Aston University
Birmingham

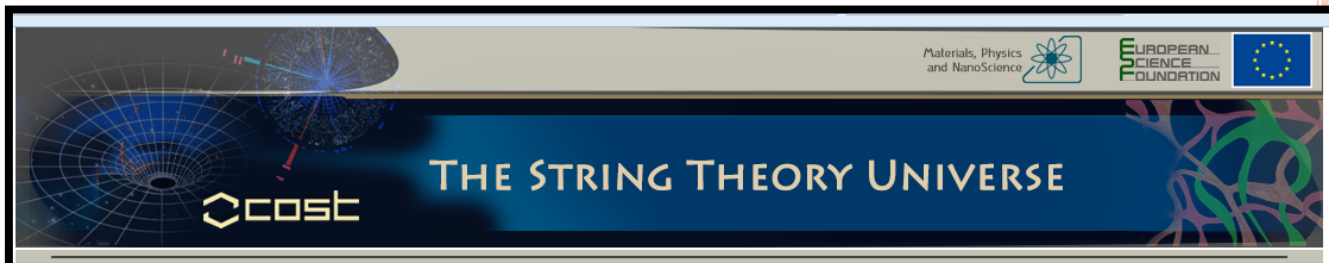
UNSEXING THE MIND:

HOW PLASTIC BRAINS *COULD* BREAK THROUGH GLASS CEILINGS.

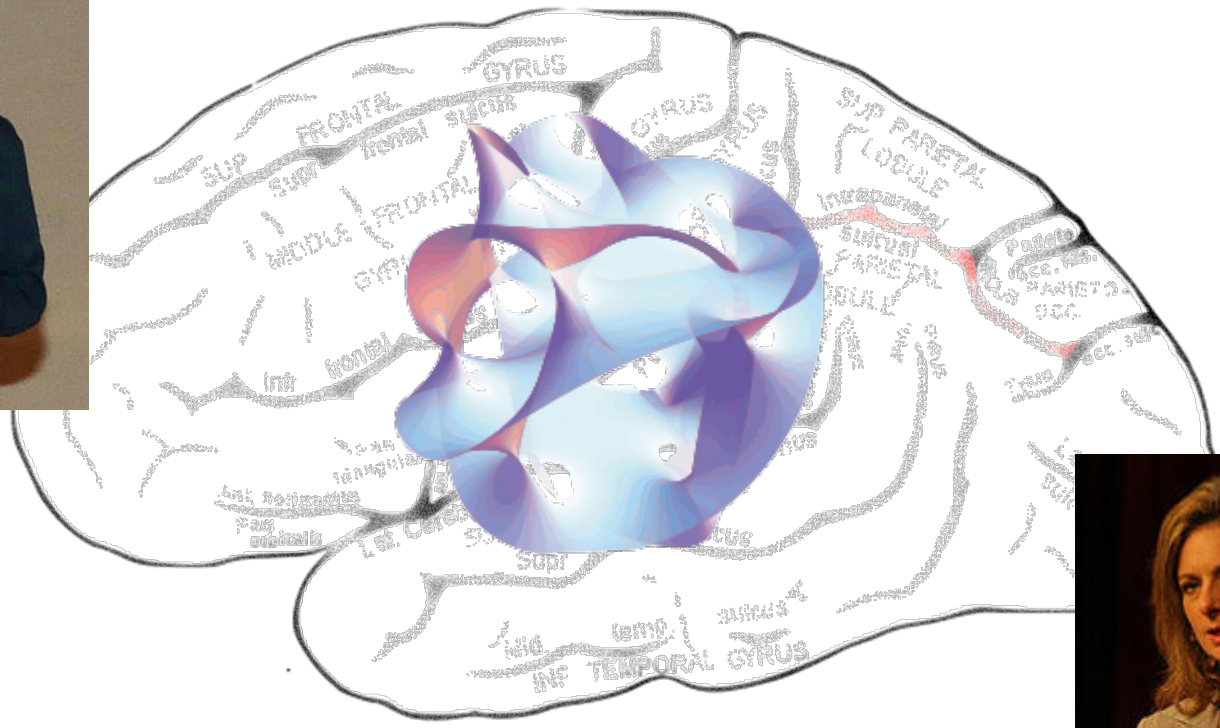
Professor Gina Rippon,
Chair of Cognitive NeuroImaging,
Aston Brain Centre, Aston University

June 2016

ihp Institut Henri Poincaré



Sex, science and the Brain – Is there a problem? YES BUT WE CAN SOLVE IT!

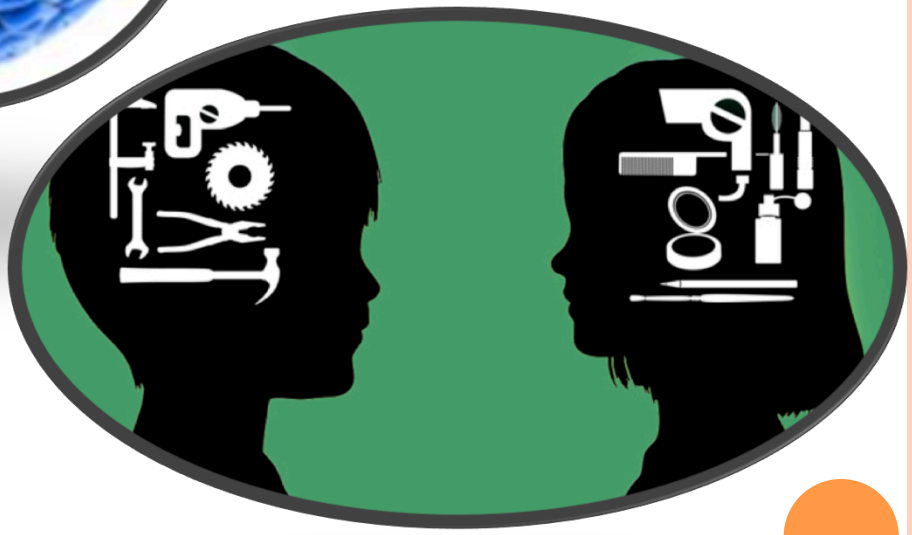


Why are there so few female scientists?

- ***Brain Level:*** ***Do girls just not have a 'Science' Brain' ?***
- ***Cognitive level:*** ***Do girls just not have 'what it takes?'***
- ***Behavioural level:*** ***Do girls just choose not to do Science?***
- ***Cultural Level:*** ***girls don't stay in science***

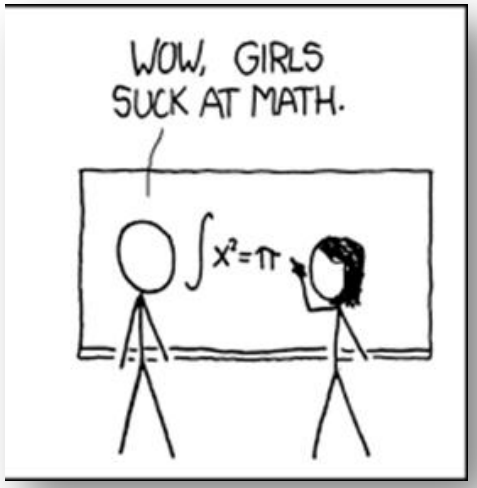
The Trouble with Girls?: Why Plastic Brains aren't Breaking Through Glass Ceilings –

Stereotypes and the brain



Stereotype threat.

- **Stereotype threat** is the experience of anxiety or concern in a situation where a person has the potential to confirm a negative stereotype about their social group [NB: 'GROUP' UNDERPERFORMS OR DOESN'T BELONG]
- Covert ('in the air') or overt (priming) stereotype threat results in significant decline in performance



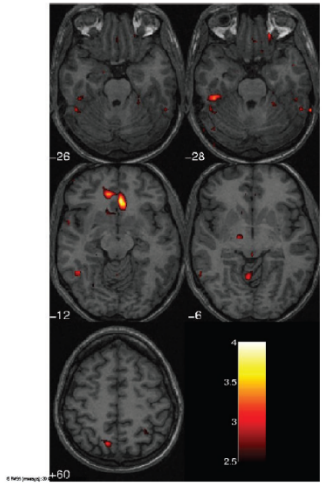


Fig. 3 Axial images (z = −26 to +60) depicting brain activations resulting from the negative stereotype–control group contrast. Areas depicted include the orbital and medial frontal gyrus, the rostral–ventral anterior cingulate, fusiform gyrus, and superior parietal lobule. Activation is superimposed onto a brain image of a single participant.

