

Unit 11: Testing and Individual Differences

I. Introductions

- A. The question of whether each person has inborn mental abilities – whether you're born with a maximum intelligence/minimum stupid level – is a touchy subject.
- B. Trying to measure "intelligence" is a tough subject. It beckons questions...
 - 1. What exactly is intelligence?
 - 2. How can you measure it? Or can you?
 - 3. Does putting an "IQ" number on "intelligence" mark the person for success as a "genius" and thus boost confidence or label them as a lifelong "doofus" and squelch their self-confidence and ambition.
- C. "Intelligence" is a concept, not a trait like height or weight. Thus, it's wrong to think we can measure intelligence as we do with height or weight.
 - 1. Different cultures define intelligence in different ways.
 - a. Western cultures, like the U.S., put a high value on factual knowledge, vocabulary, and math skills.
 - b. Other cultures, like traditional Native American cultures, may say an unschooled, but wise old shaman is intelligent. Though viewed as intelligent, this person might do very poorly on a standard intelligence test that measures vocab and math.
 - 2. An "IQ" test, or **intelligence quotient** test yields a number with 100 being average. But, it's wrong to say, "My IQ is 105." It's correct to say, "I scored 105 on an IQ test."
- D. A working definition of **intelligence** could be: the ability to learn from experience, solve problems, and adapt to new situations.

II. Is intelligence one general ability or several specific abilities?

- A. Sometimes people are extremely good at one thing, like math or art. In that field, they might be brilliant, but in other areas, might be very low-performing.
 - 1. Charles Spearman felt people have a single **general intelligence** that's usually shown simply as ***g***.
 - a. He helped develop **factor analysis** which is a statistical procedure that identifies clusters of related items. In this case, it tries to measure *g*. For instance, people that do well on verbal tests tend to also do better than average on spatial reasoning tests.
 - 2. L. L. Thurstone disagreed with Spearman. Thurstone identified 7 clusters of mental abilities: (1) word fluency, (2) verbal comprehension, (3) spatial ability, (4) perceptual speed, (5) numerical ability, (6) inductive reasoning, and (7) memory.
 - a. He did not give a single intelligence score.
 - b. But, the fact remained – when a person scored high on one of the clusters, they tended to score well on the others. Thus, there appeared to be a bit more evidence to some level of a *g* score.
 - c. Intelligence might be like athletics. There are many skills in athletics. An athlete may excel at one or two only. But, if an athlete excels at one, he or she likely would do better-than-average on others simply because he or she is naturally a good athlete.
 - 3. Satoshi Kanazawa takes an evolutionary approach saying people developed intelligence as a means of solving unique problems.
- B. Howard Gardner sees intelligence not as a single thing, but in multiplicity.
 - 1. He studies people of low or exceptional abilities. People with **savant syndrome** often score low on intelligence tests, yet they can excel beyond imagination in other areas.

- a. Some savants are like human calculators, some can tell the day of week for any day/year, some can draw amazing works of art or compose terrific pieces of music.
 - b. Most famous was Kim Peek on whom *Rain Man* was based.
 - c. These folks are sometimes referred by the term "idiot savant" – it's not a very nice term, but captures low-performing and high-performing aspects.
2. Gardner's 8 intelligences...
- a. Linguistic
 - b. Logical-mathematical
 - c. Musical
 - d. Spatial
 - e. Bodily-kinesthetic
 - f. Intrapersonal (self)
 - g. Interpersonal (others)
 - h. Naturalist
3. Evidence does point that scoring well on an intelligence test that predicts graduate school success (the GRE) also suggests that person will later be successful in their careers.
- a. This passes the "common sense test" – if you do well on the SAT or GRE, you get into the good schools, then you get the good jobs.
 - b. But, once you get there, excellence seems based more on good old-fashioned hard work. The "10 year rule" says to do well at anything requires 10 years of "intense, daily practice."
4. Robert Sternberg says there are 3 intelligences...
- a. Analytical intelligence (academic problem-solving)
 - i. These tests set up a specific problem with a single answer.
 - ii. These tests predict school success well and vocational success fairly well.
 - b. Creative intelligence
 - i. These tests measure how a person responds to a novel situation and how they create fresh ideas.
 - c. Practical intelligence
 - i. These skills are used for everyday life, so the skills-set is rather wide open. The skills could include writing, speaking, interacting, motivating, etc.
 - d. The College Board (who runs the SAT and AP program) worked with Sternberg to make new types of tests.
 - i. He came up with creativity tests like filling in a caption to a cartoon.
 - ii. The tests seemed to help predict college success or failure. They also seemed less ethnically biased.

