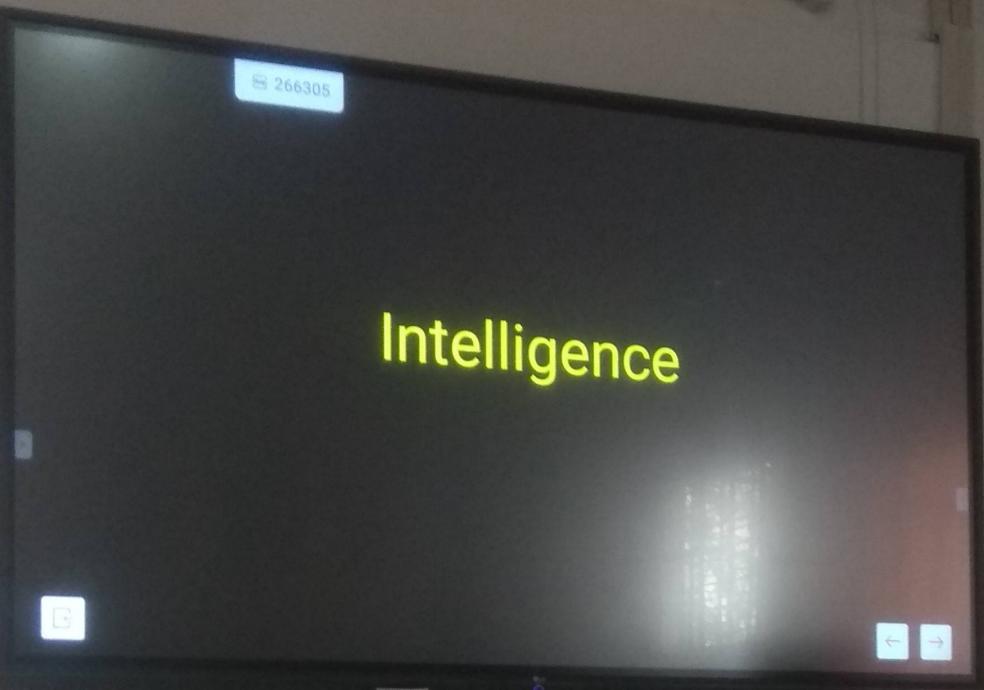


SILENCE

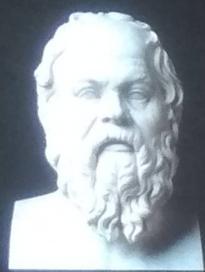
Intelligence

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SILENCE P

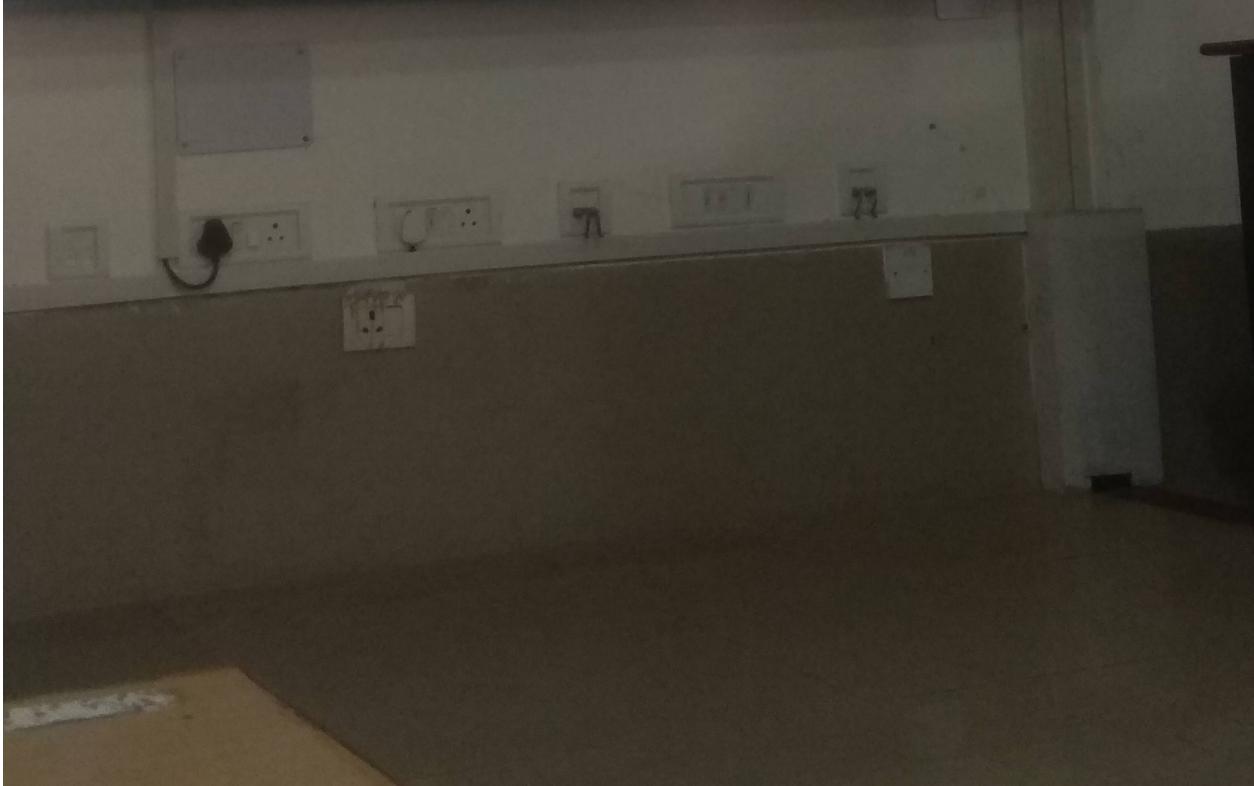
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I know that I am intelligent,
because I know that I know
nothing.

~ Socrates

AZ QUOTES



266305

Outline

- Nature of Intelligence
- Measurement of Intelligence
- Views on Intelligence
- Artificial Intelligence

Nature of Intelligence

An individual's ability to:

- *Learn from experience*
- *Adapt effectively to the environment*
- *Understand and control own thinking process*
- *Flexible adaptations w.r.t culture and social contexts*

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Measurement of Intelligence

- Traditions of Measurement
 - Psycho-physical abilities
 - Judgmental abilities
- Francis Galton
 - Intelligence is a function of psycho-physical ability
 - Measured several variables – weight discrimination, pitch sensitivity
 - Could not find a unifying link between test findings
 - Failed to predict College performance

