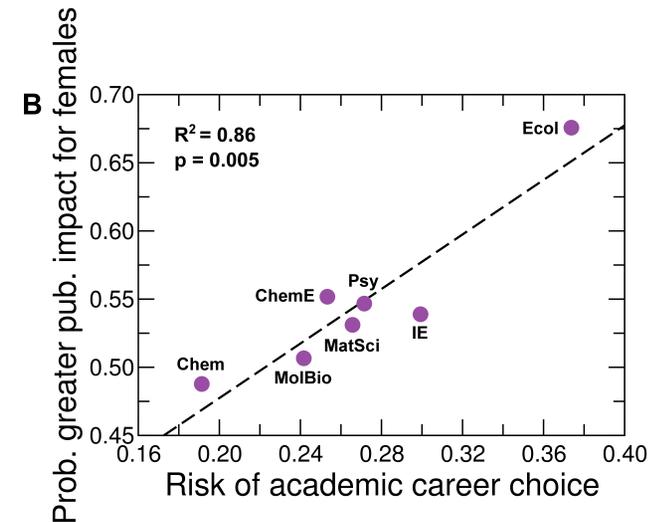
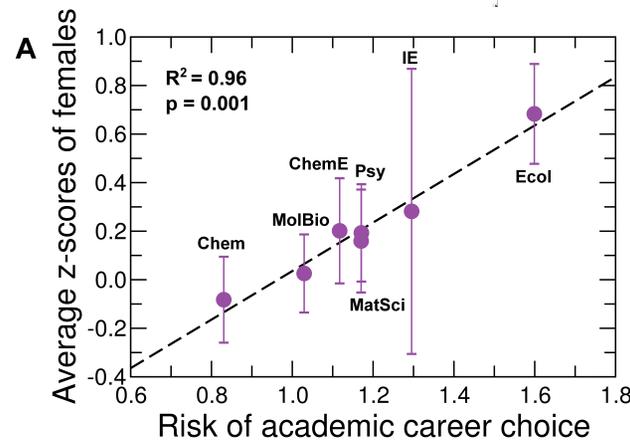
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Typical impact
vs.
Career risk



Possible non-bias causes of the gender gap in tech³

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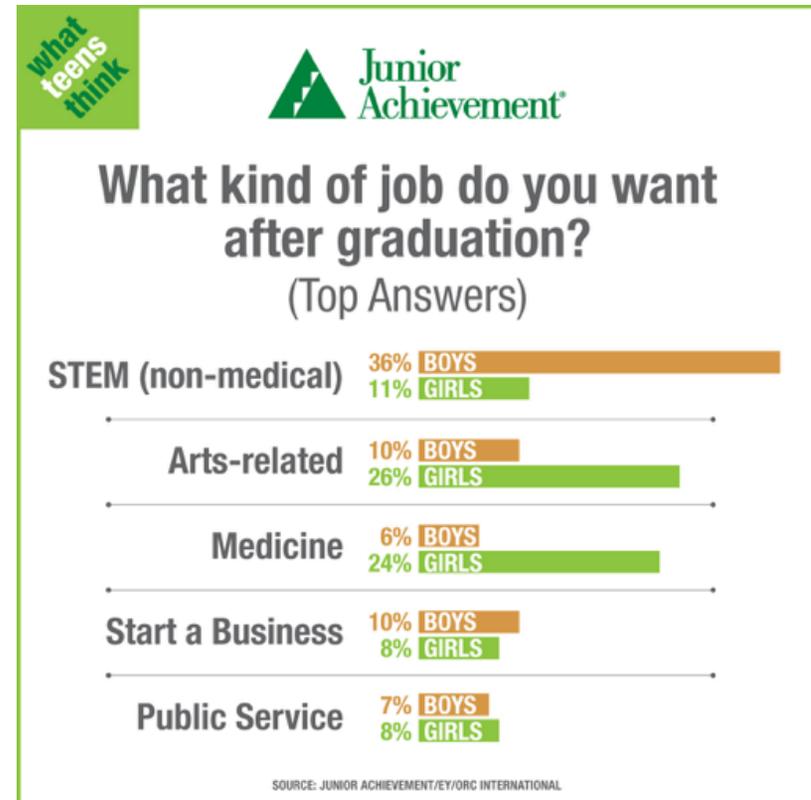
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**HOW TO DISENTANGLE
DIFF. ABILITIES AND
INTERESTS FROM
BIAS?**

Dream Jobs

New research conducted on behalf of Junior Achievement and EY shows that a surprising 91 percent of **teenage boys and girls ages 13-17** know what kind of job they want after they graduate from high school.



<https://janorthflorida.wordpress.com/2017/06/29/2017-teens-careers-survey-by-junior-achievement-usa/>

Who...



Is better at acting, has the greater range, has the most success, ..

Case for 50% females in movie casts

Women want to be in movies

Many women are recognized as extraordinary actors

No actor works 365 days/year on a movie

World is 50% female

Case against 50% females in movie casts

Movies makers do not want to tell stories about women

...

