

What first, curves on surfaces or (lack of) diversity in math?

curves on surfaces (lack of) diversity in math

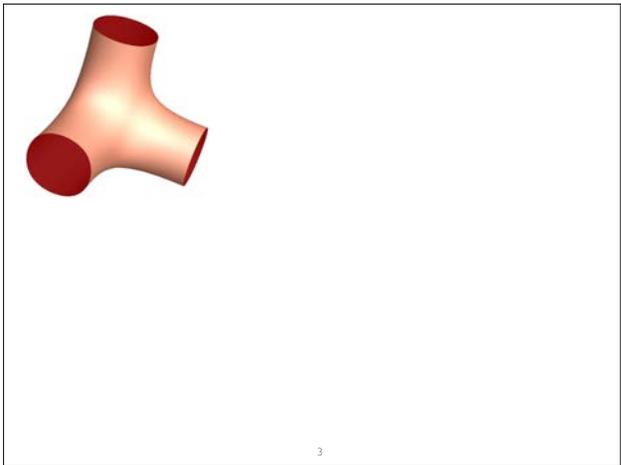
Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

3:45-4:05 Sat.

Computer driven questions and theorems in low dimensional topology

Moira Chas
Stony brook University

2



4

Torus with one boundary component

5

Encoding surfaces

6

Fix surface word - encode curves

7

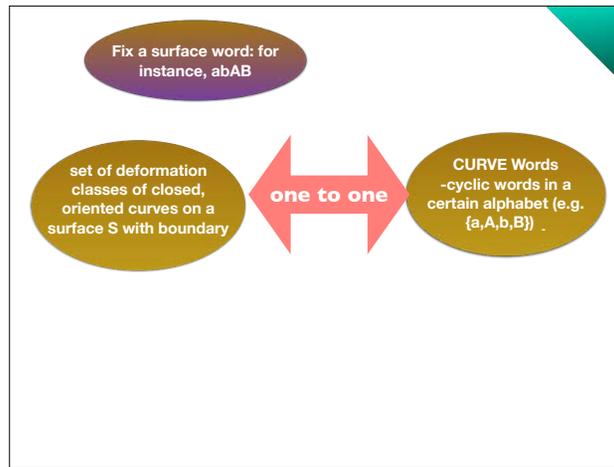
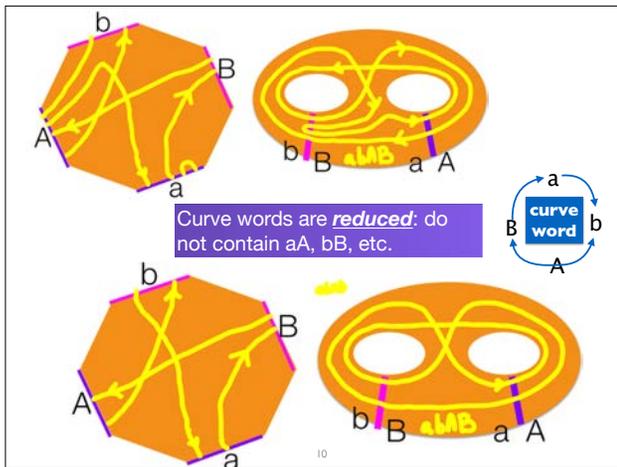
Label the brown curve (pretend words are cyclic).

