
CERN

# Gender Equality in Education

A lecture created by CERN's Diversity Office, in the framework of the CERN Teacher Programmes

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# Agenda

1. Gender balance in STEM

2. Stereotypes and bias

3. Promoting Gender Equality in Education

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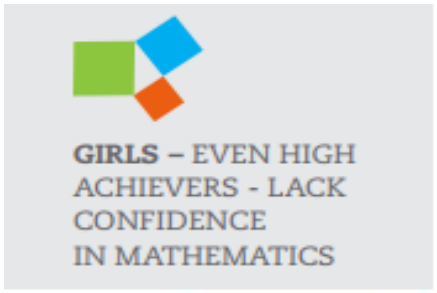
1. **Gender balance in STEM**
2. Stereotypes and bias
3. Promoting Gender Equality in Education

# **Girls are less likely than boys** to take up science subjects in high school, in western countries







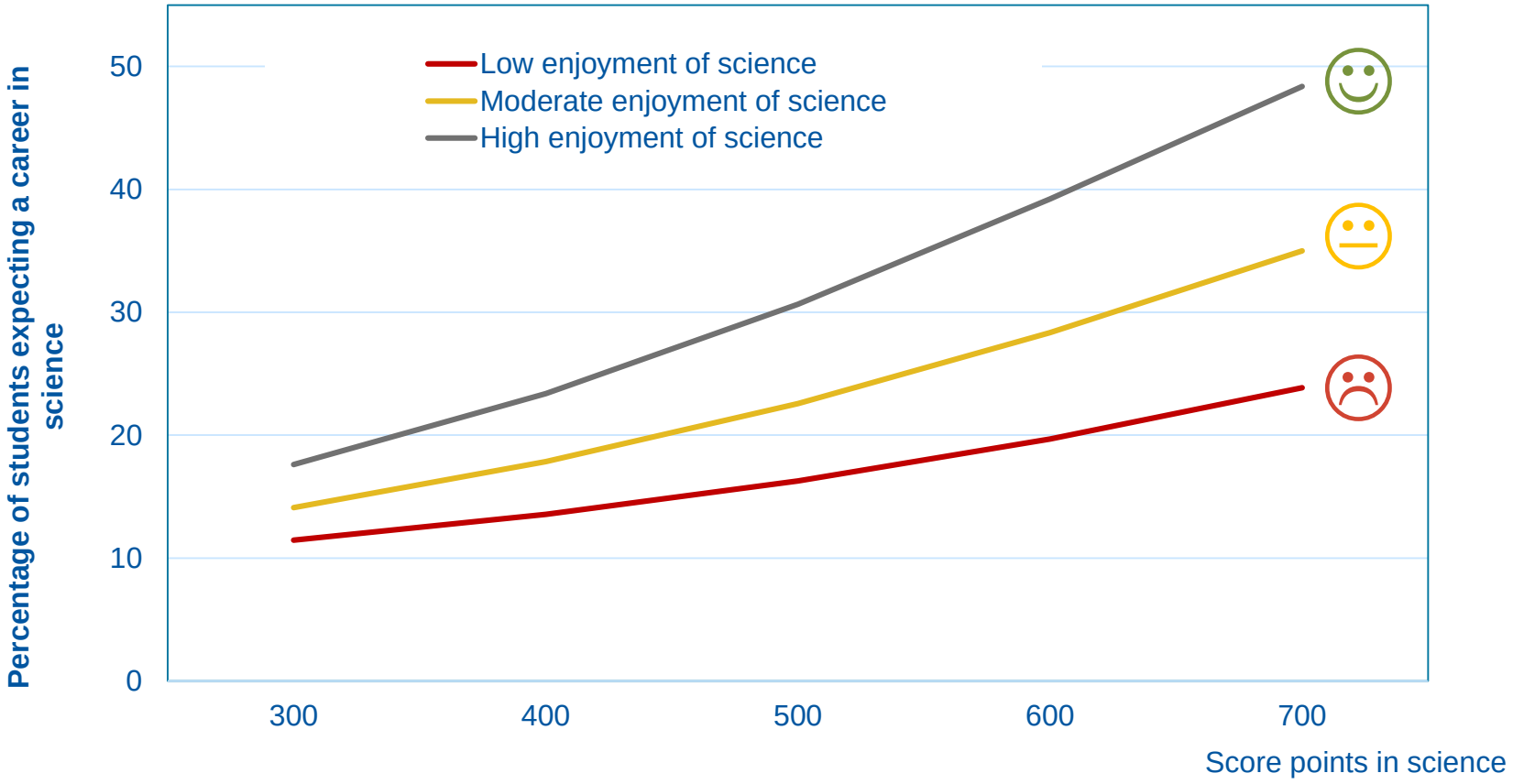

***Scientific fact:***
*"Perceptions and expectations influence the performance of students"*



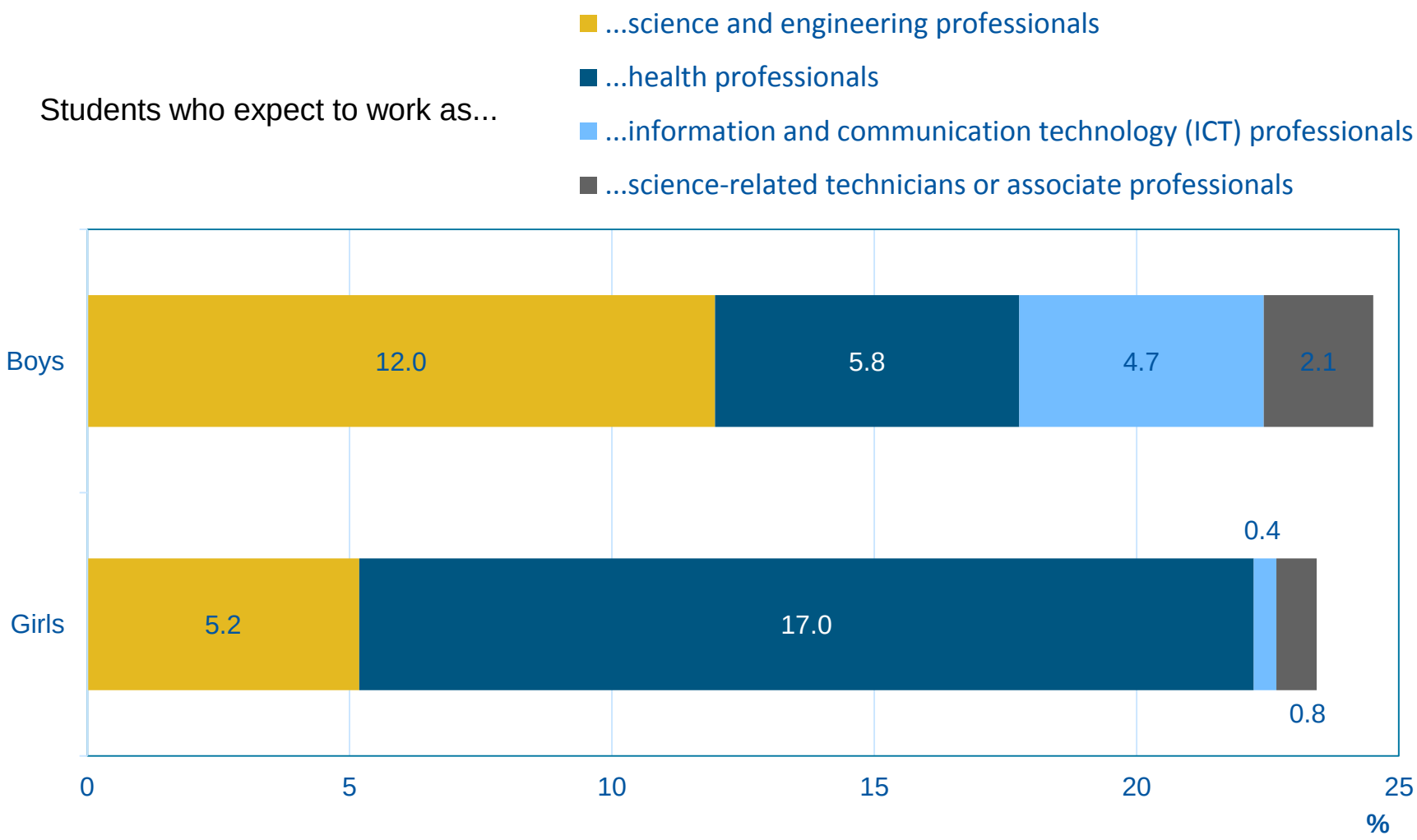
PISA study 2015, The ABC of Gender Equality in Education

