



Introduction

- The Time-Based Resource-Sharing (TBRS) model is a theory of Working Memory (WM)

Maintenance

Processing

b...c...d... **WM** 2+2=?

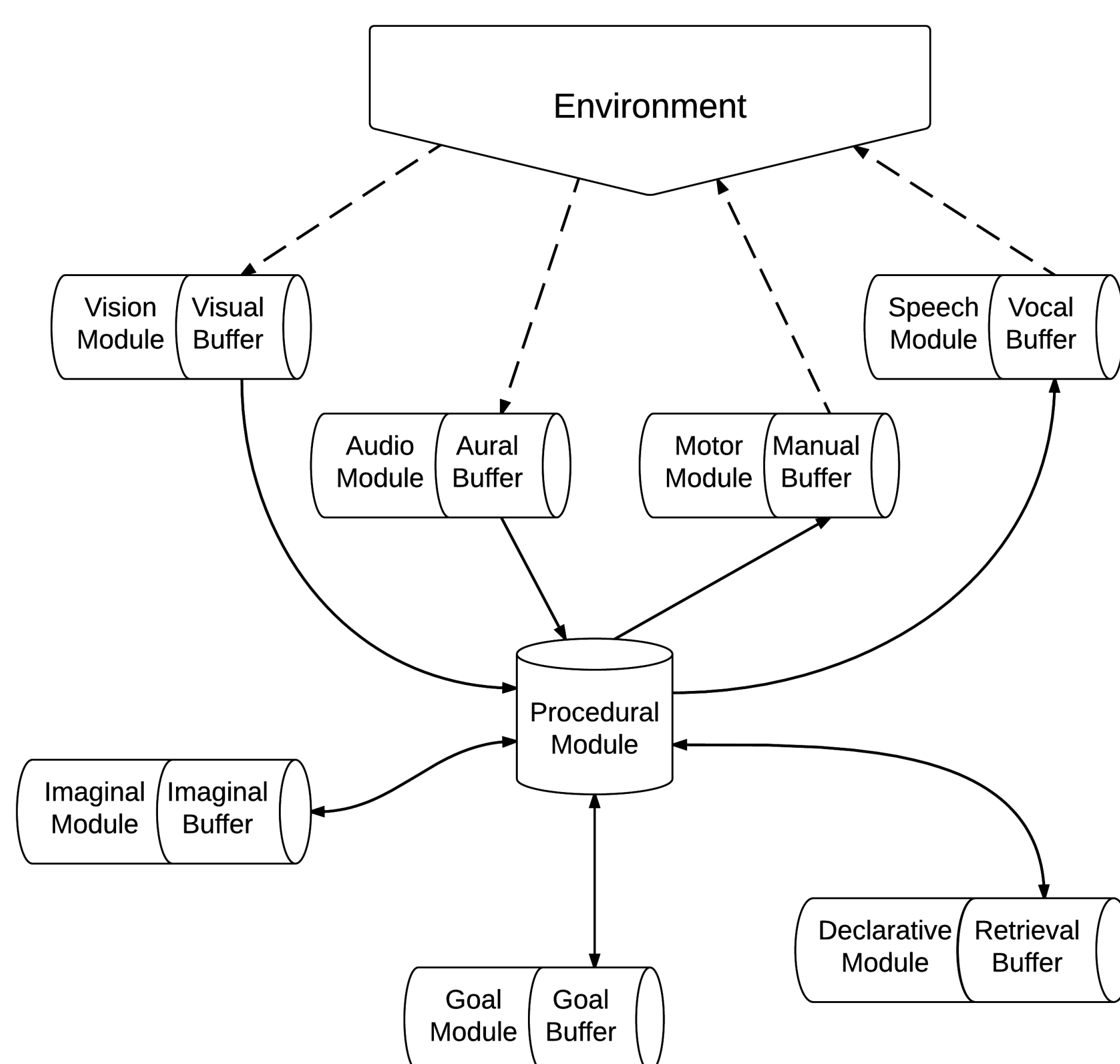
Four Premises of TBRS

- Maintenance and processing require attention
- Attention is expended within a limited-capacity focus or bottleneck
- Memory traces outside the focus of attention experience temporal decay
- Working memory rapidly switches between maintenance and processing roles to balance the temporal needs of each

