

MODULE I COGNITION

Definition-Basic elements of thought: concepts, prototypes, propositions and images - Reasoning: inductive reasoning and deductive reasoning, some basic sources of error in reasoning-Decision making, emotions and decision making - Problem solving: methods of problems solving Facilitating effective problem solving, Factors interfering problem solving.

Cognition is a general term used to denote thinking and many other aspects of our higher mental processes. When we try to understand cognition, we must examine the nature of thinking, decision-making, problem solving, and language.

Thinking is an activity that involves the manipulation of mental representation of various features of the external world. Thinking includes reasoning – mental activity through which we transform available information in order to reach conclusions. *Decision-making* is the process of choosing between two or more alternatives on the basis of information about them. *Problem solving* involves processing information in various ways in order to move toward desired goals. Finally, we share the results of our own cognition with others and receive similar input from them through the use of *language*.

THINKING: forming concepts and reasoning to conclusions

Our consciousness contains a rapidly shifting pattern of diverse thoughts, impressions, and feelings. In order to understand this complex and ever-changing pattern, psychologists have adopted two main strategies. First, they have focused on the basic elements of thought - how precisely, aspects of the world are represented in our thinking. Second, they have sought to determine the manner in which we reason – how we attempt to process available information cognitively in order to reach specific conclusions.

I. BASIC ELEMENTS OF THOUGHT

Our thought consists of three basic components: concepts, prototypes, propositions, and images.

i. **CONCEPTS:** Concepts are building blocks of thinking. They are mental categories for objects, events, experiences, or ideas that are similar to one another in one or more respects. Concepts can be represented in many ways. First, they are represented in terms of *their features or attributes*. As natural concepts are formed, the attributes associated with them may be stored in memory. Then, when we encounter a new item, we compare its attributes with the ones we have already learned. The closer the match, the more likely we are to include the item within the concept.

Second, concepts can be represented through *visual images*: mental pictures of objects or events in the external world. For example, when you are asked whether chess is a sport, you may have an image of two players bending intently over the board.

Finally, concepts are closely related to *schemas*, cognitive frameworks that represent our knowledge of and assumptions about the world.

There are two types of concepts: natural concepts and logical concepts.

Natural concepts do not have a set of defining features and members do not need have all of them. For example, ostrich cannot fly. Like schemas, natural concepts are acquired through experience and also represent information about the world in an efficient summary form. However, schemas appear to be more complex than concepts; each schema contains a broad range of information and may include many distinct concepts. For example, each of us possesses a self-schema, a mental framework holding a wealth of information about our own traits, characteristics, and expectations.

This framework, in turn, may contain numerous different concepts, such as intelligence, attractiveness, health, and so on. Some of these are natural concepts; so the possibility exists that natural concepts are represented, at least in part, through their links to schemas and other broad cognitive frameworks.

Concepts that can be clearly defined by a set of rules or properties are called *logical concepts*. For example, in geometry, a figure can be considered to be a square only if all four sides are of equal length and all four angles are 90 degrees. In contrast, concepts that are not based on a precise set of attributes or properties, do not have clear-cut boundaries, and are often defined by *prototypes*. For example, most people think apple, orange, grapes and pine apple as fruits and less likely to mention tomatoes, or olives.

ii. **PROTOTYPES:** A prototype is a concept that closely matches the defining characteristics of the concept. For example, if I ask you to imagine a dog, you may consider *German Shepard*, your prototype for a dog by which you compare all other dogs. So, if you see another dog, you could say that other dog is small (compared to your prototype), heavy, ugly, beautiful etc.

iii. **PROPOSITIONS: Relation between concepts**

Propositions are sentences that relate one concept to another and can stand as separate assertions. Propositions such as Sandra kissed her baby describe a relationship between two concepts – in this case, affection is expressed between Sandra and her child. Knowledge structures that guide our interactions with objects and events in the world around us are called *mental models*.

iv. IMAGES: Mental pictures of the world

Images are mental pictures or representations of objects or events and have a picture like quality.

