

Mental Models in Naturalistic Decision Making

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MITRE Sponsored Research

The logo for the MITRE Technology Program, featuring a stylized graphic of stacked blocks in yellow, orange, and blue to the left of the text.

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Problem

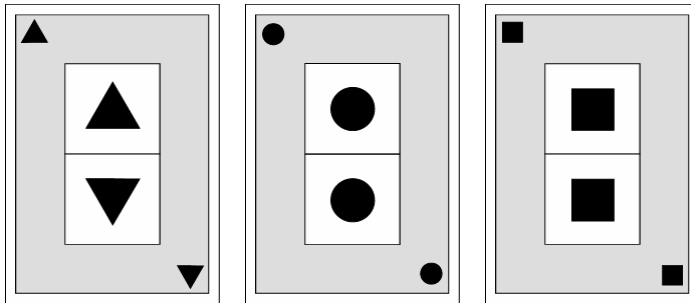
- **Computational models of cognitive functions**
 - Are needed to understand human thinking
 - And to design “decision support” systems
 - And for “modeling & simulation” of people

Background



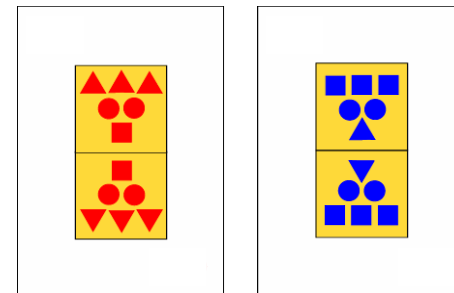
Tool for **R**esearch on **A**daptive **C**ognitive **S**trategies

A family of games played with two-sided cards



Backs of cards are “**t**racks”

Like radar image - uncertain



Fronts are “**t**reads”

Like a target I.D.

Objective

- **Measure and model cognitive performance**
- **In synthetic task environments (card game)**
- **That simulate the cognitive challenges**
- **Of dynamic diagnoses & decisions (C2)**

Activities

■ Laboratory experiments

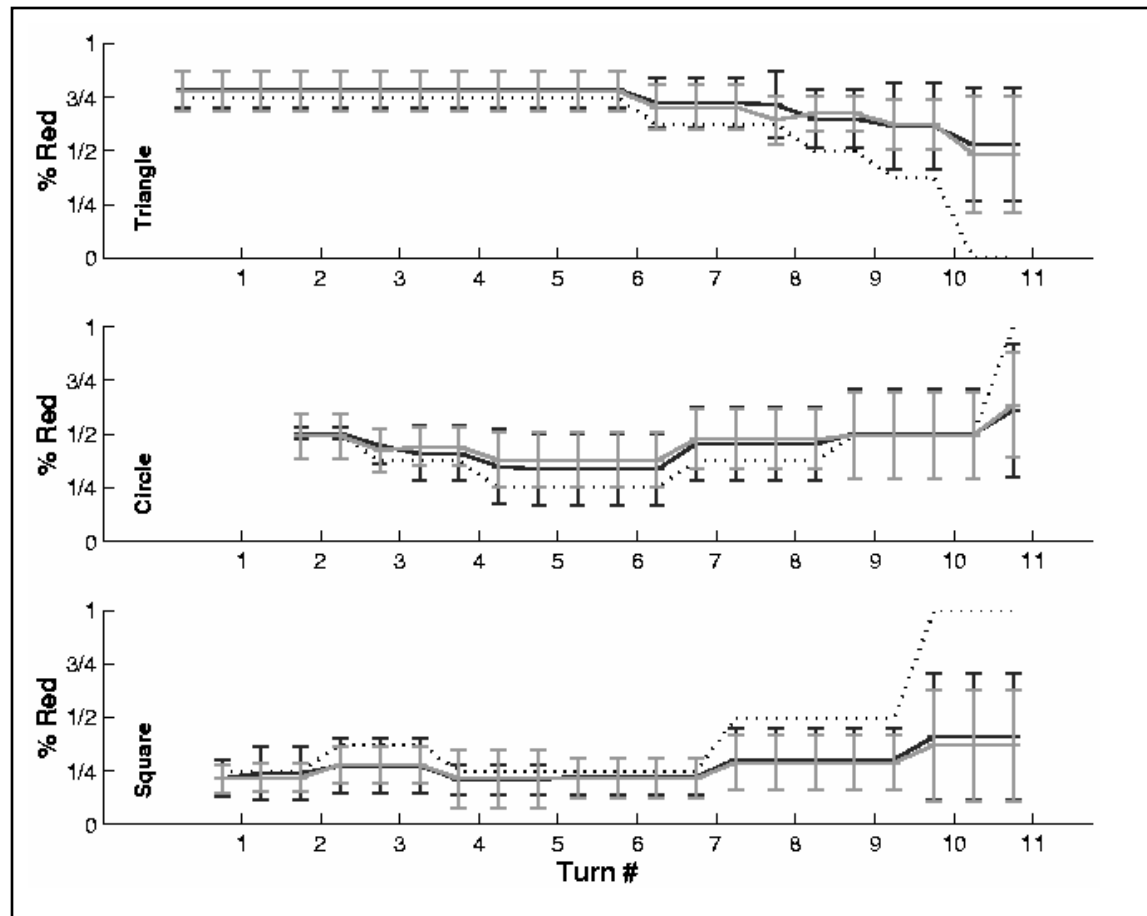
- 1. Straight TRACS: confidence judgments
- 2. Spy TRACS: information fusion (Bayes)