Modeling Goals

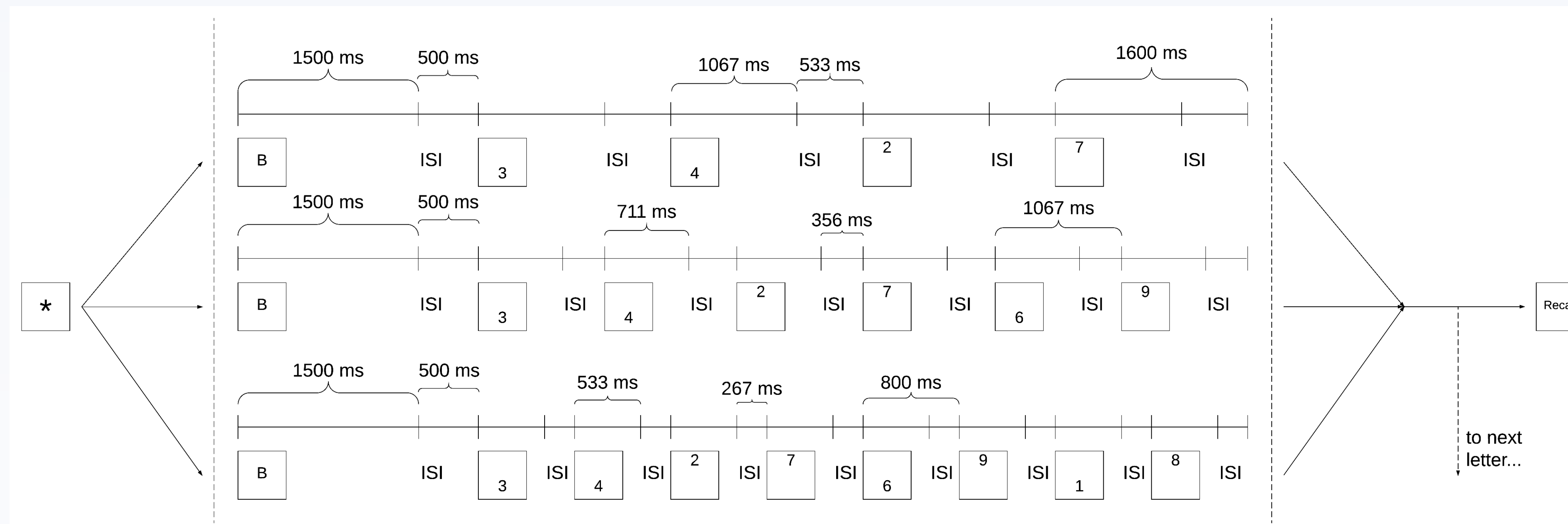
- Formalize into an end-to-end computational model (using ACT-R)
- Highlight ancillary assumptions
- Identify experiments to test these assumptions and further constrain the theory

