

## The Influence of WWI



- ▶ Testing of military recruits provided the first massive use of psychological tests
  - Robert Yerkes (**Psychological Testing Corps**) and Lewis Terman (**Stanford University**) created the **Army Alpha** and **Army Beta** tests
    - Tests intended to help the Army, primarily through the elimination of feeble-minded recruits
    - Designed to measure *native ability rather than the results of school testing* (Samelson, 1977, p. 276)

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## The Influence of WWI



- Hundreds of psychologists and psychology grad students were recruited to help
  - Among them, one David Wechsler
- Realized early on that individual testing would be too time consuming
  - Designed Alpha and Beta to be group administered
- Eventually, over 2,000,000 intelligence tests were administered
  - 8,000 men recommended for immediate discharge
  - 19,000 men were assigned to labor or development battalions

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## The Influence of WWI



- This experience engrained the psychological test in American psychology
  - Because of Alpha and Beta, the General Education Fund initiated a grant for the development of an intelligence test for children
    - National Test of Intelligence—given to approximately 7 million children during the 1920's
- ▶ Testing provided unity for the field of psychology
  - Before the war, there were big rifts in the field
    - Arguments over ontology, epistemology, and methodology

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## The Influence of WWI



- Psychologists concerned over status
  - Below psychiatrists
  - Some things never change
- Prominence in war effort helped to raise status of psychologists
- Testing allowed Terman to *bring psychology down from the clouds and [make] it useful to men*  
(Samelson, 1977, p. 275)

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## Criticisms/Problems After the War



- Mostly centered around the scientific findings from the data
- Average mental age for soldiers was 13 years
  - 12 years is considered the upper limit for feeble-mindedness
  - Fed into discussion about eugenics, race deterioration, democracy and public education

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## Criticisms/Problems After the War



- Results pertaining to race and nationality
  - Southern and Eastern Europeans inferior in scores to Northern Europeans
  - African Americans inferior to Caucasians
  - Findings were eventually abandoned, except maybe as prejudices
  - We'll talk more about this when we get to correlates of intelligence

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## Criticisms/Problems After the War



- ▶ Question as to whether Alpha and Beta actually assessed native ability rather than school learning
  - Assessment of school learning could (and probably does) account for racial differences
  - Alpha and Beta were highly correlated with school learning
  - Yerkes et al. took this to mean that native intelligence kept people in school longer rather than the other way around
  - We'll return to this, too, when we get to Correlates of Intelligence

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## Criticisms/Problems After the War



- ▶ Problems with Beta
  - Nonverbal test where examinees had to perform ballet moves
  - Some evidence that African American recruits fell asleep while examiners pantomimed instructions
- ▶ Everybody and his brother created an intelligence test
  - 1921: Thomas Edison created an intelligence test
  - Few people could answer his questions
  - Led to some loss of faith in psychological testing

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## James McKeen Cattell



- ▶ Huge promoter of psychological tests and testing
- ▶ Founded the **Psychological Corporation** in 1921 as a nonprofit publisher of psychological tests
  - Psychological Corporation remains a major publisher today, but is in the private sector

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## Defining Intelligence



- ▶ Difficulty in defining intelligence
  - Before discussing theories of intelligence, need to know what intelligence is
  - Definitions of intelligence has occupied much time amongst theoreticians in the field
    - Binet defined intelligence functionally
      - In terms of school success and level at which students performed
      - No Intelligence Quotient

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## Defining Intelligence



- ▶ Boring (1923)
  - Intelligence is nothing more than *a measurable capacity...to do well in an intelligence test. Intelligence is what the tests test.*
- ▶ Hebb (1949)
  - Felt that intelligence was an equivocal term that *each writer can define...to suit himself, and there is no sense in arguing over terminology*

