

1. NATURE VS. NURTURE

Lecture Outline

- Cover the basics
- Terminology and measurements
- Myth-busting

Nature vs. Nurture: What do we really mean?

Nature:

- “Innate” qualities
- In a psychological sense, we are talking about genetics
- “Nativism”
- *Rationalism*

- *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 capacity 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) I.e. a stimulus isn't good enough to provide the required knowledge*
 - *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.*

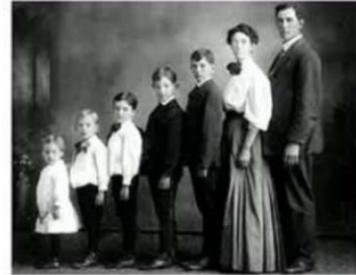
Nurture:

- *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 (1930)

The debate gets complicated...
Why? Innate qualities sound inflexible

Heritability:

- *How much of the variation of a trait (phenotype) in a population is due to genetic differences in that population (as opposed to variation in environments)*
 - *Phenotype (P) (variability) = genetic effects (G) (variability) + environmental effects (E) (variability)*
- "Heritable" is not the same as "inherited"
- E.g. "Height" in one family
 - $P(4) = G(2) + E(2)$
 - *Heritability may increase if the genetic variation increases (marriage, babies, out-breeding) i.e. now $G > 2$*
 - *Heritability may increase if the environmental variation decreases (poor diet) i.e. $E > 2$*



Nature vs. 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 L14

Nature: Genetics

- *Single nucleotide polymorphisms (SNP)*
- *AA, Aa, aa*
- *Certain combinations are more common (AA) in a population and certain combinations are more rare (aa)*
- Geneticists look at combinations for their 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.*
 - *Note: 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)*

Nurture: Environment

- *Physical environment (no garden versus garden)*
- *Internal environment (diet)*
- *Social environment (communal living) e.g. prosocial, antisocial*

- *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 (some argue)*
 - *Con: subjective (some argue), may not correlate, biases*

Nature vs. Nurture: Myths and misconceptions

1. Genes dictate

- *Eye colour – ok*
 - *Intelligence - ?!*
- *Implications for social mobility, “designer” babies, predestination?*
 - *Do genes dictate what is possible?*
 - *E.g. height – diet*
 - *“Limiting factor” – a factor that limits/does not allow someone to reach their potential i.e. the genotype is not able to reach the phenotype e.g. starving children will not grow to be tall despite having the genotype*
 - *E.g. if a population is not starved it will be able to reach its potential that their genotype for height allows for, but if it is starved the population will not grow tall*

Mini Myth: Biological differences must be due to genetic factors

- *Environment can influence biology, biology can influence environment.*
- *Do genes dictate anything at all?*
 - *Mutations – ok*
 - *Complex traits – no, because interactions occur as soon as the zygote is born (e.g. nutrition, & the state of the womb)*

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

Example: 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 e.g. a murderer who was found to have low activity of the MAOA gene got his sentence reduced*

3. All traits are heritable so heritability is irrelevant

- *A problem of communication?*
 - Often *psychology journals* are written in such a way that others do not understand
 - *Genetic studies are seen as too far removed from the application of psychology*



Navel gazing – broader utility of genetics



Too far removed from the application of psychology

- *A problem of understanding?*
 - *Variability in heritability (10% versus 80%)*
 - *The gene matters: e.g. when we know a gene polymorphism codes for differences in neurotransmitter systems*
 - *Heritability estimates associated with treatment resistance*
 - (E.g. conduct disorder with callous-unemotional traits – high and low CU respond to treatment differently)

Low CU
Heritability
estimate for
conduct problems
= 30%



High CU
Heritability
estimate for
conduct problems
= 81%

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

Fair point in some circumstances...