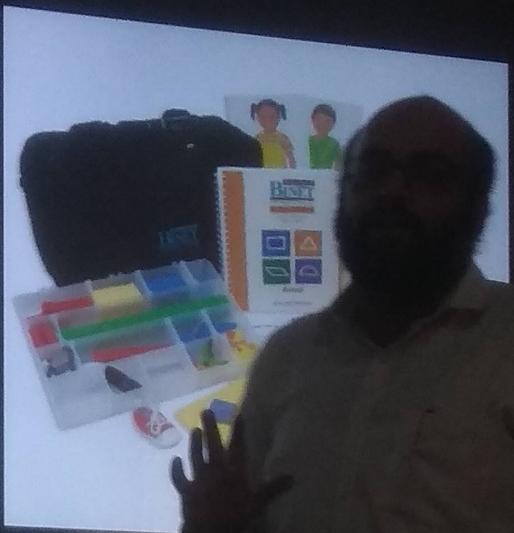
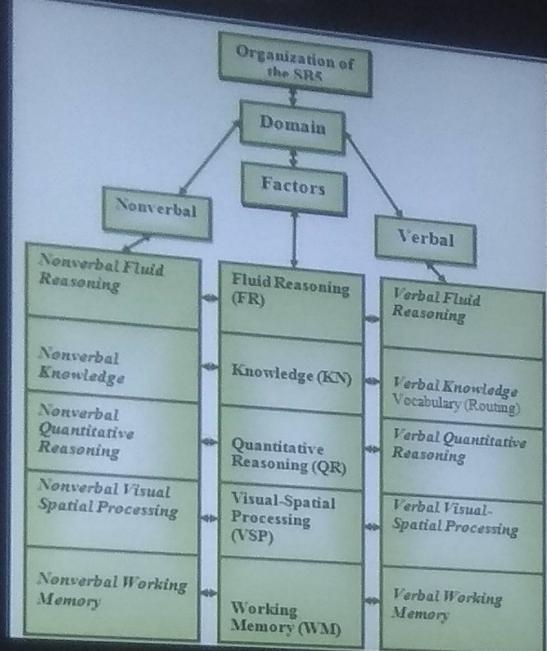
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- Alfred Binet
 - Intelligence is a function of ability to learn in an academic setting (based on judgmental abilities)
 - Three elements of intelligence: Direction, Adaptation and Criticism
 - Developed a test along with *Theodore Simon*
 - Mental age as a measure: the average level of intelligence for a person of a given age
 - Could not compare relative intelligence for different chronological ages
 - *William Stern* developed the concept of IQ – intelligence quotient
 - Ceiling effect at about ~ 16 years of age
 - *Lewis Terman* adapted it in the US – Stanford-Binet Test

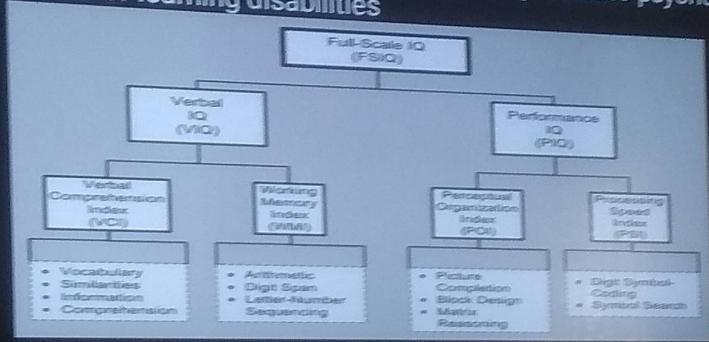


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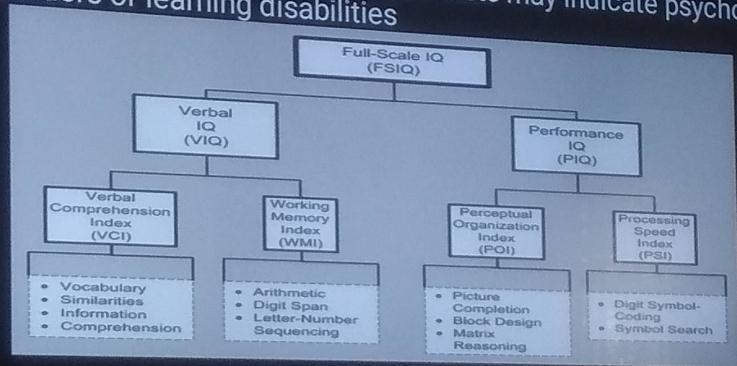
• Weschler Scales

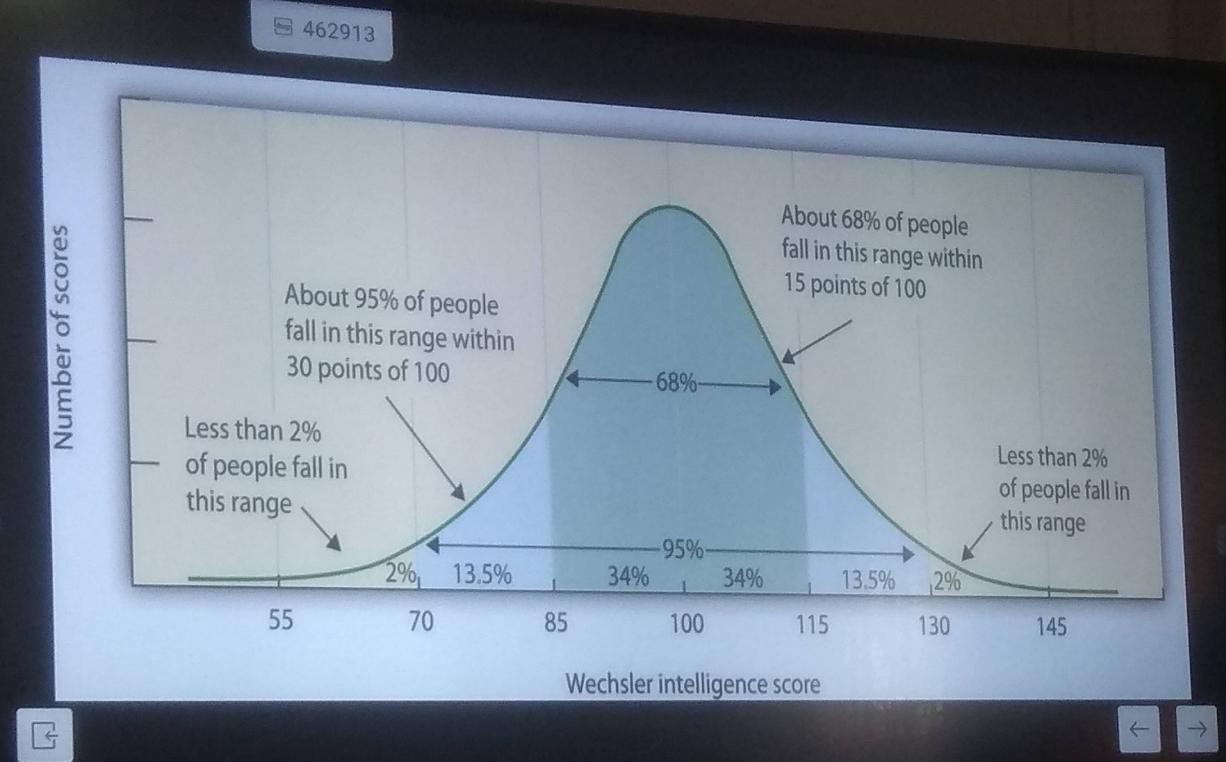
- Developed by David Weschler to overcome verbal emphasis in the Binets
- Designed a test having verbal and non-verbal/performance items
- *Deviation IQ* – difference of a person IQ score from the mean
- Different patterns of scores on sub-tests may indicate psychological disorders or learning disabilities