ACT-R Framework

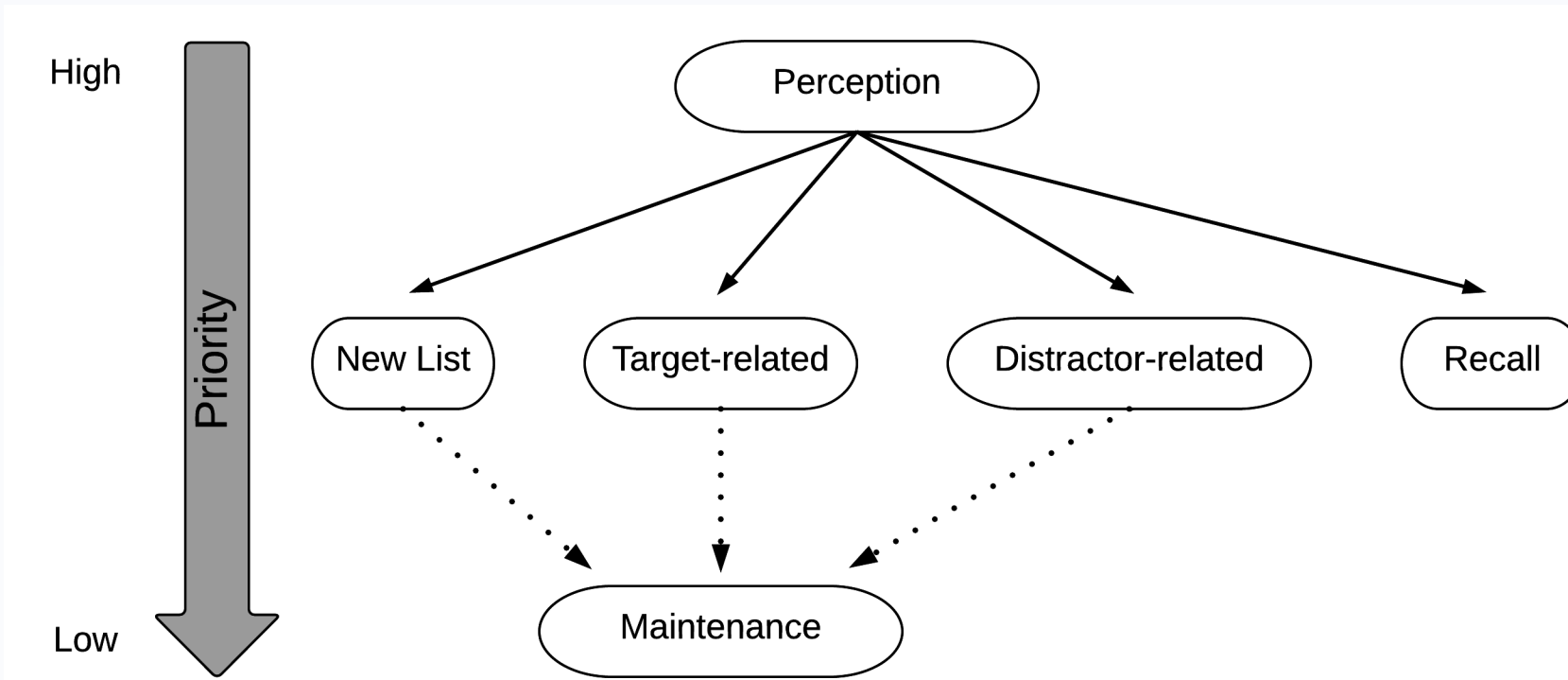


Barrouillet et al. (2007) Task Design

- Letters presented every 8.4 seconds
- Numbers presented at three different paces
- Remember letters for later recall
- Respond to number according to condition
 - Parity condition: Respond odd/even
 - Location condition: Respond bottom/top