- 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: it is possible to determine what phenotypes manifest from genotypes...
- So, we need to be hypothesis-driven – molecular genetics
 - Gene function
 - Targeted systems
 - Previous research
 - Shared data and free access
 - Replication across samples

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

- E.g. “Fat” genes
 - Commonly misinterpreted: there are genes that have been identified that make it harder to lose weight and more likely to put on weight, but they are not causal (many thin people have these genes)
 - Locus of control: many say “I have the fat genes” so there is nothing I can do about it – this is a lack of understanding about what genetic data means
 - Self-fulfilling prophecy
- Hope for improvement
 - E.g. boy with ADHD: told his brain functioned differently so he therefore thought he was stuck always behaving as he was at 12, without the understanding of neuroplasticity
- Solution?
 - Education (including for psychologists)
 - Communication: clear explanations about what genetic/psychological effects are

Points to consider:

- What can psychology do to alter genes?!
- Is “early intervention” (e.g. ages 2-4) only concerned with reducing future environmental risk factors?

Nature vs. 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

2. THE DEVELOPMENTAL PSYCHOLOGY OF JEAN PIAGET I

Cognitive development: the next 6 weeks

- We begin by considering *classic theories of cognitive development*, primarily focusing on Jean Piaget, and then contrasting his theory with that of Lev Vygotsky and Noam Chomsky (a linguist). - 3 Lectures
- Then we will *discuss contemporary theories of conceptual development*, some of it very much built on top of or in direct opposition to Piaget's work. - 6 Lectures
- Return to *Language development* (and Chomsky). - 3 lectures

What's the big question? For Piaget, and for cognitive development as a whole?

- Where does knowledge come from?
- How is it that we know anything?
- How does knowledge change with development?
- How do we use knowledge to understand and reason about our world?
- How does how we use knowledge change with development?

Where does knowledge come from?

- For Piaget, this means *structured, symbolic knowledge*. His concept of adult thought is *logico-mathematical operations, operating over structured symbolic representations*. I.e. there are discrete units in our minds that are structured e.g. the word cat, and mathematical operations happening, such that concepts are manipulated
 - Cat = structured, symbolic knowledge → logico-mathematical operations on top of this 'knowledge' to manipulate idea of cat
- Piaget's question was: *how do we get to the state of having logico-mathematical operations?*
- He rejected innate knowledge. How does the child go from no knowledge at birth, to structured symbolic representations?

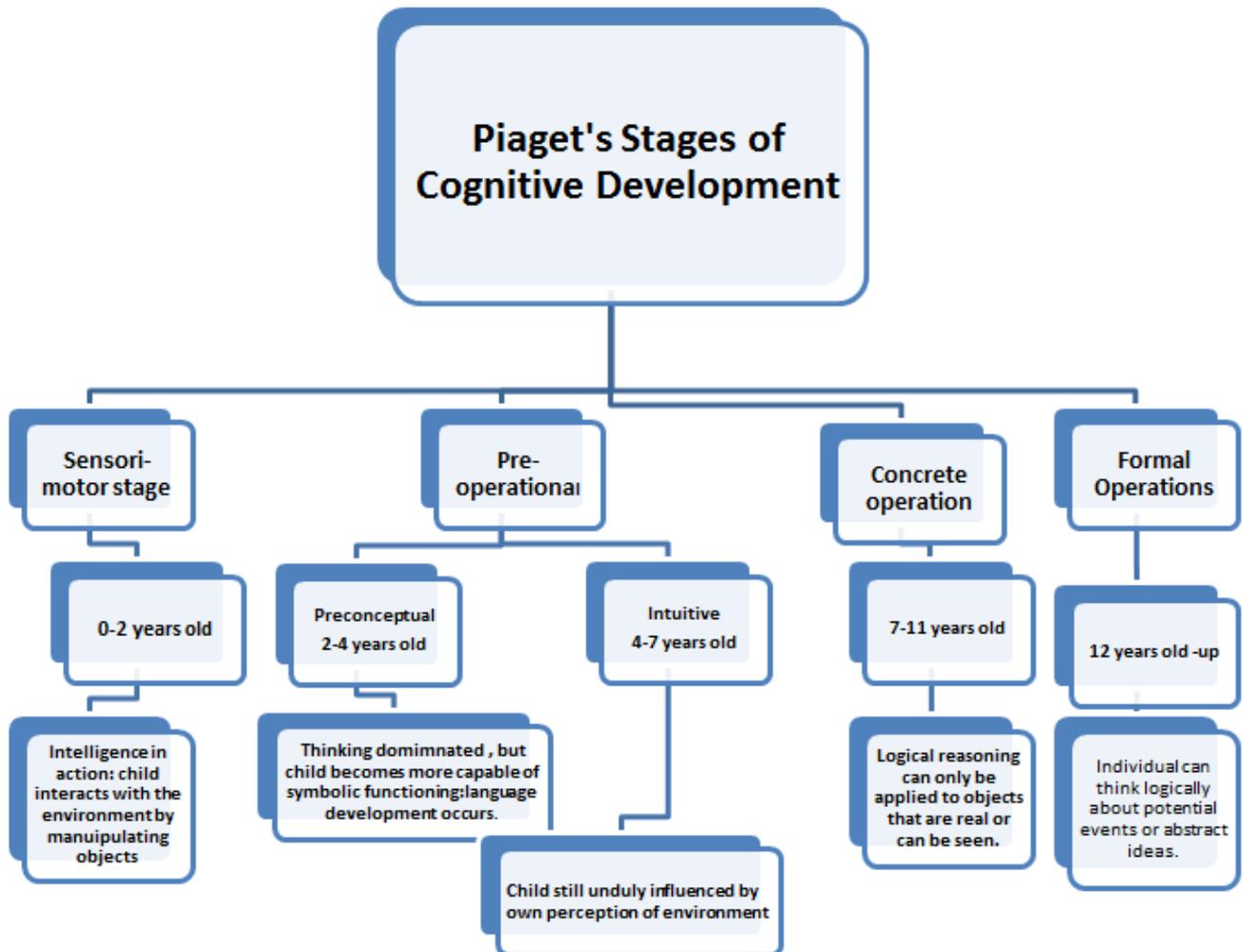
What should we hope to achieve in the next three lectures?

