

## Ch. 9: Intelligence

- The problem of defining “Intelligence”
- Binet’s Principles of Test Construction
  - Age differentiation
  - General mental ability
- General Mental Ability
  - g
  - gf - gc theory
- Multiple intelligences
- Stanford-Binet and WAIS IQ tests

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## What is “Intelligence”

- Everyone has an intuitive sense of what it is, yet nobody (laypersons or scientists) can agree
- Historically, limitations in theory and technique (stats) have been paramount
- Statistical advances often came before theoretical ones
- Tendency to mistake the IQ test score for the thing it measures (intelligence)
- Extremely controversial subject -- wealth, race, gender, class, freedom, destiny...

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## Background Intelligence

- Intelligence : from latin “intelligere” meaning “to understand”
- Dictionary: “capacity for learning, reasoning, understanding, and similar forms of mental activity; aptitude in grasping truths, relationships, facts, meanings, etc.”
- Same as “smart”, “crafty”, or “clever”?
- Uniquely Human?
- Requires Thought?
- Requires Language?

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## definitions I

- Binet: “tendency to maintain a definite direction; the capacity to make adaptations for the purpose of attaining a desired end, and the power of autocriticism”
- Spearman: ability to educe either relations or correlates
- Gardner: “to resolve genuine problems or difficulties as they are encountered”

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## APA (1995)

Individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought. Although these individual differences can be substantial, they are never entirely consistent: a given person’s intellectual performance will vary on different occasions, in different domains, as judged by different criteria. Concepts of “intelligence” are attempts to clarify and organize this complex set of phenomena.

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## brief history

- Formal testing started in 1904 in France.
- Commission formed with goal of identifying intellectually limited individuals for special educational treatment
- Foremost problem was that of defining Intelligence

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## Binet's principles 1

- Principle 1: Age Differentiation
  - Kids get smarter as they get older
  - Test items designed to be answerable by
    - 67% to 75% at the target age
    - higher % at older
    - lower % for younger
    - (e.g. an item characteristic curve)
  - Mental Age corresponds to level of average performance for a given age

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## Binet's principles 2

- Principle 2: General Mental Ability
  - Instead of trying to measure the parts that make up the whole, decided to just measure the whole
  - Solved a lot of theoretical and practical questions
  - Is this a circular argument or design?

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## Spearman's g

- Intelligence composed of
  - General Factor (g)
  - Specific Factors ( $S_1, S_2, S_3, \dots S_n$ )
- Observation: All measures of intelligence, even on seemingly unrelated subjects, have a positive correlation. No items that "smarter" people do worse on. (what about over-studying?)
- Factor Analysis : From a large number of items (Xs) deduce a smaller number of Factors (Fs) which share variance
  - Shared variance = g = about 50%

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## improving on g

- Although factor analysis does show a large "g" factor, there is more than one way to divide the variance.
- Two-factor model is a more modern approach
  - gf - "fluid"
    - reasoning ability, mental flexibility, executive functioning, problem solving, ability to learn
  - gc - "crystallized"
    - facts, figures, information, acquired knowledge that has been learned

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## Limitations of g

- Did the test methodology and techniques used to collect data overly influence the theory?
- Early tests were primarily of language, facts, figures, calculations and manipulation of objects
- Many areas not tested:
  - kinesthetic
  - social
  - musical
  - non-verbal thought
  - etc

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## Gardner's Research

- Do we learn more about the design and structure of a system when it is working normally, or functioning unusually? Often, best information comes from odd cases.
- Gardner considered
  - neurological evidence (brain damage patterns)
  - prodigies, virtuosos, savants, prodigies, autists
  - evolution
  - psychometrics
  - existence of symbolic notation

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## Autism / Savantism

- Autism

- spectrum of disorders characterized by impaired social interaction, restricted interests, obsessions, and repetitive behavior

- Prevalence 1-2 out of 1000

- Savant Syndrome

- One or more areas of mental brilliance or excellence.
- About 50% are autistic, about 50% have developmental disorder, mental retardation, brain injury or disease
- Very rare: perhaps 100 worldwide

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## Stephen Wiltshire

- Diagnosed autistic

- mute until age 3

- first words “paper” and “pencil”

