Disclaimers:
1. Math is my field.
2. There is emphasis in women because this is the group I know better. Many of the statements apply to other underrepresented groups (for instance, African American, LGTB, Latinos, …)

Some reasons why there is little diversity in math and some ideas to change this

- References to the articles mentioned here can be found at the end of these slides.
- This (always evolving) talk is posted in my website.
- Please send me any comment, suggestion, criticism, and relevant material, specially, anything that you found useful.
Undergraduate math majors: 43% are women

New PhDs in math: 28% are women

Postdocs in math: 21% are women

Tenured math faculty at PhD-granting universities: 12% are women

AMS prizes awarded at JMM 2014: 0% given to women

From AWM President Ruth Charney’s column in the Sept-Oct 2014 AWM Newsletter.
Why?
After her husband death, in 1710, Maria Winckelmann Kirch asked the Royal Berlin Academy of Sciences if she could fill her husband's position as Royal Astronomer (she had been doing the job herself since her husband became ill). The Academy refused.

In 1870, Sofia Kovalevskaya took private lessons with Karl Weierstrass, since the university would not even allow her to audit classes.
Why there is very little diversity in math?

Models, explanations, ideas.

- Gender schemas (Stereotypes)
- Implicit bias (self and from outside)
- Lack of role models (a vicious circle)
- Negative messages (expectations of brilliance..)
- Lack of mentors
- “Equal calls equal”
- Impostor feeling
- Isolation, feeling of not belonging.
- Accumulation of disadvantage.
- “Invisibility” of women
- Tendency to believe that “what it is is what ought to be.”
- Variability hypothesis???????
THE NOT SO DISTANT PAST

SOJOURNER TRUTH
<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>1893</td>
<td>New Zealand</td>
</tr>
<tr>
<td>1902</td>
<td>Australia (except aboriginal)</td>
</tr>
<tr>
<td>1906</td>
<td>Finland</td>
</tr>
<tr>
<td>1913</td>
<td>Norway</td>
</tr>
<tr>
<td>1915</td>
<td>Denmark</td>
</tr>
<tr>
<td>1917</td>
<td>Canada (except Indian)</td>
</tr>
<tr>
<td>1918</td>
<td>Austria, Germany, Poland, Russia</td>
</tr>
<tr>
<td>1919</td>
<td>Netherlands</td>
</tr>
<tr>
<td>1920</td>
<td>United States (with exceptions. Voting rights act in 1965)</td>
</tr>
<tr>
<td>1921</td>
<td>Sweden</td>
</tr>
<tr>
<td>1928</td>
<td>Britain, Ireland</td>
</tr>
<tr>
<td>1930</td>
<td>South Africa (except black people, until 1994)</td>
</tr>
<tr>
<td>1931</td>
<td>Spain</td>
</tr>
<tr>
<td>1934</td>
<td>Turkey</td>
</tr>
<tr>
<td>1944</td>
<td>France</td>
</tr>
<tr>
<td>1945</td>
<td>Italy</td>
</tr>
<tr>
<td>1947</td>
<td>Argentina, Japan, Mexico, Pakistan</td>
</tr>
<tr>
<td>1949</td>
<td>China</td>
</tr>
<tr>
<td>1950</td>
<td>India</td>
</tr>
<tr>
<td>1954</td>
<td>Colombia</td>
</tr>
<tr>
<td>1957</td>
<td>Malaysia, Zimbabwe</td>
</tr>
<tr>
<td>1962</td>
<td>Algeria</td>
</tr>
<tr>
<td>1963</td>
<td>Iran, Morocco</td>
</tr>
<tr>
<td>1964</td>
<td>Libya</td>
</tr>
<tr>
<td>1967</td>
<td>Ecuador</td>
</tr>
<tr>
<td>1971</td>
<td>Switzerland</td>
</tr>
<tr>
<td>1972</td>
<td>Bangladesh</td>
</tr>
<tr>
<td>1974</td>
<td>Jordan</td>
</tr>
<tr>
<td>1976</td>
<td>Portugal</td>
</tr>
<tr>
<td>1989</td>
<td>Namibia</td>
</tr>
<tr>
<td>1990</td>
<td>Western Samoa</td>
</tr>
<tr>
<td>1993</td>
<td>Kazakhstan, Moldova</td>
</tr>
<tr>
<td>2005</td>
<td>Kuwait</td>
</tr>
<tr>
<td>2006</td>
<td>United Arab Emirates</td>
</tr>
<tr>
<td>2011</td>
<td>Saudi Arabia</td>
</tr>
</tbody>
</table>
A (male) look at the women’s suffrage movement.

Down with man!
Husbands for old maids!

At the suffragette meetings you can hear some plain things—and see them too!
<table>
<thead>
<tr>
<th>Role</th>
<th>Description</th>
<th>Gender Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>Courtesan</td>
<td>a woman who attends a royal court as a companion or adviser to the king or queen.</td>
<td>Courtier</td>
</tr>
<tr>
<td>Courtier</td>
<td>a prostitute, especially one with wealthy or upper-class clients.</td>
<td></td>
</tr>
<tr>
<td>Mistress</td>
<td>a woman in a position of authority or control.</td>
<td>Master</td>
</tr>
<tr>
<td>Master</td>
<td>a woman having an extramarital sexual relationship, especially with a married man.</td>
<td></td>
</tr>
<tr>
<td>Governess</td>
<td>a woman employed to teach children in a private household.</td>
<td>Governor</td>
</tr>
</tbody>
</table>
Searching for an illustration that would help me put things in perspective, went to google images once more.