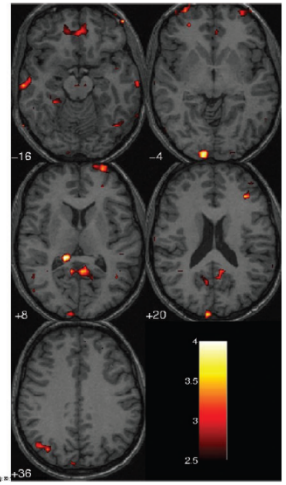


Fig. 4 Axial images (z = −16 to +36) depicting brain activations resulting from the positive stereotype–control group contrast. Areas depicted include visual processing areas, middle temporal gyrus, ventral portions of anterior PFC, and cingulate gyrus. Activation is superimposed onto a brain image of a single participant.

Steele and Aronson, 1995

Sex/Gender stereotypes in Science

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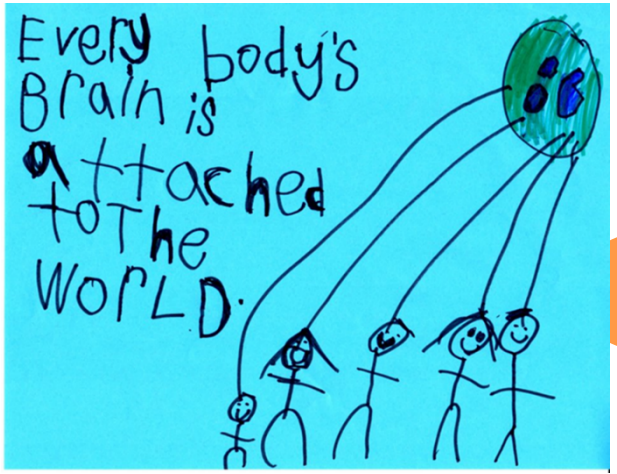
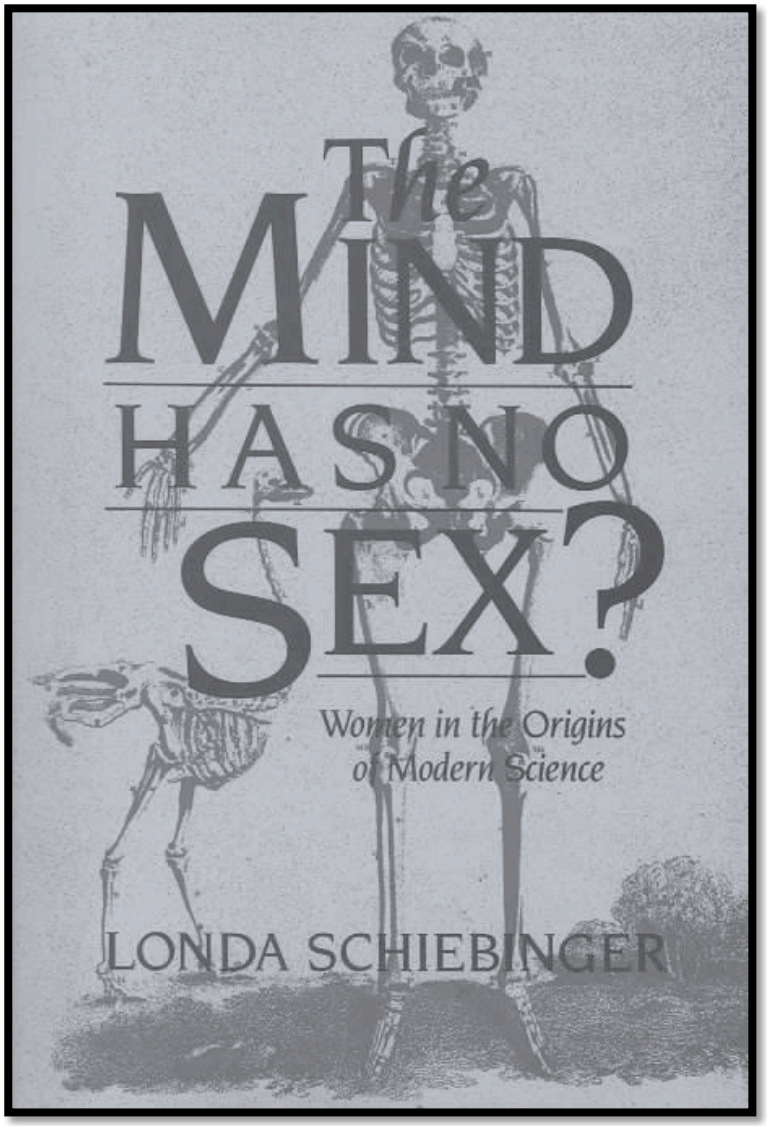
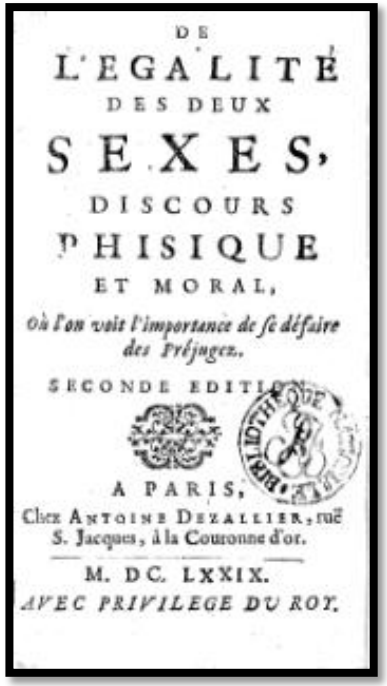
- **Girls don't do science**
  - Peer pressure; Role models

- **Science culture:**
  - (Un)conscious bias
  - Status





- Francois Poullain de la Barre (1673) :
- “L’esprit n’a point de sexe”
- "the mind has no sex"


DE
L'EGALITE
DES DEUX
SEXES,
DISCOURS
PHISIQUE
ET MORAL,
Où l'on voit l'importance de se défaire des Préjugez.
SECONDE EDITION.
A PARIS,
Chez ANTOINE DEZALLIER, ruë S. Jacques, à la Couronne d'or.
M. DC. LXXIX.
AVEC PRIVILEGE DU ROY.

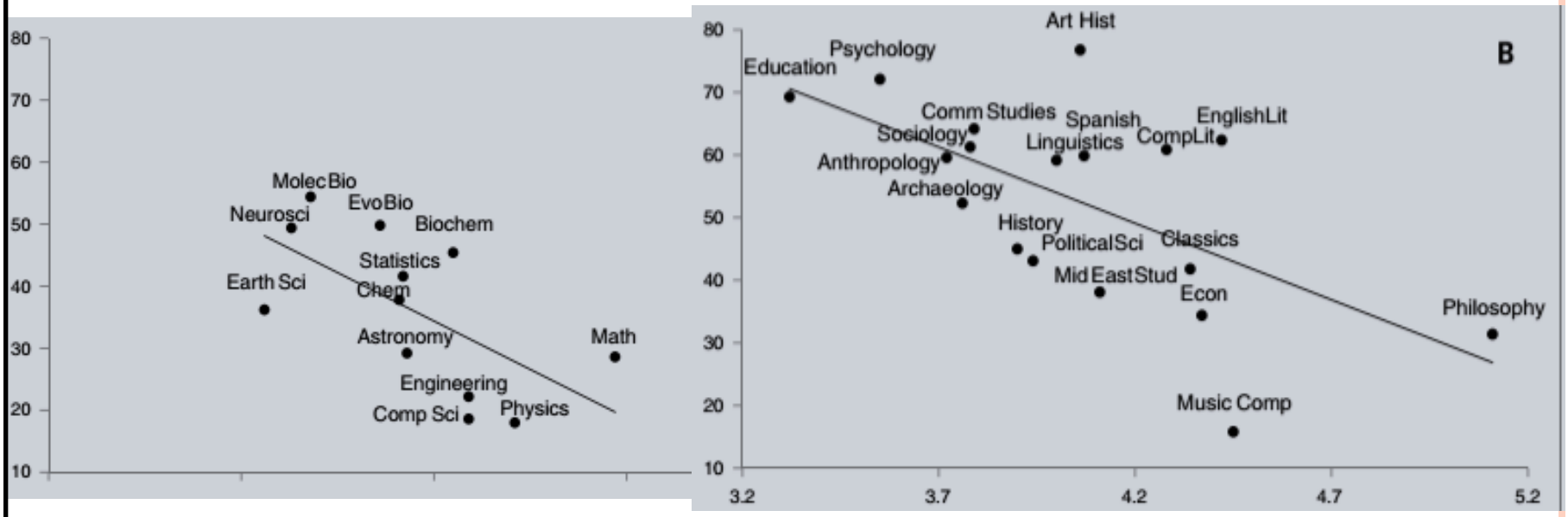
21ST CENTURY – MORE EXPECTATIONS OF 'RAW, INNATE TALENT'