III. Emotional intelligence

- A. There's academic intelligence, but there's also social intelligence. It's like the bookworm-nerd who aces all tests at school, but who can't interact with his peers. It's book-smarts vs. street-smarts.
- B. People that do well in rational thinking, and are often bosses and in leader positions, often don't do well socially.
- C. This idea of **emotional intelligence** is suggested as being made up of 4 abilities...
 - 1. Perceive emotions – A person can pick up emotions from others.
 - 2. Understand emotions – A person can predict emotions and gets their impact.
 - 3. Manage emotions – A person can show emotions appropriately.
 - 4. Use emotions – A person can adapt emotions and use them creatively.

- D. People with a high emotional intelligence, and the 4 skills above, are sound themselves and get along with others well.
- E. Sometimes, brain damage can change emotions. A man named Elliot had a brain tumor removed and was left without the ability to feel emotions. As a result, his personal and professional life suffered.

IV. Is intelligence neurologically measurable?

- A. Brain size seems to matter. Poet Lord Byron had a 5 pound brain (rather than an average 3 pound brain). And Beethoven's had many more and deeper convolutions.
 - 1. Brain size and intelligence correlate at +0.33. This is a slightly positive correlation, meaning, to a small degree, larger brains mean smarter people.
 - 2. Einstein's brain was rather normal in size, except that it was large in the lower parietal lobe which handles math and spatial info.
 - 3. Since there is a slight positive correlation between brain size and intelligence, what question then becomes, "Why?" (genetics, nutrition, stimulation, etc.).
- B. People with high education levels have more brain synapses. As to why, it could be they grew more through education or that they had more and sought more education. We don't know.
- C. People with more **gray matter** (neural cell bodies) tend to have higher intelligence.
- D. The frontal lobe seems to be where we do our processing of info – on the left side verbally, on both sides for spatial issues.
- E. The speed with which a person processes info also hints at intelligence. Speed and a score on an intelligence test correlate at about +0.30 to +0.50.
 - 1. This correlation may not be due so much to speed, as to the fact that fast-processers may be able to take in more info.

V. The origins of intelligence testing

- A. Plato saw that people have abilities unique to themselves.
- B. **Francis Galton**, at the end of the 19th century tried to measure intelligence.
 - 1. Somewhat oddly, he measured physical traits and compared them to intelligence – not surprisingly, they didn't correlate.
 - 2. His legacy was to give some measuring techniques, the term "nature and nurture", and the attempt to objectively measure intelligence.
- C. **Alfred Binet** is the father of modern intelligence testing. Around 1900, he was charged with coming up with a way to identify students who might need special teaching.
 - 1. Binet started by assuming that people develop in a step-by-step manner. If one student is slow, he or she is just at a younger stage of development. Thus, he was interested in the student's **mental age** as well as his or her **chronological age**.
 - 2. Binet felt that intelligence manifests itself in a variety of ways.
 - 3. He developed a test to predict how well a student would do in school. This is the forerunner of today's SAT and ACT which predict how a student will do in college.
 - a. Binet did not think his test measured intelligence (g). His goal was to simply identify students with special needs in school. He felt all students could learn.
 - b. Binet also worried about labeling a student as a "special needs" student and thus lowering the expectations for that student.
- D. Stanford professor **Lewis Terman** believed we could place a number on intelligence. He decided Binet's Paris-made questions were not good in California, so he made changes...
 - 1. He altered the questions, changed the age norms, upped the range from teens into "superior adults."

