People learn to make rational use of fallible heuristics

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Introduction

- People possess a large repertoire of decision strategies.
- How do they know when to use which strategy?
- Do people learn to choose heuristics rationally?
- Does rationality increase with learning?

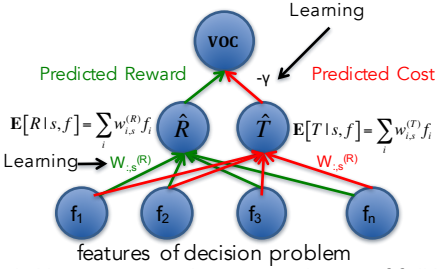
Rational strategy selection

Bounded agents should choose the strategy with the highest value of computation (VOC; Russel & Wefald, 1991, Lieder et al., 2014):

$$\underset{\text{problem}}{\text{VOC}(s,p)} = \underset{\text{reward}}{\mathbb{E}[R|s,p]} - \underset{\text{opportunity cost}}{\gamma \cdot \mathbb{E}[T|s,p]}$$

Problem: Computing the VOC is intractable

Solution: *Learn* to predict the VOC from features of the decision problem:



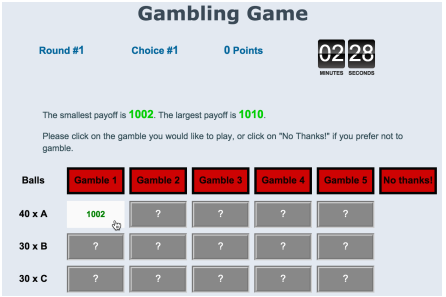
This model learns to make rational use of fallible heuristics. Here, we test two of its predictions:

1. When people deliberate too much, they learn to think less.
2. When people think too little, they learn to deliberate more.

Experiment 1: Thinking too much

Methods

Mouselab paradigm:

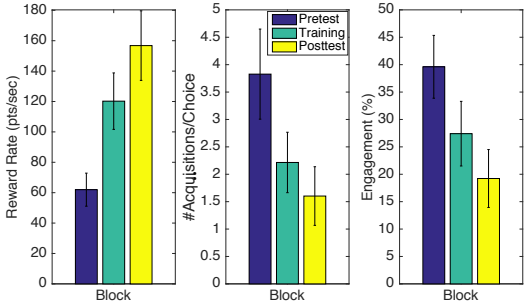


Pretest-Posttest design with types of trials:

Problem Type	Frequency	Worst Outcome	Best Outcome	Optimal Strategy
all great	25%	990	1010	random choice
all bad	25%	-1010	-1000	disengagement
high Stakes	25%	-1000	1000	disengagement
low Stakes	25%	-10	10	disengagement

Results

When people think too much, then they learn to think less:



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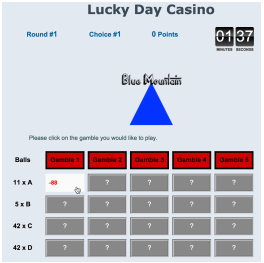
Experiment 2: Thinking too little

Methods

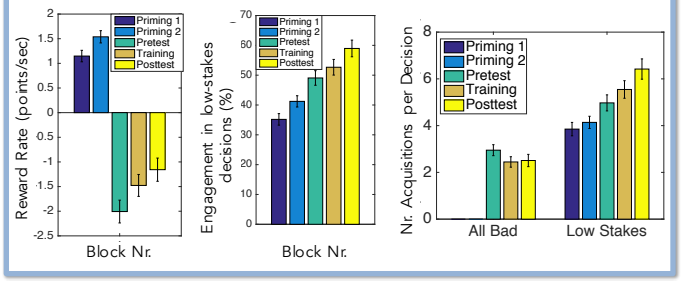


Experimental Design

Block	Low Stakes	High Stakes	All bad
0. Priming	50%	50%	0%
1. Pretest	25%	0%	75%
2. Training	25%	0%	75%
3. Posttest	25%	0%	75%

Results

When people think too little, they learn to think more.



Discussion

- Both experiments confirmed the predictions of our rational model. Further experiments, model comparisons, and simulations provided additional support (Lieder & Griffiths, 2015, under review).
- Our theory reconciles the two poles of the debate about human rationality by suggesting that **people gradually learn to make increasingly more rational use of their finite time and bounded cognitive resources.**

References

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