The conclusion seems to be the that humans evolved to be white and male… does this mean that some of us do not exist?…..
1924:
Most men ask "Is she pretty?" not "Is she clever?"

Contributions to the accumulation of disadvantage.

Most men ask
"Is she pretty?"
not "Is she clever?"

Freshness, Charm—the Enchantment of a Skin More Precious than Personality or Cleverness—do you seek it? Then for One Week Follow this Simple Beauty Method which is Bringing it to Thousands

Often we marveled at her—the girl whose only asset is her beauty. She knows so little and says so little; yet seemingly attracts everyone to her side. Too often her clever rival sits in a corner, alone.

Brains or beauty?—but why choose? Combine beauty with cleverness, charm with wisdom. Develop your beauty to bring out the sweetness of your personality. That’s what thousands of girls have done—and found new happiness as a result.

The means are simple. Have a pretty skin—remember, you can, if you try. Daily beauty treatments are unnecessary—just daily use of palm and olive oils as embodied in Palmolive.

It is worth trying for this charm thousands have, the clear, fresh skin you want—do this one week, then note the change.

Use powder and rouge if you wish. But never leave them on over night. They clog the pores, often enlarge them. Blackheads and disfigurements often follow. They must be washed away.

Wash your face with soothing Palmolive. Then massage softly into the skin. Rinse thoroughly. Then repeat both washing and rinsing. Apply a touch of cold cream—that is all. Do this regularly, and particularly in the evening.

Thus, in a simple manner, millions since the days of Cleopatra have found beauty, charm and youth prolonged.

No medications are necessary. Just remove the day’s accumulations of dirt and oil and perspiration, cleanse the pores, and Nature will be kind to you. Your skin will be of fine texture. Your color will be good. Wrinkles will not be your problem as the years advance.

Avoid this mistake
Do not use ordinary soaps in the treatment given above. Do not think any green soap, represented as made of palm and olive oils, is the same as Palmolive. Palmolive is a skin emollient in soap form.

And it costs but ten the cake!—so little that millions let it do for their bodies what it does for their faces. Obtain a cake today. Then note what an amazing difference one week makes.

Palm and olive oils—nothing else—give nature’s own skin to Palmolive Soap.
Contributions to the accumulation of disadvantage.

1939

BEAUTIFUL BUT DUMB

1952

Just 1 minute, Young Lady!

We overheard that plaint … ‘If my hair looks such a mess *one more* night, I’ll kill myself!’”
Contributions to the accumulation of disadvantage.

If your husband ever finds out

you’re not “store-testing” for fresher coffee…

…if he discovers you’re still taking chances
on getting flat, stale coffee
…woe be unto you!

For today
there’s a sure
and certain way
to test for freshness
before you buy

1952
This mother’s day,
Get back to the job
That really matters.
Contributions to the accumulation of disadvantage.
Contributions to the accumulation of disadvantage.

1970

SIMPLE ENOUGH FOR A WOMAN TO DRIVE. PHEW.

The Mini Automatic. For simple driving.

2008

Used BMW’s
You know you are not the first.
But do you really care?
Bechdel–Wallace test

To pass the test, a movie, TV show (video game, comic..), must:

1. have at least two women in it,
2. who talk to each other,
3. about something other than a man

Variation: two ethnic minorities talk to each other for more than five minutes about something other than race
You dad will have to chase the boys away when you are older.

You’d be really pretty if you just made an effort.

You won’t like that job; you’ll have to be focused on technology.

You won’t like that job; you’ll have to be focused on technology.

You’d be much prettier if you smile.

Can’t you take a joke?

"Nice [insert objectified body part here]."

"Your body/clothing/appearance is 'distracting.'"

You’d be much prettier if you smile.

"You’ll want kids one day."

"You’re such a bitch."

He picks on you because she likes you.

Is it that time of the month?

"Calm down."

Can women have it all?

You must have been beautiful when you were younger.

Can’t you take a joke? You’re bossy.

You’re bossy.

Don’t wear that to school you are going to distract the boys.

Contribution to the accumulation of disadvantage.
On the Physiological Feeble-Mindedness of Woman, P.J. Möbius Published in 1900, by 1906, eight editions had appeared.

(Irrelevant Coincidence: P.J. Möbius was the grandson of Augustus Möbius Band.)
While preparing a talk, I wanted to emphasize an idea. I searched in Google for the classical cartoon with a person and floating lightbulb. Human beings in “idea clipart” are male with one exception and white, with no exceptions.
In the last 12 years,
- **women** made up, on average, 24% of the bench,
- 32% of interruptions were **of** the female justices,
- 4% were **by** the female justices.

<table>
<thead>
<tr>
<th>Year</th>
<th>% Women</th>
<th>%interrup. to all women</th>
<th>%interrup. to each woman</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>11.11%</td>
<td>35.70%</td>
<td>35.70%</td>
</tr>
<tr>
<td>2002</td>
<td>22.22%</td>
<td>45.30%</td>
<td>22.65%</td>
</tr>
<tr>
<td>2015</td>
<td>33.33%</td>
<td>65.90%</td>
<td>21.97%</td>
</tr>
</tbody>
</table>

Jacobi and Schweers, 2017
..don’t forget that Ginger Rogers did everything Fred Astaire did, ...backwards and in high heels.”
THE STATUS QUO IN MATH
A princess lives in a row of seventeen adjacent rooms, each connected by a door to each room next to it. Each room also has a door to the outside. The princess enjoys the rooms but never stays in the same room two days in a row: at the end of each day she moves from the room she occupied to one of the rooms next to it (she chooses randomly).