There is more than one correct answer

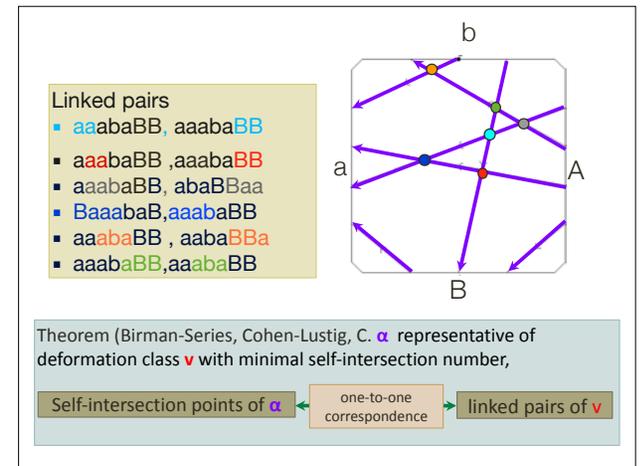
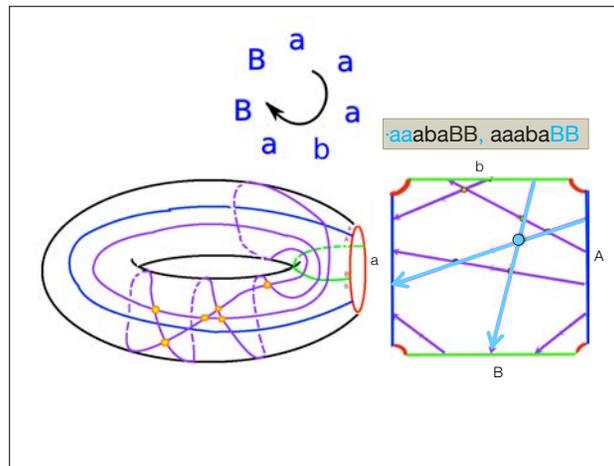
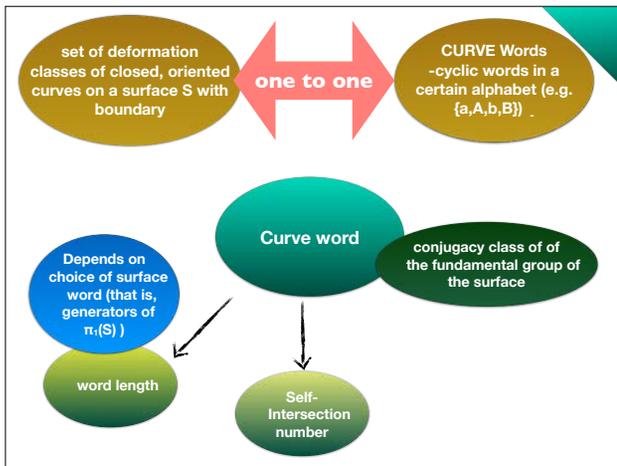
Label	Percentage
1-ab	33%
2-ba	33%
3-AB	0%
4-BA	0%
5-aab	0%
6-a	33%
7-b	0%

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

8



Fix a surface S . Consider a free homotopy class of curves w on S . The **self-intersection number of w** is the smallest number of crossings of representatives of w with transversal double intersections



Counting curves

Punctured torus

WL	SI	0	1	2	...
1					
2			# of cyclic reduced non-power words with $SI=1$, and word length = 2		
3					
4					

Non-power (cyclic, reduced) words in the punctured torus, organized by word length (rows) and self-intersection (columns)

Punctured torus

WL	SI	0	1	2	...
1		4 (a,b, A,B)	0	0	0
2		4 (ab, AB, aB, Ab)	0 = # of cyclic reduced non-power words with $SI=1$, and word length = 2	0	0
3		4 (aab,...)	0	0	0
4		10 (aaab, abAB...)	8 (aabb, abaB,...)	0	0

Non-power (cyclic, reduced) words in the punctured torus, organized by word length (rows) and self-intersection (columns)

Non-power (cyclic, reduced) words in the punctured torus, organized by word length and self-intersection.

	0	1	2	3	4	5	6	7	8
1	4	0	0	0	0	0	0	0	0
2	4	0	0	0	0	0	0	0	0
3	4	0	0	0	0	0	0	0	0
4	10	8	0	0	0	0	0	0	0
5	16	8	24	0	0	0	0	0	0
6	8	16	32	40	20	0	0	0	0
7	24	16	32	48	112	24	56	0	0
8	16	24	52	76	116	156	136	104	90

