What can we learn from twins about study and subject choice?

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How do we know about genetic influences on behaviour?

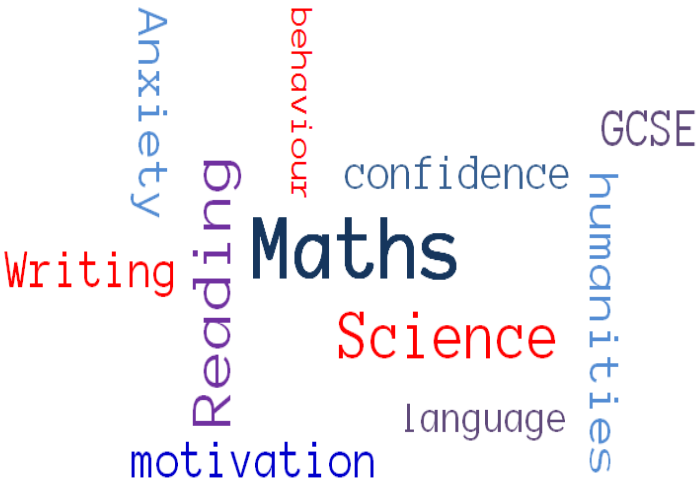
Monozygotic; MZ; Identical

Dizygotic; DZ; Fraternal

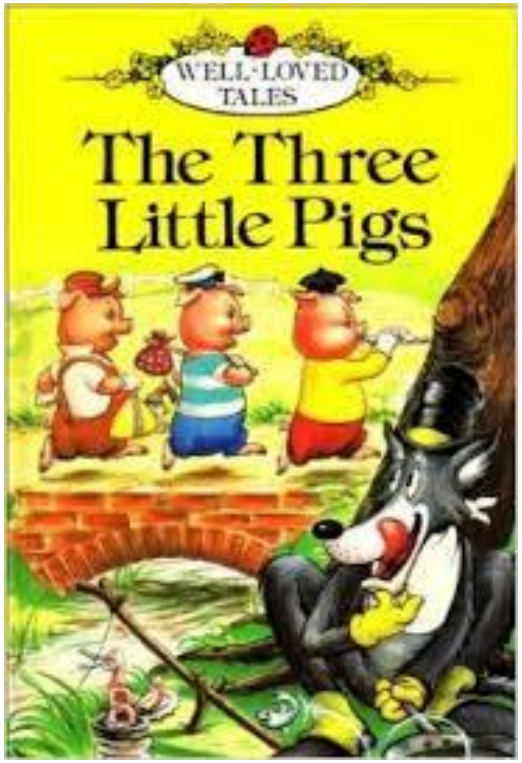
Twin studies allow us to calculate ACE estimates (A = Additive genetic, C = common environment; E = non-shared environment including error)

Heritability: A Definition

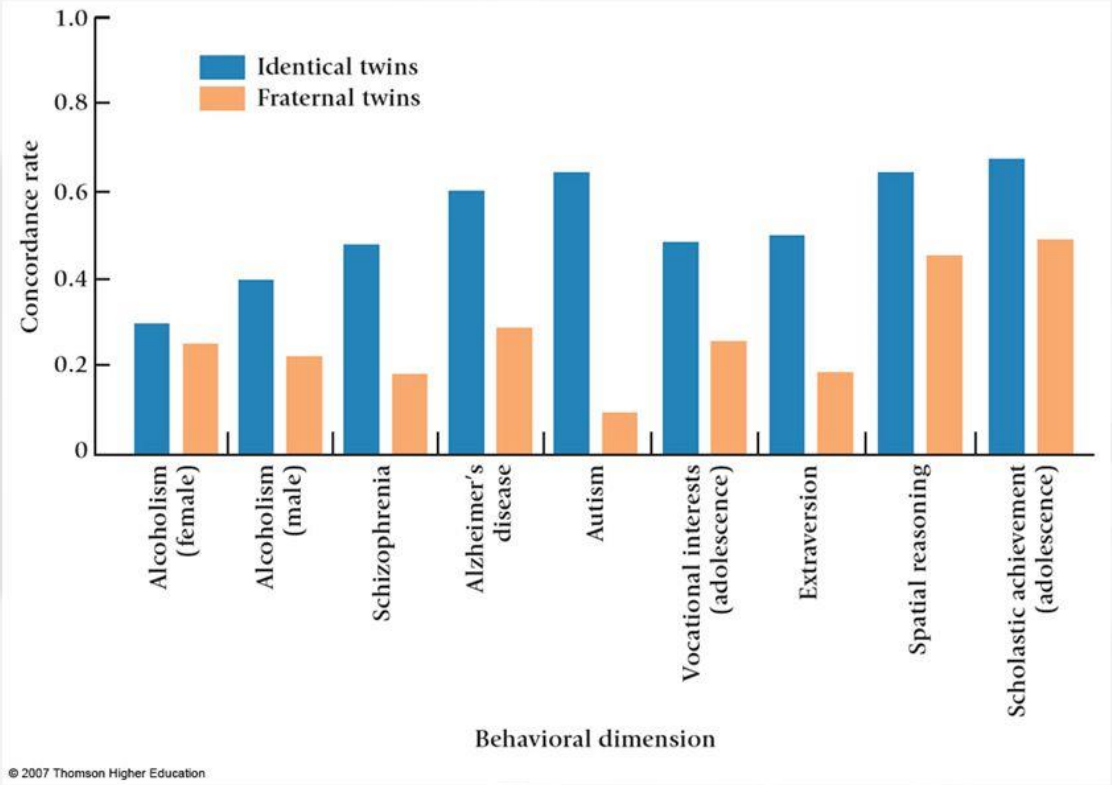
Heritability is a population statistic which represents the extent to which **individual differences** in a trait or behaviour – or a choice - can be explained by genetic differences between individuals