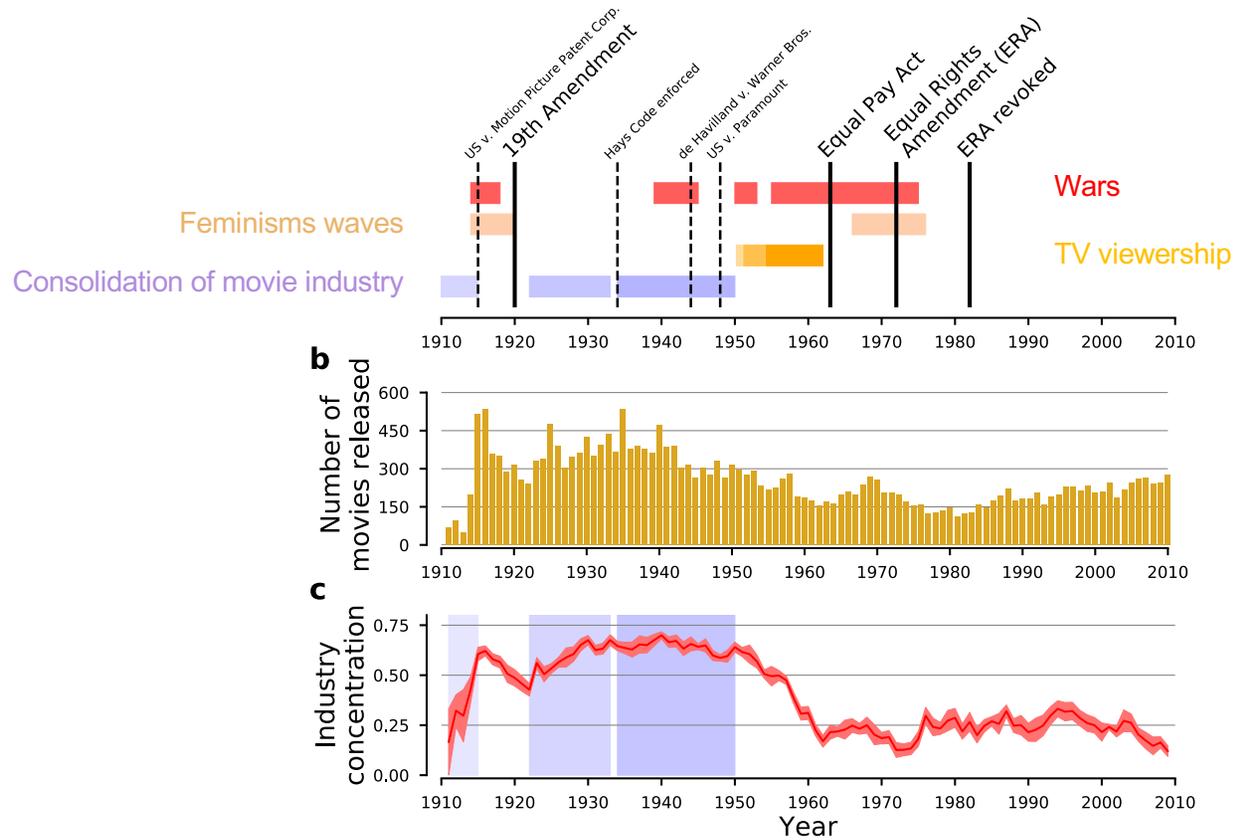
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Women are being discriminated against

