Notes on Cyril Burt and Scientific Fraud

Fancher (1985), Chaps. 1, 5

1. Nature versus Nurture

Question: What is the degree to which individual differences in intelligence are attributable to hereditary and congenital fadtors ("nature") on the on hand, or to environmental fators ("nurture") on the other?

John Stuart Mill and Nurture

John Stuart Mill
(1806-1873)

Mill's associationistic psychology:

- The human mind at birth is a *blank slate* with the capacity for receiving and recording permanent impressions.
- Impressions interact via 3 laws supplemented by "mental chemistry:
  - Law #1, Association by similarity (similar impressions tend to excite one another).
  - Law #2, Association by continguity (when two impressions are frequently experienced, then whenever one recurs, so does the other).
  - Law #3, Intensity (a greater intensity in either or both of two impressions leads to a greater frequency of their conjunction).
  - "Mental chemistry": when many impressions are operating in the mind together, there sometimes takes place a process of a similar kind to chemical combination.

Main point: Starting point of human cognition is a blank slate: *no* innate ideas.

Mill's Claim: Associationism adequately accounts for most mental characteristics, and not innate ideas or inborn responses.

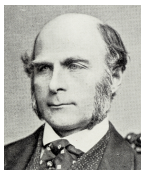
Example: Are artists innately different from scientists?

- Perhaps artists' brains are different than scientists' brains (maybe artists use the "right" side of their brains while scientists use the "left" side...).
- *Associationist claim*: The difference is *not* due to innate features of the brain. Rather:
  - Artist: had many intense childhood experiences. These generated connections among ideas that occured at the same time as the experiences, with a subsequent focus on knowledge of static objects.
  - Scientifist: Had less intense childhood experiences. These generated connections among ideas at successive times, with a subsequent focus on knowledge of processes/events.

Mill's Claim: Environmental explanations take precedent on both logical and moral grounds.

- There may be some hereditary component to intelligence, but the environmental component is so great that we should err on its side if we are concerned with addressing social issues (like gender equality).

Francis Galton and Nature



Francis Galton
(1822-1911)

Darwin's influence: Perhaps psychological differences are inheritable, based on small variations in the brain and nervous system.

- *Can smart humans be selectively bred like fast carrier pigeons?*

- 1865. Introduces statistical studies of heredity.

Adoptive family method (*Hereditary Genius* 1869)
- Compare intelligence of adopted children and their adoptive parents to determine environmental contribution to intelligence.

Twin study method (1875)
- Fraternal (dizygotic, or DZ) twins: develop from separate eggs.
- Identical (monsygotic, or MZ) twins: develop from same egg (share all the same genes).
- Compare intelligence of MZ twins separated at birth and raised in different environments to determine genetic contribution to intelligence.

- *Concept of correlation coefficient*:
  - Measure of correlation between two variables (*eg.*, height of father, height of son).
  - Takes value in range $[-1, +1]$.
  - $+1.0$ indicates perfect agreement.
  - -1.0 indicates perfect disagreement.

- *Galton's eugenics program*: two goals:
  - The development of an intellectually superior "breed" of human.
  - The institution of customs and laws to ensure that the superior breed proliferates at a faster rate than common humans.

2. Cyril Burt

Cyril Burt
(1883-1971)

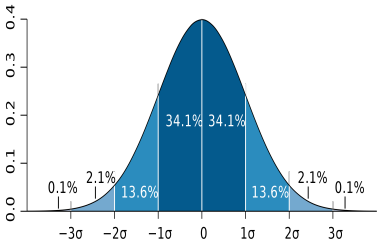
Correlation coefficient (as perfected by Karl Pearson)

Measures the degree to which two random variables X, Y deviate from their expected (*i.e.*, mean) values in similar ways.

Consider two random variables X and Y

- $E[X]$ is the "expected value" of X (the mean value of X).
- $\sigma_X = \sqrt{E[X^2] - (E[X])^2}$ is the "standard deviation" of X.

  Measures the amount of variation of the values of X about its expected value $E[X]$.
- $\sigma_{XY} = E[(X - E[X])(Y - E[Y])$ is the "covariance" of X and Y. Measures the joint variability of X and Y; *i.e.*, the degree to which they deviate from their expected values in similar ways.
- $\rho_{XY} = \sigma_{XY}/\sigma_X\sigma_Y$ is the "correlation coefficient" of X and Y, or the normalized covariance (normalized so that it only takes values in the range $[-1, +1]$).



Standard deviations for normal distribution (Bell curve) of values of a random variable (expected value is at peak of curve).

Recall: Under *ideal* scientific conditions, the correlation coefficient for the IQ of a sample of MZ twins separated at birth and reared apart can be a precise indicator of the heritability of intelligence (*to the extent that IQ measures intelligence!*).

- IQ correlation coefficient of 1.0 implies all of the IQ variability is genetic.
- IQ correlation coefficient of 0.5 implies half of IQ variability is genetic, and half is environmental and/or due to measure error.
- IQ correlation coefficient of 0 implies none of the IQ variability is genetic.f

Requirements for MZ separated-twin study:

- Must employ twins who represent a genuinely random sample of general population.
- Must employ twins who have been randomly placed in a representative range of homes.
- Must demonstrate its sample represents the full population of separated twins.
- Must employ twins that have been completely separated from each other.

Problems:

- Selective placement is the norm and tends to place MZ twins in similar environments.
- MZ twins are identified typically because they are similar; and this biases the sample twin population of any study.

- 1913-1932. Burt employed as Educational Psychologist by London County Council (in charge of all of London's public schools).
  - Has access to a huge database of student information.

