Intelligence and Creativity

Intelligence

- there are many definitions of intelligence
- the broadest definition of intelligence--the ability to profit from experience
  - this encompasses book learning and real-life skills
- to determine intelligence, intelligence tests are administered
  - these render a statistical score called the intelligence quotient (IQ)
- intelligence tests can be group tests or individual, written tests or oral
- the field of psychological testing is called psychometrics

Types of Tests

- aptitude tests--measure potential or ability (e.g. SAT)
- achievement tests--measures what has been learned or accomplished (e.g. your midterm exam)
- speed tests--consist of a large number of questions in a short amount of time
  - the goal is to how quickly one can solve problems
- power tests--consist of a large number of questions of increasing difficulty
  - the goal is to see the level of difficulty one can solve

Older Theories

- Francis Galton is known for his perspective on the nature/nurture controversy in intelligence
  - “Nature is all that a man brings with him into the world; nurture is every influence that affects him after his birth”
  - he was the first to use statistics to examine how intelligence is inherited
- thought individuals with great physical ability have better survival skills
  - better survival skills are equated with higher intelligence
- Charles Spearman--believed that intelligence was like a well that flowed through every action
  - our special intellectual abilities "flowed like streams”
  - believed in general intelligence, or a g factor
- Raymond Cattell--believed that there were two clusters of mental abilities:
  - crystallized intelligence: composed of reasoning, verbal and numerical abilities; increases with age
  - fluid intelligence: spatial and visual imagery, and rote memory; requires speed and rapid learning that declines with age
- not quite so general as Spearman, L.L. and Thelma Thurstone believed that there were seven distinct factors to general intelligence:
  - spatial visualization
  - perceptual speed
  - numerical ability
  - verbal comprehension
  - associative memory
  - word fluency
  - reasoning

Newer Theories

- Robert Sternberg--proposed the triarchic theory of intelligence
- intelligence is comprised of three kinds of intelligence:
  - analytical intelligence: most of the abilities traditionally defined as intelligence, such as the Thurstones
  - creative intelligence: the ability to adjust to new experiences, adapt and gain insights on new experiences
  - practical intelligence: matching situations to accentuate your strengths and minimize your weaknesses; ill-defined situations with multiple solutions
• perhaps the most influential modern theorist is Howard Gardner. Gardner believes in eight, distinct multiple intelligences:
  – *logical-mathematical intelligence* (math and science-oriented)
  – *linguistic intelligence* (language skills-oriented)
  – *spatial intelligence* (artists)
  – *musical intelligence* (musicians)
  – *bodily-kinesthetic intelligence* (athletes and dancers)
  – *interpersonal intelligence* (between two people)
  – *intrapersonal intelligence* (understanding ourselves)
  – *naturalistic intelligence* (understanding nature)

• Peter Salovey and John Mayer identified *emotional intelligence*, our ability to perceive and understand emotions, as well as to express and regulate them
• Daniel Goleman identified five factors of emotional intelligence
  – *self-awareness*—recognizing our own feelings
  – *mood management*—distracting ourselves from unpleasant feelings
  – *self-motivation*—to persevere with enthusiasm and confidence
  – *people skills*—the ability to communicate, understand and empathize with others
  – *impulse control*—delaying pleasurable activities until the appropriate time

**Intelligence Tests**
• the first test of intelligence was the Binet-Simon Scale in 1905
  – this was devised by Alfred Binet and Theodore Simon
  – it consisted of 30 tests arranged in order of increasing difficulty
  – Binet developed the concept of mental age
• this was later used in 1916 by L.M. Terman in devising the intelligence quotient or IQ
• Terman adapted the Binet-Simon scale while working at Stanford University
  – this became the now famous Stanford-Binet Intelligence Test, currently in its fourth edition