■ Computational analysis

- Modeling cognitive strategies (heuristics)
- And simulating human judgment (biases)

Highlight

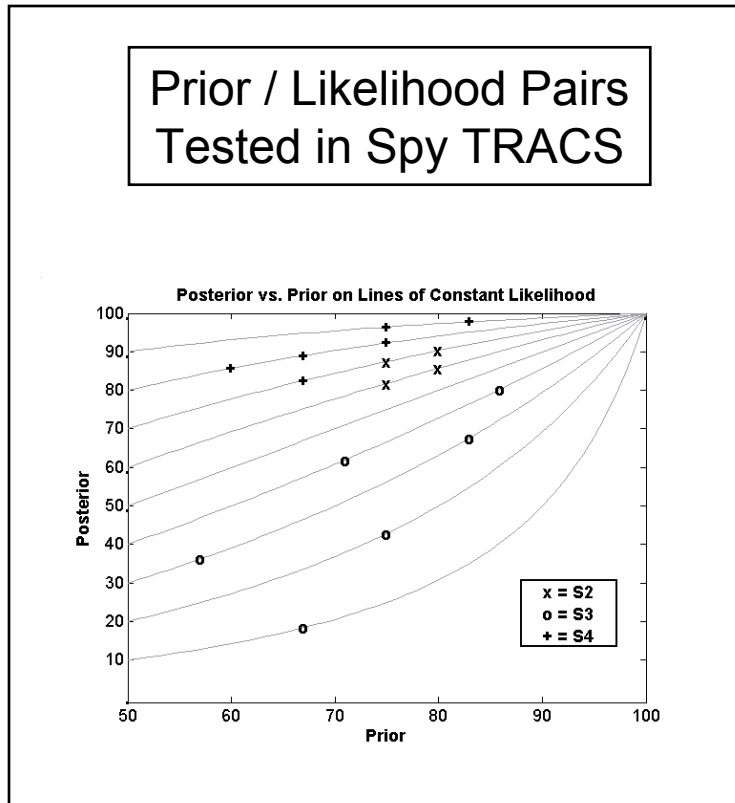
Experiment 1: Agent Model Matches Human Data



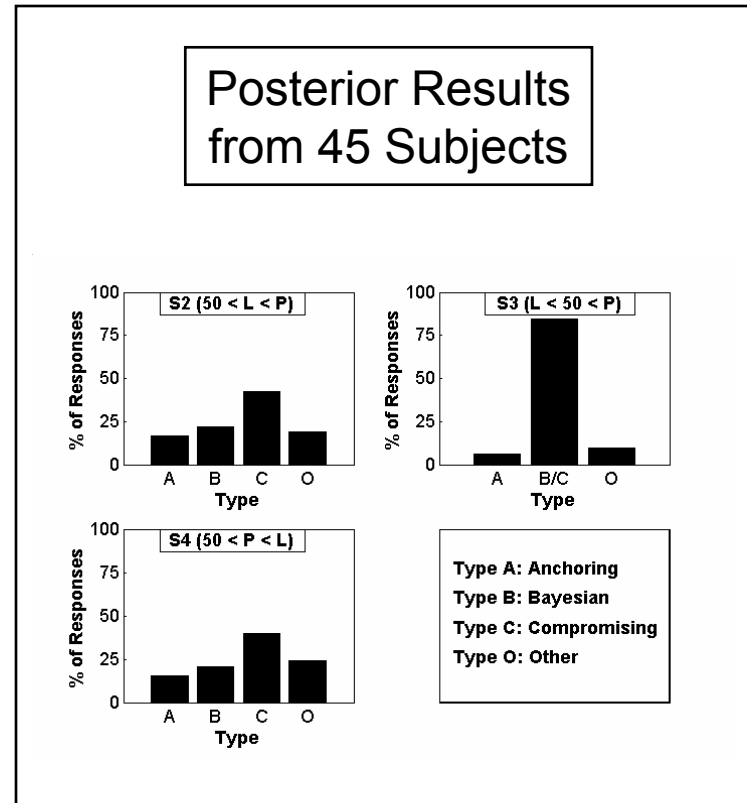
Black is human data. Gray is agent model. Dotted line is perfect player.