Environmental Influences
Shared and Non-shared



What We Know: The Evidence



- Figure 3.16 Concordance rates for identical and fraternal twins for several behavioral dimensions. FROM PLOMIN ET AL., 1994.

A Level Choices

Rimfeld, Ayorech, Dale, Kovas & Plomin (2016)

Scientific Reports

Background and Rationale

- Study/subject choice at 16 makes a difference to educational and career opportunities.

- Prior attainment is heritable and this is relevant to study/subject choice.

- Genetic factors influence aptitude but also interest and motivational factors – all relevant to achievement.

Methods

Study explored genetic and environmental influences on:

(a) the choice to do A Levels;

(b) subject choice;

(c) A Level achievement.

Sample: 6584 16-year old twin pairs (2318 MZ)

Measures: A Level results (if taken)

Who did what?

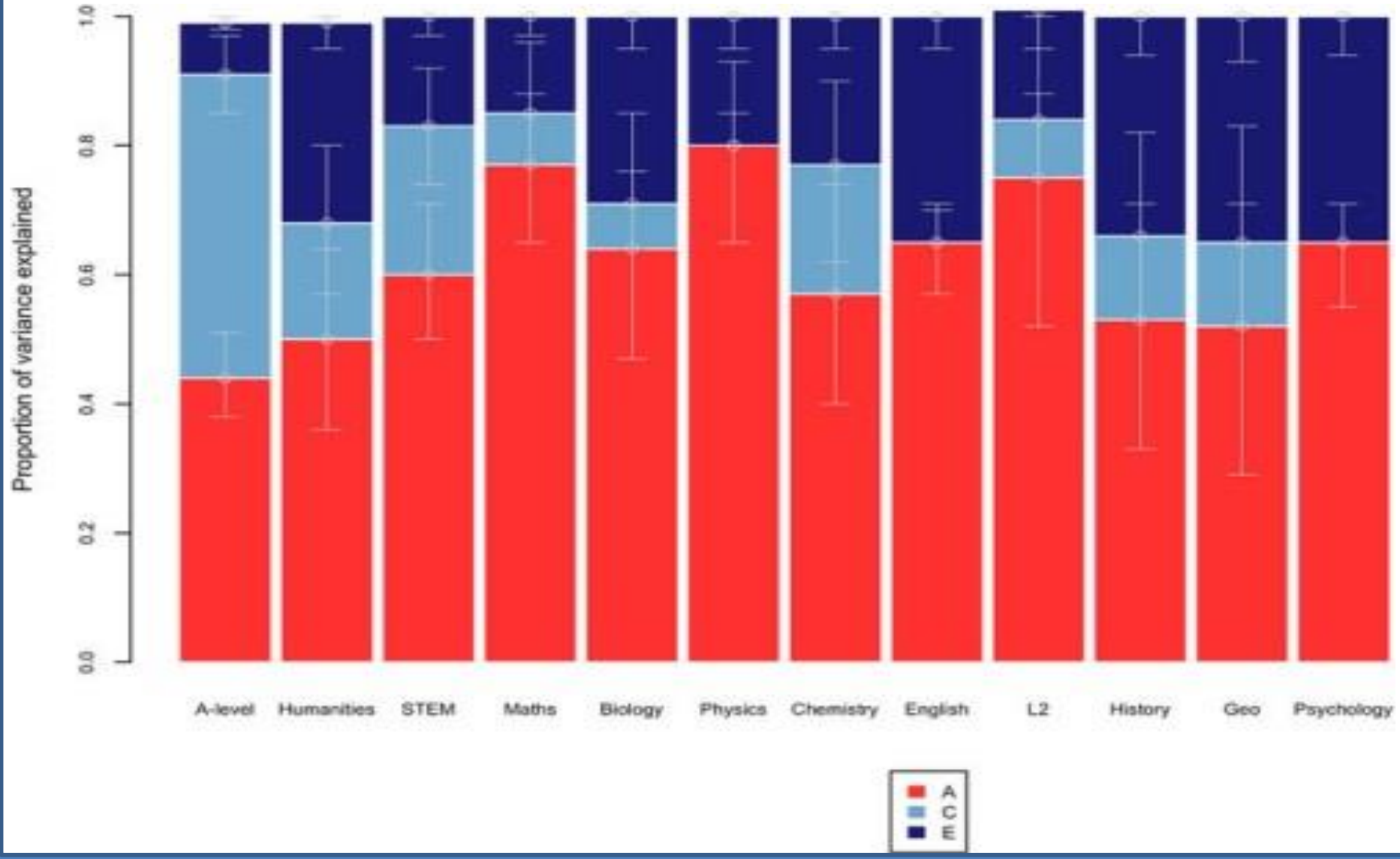
Subject	N (individuals)	Male	Female	X^2
A Levels	6613 (50%)	2826 (43%)	3787 (57%)	40.60**
Humanities	2561 (19%)	1068 (42%)	1493 (58%)	12.87**
STEM	3417 (26%)	1740 (51%)	1677 (49%)	18.57**
Maths	1988 (15%)	1147 (58%)	841 (42%)	66.93**
Biology	1634 (12%)	603 (37%)	1031 (63%)	36.53**
Physics	846 (6%)	652 (77%)	194 (23%)	188.94**
Chemistry	1276 (10%)	608 (48%)	668 (52%)	0.73
English	1807 (14%)	490 (27%)	1317 (73%)	174.43**
Second language	544 (4%)	174 (32%)	370 (68%)	28.55**
History	1291 (10%)	571 (44%)	720 (56%)	4.54*
Geography	1032 (8%)	466 (55%)	566 (45%)	0.01
Psychology	1222 (9%)	285 (23%)	937 (77%)	139.37**