II. REASONING

Reasoning is a cognitive activity in which we transform information in order to reach specific conclusions. In other words, reasoning is a process that involves inference. It is used in logical thinking and problem solving. It is goal directed and the conclusions are drawn from a set of available information. In reasoning, information from the environment and the stored information in brain are used following certain rules. There are different forms of reasoning.

i. Formal reasoning: In formal reasoning, all the required information is supplied, the problem to be solved is straightforward, there is typically only one correct answer, and the reasoning we apply follows a specific method. For example:

If you send me a mail, I will finish writing the programme.

If you do not send me a mail, then I will go to sleep early.

ii. Everyday reasoning: It involves the kind of thinking we do in our daily lives: planning, making commitments, and evaluating arguments. In such reasoning, important information may be missing; the problems involved often have several possible answers, which may vary in quality or effectiveness.

iii. Inductive reasoning:

In inductive reasoning, people infer a general rule from specific cases. That is we consider a number of different instances and try to determine (induce)

what general rule covers all the instances. Examples of this reasoning are given below:

- Mohan is mortal, Radha is mortal, Karim is mortal. Therefore, all human beings are mortal.
- Iron expands when heated; water also expands when heated; air also expands when heated. Therefore, all types of matter expand when heated.

In real life situations, much of our problem solving ability relies on inductive reasoning. In inductive reasoning we make use of analogical problem solving method i.e., to call up the solutions you have already used successfully for a similar problem in the past.

iv. Deductive reasoning: In deductive reasoning, the person tries to deduce or draw conclusions from a set of initial assertions or premises. An example of deductive reasoning is syllogism as given below.

- **Premise 1:** All human beings are mortal.
Premise 2: You are a human being.
Conclusion: You are mortal. (Valid conclusion)
- **Premise 1:** All cats have four legs.
Premise 2: I have four legs.
Conclusion: Therefore I am a cat (Invalid conclusion).

Reasoning: Some basic sources of error

There are several factors that affect our ability to reason effectively. They are:

1. **The role of Mood State:** Our mood states whether it is positive, negative or neutral can influence our ability to reason effectively.

2. **The role of beliefs:** reasoning is often influenced by emotion laden beliefs. For example, a person with deeply held convictions against the death penalty listens to a speech favoring capital punishment.
3. **The confirmation bias:** It is the tendency to pay attention to primarily to information that confirms existing information that confirms existing views or beliefs.
4. **Hindsight bias:** It is the tendency of people to overestimate their ability to have predicted an outcome that could not possibly have been predicted. For example, a letter comes in the mail informing an individual that he was selected into a college. When he tells his mother she says, "I really had a feeling that you were going to get in" (even though she had expressed doubts to his father earlier that week).

DECISION MAKING

Decision-making is a cognitive process that involves identifying, evaluating and choosing among the alternatives. There are several factors that influence our decision-making process. They are heuristics, framing and decision strategy, escalation of commitment, emotions, and naturalistic decision-making.

1. Heuristics: A Heuristic is simply a term for mental short cuts we take when making judgements and choices. For example, we all know that dogs can be dangerous and you have heard stories of vicious dogs attacking humans. Naturally, majority of us think that dogs are more dangerous. Heuristics are mental rules of thumb that permit us to make decisions and judgments in a rapid and efficient manner. Heuristics reduce the effort required, though they may not necessarily enhance the quality or accuracy of the decisions reached. Heuristics are extracted from past experience and serve as simple guidelines for making reasonably good choices quickly and

efficiently. The most frequently used heuristics are of three types: availability heuristics, representativeness, and anchoring-and-adjustment.

