Sex Differences

Lecture for PHIL 3334:
Philosophy of Biology

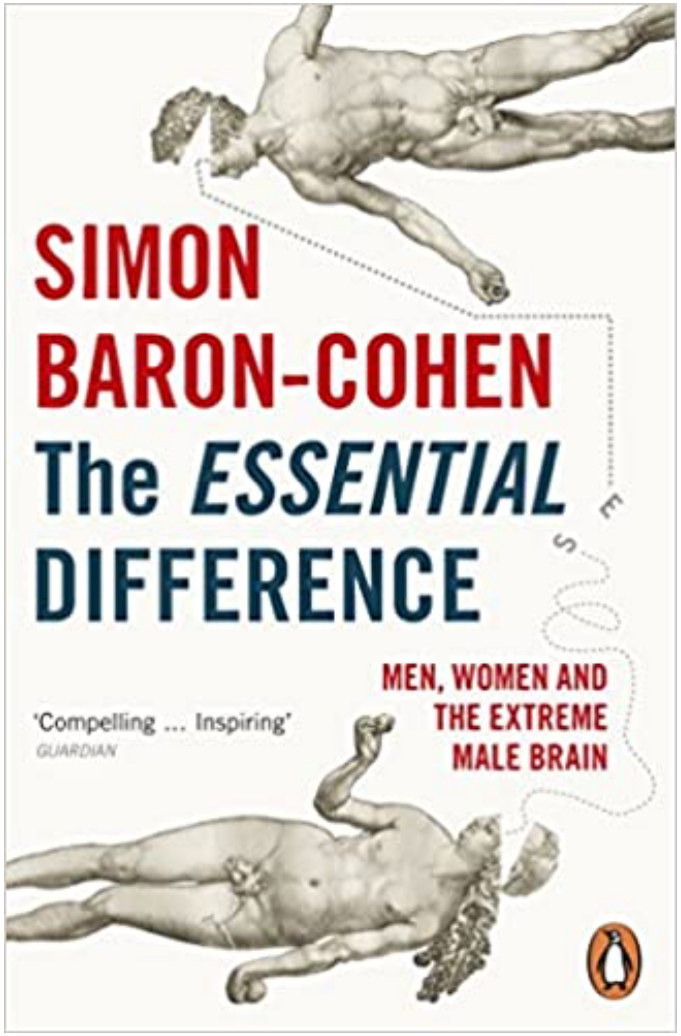
Joel Velasco

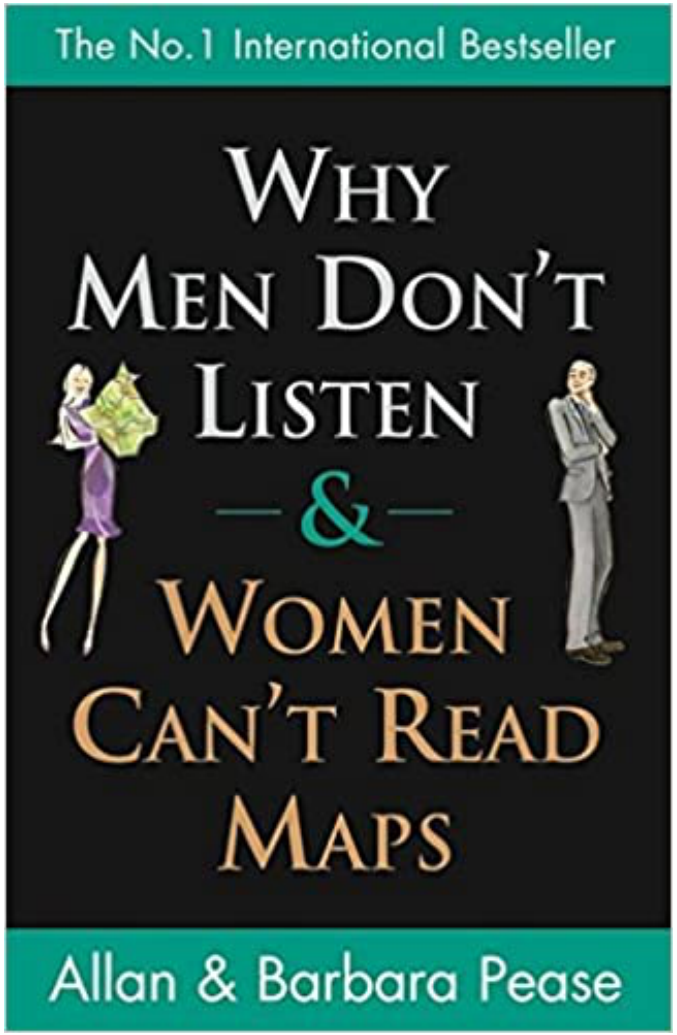
Types of differences between men and women

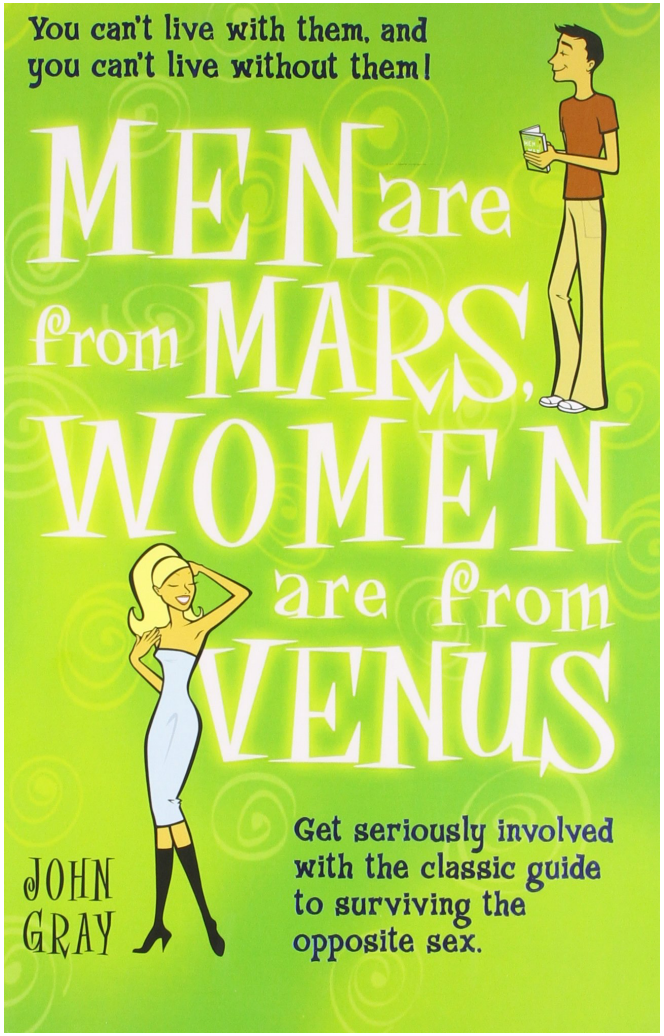
1) Phenotypic - genitals, body shape, height, weight…

2) Physiological - hormonal differences

3) Psychological(?) - are there differences in intelligence? emotional states? tastes and preferences?