On the first of June a prince arrives from a faraway kingdom to woo the princess. The princess’s guardian explains the habits of the princess and the rules he must follow: Each day he may knock on a single outside door. If the princess is behind it she will open it and meet the prince. If not, the prince gets another chance the next day. Unfortunately the prince must return to his kingdom on July 1. Can he devise a strategy to make sure he meets the princess before then?
“Math class is tough. Want to go shopping? Okay, meet me at the mall.

Issues that contribute to the accumulation of disadvantage.
Aphorism attributed to mathematician Hermann Weyl

There are only two females in the history of math, Sofia Kovalevskaya and Emmy Noether:

the former wasn’t a mathematician, the latter wasn’t a woman.
G. H. Hardy, 1940, A Mathematician’s Apology,

No mathematician should ever allow himself to forget that **mathematics**, more than any other art or science, is a young **man’s** game.
Marilyn vos Savant is a magazine columnist (with the highest recorded IQ according to the Guinness Book of Records). She writes a column where she solves puzzles and answers questions on various subjects. The most famous of them was the Monty Hall problem.

On a game show, you're given the choice of three doors:

Behind one door is a car; behind the other two, goats. You pick a door, say No. 1, and the host, who knows what's behind the doors, opens another door, say No. 3, which has a goat. Then the host says to you, "Do you want to pick door No. 2?" Is it to your advantage to switch your choice?
Since you seem to enjoy coming straight to the point, I’ll do the same. You blew it!

MAYBE WOMEN LOOK AT MATH PROBLEMS DIFFERENTLY THAN MEN.

You are the goat!

I am sure you will receive many letters on this topic from high school and college students. Perhaps you should keep a few addresses for help with future columns.

I am in shock that after being corrected by at least three mathematicians, you still do not see your mistake.

You are utterly incorrect about the game show question, .... How many irate mathematicians are needed to get you to change your mind?

"Our math department had a good, self-righteous laugh at your expense,"

MAY I SUGGEST THAT YOU OBTAIN AND REFER TO A STANDARD TEXTBOOK ON PROBABILITY BEFORE YOU TRY TO ANSWER A QUESTION OF THIS TYPE AGAIN?

You blew it, and you blew it big! Since you seem to have difficulty grasping the basic principle at work here, I’ll explain. There is enough mathematical illiteracy in this country, and we don’t need the world’s highest IQ propagating more. Shame!

This is a call to math classes all across the country. Set up a probability trial exactly as outlined below and send me a chart of all the games
Play "not switching" two hundred times and keep track of how often the contestant wins.
Play "switching" two hundred times
Faculty and grad students body in some top math departments
(Data from 2015 AMS website)

<table>
<thead>
<tr>
<th></th>
<th>% of female grad students</th>
<th>% tenured women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvard</td>
<td>9.1</td>
<td>5.6</td>
</tr>
<tr>
<td>Brown</td>
<td>32.6</td>
<td>5.6</td>
</tr>
<tr>
<td>MIT</td>
<td>17.8</td>
<td>7.9</td>
</tr>
<tr>
<td>Yale</td>
<td>10.7</td>
<td>9.1</td>
</tr>
<tr>
<td>Chicago</td>
<td>27.8</td>
<td>9.4</td>
</tr>
<tr>
<td>Princeton</td>
<td>28.6</td>
<td>10.0</td>
</tr>
<tr>
<td>Cornell</td>
<td>28.1</td>
<td>10.3</td>
</tr>
<tr>
<td>Stony Brook</td>
<td>11.3</td>
<td>11.4</td>
</tr>
<tr>
<td>CalTech</td>
<td>12.5</td>
<td>11.8</td>
</tr>
<tr>
<td>UUIC</td>
<td>35.1</td>
<td>11.9</td>
</tr>
<tr>
<td>Texas-Austin</td>
<td>36.5</td>
<td>13.3</td>
</tr>
<tr>
<td>Michigan</td>
<td>29.4</td>
<td>16.9</td>
</tr>
</tbody>
</table>
### Stony Brook Math Department Composition in 2015

<table>
<thead>
<tr>
<th>Origin</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>16</td>
<td>45.7</td>
</tr>
<tr>
<td>Russia</td>
<td>8</td>
<td>22.9</td>
</tr>
<tr>
<td>British</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>China</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Israel</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Argentina</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Germany</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Netherlands</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Romania</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Italy</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
In 2014-2015, 1214 Ph.D.s in pure math were granted in the US. 26% of those were granted to women.
All Math Ph.D’s in 2015 (including statistics, biostatistics)