Few Sex Differences for Grades

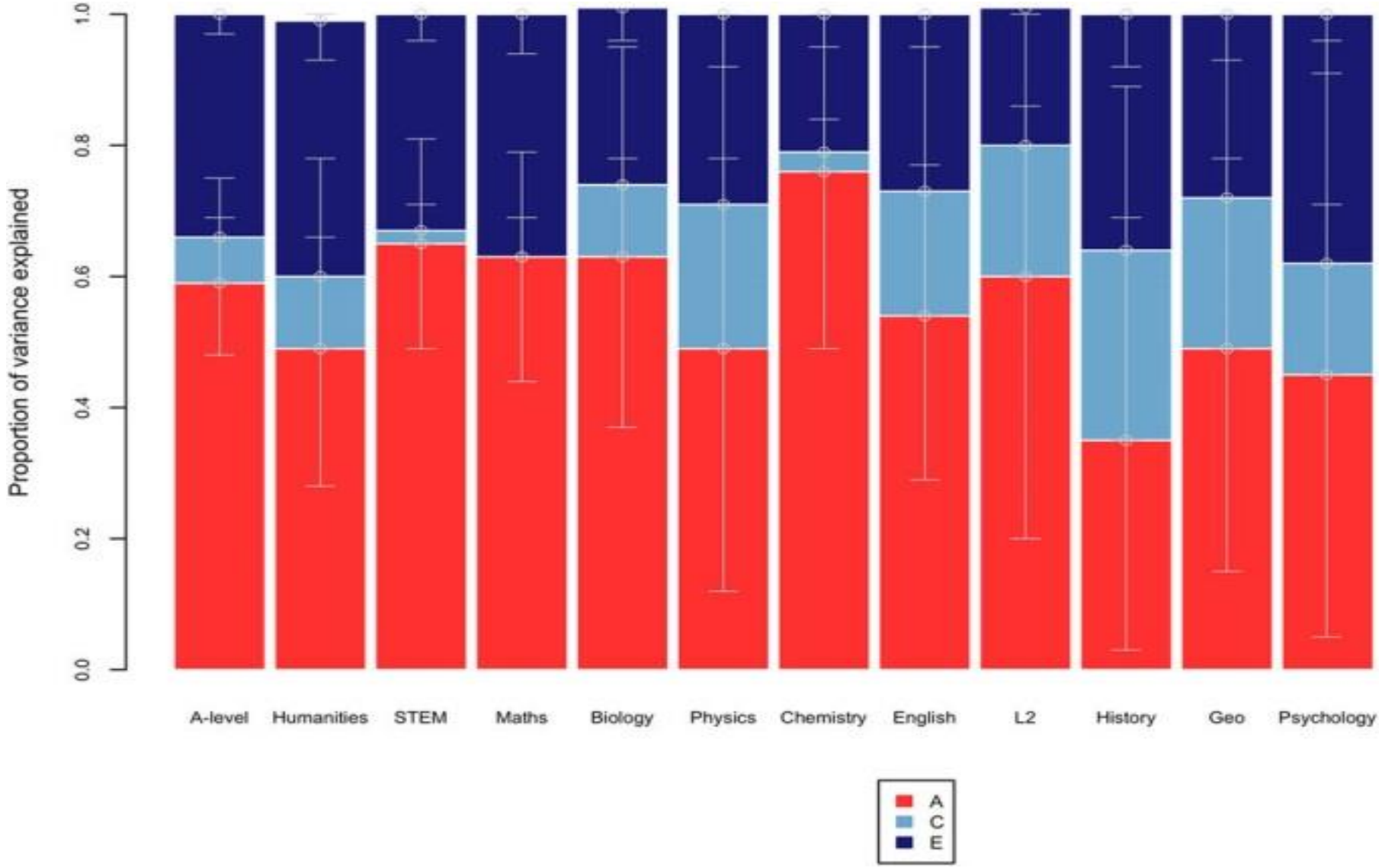
(6=A*, 5=A, 4=B, 3=C, 2=D, 1=E)

