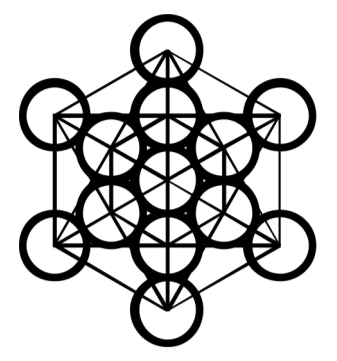


# Neural replay is connected to latent cause inference and supports fast generalization

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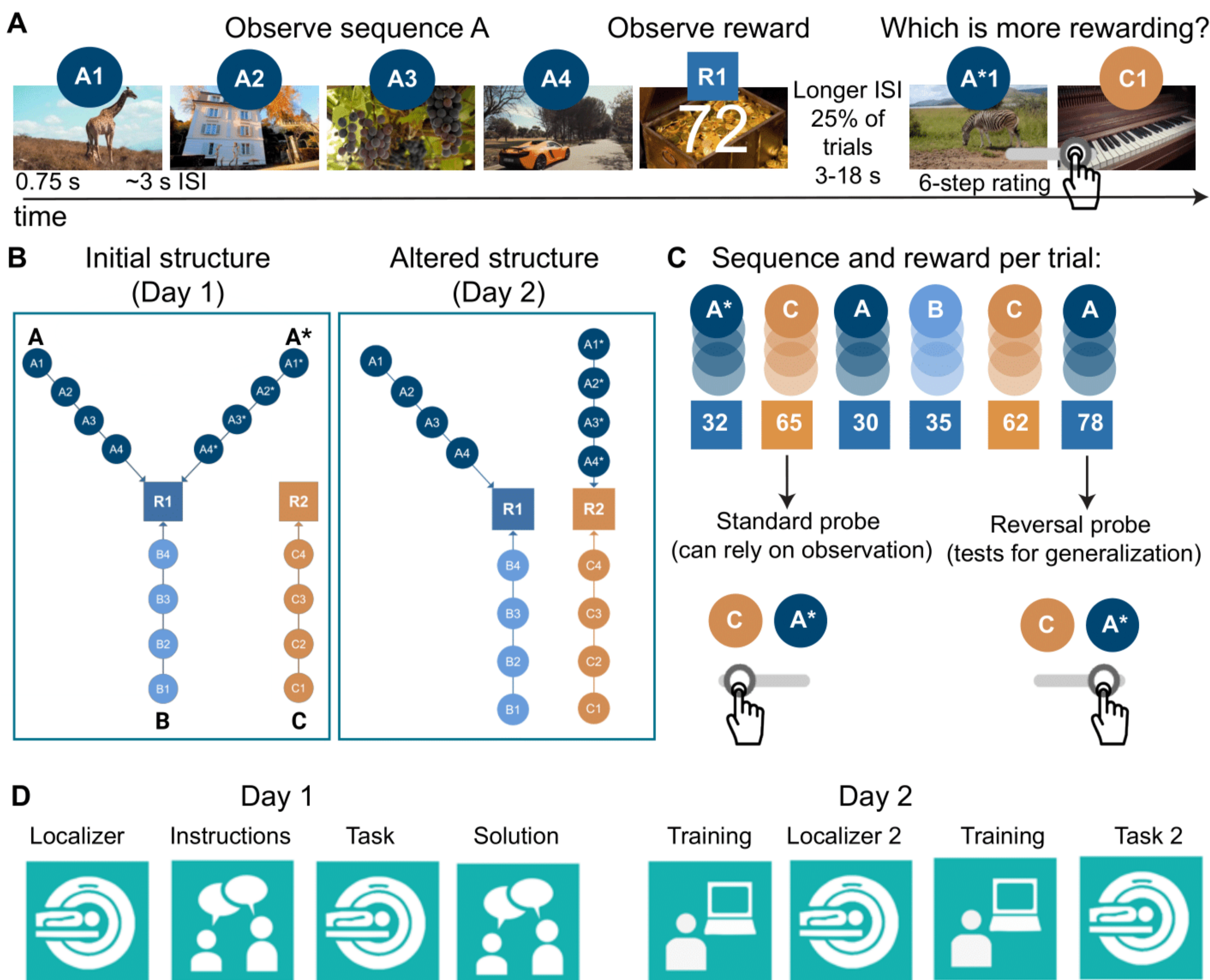


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## Intro & Design

Generalization requires inferring hidden structure + propagating value [1].  
Neural replay linked to both, but relative roles unclear [2, 3].