RESEARCH | *REPORTS*

WOMEN IN SCIENCE

Expectations of brilliance underlie gender distributions across academic disciplines

Sarah-Jane Leslie,[1*†] Andrei Cimpian,[2*†] Meredith Meyer,[3] Edward Freeland[4]



Field-specific ability beliefs
(higher numbers indicate greater emphasis on brilliance)

Scientists are born and not made?

- Males more focussed on mechanical systems from early on in life?
- Human males are primarily interested in objects and their mechanical interactions [systemisers] whereas human females are primarily interested in people and their social and emotional interactions[empathisers] –
  - **Simon Baron-Cohen (2003)**

No evidence that infants have different understanding of or responses to objects and their properties

Spelke, E.S.(2005) Sex Differences in Intrinsic Aptitude for Mathematics and Science: A Critical Review. *American Psychologist, 60, 950–958.*

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- **Science culture:**
  - (Un)conscious bias
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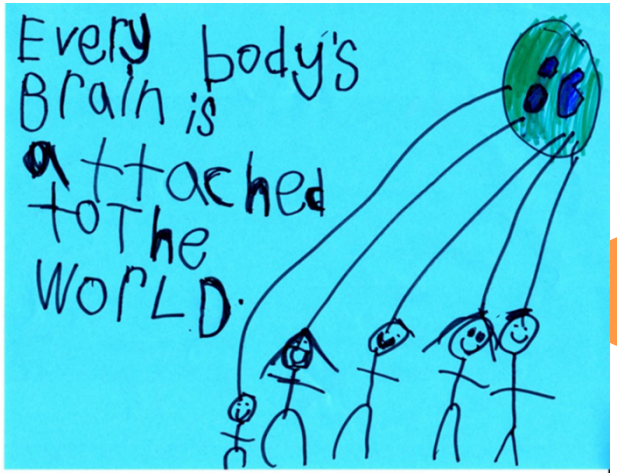
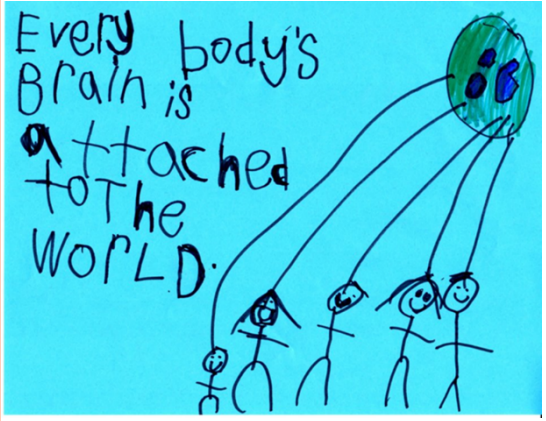


Boys are better at science than girls

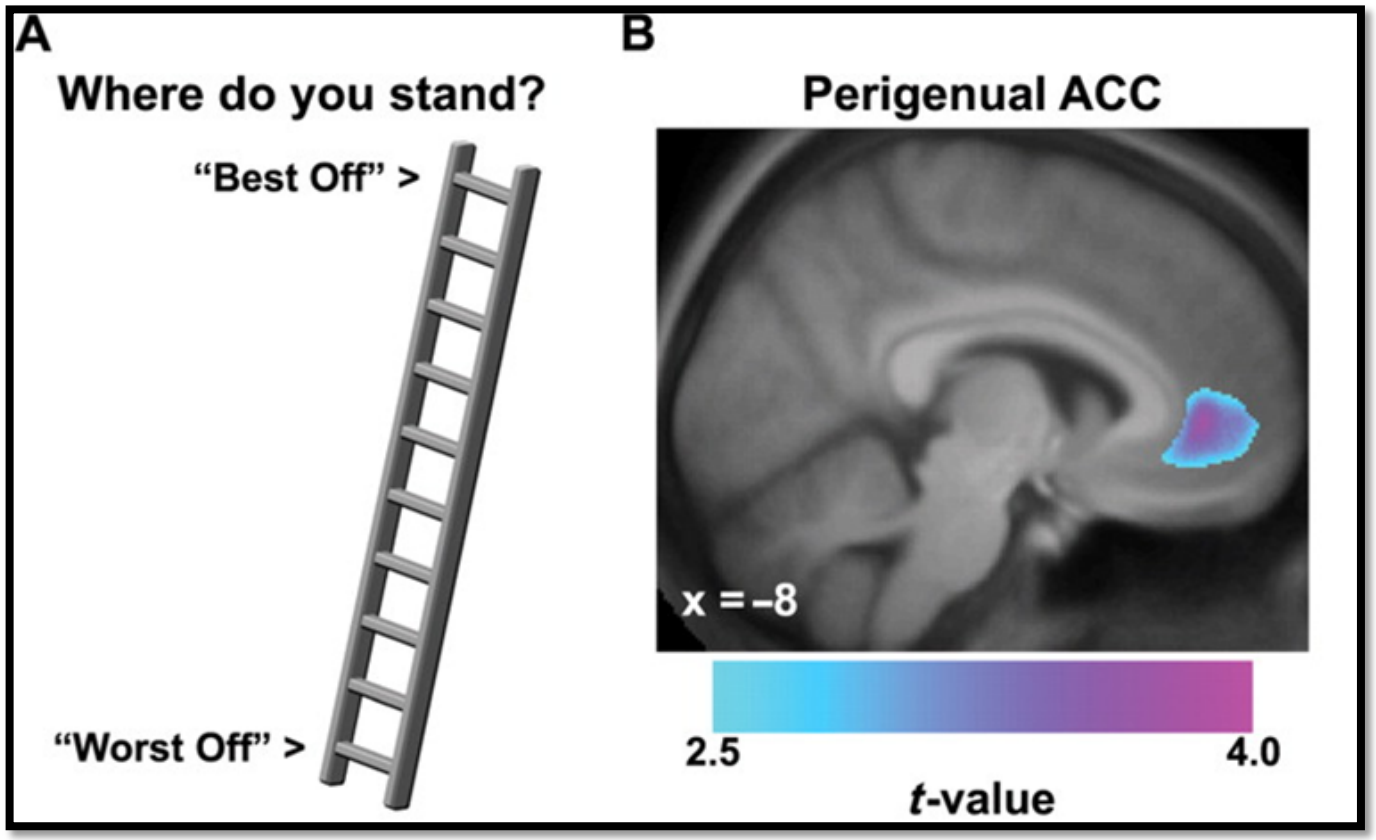
- Teachers – *On the Origins of Gender Human Capital Gaps: short and long term consequences of teachers' stereotypical biases (Lavy and Sand, 2015.*

  - 8000 primary school pupils: Mismatch between classroom-based and national assessments – boys marked higher, girls marked lower

  - Bias score determined
    - middle school test scores
    - high school matriculation scores
    - students ratings of ability
    - choice of STEM subjects.



