

Presentation by

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Science in
Public
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Are women part of mankind?

Gender diversity in science and technology and the role of science communication

To boldly go where



<https://www.youtube.com/watch?v=hdjL8WXjIGI>

No man has gone before?



<https://www.youtube.com/watch?v=qvX5tCo6FeM>

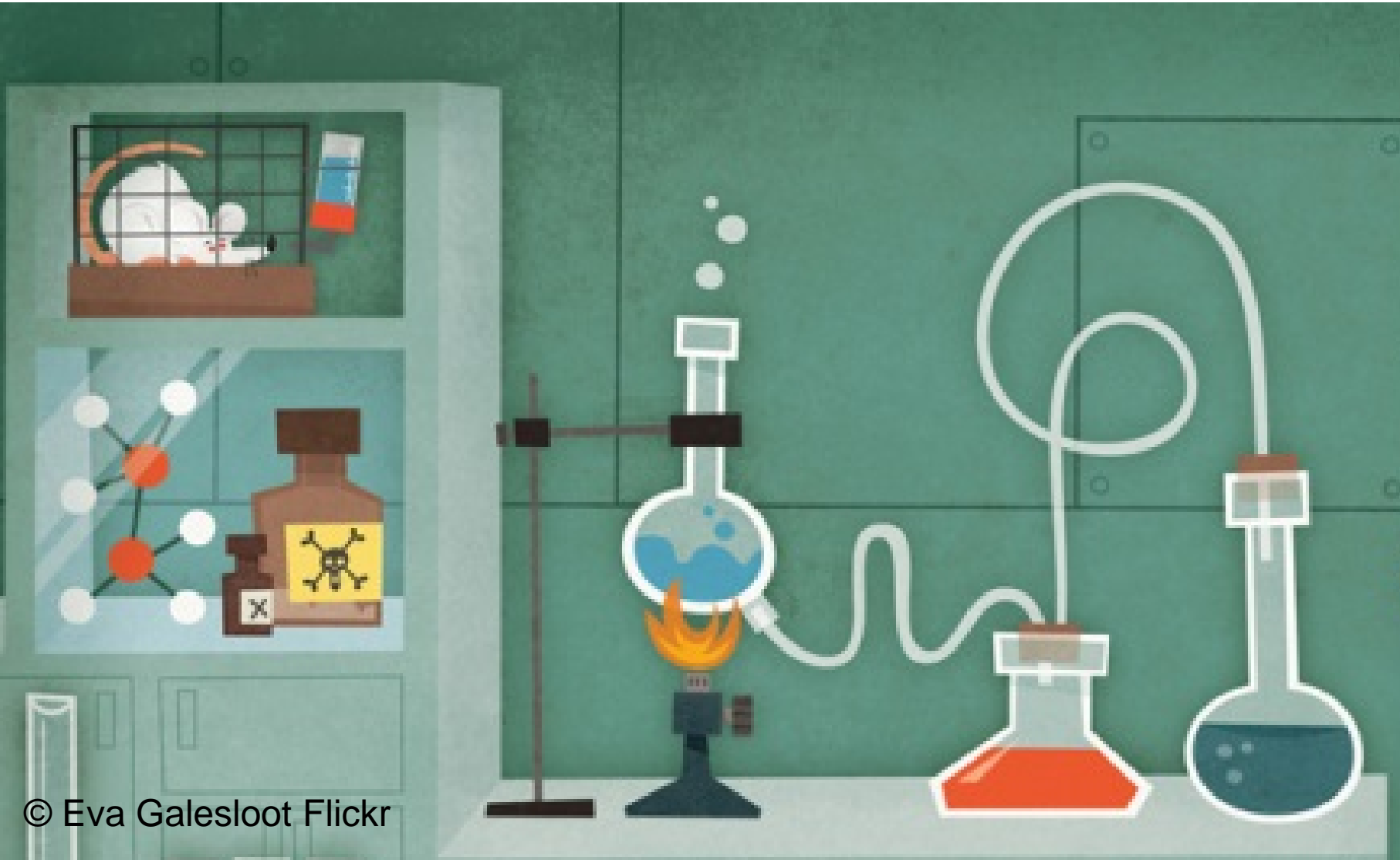
No one has gone before?