SIMON
BARON-COHEN
The ESSENTIAL
DIFFERENCE
MEN, WOMEN AND
THE EXTREME
MALE BRAIN
'Compelling ... Inspiring'
GUARDIAN


The No.1 International Bestseller
WHY
MEN DON'T
LISTEN
&
WOMEN
CAN'T READ
MAPS
Allan & Barbara Pease


You can't live with them, and
you can't live without them!
MEN are
from MARS,
WOMEN
are from
VENUS
JOHN
GRAY
Get seriously involved
with the classic guide
to surviving the
opposite sex.

what about mental differences?

It is a bit unclear what 'mental' or 'psychological' actually refers to but it is something in between physical differences (like brain and hormones) and behavioral differences (like spending more time watching sports or gambling more)

1) What are the brain differences between men and women?

2) What are the behavioral differences between men and women? — and why? What is the connection??

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Original Article

ORIGINAL ARTICLE

Sex Differences in the Adult Human Brain: Evidence from 5216 UK Biobank Participants

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Abstract

Sex differences in the human brain are of interest for many reasons: for example, there are sex differences in the observed prevalence of psychiatric disorders and in some psychological traits that brain differences might help to explain. We report the largest single-sample study of structural and functional sex differences in the human brain (2750 female, 2466 male participants; mean age 61.7 years, range 44–77 years). Males had higher raw volumes, raw surface areas, and white matter fractional anisotropy; females had higher raw cortical thickness and higher white matter tract complexity. There was considerable distributional overlap between the sexes. Subregional differences were not fully attributable to differences in total volume, total surface area, mean cortical thickness, or height. There was generally greater male variance across the raw structural measures. Functional connectome organization showed stronger connectivity for males in unimodal sensorimotor cortices, and stronger connectivity for females in the default mode network. This large-scale study provides a foundation for attempts to understand the causes and consequences of sex differences in adult brain structure and function.

Key words: brain volume, cortical thickness, fMRI, sex differences, surface area

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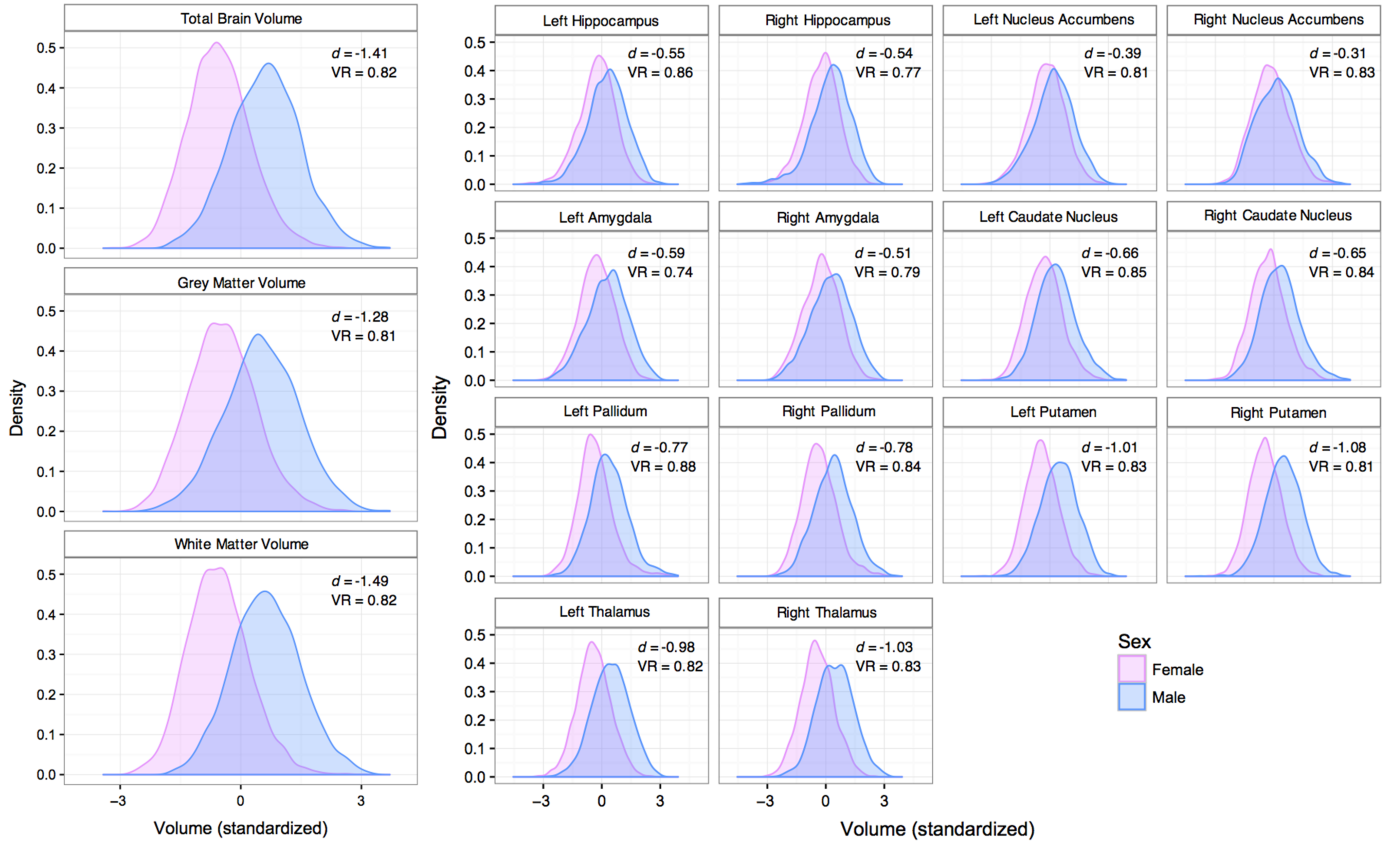
Figure 1. Density plots of sex differences in overall brain volumes (left section) and subcortical structures (right ...