<table>
<thead>
<tr>
<th></th>
<th>US+Perm.</th>
<th></th>
<th></th>
<th>Non-US</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Male</td>
<td>Fem</td>
<td>Total</td>
<td>Male</td>
<td>Fem</td>
<td>Total</td>
</tr>
<tr>
<td>Am Ind/Alas</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Asian</td>
<td>107</td>
<td>56</td>
<td>51</td>
<td>711</td>
<td>459</td>
<td>252</td>
<td>818</td>
</tr>
<tr>
<td>Bl/Afr Am</td>
<td>24</td>
<td>13</td>
<td>11</td>
<td>15</td>
<td>11</td>
<td>4</td>
<td>39</td>
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<tr>
<td>Hisp/Lat</td>
<td>32</td>
<td>22</td>
<td>10</td>
<td>38</td>
<td>30</td>
<td>8</td>
<td>70</td>
</tr>
<tr>
<td>Haw/Pac Is</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>White</td>
<td>763</td>
<td>557</td>
<td>206</td>
<td>160</td>
<td>126</td>
<td>34</td>
<td>923</td>
</tr>
<tr>
<td>Unknown</td>
<td>19</td>
<td>15</td>
<td>4</td>
<td>15</td>
<td>8</td>
<td>7</td>
<td>34</td>
</tr>
<tr>
<td>TOTAL</td>
<td>955</td>
<td>672</td>
<td>283</td>
<td>946</td>
<td>638</td>
<td>308</td>
<td>1901</td>
</tr>
</tbody>
</table>
All Math Ph.D’s in 2015 (including statistics, biostatistics)
Imposter Syndrome or Feeling

Two American psychologists, Pauline Clance and Suzanne Imes, coined the term in 1978.

They described it as a feeling of “phoniness in people who believe that they are not intelligent, capable or creative despite evidence of high achievement.” While these people “are highly motivated to achieve,” they also “live in fear of being ‘found out’ or exposed as frauds.”

Two issues are sometimes merged under the impostor feeling umbrella: “feeling like a fraud” and “being treated like a fraud.”
Implicit bias

- Implicit bias manifests in expectations or assumptions about physical or social characteristics dictated by stereotypes that are based on a person’s race, gender, age, or ethnicity.

- People who intend to be fair, and believe they are egalitarian, apply biases unintentionally.

- Some behaviors that result from implicit bias (…) can either can reduce the quality of the workforce or create an unfair and destructive environment.

Jo Handelsman and Natasha Sakraney
(President Obama’s) White House Office of Science and Technology Policy
• (…) men and women [in academia] start out on roughly equal footing.

• (…) several years down the line, the men are earning more, and they are being promoted at a faster rate than the women are.

• (…) in a group of people with outstanding early promise, will the men and women advance equally in academia? (.. ) After 10 to 12 years, the men were almost a full rank ahead of the women.
(...), men in academia publish more than women do. Even when you control for productivity, men still advance more rapidly than women do.

- Although **men publish comparatively more papers, women's papers have a higher citation rate**

Virginia Valian, 1998
SEXUAL HARASSMENT
Is it sexual harassment?  
How would you proceed?

- You (a grad student) are in a conference. A senior person approaches you and starts talking about the talk you both just attended. You listen attentively, asking an occasional question. The senior person looks at you in the eyes and caresses your shoulder.

- You (a grad student) are in a conference. Along the whole weekend, a senior person sits at your side in every talk and constantly fixates eyes on you.

- You (a grad student) receive insistent offers of intimate nature from a senior person.
Sexual harassment includes:

• Unwelcome sexual advances.
• Unwanted touching or physical contact.
• Verbal harassment of a sexual nature, including jokes referring to sexual acts or sexual orientation.
• Discussing sexual relations/stories/fantasies at work, school, or in other inappropriate places.
• Unwanted sexually explicit photos, emails, or text messages.
• Requests for sexual favors.
• Making conditions of employment or advancement dependent on sexual favors, either explicitly or implicitly.
• Pressure to engage with someone sexually.
• Exposing oneself or performing sexual acts on oneself.
• Physical acts of sexual assault.

Inspired on an article of RAINN (Rape, Abuse & Incest National Network)
Both women and men can and do experience all three forms of sexual harassment, but some subgroups face higher rates than others (e.g. LGTB, POC).
Sexual harassment in academia

Academic workplaces are second only to the military in the rate of sexual harassment, with 58 percent of academic employees indicating they had such experiences, according to one study cited in the report.

“There is no evidence to suggest that current policies, procedures, and approaches have resulted in a significant reduction in sexual harassment,”

NYTimes-June 12, 2018 about Nacional Academies for Sciences, Engineering and Medicine
Sexual harassment undermines women’s professional and educational attainment and mental and physical health.

“The cumulative effect of sexual harassment is significant damage to research integrity and a costly loss of talent in academic sciences, engineering, and medicine.”
gender harassment: verbal and nonverbal behaviors not aimed at sexual cooperation but that convey insulting, hostile, and degrading attitudes about members of one gender.

- sexist hostility: demeaning jokes or comments about women, comments that women do not belong in leadership positions or are not smart enough to succeed in a scientific career, and sabotaging women

- crude harassment use of sexually crude terms that denigrate people based on their gender

Unwanted sexual attention: Unwelcome sexual advances, which can include assault. Examples include repeated requests for dates and persistent attempts to establish sexual relationships despite rejection.

Sexual coercion: A type of sexual harassment in which favorable professional or educational treatment is conditioned on sexual activity (such as through the use of bribes or threats). Examples include promises of a better grade or a letter of reference in exchange for sexual favors.
Sexual harassment in academia: Suggestions of what to do/advice

- Read the Callisto Survivor’s Guide.

- Document as much as possible: Write it down with details, take pictures, save messages, emails..