Subject	N	Sample M (SD)	Male M (SD)	Female M (SD)	Sig
A Levels	3053	3.90 (1.16)	3.85 (1.20)	3.94 (1.13)	*
Humanities	1280	4.00 (1.14)	3.90 (1.18)	4.07 (1.10)	**
STEM	1723	3.89 (1.31)	3.85 (1.32)	3.92 (1.31)	NS
Maths	1012	4.34 (1.28)	4.27 (1.33)	4.43 (1.20)	NS
Biology	812	3.95 (1.39)	3.91 (1.34)	3.98 (1.42)	NS
Physics	443	3.97 (1.38)	3.97 (1.38)	3.96 (1.38)	NS
Chemistry	646	4.13 (1.30)	4.05 (1.32)	4.20 (1.08)	NS
English	904	4.01 (1.19)	4.09 (1.24)	3.98 (1.17)	NS
Second language	275	4.11 (1.14)	4.15 (1.21)	4.09 (1.11)	NS
History	677	4.11 (1.17)	4.11 (1.17)	4.06 (1.23)	NS
Geography	496	4.00 (1.15)	3.91 (1.19)	4.08 (1.10)	NS
Psychology	600	3.66 (1.25)	3.31 (1.14)	3.77 (1.27)	**

Heritability of A Level Choices



Heritability of A Level Achievement



In Summary

- Genetic factors influence academic choices.
- Whether 16 year olds choose to study A Levels is influenced equally by genetic and shared environmental factors.
- Choosing specific A Level subjects is heritable (50% for humanities and 60% for STEM) and this fits with rGE – choosing what you are good at and what you enjoy.
- A Level grades are also substantially heritable.

UNDERSTANDING AND INFLUENCING PUPILS' CHOICES AS THEY PREPARE TO LEAVE SCHOOL

Identifying NSE influences in adolescence

- Hypothesis generating MZ Differences Study
  - Asking families for their theories about the causes of discordance between twins.
- We asked about differences in:
  - GCSE results
  - Health and well-being
  - Future Plans
- Questionnaires completed by 497 families with MZ twins aged 16 – 19 (parent and both twins).
- Conducted in-depth telephone interviews with 97 highly discordant MZ pairs (+ a parent).

(Asbury, Moran & Plomin, 2016, 2017)

NSE influences on GCSE achievement

- Two broad categories of explanation:
  - School Environment
  - Individual Behaviour.

- 56 of 97 interviewed families were selected on grounds of different GCSE grades.
  - 42 of 56 (75%) offered explanations related to school.
    - Ability Grouping
    - Teacher Quality
    - Teacher-Pupil Relationships

Prior attainment

The slight differences resulted in Twin 1 getting an Oxford interview whereas Twin 2 was turned down at application. One grade between them but at a crucial stage.

One got 4 Cs and one got 3 Cs so one has needed an extra year in college.

Having a Plan

Twin 2 is very focused and knows what she wants to do and has done for a long time. Twin 1 is unsure at the moment and hopes when she travels it will make her mind up for her.

Twin 1 knew she needed English at Grade A to pursue her desired course at university so put in extra effort despite being in a lower set.

Work Experience

Twin 2 did a week with the Army in her last year of school for work experience and loved it so chose her career from it.

Twin 1 did her work experience with Sheffield University Mechanical Engineers - this was not because she had an interest in this, but she enjoyed it and decided to work in the building industry.

Many Similar Choices

They both want to go to University, the same University and they both want to work in immigration.

Same course, same choices, same teams. Different girlfriends (thank goodness!).

Implications and Discussion

Understanding the aetiology of major educational decisions can support thinking about ensuring equality of opportunity for all

Thank you for listening!

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