- full language developed by age 9

- Video

- Panorama

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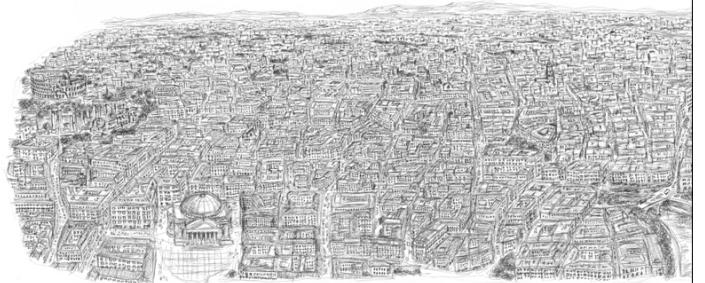
## Steven Wiltshire



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## Rome Panorama



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## incredible brain video

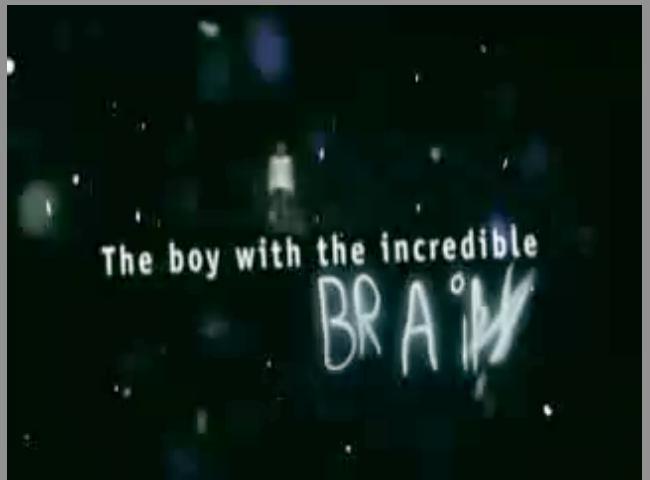
- Features several savants, some with autism
- [incredible brain video](#)

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## Incredible Brain



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## Kim Peek

- Diagnosed severely retarded
- Movie “Rain Man” based on him
- Amazing memory for fact and figures
- Severe physical and social disabilities
- Reads 8-10 books/day, retains 98% of the information, can read two pages at once (one with each eye)
- [Kim Peek Video](#)

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## Twins Flo & Kay

- Identical twin autistic / savant twins
- [Flo & Kay on You Tube](#)

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## Flo & Kay



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## Alonzo

- Severe brain damage as child
- Can not read, write, or calculate.
- Speech very limited.
- [Alonzo video on YouTube](#)

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## Alonzo



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## Gardner's 8 Intelligences

- logical-mathematical (\*)
- verbal-linguistic (\*)
- spatial (\*)
- musical
- bodily-kinesthetic
- naturalist
- interpersonal
- intrapersonal

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## Sternberg's Intelligences

- analytic (\*)
- creative
- practical

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## Criticisms of MI

- Philosophical : rejection of single intelligence factor
- Political : egalitarianism / PC : everyone is equally intelligent just in different ways
- misunderstanding / misstatement of the MI theory?
- Practical : gives weight to skills that are not valued by society.
- Theoretical : is MI just another way of describing personality styles?
- Research : little empirical support

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## Stanford Binet Early

- Binet was one of first to develop modern IQ test
- Goal - identify developmentally disabled students for special education
- Major revisions have made it into a modern test:
  - 1905 First version : 30 questions, Age Scale format
    - "Idiot", "Imbecile", "Moron"
  - 1908 Revision:
    - Mental Age

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## Stanford Binet 1916-1986

- 1916 Revision: Stanford-Binet
- IQ = MA/CA
- 1937 Revision:
  - Improved standardization sample (but still mainly urban-dwelling USA Caucasians)
  - Good psychometrics (though less reliable for younger ages and higher IQs)
- 1960 Revision
  - Deviation IQ with mean of 100 and SD of 16
- 1986 Revision -- some changes (later backtracked)

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## Stanford Binet 5 (2003)

- 5 Factors / 10 verbal/nonverbal subtests: Fluid Reasoning, Knowledge, Quantitative Reasoning, Visual/Spatial Reasoning, Working Memory.
- Full-Scale IQ (FSIQ)  $r = .97$ 
  - Verbal IQ (VIQ)  $r = .96$
  - Non-Verbal IQ (NVIQ)  $r = .95$
- Finally uses SD = 15 (instead of 16)
- Excellent normative sample (n=4800 gender, ethnicity, region, education level, plus 3000 from subpopulations: gifted, ADHD, etc.)

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