• the formula for IQ is mental age divided by chronological age times 100
• average IQ is 100
  – if someone was 17 years old chronologically and had a mental age of 17, 17 divided by 17 is 1, times 100 would be 100
• this formula became somewhat problematic because a child's and, especially an adult's, intellectual growth is not orderly.
• David Wechsler developed his own set of tests
  – one for adults (16 years and older) called the WAIS-III (Wechsler Adult Intelligence Scale 3rd Edition)
  – one for children (ages 5-16) called the WISC-III (Wechsler Intelligence Scale for Children 3rd Edition)
  – one for preschoolers called the WPPSI (Wechsler Preschool and Primary Scale of Intelligence)
• both of these yield individual scores for verbal and performance information
• for the WAIS-III and the WISC-III
  – *verbal subscales* include vocabulary, general knowledge, comprehension, arithmetic, similarities and digit span
  – *performance subscales* include picture completion, block design, picture arrangement, object assembly, coding (WISC-III only), digit symbol (WAIS-III only) and mazes (WISC-III only)
Wechsler based his IQ scores on a normal distribution or bell-shaped curve. On his tests, the standard deviation is 15, meaning that 68% of the population will fall within 85 and 115, or 1 standard deviation; 95% will fall within 2 standard deviations, and 99.7% within 3 standard deviations.

Bell Curve Diagram

Validity

- in examining intelligence tests, it is important that they are both valid and reliable
- validity is the ability of a test to measure what it intends to measure
  - face validity refers to the test appearing to measure what it is designed to measure
  - content validity asks is the sample of questions is large enough and representative enough to measure what it intends to measure
  - criterion validity refers to that fact that scores on this measuring instrument are consistent with subjects' scores on other similar instruments (e.g. a subject scores roughly the same on two or more intelligence tests)
  - predictive validity predicts how well an individual will do on a similar test of knowledge or skill
  - construct validity asks how well performance on the test relates to what is being measured (e.g. if problem solving skills are related to intelligence, individuals who score high on this test should score high on intelligence tests as well)

Reliability

- reliability is the ability of a test to provide consistent and stable scores over time
- test-retest is commonly used, where a subject takes a test on two different occasions
  - it is expected they will score consistently
- split-half reliability involves dividing the test questions in half, say odds and evens, and consistency is compared
- alternate-form method involves giving two different forms of the same test to the same individual at two different times
- interrater reliability—checks for the consistency in scoring between two scorers

Standardization

- intelligence tests are standardized, that is they have been piloted and achievement norms have been established
- a standardization sample is the group used to standardize tests
  - the score of these individuals helps to determines the difficulty level of the questions
  - this is called a norm, or a shared ideal or expectation about how to behave
  - norm referenced tests assess how an individual’s performance compares to others
- the goal of standardization is to yield equivalent exams among groups allowing for a fair comparison
Criticisms of Intelligence Tests

- **age**—a 2 year-old who is 2 years advanced mentally has an IQ of 200 \((4/2 \times 100)\) but that same person 6 years later and still advanced mentally 2 years has an IQ of 120 \((10/8 \times 100)\)
  - because chronological age is so ingrained in the IQ formula, it throws off relative scores
- **culture**—Dr. Adrian Dove, a sociologist, developed a culture-based intelligence test to illustrate the point that many standardized tests are culturally-biased
  - to counteract this, tests should be *culture-fair* and attempt to eliminate cultural and gender biases
- **motivation**—an individual's motivation, physiological and mental state can influence their performance on an intelligence test
- **labeling**—there is tremendous power in labeling
  - individuals can fall prey to a *self-fulfilling prophesy* or others can bias their attitudes toward the individual
  - multiple measures are now used for placement—results on individual tests and combined with other information such as grades and behaviors
- **within-group differences**—the range of scores on an intelligence test is greater within the same group (e.g. Hispanic Americans)
- **between-group differences**—the difference in scores on an intelligence test is much smaller when comparing one group to another (e.g. Hispanic Americans and Asian Americans)
- **stereotype threat**—the fear among members of some groups that their performance on a psychometric test may confirm negative stereotypes about that group