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## Defining Intelligence



- ▶ Intelligence as a global capacity
  - Wechsler (1939) defined intelligence as the *aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment*
  - Evidence for global nature
    - Individuals who are skilled in certain areas do not possess what would commonly be called high levels of general intelligence
    - Similarly, individuals may do poorly on one test but are adept at other areas, such as solving problems and adapting to complex life situations
  - Spearman would take up this argument

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## Defining Intelligence



- ▶ Intelligence as a set of abilities
  - Others (Thorndike) argued that intelligence is composed of several different abilities
    - Evidence for this is similar to that used to support the general intelligence position
    - People do not function at the same level in all areas
      - cf. school grades

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## Defining Intelligence



- ▶ Stoddard (1943)
  - *The Meaning of Intelligence*
    - Intelligence is the ability to undertake activities that are characterized by
      - Difficulty
      - Complexity
      - Abstractness
      - Economy
      - Adaptiveness to a goal
      - Social value
      - Emergence of originals
    - These can be done under conditions that demand *concentration of energy and a resistance to emotional forces* (Stoddard, p. 23, in Reitan & Wolfson, 1992, p. 522)

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## Defining Intelligence



- ▶ Halstead (1947)
  - The definition of intelligence is diverse and poorly operationalized

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## Defining Intelligence



- ▶ Gardner (1985)
  - Theory of multiple intelligences
    - Thorndike revisited
    - Based on Gardner's introspections on what intelligence is or should be
    - *...it is important to remain open to the possibility that many—if not most—of these competencies do not lend themselves to measurement by standard verbal methods, which rely heavily on a blend of logical and linguistic abilities.* (Gardner, p. x, in Reitan & Wolfson, 1992, p. 523)

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## Defining Intelligence



- ▶ Sternberg (1997)
  - Theory of Successful Intelligence
    - *successful intelligence is the ability to succeed in life according to your own definition of success within your sociocultural context by capitalizing on your strengths and correcting or compensating for your weaknesses—and doing this through a combination of analytical, creative and practical skills in order to adapt to, shape, and select environments* (Sternberg, 2003, p. 5)
  - Analytical Intelligence
  - Creative Intelligence
  - Practical Intelligence
  - Metacomponents
  - Cultural Relevance

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## Defining Intelligence



- ▶ Mayer & Salovey (1993, 1996)
  - Emotional intelligence
    - "the ability to monitor one's own and others' feelings and emotions, to discriminate among them and to use this information to guide one's thinking and actions" Salovey & Mayer, 1990, p. 189
    - "the capacity to process emotional information accurately and efficiently, including that information relevant to the recognition, construction and regulation of emotion in oneself and others" Mayer & Salovey, 1995, p. 197
    - Capacity to reason with emotions in four areas:
      - To perceive emotion
      - To integrate emotion into thought
      - To understand emotion
      - To manage emotion

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### Definition and Implementation Problems



- We have a number of problems when trying to define and measure intelligence
  - And few of them have been addressed—that's why we still have problems
  - What is an adequate criterion for the measurement of intelligence?
  - If someone scores highly on an intelligence test, what should that predict?

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### Definition and Implementation Problems



- What other behaviors should correlate well with high scores?
  - Traditionally, intelligence scores have been correlated with scores from other intelligence tests
- If intelligence is diverse, what are the diverse expressions of intelligence and how should they be represented fairly on an intelligence test?

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### Definition and Implementation Problems



- How do we distinguish between what is achievement and what is aptitude?
  - Or, do we have to distinguish between the two (cf., Gardner)
- Do different cultures value the same "type" of intelligence?