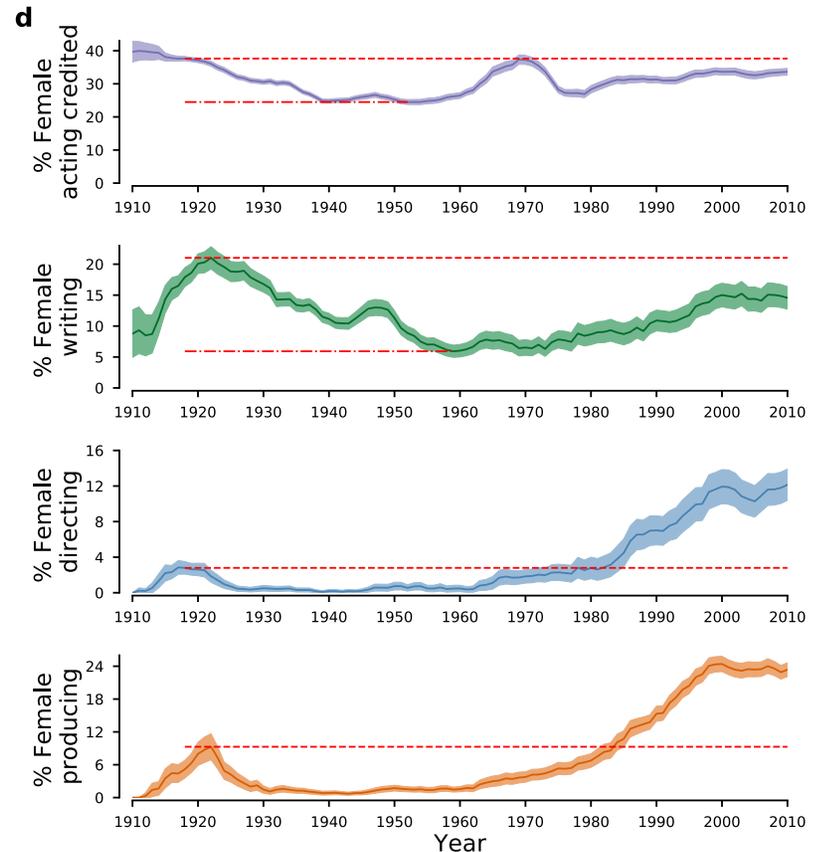
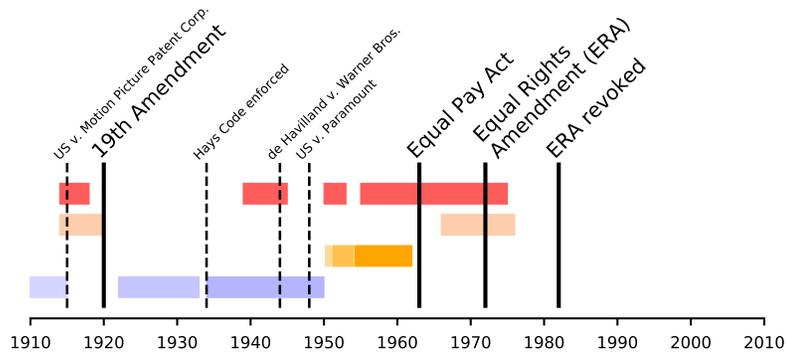
The background features a light gray gradient with several thin, white, intersecting lines that create a network-like or geometric pattern. The lines vary in orientation, some being nearly horizontal and others more diagonal or vertical.

LET THE DATA SPEAK

Hundred years at a snapshot



Female representation

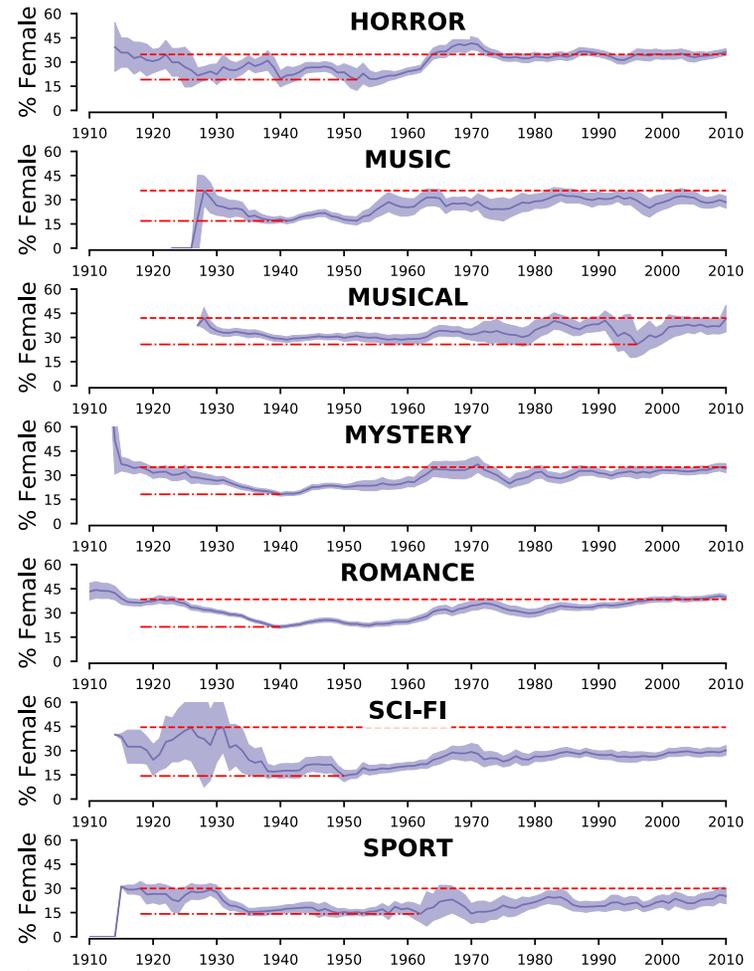
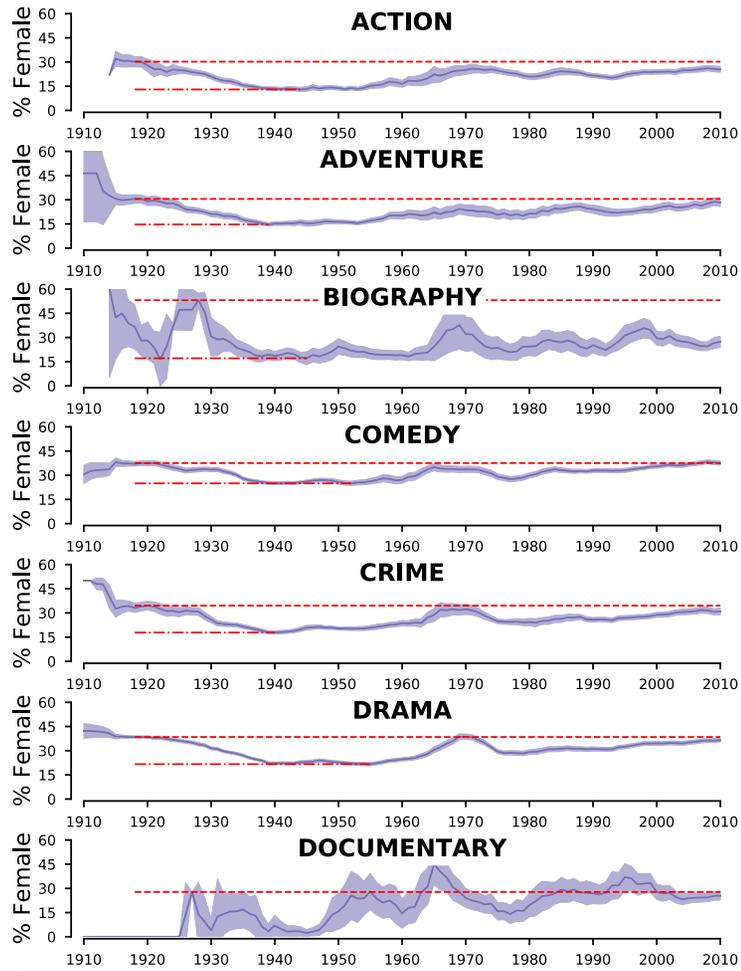