- These lectures are NOT designed to give you a full overview of Piagetian theory, and the empirical work that has followed
- What I would like you to take away from these lectures is:
 - An appreciation of the *things driving important theories*
 - As well as a sense for the *kinds of assumptions that the major theories have had to make or grapple with ...* and will continue to have to make and grapple with!

Jean Piaget (1896 – 1980)

- You have already been acquainted with the basic shape of Piaget's theory in 1st year

Piaget's Stages of Cognitive Development



- The thinking of the child is *fundamentally different at each of these stages* – there is not a ‘continuous getting better’, but instead, *categorical, qualitative changes/transformations in the child’s thoughts* → “stage independent processes”
- The ages are not necessarily exact
- Increase from *thinking as reflexes* towards *thinking with abstract reasoning/goals in mind*
- 5 salient characteristics of the stage theory (Miller text):

1. A stage is a structured whole in a state of equilibrium:

- The essence of Piaget’s stage approach is that *movement through the stages involves structural changes that are qualitative* (changes in type or kind) *rather than quantitative* (change in degree, amount, speed, or efficiency)
 - E.g. *there is a qualitative change when the child moves from structures based on actions in infancy to structures based on mental representation in the preschool years.*

- *At the end of each major period of development, the cognitive structures are in a state of balance, or equilibrium.*

2. Each stage derives from the previous stage, incorporates and transforms that stage, and prepares for the next stage:

- *The previous stage paves the way for the new stage and in the process of achieving this new stage, the previous stage is reworked.*
- *Thus, once children achieve a new stage, they no longer have the previous stage available.*
- *E.g. elementary school children can still roll or hit a ball (a skill acquired during infancy), but they now embed this skill in a number of other skills. Furthermore, a more advanced level of thought controls the old skills of rolling and hitting.*
- *One implication of this characteristic is that regression to an earlier stage should be impossible because the previous stage is no longer present*

3. The stages follow an invariant sequence:

- *Since each stage is derived from the preceding stage, the stages must proceed in a particular order.*

4. Stages are universal:

- *Of course, people with a low IQ may not progress through all the stages or may progress through them more slowly, and people generally vary on how fast they proceed through the stages. However, the crucial claim is that the same stages in the same order are found universally in children in all parts of the world.*

5. Each stage includes a coming-into-being and a being:

- *There is an initial period of preparation and a final period of achievement in each stage.*
- *Unstable, loosely organised structures mark the initial period of transition from the previous stage.*
- *Change both within a stage and between stages is somewhat gradual.*