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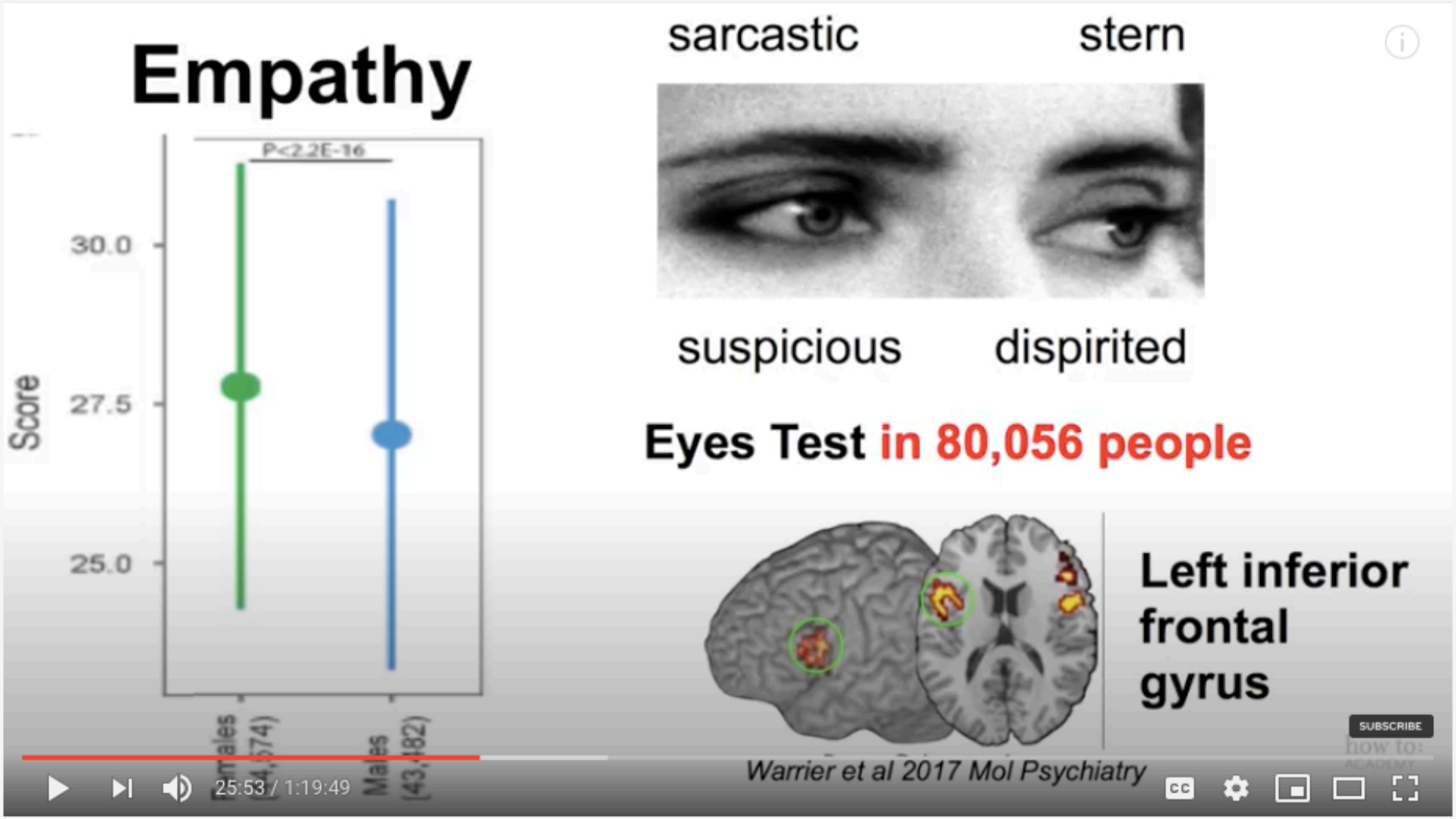
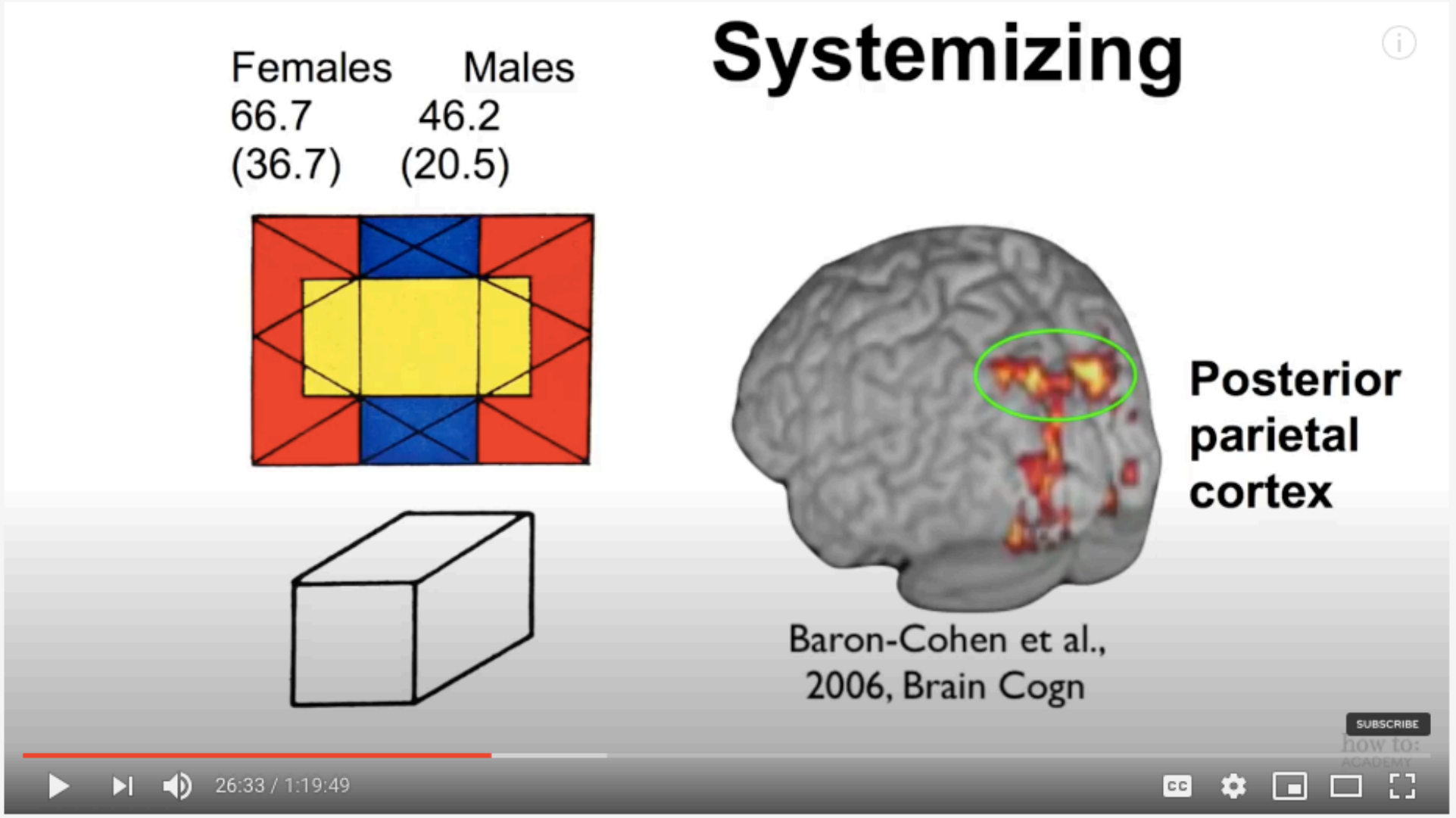