- Try to find people who went through the same situation.

- Report when and if you are ready.

- Tell a friend.

- Talk to a therapist

- Have an answer prepared

Inspired on Sexual Harassment of Women Report, Nac. Acad. Science, Med, and Eng., 2018
POSSIBLE EXPLANATIONS, MODELS
Accumulation of disadvantage

- **nothing seems overtly wrong** in most work situations, especially in academia and science, where the **meritocratic ethos** is so prominent.

- People are often unable to perceive or assess **how small imbalances can really add up**.

- Any single instance of bias is likely to be tiny, and someone might say, **you're making a mountain out of a molehill**.
Accumulation of disadvantage

- Members of a simulated organization were assigned a score with a normal distribution.
- 1% of bias points were added to men.
- At the lowest level of the pyramid there were as many women as there were men.
- At the end of the simulation, top of the pyramid, the highest career level, the distribution was 65% men, 35% women.

Martell, David, Emrich, 1996
A each hour, each yellow employee has 1% disadvantage in ascending.
In the beginning, there are 1000 yellow employees and 1000 red employees.
The graphs of the two distributions after 1000000 hours are shown below, overlapped.
There are 39 red employees in the top 5% and 39 yellow employees in the top 5%.
The proportion of yellow employees in the top 5% is 0.50.

A each hour, each yellow employee has 1% disadvantage in ascending.
In the beginning, there are 1000 yellow employees and 1000 red employees.
The graphs of the two distributions after 1000000 hours are shown below, overlapped.
There are 69 red employees in the top 5% and 26 yellow employees in the top 5%.
The proportion of yellow employees in the top 5% is 0.27.

A each hour, each yellow employee has 1% disadvantage in ascending.
In the beginning, there are 1000 yellow employees and 1000 red employees.
The graphs of the two distributions after 100000000 hours are shown below, overlapped.
There are 98 red employees in the top 5% and 1 yellow employee in the top 5%.
The proportion of yellow employees in the top 5% is 0.01.

A each hour, each yellow employee has 1% disadvantage in ascending.
In the beginning, there are 1000 yellow employees and 1000 red employees.
The graphs of the two distributions after 1000000000 hours are shown below, overlapped.
There are 100 red employees in the top 5% and 0 yellow employees in the top 5%.
The proportion of yellow employees in the top 5% is 0.
We tend to believe, what is, is what ought to be… (Naturalization of the status quo)

…nothing seems overtly wrong in most work situations, especially in academia and science, where the meritocratic ethos is so prominent. (Valian, 1998)
Lack of self-confidence

…the students who were not going on to Calculus II choose from a list of potential reasons,

'I do not believe I understand the ideas of Calculus I well enough to take Calculus II.'

• Roughly twice as many women as men chose this as one of their reasons.
• Previous research suggests that the perceived lack of understanding by women is not because women do not actually understand the material as well as men;

Ellis, Fosdick, and Rasmussen, 2016
Stereotype Threat

An instance: Women taking a math test will perform less well when told that women aren't expected to do well in math than when they are told that they can do well.

Stereotype threat refers to a situation in which people are or feel themselves to be at risk of conforming to stereotypes about their social group.

If negative stereotypes are presented regarding a specific group, group members are likely to become anxious about their performance, which may hinder their ability to perform at their maximum level.

The effect of stereotype threat (ST) on math test scores for girls and boys. Data from Osborne (2007)

Steele, Aronson, Quinn, 1999
We hypothesize that, across the academic spectrum, **women are underrepresented in fields whose practitioners believe that raw, innate talent is the main requirement for success, because women are stereotyped as not possessing such talent.** This hypothesis extends to **African Americans’ underrepresentation as well, as this group is subject to similar stereotypes.**
Lack of role models

One of the initial difficulties I faced as a woman in math was the lack of a role model. Despite having kind and encouraging professors here at Stony Brook, (often) being the only woman in the class, and not having a single female math professor resulted in self doubt. I found it hard to believe that women are good enough for math, or that I am good enough for math. I blamed all my accomplishments on affirmative action. This all changed once I met Professor Moira Chas. Her passion for the subject, the vividness and enthusiasm with which she taught, dispelled every doubt I had with regard to the competence of women in math. Not only that, Moira helped, supported, and encouraged me through difficult times. I don’t think I would have been where I am if not for Moira, and I want to pay forward what she has given me.

Lea Kenigsberg (extract from her essay for an NSF grant proposal)
Thao Do (who scored highest from the SB team on the Putnam the year we finished 4th in the country)

An excerpt from an email she sent me when she was a Freshman at Stony Brook

“Interestingly, when I searched your email on gmail, I found out that you are the person who takes care of math club in our school, which I attend every week. Also, I think I met you once in the talk of Prof John Milnor. I admire you a lot because I want to become a female math professor and I know that it is not easy.”

Role models (my personal experience)

Apologies for the praise to Moira Chas. It is not the point of this paragraph
Thao Do (who scored highest from the SB team on the Putnam the year we finished 4th in the country)

An excerpt from a recent email.

