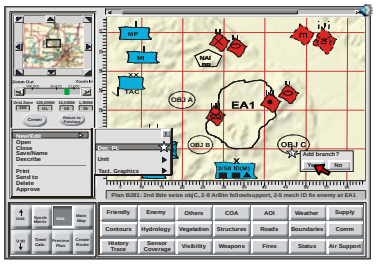
Modeling Diagrammatic Reasoning

H. A. Dye
McKendree University
701 College Road
Lebanon, IL
hadye@mckendree.edu

Laurel Allender
U.S. Army Research Laboratory
Aberdeen Proving Ground, Maryland
21005
lallende@arl.army.mil

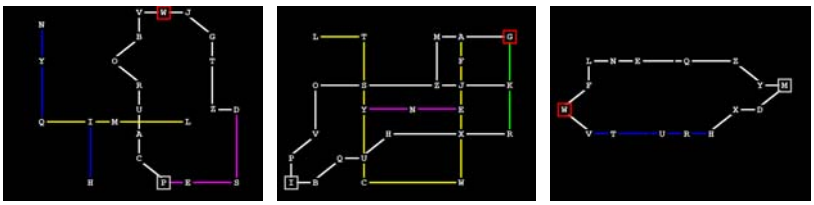
Abstract:

Diagrammatic reasoning, reasoning from graphical representations rather than from word-based representations, is pervasive in our society, and in particular in the military. Maps are specific instances of diagrams that are used to provide current, as well as past and projected information. They can be schematics, like maps for the Washington D.C. metro, or highly detailed situation awareness maps with overlaid symbology.



For certain kinds of information, notably relational and spatial information, diagrams can offer cognitive shortcuts relative to verbal descriptions. Thus, diagrams can reduce the working memory load and make possible certain cognitive efficiencies.

The research project presented here uses both an experimental and a modeling approach to further our understanding of the relationship between perception and reasoning during a problem solving task that utilizes a diagram. A fundamental issue of interest is the degree to which perception and reasoning occur in parallel. Another issue is the role of other displayed information, that is "distractor" or irrelevant information. A route planning task was used both with experiment participants and also as the task for a computational cognitive model using the ACT-R (Adaptive Components of Thought-Rational) architecture. The results provided insight into fundamental cognitive processes, as well as providing a path for future research.



Three sample maps: Vertically shaped map with a non-intersecting overlay; Diagonally shaped grid map with intersecting overlay; and Horizontally shaped grid map with no overlay.