Acting

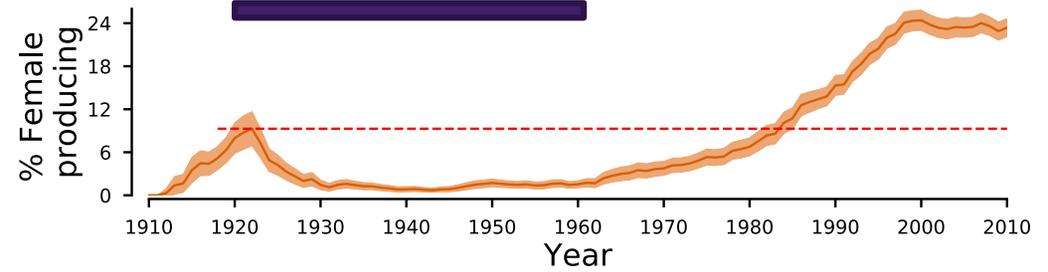
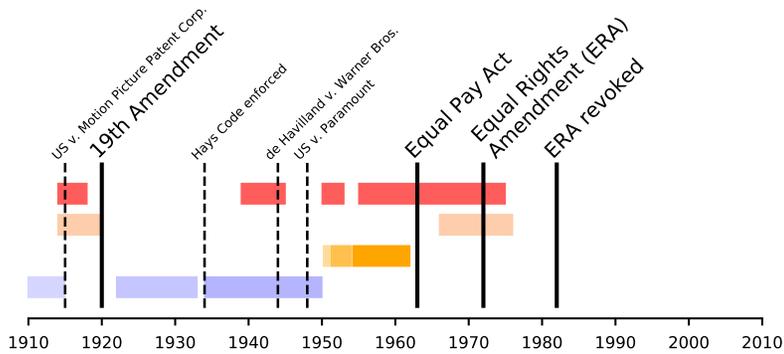
Writing