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Views on Intelligence

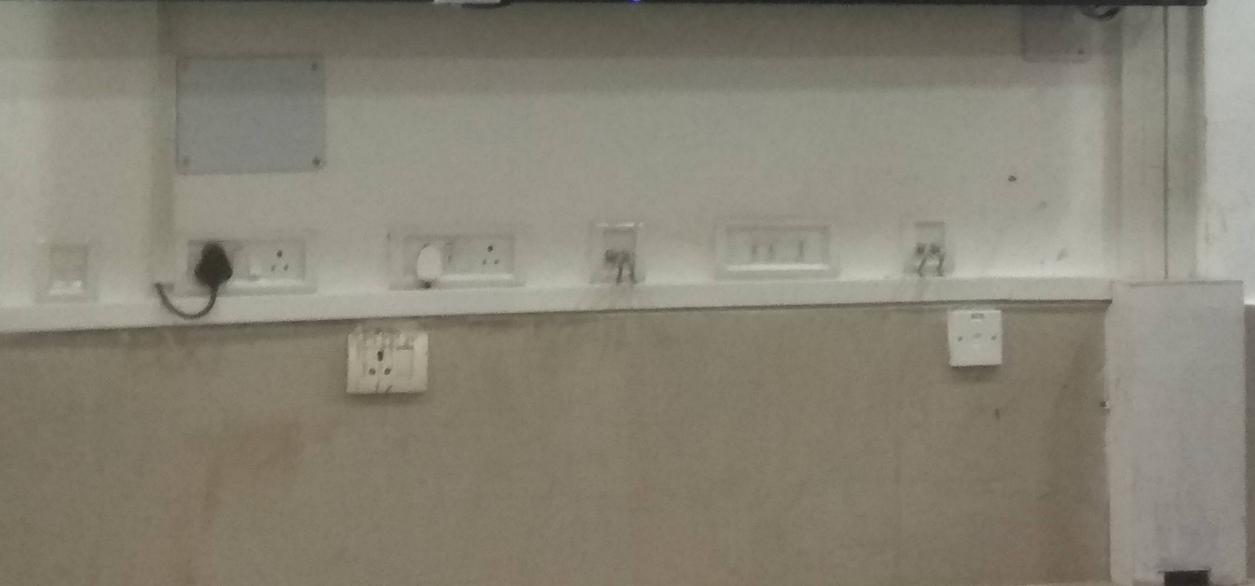
- Factorial Theories
- Information-processing Theories
- Gardner's Multiple Intelligence
- Sternberg's Triarchic Theory



H 200769

Views on Intelligence

- Factorial Theories
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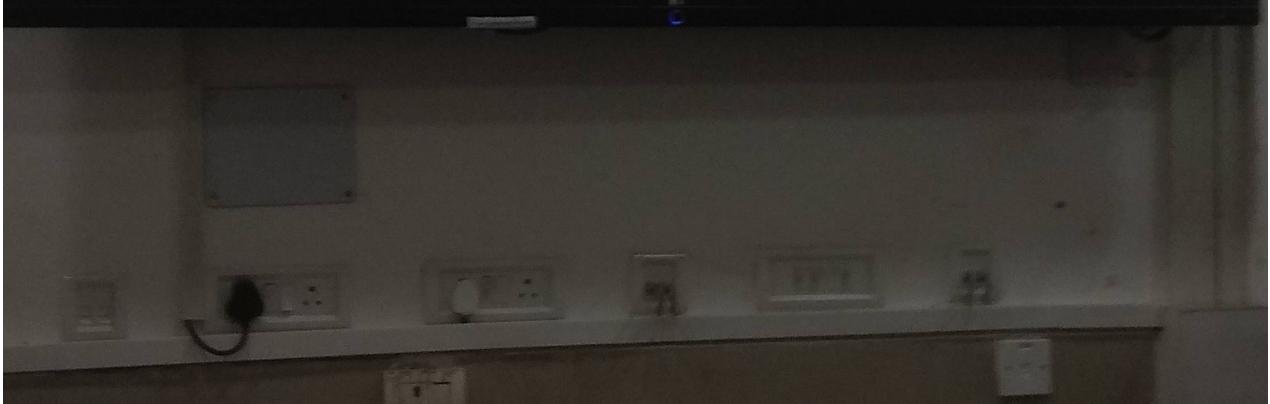
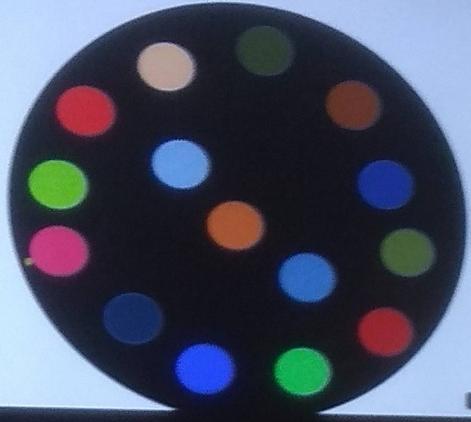
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Factorial Theories

- Factor Analysis:
 - A statistical technique that is used to reduce a large number of variables into a fewer number of factors based on some commonality
- Steps in Factor Analysis
 - Administer ability tests to a large number of people
 - Determine correlations among all those tests
 - Statistically analyze those correlations to simplify them into a relatively small number of factors

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- 15 balls –different color

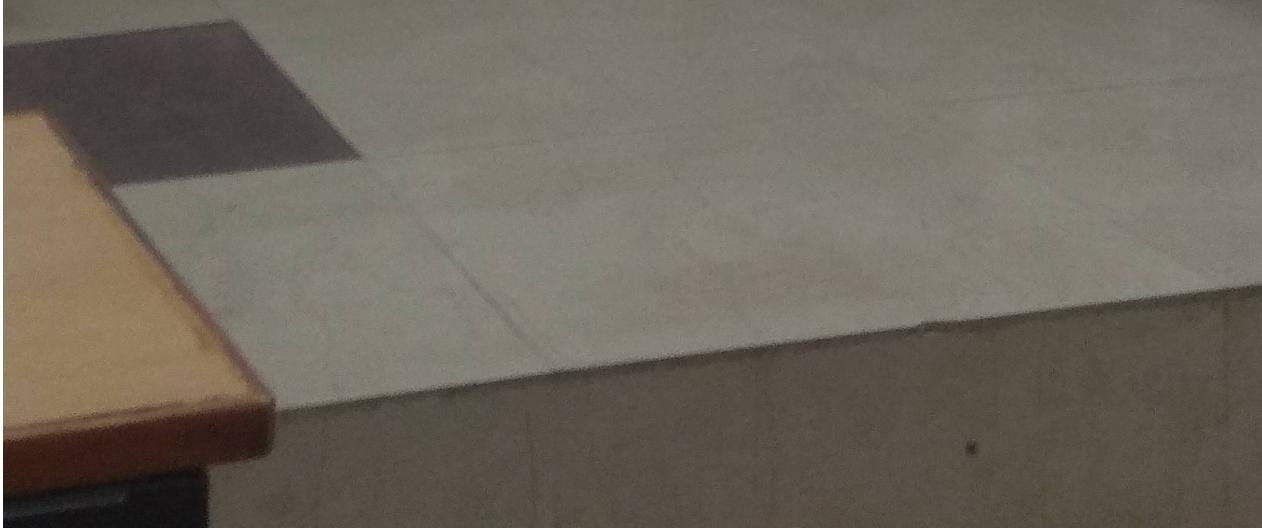
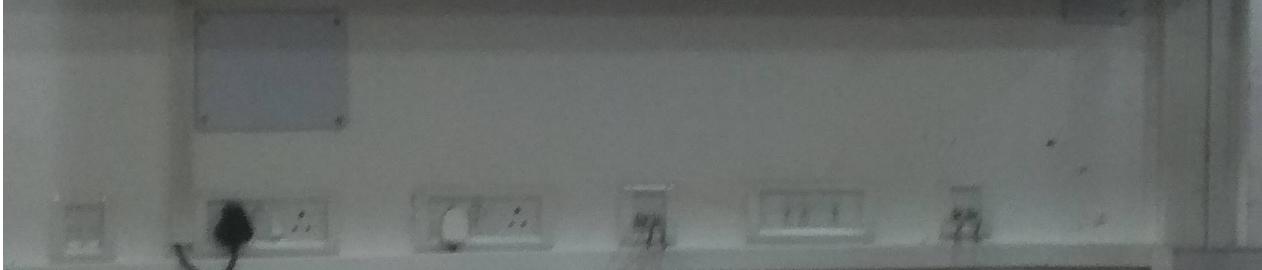


