PSYC3016: Developmental Psychology

Lecture 2: Nature versus nurture

Nature versus nurture
Overview

- First of three lectures

- L2 – Nature versus nurture
  - Cover the basics
  - Terminology and measurement
  - Myth-busting

- L3 & 4 – Behavioural genetics
  - Heritability
  - Twin studies
  - Complex interactions
  - Epigenetics
  - Why, as psychologists, should we care?

Nature versus nurture

Learning Outcomes

- LO1 – understand traditional philosophical approaches to child development – what is meant by nature versus nurture
- LO2 – understand how nature and nurture might be measured in child development studies
- LO4 – understand the implications of differing philosophical approaches might be associated with broader social constructs
- LO1 – critically evaluate the flaws, and common misconceptions, regarding the nature versus nurture debate

Nature versus nurture
What do we really mean?

Nature:

"innate" qualities
"nativism"
rationalism
Certain behaviours or cognitive abilities are innate – not learned from the environment but are present from birth or naturally develop over time.

- Modern nativism (Fodor, Chomsky and Pinker) argues that humans, from birth, have certain cognitive modules (**specialised genetically inherited psychological abilities**) that allow them to learn and acquire certain skills, such as language.
- E.g., children demonstrate a facility for acquiring spoken language but require intensive training to learn to read and write.
- Poverty of the stimulus (POS) is the assertion that natural language grammar is unlearnable given the relatively limited data available to children learning a language, and therefore that this knowledge is supplemented with some sort of innate linguistic capacity. (Chomsky)
- POS: a **genetically inherited neurological module** that confers a somewhat universal understanding of syntax that all neurologically healthy humans are born with, which is fine-tuned by an individual's experience with their native language.

Nature versus nurture
What do we really mean?

Nurture: personal experiences
behaviourism
empiricism
“tabula rasa” – blank slate, John Locke (1690s)

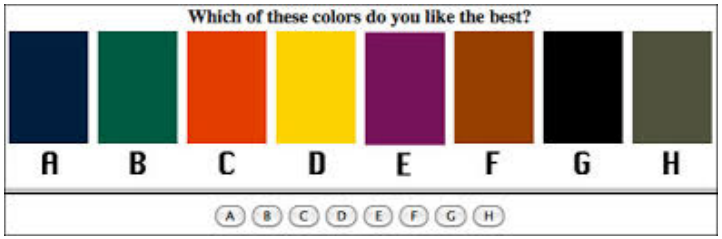
Purist behaviorism:
"Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors."
(John Watson, *Behaviorism*, 1930, p. 82)

Nature versus nurture
What do we really mean?

The debate gets complicated…

Why?

- Innate qualities *sound* inflexible.



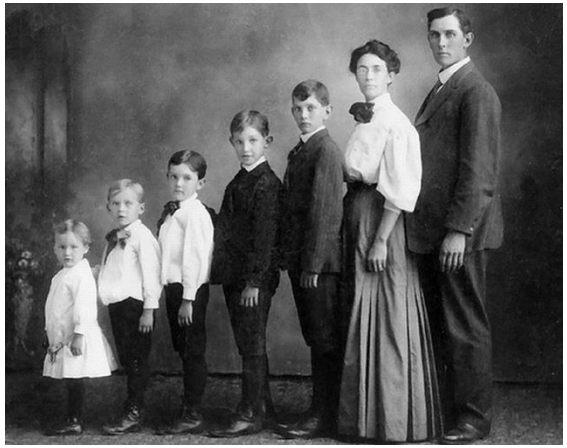
In “Not in Our Genes: Biology, Ideology and Human Nature” (1984), Lewontin, Rose and Kamin criticise "genetic determinism" from a Marxist framework, arguing that "Science is the ultimate legitimator of bourgeois ideology [...] If biological determinism is a weapon in the struggle between classes, then the universities are weapons factories, and their teaching and research faculties are the engineers, designers, and production workers."

Nature versus nurture
What do we really mean?