Directing

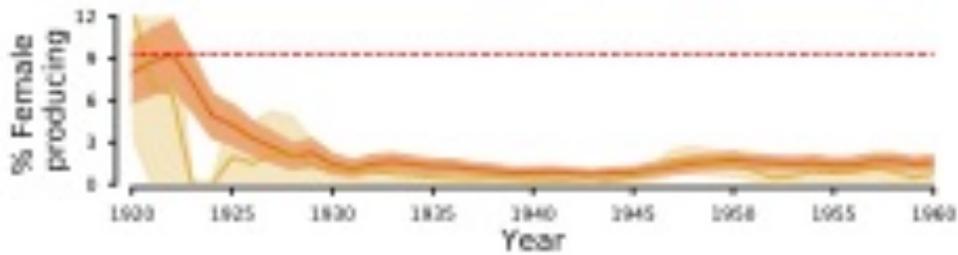
Producing



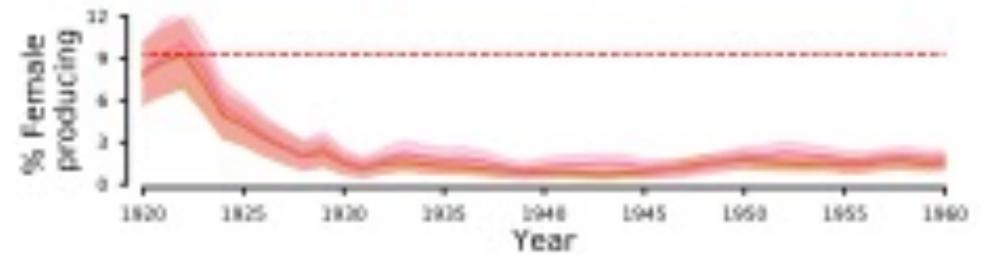
Producers



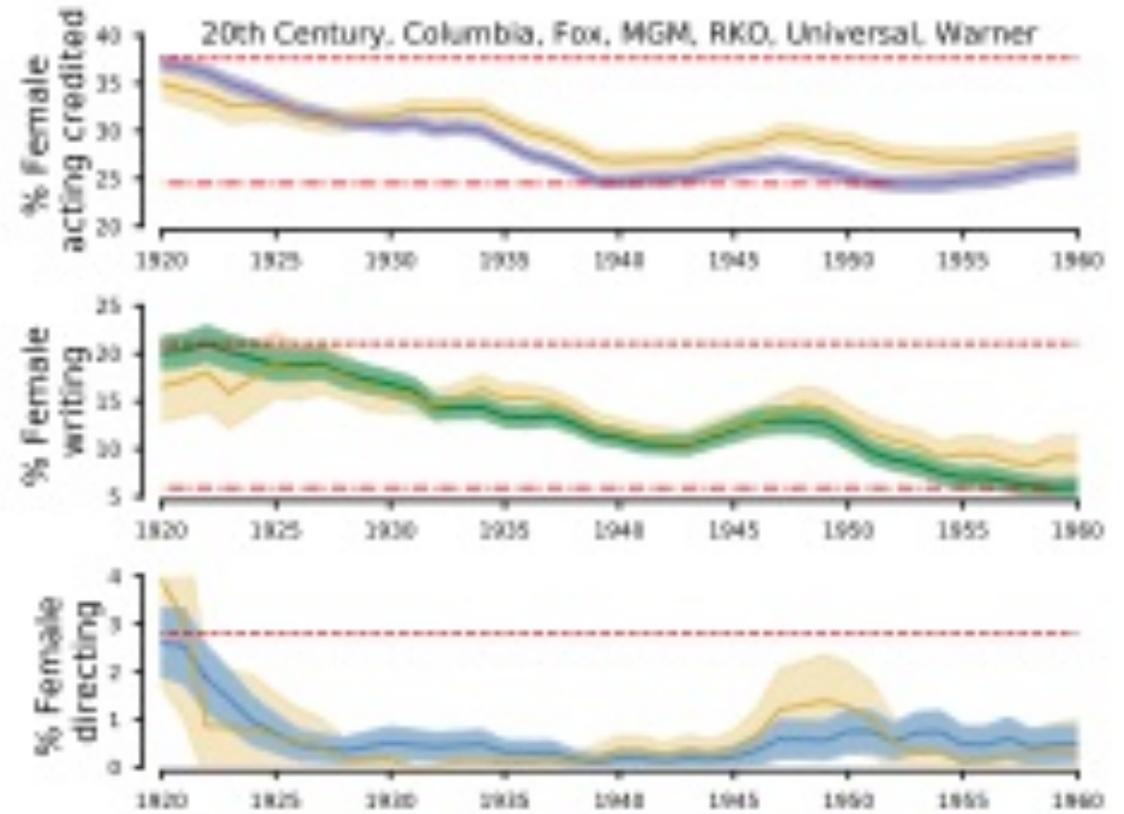
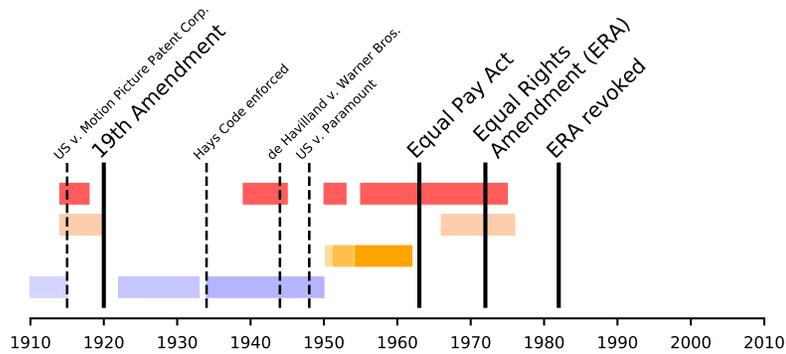
20th Century, Columbia, Fox, MGM, RKO, Universal, Warner



