

An Interactive Classroom Demonstration of Propositional and Analogical Representation

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In a cognitive psychology demonstration, students see a rat's-eye view of a maze, projected from a computer, and vocally vote for moves through the maze. The class takes false paths in the first run, but it avoids them in the second. The learning can be explained in terms of analogical imagery or in terms of propositions and rules for modifying them. The demonstration achieves three goals: It actively engages students, effectively explains the concepts, and provides a memorable referent for explaining other topics such as algorithms versus heuristics, production systems, and phrase-structure grammar.

Theories in cognitive psychology specify representations of mental states and processes that operate on the representations. Competing theories posit different representations and processes. A classic debate in theories of mental imagery juxtaposes propositional representation of spatial knowledge against analogical representation. In a propositional representation, spatial relations are explicitly encoded by symbols. In an analogical representation, spatial relations are only implicit in the medium itself and can be extracted only with additional processing. (For additional discussion of analogical and propositional representations, see Kosslyn, 1983, or Palmer, 1978.) The distinction between propositional and analogical representations, and their use in theories of mental imagery, can be especially difficult for students of cognitive psychology. This article presents an interactive classroom demonstration for explaining these concepts.

The demonstration achieves three goals—it actively engages students, clearly explains the concepts, and facilitates the explanation of other topics in cognitive psychology. This article reports results from an experiment that compared the demonstration with a more traditional lecture presentation and provided evidence for success in achieving the goals of engagement and explanation. Extensions of the demonstration to other topics are discussed.

Description of the Demonstration

The Maze Learning program in the PsychSim II software package (Ludwig, 1989) is projected onto a large screen at the front of the class. The program shows a rat's-eye view of a maze (see Figure 1) and allows the user to move through the maze by pressing keys. The maze is divided into cells (marked on the walls in Figure 1), and the user may move forward one cell (F), turn 90° to the left without moving from the cell (L), or turn 90° to the right (R).

The class votes vocally, "pandemonium" style (Selfridge, 1959), for each move, and the instructor enters the loudest vote. When the class is equivocal, the instructor moves whichever way is a false path. Before each move, the instructor clearly states what move will be made and, after the move, allows students ample time to reorient themselves. Two volunteers record the sequence of moves in their notebooks, using the simple codes of L, R, and F.

The first time through the maze, false paths are taken (top panel, Figure 2), but the program gives the user a second chance through the maze. The major result to be explained is that the class's second route avoids false paths (bottom panel, Figure 2).

Analogical Explanation

One explanation for the improvement on the second run is that people piece together a bird's-eye view of the maze in their mind's eye as they traverse the maze the first time. On the second attempt, they scan their mental image and determine which paths are false before mistakenly moving into them. This explanation is reinforced by the computer program, which displays a bird's-eye view of the two routes after both are completed, much as in Figure 2 but without the letter labels on the paths. The representation posited by this explanation is analogical because spatial relations among positions in the maze are encoded implicitly in the image, without explicit symbols.

Propositional Explanation

Improvement in running the maze can be explained without imagery. One of the volunteers calls out the sequence of moves for the first run, and the instructor copies it onto

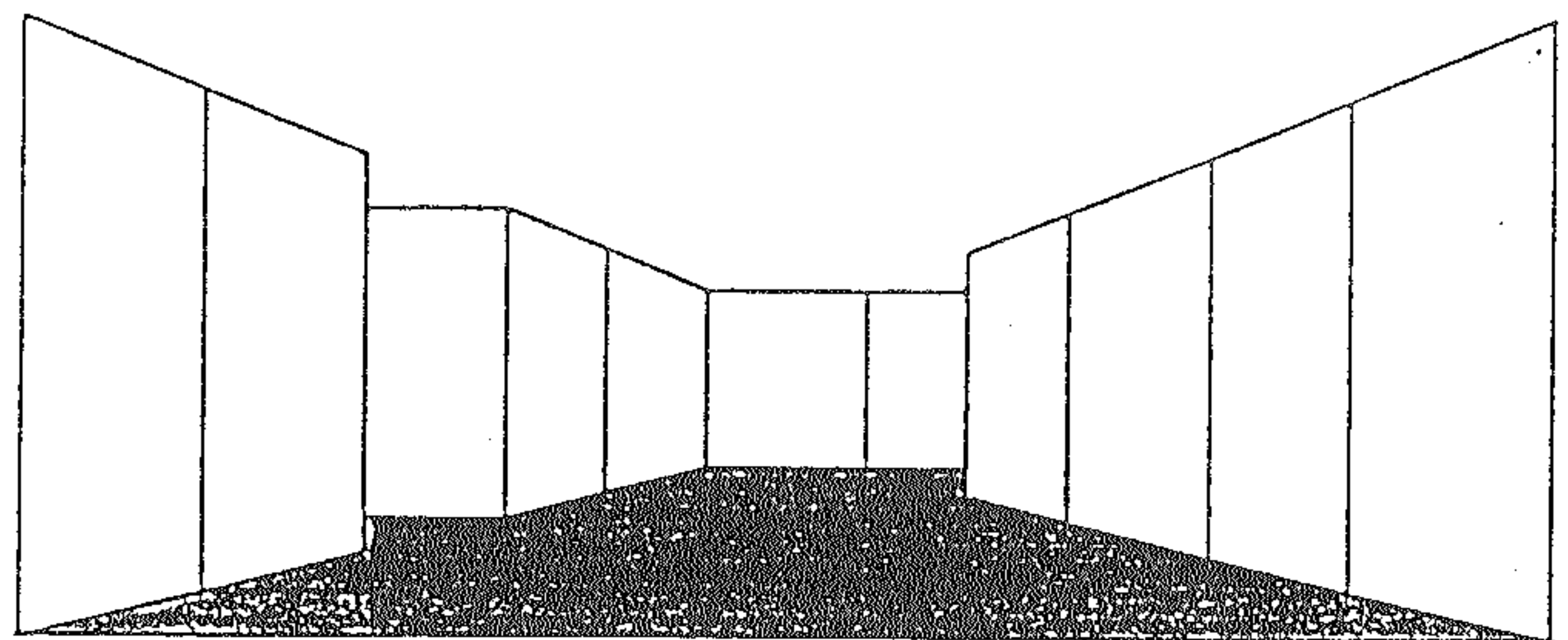


Figure 1. Rat's-eye view of a maze.

