Disentangling memory interference and motivational processes

A non-stationary diffusion/fast-guess mixture model for output interference in recognition memory

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1 Background

- **Output interference (OI):** recognition accuracy declines over the course of a memory test
- **Proposed mechanisms:** motivational and/or memory processes
- Formal approach to OI by means of **diffusion decision model** (e.g., Kılıç, 2012; Osth et al., 2018)
    - Decrease in drift rate (evidence for a cognitive process)
    - Ambiguous findings for boundary separation
- **Problem(s):** No trial-level modeling, motivation is exclusively mapped onto boundary separation parameter
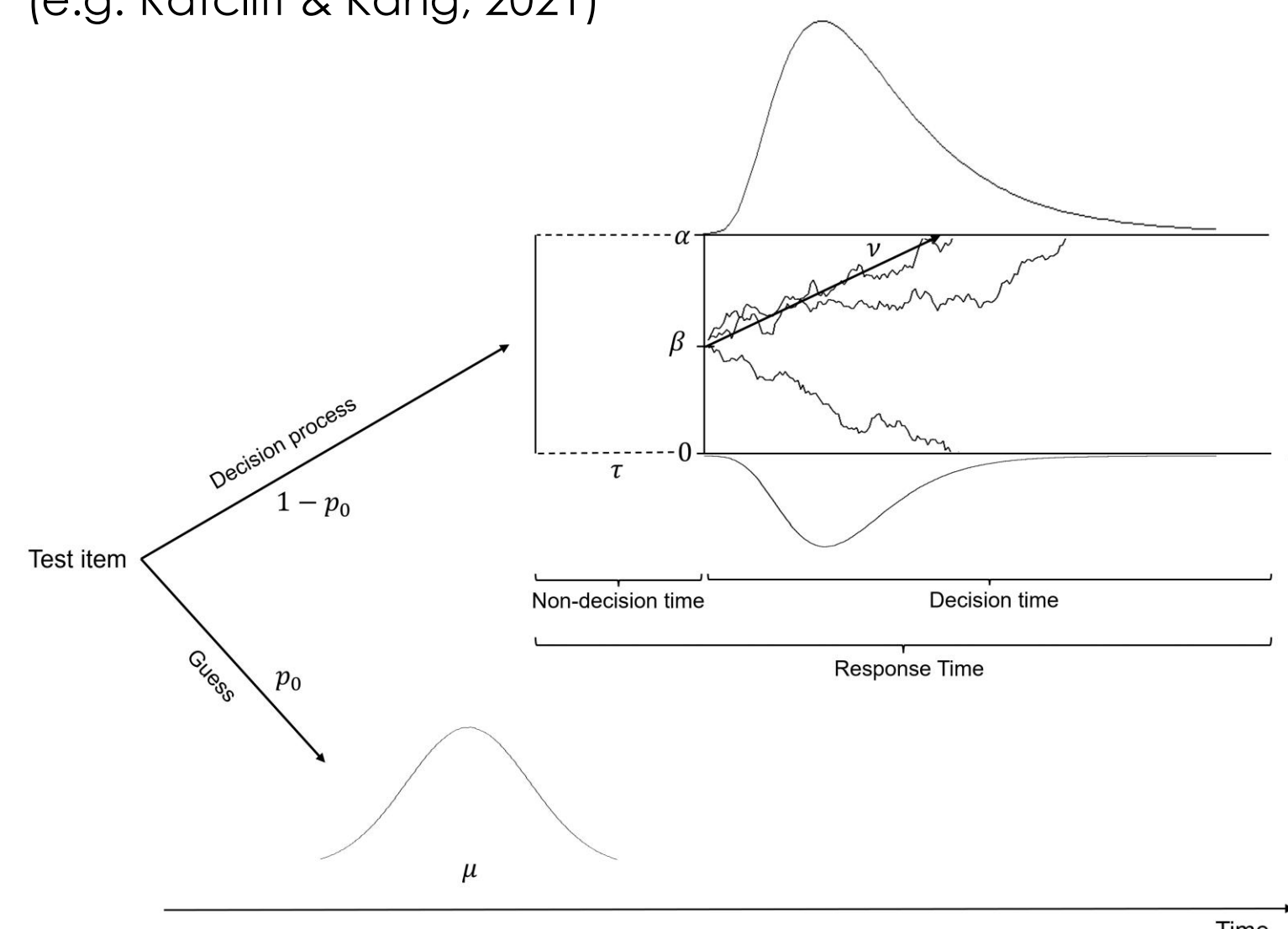
2 This Research …

… introduces **guessing** as an additional motivational measure and models **parameter trajectories at the trial level** to gain more insight into the relative processes contributing to OI.

