What is “Intelligence?”

• One general mental ability vs. multiple abilities?

Intelligence Testing
• History of Intelligence Testing
• Types of Tests
• Standardization and Norms
• Reliability and Validity
• Bias in Testing

Genetic and Environmental Influences on Intelligence
What is “Intelligence?”

What is your prototype for someone who is “intelligent?”
• Is it this woman?
• Or this guy?
Share what you think “intelligence” means
• Are these definitions vague, limited, and arbitrary. If so, why?
• Imagine how all these abilities might be tested by one of several tests
What is “Intelligence?” continued

Which of the following would be a good measure of “intelligence?” Why or why not?

- A standardized IQ test
- A person’s GPA
- Giving someone $100 to invest and see how much she/he has after a year
- Leaving the person out in the wilderness for three days with only an axe and a box of matches
- Giving an extensive exam of general knowledge
- A person’s grade in Psych?
- Math?
- Advanced acting?
- Art?
- How much is your evaluation of these measures shaped by your many years of exposure to schooling?
Do you know anyone who you think is very bright but doesn’t have good grades? Scored relatively low on the SAT? How do you know the person is bright in the first place? What is your criteria? Based on all of this, try and come up with a better way to measure intelligence.

It's hard, isn’t it? Defining “intelligence” is one of the most contentious topics in psychology today.
In many research studies, intelligence has been operationally defined whatever intelligence tests measure, which tended to be “school smarts”

- However, intelligence not constant across cultures, like height/weight
- People assign term intelligence to qualities that enable success in their own time/culture
  - In Amazon rainforest, intelligence may be understanding medicinal properties of local plants
  - In North America, it has historically meant mastering difficult academic concepts
One definition of *intelligence* is “the ability to learn from experience, solve problems, and use knowledge to adapt to new experiences” (Robert J. Gregory)

Coon defines *intelligence* as “the global capacity to act purposefully, to think rationally, and to deal effectively with the environment”

Barron’s defines *intelligence* as “the ability to gather and use information in productive ways”

Do you like any of those? Why or why not?
Another hot topic regarding intelligence is whether it can be represented as one general mental ability or multiple abilities. Early intelligence theory focused on intelligence as one general mental ability. Charles Spearman called it *general intelligence* (often shorted to “g”).

- Found that those who score high in one area, such as verbal intelligence, typically also score high in other areas, like spatial or reasoning ability.
- Postulated therefore a common skill set – “g” – underlies all intelligent behavior.
Subsequent research has replicated Spearman’s findings to a degree -- there ARE correlations between certain abilities

- There is a general intelligence factor
- It predicts performance on various complex tasks and in various jobs
  - “G is one of the most reliable and valid measures in the behavioral domain… and it predicts important social outcomes such as educational and occupational levels far better than any other trait.” (Behavior Geneticist Robert Ploman, 1999)

So why is there controversy?
Multiple Abilities?

Dr. Howard Gardner, psychologist/professor of neuroscience from Harvard University, developed *Theory of Multiple Intelligences* (MI) in 1983

- Argued against the established understanding of intelligence that people are born with uniform cognitive capacity (g) that can be easily measured by short-answer tests
  - Why were some people good at some things while others were good at others
- According Gardner, human beings have nine different kinds of intelligence that reflect different ways of interacting with the world
  - Each person has unique combination, or profile
  - Says that even though we each have all nine intelligences, no two individuals have them in the same exact configuration – similar to fingerprints
Multiple Abilities? continued

The Multiple Intelligences (MI) Chart

**Verbal/linguistic intelligence**
- using language to present your ideas, to express your feelings or to persuade others

**Logical/mathematical intelligence**
- reasoning, logical thinking; handling mathematical problems

**Musical/rhythmic intelligence**
- creating and feeling a rhythm to express a mood; detecting and analysing musical themes

**Intrapersonal intelligence**
- understanding your own interior thoughts and feelings in a very clear way

**Interpersonal intelligence**
- understanding the feelings, needs and purposes of others

**Visual/spatial intelligence**
- creating and interpreting visual images; thinking in three dimensions

**Bodily/kinesthetic intelligence**
- feeling and expressing things physically; doing hands-on work

**Naturalist intelligence**
- understanding nature, seeing patterns in the way nature works; classifying things
Multiple Abilities? continued

Gardner supports his theory based on the following. Do you think they are compelling reasons to support it?