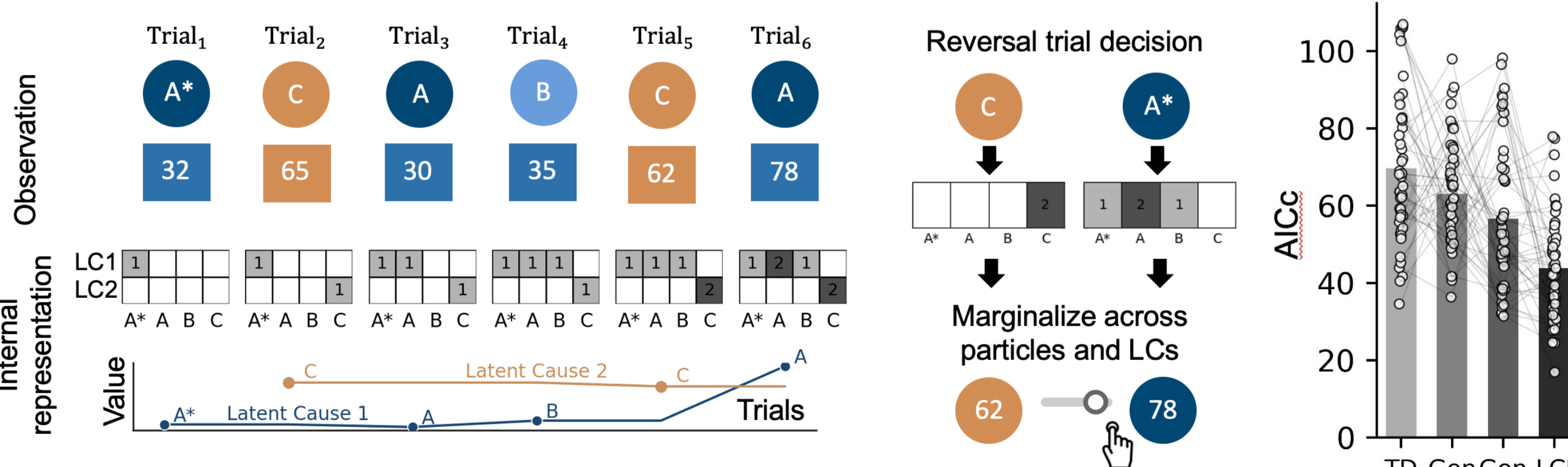
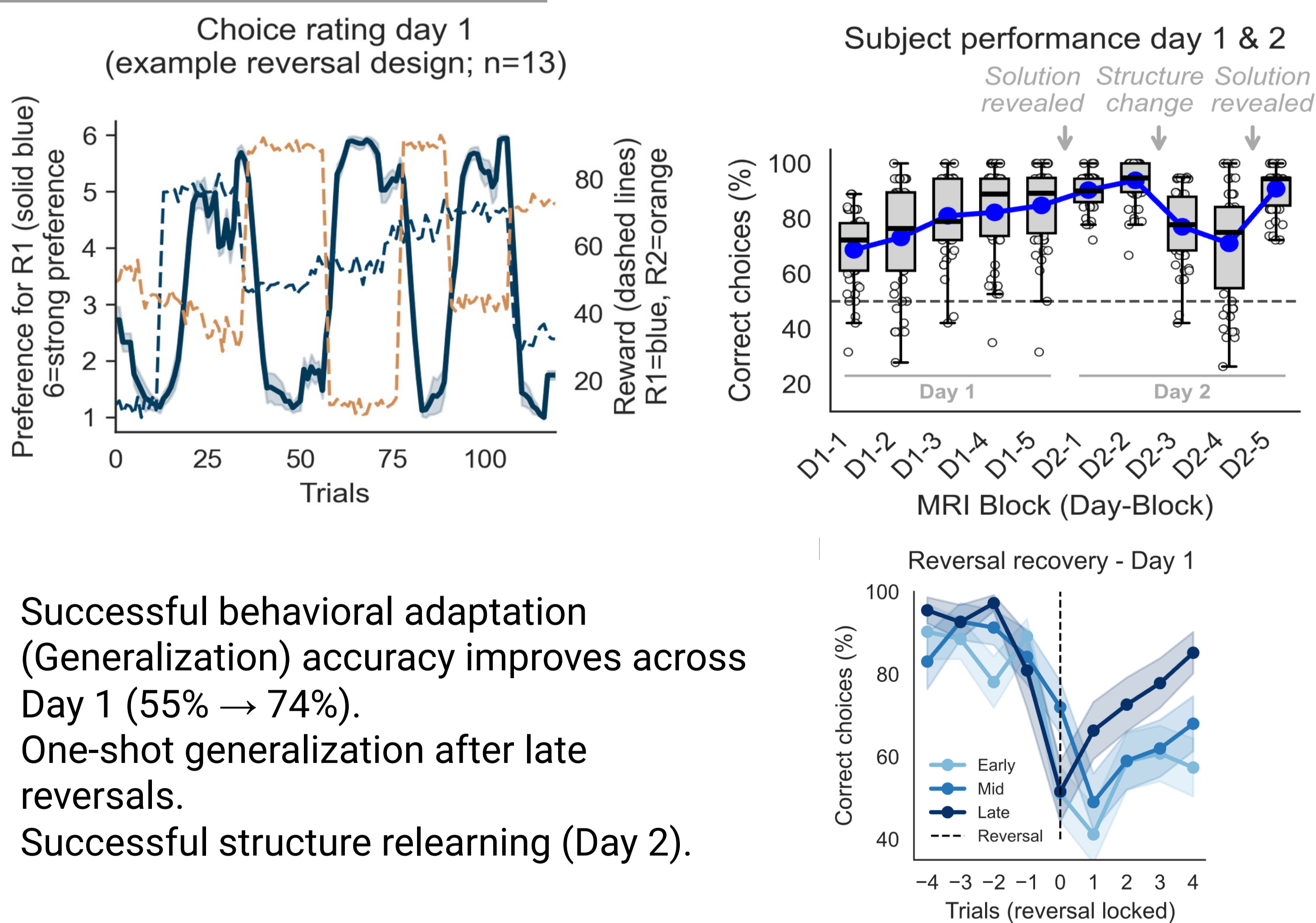
Does replay drive structure discovery or exploit structure for value updating?