Heritability: how much of the variation of a trait (phenotype) in a population is due to genetic differences in that population

Phenotype (P) = genetic effects (G) + environmental effects (E)

- "Heritable" is not the same as "inherited"
- E.g. "Height" in one family
  - Heritability may increase if the genetic variation increases (marriage, babies, out-breeding)
  - Heritability may increase if the environmental variation decreases (poor diet)



Nature versus nurture
How do we measure them?

- How is each measured?
  - **Heritability estimates** are used to measure the relative contributions of genetic and environmental factors
  - We will look at these in L3

- **Nature**: Genetics
  - Single nucleotide polymorphisms (SNP)
  - AA, Aa, aa
  - Association with disease

- Two groups of participants: with the disease and similar people without the disease
- DNA from blood/cheek/saliva
- Each person's complete set of DNA, or genome, is then purified from the blood or cells, placed on tiny chips and scanned on automated laboratory machines for SNPs.
- If certain genetic variations (e.g. aa) are found to be significantly more frequent in people with the disease compared to people without disease, the variations are said to be "associated" with the disease.
- NB: the associated variants themselves may not directly cause the disease. They may just be "tagging along" with the actual causal variants. (Problem for GWAS in particular)

Nature versus nurture
How do we measure them?

- **Nurture**: Environment
  - Physical environment (no garden versus garden)
  - Internal environment (diet)
  - Social environment (communal living)
  - Family environment (parenting practices)
  - Emotional environment (warmth, love, discipline)

- Measurement
  - Direct observation
  - Self-report questionnaire
  - Parent, teacher reports
  - Clinical interviews
  - Public, social records and data (ABS)

  - Pro: quick, easy, “real”, objective
  - Con: subjective, may not correlate, biases

Nature versus nurture
Myths and misconceptions

1. Genes dictate
   Eye colour – ok
   Favourite food – ok
   Intelligence - ?!

   - Implications for social mobility, “designer” babies, predestination?

   Do genes dictate what is **possible**?
   E.g. height – diet

   “Limiting factor”

Nature versus nurture
Myths and misconceptions

Do genes dictate what is possible?

- MINI MYTH: biological differences must be due to genetic factors.

- **Environment can influence biology. Biology can influence environment.**
- Do genes **dictate** anything?
  Mutations - ok
  Complex traits - no

Nature versus nurture
Myths and misconceptions

2. “Tabula rasa”– is society failing?

- Crime, illiteracy, poverty, racism, drug use…
- Families, schools, community, religion…

- Genes are an easy scape-goat

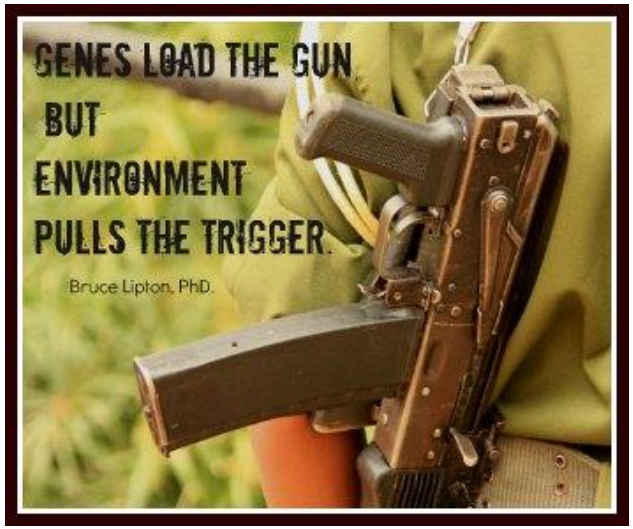
- Human bias: negative attributes – “not my fault”
  positive attributes – “all because of me”

- Happiness, generosity, kindness, well-being…
- Families, schools, community, religion…

A phenotype can be positive or negative – all are influenced by both genes and environment

