



'Intelligence'

Implicit theories of 'Intelligence'

Sternberg, Conway, Ketron, Bernstein (1981). Two studies...

Study 1:

61 people in a library, 63 in a supermarket, 62 waiting for a train

Categories:

Intelligence

Academic intelligence

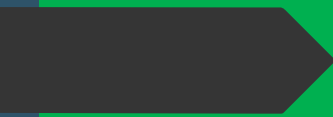
Everyday intelligence

Unintelligence.

Study 2:

122 participants.

How well each behaviours listed reflected aspects of intelligence.



Sternberg et al, 1981.

Findings: 3 Dimensions of Intelligence

1. **Practical Problem Solving**

Practical and Logical with problems.

Analyse situations and good decision making.

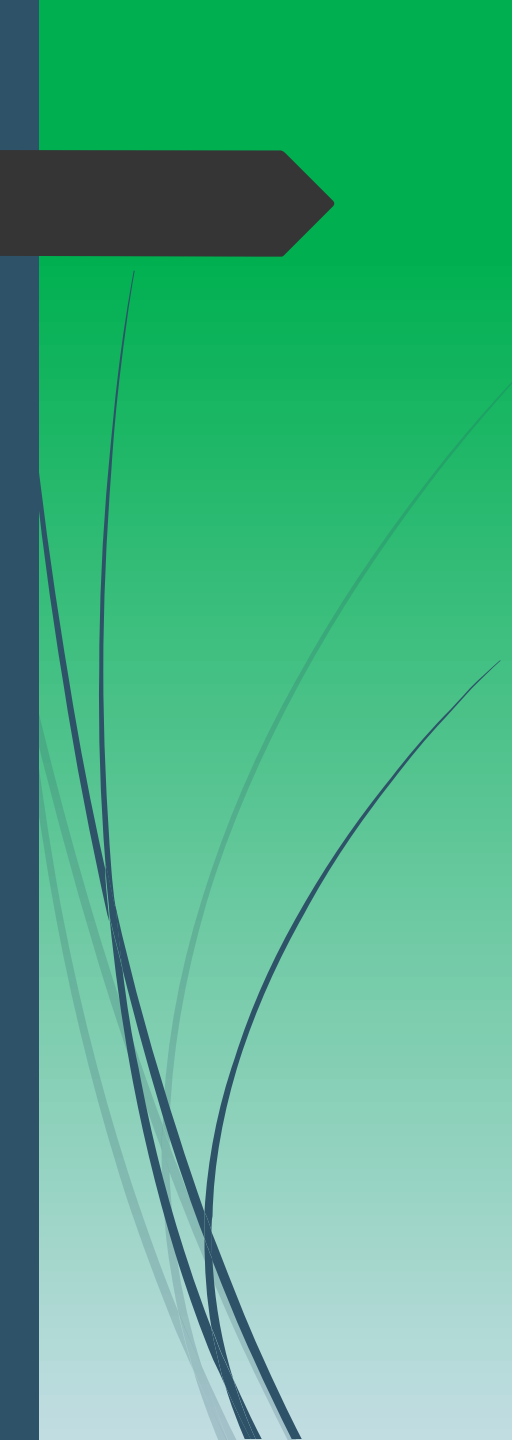
2. **Verbal Ability**

Ability to Express and converse with others.

Antonyms and Analogies.

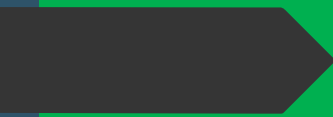
3. **Social Competence**

Skills necessary to be accepted and fulfilled socially.



Cultural Perspective

- Papadopoulos (2004).
- Western View of Intelligence.
 - Cognitive and Memory skills refer only to the individual.
 - Individualist cultures
- Eastern Cultures.
 - Social, historical and spiritual aspects of everyday interaction.
 - Collectivist cultures



Indian Culture

Baral and Das (2004)

High levels of **thinking, judgement** and **decision making** all important in intelligence.

How these aspects work together is critical.

Harmony of thought, self awareness and consciousness.

Also appreciation of others.

Politeness, interest in others, modesty.

Taiwanese Chinese

Yang and Sternberg (1997) - Five Factors

1. A **general cognitive factor** of intelligence.

Practical problem solving
Processing speed

2. **Interpersonal Intelligence.**

Relating to others.
Empathy and Politeness.

3. **Intrapersonal Intelligence.**

Knowledge about the self and
to view objectively.
e.g. meaning and purpose of
his/her life.

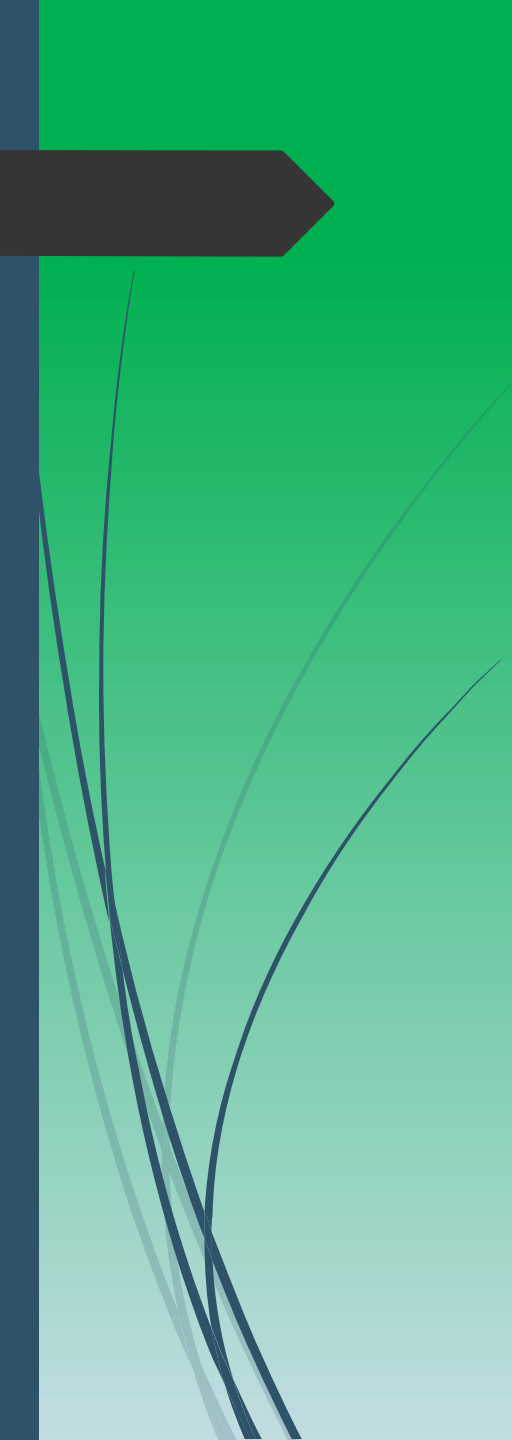
4. **Intellectual self assertion.**

Process for individual who are
confident and aware of their
intellect.

5. **Intellectual self-effacement.**

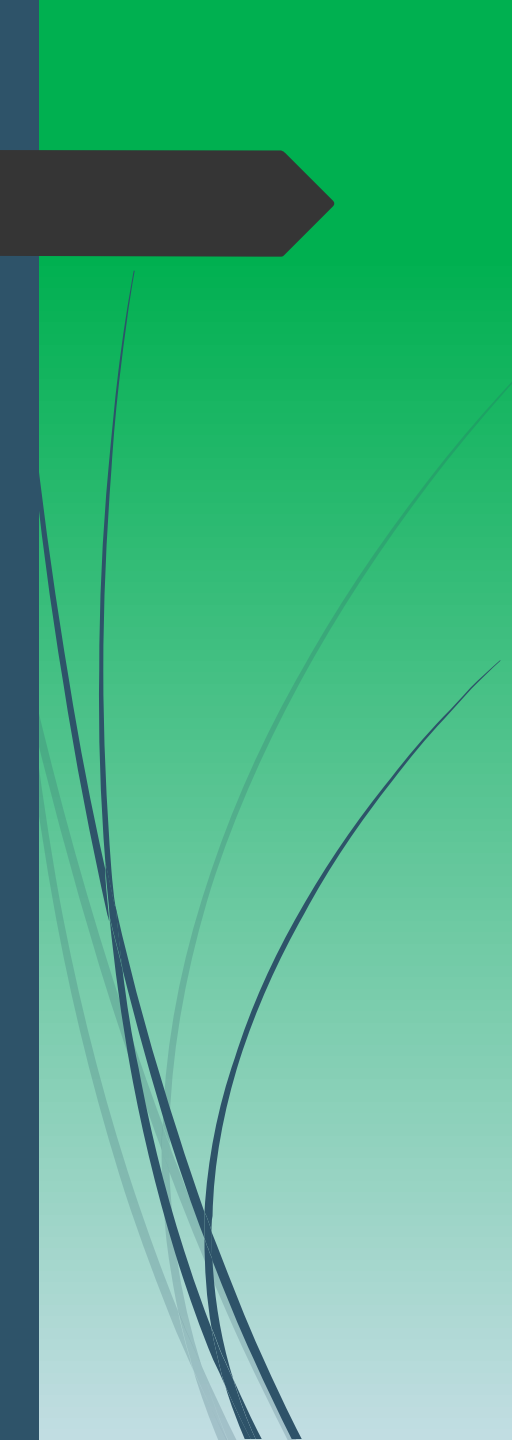
Refers to modesty or humility
surrounding intellect.

Talking at length, but only
about the topics that interest
him/her.



History of intelligence research

- Galton (1865): Central hypothesis - there are individual differences in intelligence
- Influenced by Darwinism
 - Genetic explanation for levels of intelligence (intelligence is hereditary)
 - Biological approach
- Influential in intelligence testing
- Heavily criticised approach – WHY?
 - Eugenics movement
 - Education and learning



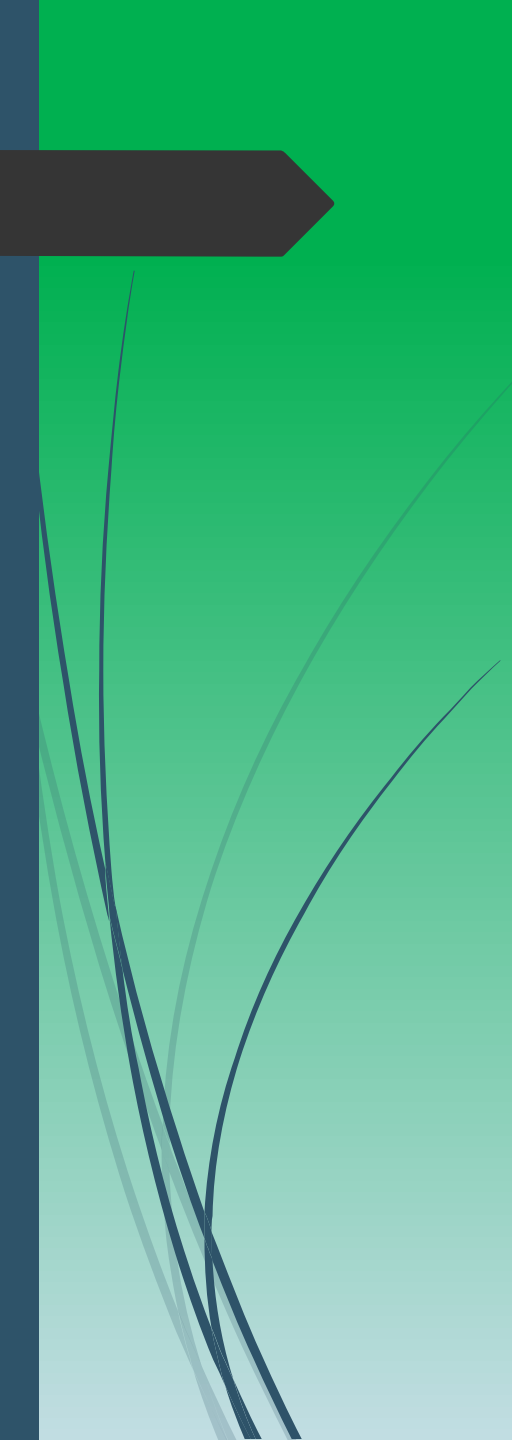
Psychometric Approach

- Underlies most definitions of intelligence
- 'Mapping' the structure of intellect
- Identifying mental competencies that underlie test performance
- Analysis of scores on intelligence tests (e.g. IQ – Intelligence Quotient)
- Factor analysis