3 Model Development

3.1 Neural Superstatistics (Schumacher et al., 2023)
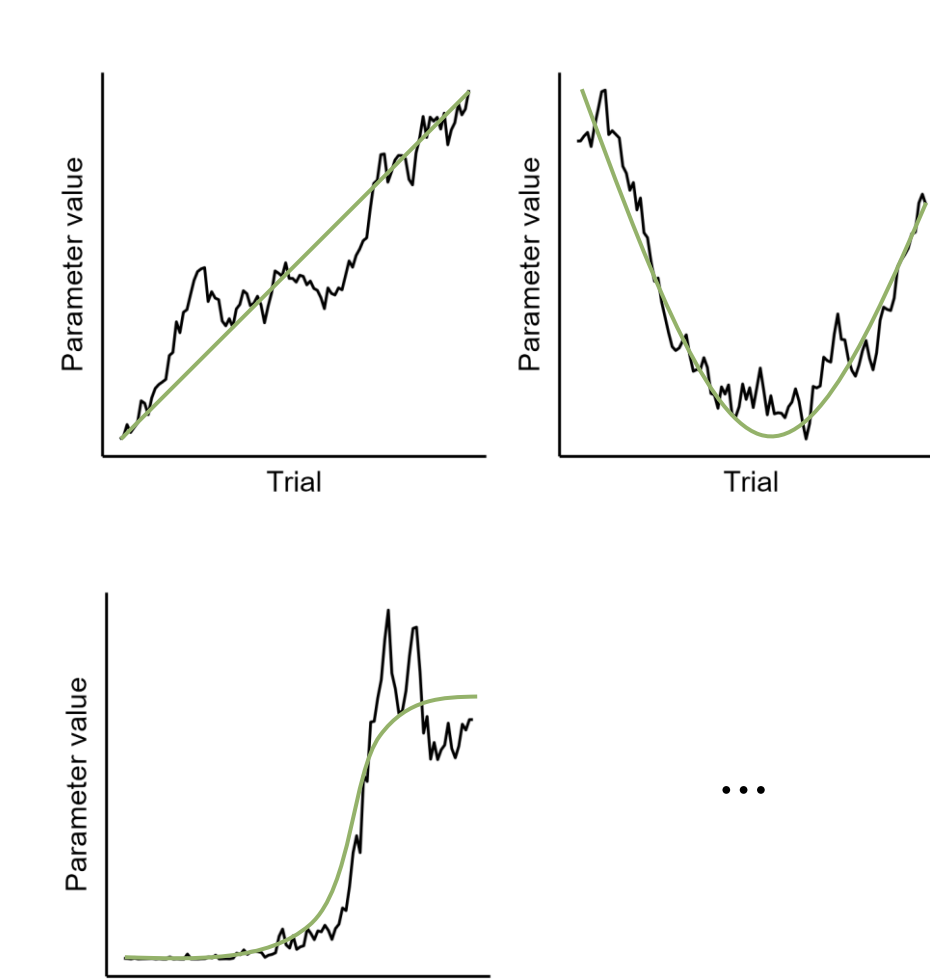
Low-level observation model:
Diffusion/fast-guess mixture model
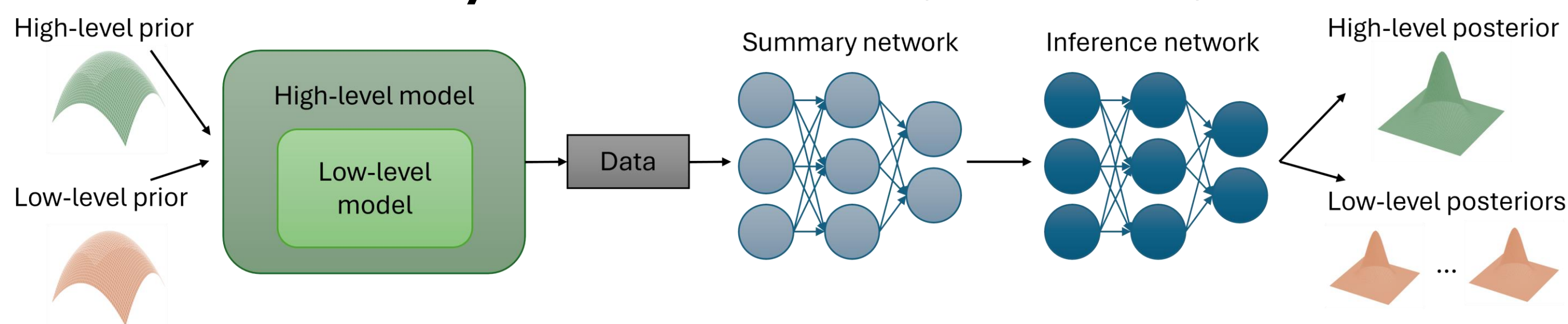(e.g. Ratcliff & Kang, 2021)