Does language matter?

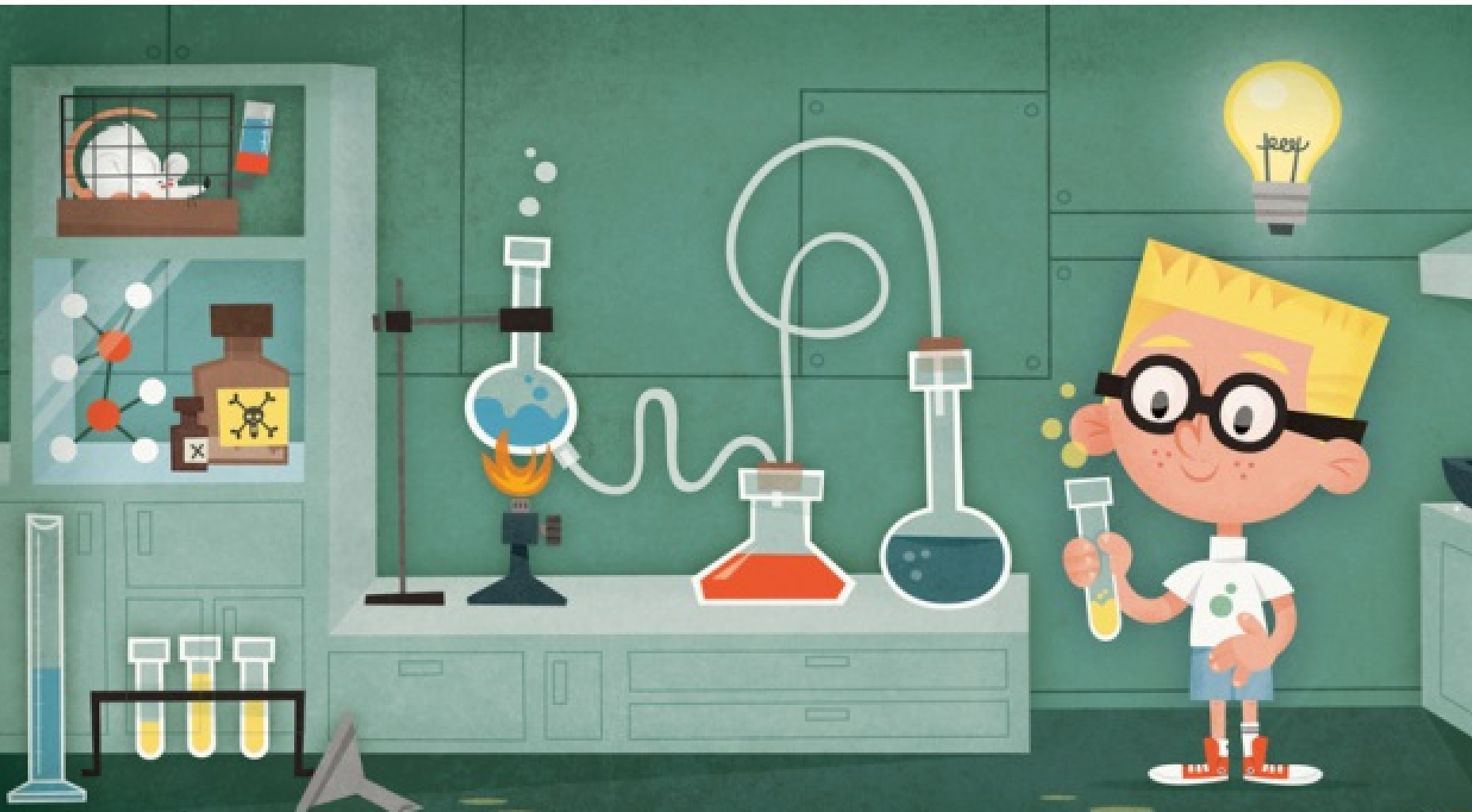
Man Made Climate Change



Does being human affect science and technology?