Status and the brain



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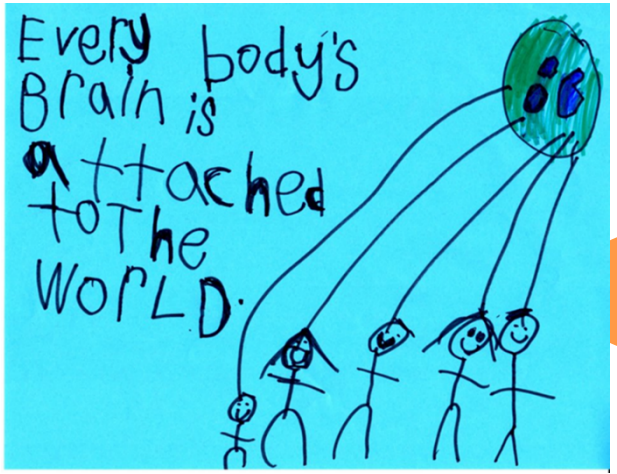
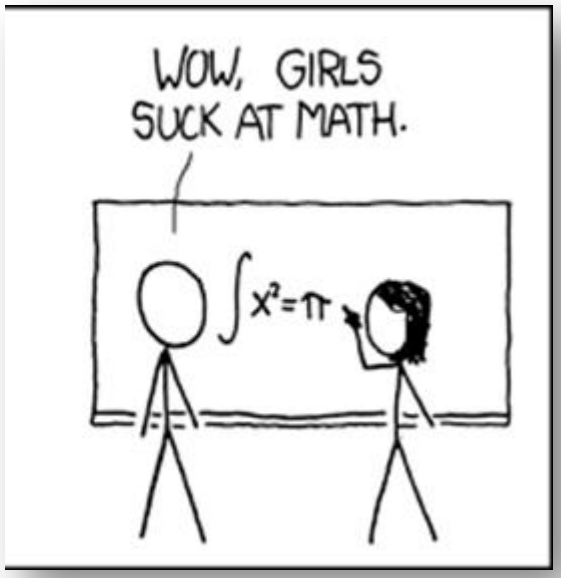


BRAIN JOURNEY 1:
PRIMARY SCHOOL (AND STEREOTYPE THREAT.)

- Implicit gender stereotypes measurable at age 6 (*Most et al, 2007)*

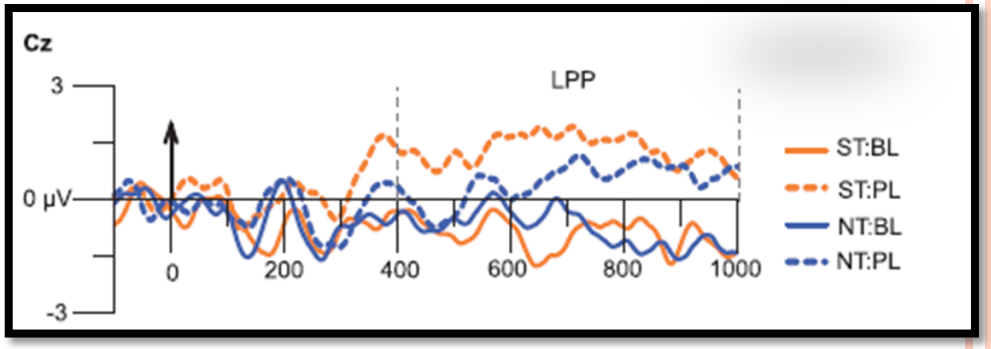
- Implicit gender-maths stereotypes measurable at age 9; predicted academic-self concept; enrolment preferences (*Steffens et al, 2010-On the leaky math pipeline*)

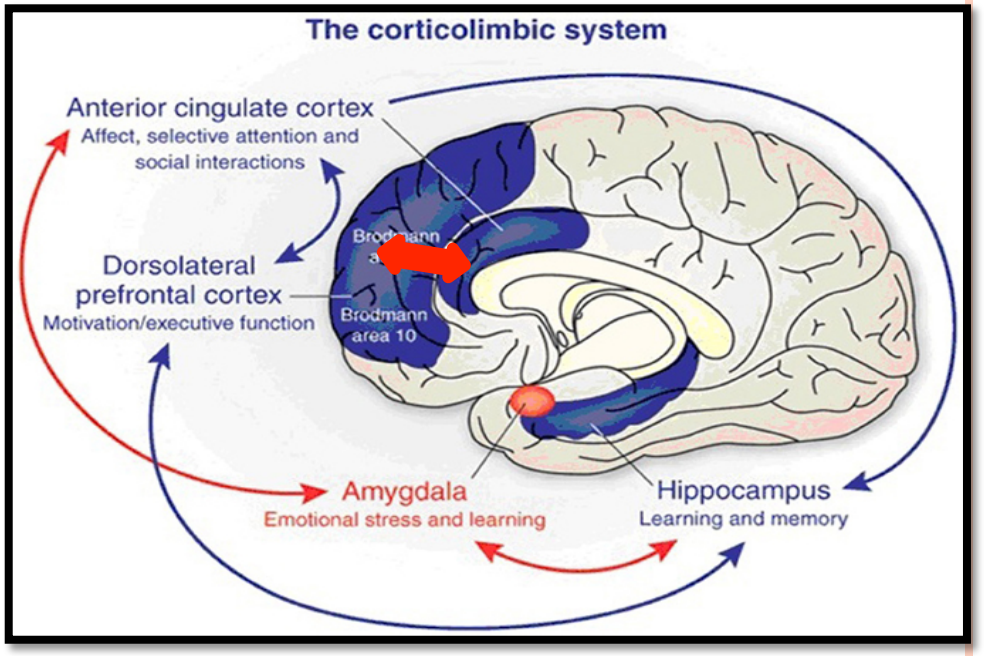


Steele and Aronson, 1995

Maths anxiety and the (brain

- Attentional bias towards negative feedback
- Earlier termination of tasks following negative feedback
- Failure to access additional support
- Increased activation of emotion regulation processes





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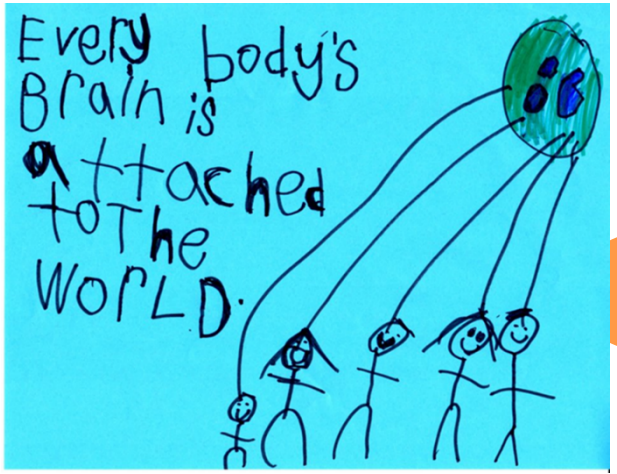
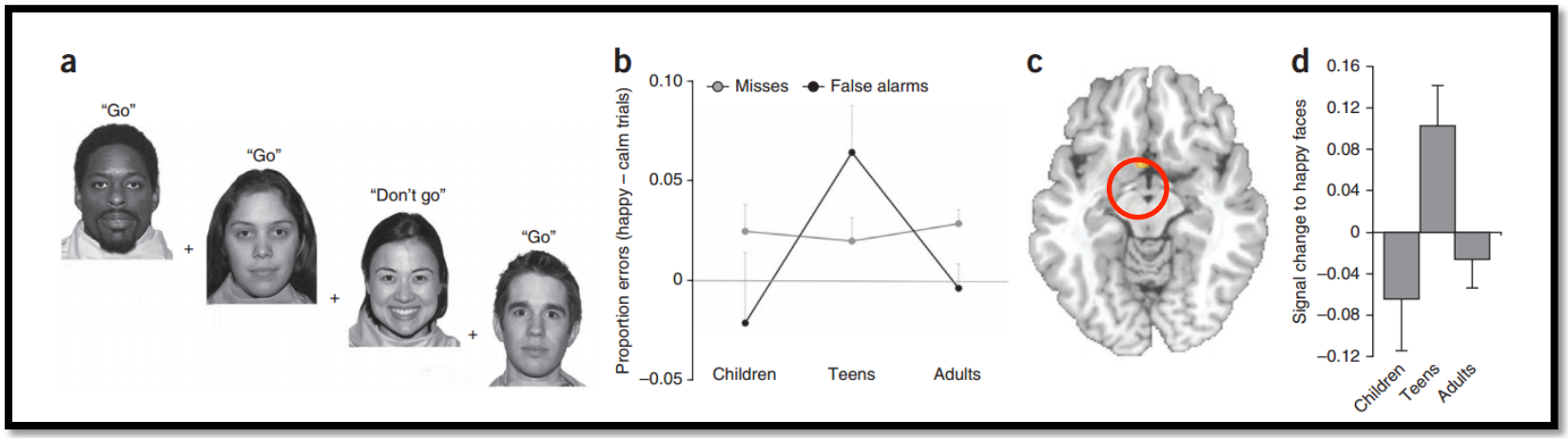


