Cognition: Thinking, Intelligence and Language

- Thinking or cognition is a mental activity that goes on in the brain when a person is processing information- organizing it, understanding it and communicating it to others.

Following aspects are involved in thinking:

a) Awareness of the information in the brain
b) Being able to make decision based on the information
c) Comparing the available information to other information
d) Ability to solve problems.

- Two types of thinking:

a) System 1 involves

- making quick decision
- using cognitive shortcuts
- Guided by innate abilities and personal experiences

b) System 2 involves

- Relatively slow, analytical and rule based
- Dependent more on our formal educational experiences

Our thinking is governed by the interplay between the two.

Mental imagery

- Mental images are one of several tools used in the thought process.
- Eg: there are how many windows in your house?
- In an experiment:

- Participants were shown a map of an island containing house, lakes, river etc.
- Thereafter the map was removed from front of them
- They were then asked to imagine various locations like the house, river etc.
- As soon as they reached a particular location they were asked to press a key, which recorded their reaction time.
- It was seen that greater the physical distance on the map between the two locations, the longer it took for the participants to scan the image for the second location.
- Thus participants were looking at their mental image and scanning it just as if it were a real physical map.
- People are also able to mentally rotate or turn images.
- When we rotate an object in our mind it takes time, just as it would if we were rotating a physical object with our hands.

Visual/ mental Imagery	Visual Perception
Visual cortex	Visual cortex
Frontal lobe (cognitive control)	Occipital lobe (visual processing)
Parietal lobe (attention and spatial memory)	Temporal (memory)

Concepts and Prototypes

- Concepts are ideas that represents a class or category of objects, events or activities.

Eg: Fruit

- The ability to think in terms of concepts allows us to communicate with each other.
- Concepts contain:

- Important features of the objects or events people want to think about
- They allow for identification of new objects and events that may fit the concept.

Eg: Being able to recognize a different breed of dog in spite of not seeing the same breed before.

- Types of concepts

a) Formal concept:

- Concepts defined by specific rules or features
- Eg: square, triangle

B) Natural concepts:

- Concepts formed as a result of ones experiences with the real world.
- They are important in helping people understand their surroundings in a less structured manner.
- They form the basis for interpreting those surroundings and the events that may occur in everyday life.

- Prototypes, they are concepts that closely matches the defining characteristics of the concept.

Eg: usually apple is a prototype for fruit.

- Prototypes are different for people belonging to different cultures and having had different experiences.
- We use a combination of cognitive processes including concepts, prototypes and mental images to identify objects in our daily lives.

Questions

1. Explain how mental images are involved in the process of thinking.
2. Describe how concepts and prototypes influence our thinking.

Problem solving and decision-making strategies

- Problem solving occurs when a goal must be reached by thinking and behaving in a certain ways.
- Different ways in which people think in order to solve problems:

1) Trial and error

- It refers to trying one solution after another until finding one that works.

2) Algorithms

- It refers to specific, step-by-step procedures for solving certain types of problems.

3) Heuristics

- It's a simple rule that is intended to apply to many situations.
- It is an educated guess based on prior experiences that helps narrow down the possible solutions for a problem.

a) Representativeness Heuristic

- It is used for categorizing objects and simply assuming that any object that shares characteristics with the members of a particular category is also a member of that category.

b) Availability Heuristic

- It is based on our estimation of the frequency or likelihood of an event based on how easy it is to recall relevant information from memory or how easy it is for us to think of related examples.

c) Working backwards

- To work backward from the goal.

d) Subgoals

- It refers to break a goal down into subgoals so that each subgoal is achieved, the final solution is that much closer.

4) Insight

- When the solution to a problem seems to come suddenly to mind

PROBLEMS WITH PROBLEM SOLVING AND DECISION MAKING

1) Functional fixedness.

- It involves thinking about objects only in terms of their typical use.

2) Mental set

- it's a tendency for people to persist in using problem solving patterns that have worked for them in the past.

