Task Specific Recommendation for Information Presentation

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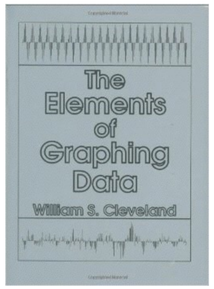
Reflect. Observe. Imagine.

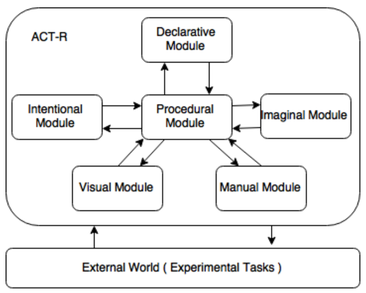
Visual Design

The emphasis in visual design is on accurately conveying large amounts of information in such a way as to make decoding easy and effective, rather than on having a dramatic effect on the viewer.



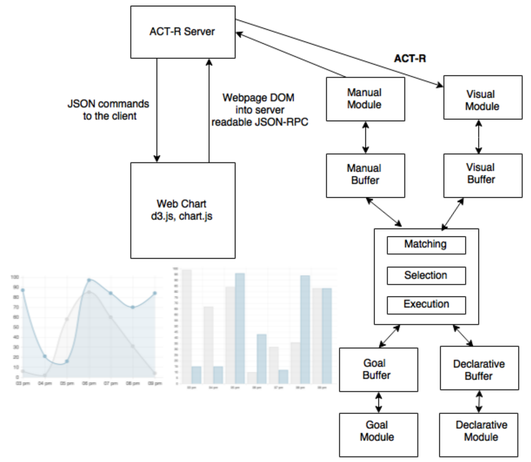
Cognitive Modeling

One of the main aims of this research is to construct models of reasoning about graphical presentations that are grounded in cognitive theory and incorporate cognitive factors such as memory decay and interference together with perceptual and motor components that provide realistic behavior.



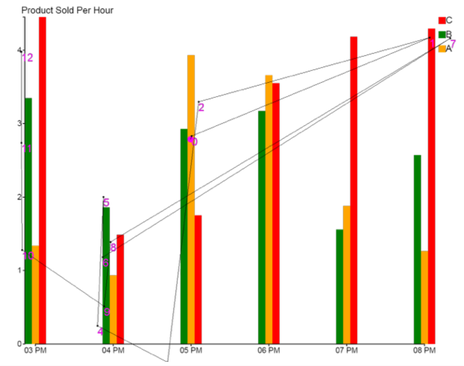
ACT-R (Adaptive Control of Thought-Rational) is a cognitive architecture mainly developed by John R. Anderson at Carnegie Mellon University. ACT-R aims to define the basic and irreducible cognitive, perceptual, and motor operations that give rise to human-level performance. In theory, each task that humans can perform should consist of a set of these discrete operations.

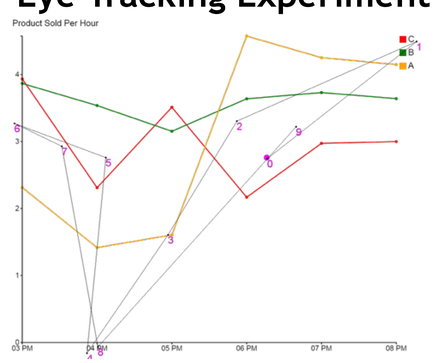
Graphical Perception Framework



Our graphical perception framework is based on Tim Halverson's work on models that can interact with Web browser-based software, while requiring little modification to task code. Simplified Interfacing for Modeling Cognition - JavaScript (SIMCog-JS) allows the modeler to specify how elements in the interface are translated into ACT-R chunks, allows keyboard and mouse interaction with JavaScript code, and allows ACT-R commands to be sent from the external software.

Eye Tracking Experiment



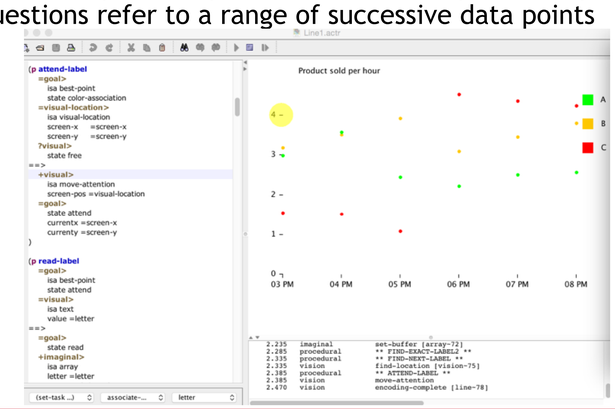


To answer a question by looking at a graph such as a line chart or bar chart, the eyes typically first go to the legend to associate label, then alternate between the data region and the axes to get the quantitative information.

Can a cognitive model reproduce such behavior?

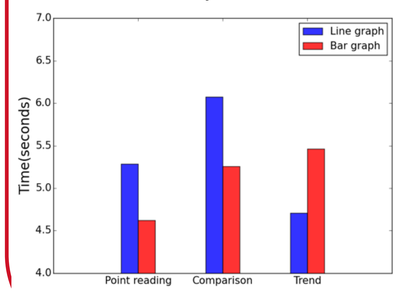
Modeling Process

The cognitive model can process three types of queries: point reading, comparisons, and trends. Point-reading questions refer to a single datapoint . Comparison questions refer to a pair of adjacent data points. Trend questions refer to a range of successive data points



Results

When complete, our models should demonstrate the same behavior as in the human eye-tracking experiment, with the finding that the line graph represents trends fairly well, but the bar graph is better for comparison.



Simulate the time to retrieve memory chunk

$$RT = Fe^{-(f*A_i)}$$

Future Study

Which graph to select for information presentation based on our cognitive model?