I find it very important to have women mathematicians around. At MIT we have a strong female community; each year there's a nice party, and several talks per semester where we invite successful female mathematicians come to share about their career path. Most of my friends at MIT now are female; I live with 2 other female grad students which is great because we often share our insecurities, how we feel stupid in math, how uncertain the future is and how hard it must be to find a tenure job nowadays.
Women may fear or suspect that their work will not be evaluated in the same way a man's is, so they need more documentation to back up what they are saying. Men may be more willing to take a flier, to come up with some intriguing hypothesis for which they have relatively meager data and just put it out there to be proven true or false. Women may believe, perhaps correctly, that they are less likely to be given the benefit of the doubt, and that their off-the-cuff ideas will be dismissed as foolish. We associate risk-taking behavior with men, and we may be less tolerant of intellectual risk-taking in women.

In many professional situations, our gender schemas have the effect of making a man seem slightly more qualified and competent than he is, and a woman slightly less
Remember the words of former Harvard president Larry Summers?

There are three broad hypotheses about the sources of the very substantial disparities with respect to the presence of women in high-end scientific professions.

❖ The first is what I call the high-powered job hypothesis… what fraction of young women in their mid-twenties make a decision that they don't want to have a job that they think about eighty hours a week.

❖ The second is what I would call different availability of aptitude at the high end, and

❖ The third is what I would call different socialization and patterns of discrimination in a search.

Variability Hypothesis?

Hill recent paper

Side note: tests developed in the US (...) include almost no questions requiring complex problem solving.

• US girls perform as well as boys on standardized math tests at all grade levels.

• Among the mathematically gifted, there may be as many as 2-to 4-fold more boys than girls.

• **This gender gap has been closing over time at all levels.**

Hyde and Mertz, 2009
WHY DIVERSITY?
Why diversity? (my take on it)

- We do not want to lose good mathematicians (by being biased)
- We should be fair, as fair as we can.
- Diversity helps to achieve excellence (by studying problems from different points of view)
- We want to attract and retain a diverse body of (grad and undergraduate) students, and a diverse faculty.
- To make High Authorities happy
IDEAS FOR INDIVIDUAL SURVIVAL AND CHANGE
Ideas for Individual Survival and change

- **Offer support** to someone else who feels insecure.

- **Find a community.** If you cannot find members of a community locally, follow a Twitter feed ( #BLACKandSTEM or #womenandSTEM can serve as reassurance that they really do belong in science. )
Remember and remind people that mistakes are valuable (if you learn from them). They help in the learning process and produce brain growth. (Jo Boaler)

Do not interpret a failure as “I am not good enough at this”.

Ideas for Individual Survival and change
Emphasize the “growth mindset” as opposed to the “fixed mindset”.

<table>
<thead>
<tr>
<th>FIXED MINDSET</th>
<th>GROWTH MINDSET</th>
</tr>
</thead>
<tbody>
<tr>
<td>SOMETHING YOU’RE BORN WITH • FIXED</td>
<td>COME FROM HARD WORK. • CAN ALWAYS IMPROVE</td>
</tr>
<tr>
<td>SOMETHING TO AVOID • COULD REVEAL LACK OF SKILL • TEND TO GIVE UP EASILY</td>
<td>SHOULD BE EMBRACED • AN OPPORTUNITY TO GROW. • MORE PERSISTANT</td>
</tr>
<tr>
<td>UNNECESSARY • SOMETHING YOU DO WHEN YOU ARE NOT GOOD ENOUGH</td>
<td>ESSENTIAL • A PATH TO MASTERY</td>
</tr>
<tr>
<td>GET DEFENSIVE • TAKE IT PERSONAL</td>
<td>USEFUL • SOMETHING TO LEARN FROM • IDENTIFY AREAS TO IMPROVE</td>
</tr>
<tr>
<td>BLAME OTHERS • GET DISCOURAGED</td>
<td>USE AS A WAKE-UP CALL TO WORK HARDER NEXT TIME.</td>
</tr>
</tbody>
</table>
Emphasize the “growth mindset” as opposed to the “fixed mindset”.

Possibles strategies for individual change: A list found in internet (unidentified source)
Advocate for yourself. This includes

- avoiding words such as ‘just’ and ‘only’ when describing your work,

- use the ‘elevator talk’ to talk to your colleagues about your math interests and achievements.
Ideas for Individual Survival and change

- My own private mantra: “It’s not about me, it is about math”
- Understand something really well and share it with others.
Ideas for Individual Survival and change

- Do not apologize for every mistake, whether real or perceived.
- Consider using a more assertive language.

“I noticed the female justices say things like, ‘May I ask,’ or, ‘Excuse me,’ before they actually get to the substance of their question, and that’s where they’re most commonly interrupted…”

Jacobi, 2017
Imagine, in detail, people who violate expected stereotypes in a positive way and practice thinking about these positive examples.
Ideas for Individual Survival and change

Fake it until you make it?
Learn about gender schemas.

• Gender schemas are largely non conscious hypothesis we all have about the different characteristics of males and females.

• We see females as nurturing, as communal, and as doing things out of concern for other people.