Is the Brain Gendered?: The Debate



Is the Brain Gendered?: The Debate

Sex Differences in the Brain: Implications for Explaining Autism

- **Simon Baron-Cohen*, Rebecca C. Knickmeyer, Matthew K. Belmonte**

See all authors and affiliations

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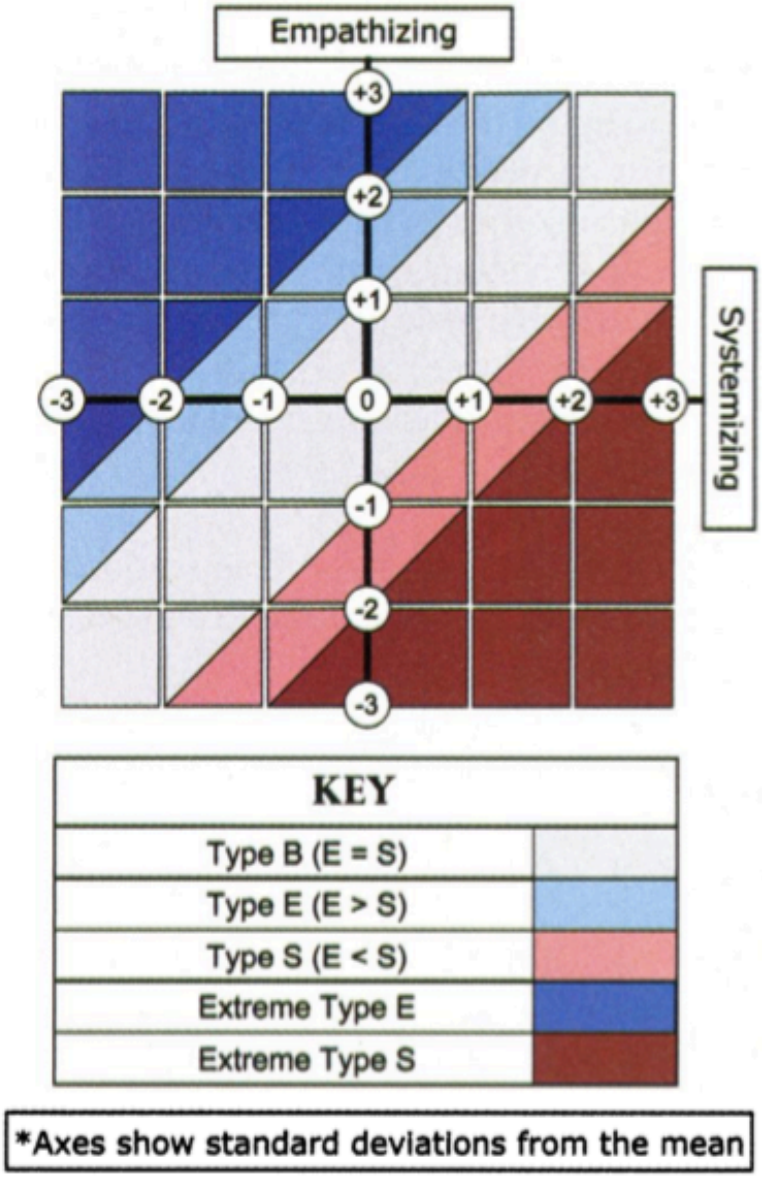
Vol. 310, Issue 5749, pp. 819-823
DOI: 10.1126/science.1115455