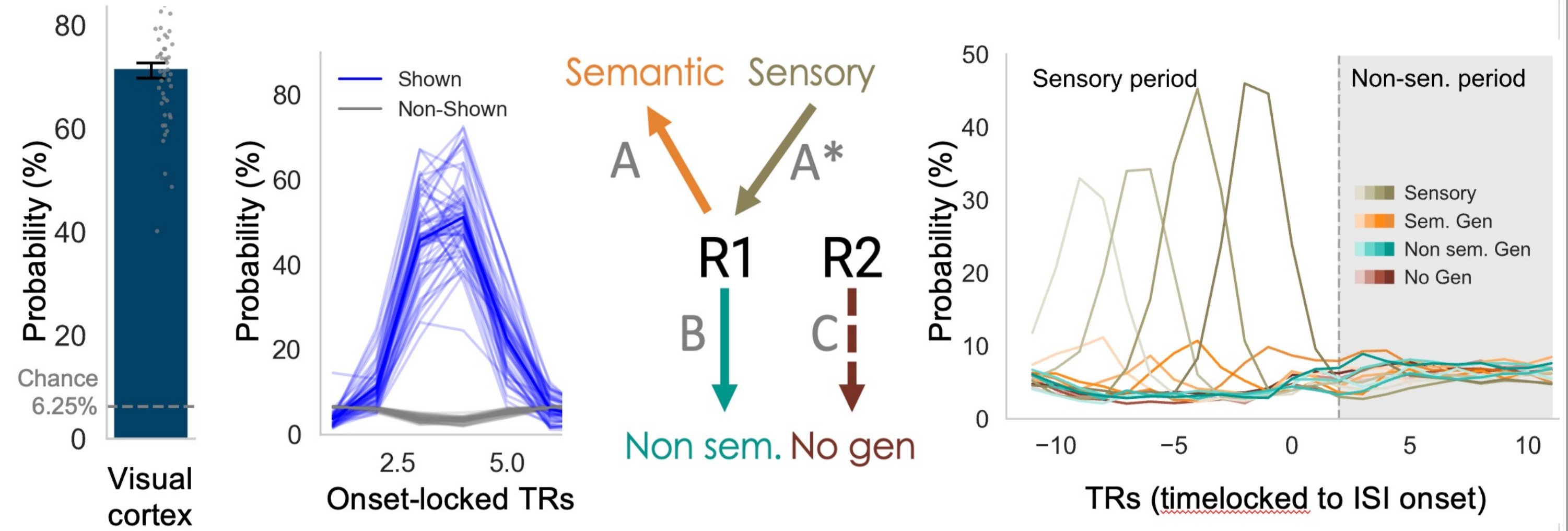
4 sequential bandits (A, A\*, B, C) → reward  
A, A\*, B share (R1); C independent (R2)  
A & A\* share semantic categories