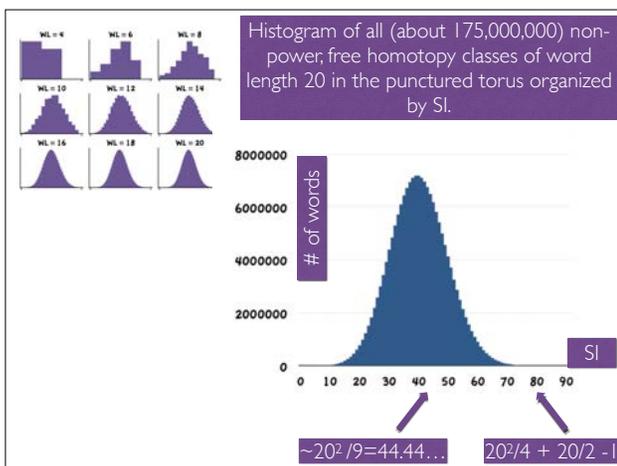
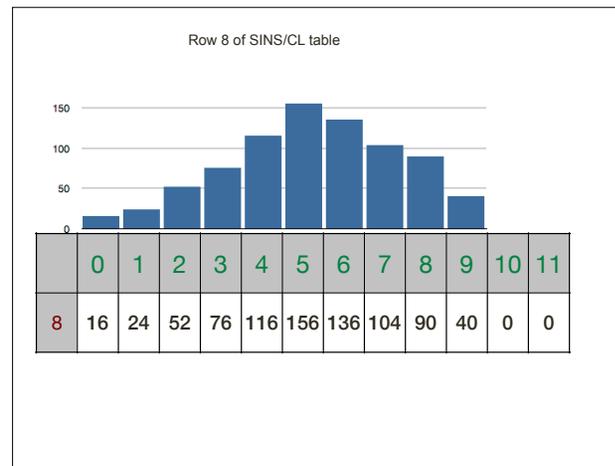
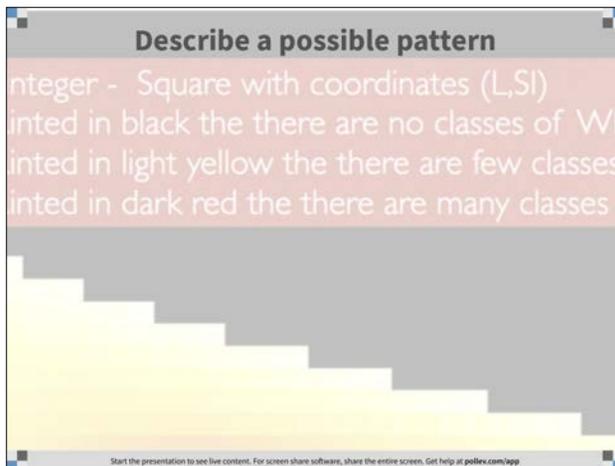
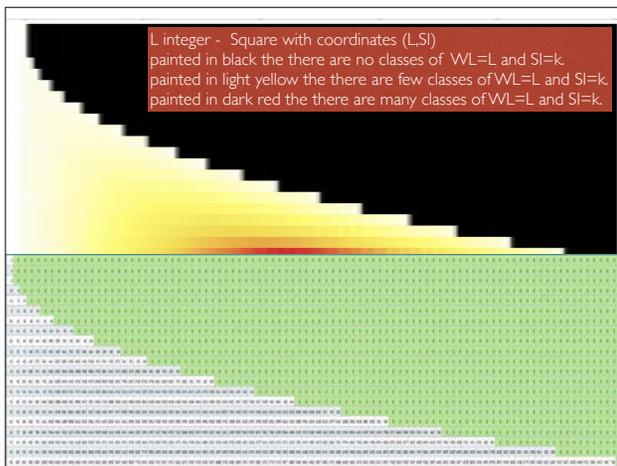
Non-power (cyclic, reduced) words in the punctured torus, organized by word length (rows) and self-intersection (columns)

	0	1	2	3	4	5	6	7	8	9	10	11	12
1	4	0	0	0	0	0	0	0	0	0	0	0	0
2	4	0	0	0	0	0	0	0	0	0	0	0	0
3	4	0	0	0	0	0	0	0	0	0	0	0	0
4	10	8	0	0	0	0	0	0	0	0	0	0	0
5	16	8	24	0	0	0	0	0	0	0	0	0	0
6	8	16	32	40	20	0	0	0	0	0	0	0	0
7	24	16	32	48	112	24	56	0	0	0	0	0	0
8	16	24	52	76	116	156	136	104	90	40	0	0	0
9	24	32	64	120	144	240	384	208	376	136	304	48	104
10	16	32	72	168	272	332	492	628	644	700	700	548	464
11	40	48	80	160	272	584	664	1200	1280	1368	1608	1368	2048
12	16	40	104	208	372	660	1048	1408	2044	2696	3088	3580	3866
13	48	48	104	264	456	752	1216	2080	2496	4464	4752	7048	6976
14	24	80	136	264	504	808	1556	2580	2888	5348	7572	8984	12480
15	32	48	120	352	680	1192	2144	3548	5616	8864	13200	18572	26276
16	32	48	120	352	680	1192	2144	3548	5616	8864	13200	18572	26276