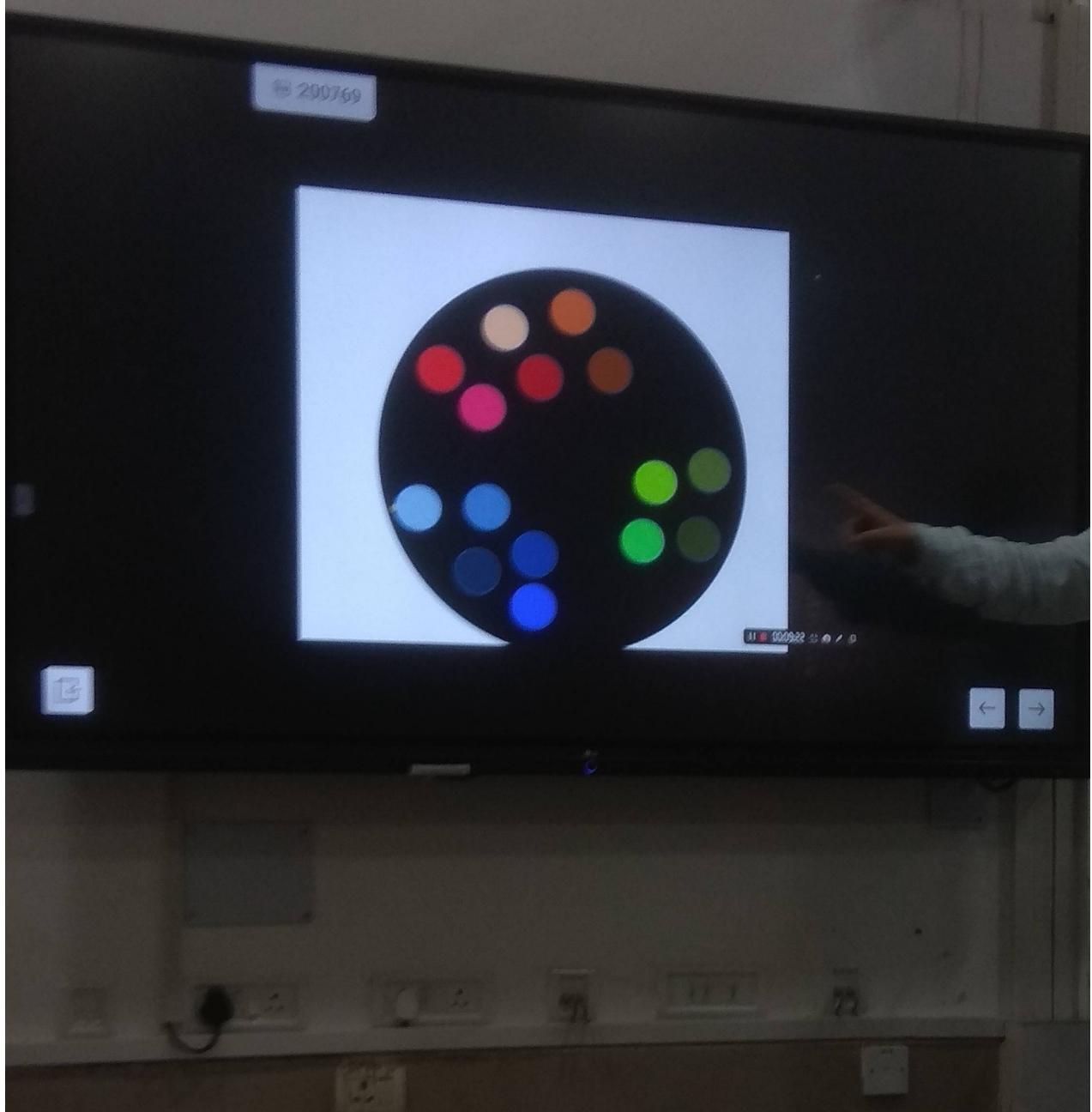
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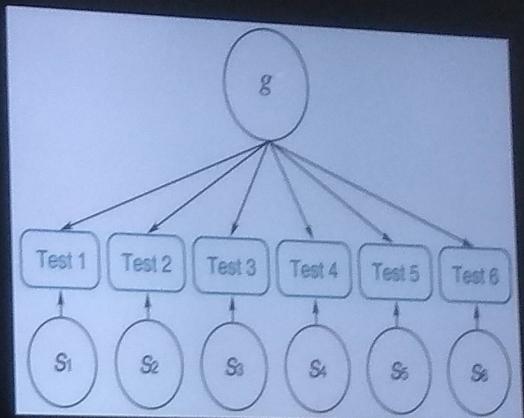
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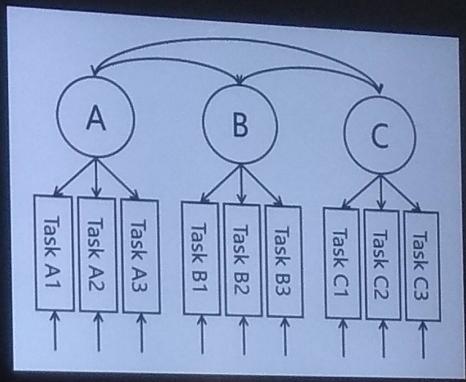
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- Spearman's g
 - Charles Spearman invented factor analysis and used factor-analytic studies to study intelligence
- Two factors:
 - General factor (g): influences all tests of mental ability
 - Specific factor (s): influence performance on a single test of mental ability



SILE

- Thurstone's Primary Mental Abilities
 - Louis Thurstone - intelligence is result of seven factors
 - Primary Mental Abilities:
 - *Verbal comprehension*
 - *Verbal Fluency*
 - *Inductive reasoning*
 - *Spatial visualization*
 - *Numbers*
 - *Memory*
 - *Perceptual Speed*



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- Hierarchical Models

- Assumed factors are arranged in a hierarchy

- Catell and Horn's Fluid and Crystallized Intelligence

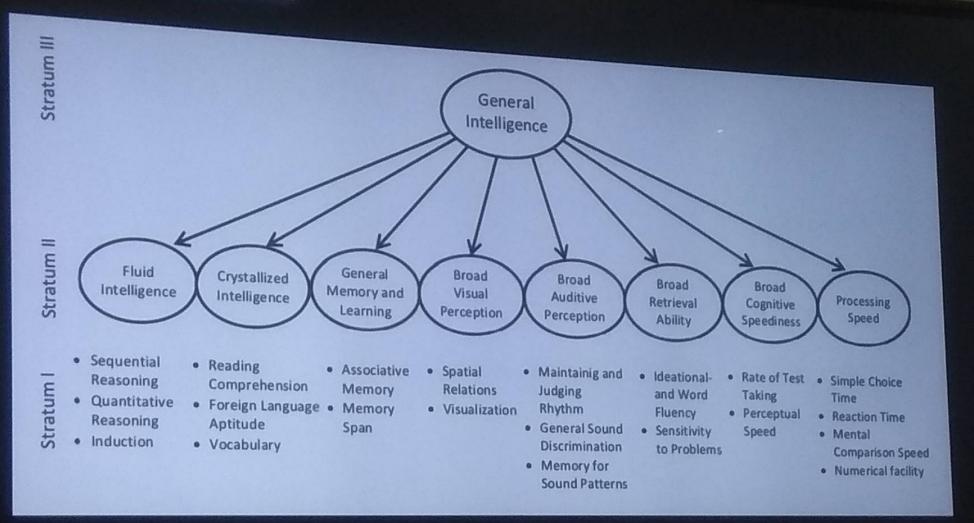
- Fluid intelligence: ability to think and reason, declines with age
 - Crystallized intelligence: accumulated knowledge overtime, increases with age

- CHC (Catell-Horn-Carroll) Model

- Carroll carried out a comprehensive reanalysis of 461 data sets
 - Proposed intelligence as structured in three-strata
 - Currently the most widely accepted model of intelligence



SILENCE P



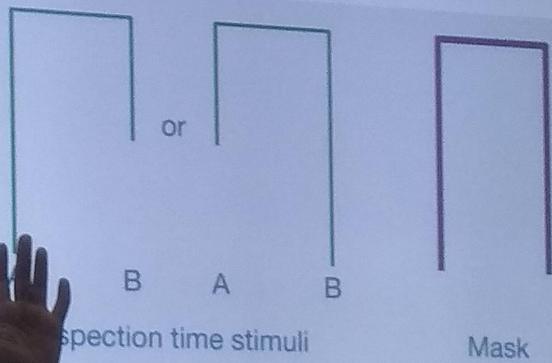
SILENCE P

Information-Processing Approach

- Inspection Time:
 - Time for which the target is presented and to which the participant responds with at least 90% accuracy
 - Correlated well with scores on intelligence test

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The task is to determine whether side A or side B of the stimulus is longer. The stimulus is presented and then quickly followed by a mask.