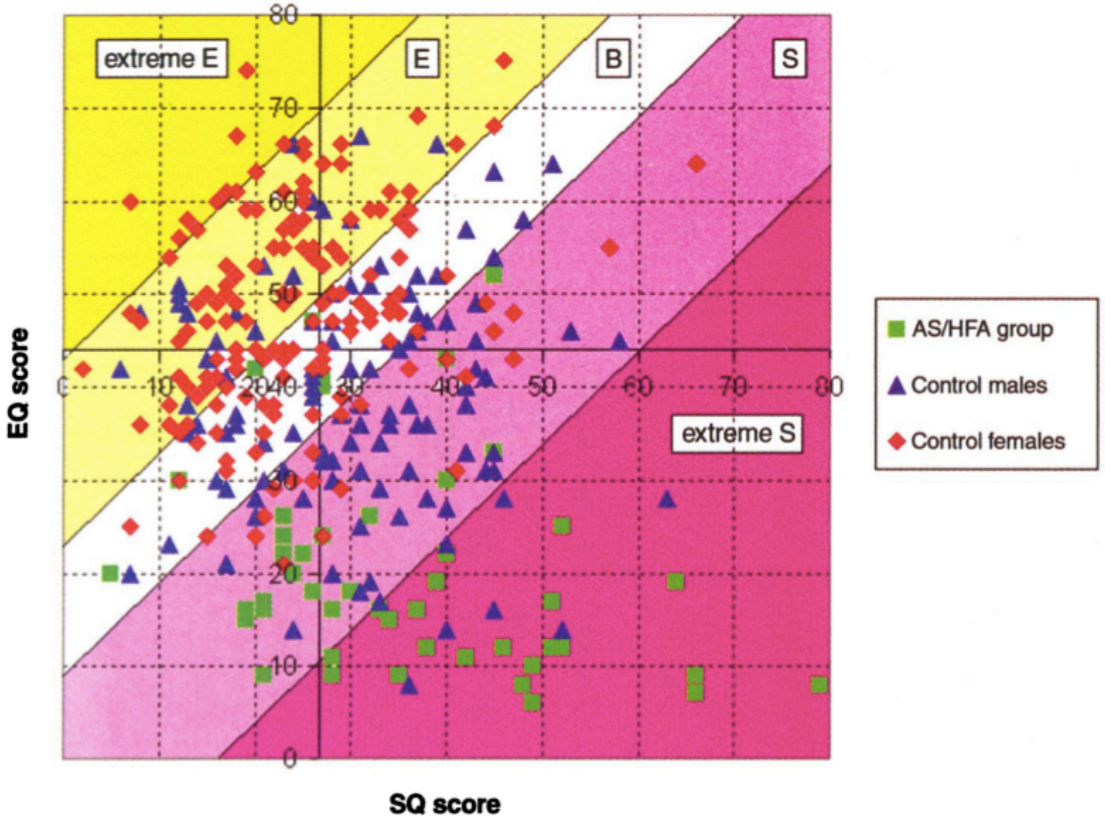


Fig. 3. SQ scores versus EQ scores for all participants, with the boundaries for the different brain types (*82*).

PNAS November 27, 2018 115 (48) 12152-12157; first published November 12, 2018 https://doi.org/10.1073/pnas.1811032115

Testing the Empathizing–Systemizing theory of sex differences and the Extreme Male Brain theory of autism in half a million people

David M. Greenberg[a,1,2], Varun Warrier[a,1], Carrie Allison[a], and Simon Baron-Cohen[a,2]

[a]Autism Research Centre, Department of Psychiatry, University of Cambridge, Cambridge CB2 8AH, United Kingdom

Table 3. Frequency distribution of brain types

Brain type	Control males, %	Control females, %	Autistic males, %	Autistic females, %
Extreme Type E	0.75	2.89	0.30	0.93
Type E	23.88	40.01	13.37	22.20
Type B	30.99	29.81	23.92	27.03
Type S	40.24	25.59	50.98	42.29
Extreme Type S	4.15	1.69	11.43	7.55

This table reports the frequency of the control and case populations based on brain types. All numbers are in percentages. n = 241,355 (male controls), 393,600 (female controls), 18,188 (male cases), and 18,460 (female cases).

Table S17: The Empathy Quotient-10 (EQ-10)

		strongly agree	slightly agree	slightly disagree	strongly disagree
1.	I am good at predicting how someone will feel.	2	1	0	0
2.	Other people tell me I am good at understanding how they are feeling and what they are thinking.	2	1	0	0
3.	It is hard for me to see why some things upset people so much.	0	0	1	2
4.	I can easily work out what another person might want to talk about.	2	1	0	0
5.	I can't always see why someone should have felt offended by a remark.	0	0	1	2
6.	I can tune into how someone else feels rapidly and intuitively.	2	1	0	0
7.	Other people often say that I am insensitive, though I don't always see why.	0	0	1	2
8.	In a conversation, I tend to focus on my own thoughts rather than on what my listener might be thinking.	0	0	1	2
9.	Friends usually talk to me about their problems as they say that I am very understanding.	2	1	0	0
10.	I find it hard to know what to do in a social situation.	0	0	1	2

Table S18: The Systemizing Quotient-Revised-10 (SQ-R-10)

		strongly agree	slightly agree	slightly disagree	strongly disagree
1.	When I learn about a new category I like to go into detail to understand the small differences between different members of that category.	2	1	0	0
2.	When I'm in a plane, I do not think about the aerodynamics.	0	0	1	2
3.	I am interested in knowing the path a river takes from its source to the sea.	2	1	0	0
4.	When travelling by train, I often wonder exactly how the rail networks are coordinated.	2	1	0	0
5.	When I hear the weather forecast, I am not very interested in the meteorological patterns.	0	0	1	2
6.	I enjoy looking through catalogues of products to see the details of each product and how it compares to others.	2	1	0	0
7.	When I look at a mountain, I think about how precisely it was formed.	2	1	0	0
8.	When I look at a piece of furniture, I do not notice the details of how it was constructed.	0	0	1	2
9.	When I learn a language, I become intrigued by its grammatical rules.	2	1	0	0
10.	When I listen to a piece of music, I always notice the way it's structured.	2	1	0	0

Natural Kinds

Scientific classification aims to divide the world into natural kinds

Clear cases of natural kinds are chemical elements — hydrogen, helium, beryllium, etc. are different kinds of things

Other examples include acid, metal, liquid, carnivore,

Traditionally, biological taxa (mammal, primate, human) are thought to be natural kinds too

Natural Kinds

We can correctly classify different types of molecules, rocks, animals, etc.

The classification isn't just based on human interests - they are *natural* kinds

There are law-like regularities governing these kinds. We use them for prediction and explanation, inductions, etc.

Kinds of humans?

The 'obvious' view is that male and female are natural kinds. They are both human, but they are different kinds of humans.

But is it really true that "male" and "female" follow law-like regularities? If you know someone is male, what else do you know about them?

natural kinds and essentialism

One traditional view of natural kinds is that they have essences

An essence makes it what it is (necessary and sufficient conditions) and explains why it has the properties it does

The atomic structure of a molecule explains why it behaves the way it does

Problems with the essentialist view for humans?