# Students expecting a career in science

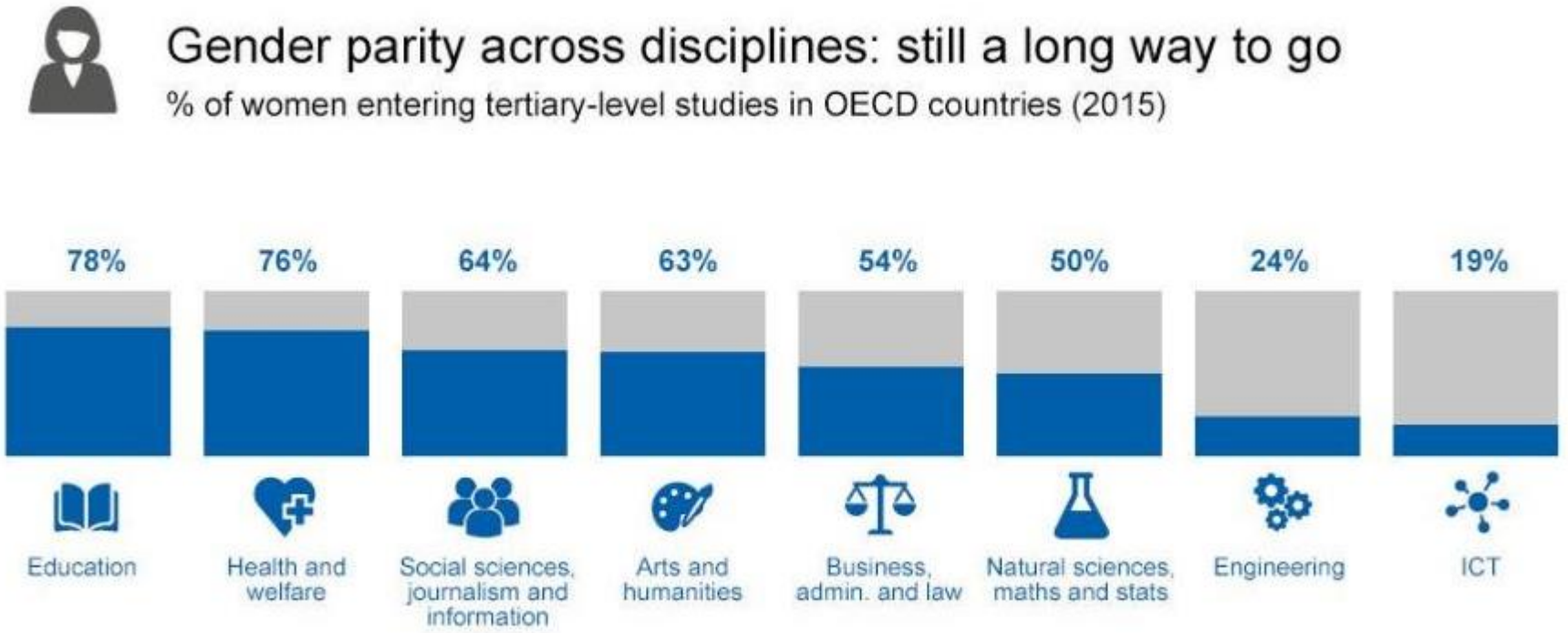
by performance and enjoyment of learning