• Savants, prodigies, and other exceptional individuals exist
• MI is supported by our evolutionary history and makes sense from an adaptive perspective
• Indications are that separate neural centers underlie various intelligences
  • Case studies of people with brain damage have isolated where specific intelligences lie within the brain
    • People with damaged speech centers still are successful musicians, visual artists, and engineers
    • People having difficulty with spatial tasks due to right-hemisphere damage who still can still speak well
    • People with lobotomies who retained logical-mathematical intelligence
Gardner “Reevaluating Intelligence” video and questions

- http://bigthink.com/videos/reevaluating-intelligence
For Gardner, intelligence is:

- the ability to create an effective product or offer a service that is valued in a culture;
- a set of skills that make it possible for a person to solve problems in life;
- the potential for finding or creating solutions for problems, which involves gathering new knowledge.
Gardner’s detractors point out that his theory is largely based on case study research

- What are the pros and cons of case study research?
  - Pros: Can be valid and informative
  - One major con: Not an experiment and therefore not generalizable to the population at large

Given Gardner has yet to produce a valid AND reliable test to prove his theory, some have criticized his theory as bordering more on philosophy than science

What is your take on this? How would you go about trying to prove Gardner’s theory? Would you bother?
Some have taken Gardner’s theory and have refined and/or expanded on it

- Robert Sternberg’s “Triarchic Theory of Intelligences” reading/questions
- Daniel Goleman’s “Emotional Intelligence” video/questions
Within the past 10 years Satoshi Kanazawa argued that general intelligence evolved as related abilities that helps people solve “novel” problems

• How to stop a fire from spreading, how to find food in a drought, how to build a rocket that can take a man to the moon, etc.

However, these abilities do not correlate with individual skill in “evolutionary familiar” situations

• Marrying/parenting, forming close friendships, athletic ability

Maybe “g” and MI can coexist?
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Genetic and Environmental Influences on Intelligence
History of Intelligence Testing

**Alfred Binet** (1904)
- In 1904, French minister of education asked him to find out a way to distinguish “slower” students from “capable” (or “capable but lazy”)
- Series of questions easy to hard, then learned which questions an average child could do at every age and compare

**Stanford-Binet Intelligence Test** (1934)
- **Lewis Terman** and others at Stanford took Binet’s ideas and revised them for North America
- After some revisions, the Stanford-Binet Intelligence Test, Fifth Edition (*SB5*) continues to be widely used
  - Measures fluid reasoning, knowledge, quantitative reasoning, spatial processing, working memory
Intelligence Quotient (IQ)

- Statistic that yields a score that reflects a person’s *mental age* (average intellectual performance) compared to his/her *chronological age* (actual age in years when taking test)
- Typically graphed on a bell curve – this should look familiar
  - (Mental Age/Chronological Age) x 100 = IQ
  - One SD away from the mean is 115, two SDs is 130, three SDs is 145
    - Works the other way too
The Wechsler Tests (WAIS-III and WISC-IV)

- Widely used alternative to SB5 (which early on worked better with children)
- WAIS-III specifically designed to test adult intelligence
- WISC-IV is a version of the Wechsler test for children
- Both give separate scores for non-verbal and verbal intelligence
Types of Tests

Provide examples of each one of these…

**Aptitude Tests**
- Measure ability or potential

**Achievement Tests**
- Measure what one has learned or accomplished

**Speed Tests**
- Measure how fast one can solve problems

**Power Tests**
- Gauges the difficulty level of problems one can solve

**Group Tests**
- Administered to a large number of people at a time; involve little/no interaction with the examiner

**Individual Tests**
- Involve greater interaction with examiner
Standardization and Norms

**Standardized Tests**
- Tests that have items that have already been tested on a similar population

**Norms**
- The average proportion of the population that get a given question correct

How are these terms related?
Reliability and Validity

As we discussed earlier this year, a research study needs to yield reliable and valid results