Non-power (cyclic, reduced) words in the punctured torus, organized by word length (rows) and self-intersection (columns)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	10	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5	16	8	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	8	16	32	40	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	24	16	32	48	112	24	56	0	0	0	0	0	0	0	0	0	0	0	0
8	16	24	52	76	116	156	136	104	90	40	0	0	0	0	0	0	0	0	0
9	24	32	64	120	144	240	384	208	376	136	304	48	104	0	0	0	0	0	0
10	16	32	72	168	272	332	492	628	644	700	700	548	464	0	0	0	0	0	0
11	40	48	80	160	272	584	664	1200	1280	1368	1608	1368	2048	0	0	0	0	0	0
12	16	40	104	208	372	660	1048	1408	2044	2696	3088	3580	3866	0	0	0	0	0	0
13	48	48	104	264	456	752	1216	2080	2496	4464	4752	7048	6976	0	0	0	0	0	0
14	24	80	136	264	504	808	1556	2580	2888	5348	7572	8984	12480	0	0	0	0	0	0
15	32	48	120	352	680	1192	2144	3548	5616	8864	13200	18572	26276	0	0	0	0	0	0
16	32	48	120	352	680	1192	2144	3548	5616	8864	13200	18572	26276	0	0	0	0	0	0
17	64	96	160	368	712	1416	2360	3984	6280	9808	16448	23408	35664	47240	64768	82216	104472	134648	155904
18	24	72	216	408	784	1424	2544	4416	7632	12236	18764	29048	42144	59280	83680	113104	149824	194344	246424
19	72	64	184	480	896	1680	2848	5224	8216	14168	21128	32816	50328	72544	107224	144664	205152	257464	354904
20	80	120	320	640	1120	1840	3040	5040	7840	12160	18400	27680	41120	60320	86400	121600	171200	241600	336000

Non-power (cyclic, reduced) words in the punctured torus, organized by word length (rows) and self-intersection (columns)



Written proved an analogous result for surfaces without boundary

Thm: (Lalley, C.) The distribution of self-intersection numbers of deformation classes of curves on a surface with boundary S sampling by word length L appropriately normalized, tends to a Gaussian with mean κL^2 and variance to $\sigma^2 L^3$ when the word length L goes to infinity.

The constants κ and σ^2 are

$$\kappa = \kappa_\Sigma = \frac{\chi}{3(2\chi - 1)} \text{ and } \sigma^2 = \sigma_\Sigma^2 = \frac{2\chi(2\chi^2 - 2\chi + 1)}{45(2\chi - 1)^2(\chi - 1)}$$

where $\chi=1-n$ is the Euler characteristic of the surface. In other words, S is a surface with a surface word of $2n$ letters.

Remark: The expected value of intersections of n random chords in a disk (where a random chord is determined by two points independently and randomly placed on the circumference, with uniform distribution), is $n(n-1)/6 \sim n^2/6$

The variance is $n(n-1)(n+3)/45 \sim n^3/45$.

$\kappa_\Sigma = 1/9$ when $\chi(\Sigma) = -1$.

Word length/intersection number with curve $w=abaBB$, in the punctured torus $abAB$

If v and w are free homotopy classes of curves on a surface, $i(v,w)$ is the smallest number of intersection points of pairs of representatives of a and b counted with multiplicity.

CLSIN	1	2	3	4	5
1					
2				# of reduced non power, words v of $wl=2$, with $i(v, abaBB)=3$	
3					
4					

Thm: (Rachel Zhang, now student at MIT.) Fix a free homotopy class w on a surface S . The distribution of intersection numbers of deformation classes of curves v with w , sampling by word length L appropriately normalized, tends to a Gaussian with mean κL where κ is a rational number that depends on w .

Word length/intersection number with curve $abaBB$, in the punctured torus

Geometric length sampling by word length (Joint with Keren Li and Bernie Maskit, 2013)

- Fix a metric on the pair of pants.
- Randomly choose 100,000 words of 100 letters.
- Compute geometric length of each word.

Theorem (2018 Gekhtman, Taylor, Tiozzo)
 The distribution of the geometry length in a hyperbolic pair of pants, sampling by word length approaches a Gaussian with mean $\kappa \cdot L$ and variance $\sigma \cdot L$ (for some positive constants κ and σ) as the word length goes to infinity.

Disclaimers:

- Math is my field.
- 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.

<https://www.womendomath.org/research/>

As of 2015, women are...