# Boys and girls' expectation of a science career



# Education choices

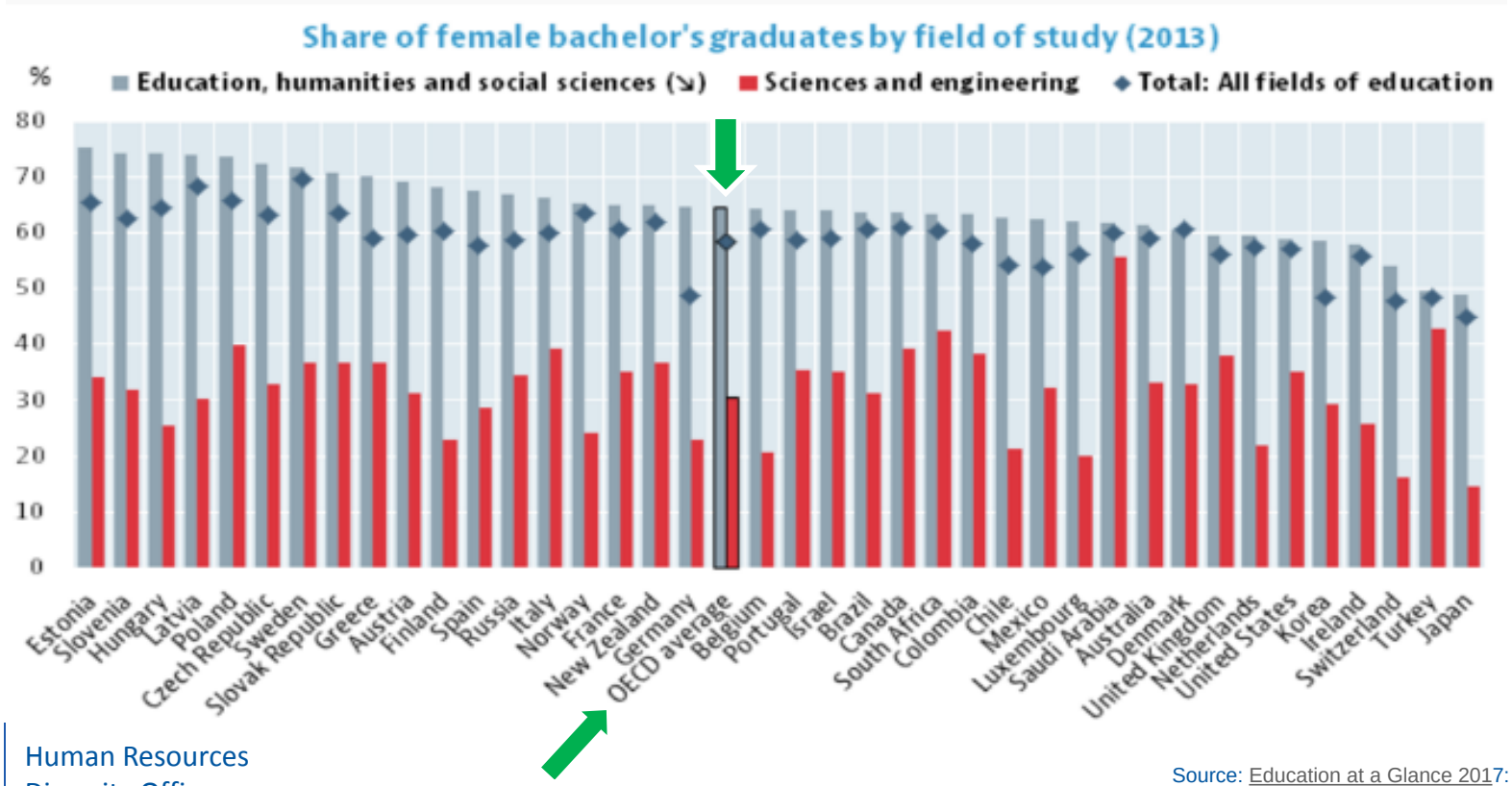





OECD, Education at a Glance 2017

# Education choices

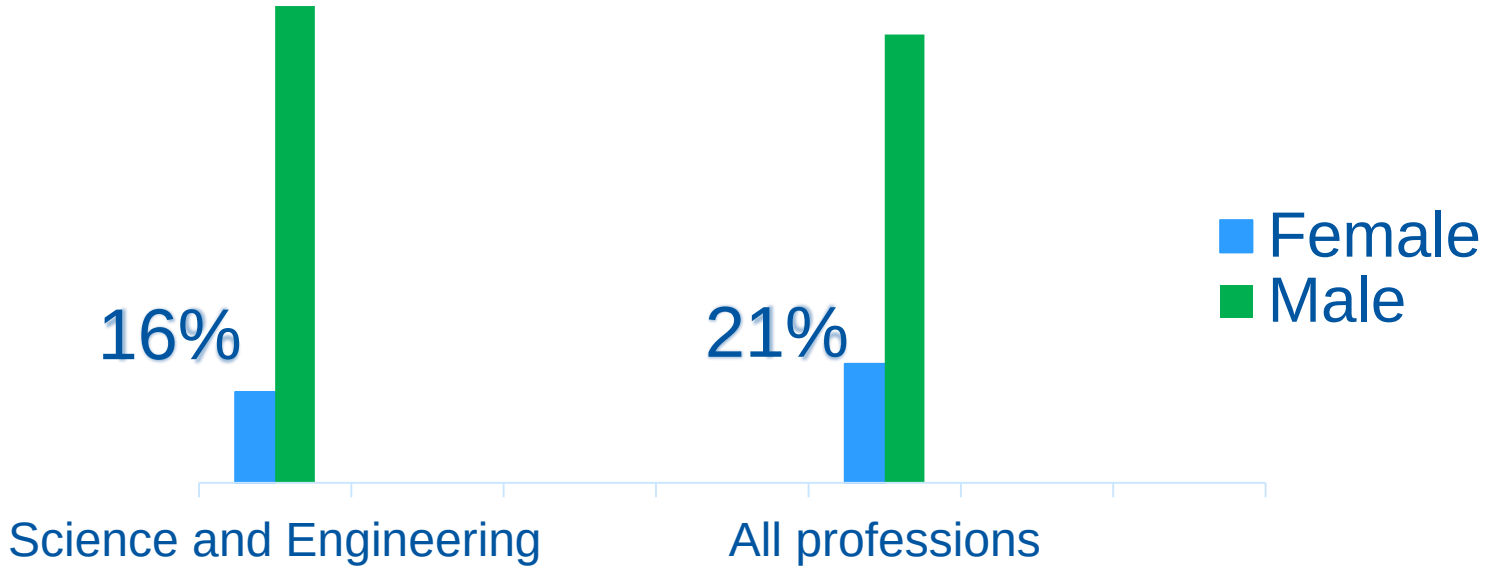
- Secondary education programmes graduates: **45% male – 55% female**
- Bachelor's degree graduates: **58% Female – 42% female**
  - BSc. in education, humanities and social sciences: **64% Female**
  - BSc. in sciences and engineering: **31% Female**




Source: Education at a Glance 2017: OECD Indicators: https://www.oecd.org/gender/data/gender-gap-in-education.htm.