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## Conceptual Framework



- ▶ Theories of intelligence can be broken down into three classes:
  - Factor analytic theories
  - Information-processing theories
  - Developmental theories

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## Factor Analytic Theories of Intelligence



- ▶ What is a factor?
  - Term used to describe the results of a statistical technique called **factor analysis**
  - In examining factors of intelligence, scores on subtests of IQ tests are correlated with one another
  - If a set of subtest scores correlate well with one another, then a factor name is created to describe what the subtests have in common

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## Factor Analytic Theories of Intelligence



SKILL	Throw	Catch	Hit	Run	Read
Throw	--				
Catch	.78	--			
Hit	.65	.77	--		
Run	.67	.65	.57	--	
Read	.10	.04	.03	.08	--

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## Factor Analytic Theories of Intelligence



- ▶ Looking for  $g$  in all the wrong places
  - Outline of the debate
    - Thorndike's grandson recently wrote:
      - ...the contest over the nature of intelligence was fought out across the Atlantic between Charles Spearman and his students in England and E. L. Thorndike and his students in the United States...
    - Nature of the debate focused on whether intelligence can be defined as a single unitary entity or whether intelligence is multi-faceted

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## Factor Analytic Theories of Intelligence



- ▶ Charles Spearman (the  $g$ -man)
  - Performance on any given test could be attributed to a combination of  $g$  and a factor specific to the test
  - Two-factor theory
  - Attempted to demonstrate the existence of  $g$  by showing an order in the intercorrelations of subtests on intelligence tests

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## Factor Analytic Theories of Intelligence



- In general, for most subjects the subtests are highly correlated
- Mental horsepower
  - In 1923, Spearman defined  $g$  as a fund of mental energy that a person could bring to a task
  - Reflects differences in people's abilities to apprehend experiences, deduce relations among these experiences, and deduce correlates
  - Thus,  $g$  was taken into the realm of encoding and memory of information, inferential reasoning, and other higher cognitive tasks

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## Factor Analytic Theories of Intelligence



### ► Edwin Thorndike (Mr. Multiple Factors)

- *In general, there is evidence of a complex set of bonds between the psychological equivalents of both what we call the formal side of thought and what we call its content, so that one is almost tempted to replace Spearman's statement by the equally extravagant one that there is nothing whatever common to all mental functions, or to any half of them.*  
(Thorndike, 1990, p. 227)
- *The primary fact is that intelligence is not one thing but many. The abilities measured by a speed test with language and mathematics are not identical with, or even very similar to, those measured by a test with pictures and less exacting in speed.* (Thorndike, 1990, p. 228)

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## Factor Analytic Theories of Intelligence



- Intelligence is the summation of multiple distinct abilities
- Thorndike's position is much like Binet's
  - Intelligence can only be understood in the context of the entire person
- Intelligence tests measure only a limited aspect of behavior
  - Abstract intelligence
- Intelligence includes:
  - Social intelligence
    - The ability to understand and work successfully with people

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## Factor Analytic Theories of Intelligence



- Mechanical intelligence
  - The ability to understand and deal with concrete things
- There is not a perfect relationship among different mental tests
- Simpson (Thorndike's student) conceded there may be something called general mental ability
  - However, there were also certain capacities that were relatively specialized and did not necessarily imply other abilities except to a very limited extent

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## Resolution to the Debate



- ▶ No firm resolution
- ▶ In 1920, Spearman claimed victory between himself and Thorndike
  - *...as regards the fundamental theory [of two factors], I venture that this has now been demonstrated with finality...it becomes a bed of Procrustes into which all our doctrines must somehow or other be made to fit.* (Thorndike, 1990, p. 228)
- ▶ Claim was premature
  - Spearman and Thorndike were never able to agree on the methodology to be used to resolve the issue

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## Resolution to the Debate



- Data presented by either side was rejected on methodological grounds
- In fact, neither side could have won using the rules as defined by the other
- ▶ People still are arguing over this today

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## Factor Analytic Theories of Intelligence



- ▶ Raymond Cattell and John Horn
  - Two types of intelligence:
    - Fluid intelligence
      - Essentially nonverbal, culture-free mental efficiency
      - At work when learning novel concepts or associations
      - Dependent upon sound neurological functioning
    - Crystallized intelligence
      - Acquired skills and knowledge that are strongly dependent upon exposure to culture
      - Reflects overlearned behaviors and the products of fluid intelligence

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## Factor Analytic Theories of Intelligence