Heredity and Intelligence

- **heredity**—there are two key studies to promote the idea that intelligence is inherited
- **twin studies** show a tremendous correlation in IQ scores
  - identical twins reared together show about a .86 correlation
  - identical twins reared apart show an amazing .74 correlation, even higher than same-sexed (.55) and opposite-sexed (.49) fraternal twins

Heredity and Intelligence Diagram

- Robert Tryon's studies on selective breeding indicate further proof of a genetic link to intelligence
  - when maze-bright and maze-dull rats grow up in a stimulating environment, both groups of rats will run a maze well
  - when the environment is not stimulating, the maze-bright rats and their offspring will run the maze much better than the maze-dull rats and their offspring
• heritability—the measure of how much intelligence is explained by genetic factors
  – typically a score of 0 (environment totally determines intelligence) to 1 (heredity totally determines intelligence)
• most psychologists disagree that racial differences in intelligence are genetically determined

**Environment and Intelligence**

• *environment*: environmentalists point out that, while individuals are born with certain innate capabilities, it is their environment that predominantly shapes their intellectual abilities

• early research focuses on *stimulus effects* (sights, sounds that stimulate intellectual growth)
• Wayne Dennis’ studies in the 1950s indicate that infants left unattended for extended periods of time showed deficits in motor and intellectual development, and rarely improved beyond normal intelligence
• research on *social interaction* by Mary Ainsworth showed that responsive caregiving (talking and playing with child) results in more confident, curious and exploring children
• the success of Project Head Start, a program of pre-education for 3-5 year olds, provides support for the environmental argument
• long-range research on this and other similar projects indicated better intellectual functioning in children who participate compared to those who do not

• *the Flynn effect*—intelligence has been steadily increasing throughout the century due to environmental factors like education, nutrition, video games and television

**Extremes in Intelligence**

• there are four levels of *intellectual disability* (formerly *mental retardation*):
  – *mild intellectual disability* involves IQ scores of 55-70; these individuals can learn basic cognitive and vocational skills, and function independently in society
  – *moderate intellectual disability* involves IQ scores of 40-55; these individuals can learn only limited language and self-help behaviors, some simple vocational skills but need help in their daily living
  – *severe intellectual disability* involves IQ scores of 25-40; these individuals have only minimum capabilities to learn and function, and require constant supervision
  – *profound intellectual disability* involves IQ scores below 25; these individuals also have only minimum capabilities to learn and function, and require constant supervision
  – individuals who are able to live in their families’ homes or in a group home for the intellectually disabled have been *normalized*

• intellectual disabilities can be a result of certain genetic and environmental factors
  – *Down syndrome*—primarily hereditary
  – *fetal alcohol syndrome*—primarily environmental from prenatal exposure to alcohol
  – *phenylketonuria (PKU)*—a combination of both genetic and environmental factors with the build up of phenylalanine in the body due to genetics with a diet limiting the build up this enzyme necessary to prevent severe, irreversible brain damage

• *giftedness* involves IQ scores of 130 or above
  • gifted students account for 2% of the population and display:
    – a high achievement motive
    – strong initiative
    – excellence in academic work
    – creativity
Creativity

- *creativity*—the ability to produce ideas that are both novel and valuable
- *threshold theory of creativity*—there is a correlation between intelligence and creativity up to an IQ of 120, and then the correlation shrivels
- areas of the brain supporting convergent thinking differ from those involved in creative, divergent thinking
  - injury to the left parietal lobe damages convergent thinking; injury to certain areas of the frontal lobes can leave reading, writing and math skills intact but destroy imagination

- creative individuals tend to have five components of creativity beyond a minimal level of aptitude:
  - expertise—they have a well-developed knowledge base
  - imaginative thinking skills—the ability to see things in novel ways, to make connections, to reorganize information
  - a venturesome personality—high toleration of ambiguity and risk, good at overcoming obstacles, and actively seeks out new experiences
  - intrinsic motivation—motivation based on one’s own interests, enjoyment, satisfaction and challenge
  - a creative environment—most creative individuals are mentored, challenged and supported by their collegial relationships; they are not loners