# Gender distribution in various professions

## at CERN



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**2. Unconscious bias and stereotypes**

3. Promoting Gender Equality in Education

# Brain plasticity

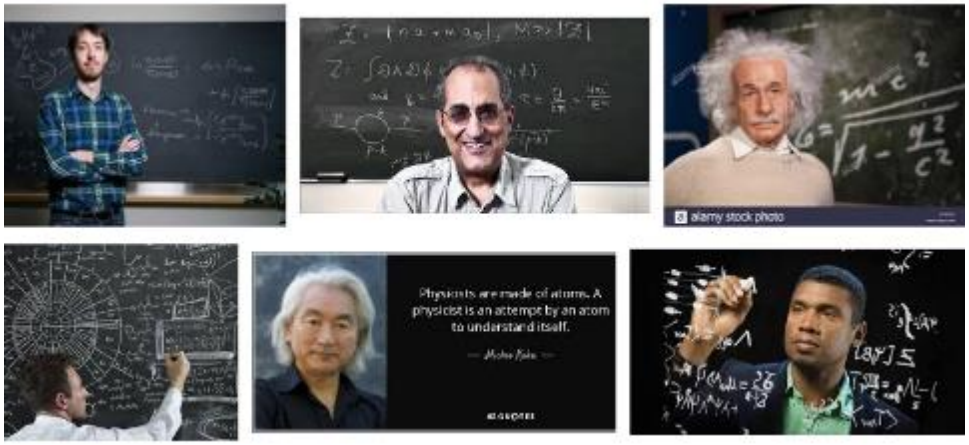
In the 19th century, **the difference in brain sizes** was a major argument to explain the hierarchy between men and women, and was supposed to reflect innate differences in mental capacity.

Nowadays, our understanding of the human brain has progressed dramatically with the demonstration of **cerebral plasticity**. The new brain imaging techniques have revealed **the role of the environment in continually re-shaping our brain** all along our lifetimes as it goes through **new experiences and acquires new knowledge**.

# How does a scientist look like?

## Stereotypes in science

Looking up the word “physicist” on the web




***C. Vidal, 2005:***
*“A human being is firstly a product of his / her own social & cultural history*

**“Sketching scientists!”**

In the 1960s and 1970s, 1% of students would draw a woman scientist. Today, roughly 1 out of 3 does.

Image: CERN

→ **Remember: science textbooks and resources matter!**

# Stereotypes

- Stereotypes are ready-made representations to filter our experience of the world
- Stereotypes can be positive or negative, accurate or not, justified or unjustified
- Many stereotyped beliefs are acquired at an early age
- They are called up almost automatically
- Persons may experience anxiety knowing that they are a target of prejudice and stereotypes
- Capable individuals within a group may unconsciously conform to their group's negative stereotype

# Unconscious bias

Refers to a bias that we are unaware of, and which happens **outside of our control.**

It is a bias that happens **automatically** and is triggered by our brain making quick judgments and assessments of people and situations, influenced by our **background**, **cultural environment** and **personal experiences**.

- Halo Effect: our overall impression of a person influences performance evaluation

- Confirmation Bias: individuals tend to search for, interpret, focus on and remember information in a way that confirms their preconceptions



Take the Harvard University Implicit Association Test!

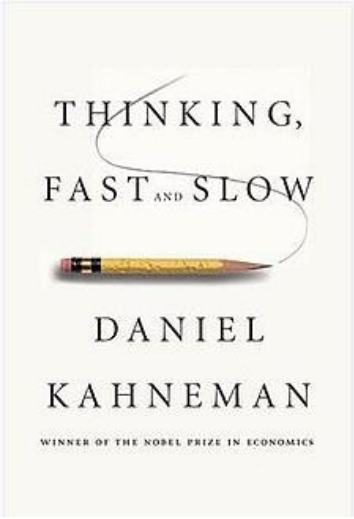
# How do we make decisions?

**SYSTEM 1 THINKING**
**Automatic system**

- *Effortless*
- *Impression, feelings*
- *Uncontrolled, Fast*
- *Prone to visual illusions*
- *Jump to conclusions*

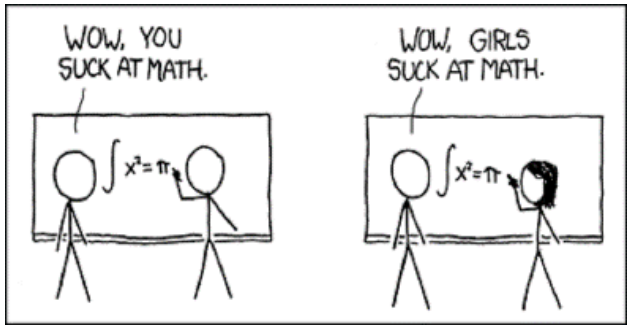
**SYSTEM 2 THINKING**
**Reflective sytem**