Periodic reward reversals test generalization  
Day 2: A\* switches R1 → R2

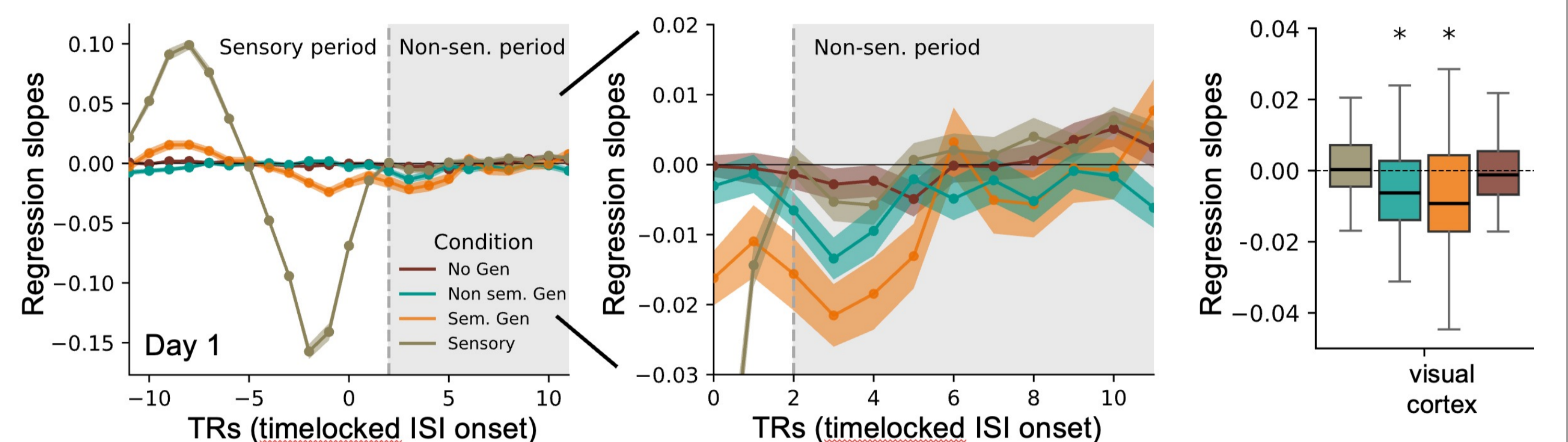
## Behavior & Modelling



## Neural results

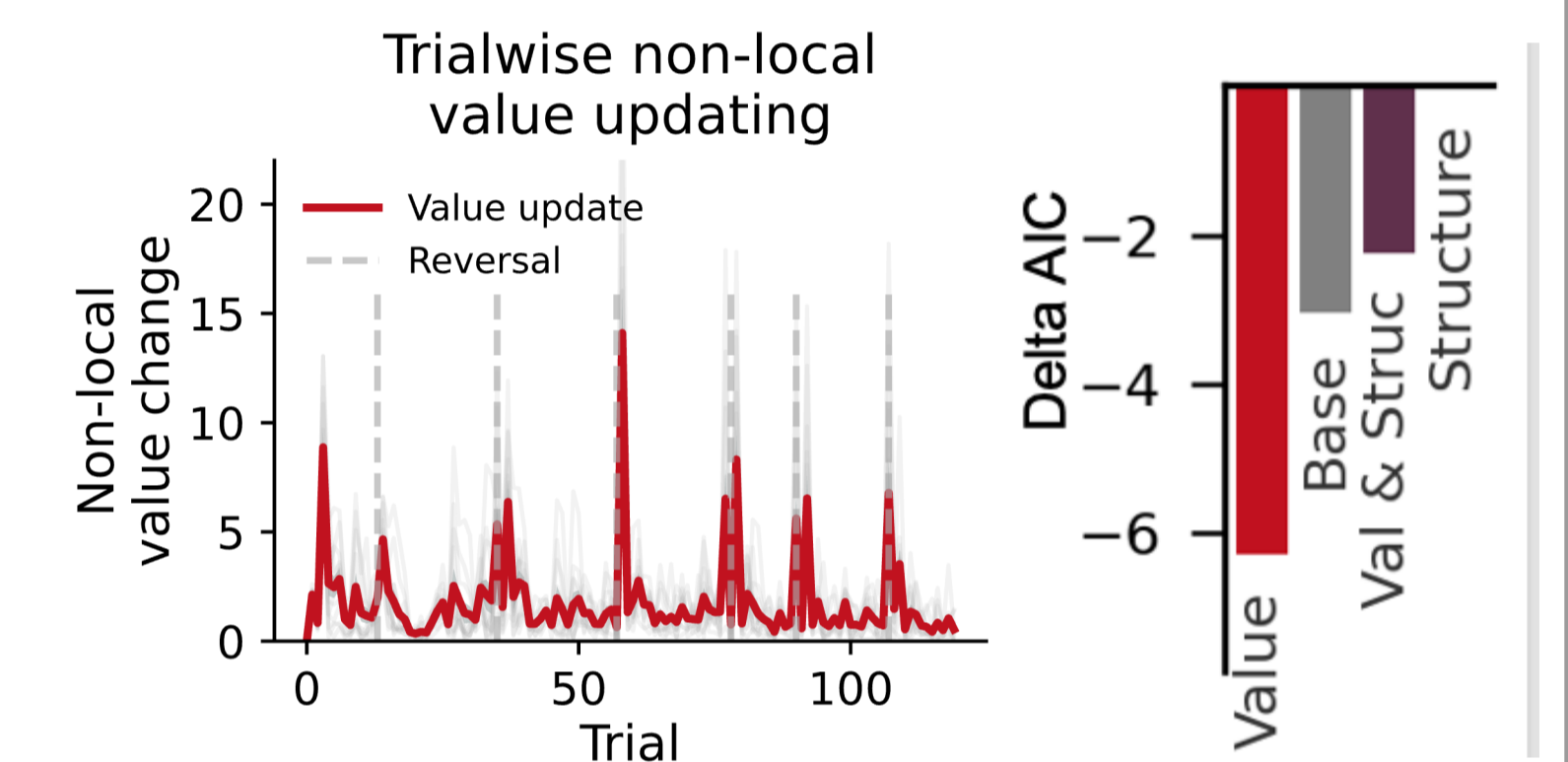


Classifiers accurately decode 16 stimuli  
Generalize from localizer to main task  
Replay conditions: sensory, semantic gen., non-semantic gen., no gen.  
Sensory-driven activation precedes ISI; reactivation follows during rest