- 1932. Burt appointed as Department Head of Psychology at University College London.

Burt and/or "colleagues" on separated twin studies based on London school children data

- 1943. 15 cases of MZ twins separated at birth. Correlation coefficient of 0.77.
- 1955. 21 cases. Correlation coefficients of 0.771 for "group test", 0843 for "individual test", 0.876 for "final assessment".
- 1957. 30 cases. Correlation coefficients of 0.771, 0.843, 0.876t.
- 1958 (article by "J. Conway"). 42 cases. Correlation coefficients of 0.778, 0.846, 0.881.
- 1966. 53 cases. Correlation coefficients of 0.771, 0.863, 0.874.

year	1943	1955	1957	1958	1966
#cases	15	21	30	42	53
group test	0.77	0.771	0.771	0.778	0.771
indiv test		0.843	0.843	0.846	0.863
final assessment		0.876	0.876	0.881	0.874

Data indicates a high level of correlation between the IQs of MZ twins separated at birth and reared apart.

- Implies that whatever IQ measures (intelligence) is due primarily to genetics (~77%-87%), and less to environmental factors.

- 1960's-1970's. Advocates of "nature" refer to Burt twin data to argue their case.

- 1972. Leon Kamin (Princeton psychologist) re-examines Burt's data.
  - Actual IQ tests were never described satisfactorily.
  - Invariant correlations over varying sample sizes: From 21 in 1955, to 30 in 1957, to 53 in 1966, correlation coefficient for group test remains unchanged at 0.771.

Leon Kamin
(1927-2017)

Extremely unlikely: as sample size increases, deviations about the mean should fluctuate, and not remain constant.

<u>*Conclusion*</u>: Minimally, Burt cooked the data.

"The numbers left behind by Professor Burt are simply not worthy of our current scientific attention. We pass on now to more serious work."

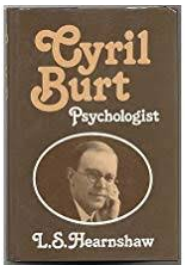
On other twin and adoptive child studies:

"I see no unambiguous evidence whatever in these studies for *any* heritability of IQ test scores... The adopted child studies, like the separated twin studies, seem to me to offer no evidence sufficient to reject the hypothesis of zero heritability of IQ scores."

Conclusion (recall Mill):

"...it is both scientifically unwarranted and ethically irresponsible to abandon environmentalistic hypotheses, and the social programs based on them, because of an assumption that most of the variance in human intellectual ability is hereditary or innate"

- 1979. Autobiography of Burt by Leslie Hearnshaw. Granted access to Burt's diaries, unpublished papers, personal correspondences.
  - Leaves no doubt that "much if not all of Burt's empirical genetic ework, including the enormously influential twin studies, had unquestionably been deliberately falsified".



3. Scientific Fraud

Robert Merton
(sociologist)
(1910-2003)

One approach: 1940's Mertonian Sociology of Science

Treat science as a social practice:

- The function of science is to produce knowledge.
- It accomplishes this by enforcing institutional *norms*.
- *Norms* = The rules that a group uses for appropriate and inappropriate (deviant) values, beliefs, attitudes, and behaviors.

Scientific Norms (what constrains scientists' actions)

(a) Universalism = The criteria used to evaluate a scientific claim should not depend on the identity of the person making the claim.

(b) Communalism = Scientific knowledge should be communally owned.

(c) Disinterestedness = Scientists should disengage their interests from their actions and judgements.

(d) Organized Skepticism = Scientific ideads should be subject to community-wide tests and challenges.

Rewards are given to community members who follow the norms; sanctions imposed on those who violate them.

Reward system (what motivates scientists to act)

Reward in science = *recognition*

- "Darwinian biology", "Copernican system", "Planck's constant", "Halley's comet", *etc.*
- prizes, historical recognition
- citations of work (indication of influence).

Advantage: Encourages original thinking and innovation.

Disadvantage: Can motivates deviant behavior...

Deviant behavior (actions that violate norms)

- Scientific fraud!
- The "Matthew Effect": All things being equal, scientists with more initial recognition tend to receive more additional recognition than scientists with less initial recognition.

> *"For whosoever hath, to him shall be given, and he shall have more abundance: but whoseover hath not, from him shall be taken away even that he hath."*

Criticism of Mertonian approach

(a) Are Mertonian norms description of actual scientific practice?

How prevalent is "deviant behavior"?

- Is the "Matthew effect" frowned upon? Tolerated? Encouraged?

How prevalent is organized skepticism?

- Do scientists really adopt a skeptical attitude toward their work (are they really engaged in falsificationism)?

(b) Are Mertonian norms prescriptive of "good" scientific practice?

Do they give an account of what science should be like, even if it might not be actually practiced in this way?

Can the norms be misused to discriminate against certain groups?

- Are they inherently gender-biased?
- Who gets to enforce them?

What constitutes "good" scientific practice?

- *Academic* science? Mertonian norms seem to apply.
- *Entrepreneurial* science? Mertonian norms definitely do *not* apply!

No communalism or disinterestedness: industry secrets and profit margins!

Which venue best supports scientific research: academia or industry?

Industry:

Advantages	*Disadvantages*
- More resources.	- Less control over projects.
- Chance to see ideas embodied in products.	- Less individual freedom.
- Compensation.	- More institutional competition.
- Less individual competition.	- Less job security.

Academia:

Advantages	*Disadvantages*
- More control over projects.	- Less resources.
- More individual freedom.	- Less time for research.
- Less institutional competition.	- Compensation.
- More job security.	- More individual competition.