COGNITIVE PROCESSES AND JUDGMENTAL STRATEGIES IN BELIEF UPDATING

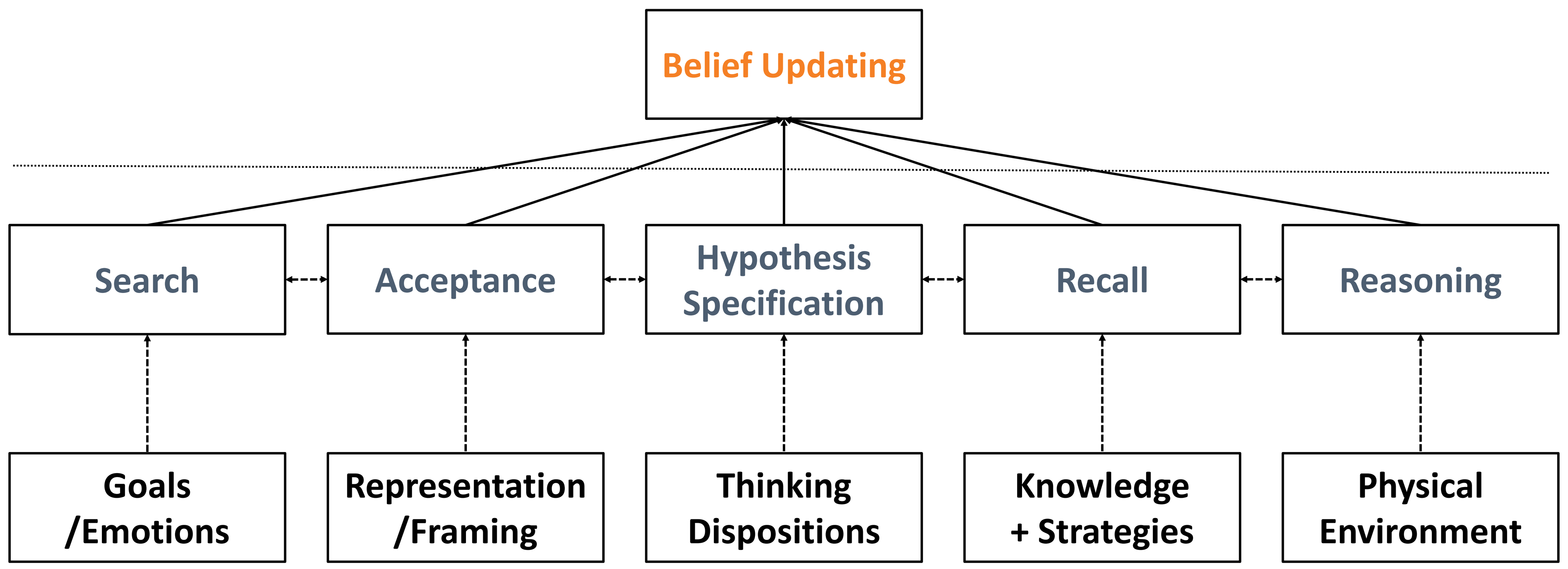
Joseph Sommer & Pernille Hemmer

Princeton University   Rutgers University, New Brunswick

PRINCETON UNIVERSITY

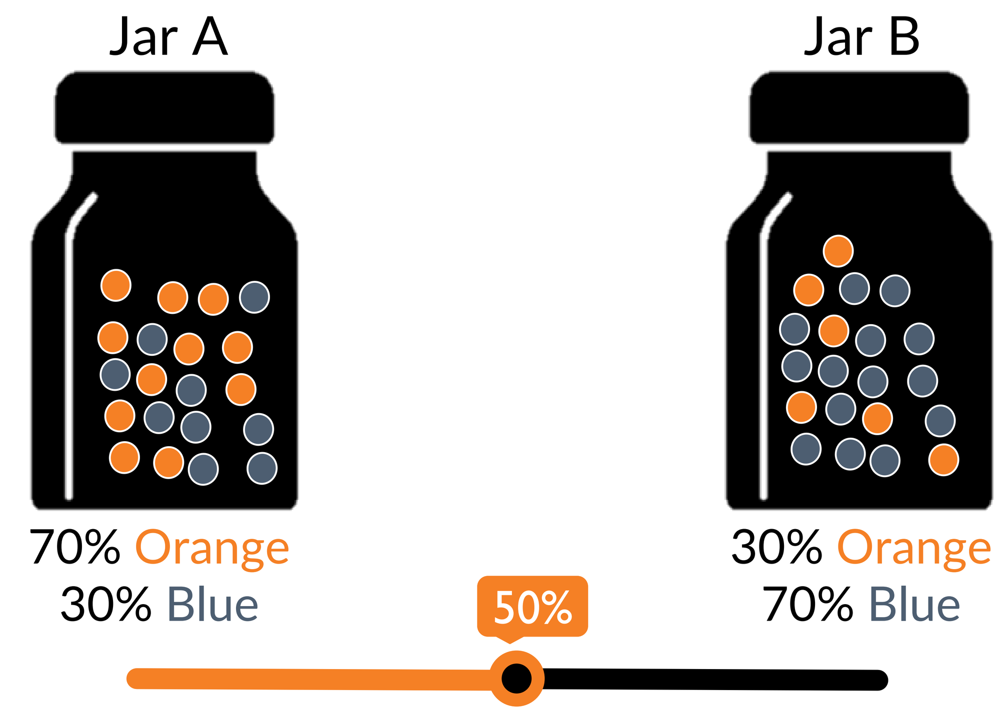
INTRODUCTION

- Sommer, Musolino, & Hemmer (2023) proposed a belief framework distinguishing **belief *updating*** from **evidence evaluation processes**
  - Updating is fast, unconscious, and approximately Bayesian



GOAL

- Can we experimentally dissociate updating and evidence evaluation?
  - Solution: a 60-year-old unsolved problem in JDM



- Suppose we flip a coin to draw from Jar A vs. B
  - Update p(drawing from Jar A | drawn marbles)

Aggregation (Simultaneous presentation)

8 orange & 4 blue

VS.

Judgment (Sequential presentation)

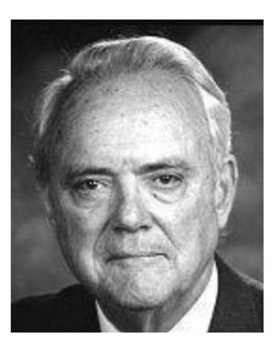