High-level transition model:
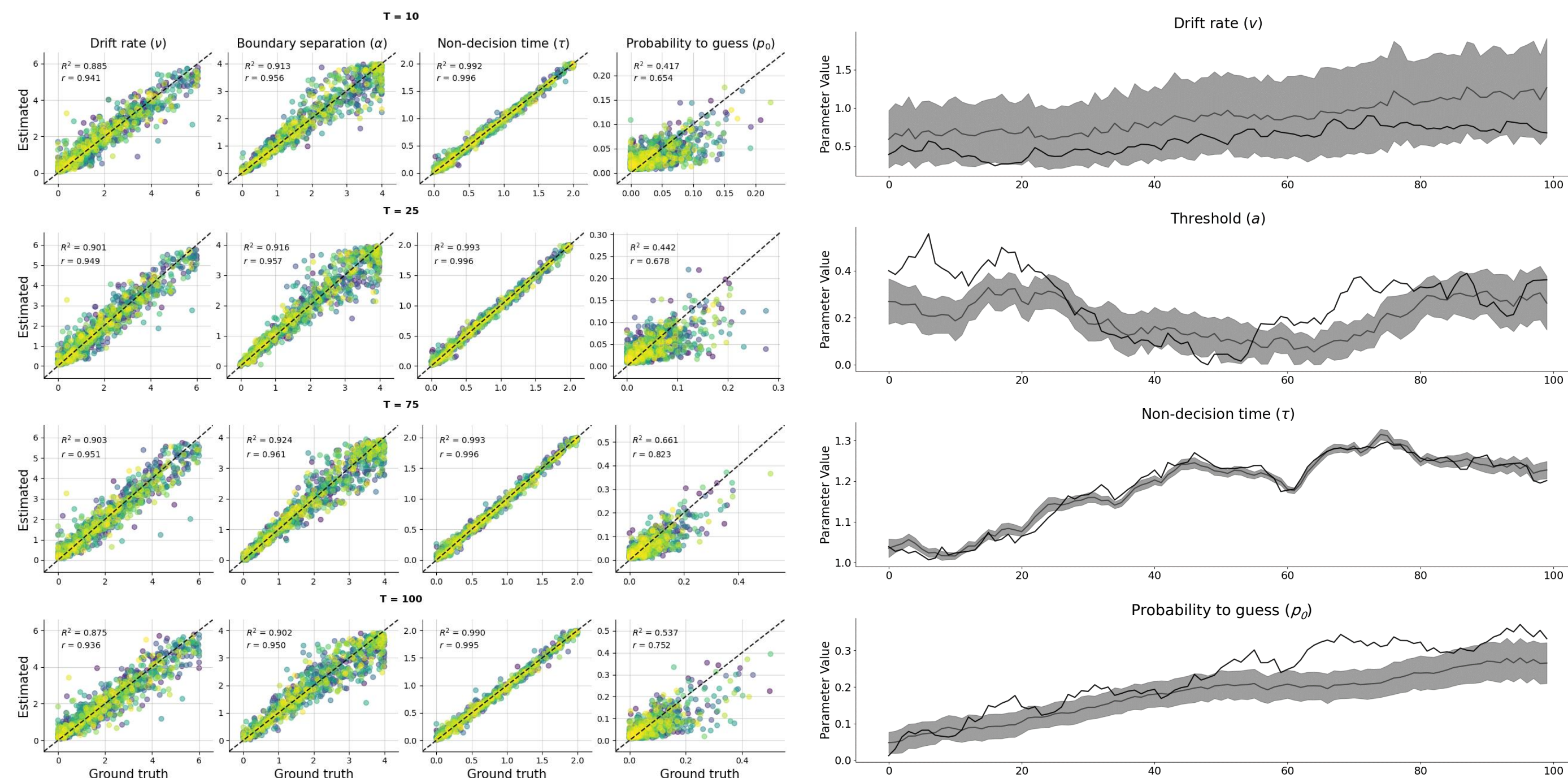Gaussian random walk