Psychometric Approach

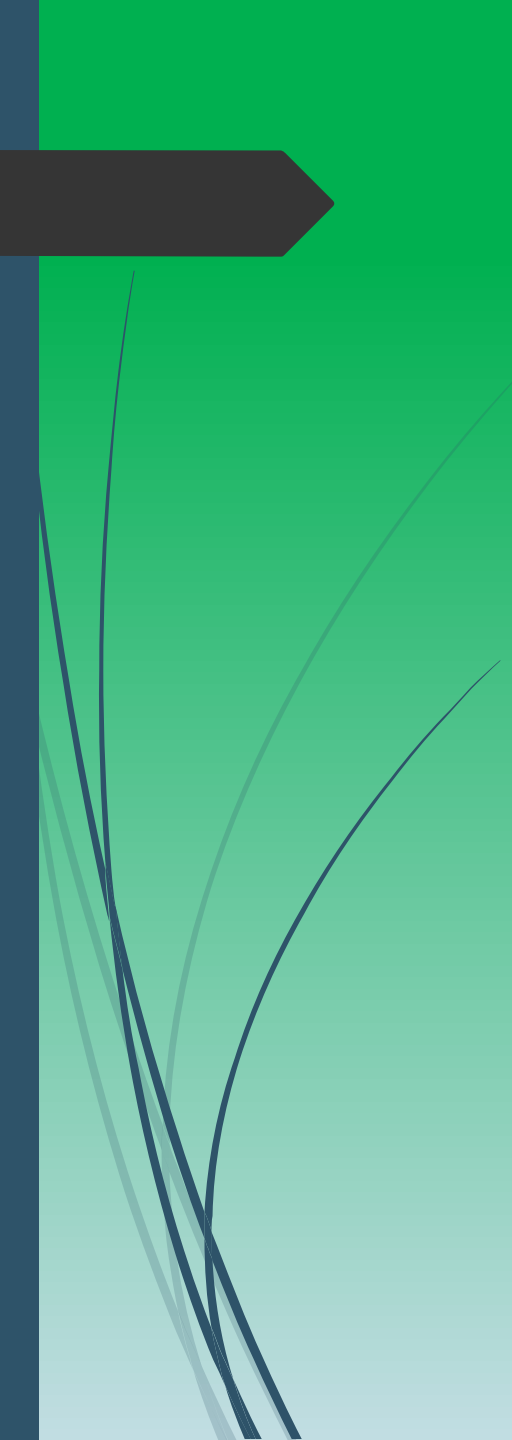
Spearman's (1923) two-factor theory

- Intellectual performance is determined partly by a general intelligence factor; the **'g' factor** - 'g' constitutes the core of intelligence
- Ability to reason and solve problems
 - Devised method of Factor Analysis
 - Argued that a person does well in one test, they will do well on another – although tests often examine different abilities
 - Important predictor of both academic and job performance
- 'g' considered the most important factor – underlies all abilities



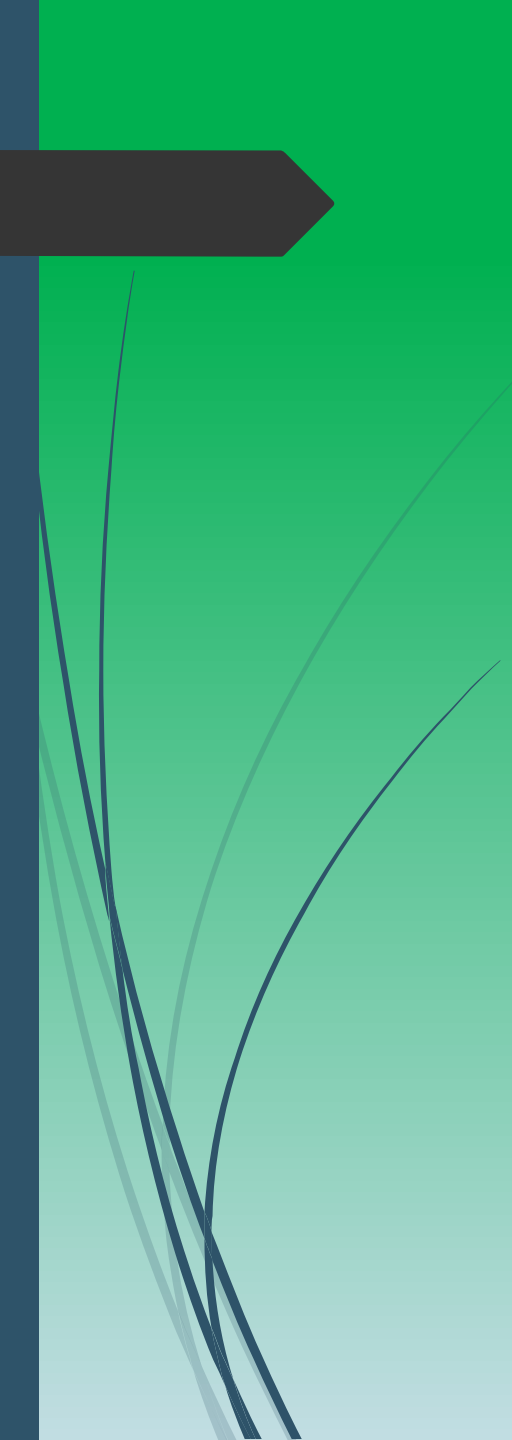
The Psychometric Approach: Spearman

- ▶ Intelligence also determined by whatever specific abilities might be required to perform a particular task; the '**s**' *factor*
- ▶ Learned and acquired in the environment
- ▶ Positive manifold: each type of intelligence needed to perform well on different tests.
 - ▶ e.g. Mathematic ability, Language comprehension etc.
- ▶ G'' implicated in all positive correlations between abilities
 - ▶ e.g. maths



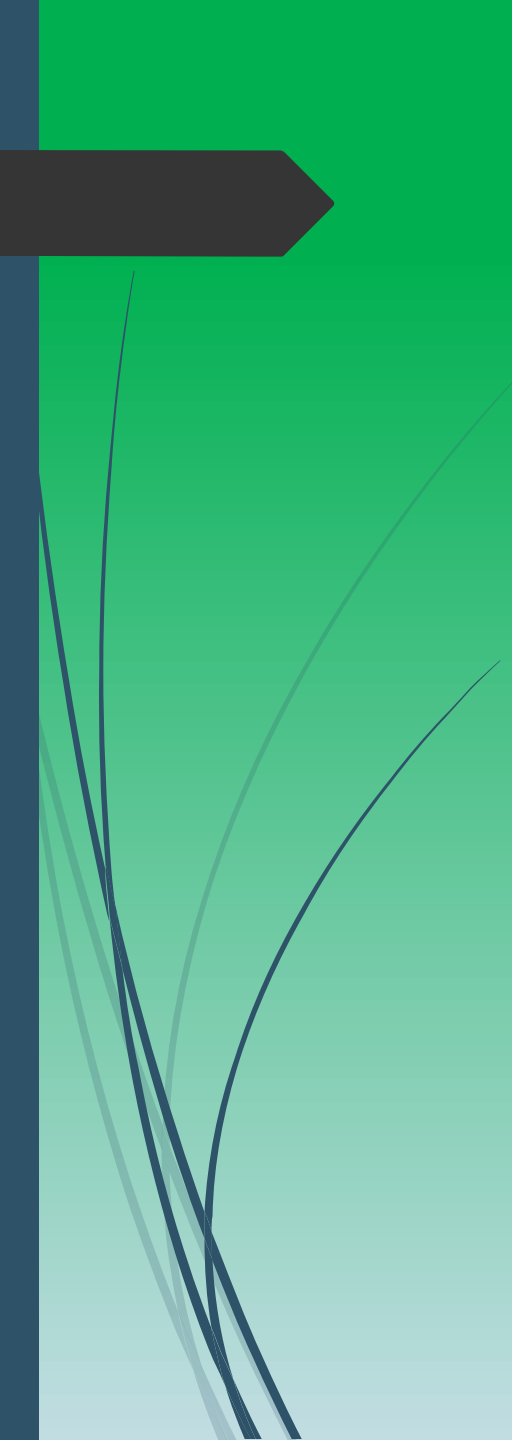
The Psychometric Approach: Thurstone:

- Concept of 'Primary Mental Abilities'
- Spearman had shown that intelligence tests correlated positively
- Thurstone challenged Spearman's conceptualisation of 'g' factor: due to only moderate correlations between different mental tasks
- Agreed on a "g" factor - but saw "g" differently.
- 'g' results **from**, rather than lies behind seven distinct abilities – primary mental abilities



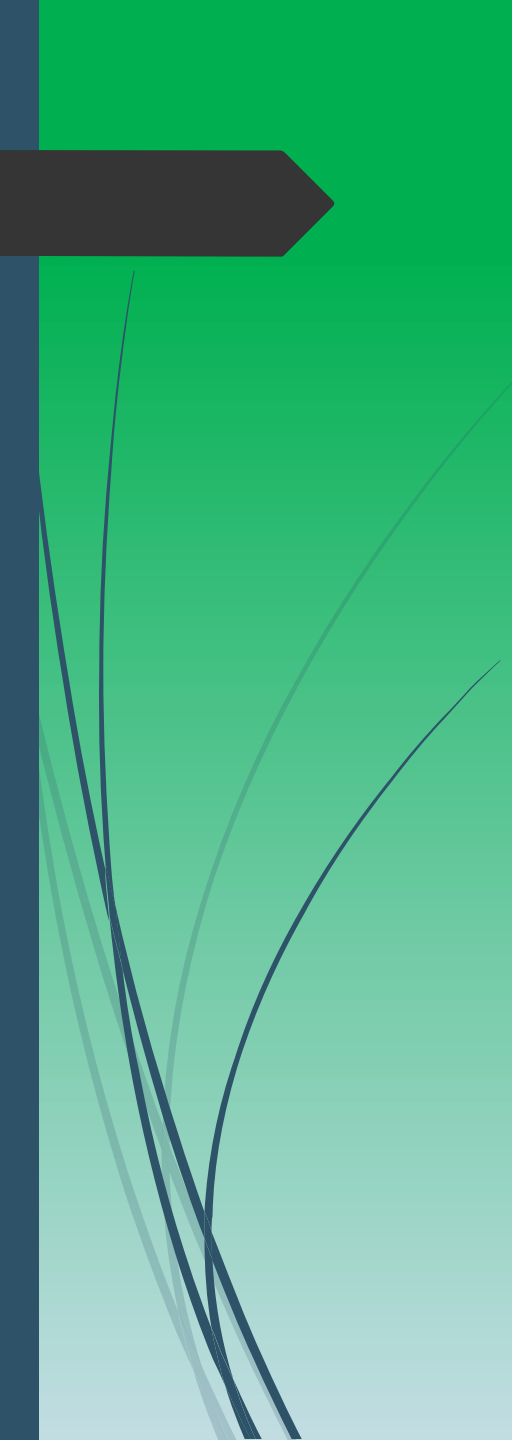
The Psychometric Approach: Primary mental abilities