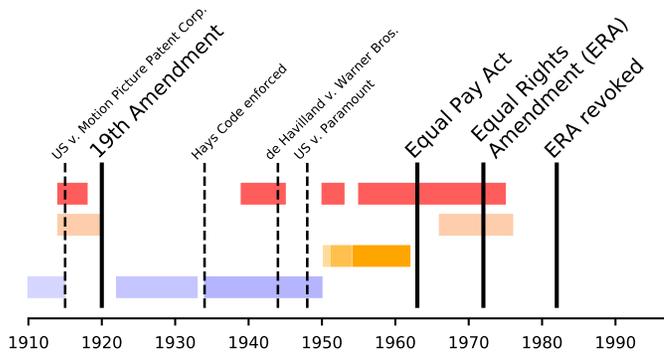
Independents



And other functions

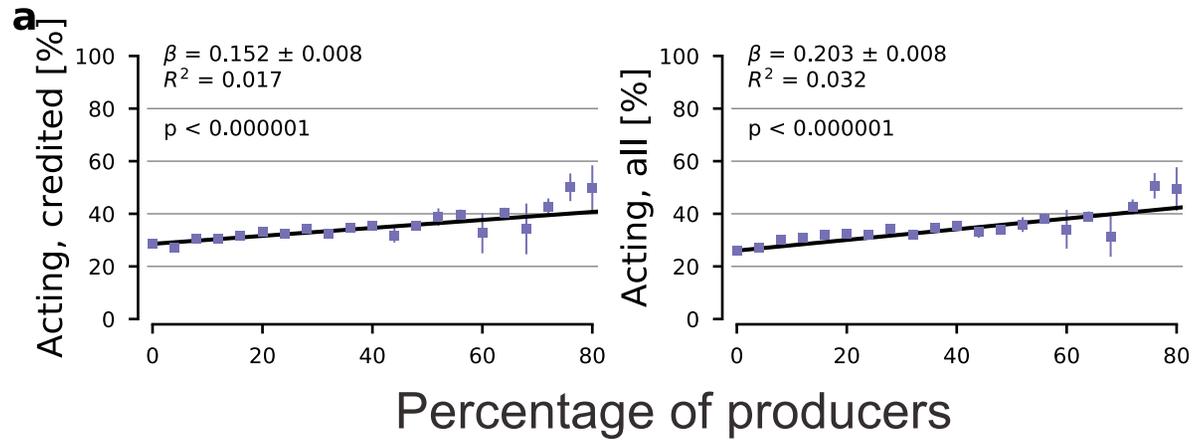
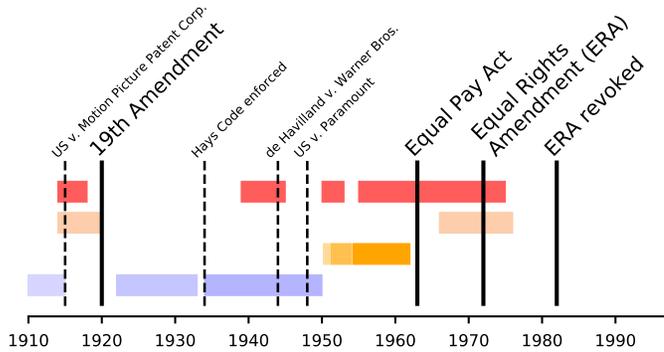


Impact of producers and directors

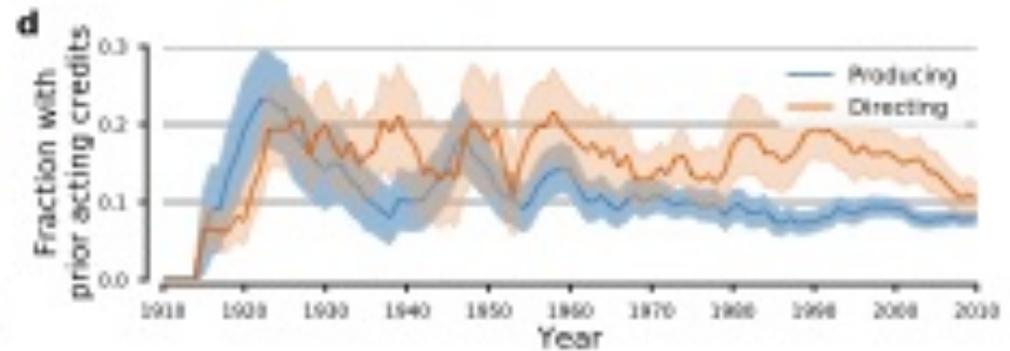
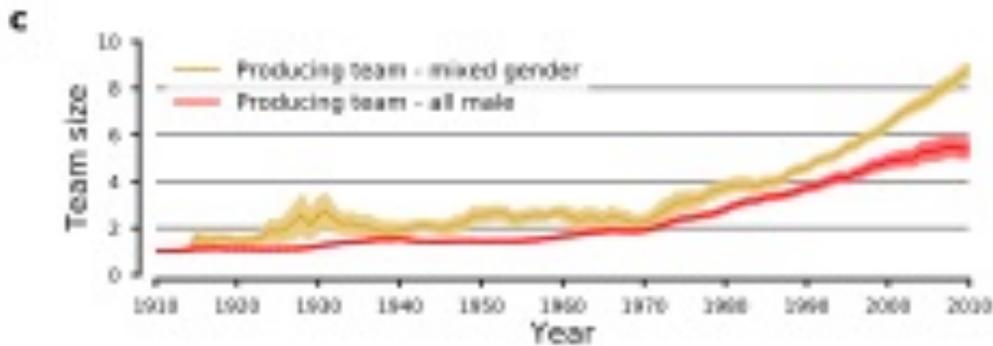
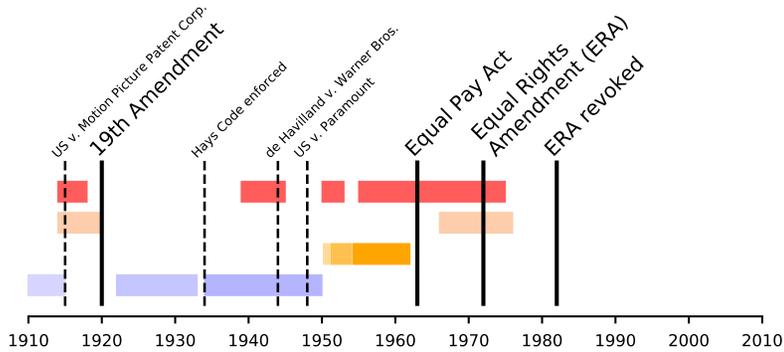