3) Confirmation bias

- It's a tendency to search for evidence that fits one's beliefs while ignoring any evidence to the contrary.

Creativity

- It is solving problems by combining ideas or behavior in new ways.
- Convergent Thinking: here a problem is seen as having only one answer and all lines of thinking will eventually lead to that single answer by using previous knowledge and logic.
- Divergent Thinking: here a person starts at one point and comes up with many different or divergent ideas or possibilities based on that point.

- How to encourage/stimulate divergent thinking?
- Brainstorming
- Keeping a journal
- Freewriting
- Mind or subject mapping

- Characteristics of creative people
- They have broad range of knowledge about a lot of subjects and are good at using mental imagery.
- They aren't afraid to be different
- They value their independence.
- They are often unconventional in their work, but not otherwise.

Questions

3.Explain some methods that people use to solve problems and make decisions.

4. Explain three common barriers to successful problem solving.

5. Write a note on creative thinking.

Intelligence

- Theories of Intelligence
- Intelligence is the ability to learn from one's experiences, acquire knowledge and resources effectively in adapting to new situations or solving problems.

1) Spearman's G factor theory
2) Gardner's Multiple Intelligence
3) Sternberg's Triarchic Theory
4) Cattell-Horn-Carroll Theory
5) Neuroscience Theory
6) Pass Model of Intelligence

Spearman's G factor Theory

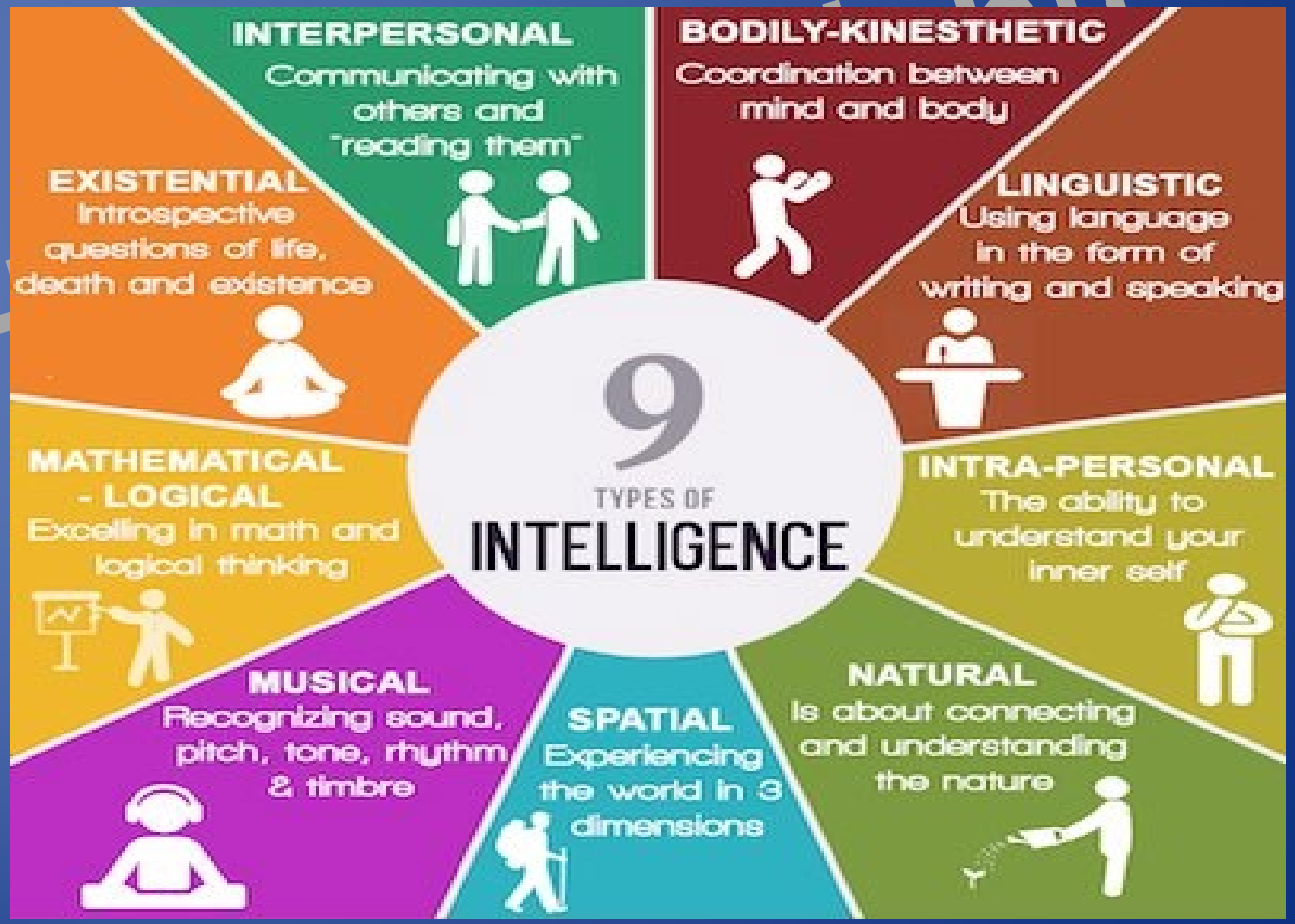
- Charles Spearman (1904) saw intelligence as two different abilities.
- The ability to reason and solve problems - g factor
- Task-specific abilities in certain areas such as music etc. – s factor
- A traditional IQ test would measure g factor.

