Research on Problem Solving

EEG Dynamics Reflect the Distinct Cognitive Process of Optic Problem Solving
"This study explores the changes in electroencephalographic (EEG) activity associated with the performance of solving an optics maze problem. College students (N = 37) were instructed to construct three solutions to the optical maze in a Web-based learning environment, which required some knowledge of physics.

"If students cannot correctly categorize a problem, they will not be able to retrieve pertinent information from long-term memory for use in solving 2. it." (Bunce et al.,1991)

3. "During construction of a problem representation, certain features of the problem may activate knowledge in memory. A schema for that particular type of problem may then be activated." (Gick, 1986)

Periodic Review Inventory Systems: Practice Problems

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Problem Solving Cycle

Types Of Problems

ill structured problems

3 types of errors

The cognitive approach to problem solving

Algorithm

Heuristics
• Newell and Simon observed that humans must use mental shortcuts for solving problems
• A heuristic may or may not lead to a correct solution
• 4 heuristics may be used in problem solving

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Isomorphic problems

• Formal structure is the same but the content differs
• E.g. games that involve constructing words from jumbled or scrambled letters

Insight is a distinctive and sometimes seemingly sudden understanding of a problem or of a strategy that aids in solving the problem.

Neo-Gestalist view

• Researchers have found that insightful problem solving can be distinguished from non-insightful problem solving in two ways.

• First, when given routine problems to solve, problem solvers show remarkable accuracy in their ability to predict their own success in solving problem even prior to any attempt to solve it.

Research from article

Gestalt psychology is based on the observation that we often experience things which are not part of our simple sensations.

The original observation was done by Max wertheimer

If we see what is not there then what is it that we are seeing?

(Dr. C. George boeree, 2000)

Early Gestalists views

• Gestalt psychologist Max Wertheimer (1945-1959) wrote about productive thinking, which involves insights that go beyond the limits of existing associations.

• Gestalt psychologists believe that insight problems require problem solvers to perceive the problem as a complete whole.

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- view the end first
- the distance between the current and goal state is decreased
2, Working forward
-solve the problem from the beginning
3, Working backward
-start at the end and tries to work back
4, Generate and test
-alternative courses of action are generated
-not in a systematic way
- see which course of action will work

Insight Problems

A small activity

A woman who lived in a small town married 20 different men in the same town. All of them are still living, and she never divorced any of them. How could she do this?

Ill structured problems and the role of insight

• Ill structured problems are situations in which the existing state and the desired state are unclear, and hence, methods of reaching the desired state cannot be found
• Domain knowledge and justification skills are essential for solving these problems.

Gestalt psychologist believed that productive thinking is different from reproductive thinking in a way that it is based on existing associations involving what is already known.

According to Wertheimer, insightful (productive) thinking differs significantly and fundamentally from reproductive thinking.

In addition to that the investigators used a clever methodology to observe the problem solving process while participants were solving routine versus insight problem.

Algebra vs. Prisoners dilemma

Types Of Problems

- Problems can be categorized according to whether they have clear paths to a solution
- Well structured problems or well defined problems have clear solution paths to solutions
- Three structured problems or ill defined problems lack clear paths to solutions
- These categories are useful in understanding how people solve problems in the real world.
- These two categories may represent a continuum of clarity in problem solving

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🏭 Well structured problems

- There is a clear pathway to the solution
- problems that require a specific set of rules to solve.
- What if your best friend asks you to bake a cake for her birthday !
  - do not know how to bake a cake
  - you can look for a recipe and follow the instructions and accomplish your goal!

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3 types of errors

- According to Simon and Reed 1976 and Thomas 1974 people make 3 types of errors
- Inadvertently moving back
- revert to a state that is further from the end goal
- Making illegal moves
- they make a move that is not permitted
- not realizing the nature of the next legal move
- do not know what to do next, given the current stage of problem

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The cognitive approach to problem solving

Problem space theory
- Solve problems by searching the problem space
- Problem space consists of the initial state, the goal state and all possible states in between
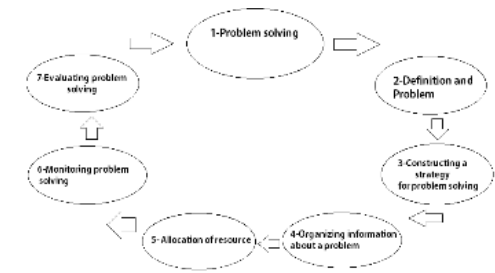
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Algorithm

- is a step-by-step procedure that will always produce a correct solution

Example : - mathematical formula
- these are good for the computers,   readily calculate all possible operations in the given space

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