Diversity in Computer Science
Learning Goals

You should be able to:

• Justify the need for diversity in the field of Computer Science with at least two different, valid reasons

• Outline changes in enrolment of women in Computer Science over the last 40 years

• List several theories as to why there are few women in computer science
There are lots of different kinds of diversity that computer science doesn't do well at

- Gender
- Ethnic/racial
- Disabilities

Note that many of the stats that I have come from the US. They still generally hold for Canada, but it's harder to get good numbers/graphs.
RQ: North American bias

"Why is there a significant contribution of women majoring in computer science/engineering from countries other than America - may it have to do with their education systems?"
Let's start with the state of CS Women in the US

From the Mercury News
Underrepresented minorities in the US

31% of US population was Black or Hispanic or first nations in 2010

Connecting with Computer Science
www.ugrad.cs.ubc.ca/~cs101
RQ: What about UBC?

"What are the historic averages and trends for women studying computer science in UBC?"

I don't have minority data for UBC.
"If a certain demographic is statistically uninterested in a particular field, why should this be of any concern? Why must professionals go out of their way to make that field more appealing to that specific demographic?"
Why diversity matters

As shown in the first reading, different ideas come from different people with different perspectives.
Some of these differences can seem quite silly but be quite profound

"Two years ago, we had a woman speaker … who is in charge of chassis design for the Ford Windstar. She gave an uproariously funny talk about the difficulty women have with a car that has been designed for the 50th-percentile male. Women have different needs, women carry purses, women use a vehicle differently, women are of a different size, etc., all of which make the 'male car' difficult to use.

As I said, it was a very funny talk. However, when I mentioned this to my wife, who has a long involvement with the Defense Department, she said, 'Yes, and it's just as true of fighter planes where it's not funny; it's a life and death matter.'"

- Bill Wulf – member of the National Academy of Engineering
A related RQ, that leads into another reason:

“Are there actually jobs available for women in fields involving computer science and what are the chances these women will beat out men for these positions?”
Another reason is that there are more computer science jobs than qualified people

"120K technical computing jobs produced annually, but we graduate only 40K BS degrees in computer science disciplines (i.e., **80K new jobs go unfilled each year**)"


It's easier to recruit from those who aren't participating much.
A nice graph on the deficit for WA state

High Employer Demand Occupations at the Bachelors and Graduate Level

- Computer Science: 2,846 (2010 Completers) + 1,867 (Additional Supply)
- Health Professions: 4,124 (2010 Completers) + 1,151 (Additional Supply)
- Engineering: 1,665 (2010 Completers) + 1,101 (Additional Supply)
- Life Sciences and Agriculture: 731 (2010 Completers) + 458 (Additional Supply)
- Physical Sciences: 385 (2010 Completers) + 353 (Additional Supply)
- Human and Protective Services: 913 (2010 Completers) + 239 (Additional Supply)


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"Computer Science in UBC is under both Bachelor of Arts and Bachelor of Science. Do you think this is also a way to encourage the majority of women to get involved in IT? " 
Let's look back at those UBC graphs

https://www.cs.ubc.ca/our-department/women/statistics
Finally, computer science is of growing importance to other fields

I'll let Maria Klawe take this one:

https://www.youtube.com/watch?v=FNSzfPnB0uc&t=12m02s
“Society seems to forget the jobs where women are the majority of the work force, eg. Nurses, kindergarten/primary school teachers. The question I am trying to get at is, will the fields of work be forever bound by tradition and social norms. Are we simply not hiring certain genders based on the norms and so called "laws" that we grew up with. ”
Excellent question!

- I worry about that, too
- Note that this is a recent turn of events [http://www.nytimes.com/2014/09/07/sunday-review/why-dont-more-men-go-into-teaching.html?_r=0](http://www.nytimes.com/2014/09/07/sunday-review/why-dont-more-men-go-into-teaching.html?_r=0)
- But this is a computer science class
- Plus female dominated fields tend to pay substantially less and have less prestige than male dominated fields (this happened in nursing and teaching, too)
RQ:

"Are women and men biologically predisposed to certain fields of study/work, or are all gender gaps due to societal conditioning, or a combination of the two? If both, how much is nature and how much is nurture?"
Why does this imbalance in CS happen?

- We have some guesses
- No one's entirely sure
- But there are some factors that we can say are issues (we'll do those next)
One problem: it starts early

We can use high school Advanced Placement (AP) exams as a proxy for this

Overall:

Computer Science


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This translates directly into people's perceptions of CS – even excluding what they "like"

Figure 2. Interest in Computer Science/Computing College Majors by Gender & Race/Ethnicity
Responses to “how good a choice Computing / Computer Science / Information Technology would be as a college major for you or someone like you?”

http://www.acm.org/press-room/membership/NIC.pdf (next 3 slides)
This is correlated with comfort with tech.
We can see how this impact what they "like"
RQ:

“What makes computer science/engineering so much more inviting to males? Does it have to do with toys/games we play as children?”
The Lego Ad mixer!

Not just informative about how we shape gender values at a young age, a great example of fun with HTML5!

http://www.genderremixer.com/lego/
“What steps has UBC taken to have women interested in more diverse and non-traditionally women dominated fields, mainly computer science?”
One example: Girlsmarts is UBC CS's annual workshops for grade 6 and 7 girls. Subjects like robotics, HTML, Human Computer Interaction.

https://www.cs.ubc.ca/grades-k-12/girlsmarts
RQ: Bias

"Given the fact that women are equally capable of excelling in science related studies as men, how come many men still believe that women are less educated about computers? "

Connecting with Computer Science
www.ugrad.cs.ubc.ca/~cs101
Let's talk about bias. There are two main ones involved.