- *Effortful*
- *Conscious decision*
- *Problem solving*
- *Thinks statistically*
- *Can be invoked to control biases*




*Daniel Kahneman, Thinking fast and slow*

System 1 thinking involves **associating new information with existing patterns**, or thoughts, rather than creating new patterns for each new experience.



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# Creating an enabling environment

Picture taken from https://www.getsmartoregon.org/about-smart/equity/

***Equitable = not treating everyone the same,***
***But creating an environment which allows everyone to give of their best…***

# Gender effects

## In STEM context, female students are:

- More likely than men to attribute success to hard work or luck rather than skill
- More likely to blame themselves for a lack of success than are male students
- Require higher grades to persist in a field than men do
- Tend to feel less comfortable in public debate, are more likely to be interrupted
- Tend to phrase their comments in a hesitant manner

# Think Equity vs Equality

**Be aware!**

**An investigation into the impact of question structure on the performance of first year physics undergraduate students at the University of Cambridge**

The Department investigated the impact of exam question style on the performance of first year Natural Sciences students who took physics as one of their options.

Their findings? **Scaffolded type questions significantly improve the performance of both men and women from all school backgrounds**, with the women benefiting more than men. In a group of 77 female students, the average exam mark increases by 13.4% for scaffolded questions.


**Traditional university question:**

A potential difference of 2.1 ± 0.1 V is applied across a resistor of resistance 4.7 ± 0.1 Ω for 55 ± 1 s. Calculate the energy dissipated, together with its uncertainty. [5 points]

**Scaffolded question (taking students through a progression):**

(a) Write down an expression for the power dissipated in a resistor when a voltage is applied across it. [1 point]

(b) A potential difference of 2.1 ± 0.1 V is applied across a resistor of resistance 4.7 ± 0.1 Ω for 55 ± 1 s. Calculate the energy dissipated. [2 points]

(c) Find an expression for the fractional uncertainty in the energy dissipated and hence calculate the uncertainty in your previous result. [2 points]

# Science engagement

and gender equality

**People from all over the world**

**celebrate the Girls in ICT Day every year**

**organising events, workshops & programs**

**to encourage women to consider careers in ICT**

Bridging the STEM and ICT gender gap in Tanzania. Teachers take a hands-on role in the training course for ICT. (Photo from the ITU Blog)


***"Could you take part?"***

To date, over 300,000 girls and young women have taken part in more than 9,000 celebrations of International Girls in ICT Day in 166 countries worldwide.

# Science engagement

and gender equality

**Numerous initiatives are held locally and globally; to spark the interest of female students in science. A few examples below:**

- Girls in ICT Day:
  http://www.itu.int/en/ITU-D/Digital-Inclusion/Women-and-Girls/Girls-in-ICT-Portal
- International Day of Women and Girls in Science:
  http://www.un.org/en/events/women-and-girls-in-science-day/
- Expanding your Horizons:
  http://eyhn.org

**Expanding Your Horizons:**

an organization providing STEM experiences to female students to spark their interest.

***Find out what's happening in your country / region!***

# How can we do better?

## Re-thinking teaching methods


**Find out more on building an inclusive classroom:**

- Institute of Physics resources, on the matter: http://www.iop.org/education/teacher/support/girls_physics/resources/page_63821.html
- A leaflet with advice for teachers, on the topic http://diversity.web.cern.ch/2016/08/gender-inclusive-teaching-2016-high-school-teacher-programme

**Join the Inclusive Physics group, a community of practice:** https://www.facebook.com/groups/2014703878781663/


***Contribute in one of CERN's four core missions: "training the scientists of tomorrow"***

# Thank you!

## Questions ?

# References and resources


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