What does Gender have to do with Physics?

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... or
Gender dimensions in Physics
– always there, often forgotten!
Disclaimer

• We should use evidence and gender research

• ... but here, I will only be able to describe it briefly.

• I will use it to illustrate useful concepts,

• ... but for full understanding and critical evaluation – go to original work.
Taxonomy of Change

Londa Schiebinger, Stanford University

1. Fix the number
   - Fix the women

2. Fix the institutions – Culture

3. Fix the knowledge – Subject

Indicator
Trap!
Focus!
Different approaches

- Numbers and statistics
- Culture – Myths
- Culture – Bias
- Knowledge
Level 1: What about numbers?
Vertical segregation – Science in Lund

Career paths in a typical Science faculty.

Many different curves – but the same outcome

Weak dependence on input!

% women in Science in Lund

Bias!
Flexible cascade model
- Science Faculty in Lund – some time ago...

% women

<table>
<thead>
<tr>
<th>Position</th>
<th>% Women</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD</td>
<td>45%</td>
</tr>
<tr>
<td>PhD&gt;Asst</td>
<td>25%</td>
</tr>
<tr>
<td>Asst prof</td>
<td>?</td>
</tr>
<tr>
<td>Asst&gt;Assoc prof</td>
<td>20%</td>
</tr>
<tr>
<td>Assoc prof</td>
<td>15%</td>
</tr>
<tr>
<td>Assoc&gt;prof</td>
<td>10%</td>
</tr>
<tr>
<td>Professor</td>
<td>5%</td>
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</tbody>
</table>
Från the "leaky pipeline"…

…. to the "vanish box"

… or "diverse pipelines"

*Etzkowitz and Ranga 2011*

*Ong et al 2017 and the Harvard project*
Myths in Science that affect knowledge production:

- Culture without culture (Beamtimes & Lifetimes)
- Priesthood/Toolmaker/Indiana Jones
- Hercules culture (UPGEM project)
- Myth of effortless success (Physics Education and Gender)
- Nerd culture of cosmopolitans (CERN study)
Culture with no Culture

Antropological study of Physics labs (SLAC and KEK)

• Culture with no culture – “longing” for objectivity

• What is excellent is perceived as male – universally

• Relationship to machines and nature (gendered)

• Grooming of new generations

... Later research: The stronger the myth of objectivity
- the more subjective we get
  
  Castilla and Benard 2010

Traweek: Beamtimes and Lifetimes
Hercules
(Hasse and Trentemöller 2008)

Trying to explain different percentage of women among Physics professors in five countries: Denmark, Estonia, Finland, Italy, Poland

Which one do you think had the highest %? ... and the lowest?
Results (women among Physics Profs):
  Denmark – 3%
  Estonia – 11%
  Finland – 12%
  Poland – 14%
  Italy – 23%

Why? Many thoughts on outside Academia – but no complete correlation (e.g. work-life balance, Classically schooled Physicist, Religion)
– but a new dimension turned up - Culture within Physics!
Hercules:

Oh yes, there is a lot of competition. This whole process is extremely competitive. The case that the department needs to make to the university is that I am not only good enough for the job, but I am the best person in the world for this job.

Care-taker:

There’s always a team behind a genius. (...) Good teamwork always brings the best results, but of course, not everyone is lucky enough to find a good group to work with. Sometimes when there are very competitive people, it is difficult to form a group..

Working bee:

But in this respect, for us not to show ourselves too much and do no crazy things, we had to sit quiet and pretend we were not there
Hercules

Denmark – 3% - Hercules
Estonia – 11% - Working bee
Poland – 14% - Working bee
Italy – 23% - Care-taker
Finland – 12% - not a clear culture

But perception of culture! What does it do to the minorities, how does it affect “feeling of non-belonging”? 
Myth of effort-less success

Boys and girls in school are
• Equally interested in method of Physics
• But in different applications

A recognized myth is
• *Successful Scientists are doing Science effortlessly.*

But correct and inclusive idea is “it is hard work”.
Effort-less comes from background, familiarity of examples, metaphors, culture, family background.
Non-belonging

Many students have a feeling of non-belonging, for many reasons.

Reactive first step – let them know it is common!

Pro-active second step – change culture, representation ....
More about these topics

- **Stewart and Valian 2018, Inclusive Academy**
- **Drew and Caravan 2021, Gender-Sensitive ...**
- **Brage and Lövkrона 2016, Core values ...**
Level 3. Gender in knowledge

http://genderedinnovations.stanford.edu/
Sometimes it is “obvious” (but often forgotten):

- Sex and/or gender in the topic you research: Medicine, Biology, Organic Chemistry, Biophysics. [Example Animal research](#)

- Or it is applied: Meteorology, Engineering, Climatology. [Example Transport system](#).

- There is always the sex of the researcher! [Example](#).

- But, what about when it is not? Are you immune?
Not obvious?

• Where sex and gender is not a part of what is studied,

• or what it is applied to ...

• Where there is a strong resistance against a gender perspective

• Where there is an idea of “Culture with no culture”

• Where the Positivistic Paradox prevails...
The Positivistic Paradox in Physics:

Physics is considered to be objective
– not affected by the sex or gender or ... of the people involved (researcher, teacher, student ...)

... but ....