Does being human affect science and technology?



Do you have a gender bias?

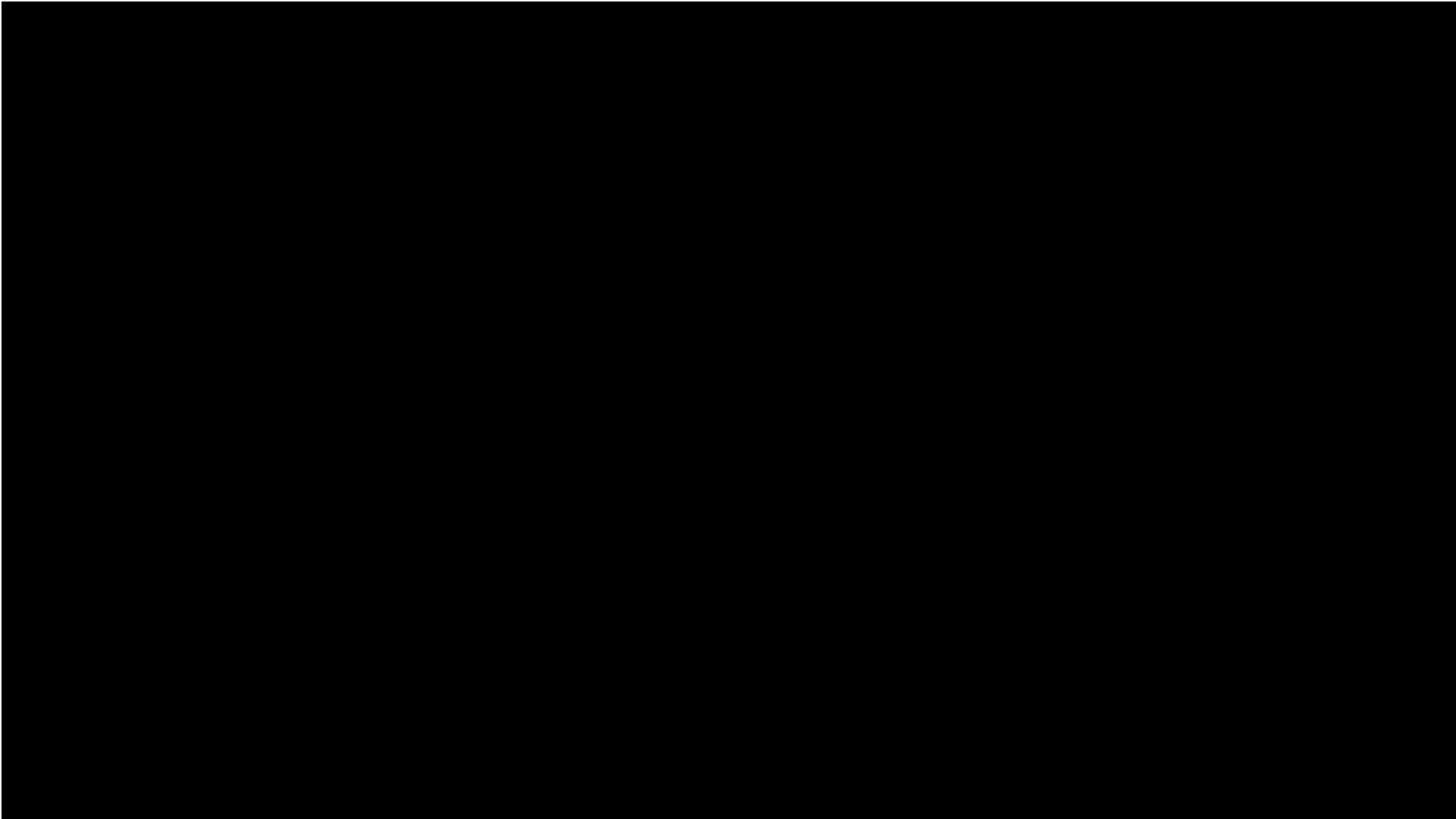


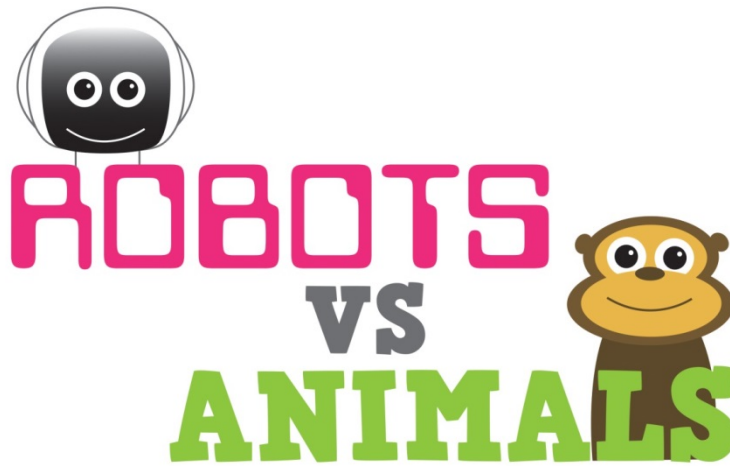
<https://twitter.com/bbcthree/status/839883748514512896?lang=en>



Redraw the Balance

<https://www.youtube.com/watch?v=qv8VZVP5csA>





