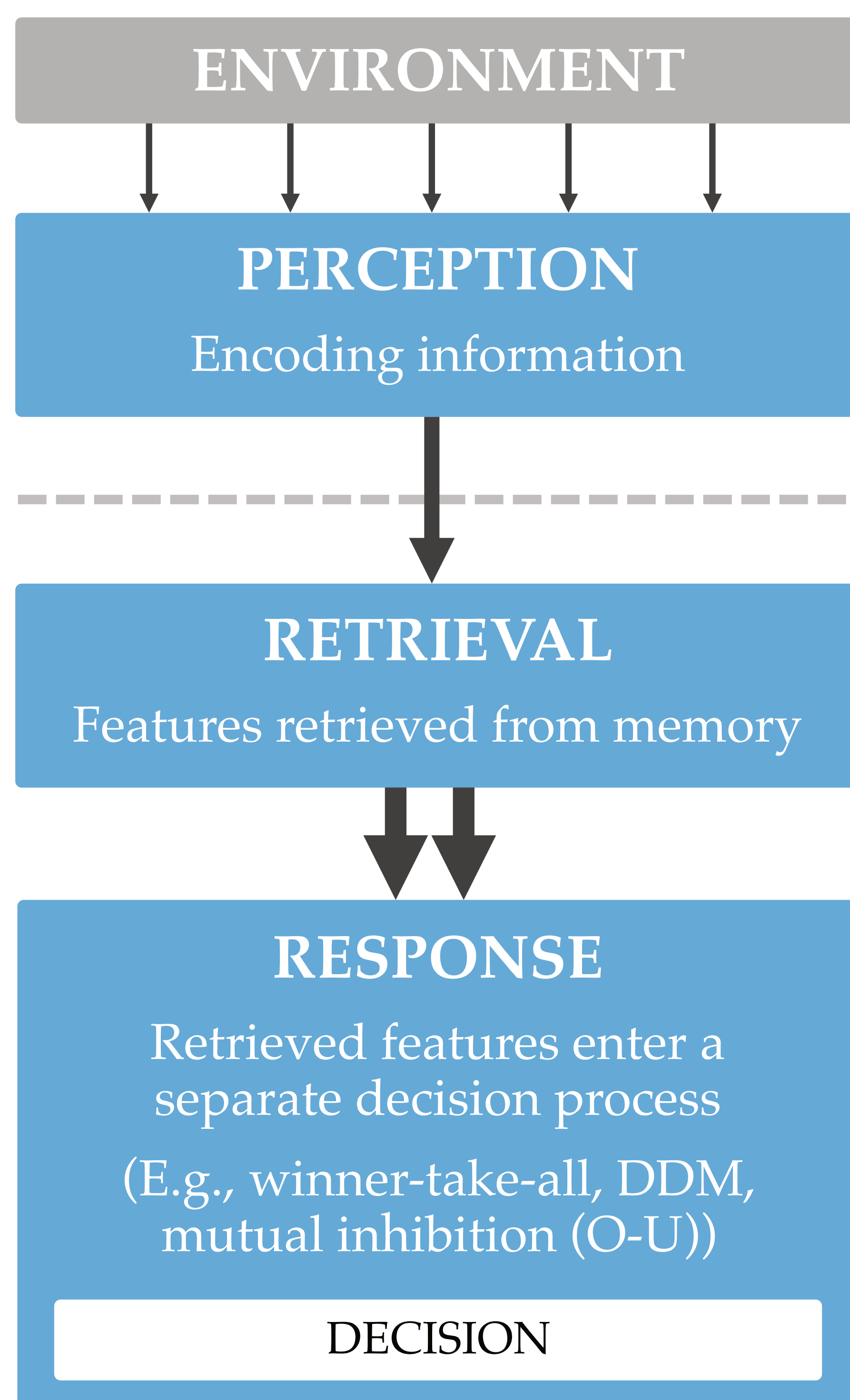


INTRODUCTION

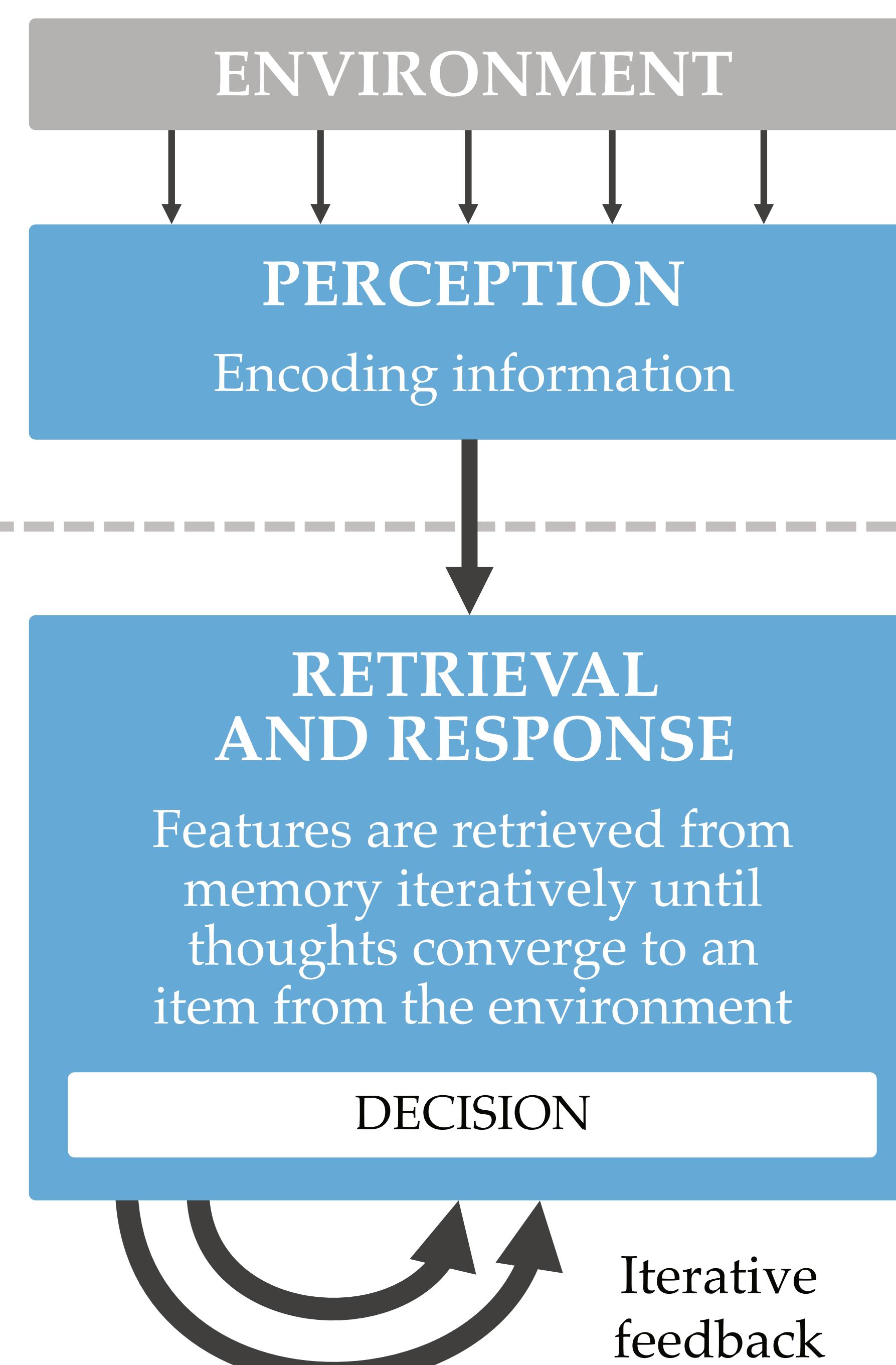
- Existing models of memory separate the encoding process from the decision process (Sederberg et al., 2008).
- But the memory system is involved in retrieval and decision-making, not just in encoding.
- We propose a model in which the same iterative memory process underlying encoding also underlies recall and decision-making.
- By endogenizing the dynamics of the response process in the memory system, the model provides a memory-based explanation for choice behavior and decision times.

MODEL COMPARISON

STANDARD MODELS



OUR MODEL



MODEL DETAILS

ENCODING

- Subjects first study a list of items.
- The encoding process is the same as in the standard temporal context model (e.g., Sederberg et al., 2008).
- List item i evokes feature representation f_i .
- This cue f_i retrieves context

$$c_i^{\text{in}} \propto M_{i-1} f_i$$

- Context evolves autoregressively:

$$c_i = (1 - \zeta) c_{i-1} + \zeta c_i^{\text{in}}.$$

- Context and features re-encoded into memory

$$M_i = M_{i-1} + c_i f_i^{\text{T}}$$

RETRIEVAL & RESPONSE

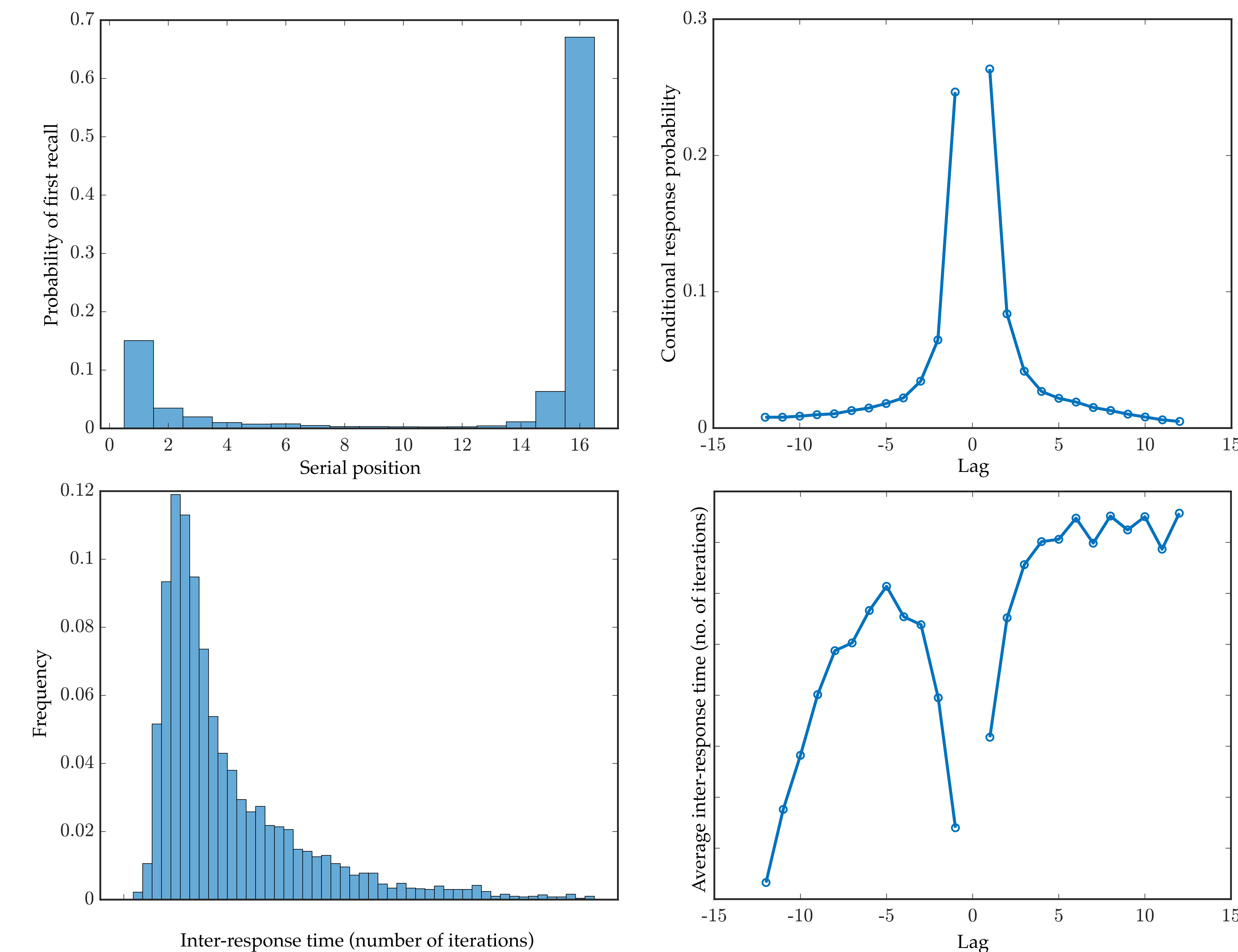
- Retrieval is the same as encoding, but two new assumptions.
- Memory iteration:**
 - Subjects retrieve features f_{t-1}^{in} from memory.
 - These features (thoughts) retrieve a new context

$$c_t^{\text{in}} \propto M_{t-1} f_{t-1}^{\text{in}}.$$

- New context retrieves new features, and so on.
- Repeat until f_t^{in} converges.
- Competitive retrieval:**
 - Larger elements of f_t^{in} shrink smaller elements of f_t^{in} .
- Result: Thoughts evolve autoregressively:

$$\Delta f_t^{\text{in}} = \underbrace{\zeta D_{t-1}^F (\Phi_0 - I) f_{t-1}^{\text{in}}}_{\text{memory iteration}} + \underbrace{\zeta D_{t-1}^F (f_{t-1}^{\text{in}} - \tilde{f}_{t-1}^{\text{in}})}_{\text{competitive retrieval}}$$

SIMULATION RESULTS



CONCLUSIONS

- Accounting for the role of the memory system in the encoding, retrieval, and response processes implies realistic temporal dynamics of recall and decision-making.
- The model serves as a memory-based microfoundation for a large class of models that have been used to understand recall and other decisions (Usher & McClelland, 2001).
- Next steps:
 - Add semantic similarity and study extra-list intrusions.
 - Apply beyond free recall: TAFC and economic decisions.

REFERENCES

- Sederberg, P. B., Howard, M. W., and Kahana, M. J. (2008). A context-based theory of recency and contiguity in free recall. *Psychological Review*, 115(4), 893–912.
- Usher, M., & McClelland, J. L. (2001). The time course of perceptual choice: The leaky, competing accumulator model. *Psychological Review*, 108, 550–592.