Culture of physics is affected by sex, gender, ...
- Class-rooms, labs, history, board rooms are almost always dominated by white men

... seems like a contradiction ...
Resistance 1: The God Trick

• *I study electrons or stars – they don’t have a sex!*

• *I study differential equations – their solutions do not depend on gender/sex!*

This is a version of the “God Trick” – we pretend we have an objective and transcendent sight or we are situated were we have an objective view. (Harraway)

From a sociology of science point of view we have to go further ...
Resistance 2: Curiosity

• “I am involved in curiosity-driven science”

• But who’s curiosity is driving Science and who decides what and how things should be researched? ... and how is that shaping the science of the future?
Subjectivity

There is a meaningful relationship between the questions we ask, who scientists are, and what we come to know.

Prescod-Weinstein, 2020, p. 439
Associate Professor of Physics
University of New Hampshire

Image source: University of New Hampshire
Conclusion

The only useful definition:
Science is what Scientists do! (“Doing Science, Doing Gender”)

.. and we do a lot of gendered things:
• We use metaphors, similes, clichés, analoges
• We choose examples
• We name things – machines, labs, particles, equations, properties ....
• We represent science with labels, pictures, ...
• We use role models
• We build our science on an epistemology.
• We choose methods, teams, collaborations, what to research
• We do th full research wheel!
Level 2: "Culture":
- bias and meritocracy
Bias and illusions

For how many balls do you see a collective motion?
Test your own bias with IAT-test.

Test of your own bias.
Banaji et al, *Project implicit*,
https://implicit.harvard.edu

Watch it in the movie *Picture a Scientist* at 50:30 minutes
Bias-experiment: IAT-test

You can test it yourself:

Implicit Association Teast (IAT)

https://implicit.harvard.edu/implicit

M. Banaji (Harvard University), T. Greewald (U of Washington) and B. Nosek (U of Virginia)

Picture a Scientist 50:30 minutes
Bias in the movies

Evaluations of candidates to a position in a lab.

John and Jenny by Moss-Racusin: Picture a Scientist 47.30 minutes
Systemic bias

1: ”Decoupling”
Saying one thing, doing another e.g.

One says: “We only look at qualifications and merits – it is all about the best candidate”

… but one does, e.g.

• Tailor-made advertisements
• Hand-picked experts
• Lack of openness

2. Standardisation
Pretending there are objective measures e.g. excellent journals and h-index.
Or using point systems with weak justification
See DORA association (sfdora.org)

similar results from Netherlands (van den Brink 2010) and Finland (Husu 2000)
Systemic bias

3. Symbolic boundary work
Justifying through stereotypes, e.g.

Sexism
• Old sexism: “Women are not fit to or it is dangerous for them to …”
• New sexism: “Women do not want to do, or someone else is against it …”

Cloudy ideas of “risk-taking” and “caring vs competition”
What can bias lead to?

Effects on recruitment, micro-aggressions and discrimination.
Bias and harassment

Actions will be harder the further it gets in this process.

Bias against some groups → Micro-agressions suppression* Non-events → Harassment Discrimination**

Awareness training → Observers By-standers → Disciplinary actions

Proactive/Preventive ................................................................. Reactive
One note on harassment/bullying and excellence

What is true?

• Some are bullies in spite of being excellent.

• Some are bullies because they are excellent.

• Some are bullies because they are not excellent — a career move for a mediocre.

Täuber and Mahmoudi 2022, How bullying becomes a career tool, Nature Humane Behaviour 6 475
Recruitment processes – a minefield of bias

Inspired by M. Dockweiler, South Danish University
LERU advice paper on bias – full process

1. **Monitor and follow up** careers and assign **accountability**.
2. **Offer training** to understand and mitigate bias.
3. **Use bias observers** in recruitment and funding processes.
4. **Evaluate the language** in recommendations etc.
5. **Eliminate pay gaps**
6. **Evaluate quality**; Compensate for **care leave**.
7. **Monitor precarious contracts** and part-time positions.
8. **Use positive actions** against vertical segregation.
Some examples
Ex: Visual representation

A Standard first year Physics book.

*Benson: University Physics.*

Reported to be sexist!
Visual representation

We should have been suspicious – first picture:

If you have lived here, it means something different to you ...
Sexist?

If you have experienced sexual harassment, it means something different to you.
Elizabeth Manley controls her angular speed by varying her moment of inertia.

During a grand jeté, a ballet dancer appears briefly to “float in air.” However, the center of mass still follows a parabolic path.

The net work done on the javelin is equal to the change in its kinetic energy.
The climber has done work to increase his potential energy.

Although the mass of Edwin Aldrin, Jr., had not changed, his weight on the moon was roughly one-sixth his weight on earth.

A weight lifter does work to lift weights but not to hold them at rest.
Conclusion

• Culture and Subject are intertwined – can’t be separated.

• Ex: Culture is breeding certain leaders, who makes priorities that shape Science.

• Culture creates an “image” of Science (and the Scientist), which affects knowledge production and sense of belonging.

• To understand the Knowledge production, we need to understand the Culture.
Gendered Research and Innovation:
Integrating sex and gender analysis into the research process

Implicit bias in academia:
A challenge to the meritocratic principle and to women’s careers –
And what to do about it

Equality, diversity and inclusion at universities: the power of a systemic approach
LERU position paper
September 2019
GeDiMIRT conference in Lund, June 2022

GENER A conference on
GeDiMIRT :

“Gender Dimensions in Physics and other
Math-intensive Research and Teaching”

Playlist of talks on youtube:
https://www.youtube.com/playlist?list=PLXGHXpAti7oG5QJHfT9qt-rPGrcPAT0ji

www.genera-network.eu
The GenderEX project

- Horizon 2020 project on Gender for Excellence in research.
- Homepage: Genderex.eu
- Conferences, courses for young researchers.
It is not easy...
Thank you for your attention!
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