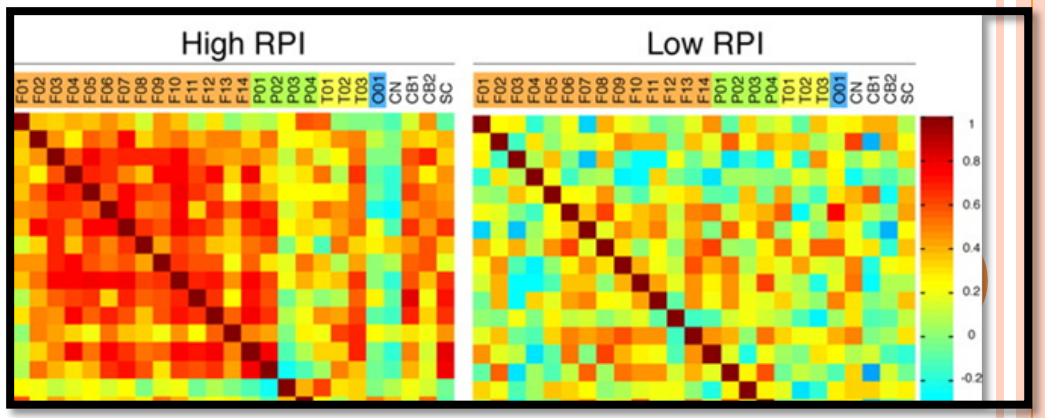
Science and the adolescent brain

- **importance of 'hot' context (driven by emotion rather than logic)** (Somerville et al, 2010)

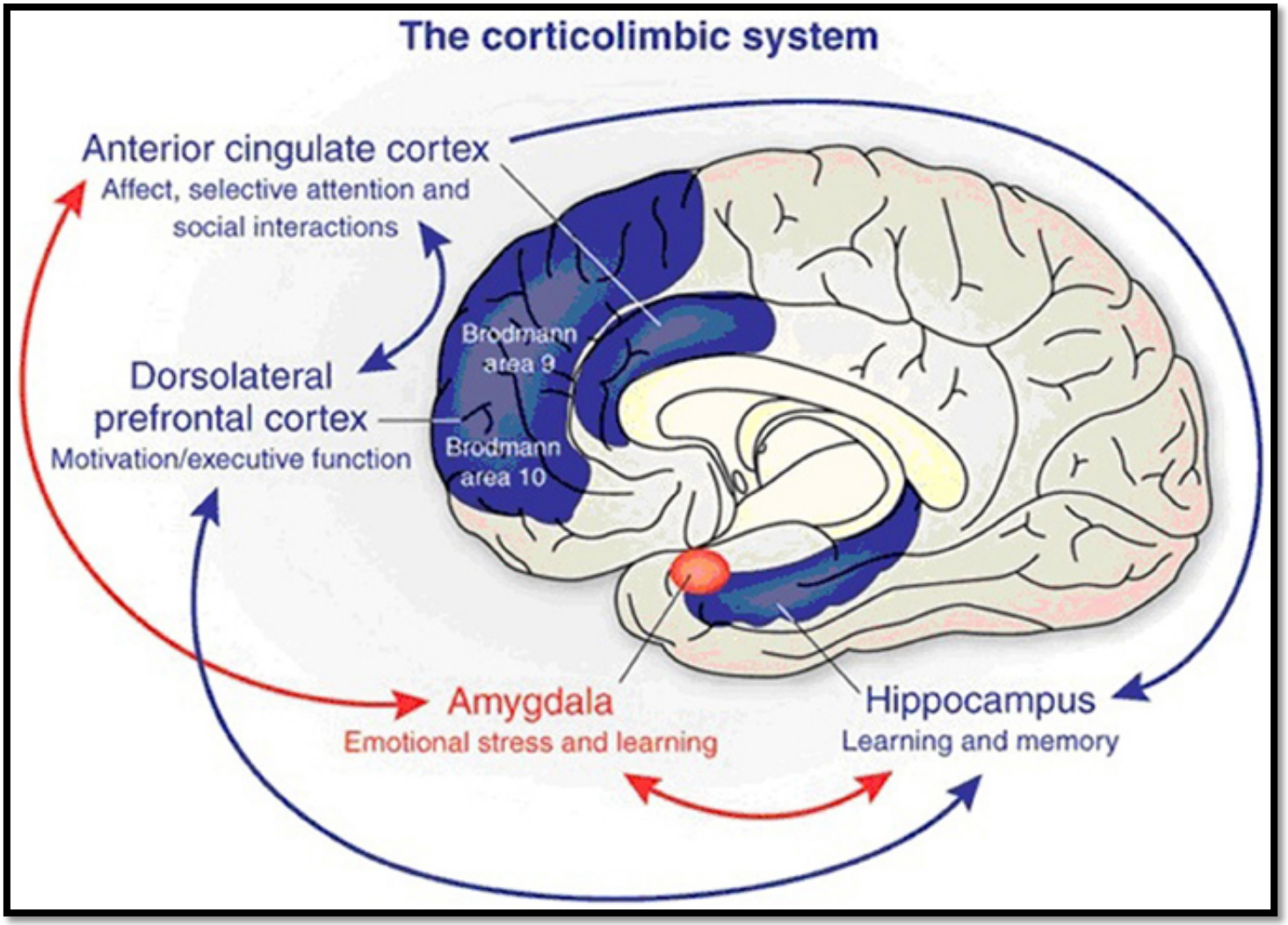


- **Under-developed mechanisms of resistance to peer influence**

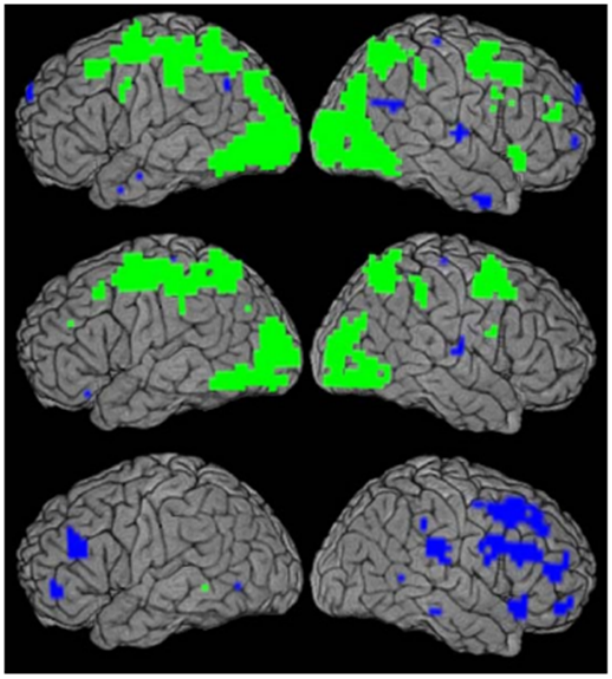
(Grosbras et al, 2007)

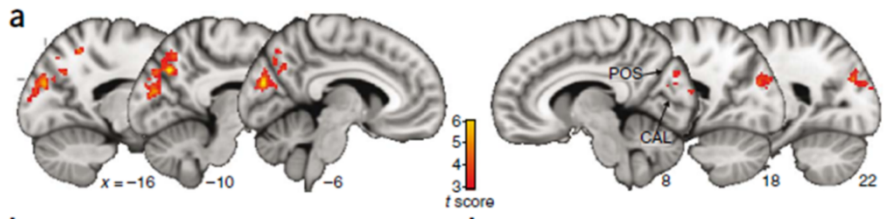


The gendered brain and science – inferior, inexperienced, threatened and alone!