2. This test was and still is called the **Stanford-Binet**.
3. The term **IQ**, short for intelligence quotient emerged. This term gives us a number, supposedly showing intelligence. The formula is: $IQ = (\text{mental age divided by chronological age}) \times 100$
 - a. So, if a child is 12 years old and has the mental age of a 12 year old, 12 divided by 12 is 1.0, times 100 gives an IQ of 100. 100 is by definition an average IQ.
 - b. If that child is 12 but has a mental age of a 13 year old, 13 divided by 12 is 1.08, times 100 gives an IQ of 108.
4. IQ tests can be used as a weapon.
 - a. In the 19th century, "eugenics" was popular. It's the idea that only smart and strong people should be encouraged (allowed) to reproduce. The idea was to stamp out the poorer human traits and continue the strong ones.
 - b. In the 1920s, immigrants were given IQ tests. They often did poorer than Anglos (people of German/English descent). This helped fuel discrimination and laws to limit non-Anglo immigrants.
 - i. The fact that non-Anglos didn't do as well likely had less to do with intelligence and more to do with education level, the culture in which the questions were written, and test-taking skills themselves.

VI. Modern tests of mental abilities

A. There are two basic types of tests...

1. **Achievement tests** measure how much you've learned thus far. Usually, a person must pass an achievement test to graduate from high school. This is to make sure he or she has "learned enough" to be a high school grad.
2. **Aptitude tests** predict how you'll do in the future. The SAT and ACT are examples of an aptitude test – they predict how a person will likely do his or her first year in college.
 - a. The SAT used to be called the Scholastic Aptitude Test. It correlates with IQ at a very high rate of +0.82.

B. Psychologist **David Wechsler** made today's most common intelligence test.

There are two versions...

1. The **WAIS** for adults (Wechsler Adult Intelligence Scale).
2. The **WISC** for children (Wechsler Intelligence Scale for Children).
3. The Wechsler test has two main categories, verbal and performance, and is broken into 11 subtests.
 - a. It gives an overall intelligence score, like the Stanford-Binet.
 - b. It also gives separate scores for verbal comprehension, perceptual organization, working memory, and processing speed.
 - c. These sub-scores can help identify strengths and problem areas.

VII. Principles of test construction

A. Like a 3-legged stool, there are 3 pillars that hold up good test construction – standardization, reliability, and validity.

B. **Standardization** means that every student takes the same test under the same circumstances. If this is achieved, we can compare one person's results to everyone else's. This is what takes place in a **norm-referenced test**. (see graph at bottom of page)

1. Usually, the group's results end up in a bell-shaped curve called a **normal curve** or a **bell curve**. The bell curve is amazingly uniform both in shape and in its natural occurrence – we don't know why, but it just happens.
2. Look at the graph of IQ scores at the bottom of this page. We see the median IQ is 100 (also the 50th percentile is 100). The break-point scores are the standard deviations. So, at -1 standard deviation a person scored at 85. Notice the percentages. 68.2% of people score within 1

standard deviation (between 85 and 115). And almost 96% score within 2 standard deviations (between 70 and 130). These percentages are amazingly stable in nature.

3. The norms must be re-calculated every so often. Compared to the 1930s, people score much higher today. In the 30s, the average would only be 76 using today's scale.
 - a. The higher IQ scores today are called the "**Flynn Effect.**"
 - b. As to why the higher IQs today, we simply don't know.

C. **Reliability** means a test gives the same or very similar results every time. It's like a bathroom scale, one that is always within a pound or two is reliable. If it varies by 30 pounds, that's not reliable.

1. There are several ways to test reliability. In essence, the test is compared to itself then its scores are correlated. If it correlates highly, it's reliable.

D. **Validity** means that a test measures what it's supposed to measure. For instance, using a bathroom scale to measure height would not give a valid measurement. It may be reliable (it may give the same result every time), but it's not valid.

1. **Predictive validity** is the idea that aptitude tests can accurately predict future performance. Largely, the evidence shows that they do.
2. Still, aptitude tests are more reliable than they are valid. That is to say that given a base score, the correlation of getting the same score is higher than the correlation of future achievement.
 - a. Predictive validity starts strong in the early grade school years, then fades.