1. Memory
2. Numerical Ability
3. Perceptual Speed
4. Reasoning
5. Spatial Ability
6. Verbal Meaning
7. Word Fluency



The Psychometric Approach: Horn-Cattell: Two factor theory

- Acknowledged Spearman's General Intelligence concept ('g')
- 'g' comprises of 2 related but distinct components
 - **Crystallized** intelligence
 - **Fluid** intelligence
- Dynamic relationship between the two components



The Psychometric Approach: Crystallized Intelligence

The ability to apply previously acquired knowledge to current problems

- Examples: vocabulary tests, information tests
- Based on the ability to retrieve previously learned information from long-term memory
- Knowledge expands during the lifetime
- Performance on crystallized intelligence tests tends to improve during adulthood and remains stable into late adulthood

The Psychometric Approach:

Fluid intelligence

Ability to deal with novel problem-solving situations for which personal experience does not provide a solution

e.g. Tower of Hanoi

<https://youtu.be/JvQtzzgL5Kg>

- Involves inductive reasoning and creativity
- Required the abilities to reason abstractly, think logically, and manage information in working memory
- Performance on fluid intelligence tests begins to decline as people enter late adulthood

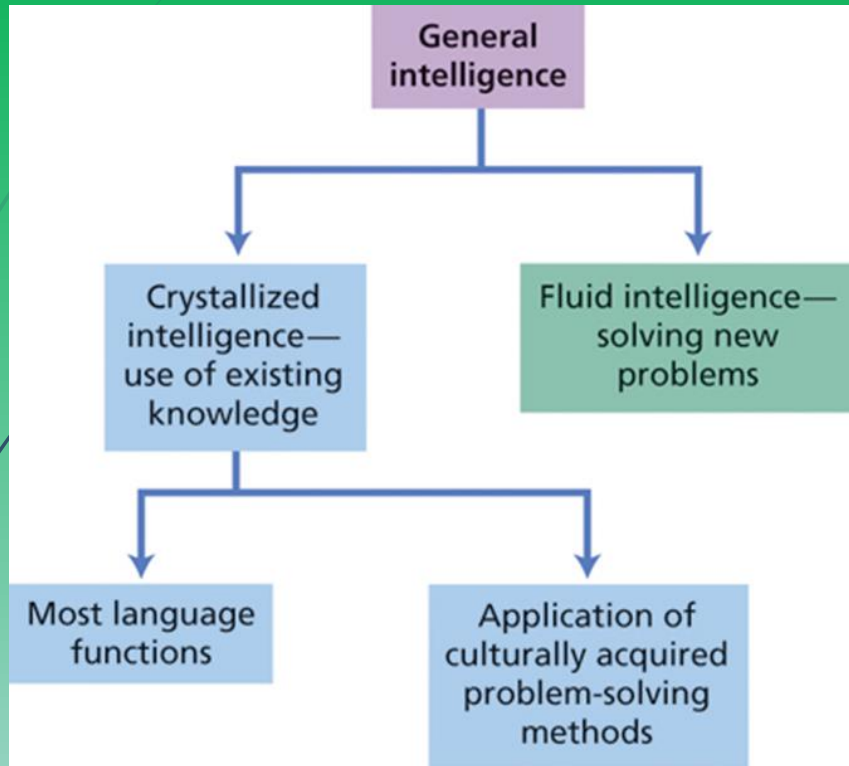


The Psychometric Approach:

Carroll's (1993) Three stratum model

- Integrative model of intelligence
 - Contains elements of Spearman's, Thurstone's and Cattell-Horn's models
- Hierarchical model - three levels of mental skill: general, broad and narrow
 - Stratum III - General Intelligence (g factor)
 - Stratum II – Fluid and crystallised intelligence, general memory and learning, broad visual perception, broad retrieval ability, broad cognitive speediness, processing speed (reaction/decision speed)
 - Stratum I – Specific cognitive, perceptual and speed tasks used in studies of cognitive ability
- Carroll – model encompasses almost all known cognitive abilities

The Psychometric Approach



(Cattell and Horn, 1971; 1985)

- Psychometric approaches are statistically sophisticated ways of:
 - providing a **map** of the mind
 - describing **how** people are different from one another

But they do not explain **why** people vary in these mental skills

Information Processing Approach

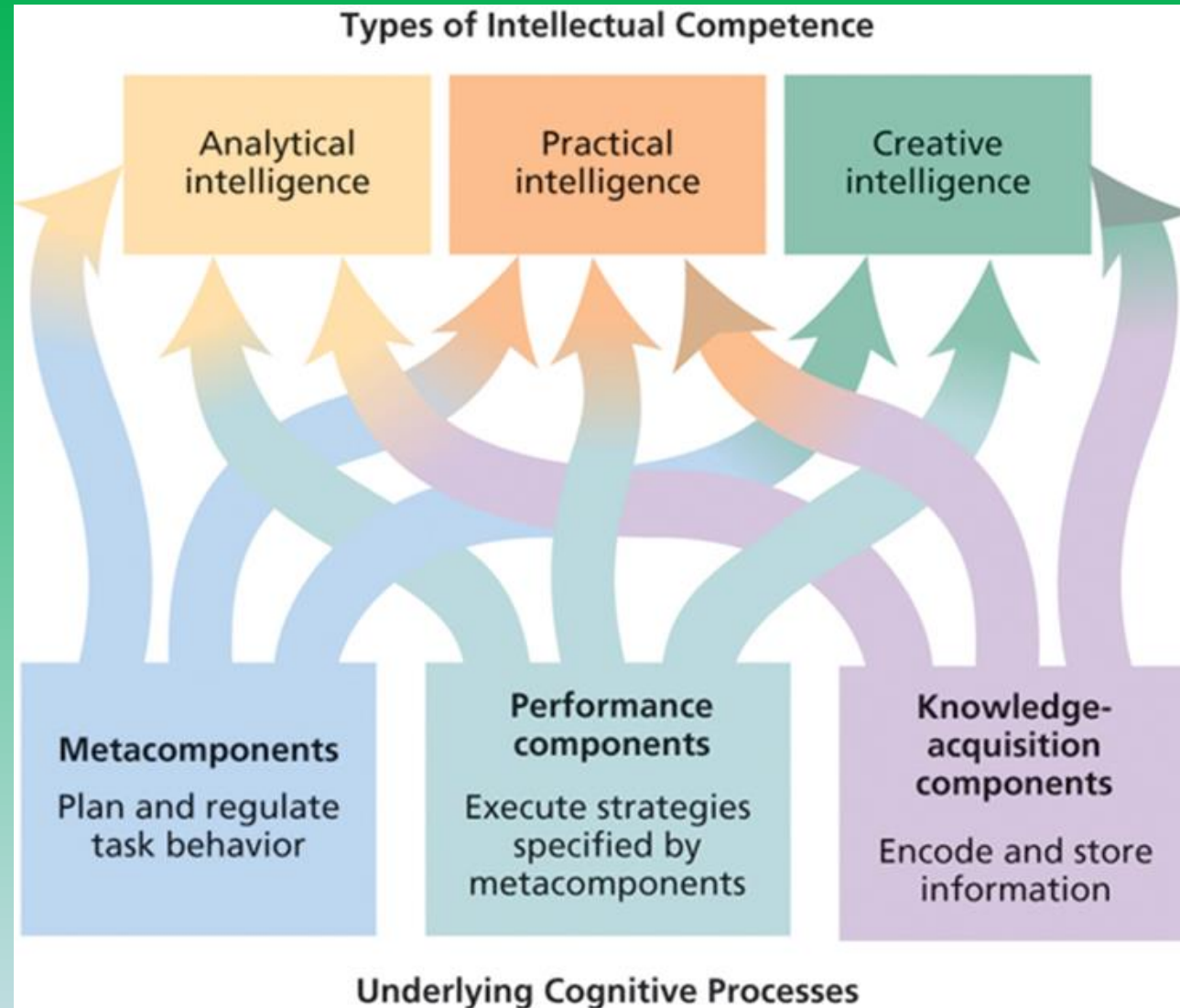
Explores specific information-processing and cognitive processes that underlie intellectual ability

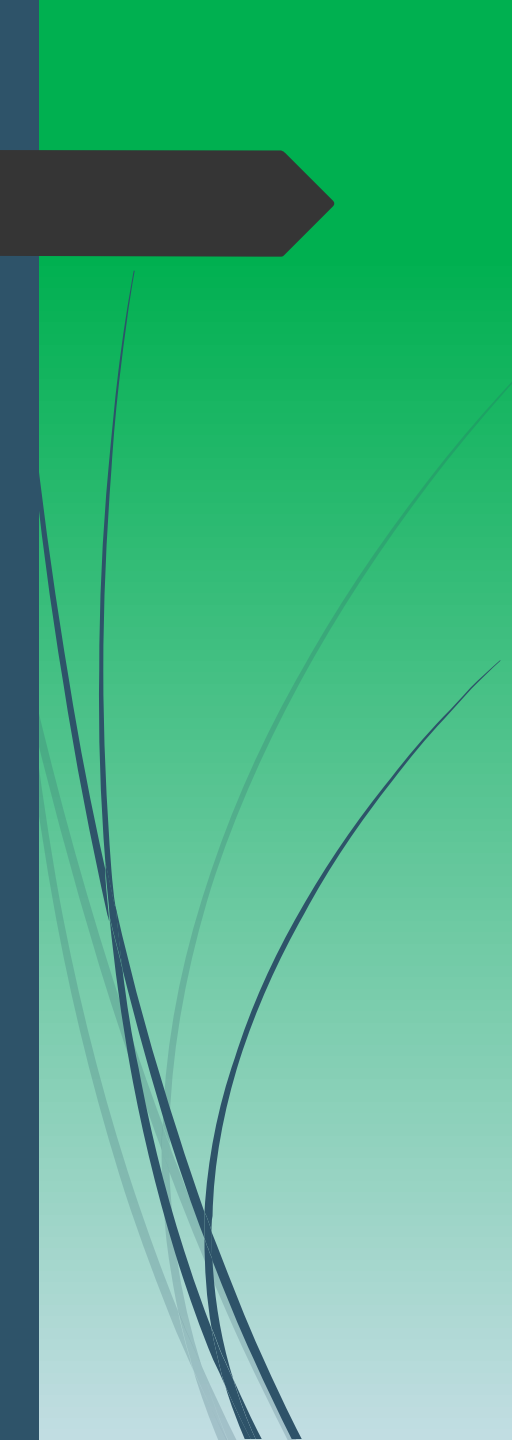
Sternberg's Triarchic Theory of Intelligence