- 41% of undergraduate math majors
- 28% of new PhDs in the US
- 25% of current postdocs in math
- 24% of tenured/tenure-stream math faculty
- 11% of full professors at PhD-granting institutions

	% of female grad students	% tenured women
Harvard	9.1	5.6
Brown	32.6	5.6
MIT	17.8	7.9
Yale	10.7	9.1
Chicago	27.8	9.4
Princeton	28.6	10.0
Cornell	28.1	10.3
Stony Brook	11.3	11.4
CalTech	12.5	11.8
UIUC	35.1	11.9
Texas-Austin	36.5	13.3
Michigan	29.4	16.9

Faculty and grad students body in some top math departments (Data from 2015 AMS website)

Why?

...and what can we do about it?

Why?

Why?

There were obvious obstacles in the past

In 1870, Sofia Kovalevskaya took private lessons with Karl Weierstrass, since the university would not even allow her to audit classes.

Brainstorm: Why there is so little diversity in Math? Why an US math dept. does not look at all like a random sample of the population?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pollvox.com/app

Accumulation of disadvantage

37

When did Black men get the vote in the US

1850 to 1876 to 1901 to 1926 to 1951 to None of
1875 1900 1925 1950 1975 the
above

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pellex.com/app

When did women get the vote in the US

1850 to 1876 to 1901 to 1926 to 1951 to None of
1875 1900 1925 1950 1975 the
above

Start the presentation to see live content. For screen share software, share the entire screen. Get help at pellex.com/app

When did African-Americans get the right to vote in the US?

15th Amendment - 1870: "The right of citizens of the United States to **vote shall not be denied** or abridged by the United States or by any State **on account of race, color, or previous condition of servitude.**"

The Voting Rights Act of 1965 **prohibited** a range of **discriminatory state voting practices.**

The Supreme Court struck down part of the Voting Rights Act in *Shelby County v. Holder* (2013), holding that the racist practices which necessitated the law in 1965 no longer present a problem in 2013.

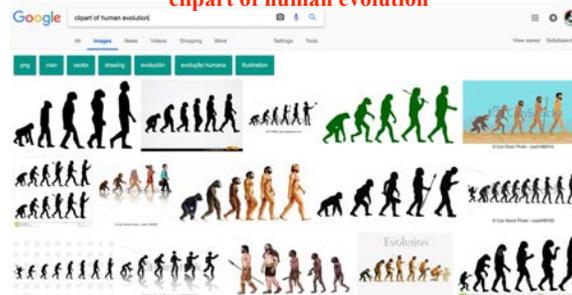
When did women get the right to vote in the US?

19th amendment, 1920 "The right of citizens of the United States to **vote shall not be denied** or abridged by the United States or by any State **on account of sex.**"

40

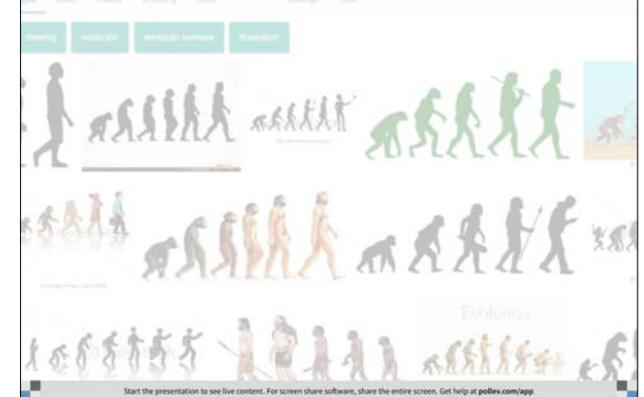
Searching for an illustration that would help me put things in perspective, went to google images once more and googled

clipart of human evolution



41

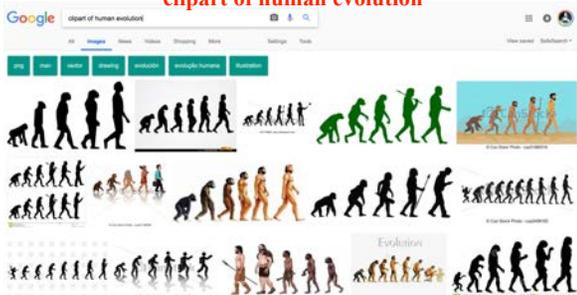
Any conclusion from the images?



Start the presentation to see live content. For screen share software, share the entire screen. Get help at pellex.com/app

Searching for an illustration that would help me put things in perspective, went to google images once more and googled

clipart of human evolution



The conclusion seems to be the that humans evolved to be white and male... does this mean that some of us do not exist?...