The diffusion/fast guess mixture model is augmented with a **temporal dimension**, allowing the parameters to gradually change resembling a Gaussian random walk.

3.2 Amortized Bayesian Inference (Radev et al., 2022)

3.3 Model Validation
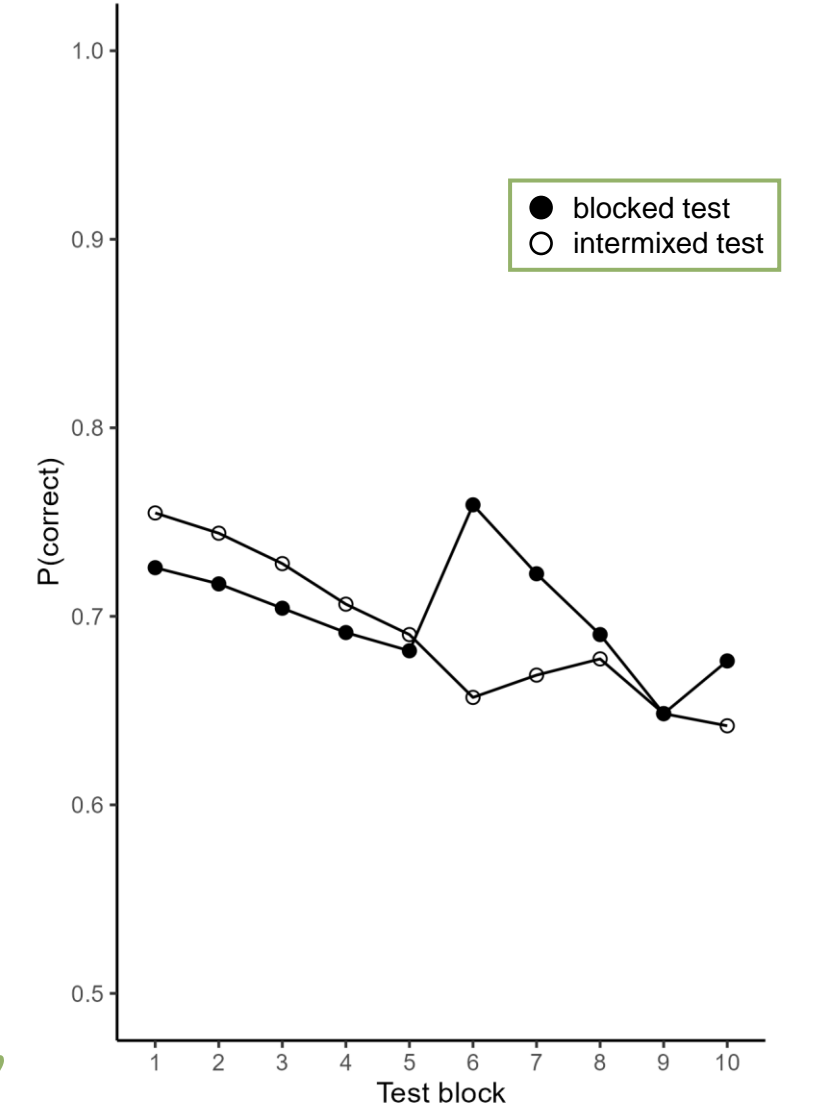

4 Data Sets

1 Schnuerch (2014):
Recognition memory for images with 2AFC response format, $i = 80$

2 Osth et al. (2018):
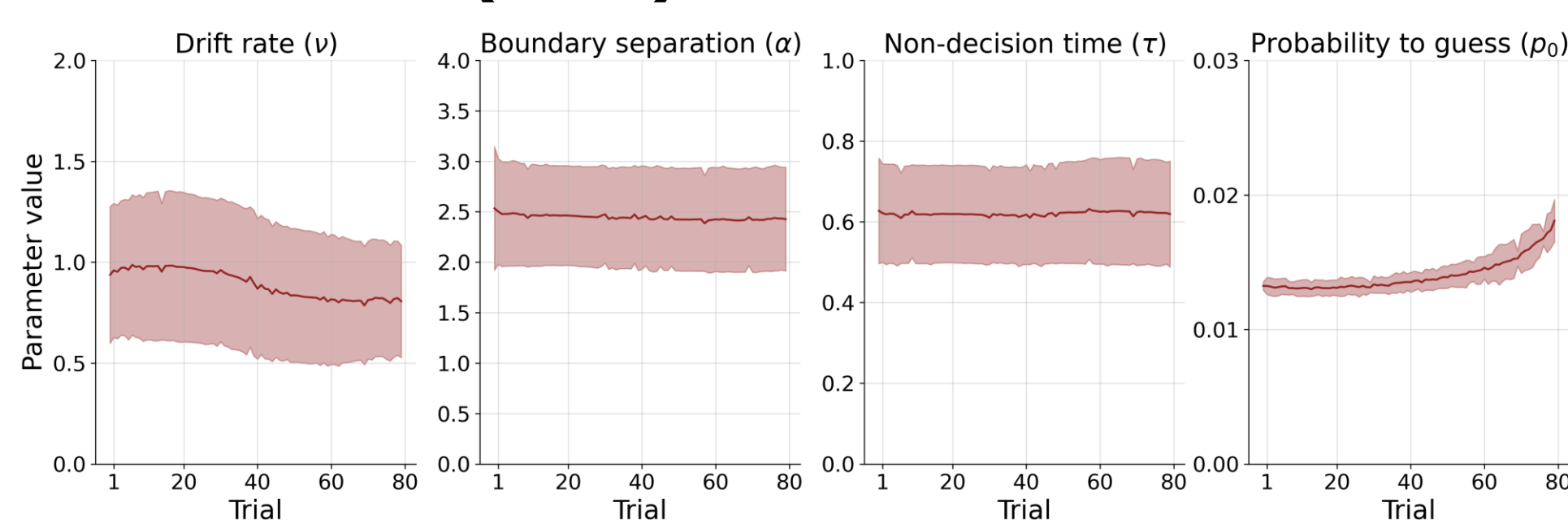Recognition memory for words with old/new categorization, $i = 96$