Availability heuristic is a cognitive rule of thumb in which the probability of various events is judged on the basis of how readily they come to mind. This shortcut tends to work fairly well, but it can lead us into error as well. [For example, researchers presented participants with lists of names and then asked them whether the lists contained more men's or women's names. Although the numbers of male and female names were about equal, nearly 80% of the participants reported that women's names appeared more frequently. Because the women named in the lists were more famous, so their names were more readily remembered and brought to mind].

Representativeness heuristic suggests that the more closely an event or object resembles typical examples of some concept, the more likely it is to belong to that concept. For example, if someone was to describe an older woman as warm and caring with a great love of children, most of us would assume that the older woman is a grandmother. She fits out mental representation of a grandmother.

In *anchoring-and-adjustment heuristic*, existing information is accepted as a reference point but then adjusted (usually insufficient) in light of various factors. For example, participants in a study were given comprehensive information regarding a property including a high and low list price before touring the property. Finally, participants were asked to estimate the actual value of the property. When the list price was high, final estimates also tended to be elevated.

2. Framing and Decision Strategy: Framing is the presentation of information about potential outcomes in terms of gains or in terms of losses. Framing describes that our choices depend on how the problem is presented,

the way the question is framed. For example, Participants were offered two alternative solutions for 600 people affected by a hypothetical deadly disease.

- **Option A** saves 200 people's lives
- **Option B** has a 1/3 chance of saving all 600 people and a 2/3 possibility of saving no one.

72% of the participants choose option A.

They offered the same scenario to another group of participants, but worded differently.

- If **Option C** is taken, then 400 people die
- If **Option D** is taken, then there is a 1/3 chance that no people will die and a 2/3 possibility that all 600 will die.

However, in this group, 78 % of the participants choose option D

The first list of participants were given a positive frame (emphasize of lives saved) whereas the second list were given a negative frame (emphasis on lives lost)

3. Escalation of commitment: The tendency to become increasingly committed to bad decisions even as losses associated with them increases.

4. Emotions and Decision-making: One important aspect of decision-making is role of emotions; in particular, how people feel about the outcomes of decisions they make. Our reactions to outcomes are often heavily influenced by the way decisions turn out. When desirable outcomes flow from a decision, we tend to be happy and vice versa. Our reactions to decision outcomes can also be influenced by our expectations i.e., what we anticipate will happen and by comparisons we make between the actual outcome and other outcomes that could have been occurred, a tendency referred to as counterfactual thinking.

5. Naturalistic decision-making: Decision-making as it occurs in the real world has been termed naturalistic decision-making.

PROBLEM SOLVING

Problem solving is a process of overcoming difficulties that appear to interfere with the attainment of a desired goal. It is an important kind of thinking.

Most psychologists agree that there are four stages in problem solving: problem identification, generates potential solutions, evaluate the solutions, and try the potential solutions and evaluate them.

Methods of Problem solving

There are many rules used in solving problems. The simplest problem approach is *trial and error*, a technique in which possible solutions are tried until a successful one is found.

A second general approach to solving problems involves the use of *algorithms*. Algorithms are sets of rules, which, if followed correctly, guarantee a solution to a problem. Rules of multiplication or any mathematical and any scientific formula are examples of algorithms.

Heuristics are short-cut rules of thumb that often lead to quick solutions. In contrast to algorithms, heuristics do not guarantee a correct solution to a problem. For example, in DWARG, we can find the familiar combination dr and gr. We may then quickly find draw, drag, and grad. Heuristics are based on past experiences with these problems and involve reasoning. The drawback to this method is that we might miss some words.

One type of heuristic device is the *means-end analysis*. In using this heuristic device, we try to solve a problem by evaluating the difference between the current situation and the goal.

Analogy is another strategy for solving problems based on applying solutions that were previously successful with other problems similar in underlying structure.