Model Design

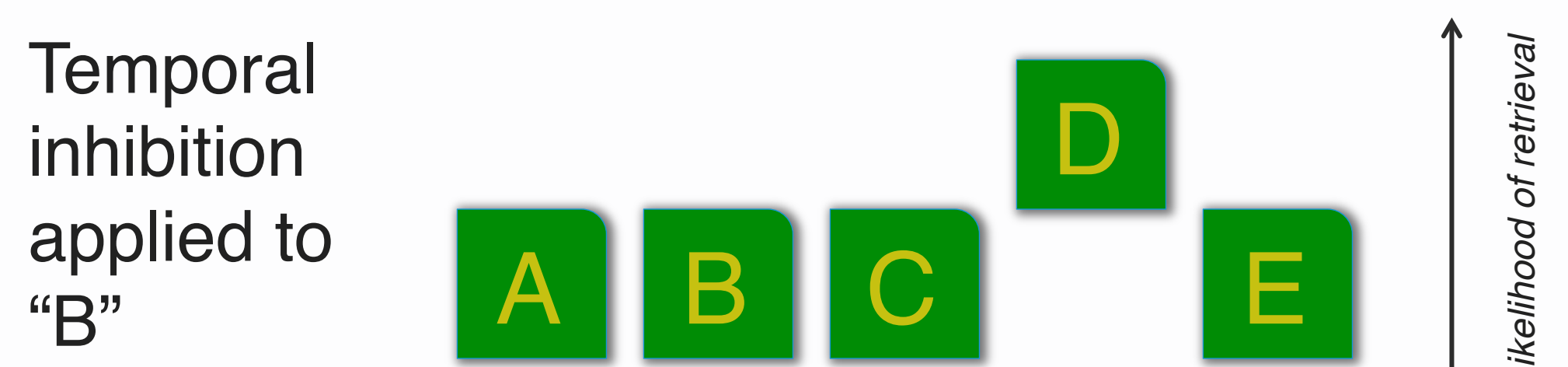
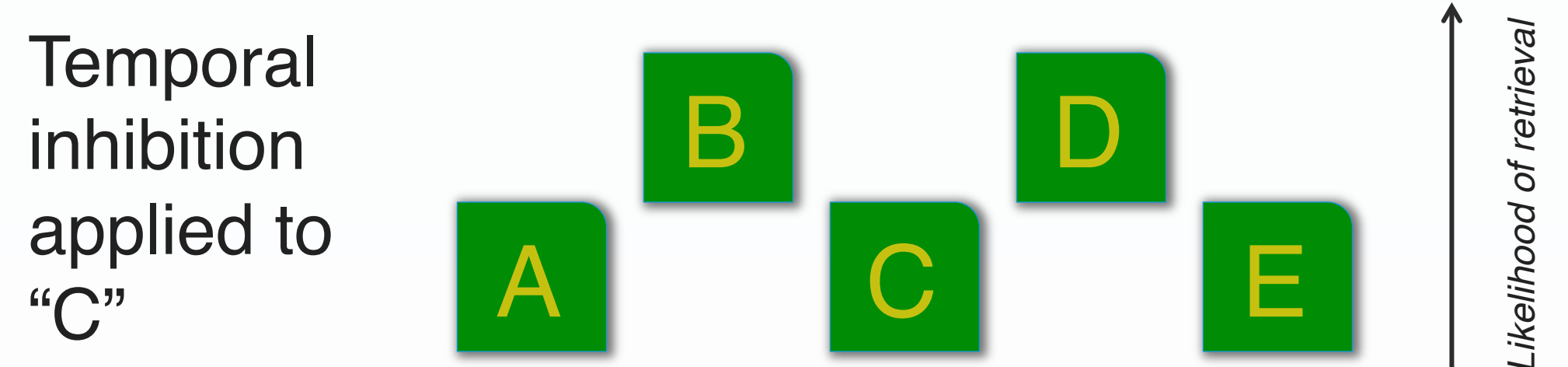