People like me do that – and it's okay!
Vicarious experience and perceived self-efficacy

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Engineering has an image problem

#9%
is not enough
5%

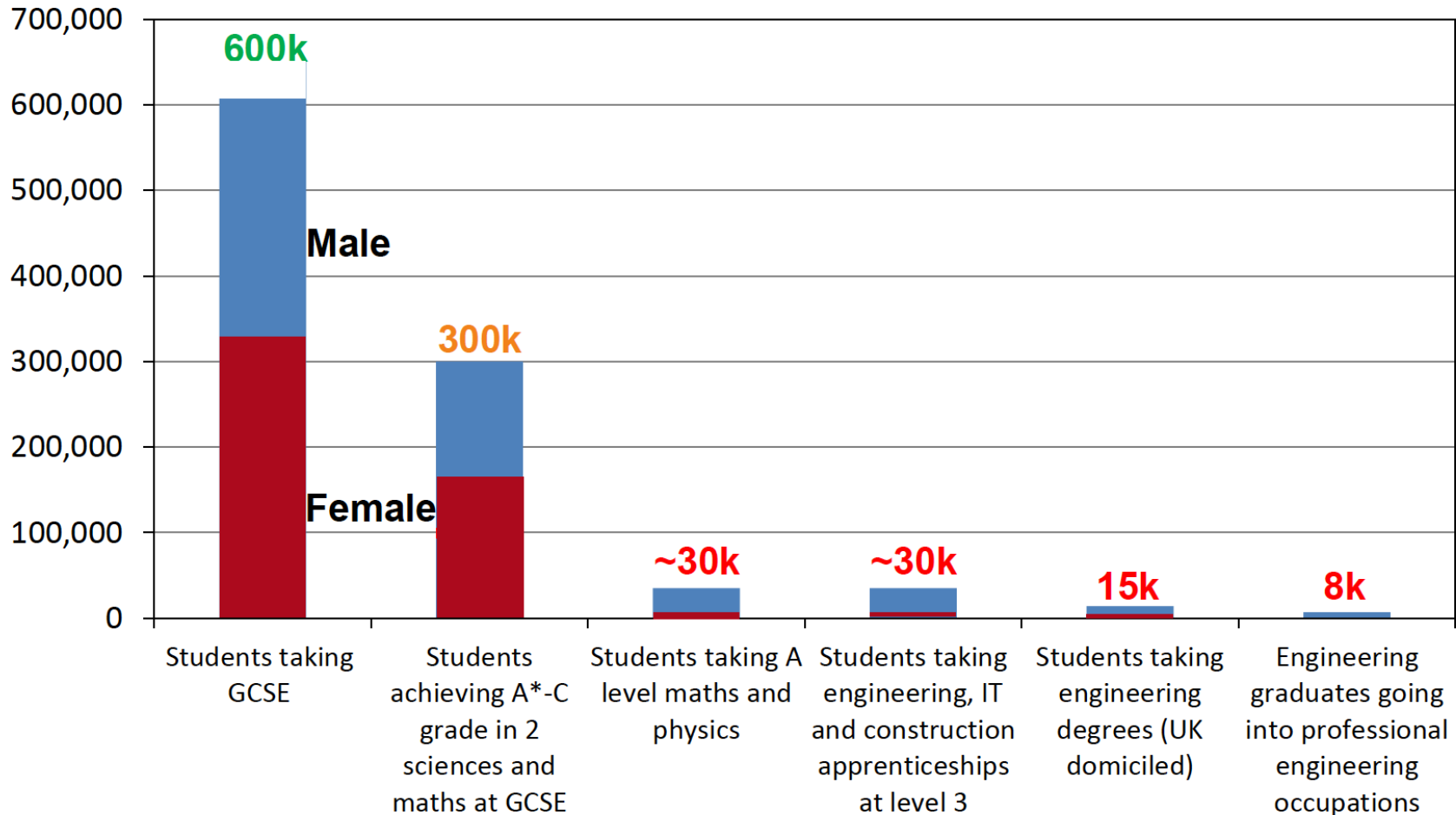
of primary school
teachers have a STEM
higher qualification