1) Not clear what the necessary and sufficient conditions for male vs. female are

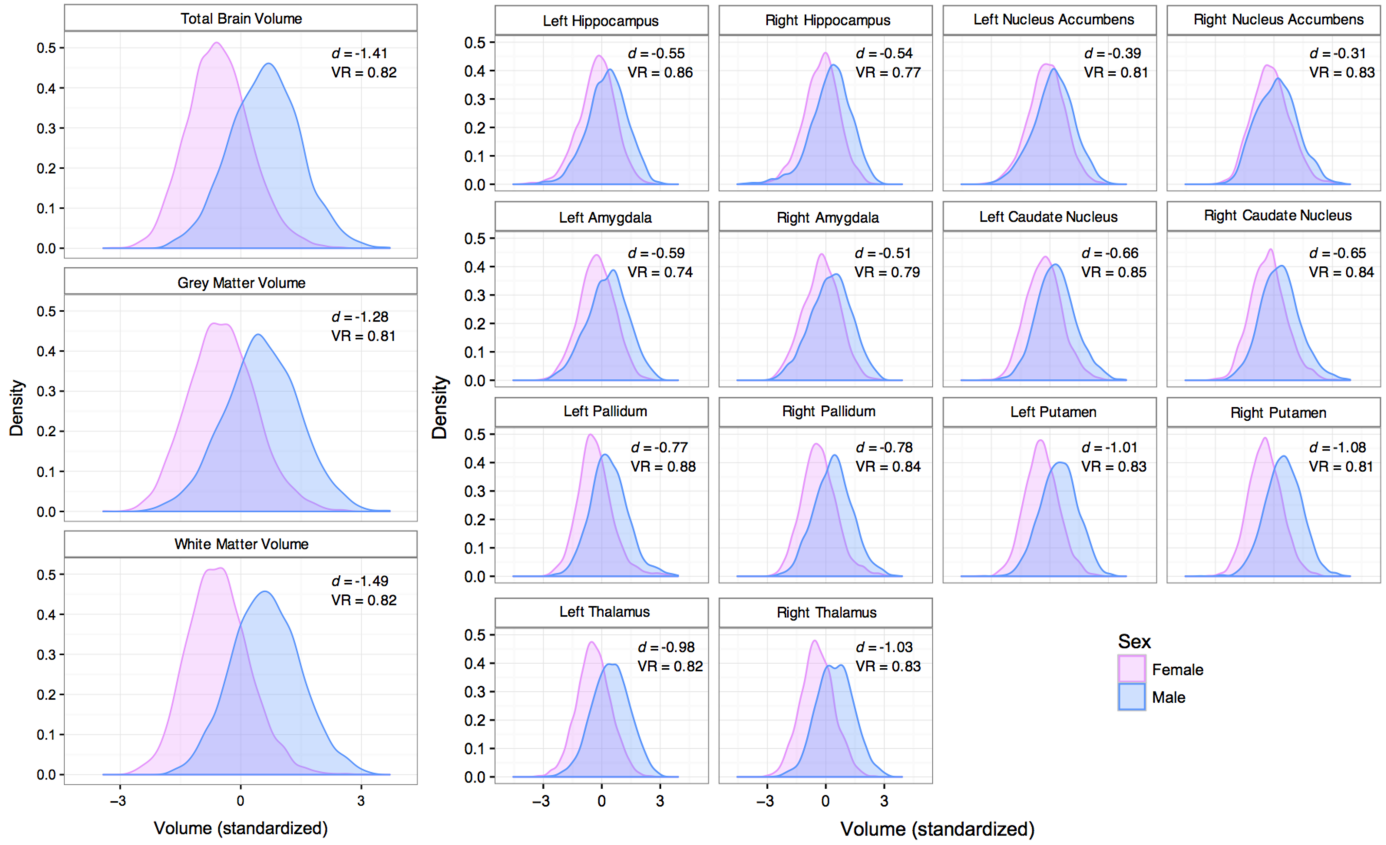
2) Not clear that the plausible conditions are all that explanatory (sex vs. gender)

Problems with the essentialist view of the brain

Cordelia Fine talks about three problems for the essentialist view of brains:

1) overlap - variability within male and female and huge overlap between male and female
2) contingency - group differences sometimes disappear (or reverse) in subgroups
3) mosaicism many dimensions of differences that can independently vary

Figure 1. Density plots of sex differences in overall brain volumes (left section) and subcortical structures (right ...



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Mosaicism

Studies indicate that on average, men:

1) are better at mental rotation of objects
2) are more physically aggressive
3) more interested in things vs. people
4) more prone to dyslexia, schizophrenia and drug and alcohol addiction
5) less prone to alzheimer's
6) more interested in no-strings attached sex
7) better at mathematical word problems
8) worse at mathematical calculation… (and more)

But it is typically not true that the same people have ALL of the more "masculine" traits

Problems with the essentialist view of the brain

So it is really useful to talk about "the male brain"?

Baron-Cohen says yes, "male brain" just means the kind of brain that more men have than women. Not all men have a male brain, not all women have a female brain

But very plausibly this kind of labeling just feeds in to the already-existing stereotypes and leads to serious misunderstandings about the nature of the evidence

Are these differences natural?

It seems clear that behavioral and psychological differences are heavily shaped by culture and upbringing. So how much of these differences are "natural"?

It might seem that brain differences indicate that these are "biological" rather than cultural, but the brain is quite plastic and is shaped by our experiences. So possibly, many of these differences are not natural.