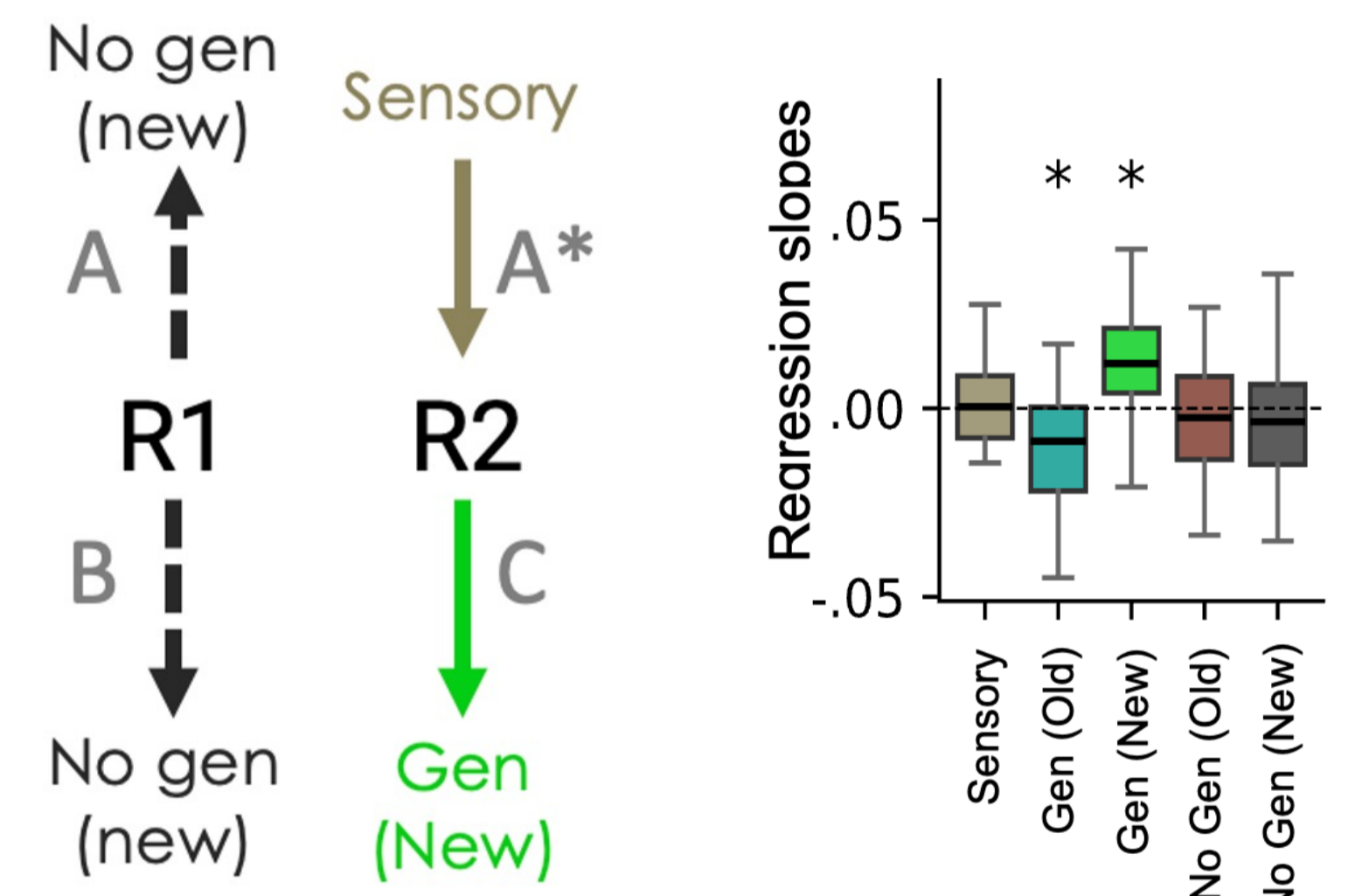
## Sequence analysis (Visual Cortex)

Backward replay of unobserved reward-sharing sequences.  
Trial-wise replay predicted by latent cause model value updates.