	Actors [All]		Actors [Credited]		Writers [†]	
	1920–1960	1960–2010	1920–1960	1960–2010	1920–1960	1960–2010
No. observations	10,796	9,668	10,796	9,668	277	3,848
adj- R^2	0.217	0.130	0.190	0.118	0.105	0.339
Intercept	25.0*** [24.4, 25.6]	29.7*** [29.0, 30.4]	27.9*** [27.2, 28.5]	30.2*** [29.5, 30.9]	10 [-1, 23]	5.6*** [3.2, 8.1]
% Producers	0.058*** [0.035, 0.081]	0.070*** [0.054, 0.085]	0.03 [0.01, 0.06]	0.065*** [0.048, 0.081]	0.1 [-0.1, 0.2]	0.19*** [0.15, 0.24]
% Directors	0.05 [0.01, 0.08]	0.080*** [0.067, 0.094]	0.0 [0.0, 0.1]	0.09*** [0.07, 0.10]	0.51*** [0.31, 0.71]	0.51*** [0.49, 0.54]
Action	-3.8*** [-4.6, -3.0]	-6.2*** [-7.2, -5.2]	-4.4*** [-5.3, -3.5]	-6.3*** [-7.3, -5.2]	-12 [-27, 2]	-3 [-6, 0]
Adventure	-3.6*** [-4.4, -2.8]	-5.1*** [-6.2, -4.0]	-4.0*** [-4.8, -3.1]	-5.3*** [-6.5, -4.1]	7 [-6, 21]	-1 [-4, 2]
Comedy	2.0*** [1.4, 2.6]	2.6*** [1.9, 3.3]	2.7*** [2.1, 3.4]	2.5*** [1.7, 3.2]	3 [-7, 13]	-1 [-3, 0]
Crime	-4.1*** [-4.8, -3.4]	-3.4*** [-4.4, -2.5]	-3.9*** [-4.6, -3.1]	-3.6*** [-4.6, -2.6]	0 [-12, 11]	-2 [-5, 0]
Drama	1.8*** [1.2, 2.3]	2.3*** [1.7, 3.0]	2.4*** [1.8, 3.1]	2.5*** [1.8, 3.2]	6 [-4, 16]	0 [-2, 2]