43

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.**



Mountains are molehills piled one on top of the other

Virginia Valian, 1998

44

Accumulation of disadvantage

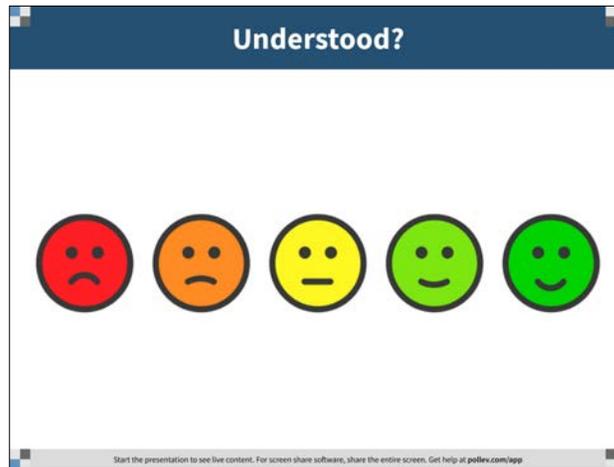
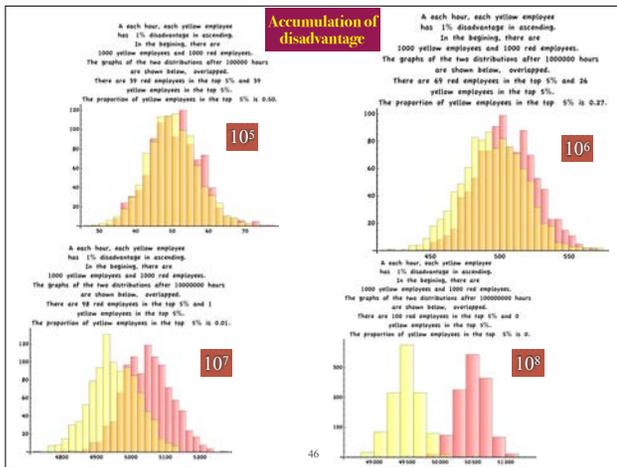
- Members of a simulated organization were assigned a score with a normal distribution.
- 1% of bias points were added to men.
- At the lowest level of the pyramid there were as many women as there were men.
- At the end of the simulation, top of the pyramid, the highest career level, the distribution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

The cause for such distribution is the repeated disadvantage of 1%.



Martell, David, Emrich, 1996

45



Contributions to the accumulation of disadvantage.

1924 :
Most men ask "Is she pretty?" not "Is she clever?"

48

Contributions to the accumulation of disadvantage.

If your husband ever finds out you're not "store-testing" for fresher coffee... you're not "store-testing" for fresher coffee...

1952

...if he discovers you're still taking chances on getting flat, stale coffee ... now he needs you! For today there's a sure and certain way to test for freshness before you buy

49

Contributions to the accumulation of disadvantage.

This Mother's Day, Get Back To The Job That Really Matters.

2011

This mother's day, Get back to the job that really matters

50

Contributions to the accumulation of disadvantage.

1934

1965

2015

ARE YOU BEACH BODY READY?

51

1952

Most people wouldn't have anything to object to this dialog.

Okay, girls, come on in.

52

Contributions to the accumulation of disadvantage.

Add that appeared in my Facebook page, on July 15, 2020

COMFORT HAS NEVER BEEN SO ALLURING.

INEZ

Heels that are meant to be worn. inez.com Truly Comfortable Heels

53

Contributions to the accumulation of disadvantage.

I love math Baseball T-Shirt ★★★★★ (52)

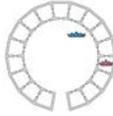
I'm too pretty to do math

54

The Princess Problem

BY GARY ANTONICK JANUARY 27, 2014 12:00 PM

Contributions to the accumulation of disadvantage.



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?

Sexual Harassment

Is it sexual harassment? How would you proceed?

- ❖ You (a student) are in a in 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 student) are in a in conference. Along the whole weekend, a senior person sits at at your side in every talk and constantly fixates eyes on you.
- ❖ You (a student) receive an offer of intimate nature from a senior person.

57

A senior person starts talking to you. You listen attentively, asking an occasional question. The senior person looks at you in the eyes and caresses your shoulder

Yes No

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

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

Yes No

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

You (a student) receive an offer of intimate nature from a senior person.