3 Criss et al. (2018):
Reduction of OI by switching material from words to faces with 2AFC response format, $i = 100$
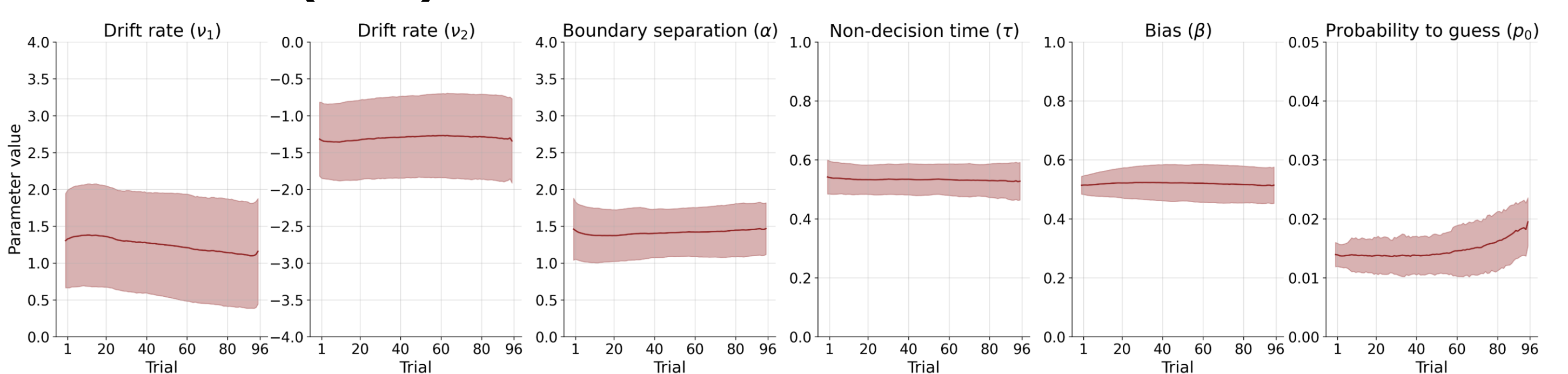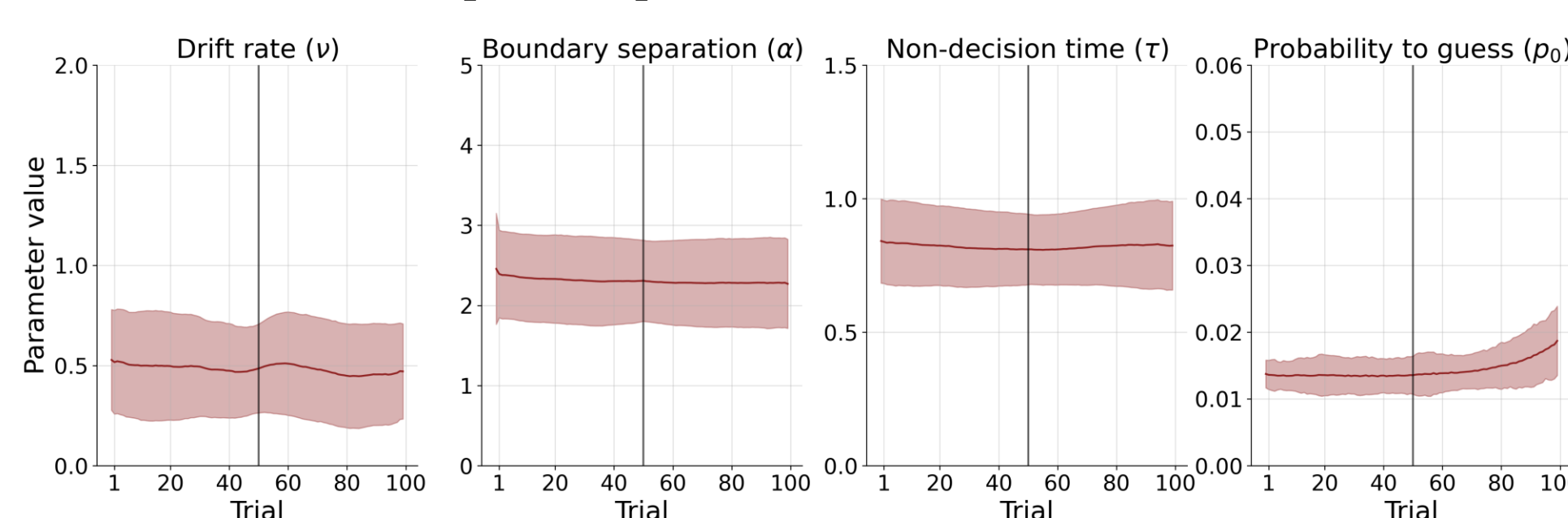

5 Reanalysis Results

1 Schnuerch (2014):

2 Osth et al. (2018):

3 Criss et al. (2018):

The **drift rate declines** over the course of the test. The boundary separation changes with time, but trends are ambiguous across data sets. The **probability to guess**, which was introduced as a new measure of motivation, **increases** with the number of test trials. The non-decision time is unaffected by time.

6 Discussion

- We find an **effect of retrieval and motivational processes** and demonstrate the **need to consider dynamics** in decision-making in recognition memory.
- **Limitations:**
    - No conclusions towards underlying mechanisms (e.g., item vs. context noise)
    - Can random walk appropriately capture dynamics in guessing?
- Further validation of neural superstatistics approach: experimental manipulations are captured in the relevant parameter (also see Schumacher et al., 2024)

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