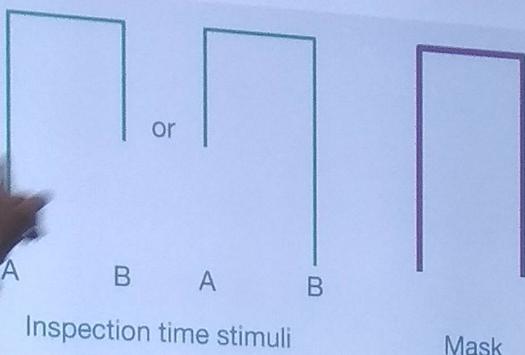


Comparing the lengths is easy when you have enough time to view the stimulus but difficult when the task decreases viewing time severely.



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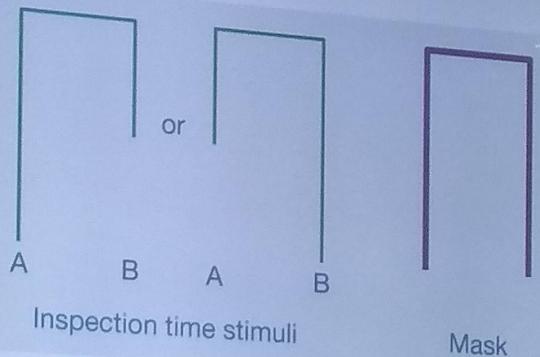


Judging the lengths is easy when you have enough time to view the stimulus but difficult when the mask decreases viewing time severely.



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- **Lexical-Access Speed**
 - The speed with which information about words can be retrieved
 - Stimulus - AA Aa Ab
 - Task - Name matching, Physical matching
 - $\text{Lexical Access} = \text{RT}_{\text{NM}} - \text{RT}_{\text{PM}}$
 - Lexical access correlates well with intelligence



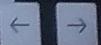
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- Common factors in information-processing approach to intelligence:
 - Breadth of Declarative Knowledge
 - Breadth of Procedural Knowledge
 - Working Memory Capacity
 - Speed of Processing

069697

Theory of Multiple Intelligence

Type of Intelligence	Tasks Reflecting this Type of Intelligence
Linguistic intelligence	Used in reading a book; writing a paper, a novel, or a poem; and understanding spoken words
Logical-mathematical intelligence	Used in solving math problems, in balancing a checkbook, in solving a mathematical proof, and in logical reasoning
Spatial intelligence	Used in getting from one place to another, in reading a map, and in packing suitcases in the trunk of a car so that they all fit into a compact space
Musical intelligence	Used in singing a song, composing a sonata, playing a trumpet, or even appreciating the structure of a piece of music
Bodily-kinesthetic intelligence	Used in dancing, playing basketball, running a mile, or throwing a javelin
Interpersonal intelligence	Used in relating to other people, such as when we try to understand another person's behavior, motives, or emotions
Intrapersonal intelligence	Used in understanding ourselves—the basis for understanding who we are, what makes us tick, and how we can change ourselves, given our existing constraints on our abilities and our interests
Naturalist intelligence	Used in understanding patterns in nature



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069697

The Gardner Criteria

Gardner's criteria for defining an intelligence are less rigorous than they appear. Gardner requires that only a majority be satisfied and some of the criteria are easy to satisfy. The psychometric criterion is the most rigorous of the eight, but Gardner has largely ignored it.

CRITERION	REASONING UNDERLYING CRITERION
Support from psychometric findings	Performance on tasks tapping the same intelligence should be more correlated than performance on tasks tapping different intelligences.
Support from experimental psychological tasks	It should be easier to carry out two tasks simultaneously if they rely on different intelligences than if they rely on the same one.
Potential isolation by brain damage	Intelligences that are separate cognitively are separate in the brain.
Evolutionary plausibility	Intelligences evolve if they are adaptive.
A core set of operations	Operations that enable the intelligence should be distinct from operations supporting other intelligences.
Susceptibility to encoding in a symbol system	Symbol systems exist to code what the mind is most sensitive to—the stuff of intelligences.
A distinct developmental history	Each intelligence goes through a definable set of stages as it develops toward an end-state of expertise.
The existence of exceptional individuals (e.g., idiot savants, prodigies)	One intelligence can be exceptionally well developed while others are in the normal or subnormal range.

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299073

Triarchic Theory of Intelligence

- Three Aspects of Intelligence
 - Internal World
 - Experience
 - External World
- Three Components
 - Meta-components – Higher processes
 - Performance components – Low level
 - Knowledge-acquisition components