1 orange

1 orange

1 blue …

HYPOTHESIS & PREDICTIONS

- Edwards found less conservatism, relative to Bayesian updating, for *judgment* than for *aggregation*
  - The mechanism underlying this difference was never identified



"the major cause of conservatism is human **misaggregation** of the data… **[people] perceive each datum accurately and are well aware of its individual diagnostic meaning,** but are unable to combine its diagnostic meaning… with other data"

Conservatism in Human Information Processing (Edwards, 1968/1982)

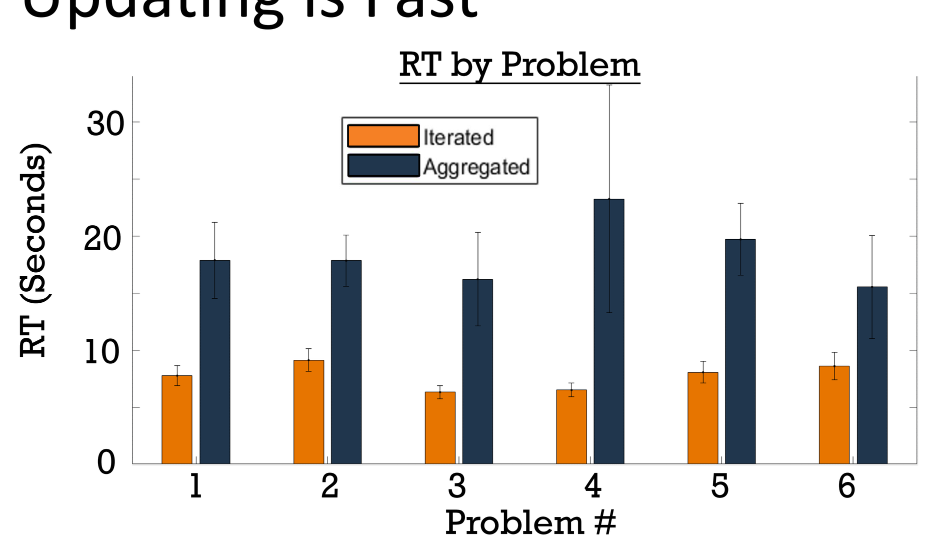
Hypothesis: Updating = Judgment; Aggregation = Evidence Evaluation

- If so, the framework makes predictions:
  1. Updating should be fast
  2. Updating should be inaccessible to verbal report
  3. Updating should be approximately Bayesian