OVERCOMING INEXPERIENCE: THE POWER OF PLASTICITY

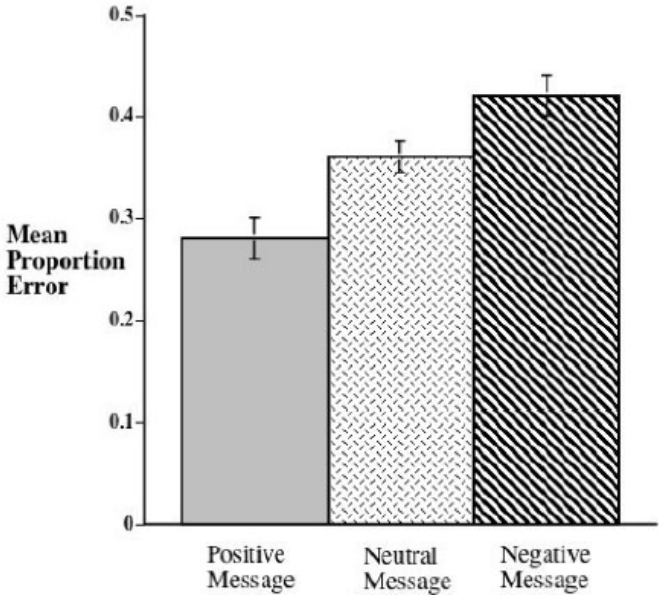


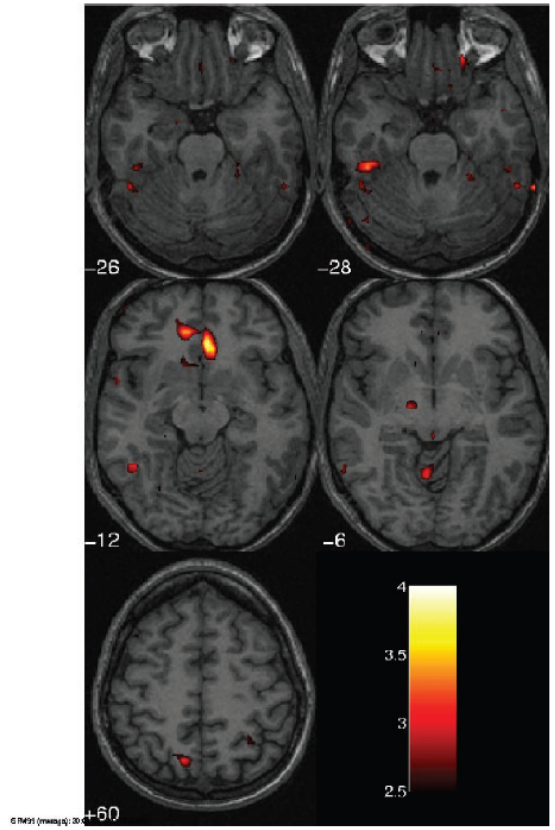


Plasticity, plasticity, plasticity... and the rigid problem of sex

Cordelia Fine[1], Rebecca Jordan-Young[2], Anelis Kaiser[3], and Gina Rippon[4]

SCIENCE AND THE BRAIN – THE POWER OF POSITIVITY





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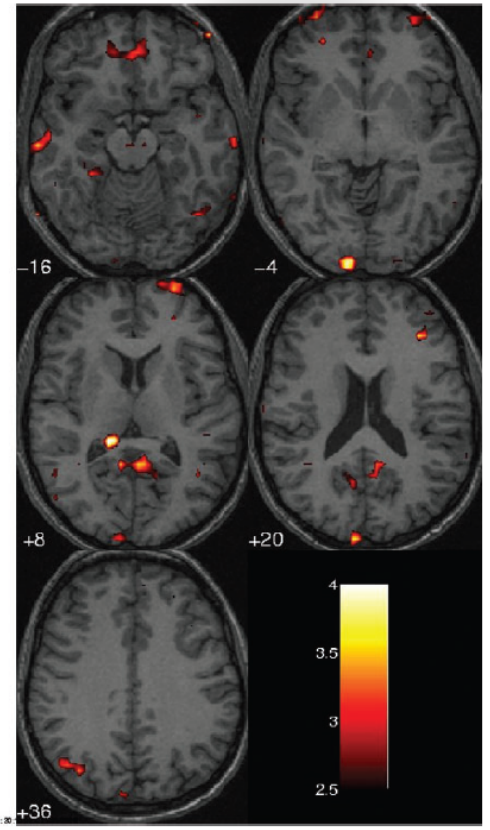

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Science and the brain – the power of empowerment

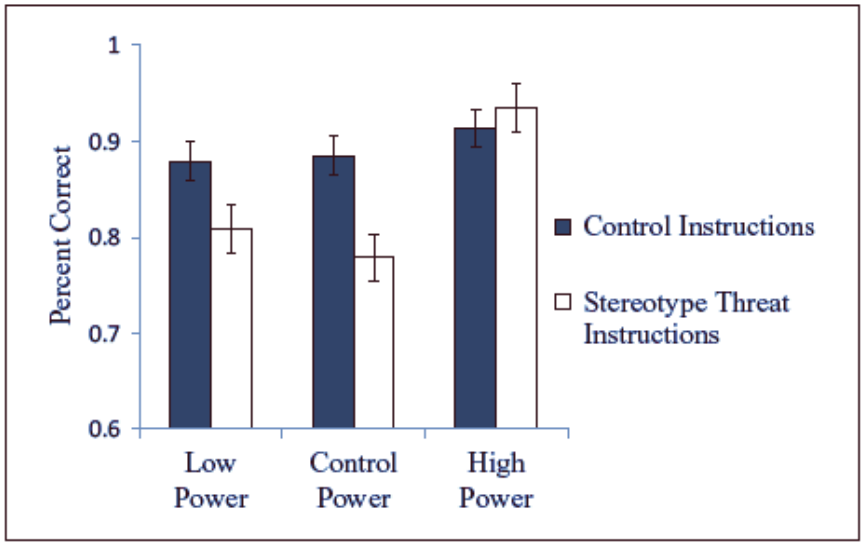
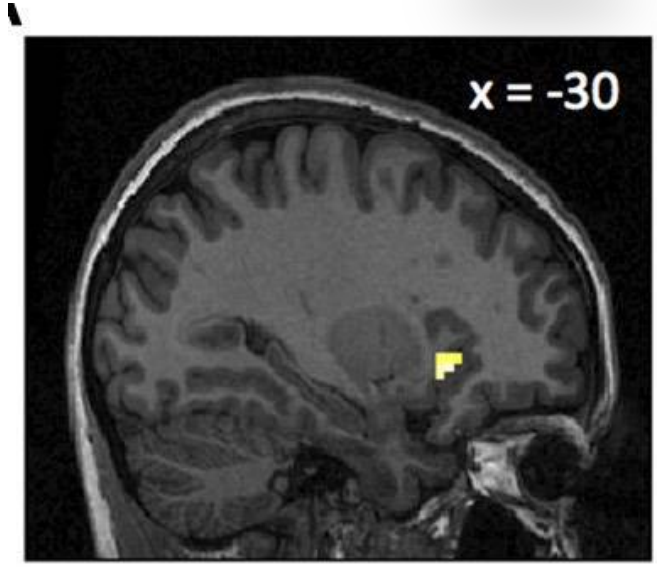


Figure 2. Accuracy on the modular arithmetic test in Experiment 2 as a function of power and stereotype threat
Note: Error bars indicate standard error.



