

Intelligence Testing

Intelligence testing

A brief history of intelligence

- The concept of 'intelligence' is relatively new, unknown a century ago, though it comes from older Latin roots
 - *inter*= between, within + *legere* =to bring together, gather, pick out, choose, catch up, catch with the eye, read; *intellegere* = to see into, perceive, understand
- Francis Galton revived the term in the late 19th century, arguing for its innateness

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Alfred Binet (Repeat slide)

- Goodenough (1949): The Galtonian approach was like “inferring the nature of genius from the the nature of stupidity or the qualities of water from those of....hydrogen and oxygen”.



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- Alfred Binet (1905) introduced the first modern intelligence test, which directly tested higher psychological processes (real abilities & practical judgments)
 - i.e. picture naming, rhyme production, weight ordering, question answering, word definition.

A brief history of intelligence

- Some objected to the innateness bias, and suggested the term be replaced with 'general scholastic ability' or 'general educational ability'
- However, this did not catch on = most theorists today posit a construct of intelligence that is independent of education

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Defining intelligence

- Binet (1916) defined it as the capacity to judge well, to reason well, and to comprehend well
- Terman (1916) defined it as the capacity to form concepts and grasp their significance
- Pintner (1921) defined it as the ability of an individual to adapt well to new situations in life
- Thorndike (1921) defined it as the power of good responses from the point of view of truth or fact
- Thurstone (1921) defined it as the capacity to inhibit instinctive response, imagine a different response, and realize the response modification into behavior

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Defining intelligence

- Spearman (1923) defined it as a general ability involving mainly the ability to see relations and correlates
- Wechsler (1939) defined it as the global capacity of an individual to act purposefully, think rationally, and deal effectively with the environment
- Piaget (1972) defined it as referring to the superior forms of organization or equilibrium of cognitive structuring used for adaptation to the to the physical and social environment
- Sternberg (1985) defined it as the mental capacity to automatize information processing and to emit contextually appropriate behavior in response to novelty
- Gardner (1986) defined it as the ability to solve problems or fashion products valued within some setting.

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Defining intelligence

- You can take your pick of definitions but most agree that intelligence has to do with the related capacities of:
 - i.) Learning from experience
 - ii.) Adapting to ones environment
- Think of a person lacking either of these, and you pick out people who seem to lack intelligence
- Note however that very few formal tests of intelligence really demand subjects to do either of these!

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Defining intelligence

- Factor analytic studies (Sternberg, 1981) of informal views of an 'ideally intelligent' person capture these characteristics
 - They emphasize practical problem solving and social competence (the same thing?) as signs of intelligence, along with a factor loaded on verbal ability

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A brief history of intelligence *testing*

- As you may recall, Clark Wissler did the first basic validation research, examining the relation between the old Galtonian 'mental test' scores and academic achievement
 - But he neglected to sample the full range of the population
- Lewis Terman (1916) created the Stanford-Binet Scale, which incorporated old items from the Binet scale, plus some new items
 - It was also poorly standardized, on 1000 children and 400 adults who were not selected with care

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A brief history of intelligence *testing*

- The 1937 revision of the scale was improved:
 - It had wider range (more room on the floor and ceiling)
 - It had two parallel forms to permit re-testing
 - It was standardized on a carefully selected population, of 100 children in each six-month interval from 6 to 14 years, and 100 in each year from 15 to 18, with control of sex, selected from 17 different communities
 - Alas, they were all white and (therefore) above average SES
- The test was re-normed in 1960 and 1972, and revised completely in 1986 (SB-IV)

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Item analysis in the Stanford-Binet

- To select items from the initial pool, Terman required that:
 - i.) The item was judged to be a measure of intelligent behavior
 - ii.) The number of children who passed the item increased with age
 - iii.) Children who passed the item had significantly higher mean mental age than those that failed it

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Why the Wechsler?

- David Wechsler was dis-satisfied with the fact that the Stanford-Binet was designed for children
- He designed the Wechsler-Bellevue scale in 1939 to address this limitation
 - It was revised in 1947, re-standardized and released as the WAIS in 1955, and revised and re-standardized as the WAIS-R in 1981
- The WISC (1949) was last revised (WISC-R) in 1991, for ages 6-17.
- There is also a Wechsler Preschool and Primary Scale of Intelligence, for children aged 3-7 - the WPPSI-R (1989).

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Standardization Sample for the WAIS-R

- The WAIS-R was standardized on 1880 adults in 9 age groups from 16-74 years of age
- The sample was stratified by sex, geographical region, ethnicity, education, and occupation

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Point scale versus age scale formats

- The Binet scale (until last revision) used an age scale format = it had groups of items (mixed by content and type) that could be passed by 2/3 - 3/4 of individuals at a particular age, and subjects were tested to a criterion
- The WAIS-R uses a point scale format: points are given for each item passed
 - This allows grouping & analysis of items by content, thereby allowing analysis by individual content areas
 - You can ask questions like "Is this person strong in area X?"

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Why the sub-scales?

- Wechsler had hoped that the scatter on the subscales would be diagnostically useful
- Alas, none of his hypotheses about this were confirmed
- Later work has been equivocal (or worse) about the validity of pattern analysis
- What might be the problem?
 - i.) The individual subscales are not very reliable
 - ii.) Some of the subscales are highly correlated

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Some diagnostic utility of the IQ scales

- Differences between verbal and nonverbal IQ are still widely held to be diagnostic of some kinds of organic brain damage (though the jury is still out on this)
- The difference may help distinguish intelligence and opportunity, since the verbal IQ is more influenced by educational opportunity than the performance IQ.