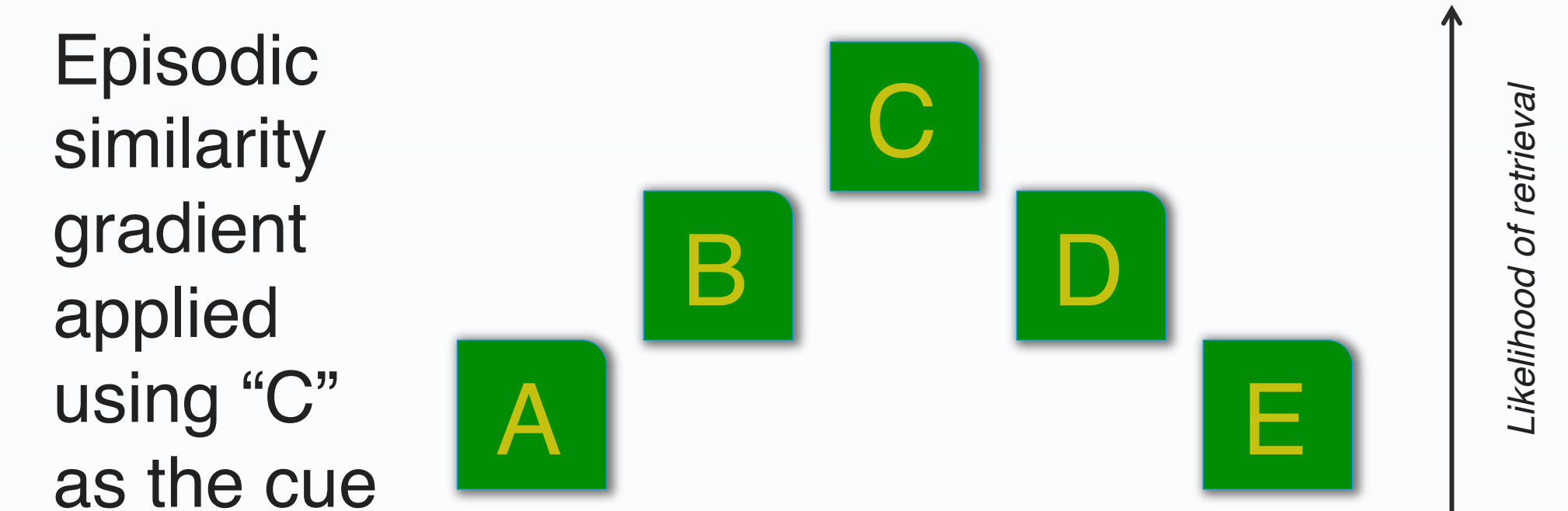
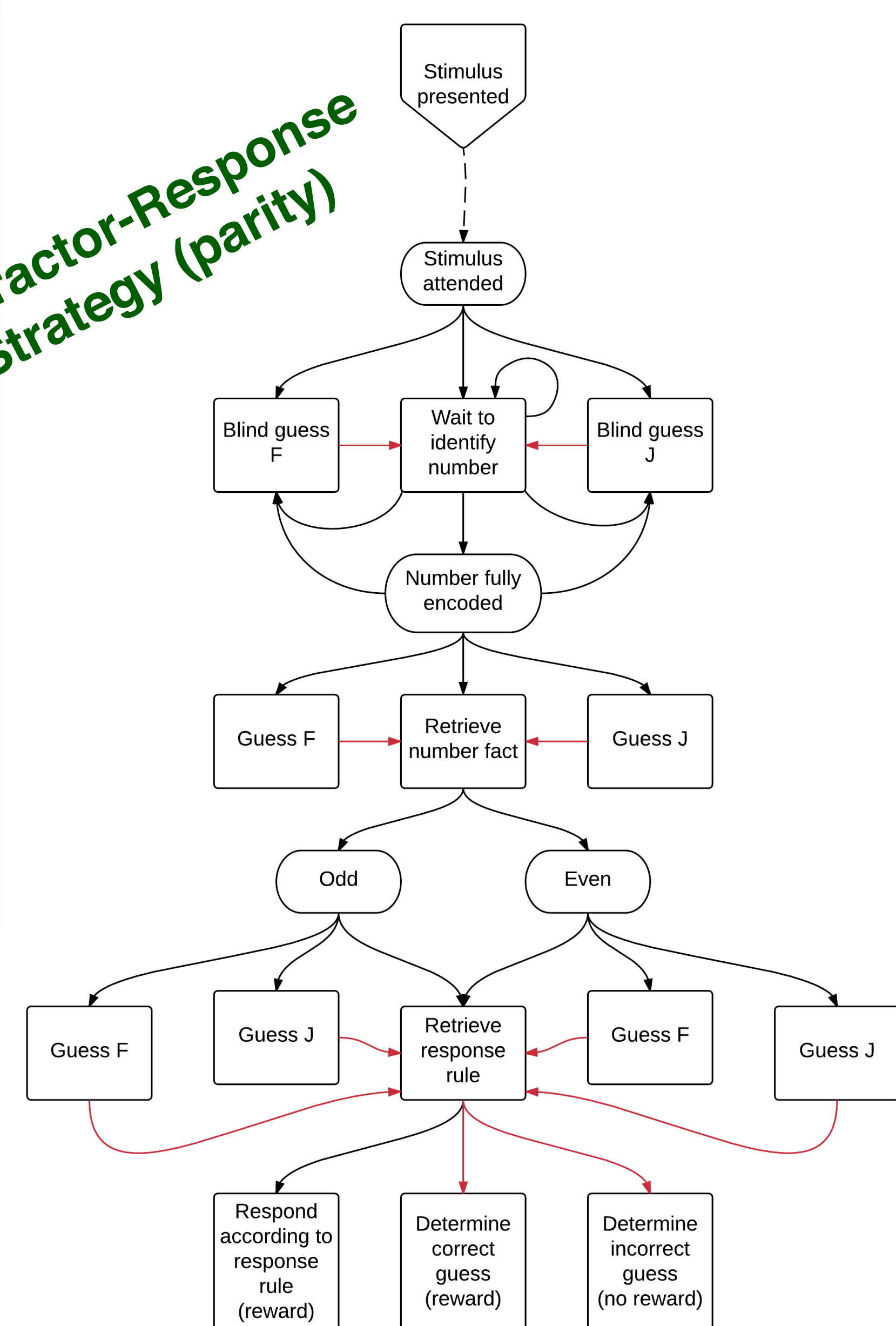