• We see males as capable of independent action, doing things for a reason, and getting down to the business at hand.
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<td>reliable</td>
<td>41.</td>
<td>warm</td>
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<tr>
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<td>yielding</td>
<td>22.</td>
<td>analytical</td>
<td>42.</td>
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<td>23.</td>
<td>sympathetic</td>
<td>43.</td>
<td>willing to take a stand</td>
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<tr>
<td>4.</td>
<td>defends own beliefs</td>
<td>24.</td>
<td>jealous</td>
<td>44.</td>
<td>tender</td>
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<td>5.</td>
<td>cheerful</td>
<td>25.</td>
<td>leadership ability</td>
<td>45.</td>
<td>friendly</td>
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<td>6.</td>
<td>moody</td>
<td>26.</td>
<td>sensitive to other's needs</td>
<td>46.</td>
<td>aggressive</td>
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<tr>
<td>7.</td>
<td>independent</td>
<td>27.</td>
<td>truthful</td>
<td>47.</td>
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<td>8.</td>
<td>shy</td>
<td>28.</td>
<td>willing to take risks</td>
<td>48.</td>
<td>inefficient</td>
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<tr>
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<td>29.</td>
<td>understanding</td>
<td>49.</td>
<td>acts as a leader</td>
</tr>
<tr>
<td>10.</td>
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<td>30.</td>
<td>secretive</td>
<td>50.</td>
<td>childlike</td>
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<tr>
<td>11.</td>
<td>affectionate</td>
<td>31.</td>
<td>makes decisions easily</td>
<td>51.</td>
<td>adaptable</td>
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<tr>
<td>12.</td>
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<td>32.</td>
<td>compassionate</td>
<td>52.</td>
<td>individualistic</td>
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<tr>
<td>13.</td>
<td>assertive</td>
<td>33.</td>
<td>sincere</td>
<td>53.</td>
<td>does not use harsh language</td>
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<td>14.</td>
<td>flatterable</td>
<td>34.</td>
<td>self-sufficient</td>
<td>54.</td>
<td>unsystematic</td>
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<tr>
<td>15.</td>
<td>happy</td>
<td>35.</td>
<td>eager to soothe hurt feelings</td>
<td>55.</td>
<td>competitive</td>
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<tr>
<td>16.</td>
<td>strong personality</td>
<td>36.</td>
<td>conceited</td>
<td>56.</td>
<td>loves children</td>
</tr>
<tr>
<td>17.</td>
<td>loyal</td>
<td>37.</td>
<td>dominant</td>
<td>57.</td>
<td>tactful</td>
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<tr>
<td>18.</td>
<td>unpredictable</td>
<td>38.</td>
<td>soft spoken</td>
<td>58.</td>
<td>ambitious</td>
</tr>
<tr>
<td>19.</td>
<td>forceful</td>
<td>39.</td>
<td>likable</td>
<td>59.</td>
<td>gentle</td>
</tr>
<tr>
<td>20.</td>
<td>feminine</td>
<td>40.</td>
<td>masculine</td>
<td>60.</td>
<td>conventional</td>
</tr>
</tbody>
</table>

n=1(3) masculine
n=2(3) feminine
This discussion is about issues affecting certain groups of people,

- Not all members of these groups will be affected in the same way.
- Non-members of these groups might be affected by the same or similar issues.
- Outliers exist.
- Problematic situations occur with certain frequency but not all the time, and affect not only members of underrepresented groups.
THANKS
Many people, (mainly Virginia Valian and also Benson Farb, Amie Wilkinson, Helen Grundman, Jean Taylor, Dennis Sullivan, Katrin Wehrheim, Moira Soto) gave me suggestions for this presentation. The final product is of course my responsibility.

The section about mentoring owes a great deal to a talk by Abigail Stewart. https://www.drp-network.org/workshop-2018.html
Ellis, Jessica, Bailey K. Fosdick, and Chris Rasmussen. "Women 1.5 times more likely to leave STEM pipeline after calculus compared to men: Lack of mathematical confidence a potential culprit." PloS one 11.7 (2016): e0157447.


Dealing With Impostor Syndrome When You’re Treated as an Impostor, June 12, 2018, by Kristin Wong, NYTimes


Implicit bias Jo Handelsman and Natasha Sakraney

Why Are There Still So Few Women in Science? NYTimes,

Jo Boaler website

You got the job! So what do you feel like a loooser? Battle Tactics For Your Sexist Workplace, Podcast by Jeannie Yandel and Eula Scott Bynoe
IDEAS FOR CHANGE IN HIRING PRACTICES
Ideas for change in hiring practices

- Pause and question our schemas regularly
- Implicit bias makes us forget people who belong to certain groups. Thus, it may be useful to make a conscious effort to bring those people “to the table” when organizing lists (of conferences, of candidates for a position…)
Ideas for change in hiring practices

- In fact, **widening the pool of female candidates does help**. Women progress faster through the ranks in those law schools with a high percentage of female faculty members than they do in schools where there are few female professors.

- **Studies have shown that when people are asked to rate a female candidate for a managerial job, they rate her more positively if she is one of several women in the candidate pool than if she is the only woman.**

  Valian, 1998
Ideas for change in hiring practices

When assessing the behavior or performance of someone from a stigmatized group, try to focus on concrete positive and negative factors and your memory of what actually happened, rather than relying on overall “gut” feelings.
Ideas for change in hiring practices

Instead of

"We particularly encourage applications from minorities and under-represented groups." write

"We aim to be a diverse and inclusive department."

(unless you really have a diverse and inclusive department)

❖ Consider placing this sentence right after the sentence near the top, to make clear that it is not a pro forma interest.
Ideas for advising: A list found in internet (unidentified source)
Advising students

The mentee/student’s expectations:

❖ I don’t belong
❖ I’m not good at this
❖ People like me can’t do this
❖ You aren’t like me
❖ You can’t help me/you won’t help me

Based on a talk by Abigail Stewart
Surface-level differences (like gender, race, age...) will decrease “interpersonal comfort”.