Gender identity is
formed between ages

5-7



Overview- The engineering Skills Challenge



Social Cognitive Theory

“An individual's learning is not only related to their personal capabilities and experience, but also to their observations of others within the context of social interactions, experiences, and outside media influences”.

Fogg-Rogers, L., Sardo, A.M., Boushel, C. (2017)

Direct learning

Experience of success and emotional arousal = mastery



Indirect learning

Social norms and social persuasion
Vicarious experience = role modelling



Why girls think being an engineer or a scientist isn't for them:

Tomorrow's Engineers

62% of girls regard engineering as being 'more for men'

#TEweek13

To see what we're doing to make a difference, visit bit.ly/GirlguidingTEW13

they would be put off by the working environment

22%

not enough female role models in the industry

60%

lack of knowledge of such jobs

43%

not many girls or women do these kinds of jobs

47%

sexism in the workplace

30%

Source: Girls' Attitudes Survey Statistics 2011 & 2012



WE DISCOVER, WE GROW

Girlguiding

Registered charity number 306016

Social persuasion...



STEM engagement... with whom?

Engineers

- Improving public engagement skills is a key aim for engineering professional bodies (EPC, 2014)
- Recruitment into engineering is needed to meet the employment gap

Teachers

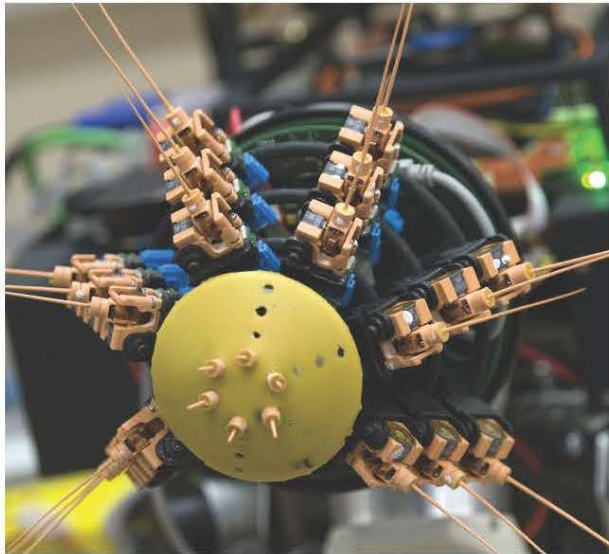
- 50% of primary school teachers identify low confidence and subject knowledge in engineering (ENGINEER, 2014)

Key Stage 2 Primary School Children

- Children, particularly girls, decide on the appropriateness of science as a career before age 11 (Archer et al, 2013).
- Girls like connecting STEM disciplines with relevant real-world problems (High Level Group on Science Education, 2007).