Criticism:

- Oversimplified the concept of intelligence

Gardner's Multiple Intelligences

- Howard Gardner (1993) proposed the existence of several kinds of intelligence.

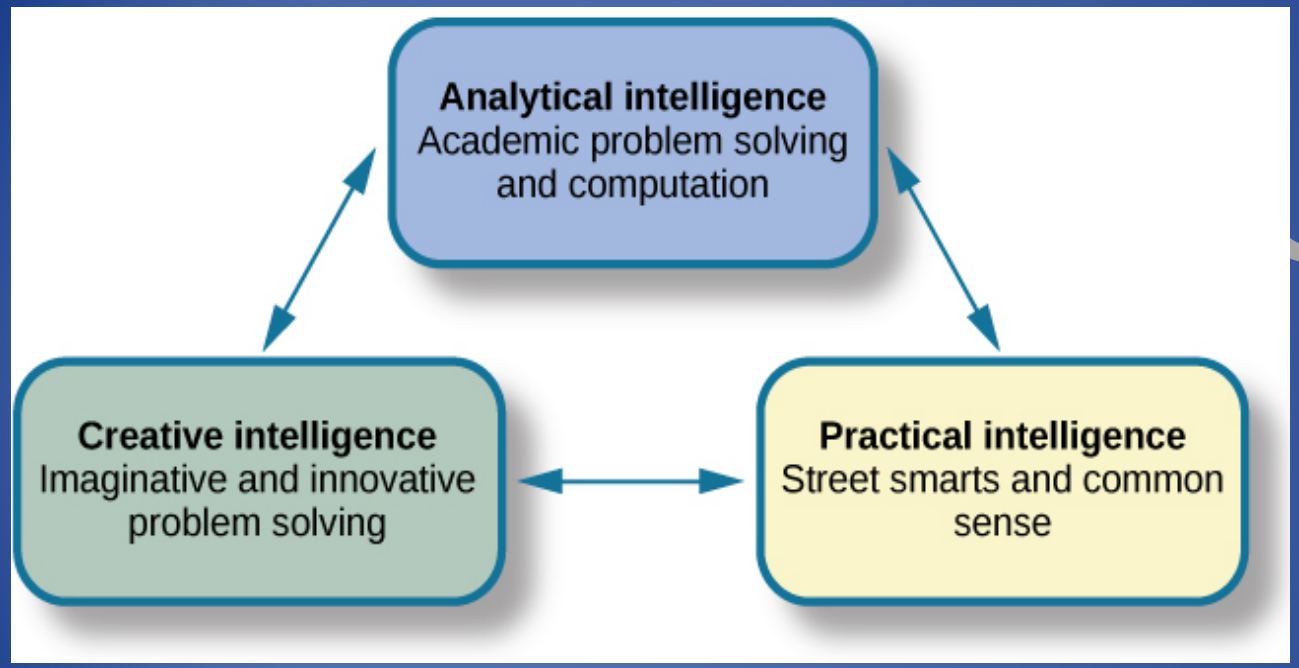


- The idea of multiple intelligence has great appeal, especially for educators

Criticism

- They are just 9 different abilities and not necessarily the same thing as intelligence

Sternberg's Triarchic Theory



- Practical Intelligence predicts success in life.
- Practical Intelligence has low relationship to academic intelligence.

Cattell-Horn-Carroll Theory

- **The first component of the CHC framework is the general intelligence or g (General)**

- **Raymond Cattell suggested intelligence was composed of: (Broad)**
- Crystalized Intelligence, refers to acquired knowledge and skills.
- Fluid Intelligence, refers to problem solving and adaptability in unfamiliar situations.

- **John Horn added other abilities like: (Broad)**
- Visual and auditory processing
- Memory
- Speed of Processing
- Reaction Time
- Quantitative skills
- Reading-writing skills

- **John Carroll (Narrow)**
- Developed a three-tier hierarchical model of cognitive abilities

Neuroscience Theory

- Brain has been closely linked to intelligence
- Different brain areas operate on different cognitive abilities
- Frontal and Parietal areas of the brain play the most important roles.
- According to Neuroscience theory of intelligence which is Parieto-Frontal Integration Theory P-Fit, posterior cingulate cortex, insular cortex and specific subcortical areas play critical roles.
- Working memory is tied to fluid intelligence i.e. the ability to adapt and deal with new problems.

Pass Model of intelligence

- The Planning, Attention-Arousal, Simultaneous and Successive cognitive processing model developed by J.P. Das.
- Three functionals units performing various functions

1)	**Cortical Arousal and Attention**	**Brain stem and reticular activating system**