- **Conscious bias** is when you're biased and you know it (and you're generally not sorry)
- **Unconscious bias** is when you're biased… and you may not know it (and if you do, you're sorry)… and you may even be biased against what you believe!
An example of unconscious bias

- [http://wwest.mech.ubc.ca/diversity/unconscious-bias/](http://wwest.mech.ubc.ca/diversity/unconscious-bias/)

RQ:

"why do you think it is that the history described in "Bras in Space: the incredible story behind the up coming film" isn't more well known than other aspects of the space race? ”
Bias exists many ways

"A research article written by a woman and published in any of the top journals will still receive significantly fewer citations than if that same article had been written by a man."

"Articles published by women in the top IR [International Relations] journals are cited less often than those written by men even after controlling for the age of publication, whether the author came from a [top research] school, the topic under study, the quality of the publishing venue, the methodological and theoretical approach, and the author’s tenure status."

http://curt-rice.com/2013/10/19/the-great-citation-hoax-proof-that-women-are-worse-researchers-than-men/
It even exists in how we think about ourselves

Self-citations are citations made to the author's own work

### TABLE 5. T-test comparing self-citations among author gender

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>95% confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-authored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>0.40</td>
<td>0.02</td>
<td>0.37–0.43</td>
</tr>
<tr>
<td>Women</td>
<td>0.25</td>
<td>0.03</td>
<td>0.19–0.31</td>
</tr>
<tr>
<td>Difference</td>
<td>0.15***</td>
<td>0.04</td>
<td>0.07–0.24</td>
</tr>
<tr>
<td>Coauthored</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>0.91</td>
<td>0.04</td>
<td>0.83–1.00</td>
</tr>
<tr>
<td>Women</td>
<td>0.41</td>
<td>0.16</td>
<td>0.08–0.74</td>
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<tr>
<td>Difference</td>
<td>0.50**</td>
<td>0.24</td>
<td>0.03–0.97</td>
</tr>
<tr>
<td>Mixed gender</td>
<td>0.89</td>
<td>0.06</td>
<td>0.77–1.01</td>
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<tr>
<td>Difference</td>
<td>−0.02</td>
<td>0.08</td>
<td>−0.17–0.13</td>
</tr>
</tbody>
</table>

Notes: ** p < .05; *** p < .01.

http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=9038606
Fun topic: Impostor syndrome

Impostor syndrome is the feeling that you’re not as good as people think you are. It’s the feeling that you’re a fake.

Confidence in ability to write a computer program:

- **Students with high math ACT scores**
  - Male CS majors: 63%
  - Male non-CS majors: 60%
  - Female CS majors: 48%
  - Female non-CS majors: 44%

- **Students with low math ACT scores**
  - Male CS majors: 53%
  - Male non-CS majors: 49%
  - Female CS majors: 37%
  - Female non-CS majors: 34%

Especially interesting: High-scoring female CS students vs. low-scoring male non-CS students
The way things work

Currently in North America, often [HUGE STEREOTYPE DISCLAIMER HERE!] women and underrepresented minorities tend to be more motivated by how to use technology than how it works.

That's not to say that white/Asian males aren't motivated by this as well.
That's also not to say this is innate.
I have a theory about that…

- One of the goals of this course is to help you realize all the things that computer science can do.
- I think that more people would be interested in computer science if we pointed out all the awesome things that computer science can do.
- You’ll have opportunities to point out some of the awesome things computer science can do.
- We’ll collect them all and then we can hopefully mount a campaign to change the world!
Awesome CS examples


- Astronomers create first realistic virtual universe: [http://www.sciencedaily.com/releases/2014/05/140507142849.htm](http://www.sciencedaily.com/releases/2014/05/140507142849.htm)
Another factor: people tend to like what they feel they do well in

- Boys tend to have more computing experience with computing than girls
- White people and Asians tend to have more computing experience than underrepresented minorities

This can lead to a classroom where women and underrepresented minorities feel intimidated.
RQ: Affirmative action

“Currently there are all sort of affirmative actions to support women’s involvement in the area of technology. Despite the social benefit of action, won’t this slow down the advancement in technology? Because, sometimes chances are given to a woman (affirmative action) when there is even a man who can do the job better than her.”
"It seems that computer scientists have to be 'amazing' at math… Is it important to excel in math or is it just a stereotype?"
RQ: which brings us to this class

“What are some of the main draws of computer science for both genders and how do you plan on incorporating them into the course?”
You may have noticed some things about this class

• You can't take it if you have university credit for a computer science class
• It's focused on how computers interact with society

These are not accidents.
How does this work out? (Data from last year)

- CPSC 101: 57 out of 121 women (47%)
- CPSC 110: 121 out of 310 women (39%)
- CPSC 304 – Databases: 21/114 (18%)

I can't get data on racial background
In case you're interested in more…

There's an annual celebration of women in computer science:

http://www.gracehopper.org

I’ll be going there to present at a workshop on how to survive grad school on October 6.

I’ll report back when I return.
Learning Goals Revisited

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