Over millennia of evolution, animals have developed senses way beyond human capabilities to adapt to their environment.

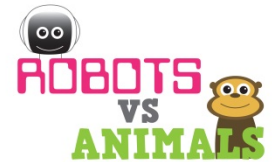


Now in the age of high-tech robotic engineering, the science of biomimetics seeks to copy and improve these skills to develop futuristic robots.

**But which are better, robots or animals?
You decide!**



Project methods

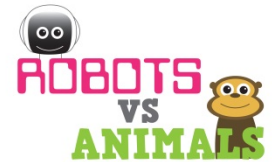


- Ten early career engineers
 - Contributed throughout year long project
- Training and support
 - Provided by a project coordinator and mentors – senior engineers with experience in public engagement
- Culture of public engagement
 - Opportunities presented throughout the year to generate a shared theme
 - Four further MSc students, and ten doctoral students also participated





Mastery of storytelling



Emotions

Make people care about your research – surprise or conflict

Characters

Relatable and relevant science and engineering

Blending

Provide a bridge between what you know and what they know using a story structure or well-known topic

Narrative

Keep it engaging and make ideas ‘sticky’

Stories provide relevance and context to give us meaning



Haven (2007)



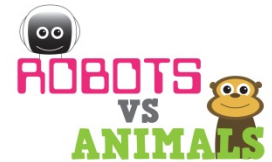
Science communication

“The most contemporary view of learning is that people construct new knowledge and understanding within the *context* of they *already know* and *believe* and do it only when they can see how the new information is *relevant* to them.” Haven, 2007