2)	Coding information using simultaneous and successive processes and planning	Occipital-Parietal lobe and Frontal-temporal lobe
3)	Self monitoring and structuring of cognitive activities	Prefrontal area

- The PASS theory blends neuropsychological, cognitive and psychometric approaches to intelligence.

Question

6. Explain the Spearman's G factor theory and Sternberg's triarchic theory.
7. Explain Garders theory and CHC theory of intelligence
8. Explain the neuroscience theory and PASS model of intelligence

Measuring Intelligence

- Binet's Metal Ability Test

- A French Psychologist Alfred Binet was asked to develop a test to differentiate slow learners from fast learners by French Ministry of Education.
- He and his colleague developed a test not only differentiating slow learners from fast learners but also between children of different age groups.
- They noticed that the fast learners seemed to give answers to questions that older children might give whereas the slow learners gave answers that were more typical of a younger child.
- Thus the key element here was the **Mental Age** at which children could successfully answer a particular level of questions.

- Stanford-Binet and IQ
- Lewis Terman (1916), a researcher at Stanford university adopted a method for comparing mental age and chronological age .
- IQ= MA/CA X 100
- Eg: IQ= 15/10 X 100
- = 150
- The quotient allows test takers to compare the intelligence levels of people of different age groups.
- However, this method becomes meaningless as the person's chronological age passes 16 years.
- Stanford-Binet Intelligence Scale is used by educators to make decisions about the placement of students into special education program. (Disabilities and Gifted)
- The SB5 yields an overall estimate of intelligence, verbal and non-verbal domain scores composed of 5 primary areas of cognitive abilities- fluid reasoning, knowledge, quantitative processing, visual-spatial processing and working memory.