Yes No

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

What can you do in one of those cases?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

Sexual harassment

- sexist hostility:
- gender harassment: "put-downs"
- crude harassment
- Unwanted sexual attention "come-ons"
- Sexual coercion
- Impact ≠ Intent

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 of Women, Nac. Acad. Science, Med, and Eng., 2018

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 National Academies for Sciences, Engineering and Medicine

Sexual harassment in academia: Suggestions of what to do/advice

- Read the Callisto Survivor's Guide. www.projectcallisto.org/survivors-guide.pdf
- Document as much as possible: Write it down with details, take pictures, save messages, emails.. If possible, document before talking to anybody, and with a time stamp.
- 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

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."



2018 Report by National Academies for Sciences, Engineering and Medicine

We tend to believe,

Naturalization of the status quo

What is, is what ought to be...



A typical math department from a research university

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

66

Lack of self-confidence

...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

67

Stony Brook Math Department Composition in 2015

Origin	Total	%
US	16	45.7
Russia	8	22.9
British	2	5.7
China	2	5.7
Israel	2	5.7
Argentina	1	2.9
Germany	1	2.9
Netherlands	1	2.9
Romania	1	2.9
Italy	1	2.9
	35	100.0

Equal calls equal

68

Applicants to SB Math Dept. 2015

Applicant Race (for 5 jobs out of 5 posted)	Total Appl		Asian or Pacific Islander		Black		Hispanic		Other		White		Unknown		Int'l Appl	
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
Male	1008	80.51%	329	79.66%	10	100%	33	86.84%	27	81.82%	602	83.03%	7	21.21%	302	82.74%
Female	216	17.25%	83	20.10%			5	13.16%	6	18.18%	121	16.69%	1	3.03%	54	14.79%
Unknown	28	2.24%		0.24%							2	0.28%	25	75.76%	9	2.47%
Total Appl	1252	100%	413	32.99%	10	0.80%	38	3.04%	33	2.64%	725	57.91%	13	1.04%	365	29.15%

<http://www.projectcallisto.org/2015/01/15/stonybrookmathdept2015/>

Race and Hispanic Origin		%
1	White alone, percent	76.3%
2	Black or African American alone, percent (a)	13.4%
3	American Indian and Alaska Native alone, percent (a)	1.3%
4	Asian alone, percent (a)	5.9%
5	Native Hawaiian and Other Pacific Islander alone, percent	0.2%
6	Two or More Races, percent	2.8%
7	Hispanic or Latino, percent (b)	18.5%
8	White alone, not Hispanic or Latino, percent	60.1%

17%

- In 2014-2015, 1214 Ph.D.s in pure math were granted in the US
- 26% of those were granted to women.

Some groups disqualify themselves

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 refers to the former. The latter is discussed in the following slides.

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.**
- Many experiments suggest that people who intend to be fair, and believe they are egalitarian, **apply biases unintentionally.**
- Some behaviors that result from implicit bias (...) can either 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

71

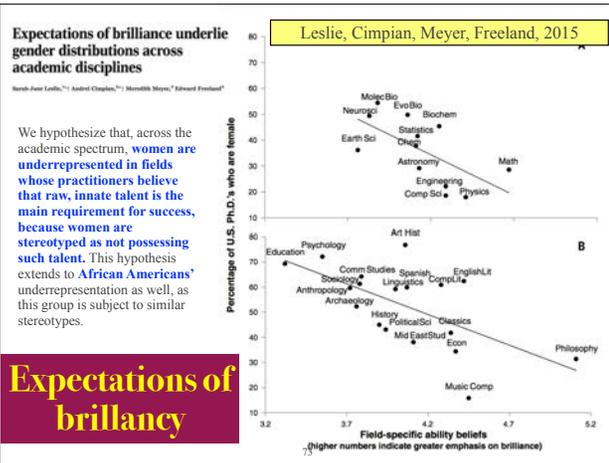
Self-demands of perfection

Publishing in academia

- (...) 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

72



Expectations of brilliancy

In one word, give an idea of what can we do to improve the lack of diversity in Math

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

Ideas for change

Emphasize the “**growth mindset**” as opposed to the “**fixed mindset**”