• The same is true for intelligence tests

Reliability

• Refers to the consistency of the test
  • No matter how often you take a test (or one like it), you get a very similar score
  • Reliability can be measured in different ways
    • *Split-half reliability* – split the test questions in half at random and the scores on the two halves should be close to the same
    • *Equivalent-form reliability* – equal, but different forms yield very similar score
    • *Test-retest reliability* – Very similar scores if given the same test twice
Validity
• Refers to the accuracy of the test
  • It measures what it is supposed to measure
  • Note, then, an unreliable test is cannot be valid
    • The opposite is not true – a test can still be reliable (consistent) but still not valid if not designed correctly
• There are also different kinds of validity
  • *Content validity* – how well a measure reflects the entire range of material it is supposed to be testing
    • *Face validity* – superficial measure of content validity; measures a key component
  • *Criterion-related validity* – test measures current (concurrent validity) or future ability (predictive validity)
  • *Construct validity* – comparison of test score is highly correlated with existing and accurate metric
Bias in Testing

Take the “Miller Analogies Test”
• This is standard test that is widely used
After we go over the answers, tell me if you think this test is “biased” or not

Take the “Dove Intelligence Test” next
• Is that a “fair” test?
• Why did I give it to you?

Culture-fair test
• A test written in such a way that it is valid across cultures
• Many argue widely used IQ tests or the SAT are not culture-fair. What do you think? Should it matter?
Testing & Individual Differences
Unit Outline

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Genetic and Environmental Influences on Intelligence
You all are in AP Psychology. Therefore, let’s assume that you all are pretty bright (for the time being :) ).

Do your mental capabilities come more from your genetic make-up (i.e. your parents) or more from the environment (the opportunities you have had to learn at home/outside the home)?

The nature vs. nurture debate has been front and center during the study of intelligence

- Research shows that both play a role
We talked about *heritability* before. What does that mean again?

- The measure of how much a trait’s variation is explained by genetic factors (0 = environment totally responsible, 1 = genetics totally responsible)
- Estimates are that the heritability of intelligence – to the extent which intelligence test score variation can be attributed to genetic variation – ranges from .5 to .8
- Quick case study: Most, if not all of you, know at least one set of identical twins. How similar are their cognitive abilities? Can you really isolate why?
Monozygotic twins score much more similarly on intelligence tests than do fraternal twins. Furthermore, research on identical twins separated at birth has found strong correlations in intelligence scores.

- Often twins are placed in households with similar SES – that may throw the validity of this finding off a bit.

Other research has found the following. Do these findings support the influence of genetics, environment, or both on intelligence?

- Performance on intelligence tests has been increasing steadily throughout the century – this is known as the *Flynn effect*.
- Participation in government programs such as Head Start have been shown to lead to higher scores on intelligent tests.
- There are racial differences in IQ scores.
The fact that there are racial differences in IQ scores is, of course, very controversial.

- Some argue this is evidence that intelligence is largely genetically determined.
- Others disagree, arguing that these racial differences are more likely explained by differences in environments, particularly socioeconomic factors.
  - They also argue that test bias plays a role.
One of the most controversial books on the subject is “The Bell Curve” by Richard Herrnstein and Charles Murray (1994)

• Their conclusions were based off of a very large longitudinal study
• Most controversial was the authors’ discussions of racial differences in intelligence…
  • They argued that these IQ differences are genetic
• …and their take on the impact of those differences on American society and the government’s efforts to improve it. They recommended:
  • The elimination of welfare policies that encourage poor women to have babies
  • Reducing immigration into the U.S. which was argued to lower the average national IQ
  • Against policies of affirmative action
In Closing…

How is human “intelligence” defined?

What is “g?”

Describe the multiple intelligence theories put forth over the past few decades

How much do “intelligences” vary from person to person?

How heritable are “intelligences?”