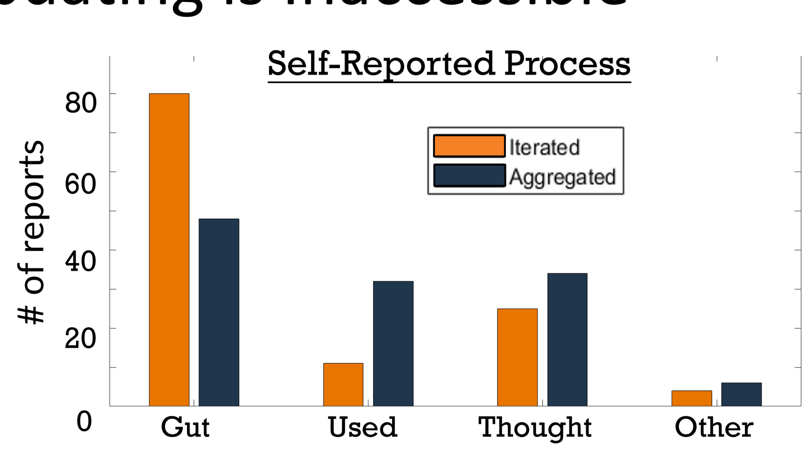
IS BELIEF UPDATING RATIONAL?