- Addresses both the psychological processes involved in intelligent behaviour and the diverse forms that intelligence can take
- Divides cognitive processes into three specific components:

Metacomponents	Performance components	Knowledge-acquisition components
The higher-order processes used to plan and regulate task performance	The actual mental processes used to perform the task	Allow us to learn from our experiences, store information in memory and combine new insights with previously acquired information

Information Processing Approach





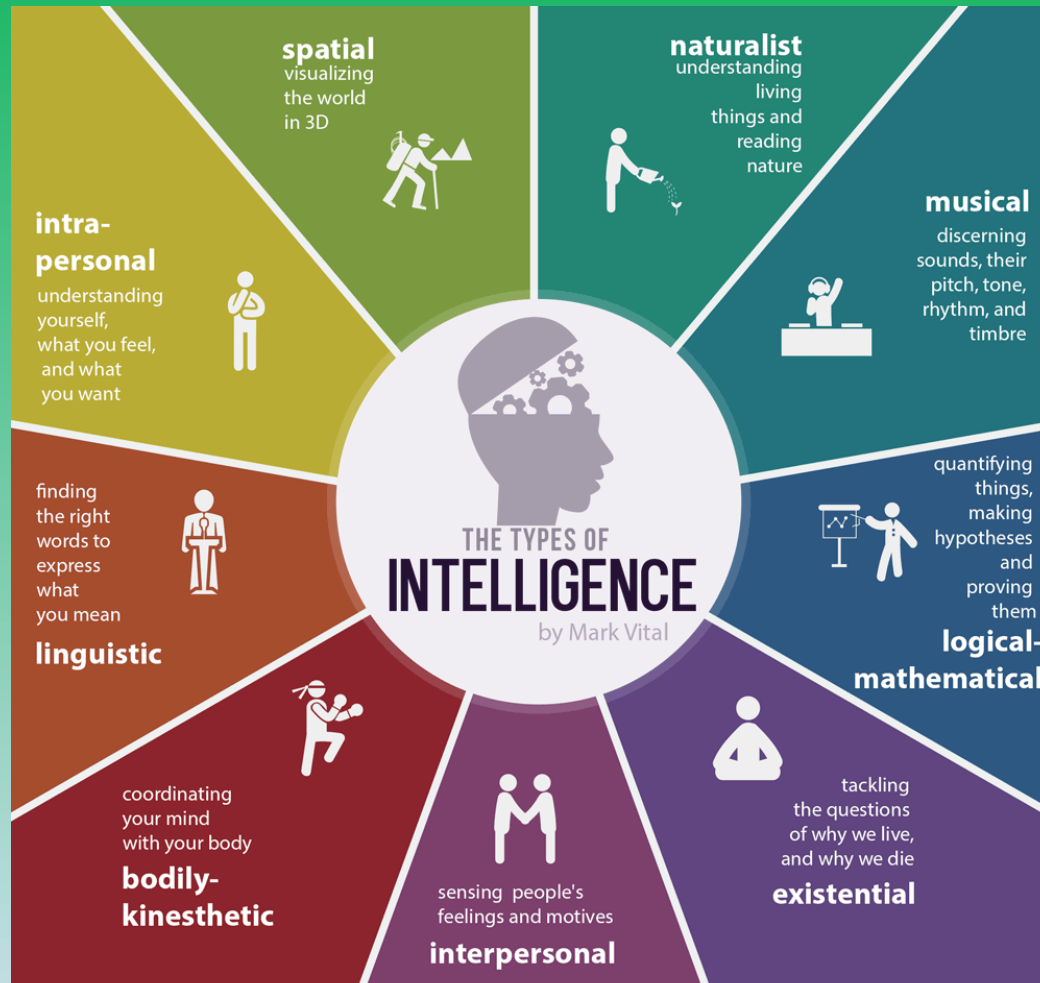
Systems Models:

Gardner: Multiple Intelligences

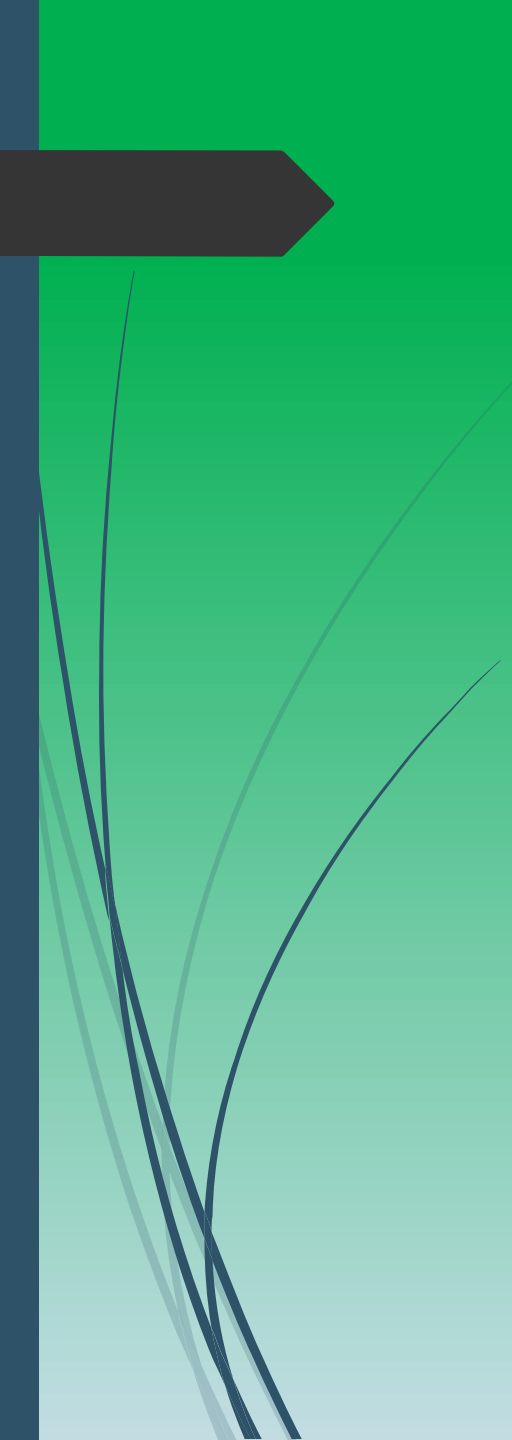
- Argues people are not born with all of the intelligence they will ever have
- 'Intelligence' can be learned throughout life
-
- People can develop each aspect of intelligence to an average level of competency
- Gardner: Intelligence is the ability to solve problems or fashion products that are valuable in one or more cultural settings.

Systems Models:

Gardner: Multiple Intelligences

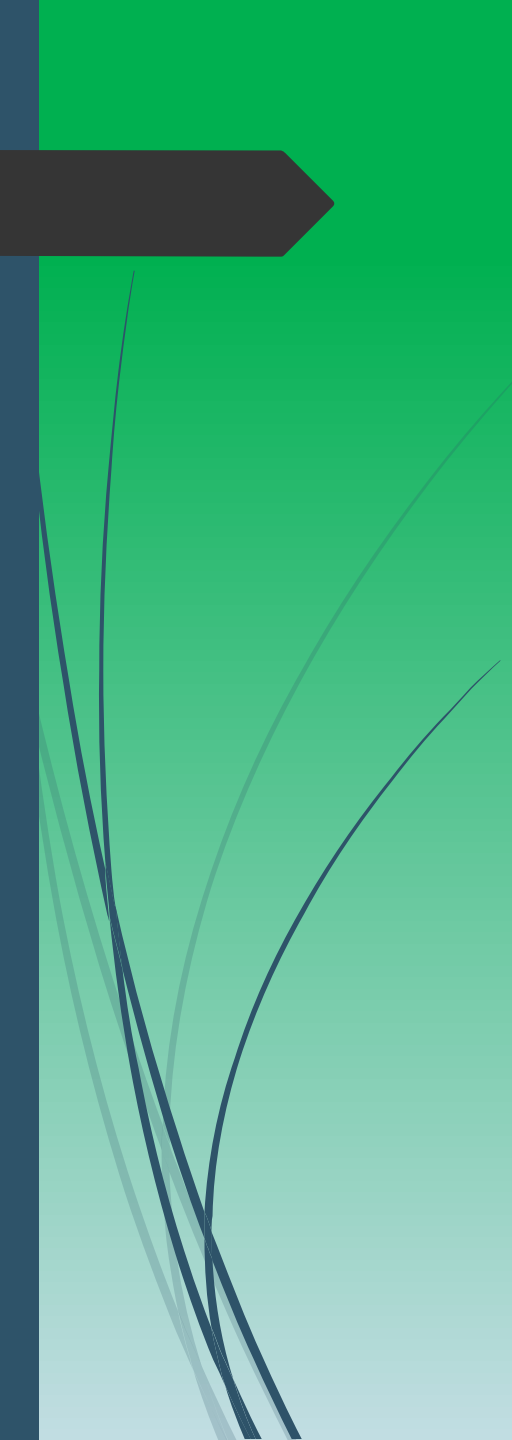


- Linguistic
- Logical-mathematical
- Musical
- Spatial
- Bodily-kinaesthetic
- Interpersonal
- Intrapersonal
- Naturalistic
- Existential



Principles of Gardner's Multiple Intelligences Theory

- ▶ Intelligence is not singular - intelligences are multiple
- ▶ The use of one of the intelligences can be used to enhance another intelligence (e.g. spatial and bodily-kinaesthetic)
- ▶ Every person is a unique blend of dynamic intelligences.



Defining multiple intelligences: criteria

- Each of the intelligences has been tested using various measures not necessarily associated with intelligence
- Each of the intelligences can work without the others being present
- Each of the intelligences has a set of identifiable operations
- Each of the intelligences can be symbolized or has its own unique symbol or set of symbols

Linguistic Intelligence?

- Gardner's definition:

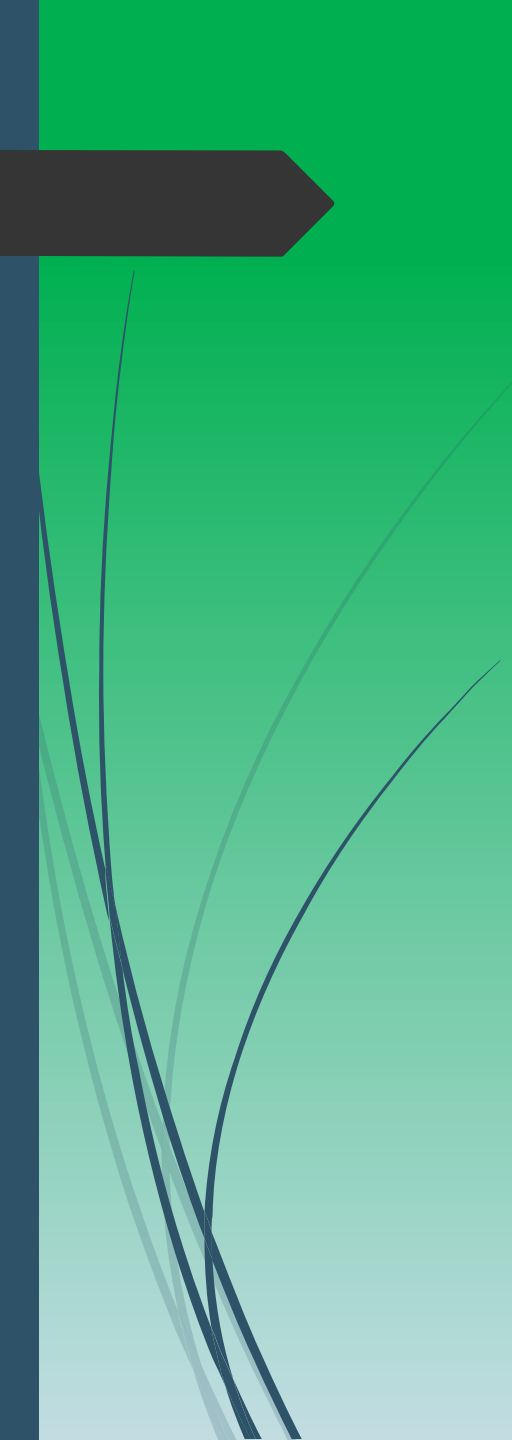
Linguistic intelligence is the capacity to use language, your native language, and perhaps other languages, to express what's on your mind and to understand other people.