FIXED MINDSET	SKILLS	GROWTH MINDSET
<ul style="list-style-type: none"> SOMETHING YOU'RE BORN WITH FIXED 	SKILLS	<ul style="list-style-type: none"> COME FROM HARD WORK CAN ALWAYS IMPROVE
<ul style="list-style-type: none"> SOMETHING TO AVOID COULD REVEAL LACK OF SKILL TEND TO GIVE UP EASILY 	CHALLENGES	<ul style="list-style-type: none"> SHOULD BE EMBRACED AN OPPORTUNITY TO GROW MORE PERSISTANT
<ul style="list-style-type: none"> UNNECESSARY SOMETHING YOU DO WHEN YOU ARE NOT GOOD ENOUGH 	EFFORT	<ul style="list-style-type: none"> ESSENTIAL A PATH TO MASTERY
<ul style="list-style-type: none"> GET DEFENSIVE TAKE IT PERSONAL 	FEEDBACK	<ul style="list-style-type: none"> USEFUL SOMETHING TO LEARN FROM IDENTIFY AREAS TO IMPROVE
<ul style="list-style-type: none"> BLAME OTHERS GET DISCOURAGED 	SETBACKS	<ul style="list-style-type: none"> USE AS A WAKE-UP CALL TO WORK HARDER NEXT TIME

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.

Role models

Apologies for the praise to Moira Chas, which is not the point of this slide.

Lea Kenigsberg (extract from her essay for an NSF grant proposal)

Can you expand your previous idea of what to do for lack of diversity in math?

Start the presentation to see live content. For screen share software, share the entire screen. Get help at poller.com/app

Ideas for 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.)

Gender schemas

- Women may fear or suspect that their work will not be **evaluated in 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**

Ideas for change

- 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 change

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 change

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.



	% Women	%interrup. to all women	%interrup. to each woman
1990	11.11%	35.70%	35.70%
2002	22.22%	45.30%	22.65%
2015	33.33%	65.90%	21.97%

Jacobi and Schweers, 2017

82

What does this research suggest to you?



Start the presentation to see live content. For screen share software, share the entire screen. Get help at palllex.com/app

Ideas for 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

84

In short, mathematics only exists in a living community of mathematicians that spreads understanding and breaths life into ideas both old and new.

The question of who is the first person to ever set foot on some square meter of land is really secondary.

Revolutionary change does matter, but revolutions are few, and they are not self-sustaining --- they depend very heavily on the community of mathematicians.

Bill Thurston

Ideas for change

- ❖ My own private mantra: “It’s not about me, **it is about math**”
- ❖ **Understand something really well** and share it with others.

86

Ideas for change

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.

Ideas for change

- ❖ Mathematicians are in eternal graduate students, always learning. We need to face this issues with the same spirit of “eternal learning”.
- ❖ Research show that biases are stronger when we are tired, hungry...
- ❖ Are we done?

88

Q&A

Top

Start the presentation to see live content. For screen share software, share the entire screen. Get help at palllex.com/app

This discussion is about a 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 exists.
- ❖ Problematic situations occur with certain frequency but not all the time, and affect not only members of underrepresented groups.

90

References

- Ellis, Jessica, Bailey K. Foadick, 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](#)." *Post one* 11.7 (2016): e0157447.
- [A Conversation With Virginia Valian: Exploring the Gender Gap and the Absence of Equality](#), by Natalie Angier, NYTimes, Aug 25 1998.
- Martell, Richard F., David M. Lane, and Cynthia Enrick. "[Male-female differences: a computer simulation](#)." (1996): 157.
- Valian, Virginia. "Why so slow? The advancement of women 280 (1998).
- Hyde, Janet S., and Janet E. Mertz. "[Gender, culture, and mathematics performance](#)." *Proceedings of the National Academy of Sciences* 106.22 (2009): 8801-8807.
- [Dealing With Imposter Syndrome When You're Treated as an Imposter](#), June 12, 2018, by Kristin Wong, NYTimes
- Leslie, S. J., Cimpian, A., Meyer, M., & Freeland, E. (2015). [Expectations of brilliance underlie gender distributions across academic disciplines](#). *Science*, 347(6219), 262-265.
- Spencer, S. J., Steele, C. M., & Quinn, D. M. (1999). [Stereotype threat and women's math performance](#). *Journal of experimental social psychology*, 35(1), 4-28.
- [Female Supreme Court Justices Are Interrupted More by Male Justices and Advocates](#), Harvard Business Review, 2017.
- [Implicit bias](#) Jo Handelsman and Natasha Sikraney
- [Why Are There Still So Few Women in Science?](#) NYTimes,
- [In Braker](#) website
- [You get the job? So what do you feel like a boss?](#) Battle Tactics For Your Sexist Workplace, Podcast by Jennie Yandel and Eula Scott Byrnes

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.
- ❖ Some of these slides are inspired in a talk by Abigail Stewart. <https://www.drp-network.org/workshop-2018.html>