

## **Modeling Diagrammatic Reasoning: Route Planning on Maps**

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### **ABSTRACT:**

Diagrammatic reasoning, reasoning from graphical representations rather than from word-based representations, is of particular importance for the military. Maps, pervasive in the military, are specific instances of diagrams that are used to provide current and projected information. Military maps are used for mission planning and increasingly for real-time situation awareness updates. Diagrams can offer “cognitive shortcuts” relative to verbal descriptions of certain kinds of information, notably relational and spatial information. Thus, diagrams reduce the working memory load and make possible certain cognitive efficiencies. However, for more complicated maps or maps that change over time, users may have difficulty extracting all relevant information or fail to notice changes in the map.

We are investigating the relationship (and dependencies) between perception and reasoning during a problem solving task that utilizes a diagram. The goal of this research project is to produce cognitively congruent models of a diagrammatic reasoning task. We collected data from human participants performing two simple tasks on a 5x5 grid-based map. Grid-based maps consist of labeled points, lines, and regions. The simplicity of these maps allows us to isolate the effect of specific changes in the maps and extract rich cognitive data. Specifically, the two tasks consist of either searching for a target location (perception) on the map or planning a route from a starting location to the target location and executing that plan (perception and decision making). Using this data, we have constructed a human cognitive model performing these same tasks. The data suggests several hypotheses, which will be examined in a future study on route planning using a more complex and realistic graphical maps modeled after a subway maps.

**KEY WORDS:** cognitive models, diagrammatic reasoning, ACT-R

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