- Gardner: Linguistic Intelligence

- Can understand words and manipulate the structure of language
- Has highly developed communication skills including writing, speaking, and story-telling
- Knows and correctly uses rules of grammar
- Enjoys reading, writing, and speaking
- Has a large vocabulary

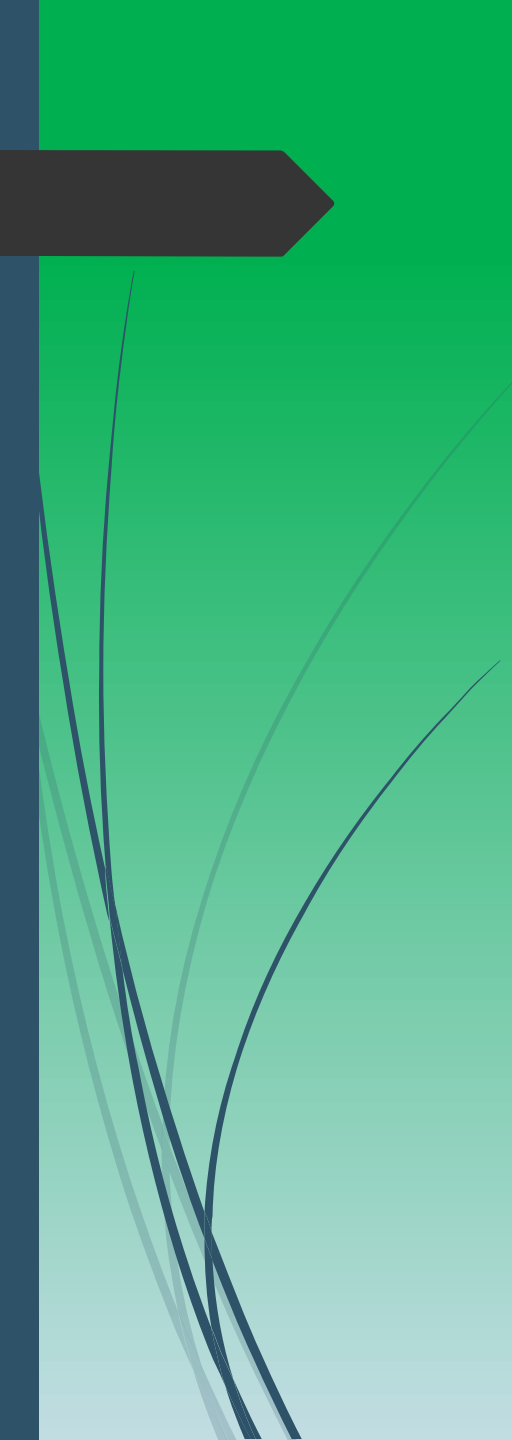
Logical-mathematic Intelligence

- The capacity to use numbers effectively and reason rationally/logically
- Ability to see cause and effect clearly
- Ability to identify a problem and work systematically on a solution.
 - Categorization
 - Classification
 - Inference
 - Generalization
 - Calculation
 - Hypothesis testing



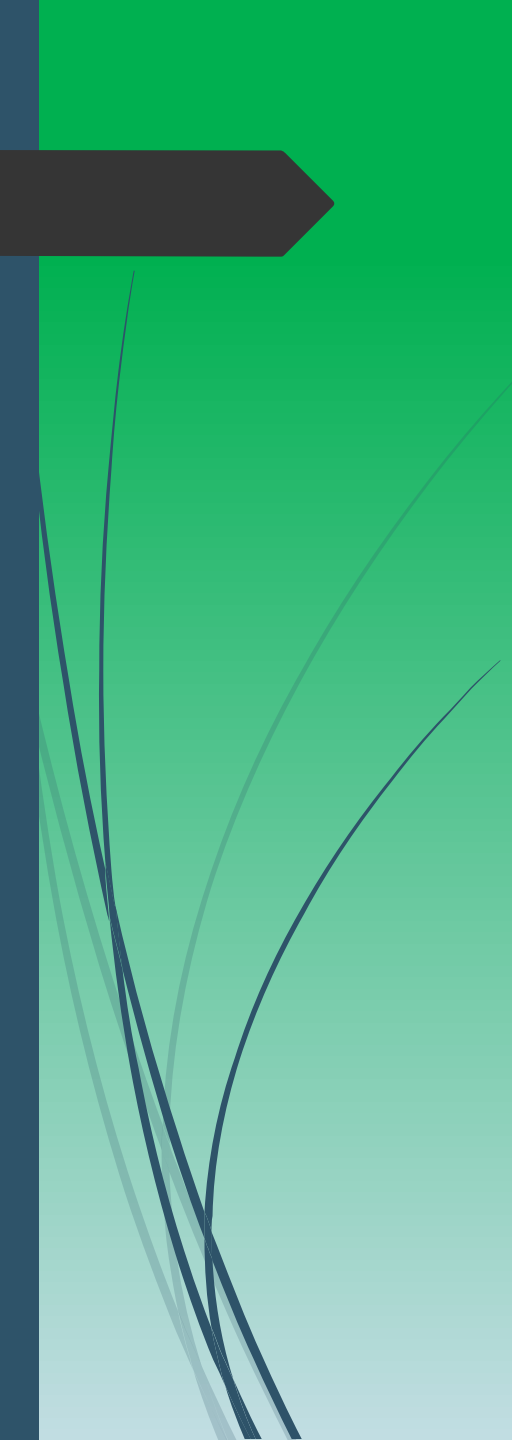
Spatial Intelligence?

- The brain's ability to perceive and interpret visual stimuli - how our minds process what we see
- Important ability:
 - e.g. the arts - the ability to transfer a vision to a painting, sculpture, or film is a key quality
 - e.g. architecture - transferring a vision of a structure into a blueprint
 - Envisioning your route home, the layout of a room etc.



Bodily-Kinaesthetic?

- Expertise in using one's whole body to express ideas and feelings
 - e.g. acting, dancing, sports, and using body language
- The ability to use one's hands to produce or transform things
 - E.g. sculpting clay and hands-on learning



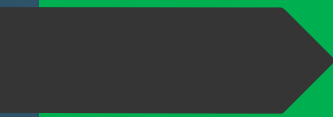
Musical Intelligence?

- Ability to distinguish sounds and the ability to make your own melodies

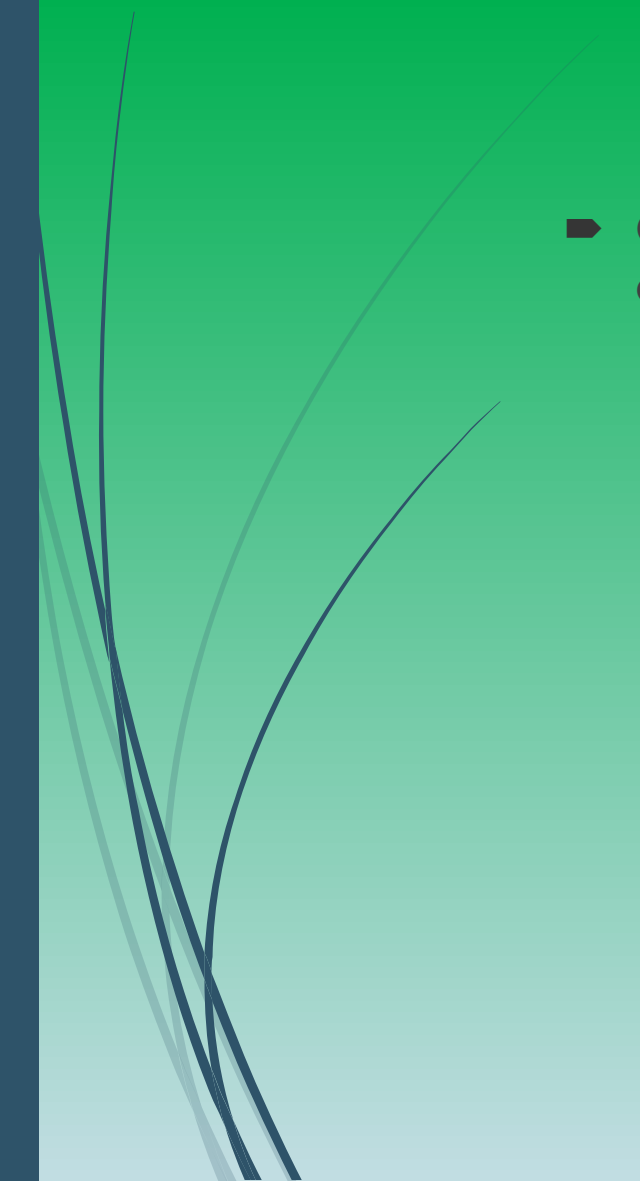
- Ability to...

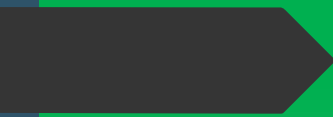
- Perceive
- Discriminate
- Transform
- Express

...all kinds of musical forms



Interpersonal intelligence?

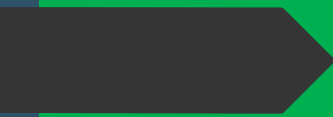
- Gardner's Definition: Ability to understand others and interact with a variety of people effectively with a level of ease
- 



Intrapersonal intelligence

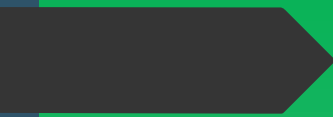
- Self-knowledge and ability to act adaptively on the basis of that knowledge.
- Recognising an accurate picture of oneself (strengths and weaknesses)
- Awareness of inner moods, intentions, motivations, temperaments, and desires
- Capacity for self-discipline, self-understanding, and self-esteem.

How well you know yourself



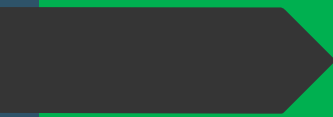
Naturalistic Intelligence?