Find deep level similarities (like values, tastes, experiences). Interpersonal comfort decreases anxiety and improves performance.

Seek out ways to collaborate or be on the same footing.

Consider creating interdependent “jigsaw” conditions, team projects where every member of the team has an individual task.

Be aware that most likely, you will have a certain degree of anxiety in presence of a member of an underrepresented group.

Based on a talk by Abigail Stewart
A mentor gives students access to an interpersonal relationship with a ”role model” in an area where they are trying out a “possible self”.

This identification becomes more difficult if you seem impossibly skilled.

Based on a talk by Abigail Stewart
How can implicit biases affect the mentor-mentee relationship? The mentor might

- have lower expectations than the student can meet
- give overly positive feedback (because of low expectations)
- create a patronizing environment

It is important to be aware of our own implicit biases and how these biases might enter mentoring experiences

Based on a talk by Abigail Stewart
Advising students

Good mentoring practices

- Communicate high and reasonable expectations. Express confidence student can meet them
- Provide accurate and fair feedback
- Provide encouragement

Based on a talk by Abigail Stewart
“My own sex, I hope, will excuse me, if I treat them like rational creatures, instead of flattering their fascinating graces, and viewing them as if they were in a state of perpetual childhood, unable to stand alone.”
— Mary Wollstonecraft, *A Vindication of the Rights of Woman* 1792

“The history of men's opposition to women's emancipation is more interesting perhaps than the story of that emancipation itself.”
— Virginia Woolf, *A Room of One's Own*

“It is difficult for men to measure the enormous extent of social discrimination that seems insignificant form the outside and whose moral and intellectual repercussions are so deep in woman that they appear to spring from an original nature. The man most sympathetic to women never knows her concrete situation fully.”
— Simone de Beauvoir, *The Second Sex*

“Misogynists have often reproached intellectual women for 'letting themselves go'; but they also preach to them: if you want to be our equals, stop wearing makeup and polishing your nails. This advice is absurd. Precisely because the idea of femininity is artificially defined by customs and fashion, it is imposed on every woman from the outside[...]. The individual is not free to shape the idea of femininity at will.”
— Simone de Beauvoir, *The Second Sex*
Ideas for dealing with sexual harassment - Institutional

Strive for Strong and Diverse Leadership

Make it an Explicit Goal: College and university presidents, provosts, deans, department chairs, and program directors must make the reduction and prevention of sexual harassment an explicit goal of their tenure.

Develop Leadership Skills: Support and facilitate leaders at every level (university, school/college, department, lab) in developing skills in leadership, conflict resolution, mediation, negotiation, and de-escalation, and ensure a clear understanding of policies and procedures for handling sexual harassment issues.

Move Beyond Legal Liability: Leadership training programs should include training on how to recognize and handle sexual harassment issues, and how to take explicit steps to create a culture and climate to reduce and prevent sexual harassment—and not just protect the institution against liability.
Ideas for dealing with sexual harassment - Institutional

Provide Support for the Target

Access to Support Services: Provide means for the target of harassment to access support services (social services, health care, legal, career/professional).

Informal Reporting: Provide alternative and less formal means of recording information about the experience and reporting the experience.

Provide anonymous, confidential reporting systems. Callisto is an online system that allows targets to control the disclosure of information, access supportive services, and share information on alleged perpetrators.

Provide confidential reporting channels outside of the faculty or usual workplace hierarchy, such as an ombudsperson.

Explore the use of restorative justice processes. The Campus PRISM (Promoting Restorative Initiatives for Sexual Misconduct) Project calls for accountability through collaboration and prevention through education.

Prevent Retaliation: Develop approaches to prevent the target from experiencing or fearing retaliation in academic settings.

• Be prepared to take action to ensure the target of the harassment is able to continue his/her academic work. This could include using mutual no contact orders between the accused and accuser, changing class schedules, changing the locks at the housing facility or workplace, rescinding building access for the accused, and reassigning advisors, mentees, and supervisors.
Ideas for dealing with sexual harassment - Institutional

Improve Transparency and Accountability

Clear Policies: Develop and share clear, accessible, and consistent policies on sexual harassment and standards of behavior. Make clear that people will be held accountable for violating the policies.

Include a range of clear disciplinary actions that correspond with the severity of the harassment.

Engage the academic community in policy and practice reviews. Some institutions have created student advisory boards and forums for students to meet with the Title IX Steering Committee.

Transparency about Handling Reports: Be as transparent as possible about how the institution is handling reports of sexual harassment.

- Yale University publishes a semiannual Report of Complaints of Sexual Misconduct and an annual campus safety report to inform the campus community.

Assess Climate: Utilize climate surveys to further investigate and address systemic sexual harassment.

- The results of climate surveys should be shared publicly to demonstrate to the campus community that the institution takes the issue seriously. The Administrator- Researcher Campus Climate Collaborative (ARC3) survey has been used by more than 150 higher education institutions.

Research Integrity: Consider sexual harassment equally important as research misconduct in terms of its effect on the integrity of research.

- The U.S. Geological Survey and the Department of the Interior have broad scientific integrity policies that apply to employees, appointees, volunteers, grantees, and contractors. Some scientific societies such as the American Geophysical Union have developed new ethics policies that explicitly call out sexual harassment and discrimination.