Problem solving: Methods and obstacles

Problem solving

- The process of figuring out how to reach a goal, starting from an initial state
- Core elements:
  - Initial state: Starting mental/environmental state
  - Goal state: Desired mental/environmental state
  - Operators: Actions that change the current state
- What makes a problem hard?
  - Too many states or operators
  - Bad or incomplete operator-selection knowledge

The Hobbits and Orcs problem

3 Hobbits and 3 Orcs are on one side of the river and all want to cross. There is a boat that holds 1 or 2 creatures.

Path constraint: If there are more Orcs than Hobbits in one place, the Orcs eat the hobbits.

Problem-solving heuristics

- Heuristics for selecting operators when there is a choice
- Hill-climbing:
  - Prefer operators that move you closer to the goal, avoid ones that move you away
  - People getting stuck in (5) is evidence for hill-climbing
    - Moves 1 more creature off destination bank than seems necessary

Problem-solving heuristics

- Means-end analysis:
  - Set a subgoal to reduce a difference between the current and goal states
  - Select operators that achieve that subgoal
  - These may move you away from the supergoal
The monkey and bananas problem

(Köhler, 1927)

• Initial state: banana, boxes lying around
• Goal: Get banana
• Operators:
  – Jump
  – Get boxes
  – Stack boxes

The two-strings problem

What makes problems hard?

• States and operators can be ill-defined
• Bad or missing operator selection knowledge
  – Functional fixedness:
    • Objects prime their usual functions
    • Pliers + nails = pulling nails out of things
  – Mental set:
    • Get stuck on solutions that worked before but may not now