- Ability to discriminate amongst living organism
- Knowledge of plants, animals etc. What is poisonous etc.
- Sensitivity to other features of natural world – e.g. clouds, rock formation
- Our evolutionary past
- Bacteriologist / Virologist

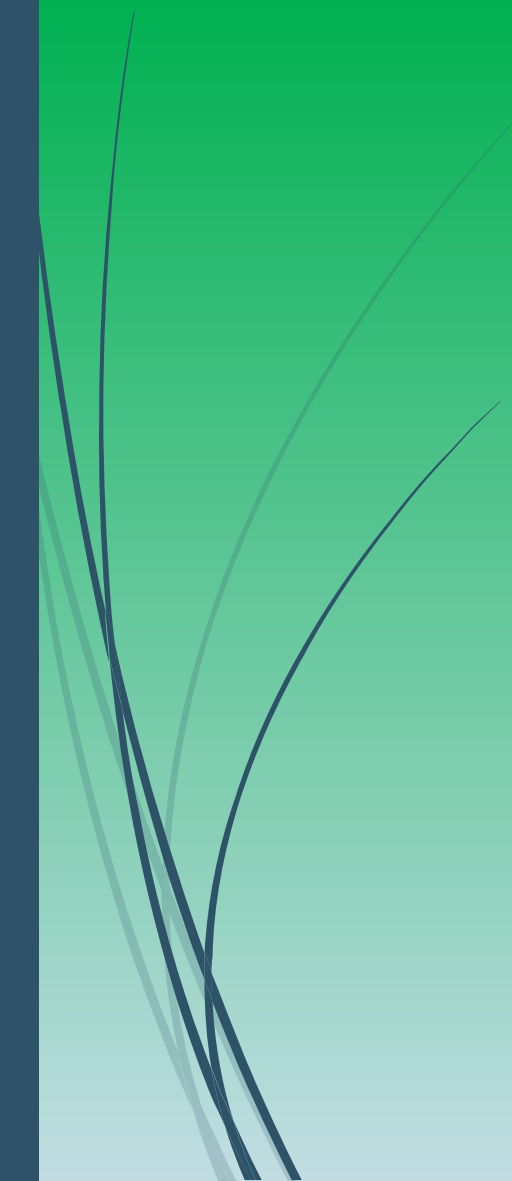


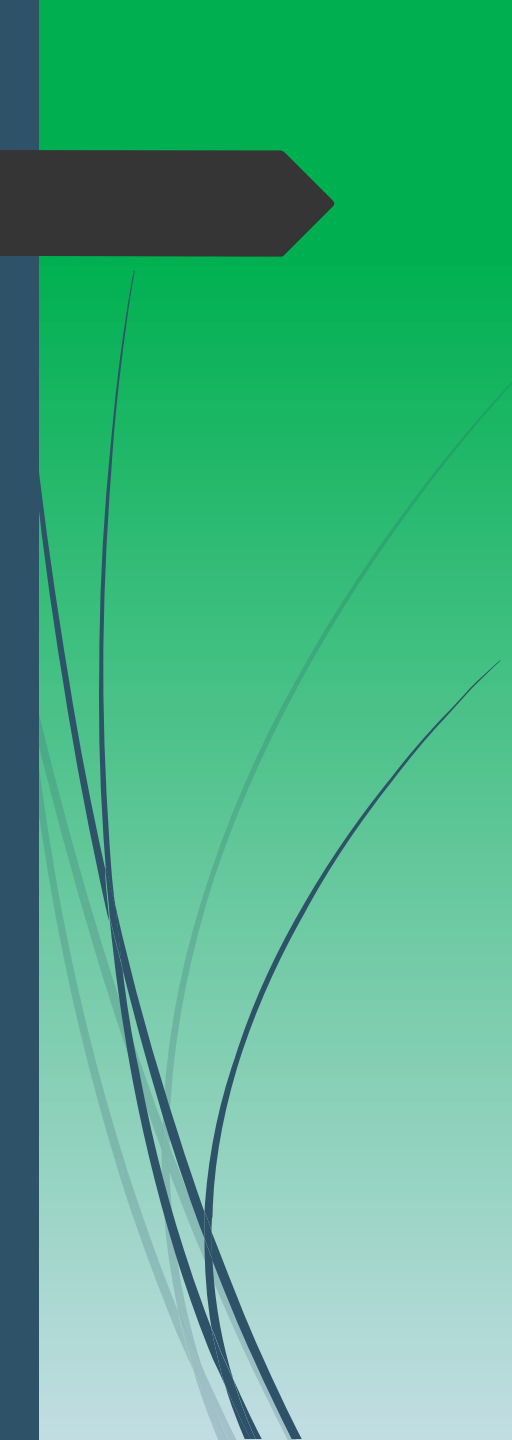
Existential Intelligence

- Also known as Moral Intelligence.
- Sensitivity to handle and tackle deep questions about human existence.
 - Meaning of life?
 - Why are we here?
 - How did we get here?



Biological Models

- Speed of processing
 - Electrical -speed of conduction of neural impulses
 - Metabolic
- 



Influences on development of intelligence

- Genetics
- Environment - **Such as?**
 - Womb environment
 - Socio-economic status
 - Nutrition
 - Responses of others (encouragement; stimulation)
 - Opportunities (e.g. environment; education; physical health/ability)
 - Mental and physical experiences

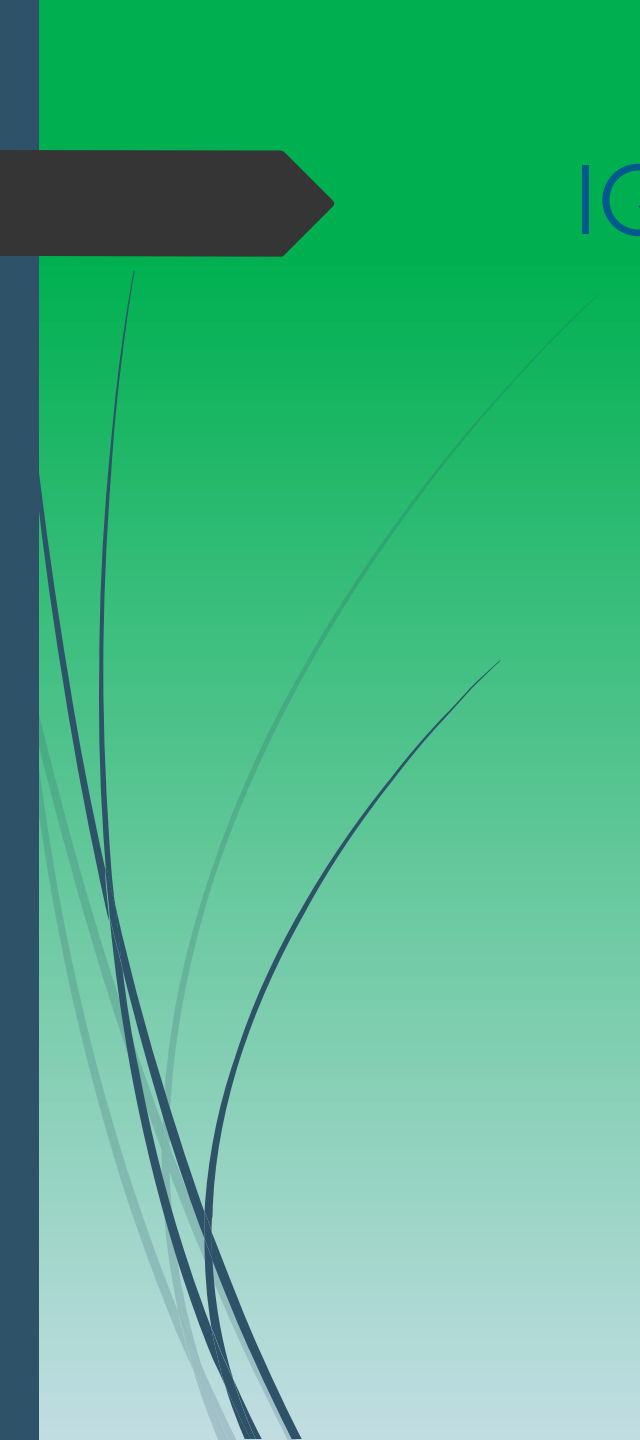


Measuring Intelligence: Binet-Simon scale (1905)

- First intelligence test.
- Identify children who might require special education – ‘mentally deficient’.
-
- 30-item scale – norms based in just 10 cases (age groups 3, 5, 7, 9, 11)
- Items ordered in increasing order of difficulty – presented to all age groups
- Revisions – 1908, 1911

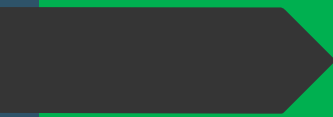
Stanford-Binet test (1915)

- Lewis Terman - Adapted Binet-Simon test to suit American Children.
- Aged range 4-16.
- Used the concept of Intelligence Quotient (IQ: proposed by Stern, 1912).
- Three classes of scores : <90; 90–109; 110+
- Validity and Reliability: correlation between IQ score and grade progress



IQ

- Intelligence Quotient (IQ): $\text{Mental age} / \text{Chronological age} \times 100$
- E.g.
- Mary is 5 years old and has a mental age of 6 years
- $\text{IQ} = 120$
- John is 5 years old and has a mental age of 3
- $\text{IQ} = 60$



Further tests.

- Increase in demand for intelligence tests.
- Yerkes (1917).
- Develop tests for the Army to assess potential recruits.
 - Focus on 'common sense' intelligence.
- Current tests time intensive.
 - Army Alpha Test
 - Army Beta Test

Army Alpha Test

Examined knowledge in both oral and written language (verbal skills)

1. Follow Oral Instructions
(Comprehension)

2. Solve Arithmetical Problems

3. Show practical judgments – making the correct choice.

4. Use synonyms and antonyms.

5. Rearrange disarranged sentences.
E.g. "bumped door the head cat went the it's and through

6. Complete a series of numbers.

7. Analogies.

8. Demonstrate everyday knowledge.

Army Beta Test

Comparable to the Alpha test but focus not on the English Language.

1. Complete a maze
– find quickest route.

2. Cube analysis.

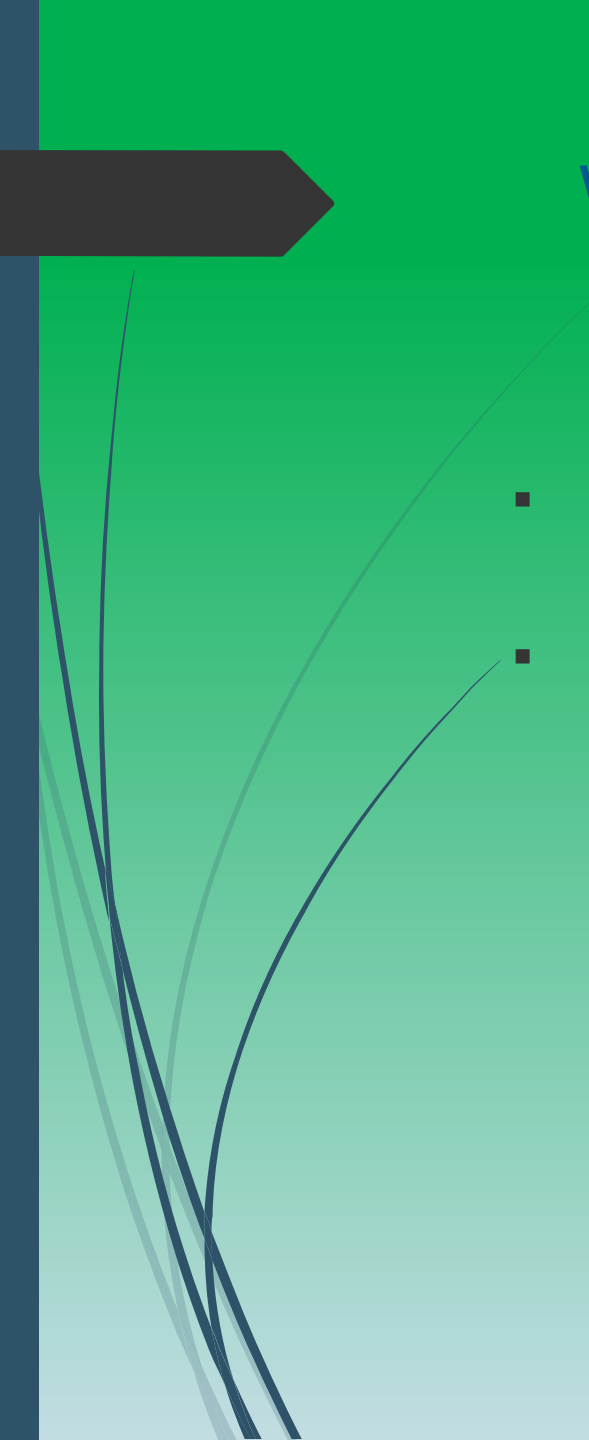
3. Sight – left to right
sequences X-O.