But — some studies seem to indicate differences even in babies

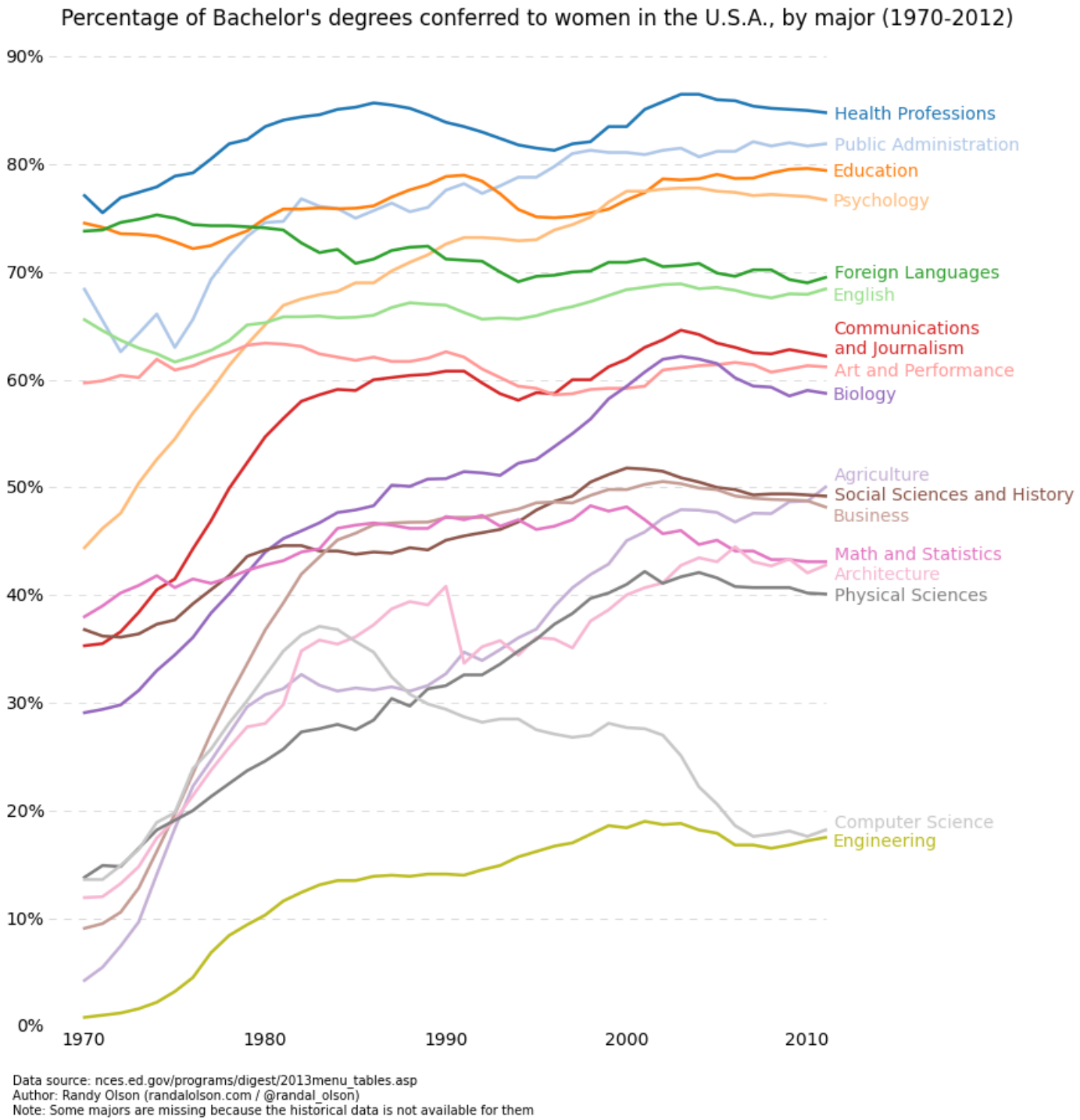
Are these differences significant?

The Spelke-Pinker debate in 2005 was prompted by Larry Summers (president of Harvard) commenting on the gender imbalance of many jobs including faculty in particular departments at Harvard. His explanation:

1) High powered job hypothesis
2) differential aptitude at the high end
3) different socialization and patterns of discrimination

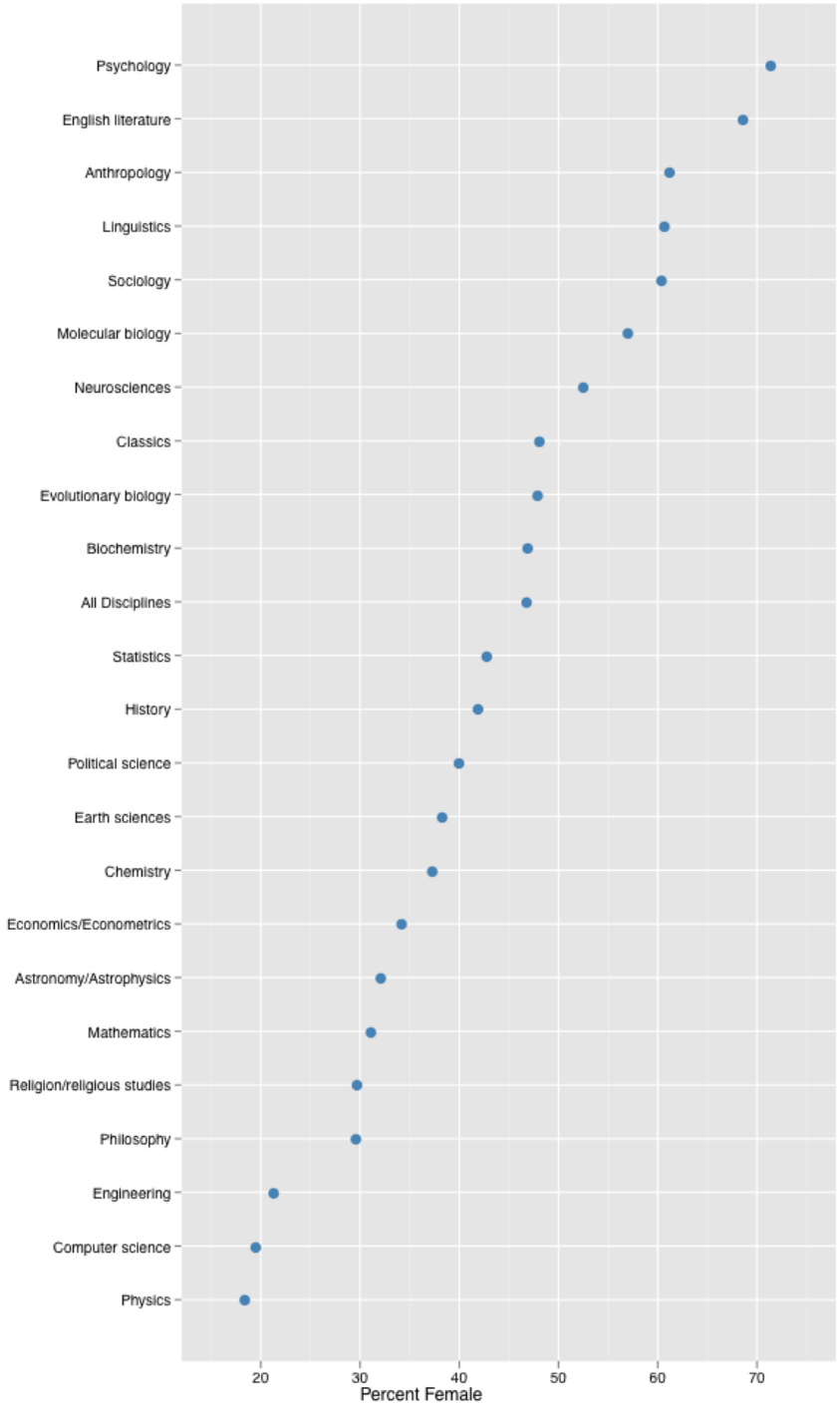
A Datum:

- Underrepresentation of women among tenure-track faculty in elite universities in physical science, math, & engineering (SME):
  - Mathematics: 8.3%
  - Chemistry: 12.1%
  - Chemical engineering: 10.5%
  - Physics: 6.6%
  - Mechanical engineering: 6.7%
  - Electrical engineering: 6.5%
  - Civil engineering: 9.8%
  - Computer science: 10.6%
  - Astronomy: 12.6%



Data source: nces.ed.gov/programs/digest/2013menu_tables.asp
Author: Randy Olson (randalolson.com / @randal_olson)
Note: Some majors are missing because the historical data is not available for them

Percentage of Ph.Ds awarded in the U.S. to Women in 2009, Selected Disciplines



Source: Survey of Earned Doctorates.

http://www.kieranhealy.org/blog/archives/2011/02/04/gender-divides-in-philosophy-and-other-disciplines/

Philosophy in Disciplinary Perspective:
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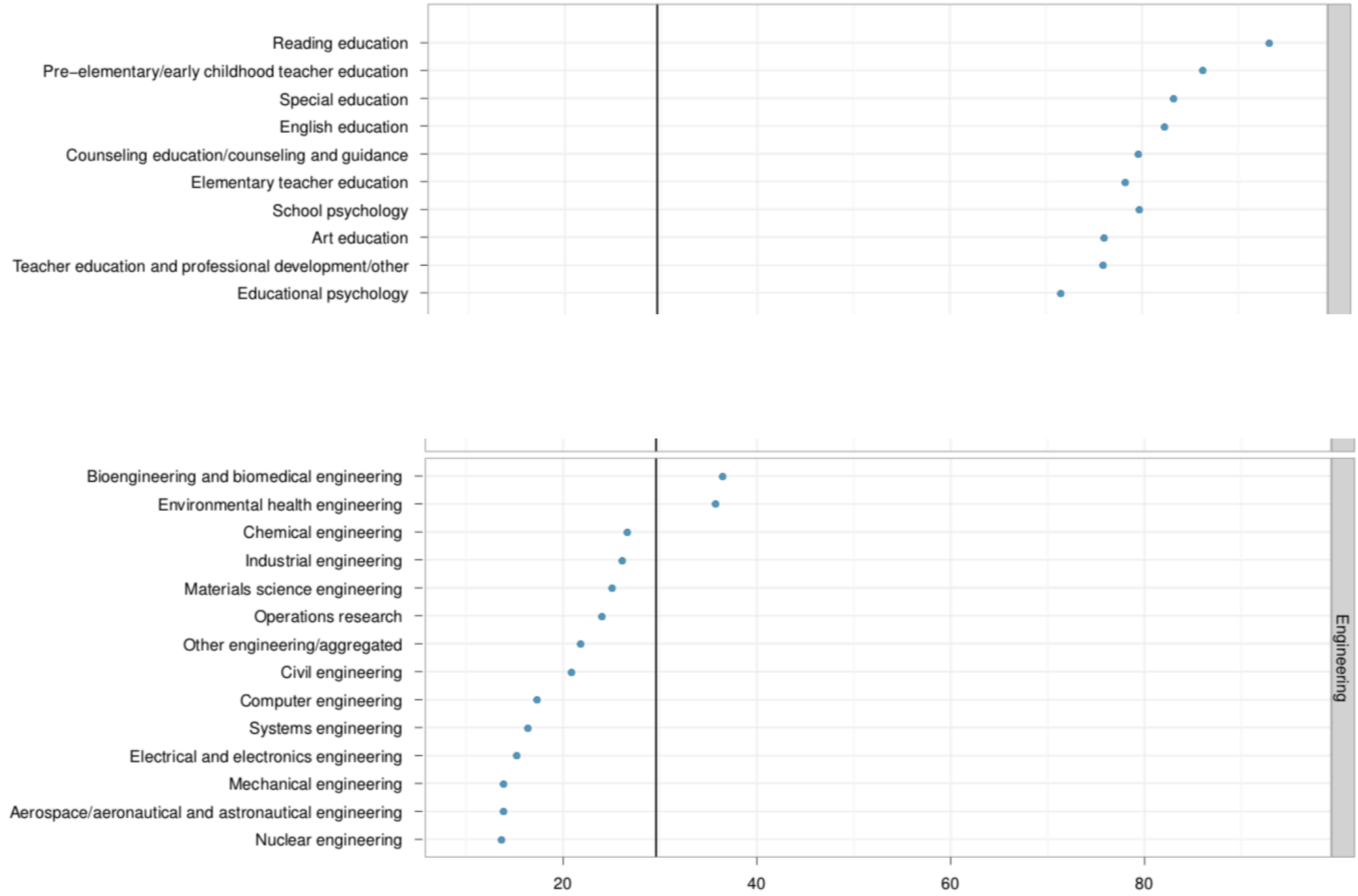

Explanation?

Elizabeth Spelke suggests that discrimination (sometimes outright, sometimes more subtle) plus social and cultural forces can entirely explain these differences

Steven Pinker (and Larry Summers) agree those make a difference, but think that biological differences also play a role (and probably a large role). For example, they lead to differences in aptitude and differences in interests

Explanation?

Elizabeth Spelke suggests that discrimination (sometimes outright, sometimes more subtle) plus social and cultural forces can entirely explain these differences

Key arguments from Spelke include known affects of gender on parental (and societal) expectations and our expectations affect what we actually perceive

Explanation?

Steven Pinker (and Larry Summers) agree those make a difference, but think that biological differences also play a role (and probably a large role). For example, they lead to differences in aptitude and differences in interests

Key arguments from Pinker include known differences between male and female brains, babies, and other animals.

Also, small differences in the mean can still lead to large differences at the tails (especially with higher male variance)