Maintenance Cycle

$$A_i = \ln\left(\sum_{j=1}^n t_{ij}^{-\delta}\right) - \ln\left(1 + \left(\frac{t_{in}}{\gamma_s}\right)^{-\gamma_d}\right) + P_i + \beta + \epsilon$$

$$P_i = \begin{cases} 0 & \text{if chunk } i \text{ matches the request perfectly} \\ -\infty & \text{else if chunk } i \text{ is not a target chunk} \\ -\eta \cdot \ln\left(1 + \frac{|\epsilon_i - \epsilon_{requested}|}{\omega}\right) & \text{else if chunk } i \text{ is a target chunk} \end{cases}$$

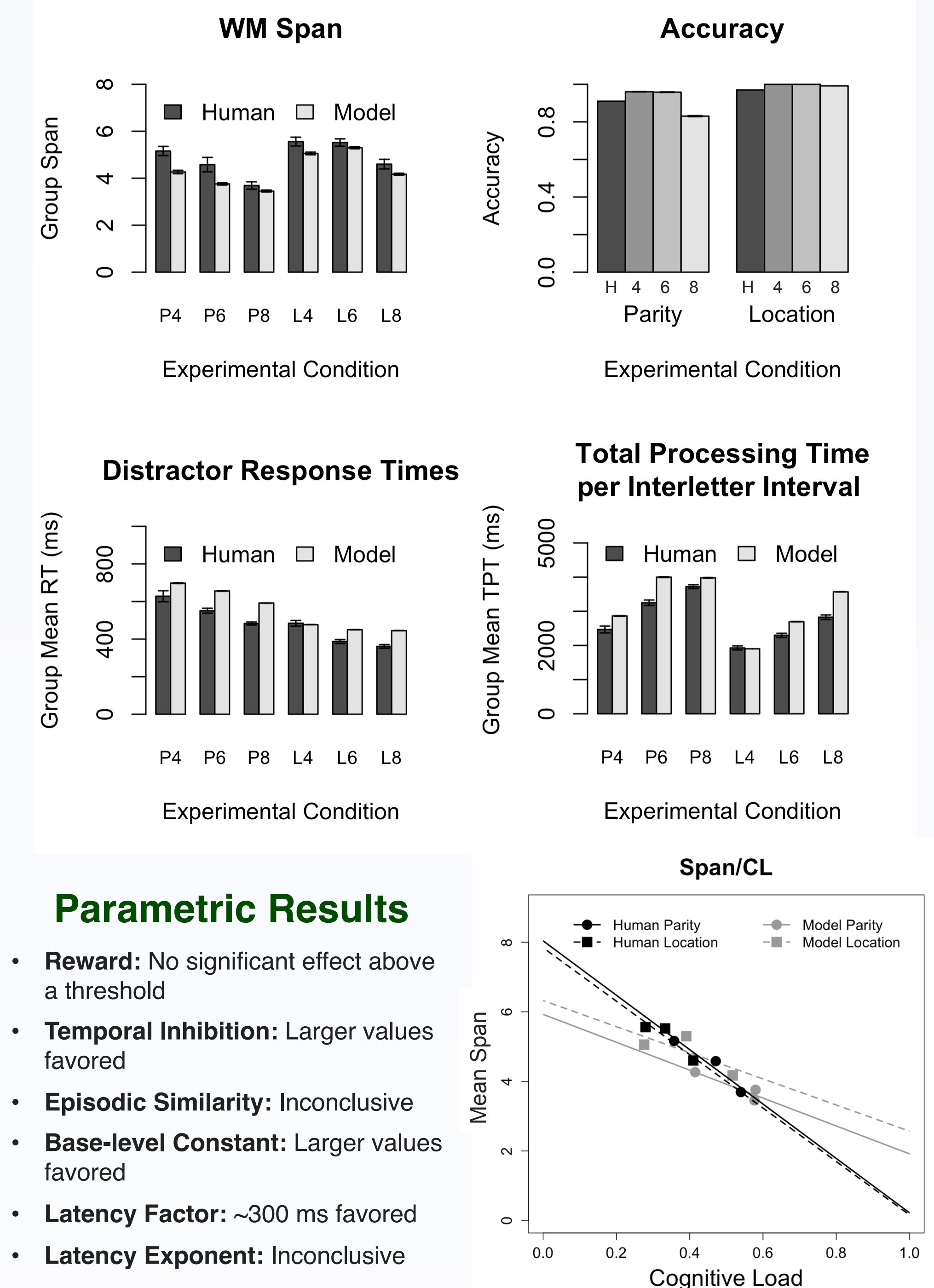
Distractor-Response Strategy (parity)



Model Simulation

- Coarse grid search of six free parameters using MindModeling@Home
- 5⁶ = 15,625 parameter combinations
- 50 simulations each = 781,250 unique runs

Results



Ancillary Assumptions

- Training versus self-generated feedback
- List representation underspecified in TBRS
 - Serial position data needed to constrain episodic similarity parameter
- Articulatory rehearsal not included
- ACT-R's fan mechanism ignored

References

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Acknowledgements

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