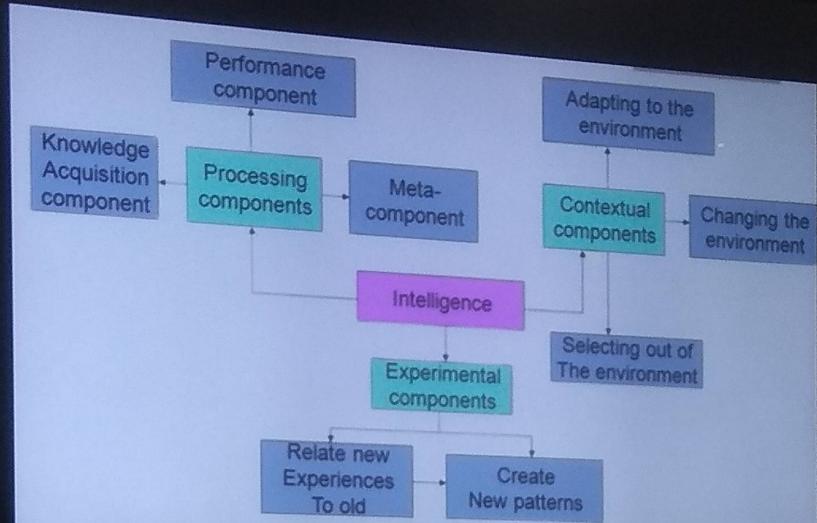
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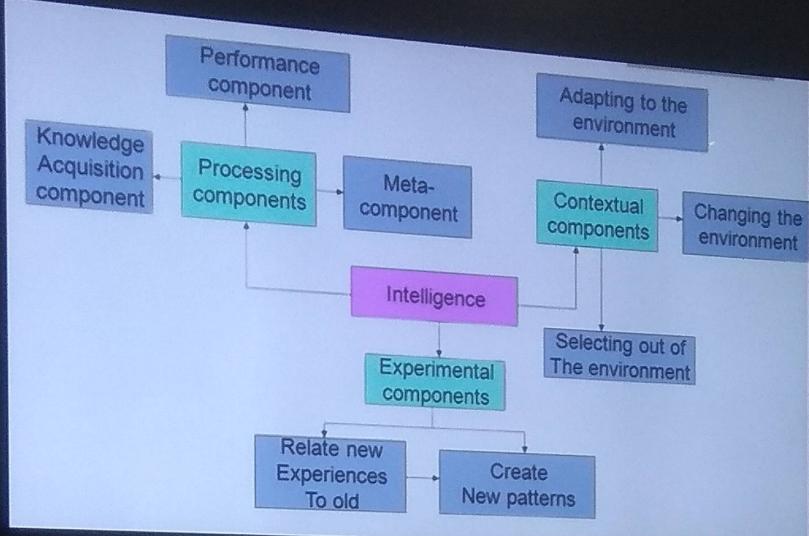
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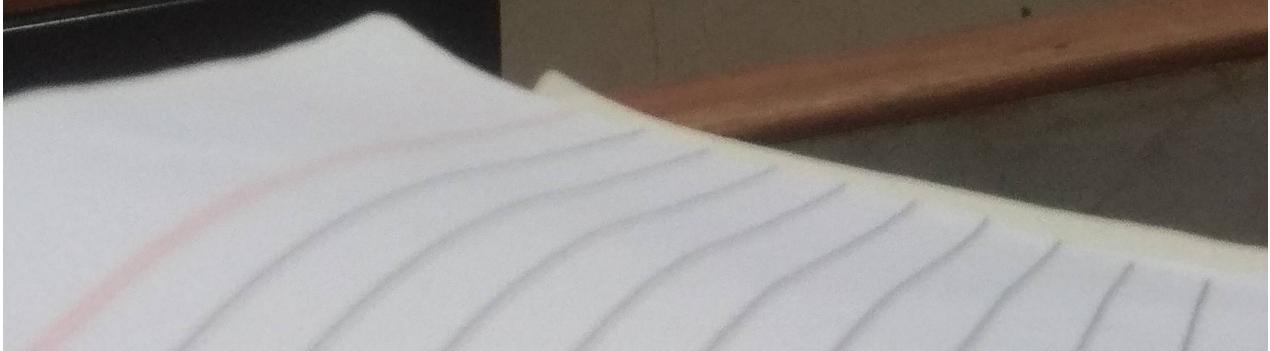
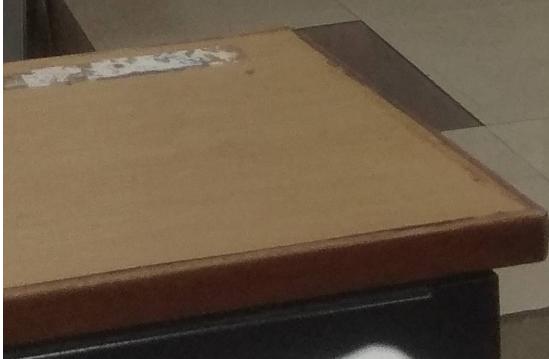
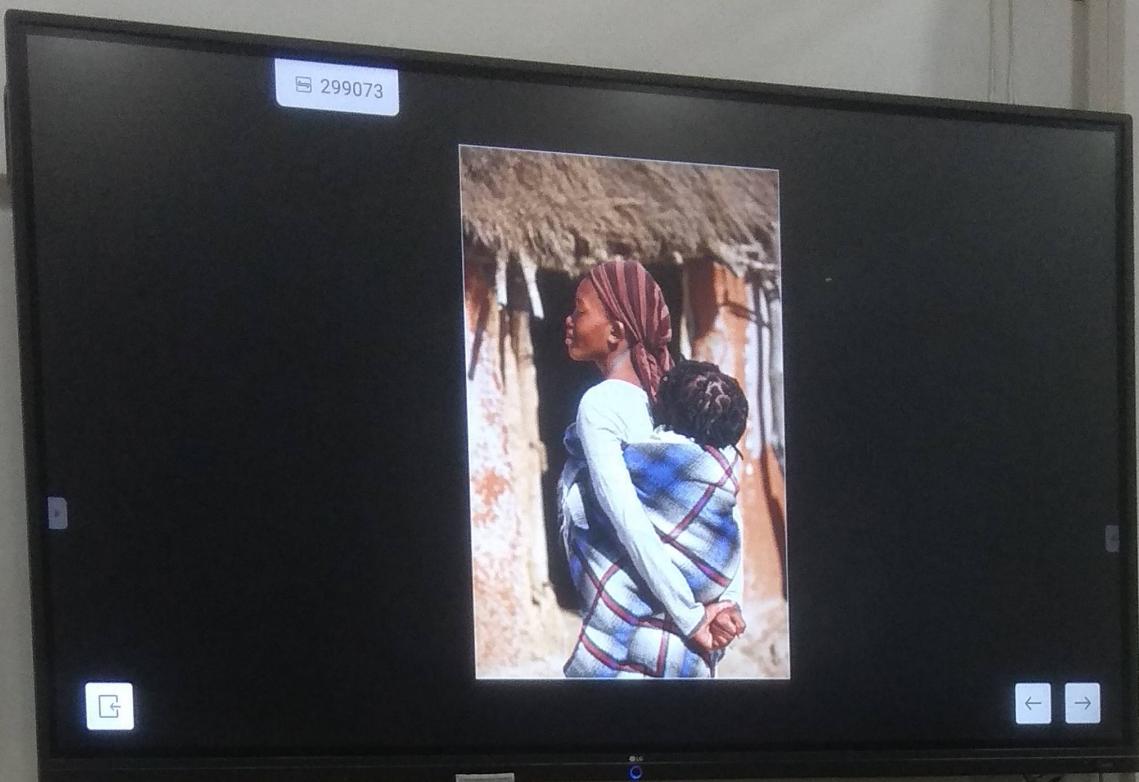


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Triarchic Theory of Intelligence

- Three Aspects of Intelligence
 - Internal World
 - Experience
 - External World
- Three Components
 - Metacomponents – Higher processes
- Three kinds of intelligence
 - *Componential or Analytic*
 - *Experiential or Creative*
 - *Contextual or Practical*



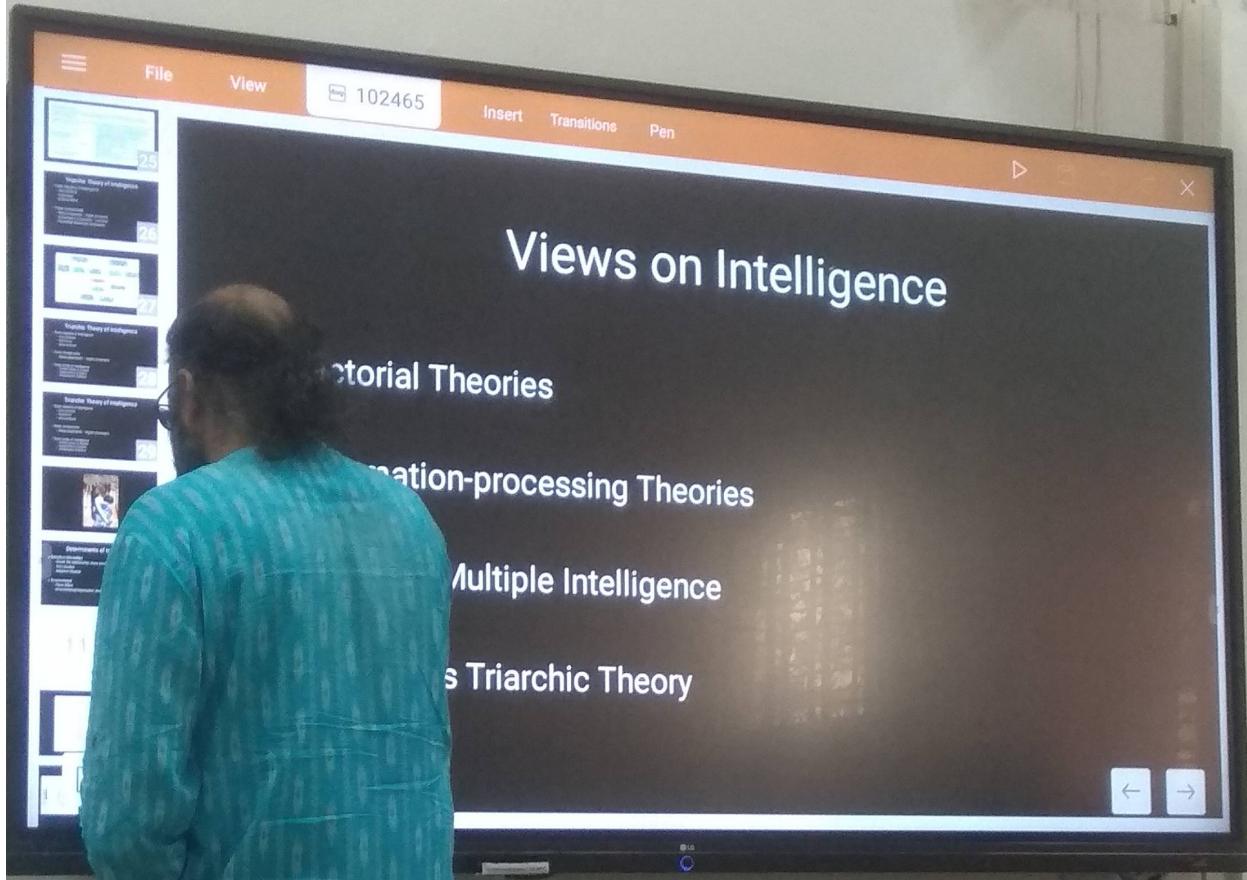
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Determinants of Intelligence