Nature versus nurture
Myths and misconceptions

The problem of violence



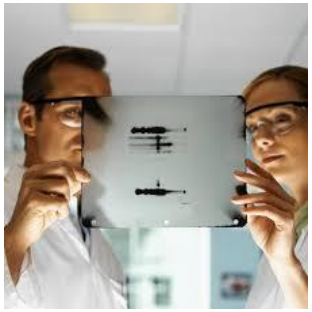
Criminal responsibility: the "warrior" gene (MAOA)

- High proportion of violent offenders have low activity variant of MAOA gene
- BUT, majority of people with low activity variant do not commit violent crime
- MAOA genetic testing used to reduce prison sentence
- Recommended reading: http://www.nature.com/news/2009/091030/full/news.2009.1050.html

Nature versus nurture
Myths and misconceptions

3. All traits are heritable so heritability is irrelevant

   - A problem of communication?



Navel gazing – broader utility of genetics

Too far removed from the application of psychology

Nature versus nurture
Myths and misconceptions

3. All traits are heritable so heritability is irrelevant

- A problem of understanding?
- Variability in heritability (10% versus 80%)
- The gene matters: e.g. neurotransmitter systems
- Heritability estimates associated with treatment resistance (e.g. conduct disorder with callous-unemotional traits)

Low CU
Heritability estimate for conduct problems = 30%

High CU
Heritability estimate for conduct problems = 81%

Nature versus nurture
Myths and misconceptions

4. What about the mechanism? Genetics tells us nothing about the aetiology

Fair point?

- E.g. GWAS “fishing trip” can identify regions of DNA coding for seemingly unrelated proteins

- Identified DNA might not even be of functional relevance

- How do we get from genotype to phenotype?
  - Just because it is difficult doesn’t mean it is not worthwhile

Nature versus nurture
Myths and misconceptions

- So, we need to be hypothesis-driven – molecular genetics
  - Gene function
  - Targeted systems
  - Previous research
  - Shared data and free access
  - Replication across samples

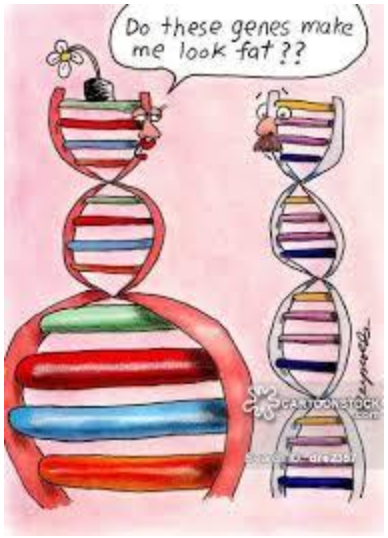
"The future of genetic research in developmental psychology lies in molecular genetic studies of DNA that will eventually identify specific DNA variants responsible for the widespread influence of genes in psychological development. Identifying these DNA variants will make it possible to address questions about developmental, multivariate, and gene-environment mechanisms with far greater precision and power.
For example, in 1993 a gene was identified that increases risk fivefold for dementia later in life (late-onset Alzheimer's disease, or LOAD; Corder et al., 1993). Study of this gene can now be used to investigate its effects earlier in life (developmental), its effect on other types of dementia and other comorbid disorders such as depression (multivariate), and its correlation and interaction with environmental factors, such as its role in worsening the effects of such head injuries as those caused by boxing (gene-environment interplay)."
(Robert Plomin, 2004)

Recommended reading: http://psychology.uchicago.edu/academics/doctoral/developmental/plomin_2004.pdf

Nature versus nurture
Myths and misconceptions

5. Genetic literacy: “The general public will misinterpret genetic findings”

- E.g. “Fat” genes
  - Locus of control
- Hope for improvement
  e.g. boy with ADHD
- Solution?
  - Education (including psychologists)
  - Communication



PTC: What can psychology do to alter genes?!
PTC: Is “early intervention” only concerned with reducing future *environmental* risk factors?

Nature versus nurture
What do we **not** mean?

- We do **not** mean **either/or**
  - Phenotype = G + E
  - The “versus” debate is over

- We do **not** mean that genetic and environmental factors are **equally** important for all traits

- High heritability does **not** mean that psychological study is worthless

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