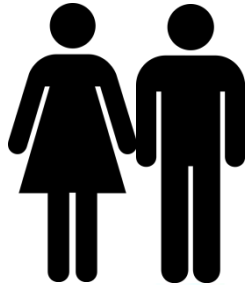
Results - audiences



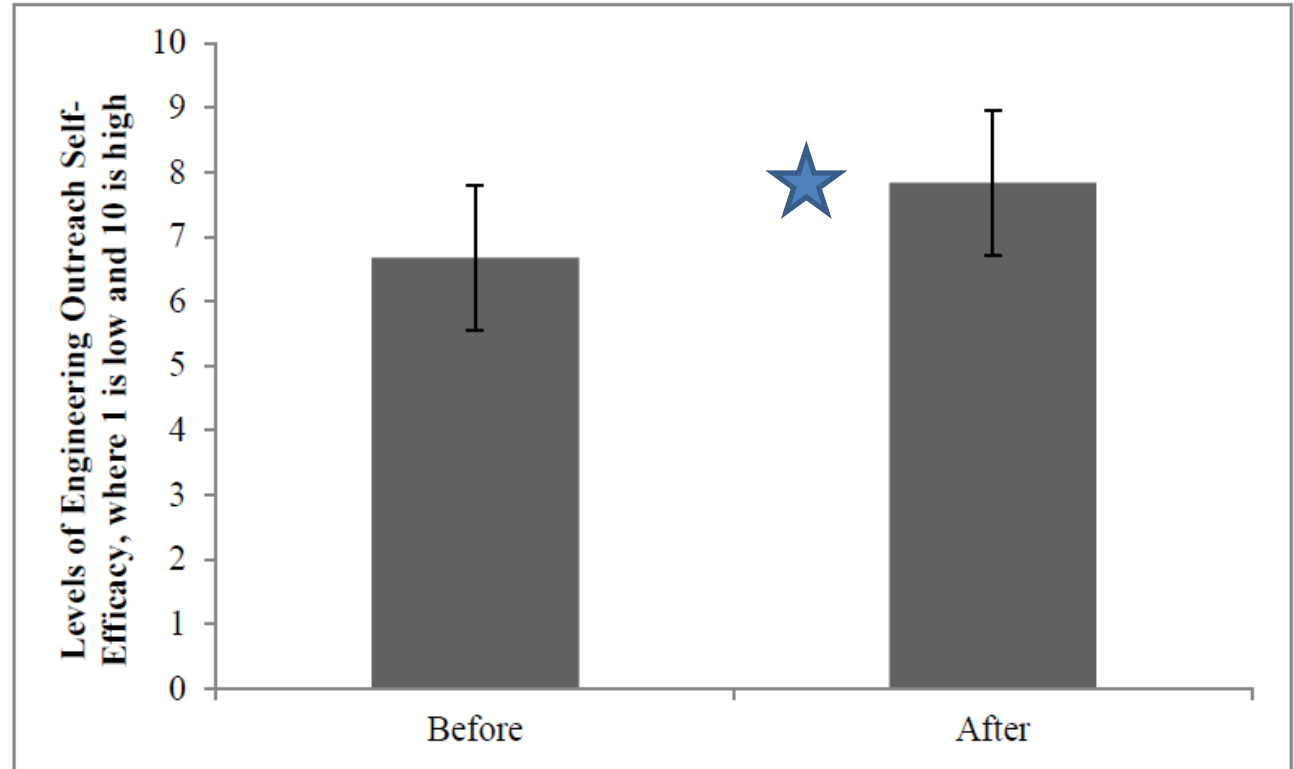
Engineers' Perceived Self-efficacy



Mastery



Social persuasion
and social norms



Fogg-Rogers, L., Sardo, A.M., Boushel, C. (2017). Robots vs Animals: establishing a culture of public engagement and female role modelling in engineering higher education. *Science Communication*

Engineers – Communication skills

I always struggle to really say what I want to say because of the extremely technical language that's been used among engineers. Having this training, it helped me to formulate what I want to say, it helped me to be able to formulate a sentence that has the wow factor. (Engineer 3, ECE, Female)

We had to present it in a way that it's easily accessible. So there had to be a narrative story; why is it done and what we're inspired by and things like that. It's quite difficult for engineers to communicate about their work but throughout the activities like that we learn how to do it. (Engineer 2, ECE, Female)

Engineers – Coordinator and peer support

I think it [a coordinator] was a very important figure in the project. Because without someone to do this public relationship, as researchers we don't have the contacts, the know-how to contact the venues and so I think it's very important for the lab to have someone given the task of public engagement and then read through to the scientists. (Engineer 7, ECE, Female)

[The organisers who] were running the project very carefully put the right people together; that someone who had a bit more experience with someone that hadn't had much experience interacting with other people and with children especially. They learned a great deal from it and enjoyed it a great deal. (Engineer 11, Research Supervisor, Male)

Engineers – Support for female role models

I think it is good to have a woman presenting in sciences to show them things instead of ...[men saying] to a girl “Oh yeah, you can do this.” That is not necessary. I think [an] equal distribution of outreach activities between women and men would be really nice to show that both [genders] can be engineering staff. So if for example an outreach activity involves ten people, the ideal would be five women and five men, not nine men and one woman. (Engineer 4, ECE, Female)

You know the lack of women in engineering and STEM in general is shocking, it's disgraceful. I've [heard] it described as wasting essentially 50% of the human potential on the planet and that is absolutely true. I think one of the ways that we address that... is by having great role models and so I think it's extremely important.
(Engineer 12, Research Supervisor, Male)

Engineers – Purposive selection was controversial

Employing women just for the sake of employing women and making their numbers up - I think it actually undermines and devalues the participation of women in such events. The quality is in the scientist regardless of gender. (Engineer 15, Research Supervisor, Male)