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Other intelligence tests

- There are myriad of other tests of intelligence including:
 - British Ability Scale / Differential Ability Scale (DAS)
 - Peabody Picture Vocabulary Test (PPVT-R)
 - Columbia Mental Maturity Scale (CMMS)
 - Ravens Progressive Matrices
 - + many more
- Some allow group testing, by using closed-choice formats, allowing for mass screening

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Are all intelligence tests the same?

- Ideally IQ scores obtained with different instruments should be identical
- In reality, the instrument makes a difference: A Wechsler IQ may not be identical to a Stanford-Binet IQ
 - It is important to specify the instrument

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Can't we make intelligence tests the same?

- Distributional characteristics should make interchanging IQ scores easy
 - Alas, intelligence is not perfectly normal
 - there is a hump at the bottom due to many factors which impinge on intelligence in early development
 - Some have argued that assortative mating has flattened the distribution (= more very low and high scores than normal)

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Does IQ matter?

- Terman & Oden (1959) followed ultra-high IQ children (IQ > 140) for 40 years
 - The gifted children were heavier at birth; walked, talked, and matured earlier; their general health was better; they earned more degrees and more money
 - However, none went on to become super-successful Einstein-types
- Some suggested the positive findings might be due to selection bias, since the initial selection was based on teacher ratings
- Esquire magazine's "the smartest people in America"
- Marilyn Von Savant and her mistakes

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Is IQ innate?

- The literature on IQ heritability is huge and controversial
- Heritability in IQ has been estimated between 0.50 and 0.72 (= 50% - 72% of variability is due to genes)
- The best evidence comes from twin studies (ie. Bouchard, 1984)
 - IQ of identical twins reared apart (even in very different circumstances) correlate almost as high as those of identical twins reared together
 - Honzik (1957) showed almost no correlation between IQ of adopted children and IQ of their adoptive parents

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Is IQ due to environment?

- However, children reared under conditions of little human contact can show huge improvements (30-50 IQ points) after being placed in normal environments
- Jensen (1977) tested the hypothesis of cumulative effects of environmental disadvantage, hypothesizing that older deprived children should do worse on IQ tests than their younger siblings
 - He found some support for this hypothesis- about 1 point per year for ten years between 5 and 16 years of age, estimated to be higher if earlier years were included
 - Disadvantaged adoptees into advantaged homes often out-perform their pre-adoptive peers (Scarr & Weinberg, 1983)

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Is IQ due to environment?

- A purely innate general intelligence should be stable over generations
 - Intelligence is not stable
 - Standardization samples major IQ tests between 1932 and 1981 tended to be higher than their predecessors
 - Overall, humankind appears to have picked up nearly 14 IQ points in the last century
 - Similar observations have been made in other countries using other tests
- [However, I note that this does not seem to have stopped humankind from engaging on a huge scale this century in some dangerously stupid behaviors...]

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Is IQ due to environment?

"...psychologists should stop saying that IQ tests measure intelligence. They should say that IQ tests measure abstract problem-solving ability (APSA), a term that accurately conveys our ignorance. We know that people solve problems on IQ tests; we suspect that those problems are so detached, or so abstracted from reality, that the ability to solve them can diverge over time from the real-world problem solving ability called intelligence; thus far we now little else."

Flynn, J.R. (1987). Massive IQ gains in 14 nations: What IQ tests really measure, *Psychological Bulletin*, 101, 88, 171-191.

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How I know that IQ is not everything:

A personal account of the smartest man
whose IQ I have measured
(and maybe of my three most brilliant friends)

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How to be intelligent

- Rely on multiple methods
 - Try multiple approaches to problems and select the best or what is common to all (the lesson of science)
 - The way we represent problems makes them easier or harder to solve
 - Therefore: persevere, with mutation
- On the one hand: Be wary of what averages out
 - Where there is disagreement, there is probably also error and (therefore) unreliability
- On the other hand: Pay attention to what averages out
 - particulars are suppressor variables: they may modulate why the general case does not apply
 - Being aware of what is general and what is particular is what makes for adaptivity, the cardinal sign of intelligence

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How to be intelligent

- Distrust memory
 - Memory misleads by simplifying: better to rely on written records
- Be humble
 - The proud are less likely to distrust their own understanding
- Seek rationality over intelligence
 - Intelligence can tell us how to do what we have decided to do, but not what we should decide to do
 - Rationality combines intelligence and integration: a priority system that is not based on raw intelligence but an emotional/moral/practical sense of priority

“Eroticize intelligence”

- Douglas Coupland/ *Generation X*

“Intelligence is actually style, an individual's method of operation, his approach. Intelligence is the connections one chooses to make by virtue of one's personality or being, one's disposition towards certain choices.”

- Christopher Dewdney/ *The Immaculate Perception*

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How to be intelligent

- Know that intelligence is not everything

“Nobody can feel better than the man who is completely taken in. To be intelligent may be a boon, but to be completely trusting, gullible to the point of idiocy, to surrender without reservation, is one of the supreme joys of life.”

- Henry Miller / *Sexus*

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