

# Intelligence

Intro Psychology  
Georgia Tech  
Instructor: Dr. Bruce Walker

# Today

- Intelligence
- Testing

## Recall: Cognitive Development

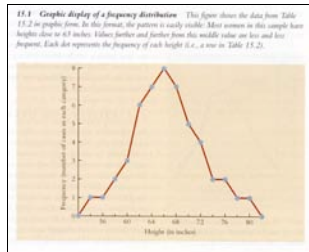
- Children are like amateur scientists
- Equipped with a surprising amount of basic heuristics and general learning mechanisms (statistical learning)
- Much of development is getting the right stuff at the right time.

## Intelligence

- Long history
- Many fundamental misconceptions
- Central topic in understanding what makes people different from one another.

## Intelligence and its measurement

- Variation as an essential component of evolution
- Adolphe Quetelet, scientist for the Belgian Army Quartermaster corps, first plotted frequency distribution.
- Statistical procedures were developed to help think about variation.



## Statistical Characteristics of Tests

- **Reliability**
  - How consistent is a test?
  - basically a correlation of the test with itself test-retest, alternate forms, split-half

## Statistical Characteristics of Tests

- **Validity**
  - Does the test measure what it is supposed to measure – perhaps biggest problem with psychological tests.
  - **Predictive validity** - does a test predict future performance?
  - **Construct validity** - does a test predict other measures that we think have to do with the hypothetical construct we think we are measuring?

## Standardization of Tests

- If test is administered to a large sample that we know something about (i.e., normal 7 years olds, psychotic patients, etc.) we say it is **standardized**
- **Norms** – the frequency distribution of scores from the standardization sample

## Mental Tests and Intelligence

- Sir Francis Galton (1822-1911) pursued the idea that human mental characteristics were hereditary (called himself a **Eugenicist**)
- Developed statistical techniques to see whether blood relatives shared similar characteristics.
- Most important of which was an early form of the **Correlation Coefficient**  $r = -1.0$  to  $+1.0$

## Intelligence

- **Achievement vs Aptitude**
- Tests were developed before people defined what it was they were measuring. We still don't agree on what intelligence is.

Video clip

## Intelligence Tests

- **Alfred Binet** (1857-1911)
  - when France first began public schooling as a result of the industrial revolution, he was asked by minister of education to devise a test to identify children that needed special schooling (educable mentally retarded)
  - Binet proposed idea of **Mental Age**
    - a child that could answer questions that a normal 9 year old could answer was assumed to have mental age of 9 year old
  - (compare to visual acuity, e.g., 20/20)



## Intelligence Quotient (IQ)

- idea of intelligence quotient was proposed by William Stern, a German psychologist
- **$IQ = \text{Mental Age} / \text{Chronological Age} \times 100$**
- **Thus, 'average intelligence' will always be 100**

## Stanford-Binet

- The Binet-Simon test was brought to America, **standardized** on American sample and published in 1916 by a Stanford psychologist named Louis Terman – Stanford-Binet.
- This test is still viable and used today – just re-standardized in 1989

## David Wechsler – Wechsler Adult Intelligence Scale - WAIS

- Argued that Binet's test was too verbal
- Proposed two components **Verbal and Performance Subscales**
- Performance is largely spatial information
- Deviation IQ – standardized his test to have mean of 100 and SD of 15, thus by knowing a score, you know what percentile on normal population the score would match

## General Intelligence – g

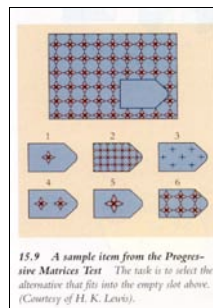
- All subscales of IQ test correlate with one another, this suggests a common underlying factor or general intelligence
- **Charles Spearman** (1863-1945) **Factor Analysis – g**

## Fluid & Crystallized Intelligence

- Raymond Cattell and John Horn proposed that **Fluid intelligence - gF** – represents ability to acquire new information or to grasp new relationships. Some think the mechanism for gF is **working memory capacity** - Engle et al 1999.
- **Crystallized intelligence – gC** – what you have learned from the culture – your knowledge. gC is clearly dependent, to some extent, on gF

## Fluid & Crystallized Intelligence

- Tests of Crystallized intelligence are largely for verbal knowledge
- Tests of Fluid intelligence are largely non-verbal and spatial skills
- gF tends to decline with age
- gC does not



## Information-processing Approach

- Cognitive correlates – take established elementary cognitive processes or structures and see how these correlate with intelligence test performance – **Working Memory and gF**

## Is Intelligence Inherited or a Product of the Environment?

- Today's battle in the Nature – Nurture War
  - Predicated on a fundamental misunderstanding of the relationship between genetic endowment, environmental influences, and their relative separability.
- Galton found that mental characteristics of relatives tended to correlate – closer relatives correlated more closely – highest correlation is for identical twins.

## Is Intelligence Inherited or a Product of the Environment?

- Issue is clouded by racial issues and those with racial agendas.
- “Bell Curve” - Here's the basic argument (thumbnail really)
  - Racial differences are consistently found on many different standard measures of intelligence
  - Intelligence has a significant heritable component
  - Intelligence correlates with success later in life
  - THUS - Racial differences in IQ scores reflect inherent racial differences in intellectual abilities AND explain why racial groups are not randomly distributed throughout the income spectrum.

## Is Intelligence Inherited or a Product of the Environment?

- Problems with “Bell Curve” reasoning
  - Heritability is used as an immutable inaccurately deterministic factor.
    - Note also the “heritability” does not imply “immutable” or unchangeable
    - Example - Height is heritable about .9 (about 80% of variance in height is traceable to genetic endowment). Height in Japan has increased considerably across three generations.
    - Children raised in impoverish orphanage (in Iran) achieved IQ scores of about 50 (extremely retarded) whereas children adopted before age 2 showed normal intelligence (100).

## Developmental/Environmental influences

- William Greenough
  - rats raised in “rich” or “impoverished” environment
  - rats in rich environment developed thicker cerebral cortex, denser dendritic branching
  - learning rates were accelerated relative to “impoverished” rats.

## Upcoming

- Social Development
- Exam 2
- Social Cognition