Impact of producers



Transitions from acting to producing





**THIS IS NOT A
UNIQUE CASE**

Computer Science

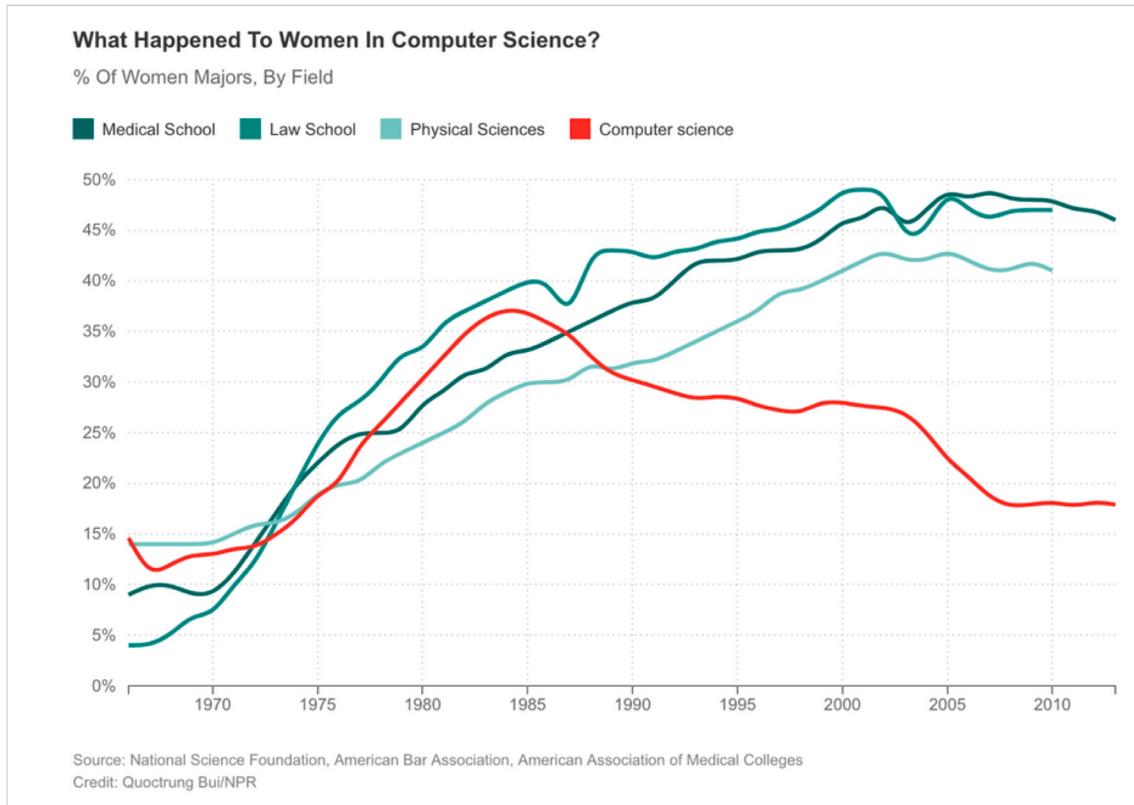
A Brief History of Women in Computing

Women invented the field. Then men pushed them out of it.

 Faruk Ateş [Follow](#)
Aug 9, 2017 · 7 min read



Computer Science



English fiction writing

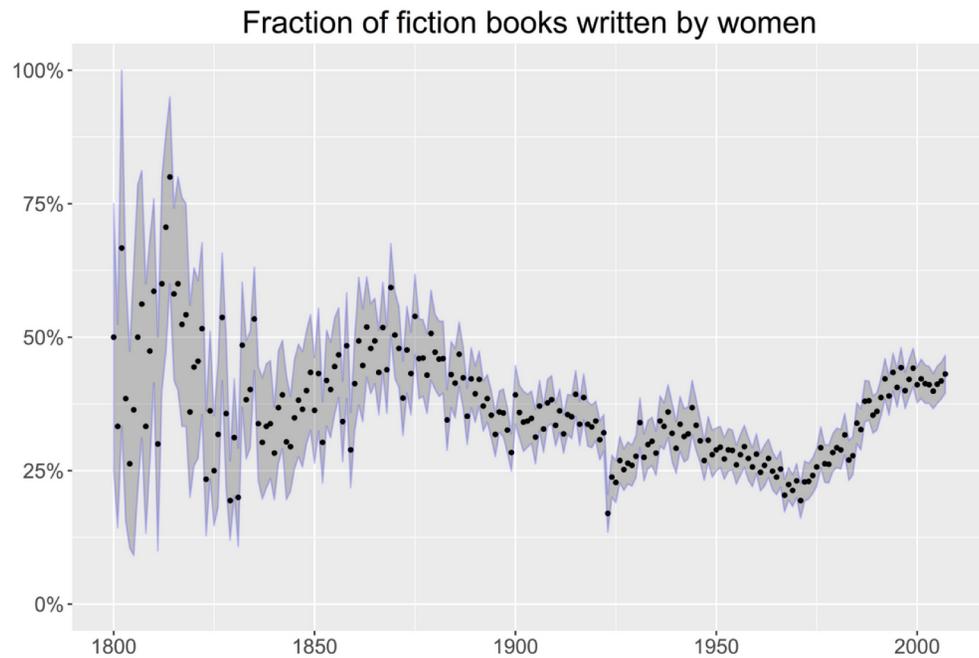


Figure 2. The fraction of English-language volumes of fiction in HathiTrust written by women. Dots are the fraction actually recorded for a given year of publication; the shaded area represents a 95% confidence band calculated by bootstrap resampling.



<http://culturalanalytics.org/2018/02/the-transformation-of-gender-in-english-language-fiction/>

Midwifery

Beginning in the early 1800s, middle-class families started using doctors for childbirth.

As anesthesia became more widely used towards the end of the 1800s and early 1900s, delivery began shifting to hospitals.

By 1900, physicians were attending about half of the nation's births. Midwives were only used for those who could not afford a doctor.

<https://www.registerednursing.org/answers/history-midwifery/>

Lessons

Research suggests that periods in which an industry grows in importance, with increasing financial rewards, and with greater consolidation, are particularly susceptible to collapses of diversity.

And to History being re-written.

Discrimination is still real and ongoing

The background features several thin, light gray lines forming geometric shapes. There are two large, irregular shapes that resemble stylized brackets or frames, one positioned above and one below the central text. Additionally, there are several diagonal lines extending from the corners towards the center of the page.

THANK YOU!