VIII. Stability or change?

- A. The question is, "Is our intelligence the same all our life?"
- B. It's not possible right now to measure a baby's intelligence. Any "test" or observation hasn't correlated with later high IQ.
- C. By age 4, a child's intelligence test scores begin to predict later intelligence scores.
- D. After age 7, intelligence test scores grow stable.
- E. By late adolescence, these scores are *extremely* stable.
 1. Among 23,000 college students, their SAT scores (just before college) and their GRE scores (just before grad school) correlated at a very high +0.86.
 2. 542 Scots were tested for intelligence at age 11 in 1932 and again 70 years later near the year 2000. Their IQ scores correlated at a high rate of +0.66.
 - a. Also, those with a high IQ had a lower chance of getting Alzheimer's.

IX. Extremes of intelligence

- A. The low extreme of intelligence is below an IQ of 70. To be labeled as having an intellectual disability a person must meet two things: (1) have a low IQ and (2) have trouble to meeting the demands of taking care of one's self.
 1. 1% of Americans meet these criteria. There are 50% more males in this group. (view the chart at the bottom of this page)
 2. Intellectual disability" is the new term for "mental retardation." The terms "moron", "imbecile", and "idiot" used to be clinical terms. When they became part of a person's everyday talk, the terms were dropped because of the negative/hurtful labels placed on those intellectually disabled.
 3. Intellectual disability can be due to a known cause like **Down syndrome** (where a person has an extra chromosome) or due to unknown reasons.
 4. Care for the intellectually disabled has gone through three stages:
 - a. At home – the idea was they were best at home on the farm.
 - b. In a residential home – the idea was that a family should grow too close, then give the child over to a residential home; they were often ignored.

- c. Back at home – the idea is that this is where they'll be loved most and get the most normal life possible.
 - B. The high extreme of intelligence is above an IQ of 135.
 - 1. Usually, these people do better in almost everything. Compared to others, they're healthier, well-adjusted, and academically successful.
 - 2. Labeling a student as "gifted" and putting that child into special "tracking" courses can be controversial.
 - a. It begs the question, if one child is "gifted", then the others are therefore "not gifted." Does this create a self-fulfilling prophecy for one group to do well and one poorly?
 - b. Isolating the "gifted" could also insulate them socially and hurt people-skills.
 - c. Tracking could also isolate and segregate the races because minority and low-income groups are normally placed in lower academic groups.
- X. Twin and adoption studies
 - A. The nature-nurture argument may be strongest over intelligence. Are some people smart/dumb because they inherited those traits, or is it because of the way that they were raised? Or both?
 - B. As always, to try and answer the nature-nurture controversy, we look at twins, siblings, non-related people, and the environments in which they're raised. (see chart at bottom of this page)
 - C. Adopted children are also studied. Their IQs start somewhat like their adoptive parents, but grow more and more like their biological parents as time goes on.
 - D. The overall conclusion is that an estimate of 70% of intelligence is due to genetics. In the case of intelligence, it seems that nature wins the nature-nurture battle.
- XI. Heritability
 - A. **Heritability** tries to measure the variation of difference in a trait that's inherited genetically, in this case, the variation of intelligence between people that's inherited.
 - B. Intelligence is estimated to have a heritability rate of 50%.
 - 1. This does not mean 50% of intelligence is inherited.
 - 2. It does mean that 50% of the difference in intelligence between people is due to heredity.
- XII.Environmental influences
 - A. Though nature seems to win the nature-nurture battle for intelligence, the environment still matters.
 - B. On rare occasions like in war-torn countries, infants get little or no interaction by adults. In such a deprived environments, their development is stunted.
 - 1. For example, kids in this situation had language skills that were far behind.
 - C. The problem then moves to everyday society and socio-economic levels. Well-to-do families tend to raise kids in supportive environments. Low socio-economic families often raise kids in less-supportive environments. The areas of concern are...
 - 1. Nutrition and malnutrition
 - 2. An environment that stimulates the senses or not
 - 3. Interaction or social isolation
 - D. Many upper-middle class parents try to jump-start their children's intellectual development. This is sometimes called the "Mozart effect." Most studies show that this kind of jump-starting is a waste of time.
 - E. Schooling does affect intelligence. The two interact and affect later income levels.
 - 1. To try to level the playing field between high and low socio-economic level kids, the Headstart Program was started in 1965. It's a preschool program for disadvantaged kids.