4. Matching numbers
to symbols.

5. Similar test but with
Digits and not
number figures.

6. Jigsaw like test.

7. Geometric
construction –
mentally rearranging
graphs to construct a
figure.



Wechsler

- Wechsler (1939) developed an intelligence test for adults
- Wechsler tests are now in their fourth/fifth editions
- **Wechsler Adult Intelligence Scale–IV (WAIS-IV)**
- **Wechsler Intelligence Scale for Children-V (WISC-V)** for children 6 to 16
- **Wechsler Preschool and Primary Scale of Intelligence (WPPSI)** for children 4 to 6

WAIS and WISC

- Both WISC and WAIS contain a number of subtests.
 - Verbal.
 - Performance.
- WISC child specific'
 - Cognitive Abilities
 - Gifted Children
 - Learning Difficulties

Subtests

Verbal Scale

- Five Mandatory Subtests
 - Information
 - Similarities
 - Arithmetic
 - Vocabulary
 - Comprehension
- One Supplementary Test
 - Digit Span: can be substituted for one of the other tests - only if the data from a mandatory subtest is missing or invalidated.

(Kamphaus, 1993)

Subtests

- **Performance Scale**

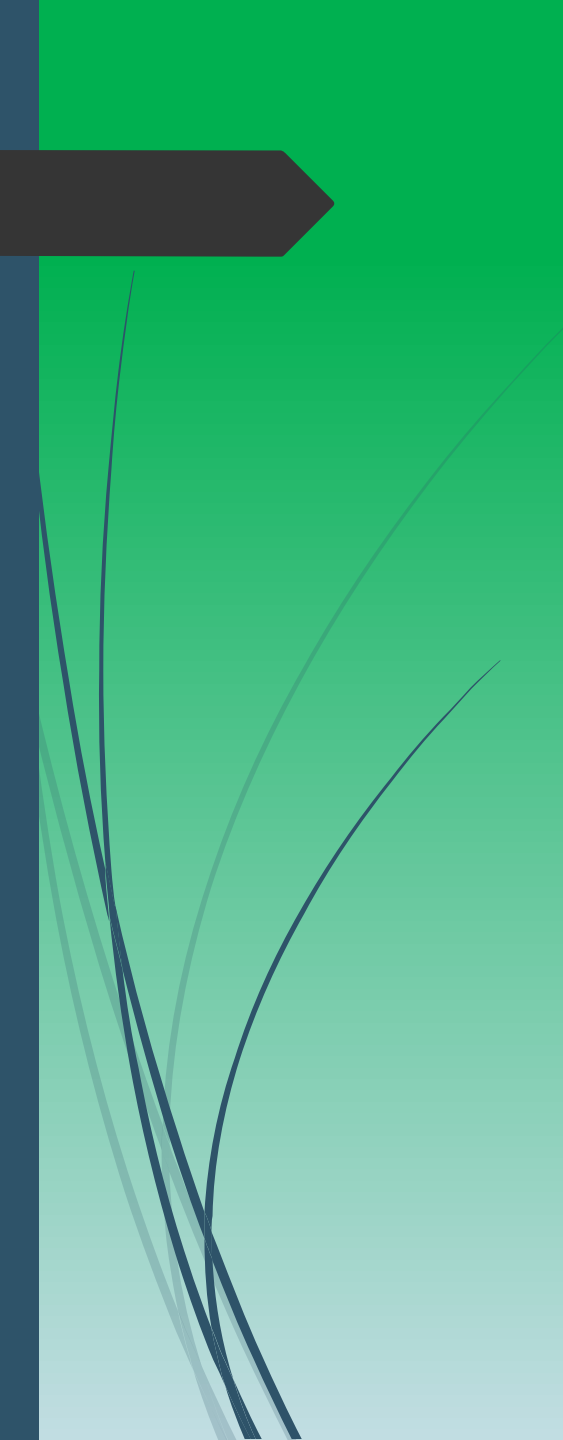
- Five Mandatory Subtests

- Picture Completion
 - Picture Arrangement
 - Block Design
 - Object Assembly
 - Coding

- Two Supplementary Subtests

- Mazes: can be substituted for any of the mandatory subtest if the data is missing or invalidated.
 - Symbol Search: can only be substituted for the Coding subtest.

(Kamphaus, 1993)



Wechsler and Stanford-Binet: Differences

- 1. Wechsler's testing could be applied to all ages
- 2. The scoring
 - Deviation IQ – deviation from average IQ score (100) (Wechsler)
 - $\text{Actual Test Score} / \text{Expected score for someone that age} \times 100$ (Stanford-Binet)

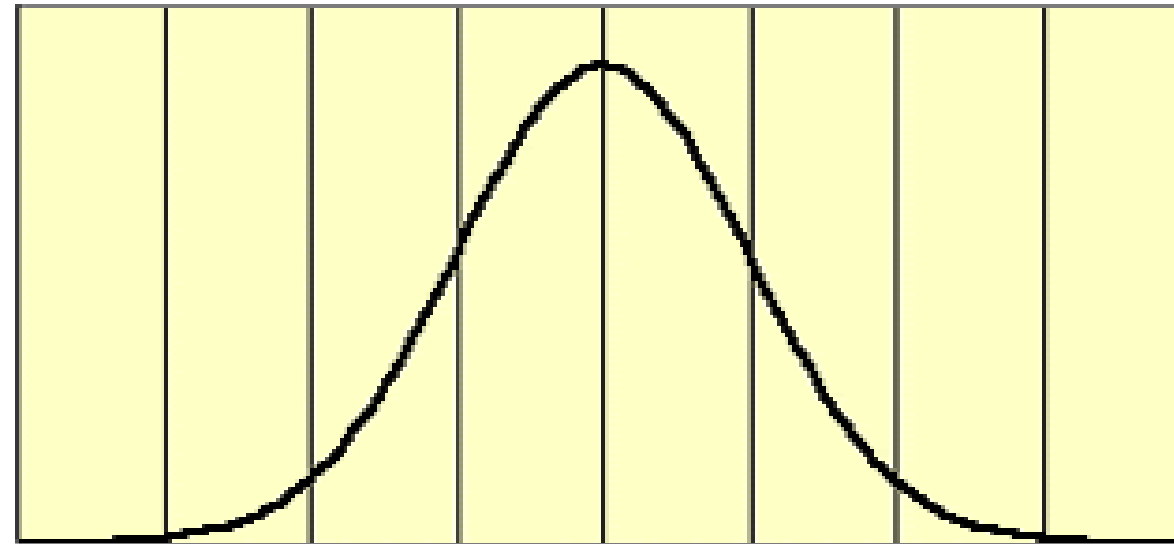
Distribution Curve.

IQ Comparison Site

<http://members.shaw.ca/delajara/>

Copyright 2002 Rodrigo de la Jara

IQ Normal Curve



Standard Deviations	-4	-3	-2	-1	0	1	2	3	4
Wechsler IQ	40	55	70	85	100	115	130	145	160
Stanford-Binet IQ	36	52	68	84	100	116	132	148	164
Cumulative %	0.003	0.135	2.275	15.866	50.00	84.134	97.725	99.865	99.997

Intelligence testing: Issues

- Two major problems with the design of intelligence tests.
- No clear, operationally defined concept of 'intelligence'
- Designing a test that is not partially an achievement test
 - Achievement tests measure an acquired skill or knowledge.
e.g. school tests
 - Aptitude tests measure natural talents and abilities.
e.g IQ tests

Testing Intelligence: cultural bias

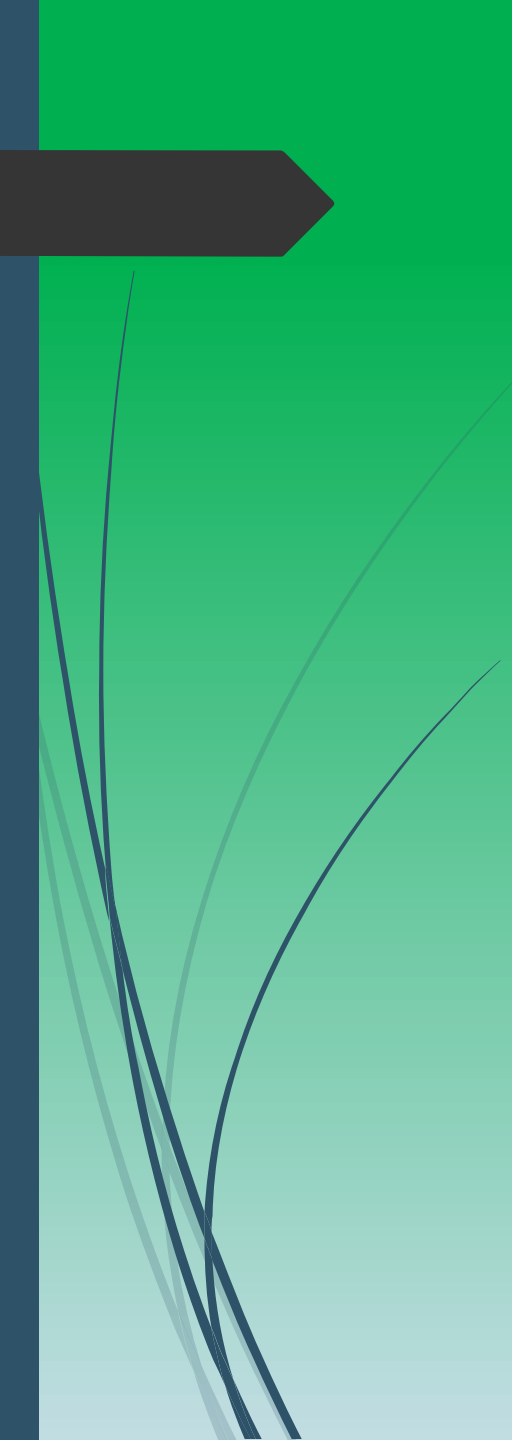
Question:

What should you do if you find an unaccompanied three-year-old child in the street?