-30, 26, -4

On the Experience of Feeling Powerful: Perceived Power Moderates the Effect of Stereotype Threat on Women's Math Performance

Katie J. Van Loo[1] and Robert J. Rydell[1]

Dynamic social power modulates neural basis of math calculation

*Tokiko Harada[1], Donna J. Bridge[1,2] and Joan Y. Chiao[1,2]**

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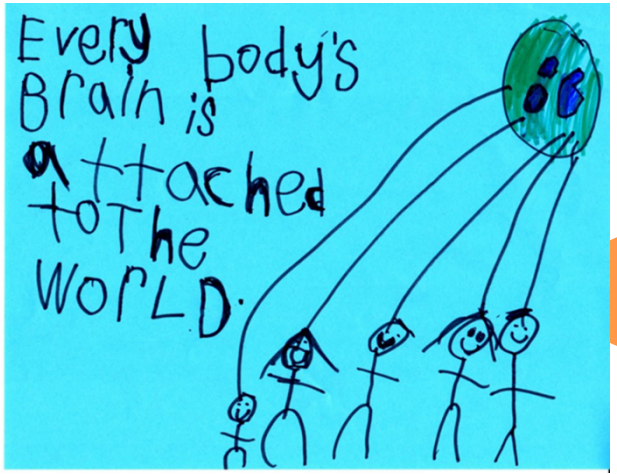
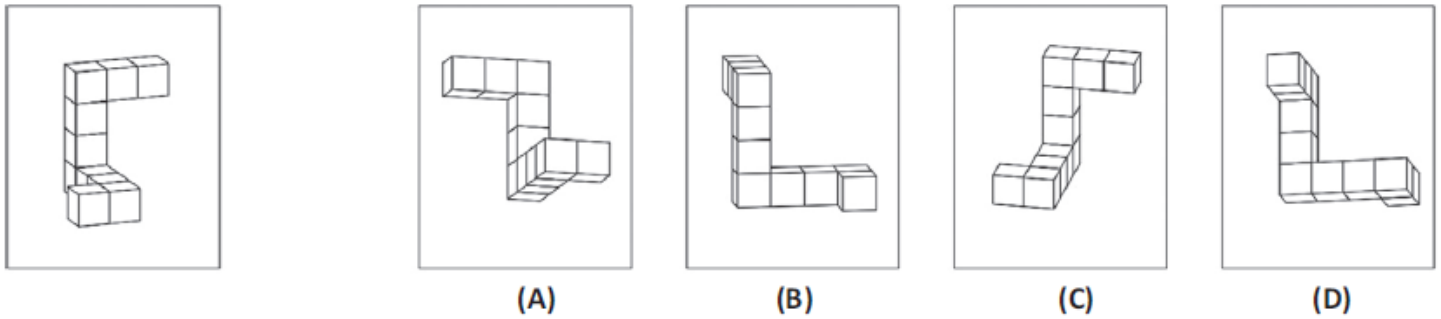


Fixing the science -

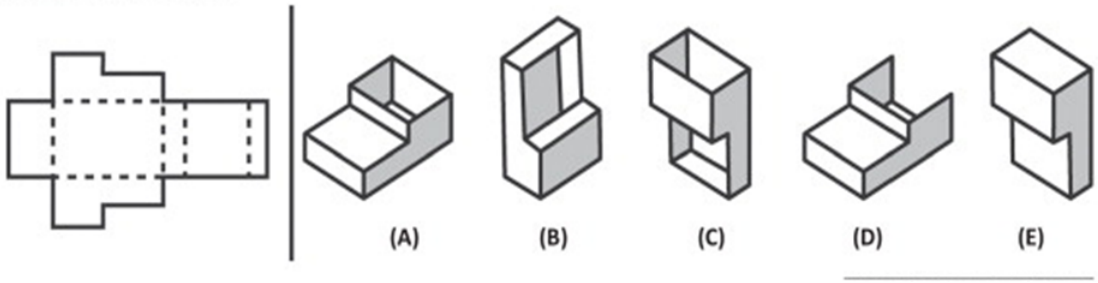
- **Science teaching**
  - Teacher training – unconscious bias;
  - Science as a subject for success
- **Science's Image**
  - People like me
  - Role Models
  - Image initiatives?
- **Science's culture**
  - Tackle (un)conscious bias
  - Science as a collaborative activity

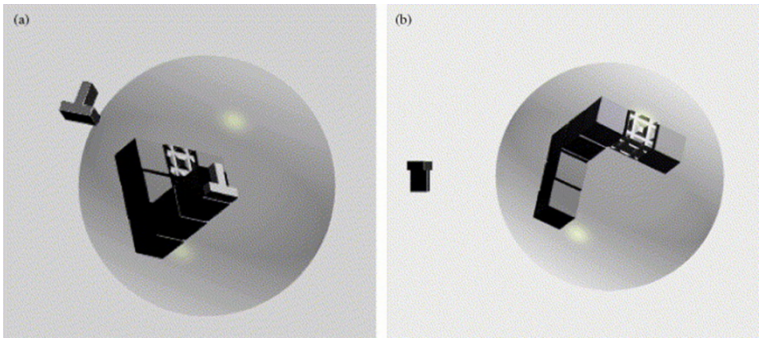
Curriculum – how are you asking the questions? (the importance of getting it right)