- Genetics (Heredity)
 - Closer the relationship, more similar the IQ
 - Twin Studies
 - Adoption Studies
- Environment
 - Flynn Effect
 - Environmental Deprivation and Enrichment





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Determinants of Intelligence

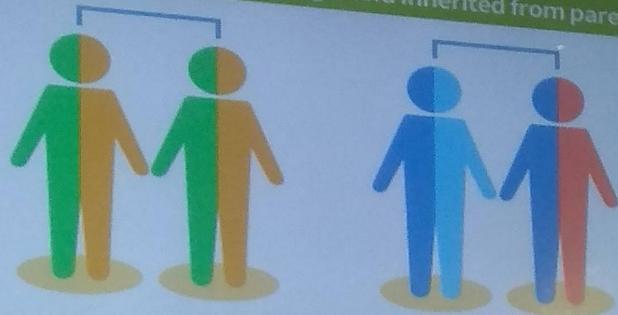
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SILENCE

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Differences in genetic background inherited from parents



MZ-pairs

Both inherit 100%
similar genes

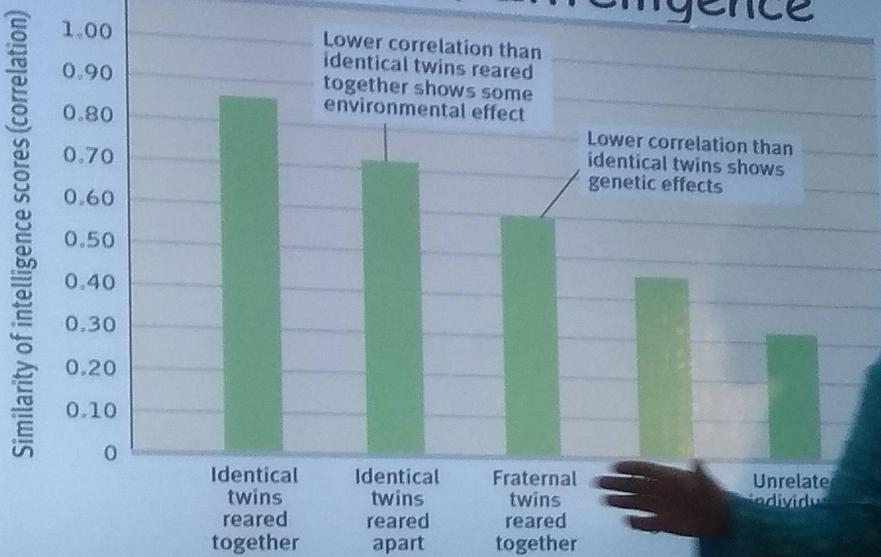
Always of the same sex

DZ-pairs

Both inherit approximately
50% similar genes

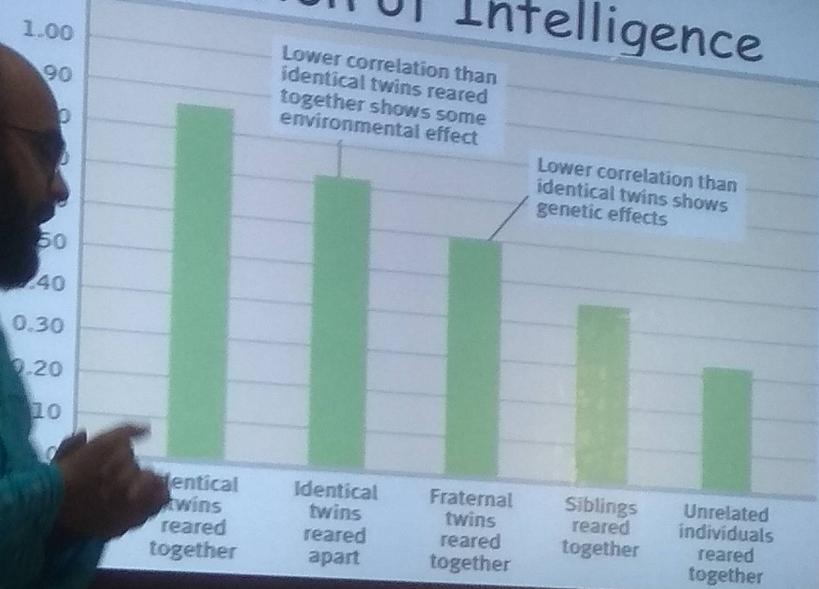
Same or different sex

Correlation of Intelligence



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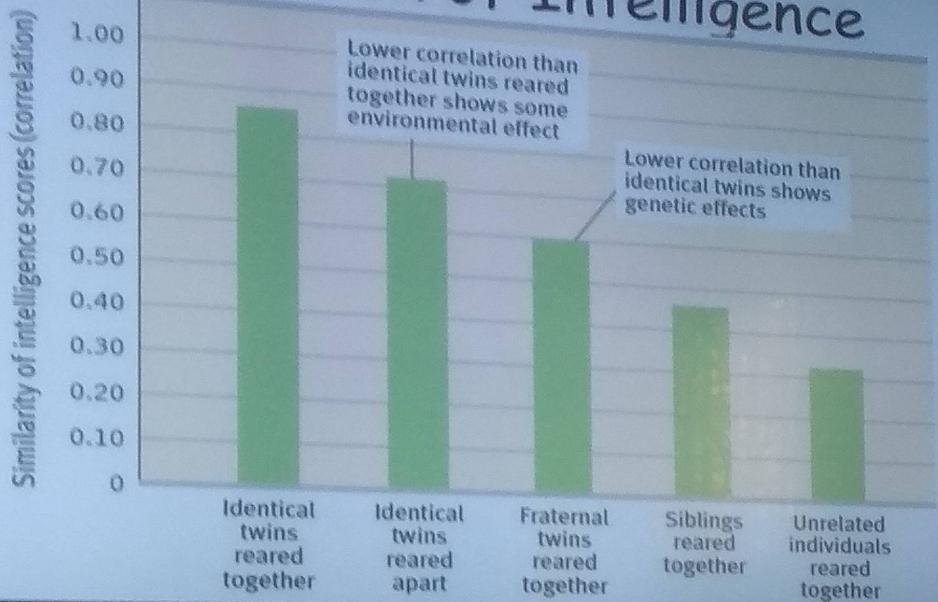
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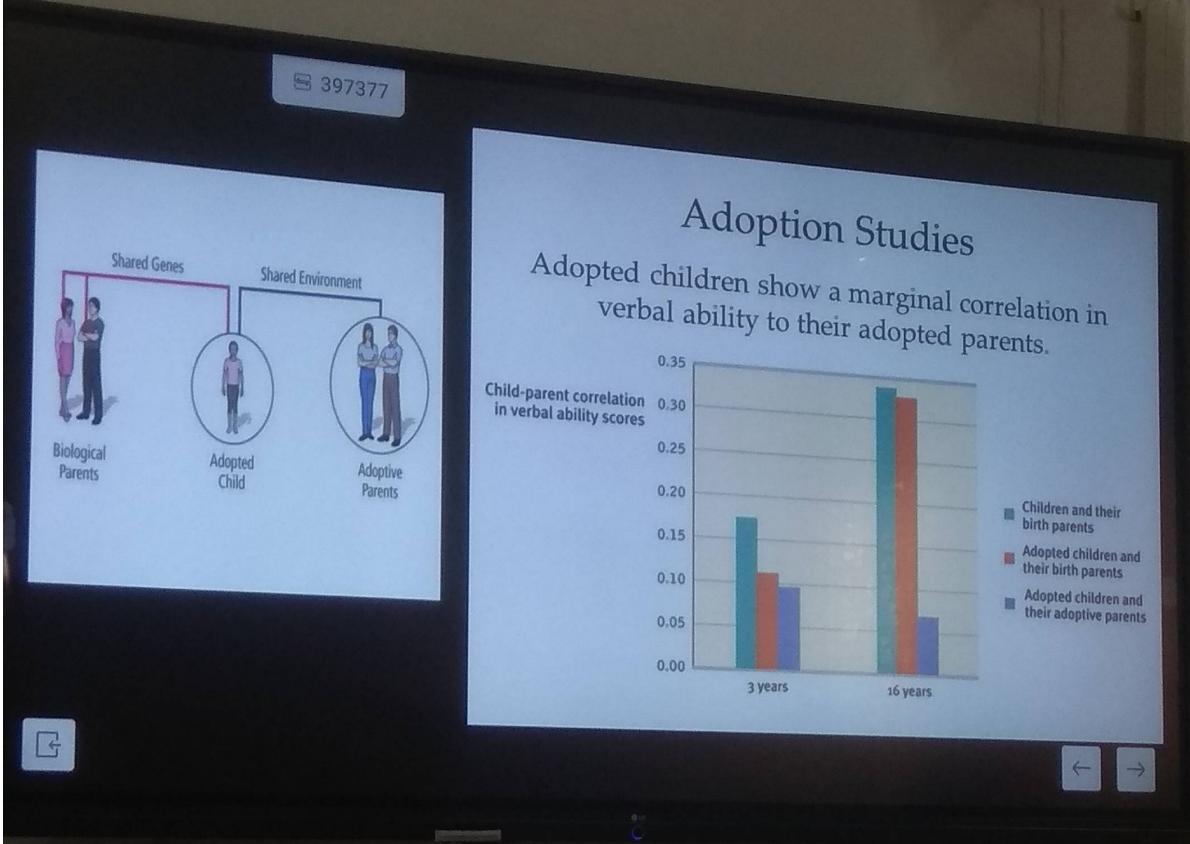


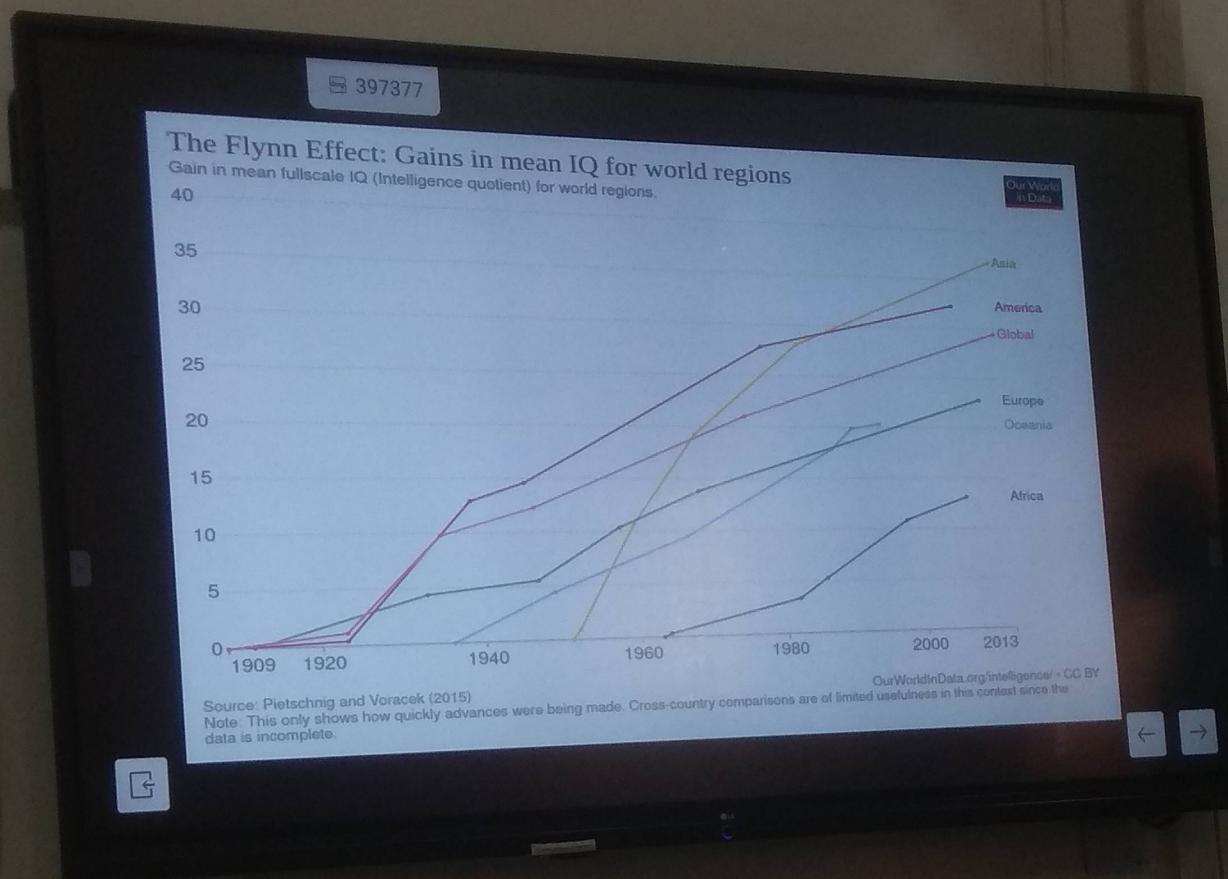
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Correlation of Intelligence







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Environmental Influence

- Environment Deprivation and Enrichment
 - *Absence of environmental stimulation may lead to decrease in IQ*
 - *Presence of favorable conditions seem to lift IQ*
- Intervention Program
 - *Begin early in life*
 - *Provide new learning experience*
 - *Broad in scope and matched to child's development*

135233

Gender Differences

- Small differences when compared on average
- Females better at spelling, writing and pronouncing
- Males do better spatial tasks, geometry and geography



SILENCE P

Artificial Intelligence

- Computers cannot think, they can be programmed to make them appear to be thinking
- Understanding Cognitive Processes
 - Insight into how people process information
 - Comparing human and computer performance relatively

135233

Artificial Intelligence

- Turing Test
 - External observer must be able to tell whether s/he talking to a computer or human
 - If the observer cannot distinguish, then computer has passed the Turing test
- Chinese Room Argument
 - A digital machine cannot have a mind, it is merely following instructions laid out in the program