Demonstration

Experiment 2: Mental Confusion in Data Fusion



The Game Tests a Good Sample of Bayes Space



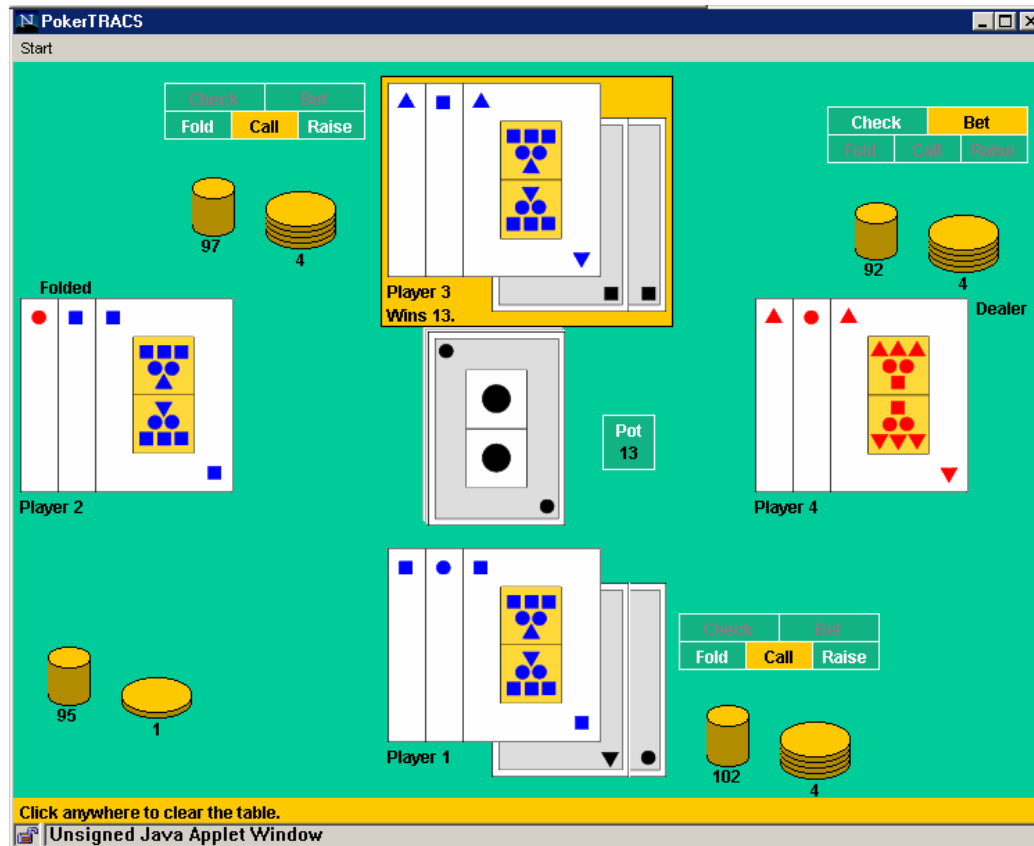
Dominant Mode of Response is Conservative, ~20% is Bayesian

Impacts

- **Psychological insights help us to identify:**
 - **Mental limits in many C2 & intel tasks**
 - **Where people need “decision support”**
- **Computational models of human thinking are:**
 - **Needed to improve human-system design**
 - **And to model and simulate human behavior**

Future Plans

Poker TRACS: A Micro World of Command and Control



For Investigating Diagnoses, Decisions and Deception