Stages of problem solving

The important stages in problem solving are:

- 1. Problem awareness:** The first step in the problem solving is the awareness of the difficulty or problem that needs a solution.
- 2. Problem Understanding:** The problem should be properly identified by a careful analysis. He should be clear about what exactly is his problem. The problem then should be pin pointed in terms of the specific goals and objectives. Thus, all the difficulties and obstacles in the path of the solution must be properly named and identified. The problem-solving efforts should also be properly analyzed.
- 3. Collection of the relevant information:** In this step, the individual is required to collect all the relevant information about the problem through all possible sources. He may consult experienced persons, read the available literature, revise his old experiences, think of possible solutions, etc.
- 4. Carrying out the plan:** In this stage, person carries out his plan of action which he has either retrieved from his long term memory or thought of a new plan.
- 5. Verification:** We tend to evaluate the results after we have carried out a plan. The problem solver compares the solution with the encoded problem in memory. He evaluates the steps carried out while executing the production system. He also evaluates whether the problem solving strategies are useful for similar other problems. The verified solution may then become a useful product of his problem solving behavior that can be utilized in solving other future problems.

FACILITATING EFFECTIVE PROBLEM SOLVING: the role of Meta cognitive Processing.

Sometimes talking through a problem may facilitate our ability to solve problems by expanding our level of awareness. This process has been termed as metacognitive processing.

FACTORS AFFECTING /INTERFERING PROBLEM SOLVING

There are certain factors, which generally affect problem solving. They are:

1. Mental set
2. Functional fixedness
3. Rigidity
4. Well defined and ill defined problems
5. Anxiety
6. Attention span
7. Incubation
8. Brain storming

a) Mental set: Mental set refers to the tendency for people to persist in using problem solving patterns that have worked for them in the past. Solving problems in one way may lead the person to approach other problems in the same way and not try something new. In the case of similar problems, mental set may facilitate problem solving. However, mental set may create difficulties when problem requires new solutions, or new rules.

b) Functional fixedness: Functional fixedness is the tendency to view an object in terms of its name or familiar usage. For example, a plier can be used as a tool for grasping, a paperweight, or a weapon. But we have

used it only for grasping things. So we have the tendency to think it as a grasping tool.

- c) **Rigidity:** It involves continuing to use a response that worked in other situations. For example, persons working on computer often find themselves victims of such rigidity. While doing computer programming and developing a technique for performing some operation in one programme persons use it again in later programmes while a simpler method may also work for the latter problem.
- d) **Well-defined and ill-defined problems:** There are well-defined problems, the goal is specified clearly while in ill-defined problems it is vague. Secondly, for well-defined problems, the information necessary to solve the problem is usually specified precisely in the statement of the problem whereas for ill-defined problems, the relevant information is usually not specified precisely. You have a well defined problem for your experiments as you have a well defined goal and relevant information available. But the choice of your career may be example of an ill-defined problem.
- e) **Anxiety:** In some problems goals give rise to factors like conflicting motives and values, which are likely to hinder problem solving. Conflicts and frustrations give rise to anxiety, which may have negative effect on problem solving. But moderate degree of anxiety could also motivate a person to make more efforts in understanding and solving the problem. Moderate degree of anxiety facilitates problem solving when the person involved is competitive as it increases efficiency in dealing with the problem.
- f) **Attention span:** If we are able to pay attention to the important information and ignore the information that is irrelevant we are in a better position to solve the problem.

g) Incubation: Incubation refers to increase in the likelihood of solving a problem that results from the problem under consideration. The reason may be that when the person is away from the problem, he works continuously on it unconsciously and later on may come out with a solution. In daily life sometime, when we are busy doing something else, we suddenly have the flash of that information. But rest interval or withdrawal does not always guarantee solution to the problem.

h) Brainstorming: Is the process by which individuals are encouraged to produce solutions of problems in a group. Subjects in a brain storming session are asked to indicate all the possible solutions of a problem that occur to them. They have to give as many solutions as they can within a given time. This strategy overcomes the problem of fixedness, which hinders problem solving.

+ + + + + + + +