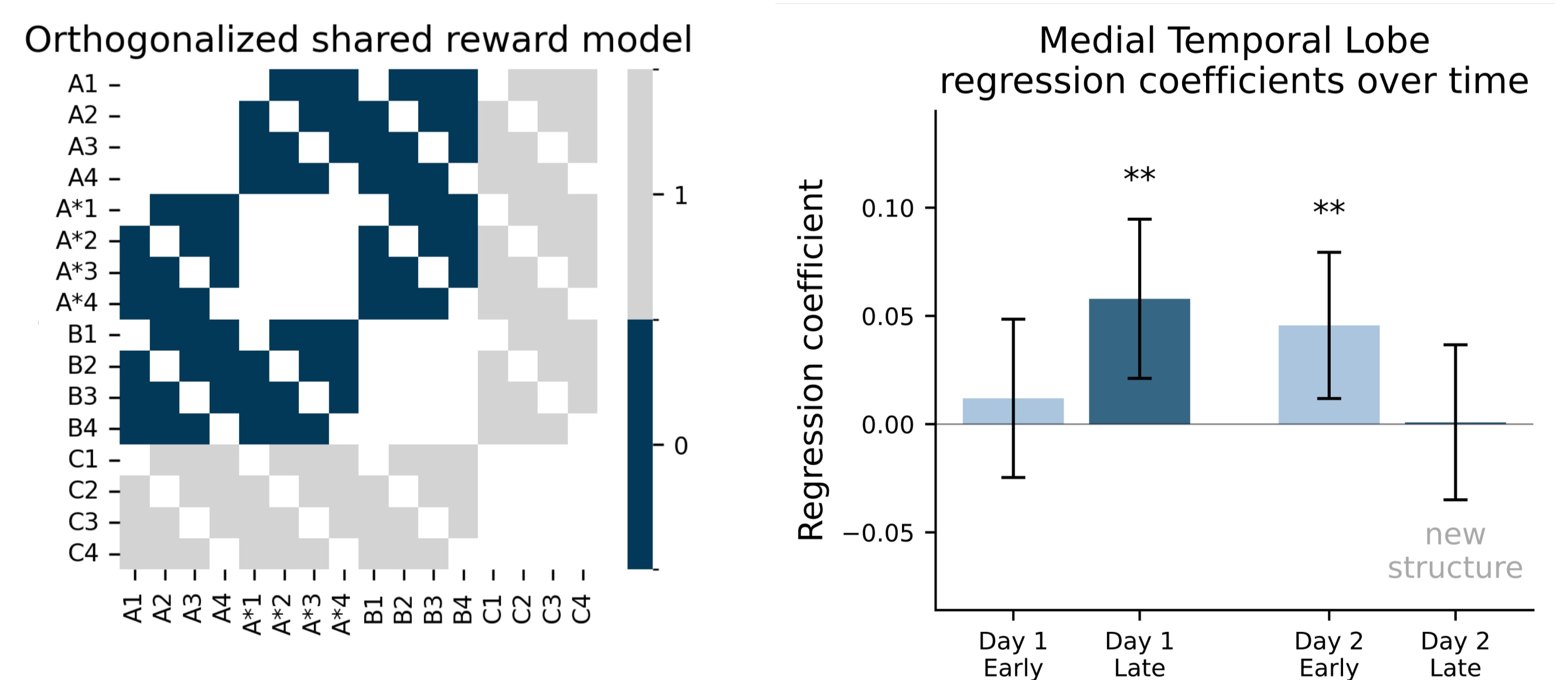
## Day 2 structure relearning

Old valid links: continued backward replay.  
New links (A\* - C): forward replay emerges  
Obsolete links: replay ceases.



## Representational Similarity (MTL)

MTL aligns with reward structure Day 1; reorganizes after structure change



## Conclusions

1. Replay exploits latent structure for value propagation
2. Replay content tracks LCI-derived value updates trial-by-trial
3. MTL encodes abstract structure; visual cortex replays selectively

## References

- [1] Liu, Y., Mattar, M. G., Behrens, T. E. J., Daw, N. D., & Dolan, R. J. (2021). Experience replay is associated with efficient nonlocal learning. *Science*, 372(6544), eabf1357.
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