- 'Correct' answer on test: Call police
- Minority city children or rural children may select a different answer e.g...
 - Take child home with them and then contact authorities.
 - Ignore them
 - Not understand the question requirement
e.g. if it doesn't say whether they know the child

Testing Intelligence: cultural bias

- If tests have time limits, test biased against groups who are not concerned with time/have never encountered timed tests.
- If languages differ, same words may have different meanings for different groups of participants.
- Language skills vary depending on whether first language or not
- Types of test items: some cultures have less experience with images (drawing/photographs)



Testing Intelligence: culture-fair tests

- Culture-Fair Tests: intended to be culturally unbiased
- Two types of culture-fair tests
 - Questions are familiar to people from all socioeconomic and ethnic backgrounds – but, difficult to develop
 - Tests with no verbal questions – but, bias against non-visual thinkers

Other issues regarding bias

■ Concerns...

- The potential to discriminate against specific subgroups.

- Cultural and other issues.

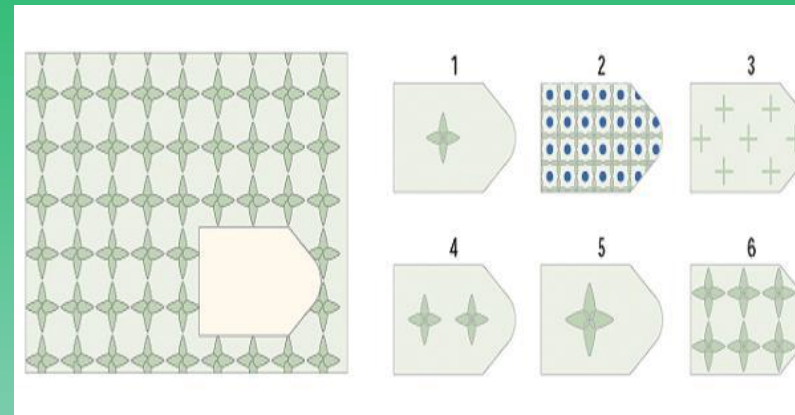
■ IQ Test Bias and Autism

- “ASD was less strongly associated with intellectual disability than traditionally held and there was only limited evidence of a distinctive IQ profile. Adaptive outcome was significantly impaired even for those children of average intelligence”

(Charman et al, 2011)

Raven Progressive Matrices Test

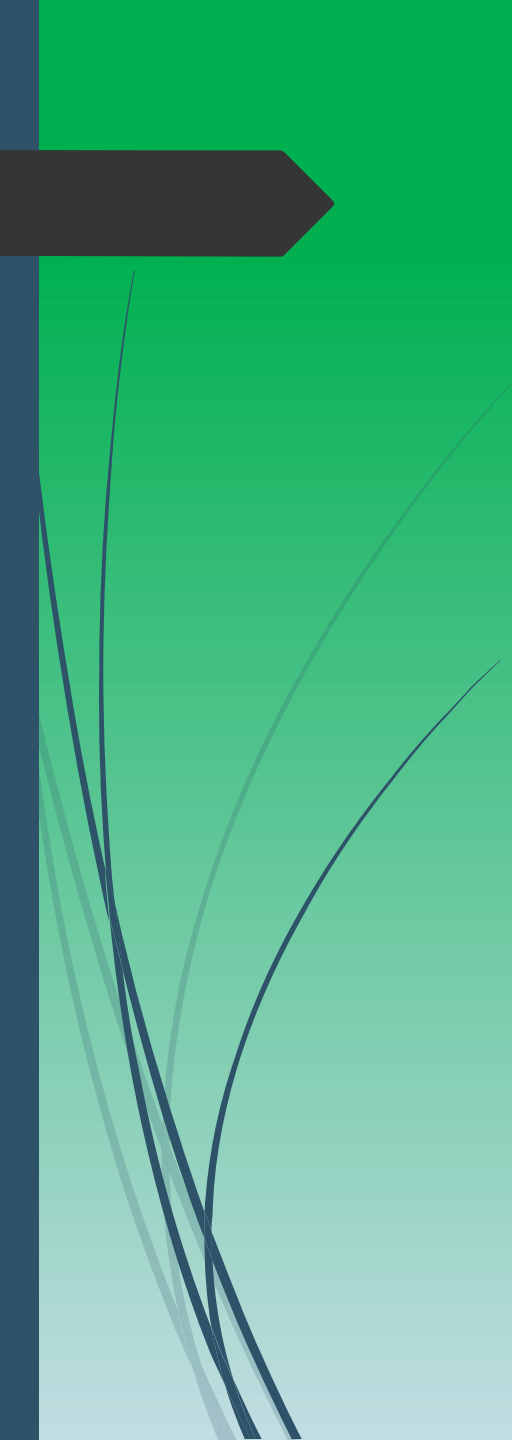
- Raven (1938).
- Tested abstract ability that was argued to be free of cultural influence (language).
- Non-verbal problems.
- Age 6+
- Complete the matrix by selecting the appropriate missing symbol from the group of symbols.
- Raven's Progressive Matrices considered best measure of "g" (Jensen, 1998).



Face Validity

- Most basic form of validity.
- Does it appear to be measuring what its supposed to be measuring.
- Intelligence Tests?

e.g. A number of jigsaw puzzles probably measures an aspect of intelligence in 2D and/or 3D object assembly.



Concurrent Validity

- How does the test measure when compared to other tests?
(e.g. those that have been validated).
- Neisser et al (1996)
 - strong correlation between a variety of intelligence tests.
 - measuring the same thing

Predictive Validity

- Relationship between the test and later scores

e.g. knowledge, skills or ability

e.g. school achievement

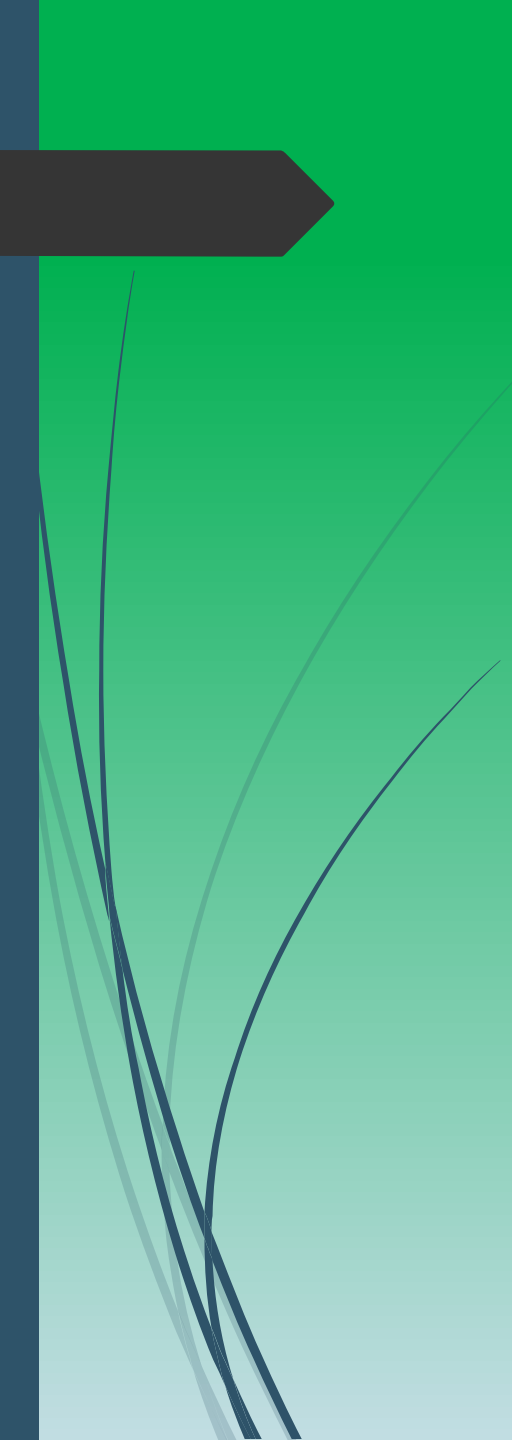
- Studies have highlighted that some intelligence test have a high predictive ability when it comes to success in jobs, academic qualifications etc.

(Maltby et al, 2010).

- Occupational intelligence testing for suitability for employment positions

Influential factors on IQ scores.

- Motivation
- Fatigue
- Anxiety
- Nutrition
- Iodine (Qian et al, 2005)
 - Iodine deficient area (given supplements).
 - Iodine deficient area (no supplements).
- Supplements:
 - 8.7 higher IQ points



Flynn effect

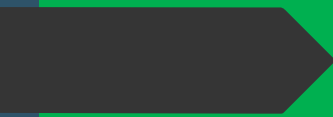
- Year on year rise in intelligence test scores in all parts of the world.
- Tested different versions of WISC.
 - 100 on newer version.
 - 108 on older version.
- Flynn concluded you had to be more intelligent to score 100 on newer version than you did to score 100 on older version.

Flynn effect.

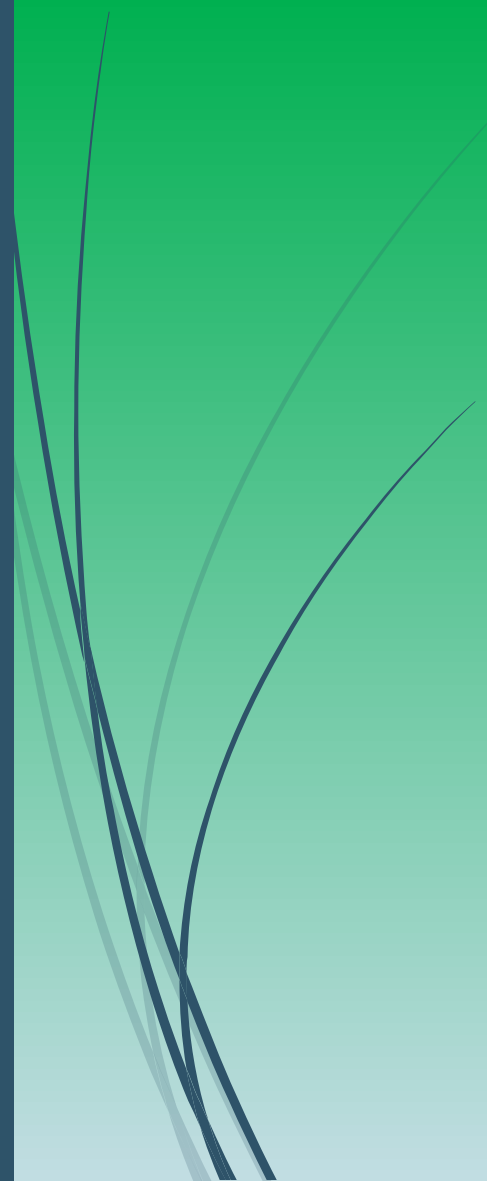
- Findings shown across different cultures
 - e.g. Kenyan children (Daley et al, 2003)
- Across cultures...
- Highest rises in non-verbal tests.
 - 15 points per generation.
- Lowest was in verbal tests.
 - 9 points per generation.

However...

Some relatively recent evidence to suggest some slowing/reversal of the Flynn effect (e.g. Sundet et al, 2004; Teasdale et al, 2005)



Suggested explanations

- 
- Nutritional gains
 - Longer periods of schooling
 - Increased familiarity with IQ tests (and other similar assessments)
 - Improved early experiences

Reading and Video

- Maltby, J., Day, L., & MacAskill, A. (2013). *Personality, Individual Differences and Intelligence* (3rd ed.). Harlow: Pearson Education Limited.
- (Section 2, Chapter 13)
- What makes us Clever? An Horizon Guide to Intelligence (2010).
- <http://www.youtube.com/watch?v=tyoJcrHB88k&list=PL81EA943A01715BD5>