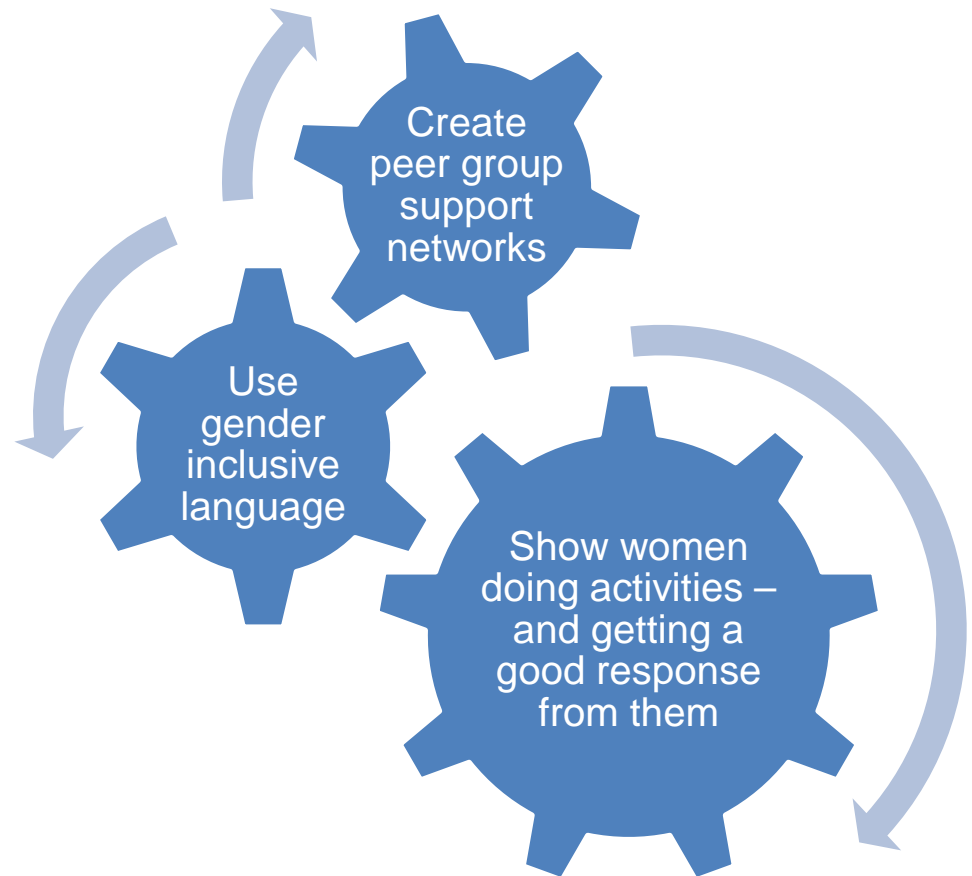
Maybe constantly throwing girls at them in engineering isn't actually working and maybe there's another way to do it... I do feel sometimes there could be more encouragement, positive encouragement, for boys to be doing it as well where I think boys can miss out because it's just assumed that that's what they're going to do. (Engineer 8, ECE, Male)

Role modelling

Improving self-efficacy for STEM teaching or public engagement requires:

- Mastery opportunities
- Vicarious experience – watching others who are more experienced than you (role modelling)
- Social persuasion from peer group

To encourage girls into STEM we need to change social norms.



References

- Cunningham, C. M., Lachapelle, C. P., & Hertel, J. (2012). *Research and evaluation results for the Engineering is Elementary project: An executive summary of the first eight years*. Boston, MA: Museum of Science
- EngineeringUK. (2015). *The state of engineering*. Retrieved from http://www.engineeringuk.com/EngineeringUK2015/EngUK_Report_2015_Interactive.pdf
- Fogg-Rogers, L., Sardo, A.M., Boushel, C. (2017). Robots vs Animals: establishing a culture of public engagement and female role modelling in engineering higher education. *Science Communication*
- France, B., Bray, B. & Fogg-Rogers, L. (2017). Organisational culture and its role in establishing a sustainable science communication platform. *International Journal of Science Education Part B*.
- Haven, K. (2007). *Story Proof: The science behind the startling power of story*. Libraries Unlimited.
- High Level Group on Science Education (2007) *Science Education Now. A renewed pedagogy for the future of Europe*. Brussels: EC.