2. The results of Head Start are mixed...
 - a. The kids do show a higher readiness to start kindergarten.
 - b. But, the gains seem to wear off by about age 8 or 9.
3. A person's attitude and motivation also matter to a large degree. People that view their life and abilities as changeable, rather than fixed, often push themselves harder and achieve more – effort matters!

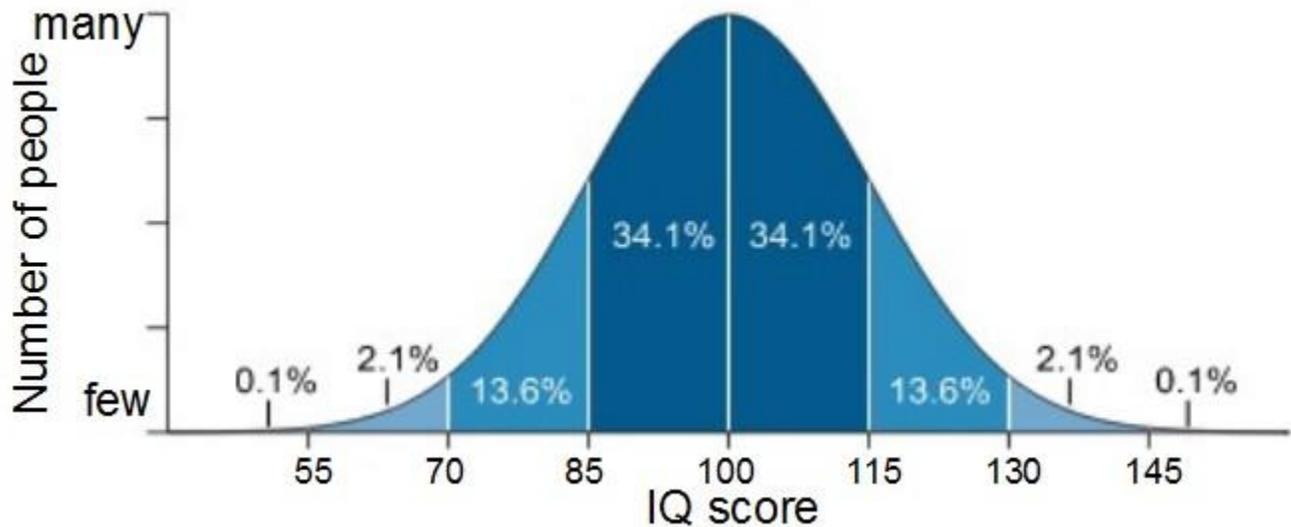
XIII. Group differences and intelligence test scores

- A. Gender plays a role in differing intelligence scores.
 1. Males and females are very similar in terms of intelligence. In one study, girls' average IQ was 100.6 and boys' was 100.5. In another study, girls averaged 99.9 and boys averaged 99.1.
 2. Despite being overwhelmingly similarly in intelligence scores, there some gender differences. These differences seem to "get all the press." Gender-based intelligence differences are
 - a. Spelling – Females spell better.
 - b. Verbal ability – Females are by far better than males.
 - c. Nonverbal ability – Females are better at locating things and remembering pictures.
 - d. Sensation – Females are more sensitive to touch, taste and smell.
 - e. Emotion-detecting ability – Females are better at recognizing emotions of others.
 - f. Math and spatial ability – The results are mixed. In many studies, the two genders perform identically. In some studies and areas of the globe, girls do better here, in others, boys do better.
 - i. The difference is highlighted at the high end – among kids that score very high on the SAT math, boys outnumber girls 13 to 1.
 - ii. Boys are better in their spatial ability, such as the ability to rotate a shape around in their imagination.
 3. It's not correct to make blanket statements like, "Girls are better verbally, boys are better at math."
 4. Though boys' and girls' overall IQs are very similar, there are more boys than girls at both the low and high ends of the IQ scale.
- B. There are IQ score differences based on ethnicity and race.
 1. On average, the races score differently on IQ tests. And, people who score higher on IQ tests are more likely to achieve higher education and earn higher incomes.
 2. As groups in America, IQ scores are as follows:
 - a. Blacks average about 86.
 - b. Hispanics average about 88.
 - c. Whites average about 100.
 - d. Asians average about 105. They do very well on math and aptitude tests.
 3. As to why these differences occur, it goes back to nature vs. nurture.
 - a. As to nature, there is no proof that one race is more or less intelligent than another.
 - b. As to nurture, undoubtedly the environment affects one's education and results on IQ tests. The question is, how much?
 - i. Often, blacks and Hispanics grow up in less well-off circumstances.
 - ii. In Asian-American cultures, parents often push their children hard to do well in school.