- Each type are subfactors of a general intelligence
- Some intelligence tests tap into fluid intelligence
  - Block Design, Number and Letter Series, Paired Associations, Figural Analyses, Matrix Reasoning
- Some tap into crystallized intelligence
  - Vocabulary, General Information, Abstract Word Analogies
- Created Kaufman Assessment Battery for Children (K-ABC) and Kaufman Adult Intelligence Test (K-AIT)

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## Factor Analytic Theories of Intelligence



- Both tests use sequential and simultaneous processing
  - **Sequential processing**
    - Emphasizes serial, or temporal, order of stimuli when solving problems
  - **Simultaneous processing**
    - Demands a gestalt-like, frequently spatial, integration of stimuli to solve problems
- ▶ David Wechsler and the Wechsler scales
  - Believed in g
    - And that intelligence was a part of the larger whole of personality

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## Factor Analytic Theories of Intelligence



- Intelligence as global capacity
  - 1939: intelligence is the *aggregate or global capacity of the individual to act purposefully, to think rationally, and to deal effectively with his environment*
  - Global capacity is a primary factor in defining intelligent behavior
- The Wechsler-Bellevue Intelligence Scale
  - Created this scale in response to the criticisms of the Stanford-Binet
  - After studying current intelligence tests, Wechsler selected 11 different subtests

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## Factor Analytic Theories of Intelligence



- Sources included:
  - 1916 Stanford-Binet
    - Comprehension, Arithmetic, Digit Span, Similarities, and Vocabulary
  - Healy Picture Completion Tests
    - Picture Completion
  - Army Alpha
    - Picture Arrangement
  - Kohs Block Design Test
    - Block Design
  - Army Beta
    - Digit Symbol and Coding

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## Factor Analytic Theories of Intelligence



- Wechsler designed original material for all subtests
  - Though some items differed only slightly from their original forms
- Selected tasks that were easy to administer and score, were appropriate across a wide range of ages and ability levels, and had been proven to discriminate between high and low levels of intellectual ability
- Divided test between verbal and nonverbal subtests
- IQ obtained from the scale was designed to represent an index of general mental ability

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## Factor Analytic Theories of Intelligence



- Broad verbal and nonverbal domains
  - Underscored Wechsler's convictions that there are different ways in which intelligence can manifest itself
  - Distinction between Verbal and Performance subscales reflects the different ways in which intelligence could be measured, not different types of intelligence
- Multifaceted nature of intelligence
  - We do not measure intelligence directly
  - Subtests he selected were a means to an end

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## Implications



- ▶ Specific tasks are unimportant
  - As long as they meet psychometric criteria and correlate with other variables
- ▶ No assumption is made about relative importance of abilities
- ▶ Can not measure intelligence in the absolute sense
  - Can only measure an individual's relative standing on intelligence measures

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## Empirical Evidence for Wechsler Scales



- ▶ Verbal-Performance Dichotomy
  - Factor analysis
  - Kaufman (1975)
  - Other studies
- ▶ Recent studies suggest a 4-factor solution
  - Verbal Comprehension
  - Perceptual Organization
  - Processing Speed
  - Working Memory
  - See WISC-IV & WAIS-IV

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## Global Ability



- ▶ Results w/Wechsler scales support *g*
- ▶ Most of the subscales have high commonality
- ▶ Data suggests a strong single factor that cuts across all scales
  - Subscales that load highest w/*g*:
    - Vocabulary
    - Block Design

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## Current Controversies



- Does the test do more than differentiate people who are high and low in general ability?
- What is general intelligence?

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## Theories That Incorporate Multiple Types of Intelligence



- Gardner
  - Intelligence is the ability to solve problems in a given environment
  - Types of Intelligence:
    - Linguistic
    - Musical
    - Logical/Mathematical
    - Spatial
    - Bodily/Kinesthetic
    - Intrapersonal
    - Interpersonal
    - Nature
    - Spiritual
    - Existential

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