(A) Mental rotation task

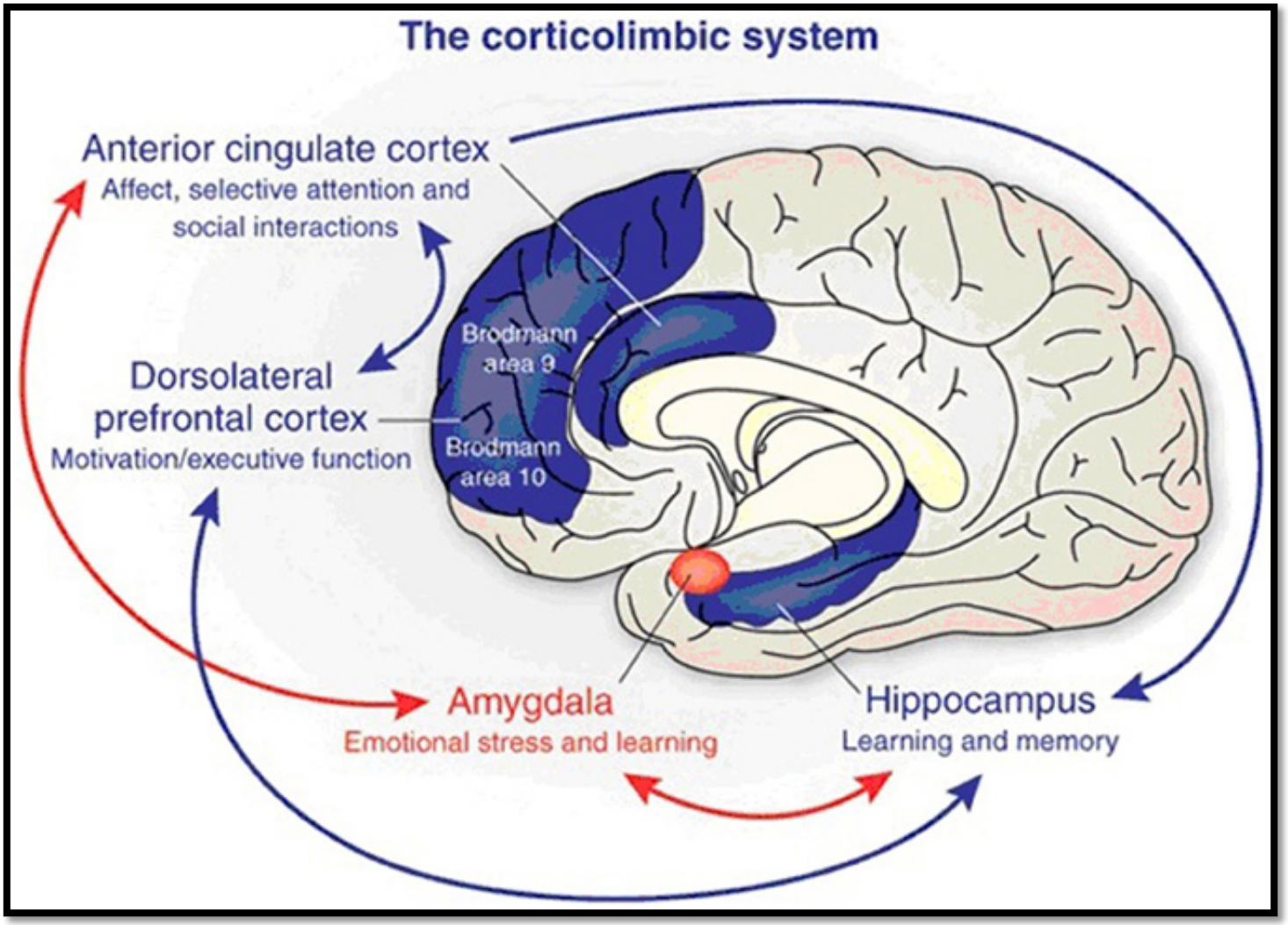


(B) Mental folding task

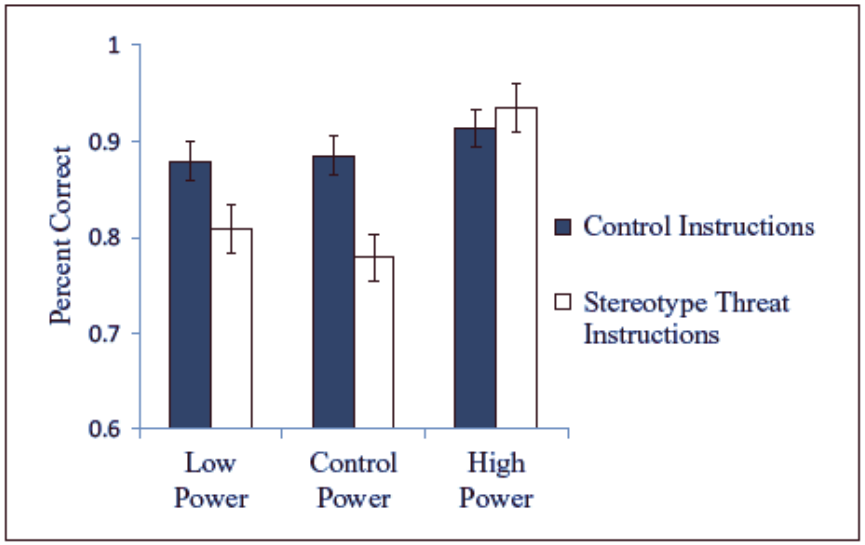




Managing anxiety:emotion regulation the power of positive feedback



The power of empowerment



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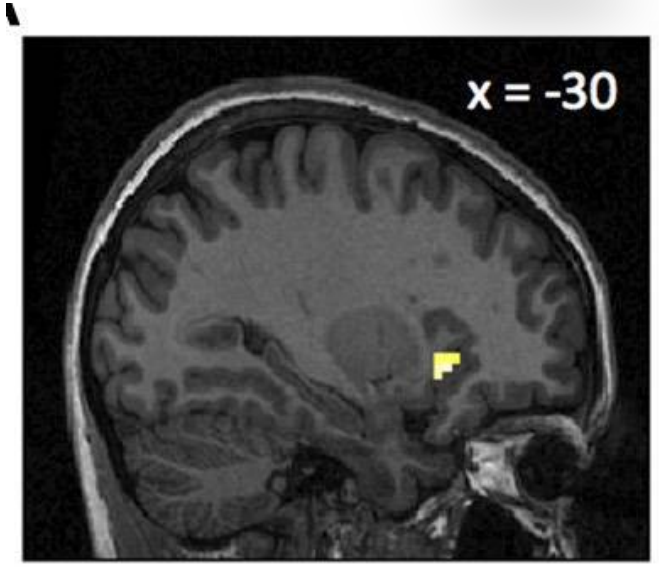

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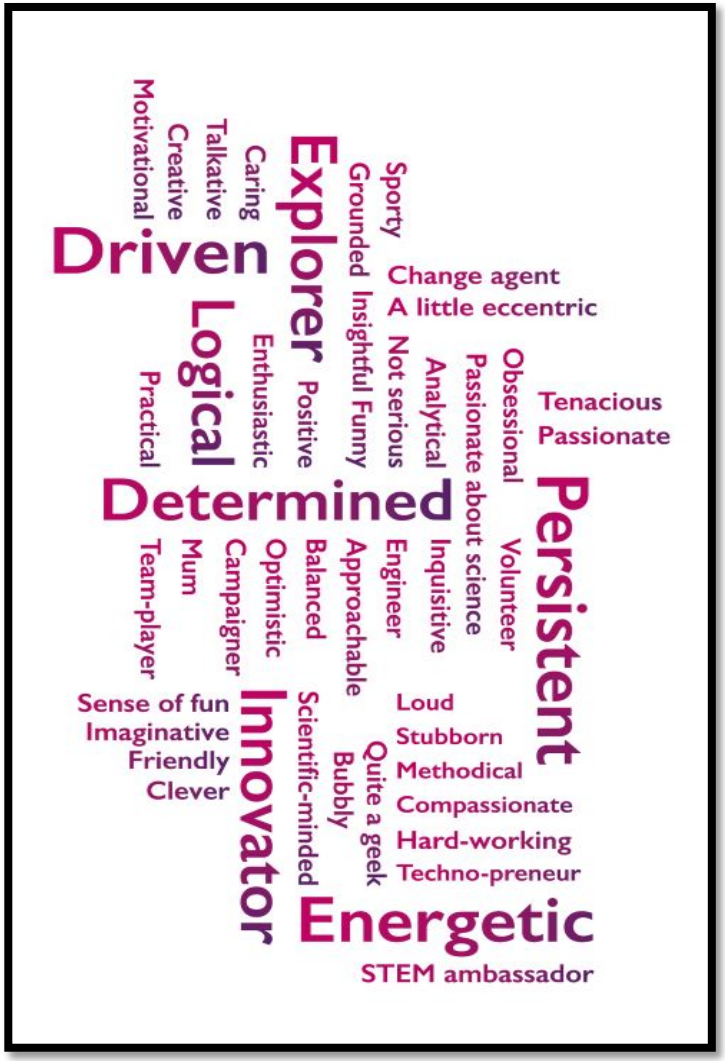
Role model empowerment

Fig. 1. Participants' perspective while delivering the speech in the virtual reality environment, for each of the four conditions.

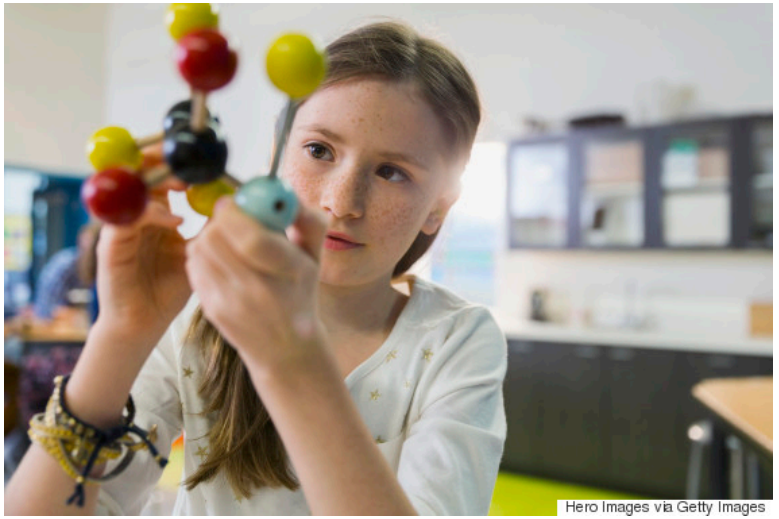
Helpful Initiatives?



Helpful initiatives?

Institute of Physics

EDF – Pretty Curious



Science culture

- *(Un)conscious bias –*
- *Status of women in Science*
  - *'Practice' of Science*"……child care and lack of research collaboration are the two factors that cause significant gender differences in scientific publishing. Women with young children and women who do not collaborate in research with other scientists are clearly less productive than both their male and female colleagues."


POWER
OF
PLASTICITY
POSITIVITY
EMPOWERMENT