XIV. The question of bias

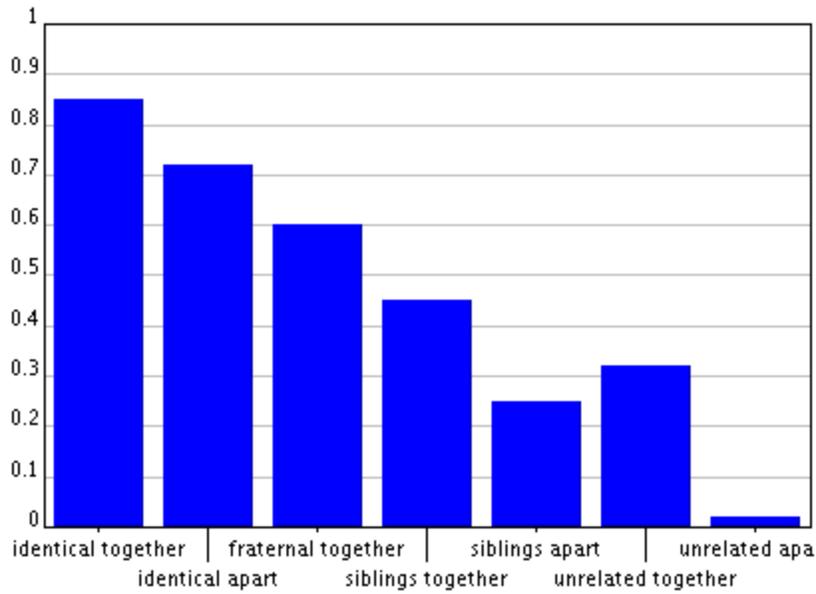
- A. Though it may be a mix, there are 3 possibilities as to why some races do better than others...
 1. The races are genetically different.

2. The races are socially different in their upbringing.
 3. The tests themselves are biased for/against certain races.
- B. As to tests being biased, the tests may be written by people who've come from a typical upper-middle class background. A person who has not grown up in a similar environment may be a step behind.
1. Those who defend the tests say that the tests are just the messengers, the measuring sticks, not the cause of the difference.
 2. Most psychologists agree today that the major aptitude tests are no longer biased.
- C. Expectations play an important role in test results too.
1. Men and women were given a math test. Women scored lower than men, except when they were told that women usually score equal to men. In this case, when they expected to do as well as men, they did.
 2. # Black students did better when they were tested by black instructors than by white instructors. The idea is that there's a built-in expectation between the races. This is called the **stereotype threat**. The bottom line, when people think they'll do well, they tend to do better; when they think they'll do poorly, they do.



New Term	Old Term	IQ Level	Education Possible	Life Adaptation Possible
Borderline	Borderline	70-84		
Mild	Moron	50-70	6 th grade maximum by late teens. Special education helpful.	Can be self-supporting socially and vocationally. May need help in stress.
Moderate	Imbecile	35-50	2 nd to 4 th grade by late teens. Special education necessary.	Can be semi-independent. Can labor in a sheltered job.
Severe	Imbecile	20-35	Limited speech, toilet habits.	Can learn simple tasks but requires total supervision.
Profound	Idiot	Below 20	Little or no speech, no toilet-training, unresponsive.	Requires total care.

Correlation of IQ scores by relation & environment



Relation and Environment	Approximate Correlation of IQ Scores (shows similarity of the scores)
Identical twins raised together	+0.85
Identical twins raised separately	+0.72
Fraternal twins raised together	+0.60
Siblings raised together	+0.45
Siblings raised separately	+0.25
Unrelated children raised together	+0.32
Unrelated children raised separately	+0.02

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