- The Wechsler Test
- David Wechsler was the first to devise a series of tests designed for specific age groups.
- The Wechsler tests now provide an overall score of intelligence and index scores related to cognitive domains:

1) Verbal Comprehension Index
2) Perceptual Reasoning Index
3) Working Memory Index
4) Processing Speed Index

Question

9. Explain the measures of intelligence.

Test Construction: Good test and Bad test

- **Reliability and Validity**
- Reliability refers to the test producing consistent results each time it is given to the same individual or group of people.
- Validity is the degree to which a test actually measures what its supposed to measure.
- **Standardization of tests**
- It refers to the process of giving the test to a large group of people that represents the kind of people for whom the test is designed.
- It also requires an establishment of consistent and standard methods of test administration.
- This comparison group whose scores will be used to compare individual test results.
- This group is chosen randomly.

- **Norms**
- The scores from the standardization group would be called the norms, the standard against which all others who take the test would be compared.
- Norm means an average score.
- **IQ tests and Cultural Bias**
- Every individual's culture and economic backgrounds are different.
- Thus a test designed by the test developer from a specific culture and the test taker too belonging to the same background will have an undue advantage as compared to the test taker belonging to different culture
- Eg: An IQ test developed in English language and given to a person who can only read and write in Chinese.

- **Usefulness of IQ tests**
- IQ tests are used for predicting academic success and job performance.
- Intelligence testing also plays an important role in neuropsychology where specially trained psychologists use intelligence tests and other forms of cognitive and behavioural testing to assess neurobehavioral disorders in which cognition and behaviours are impaired as a result of brain injury or brain malfunction.

Question

10. Explain the ways to evaluate the quality of a test.

Individual Differences In Intelligence

- Intellectual Disability
- It's a neurodevelopmental disorder.
- Here the person exhibits deficits in mental abilities, which is typically associated with an IQ score of below 70.
- The person's adaptive behavior allow people to live independently which is severely below a level appropriate for the person's age.
- These limitations must begin in the developmental period.

Diagnosis

- Previous editions of DSM relied heavily on IQ tests for determining the diagnosis of Mental Retardation.
- DSM 5 bases its diagnosis on intellectual functioning of adaptive functioning determined by IQ tests, which impacts adaptive functioning in three domains
- Conceptual (Memory, reasoning etc)
- Social (empathy etc)
- Practical (self-management skills)
- Intellectual disability can vary from mild to profound.

Causes

- Unhealthy living conditions can affect brain development.
- Prenatal exposure to mercury as well as other toxicants.
- Deficits may be attributed to factors resulting in inadequate brain development or other health risks associated with poverty.

Eg: malnutrition

- Biological causes

- Down syndrome
- Fetal Alcohol syndrome
- Fragile X syndrome

- Lack of oxygen during birth
- Damage to the fetus in the womb from disease, infections, or drug abuse by mother.
- Disease or accidents during childhood.

Giftedness

- At the other end of the intelligence scale are those who fall on the upper end of the normal curve, above an IQ of 130.
- 140-145 highly advanced or geniuses.
- According to Terman's longitudinal study on gifted students it was seen that:
- They are socially well adjusted and often skilled leaders too
- They are above average in height, weight and physical attractiveness.
- They were successful as adults

Emotional Intelligence

- EI is the accurate awareness of and ability to manage one's own emotions to facilitate thinking and attain specific goals and the ability to understand what others feel.
- The concept of EI was first introduced by Peter Salovey and John Mayer (1990) and later popularized by Daniel Goleman (1995)
- An individual with EI possesses self-control of emotions such as anger, impulsiveness and anxiety.
- EI and general intelligence may be related.
- Individuals with high EI tended to have better social relationships.
- Medical school students with high EI tended to perform better in courses related to patient relationships.

