Chapter 11—Problem Solving

What is a Problem?

- Problem—occurs when there is an obstacle between a present state and a goal, and it is not immediately obvious how to get around the obstacle
    - Difficult and not immediately obvious
- Two Types of Problems:
    - Well-Defined Problem—usually have a correct answer and there is certain procedures that, when applied correctly, will lead to a solution
    - Ill-Defined Problem—occurs frequently in everyday life, do not necessarily have a "correct" answer, and the path to their solution is often unclear

The Gestalt Approach: Problem Solving as Representation and Restructuring

- Problem solving for Gestalt psychologist was about:
    - How people represent a problem in their mind
    - How solving the a problem involves a *reorganization* or *restructuring* of this representation
- Representing a Problem in the Mind:
    - Gestalt idea of representation and restructuring in problem solving
    - Wolfgang (1929) asks us to determine the length of the segment marked x, if the radius of the circle has a length r
        - Key to solving problem is to create a mental representation of x as being a diagonal of the small rectangle
        - Representing x as a diagonal enable us to reorganize the representation by creating the rectangle's other diagonal
        - Length of x equals the length of r
        - Doesn't require mathematical equations, instead the solution is obtained by first *perceiving* the object and then *representing* it in a different way—Gestalt psychologist called this process restructuring
    - Restructuring—process of changing the problems representation
- Insight in Problem Solving:
    - Insight—a sudden realization of a problem's solution

        - Research strategy was to devise problems and situations that made it difficult for people to achieve the restructuring needed to solve the problem

        - Hoped to learn about processes involved in problem solving by studying *obstacles* to problem solving

- Obstacles to Problem Solving:

    - Fixation—peoples tendency to focus on specific characteristics of the problem that keeps them from arriving at a solution

        - Functional Fixation—restricting the use of an object to its familiar functions or uses

            - Candle problem (Duncker)

        - Candle Problem—illustrates how functional fixedness can hinder problem solving but giving participants a number of objects and the person is given a task of mounting a candle on a wall so it can burn without dripping wax on the floor

            - Used to study functional fixedness

            - Solution occurs when the person realizes that the matchbox can be used as a support rather than as a container

            - Fact that seeing the boxes as containers inhibited using them as support is an example of functional fixedness

        - Two-String Problem—participants task was to tie together two strings that were hanging from the ceiling

            - another example of functional fixedness

            - difficult because strings are separated so it is impossible to reach one of them while holding the other

            - used pliers to create a pendulum to swing within persons reach

            - 60% did not solve this problem because the focused on the function of the pliers and did not think to use them as a weight

            - Accidentally brushing string triggered insight that the pliers could be used as weight

            - According to Gestalt, the solution to the problem occurred once the participants restructured their representation of how to achieve the solution and their representation of the function of the pliers

    - Both the Candle and Two-String Problems are difficult because of people's preconceptions about the uses of objects

- Situationally Produced Mental Set—when a person encounters a situation that influences his or her approach to a problem
    - Water-Jug Problem—participants were given three jugs of different capacities and were required to use these jugs to measure out a specific quantity of water
        - A.S. Luchins (1942) used to demonstrate the situationally produced mental set

Modern Research on Problem Solving: The Information Processing Approach

- Newell and Simon described problem solving as a search that occurs between the posing of the problem and its solutions
- Idea of problem solving as a search is part of our language
    - "searching for a way to reach a goal"
- Newell and Simon's Approach:
    - Initial State—conditions at the beginning of the problem
    - Goal State—the solution of the problem
    - Tower of Hanoi Problem—a problem involving moving discs from one set of pegs to another set
        - has been used to illustrate the process involved in Means-End Analysis
        - As three discs stacked on the left peg, and the goal state as these discs stacked on the right peg
        - Operators—rules that specify which moves are allowed and which are not
    - Intermediate State—various conditions that exist along the pathways between the initial and goal states
    - Problem Space—the initial state, goal state, and all the possible intermediate states for a particular problem
    - Means-Ends Analysis—a problem solving strategy in which the goal is to reduce the difference between the initial state and the goal state and achieved by working to achieve subgoals that move the process of solution closer to the goal
        - one way to direct the search is to use this strategy
        - Primary goal is to reduce the difference between the initial state and the goal state, which is achieved by creating subgoals
        - Subgoals—goals that create intermediate states that are closer to the goal
    - One of the main contributions of Newell and Simon's approach to problem solving is that is provided a way to specify the possible pathways from the initial state to the goal states