EXPERIMENTAL RESULTS

1. Updating is Fast



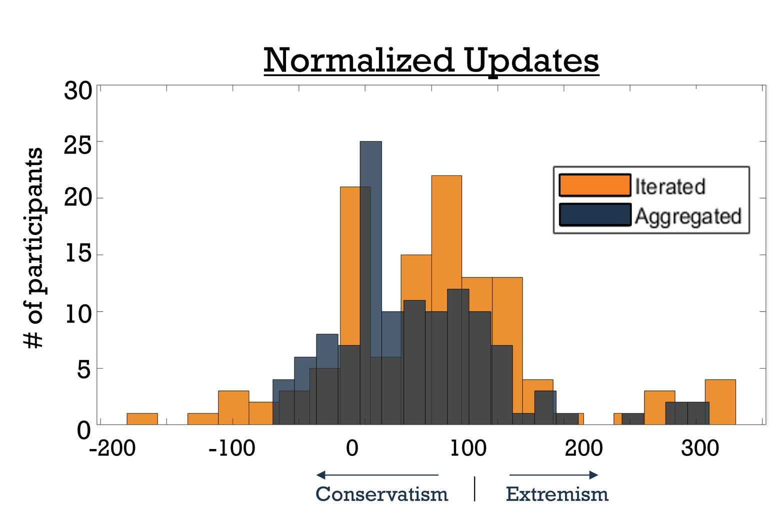
2. Updating is Inaccessible

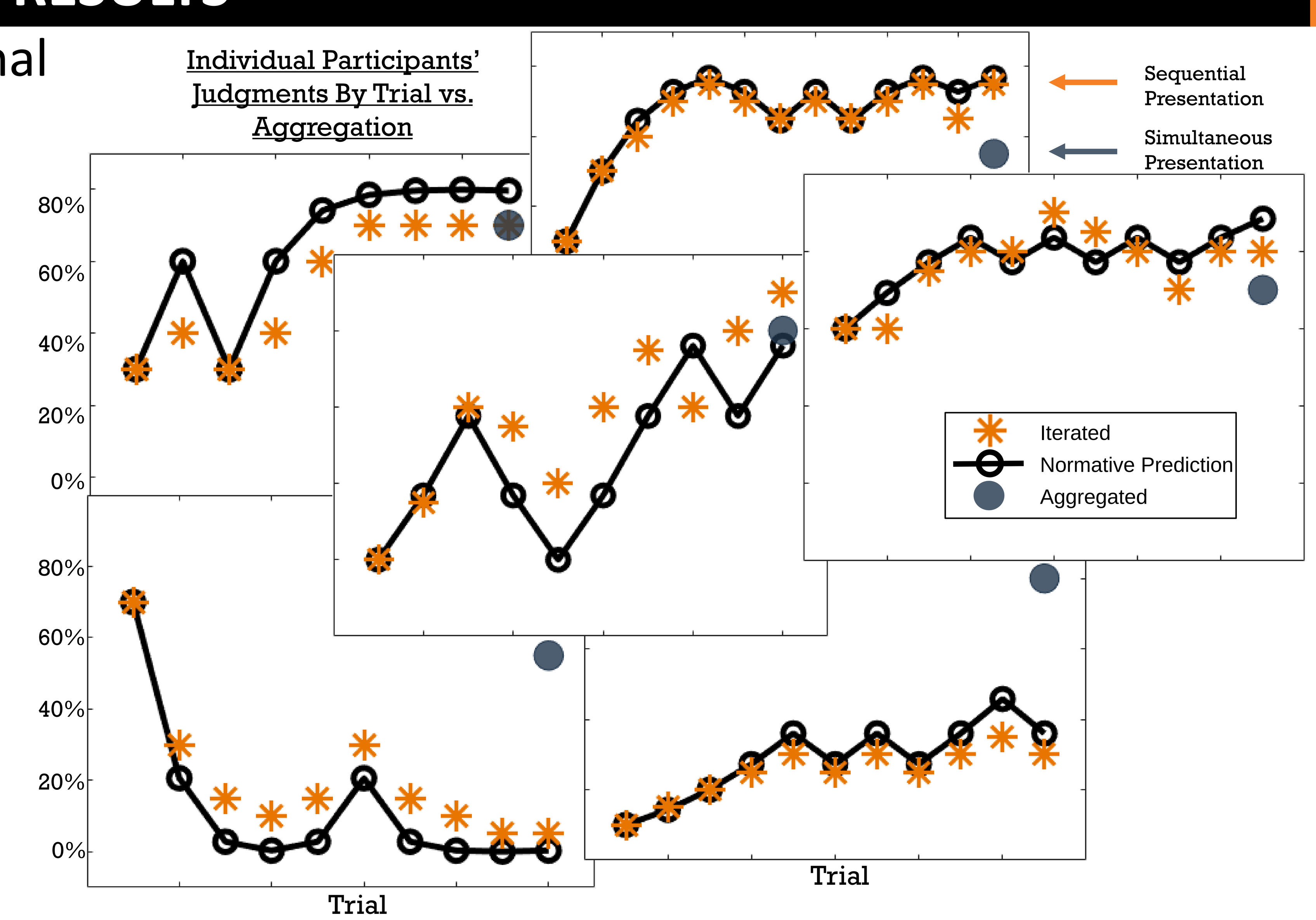


3. Updating is (often) ~Rational

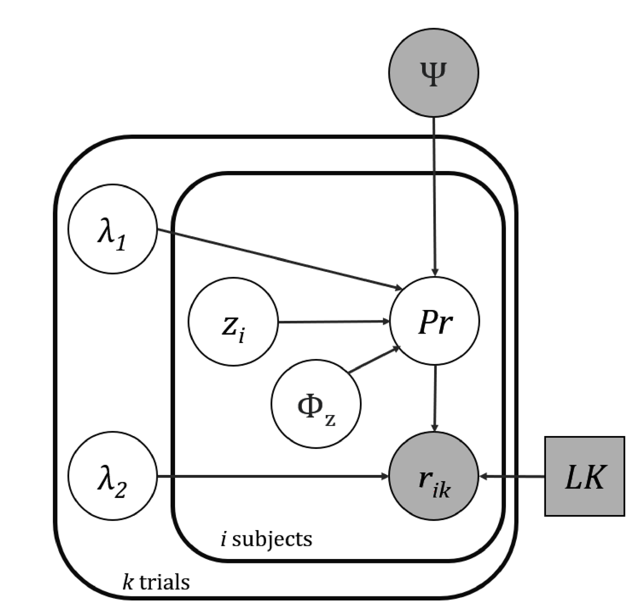
Measuring Updating

$$\frac{(\text{Subjective Posterior} - \text{Subjective Prior})}{(\text{True Posterior} - \text{True Prior})} \times 100$$





MIXTURE MODEL



Five Judgment Strategies

$z_i \sim \text{Categorical}(⅕, ⅕, ⅕, ⅕, ⅕)$

$\Psi \leftarrow 0.5$

$\Phi_1 \leftarrow \dfrac{p(D|H) * p(H)}{p(D|H) * p(H) + p(D|{\sim}H) * p({\sim}H)}$

$\Phi_2 \sim \text{Uniform}(0,1)$

$\Phi_3 \leftarrow \dfrac{p(D|H)^c * p(H)}{p(D|H)^c * p(H) + p(D|{\sim}H)^c * p({\sim}H)}$

$\Phi_4 \leftarrow p(H)$

$Pr \leftarrow \begin{cases} \Phi_z \text{ if } z = 1{:}4 \\ \Psi \text{ if } z = 5 \end{cases}$

$r_{ik} \sim \text{Gaussian}(Pr, \lambda_2)$

$\lambda_1, \lambda_2 \sim \text{Gamma}(.001, .001)$

$\sigma_1 \leftarrow 1/\sqrt{\lambda_1}\,;\ \sigma_2 \leftarrow 1/\sqrt{\lambda_2}$