Nature Nurture Issues regarding Intelligence

- Twin and Adoption Studies
- By comparing the IQs of two types of twins reared together (similar environment) and reared apart (different environment), researchers can get a general idea of how much influence heredity has over intelligence.

Questions

11. Explain Individual differences in Intelligence using the concepts of intellectual disability, giftedness and EI.

Language

- Language is a system for combining symbols such as words so that an infinite number of meaningful statements can be made for the purpose of communicating with others.
- Language is a very important part of how people think.

Grammar

- Grammar is a system of rules governing the structure and use of a language.
- According to Noam Chomsky, humans have an innate ability to understand and produce language through a device he called the Language Acquisition Device (LAD).
- He defined LAD as an innate "program" that contained a schema for human language.
- Humans may learn the specific language through the process of imitation, reinforcement and shaping.
- The complexities of the grammar to some degree are wired in to the developing brain.

- Phonemes
- Phonemes are the basic units of sound in a language.

Eg : alphabet a in car and a in day

- There is a difference in the sound of “a”
- Th, sh and au are also phonemes
- Phonemes of different languages are also different.
- Infants are born with the ability to recognize all phonemes, however after 9 months, that ability reduces and the infant recognizes only the phonemes of the language to which the infant is exposed.

- Morphemes
- They are the smallest units of meaning within a language.
- Eg: playing- play and ing

- **Syntax**
- Syntax is a system of rules for combining words and phrases to form grammatically correct sentences.
- Eg: John kidnapped the boy and John, the kidnapped boy.
- Although all 4 words are the same, but the meaning is different.
- **Semantics**
- They are rules for determining the meaning of words and sentences.
- **Pragmatics**
- It is the practical aspects of communicating with others.
- It involves knowing things like how to take turns in a conversation, the use of gestures to emphasize a point or indicate a need for more information, and the different ways in which one speaks to different people.
- It also involves intonation i.e. rhythm and emphasis to use when communicating with others.

Question

12. Explain the different elements of language

Development of language

- Language development is a very important milestone in the cognitive development.
- Language allows children to think in words rather than just images.
- Language development in infancy is influenced by the:
- Language they hear
- A style of speaking (child-directed speech)
- Receptive productive lag (produce less but understand more).

Relationship between language and thoughts

- Does language influence thought or does thinking influence language?
- Two theories on the Relationship between language and thoughts
- **Jean Piaget and Lev Vygotsky often debated the relationship between language and thoughts.**
- **According to Piaget** concepts preceded and aided the development of language.
- Eg: the child would have a concept of mother before learning the word mummy.
- According to Piaget preschoolers tend to talk to themselves even when playing with other children.
- Collective monologue, each child would be talking about something totally unrelated to the speech of the other.
- This kind of nonsocial speech was egocentric and would reduce when the child would become more social.

- **According to Vygotsky** language helped develop concepts and that language could also help the child learn to control behavior.
- Eg: after learning the word mummy the child could connect all the words associated with the word the mummy like warm, soft, safety, food etc.
- He related the egocentric speech to private speech, as a way to form thoughts, control actions, to plan their behavior and control their actions.
- Since socializing with other children would demand much more self control and behavioral regulation, private speech would actually increase as children become more socially active.

Linguistic Relativity Hypothesis

- Thought processes and concepts are controlled by language.
- Words people use determine much of the way in which they think about the world around them.

Bilingualism and Multilingualism

- Some research state that bilingualism seems to facilitate cognitive development.
- The learner's mother tongue for learning across the curriculum offers a strong base for basic education and transfer of skills.
- It is essential that the learner is taught and assessed in a language that is well understood and spoken by him so that he is able to use earlier experiences and resources to create new knowledge.

Animal studies in Language

- Animals communicate in many ways.
- According to a study on a chimpanzee it was seen that after training he was able to:

- understand about 150 english words
- Follow correctly complex instructions up to the level of a 2 year old child.

13. What is language development? Explain the relationship between language and thoughts.

Chapter 1 questions

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