Temporal (a)symmetries in cued recall of naturalistic events

Xinming Xu and Jeremy R. Manning
Dartmouth College

DARTMOUTH

Contextual Dynamics Laboratory

Sketchpad Series

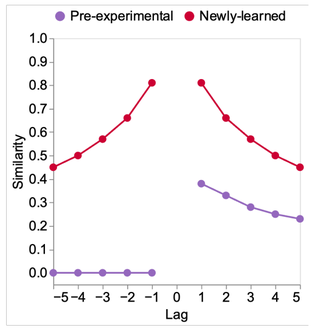
Background

- Episodic memory involves retrieval of temporal context (Manning, 2024), which could facilitate retrieval of nearby events (both past and future).
- The Temporal Context Model (and similar) suggests that the retrieved context is a combination of item's pre-experimental context (forward asymmetric cue) and newly-learned context (symmetric cue), resulting in a forward asymmetric retrieval cue for nearby items (Howard & Kahana, 2002).

$$C_t = \rho C_{t-1} + \beta C_{enc}^{IN}$$

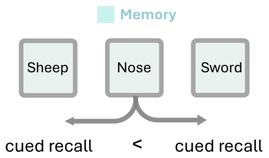
$$C_{rec}^{IN} = (1 - \gamma_{FC}) C_{enc}^{IN} + \gamma_{FC} C_{t-1}$$

Pre-experimental context Newly-learned context

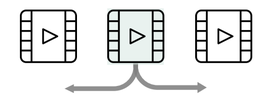


Howard & Kahana, 2002

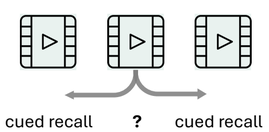
- Cued recall of word lists exhibits a forward asymmetry (Kahana & Caplan, 2002).



- However, naturalistic events have pre-experimental associations, and there is a backward asymmetry in inferring unobserved past events and future naturalistic events (Xu et al., 2024).



- Here, we test temporal (a)symmetries in cued recall of naturalistic events.

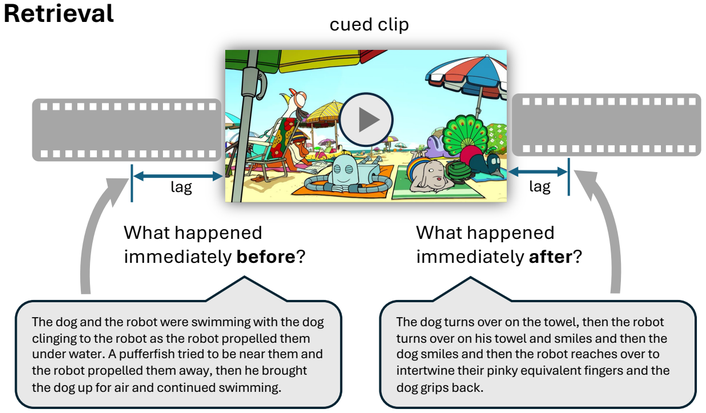


Methods

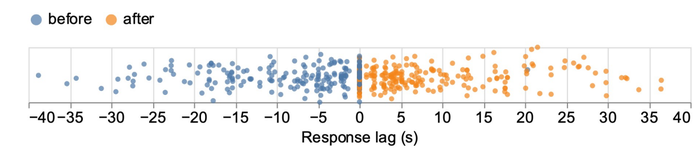
Encoding

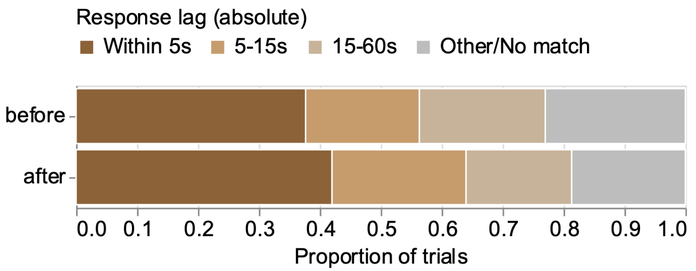
Three 30-min-long segments from each movie

Retrieval

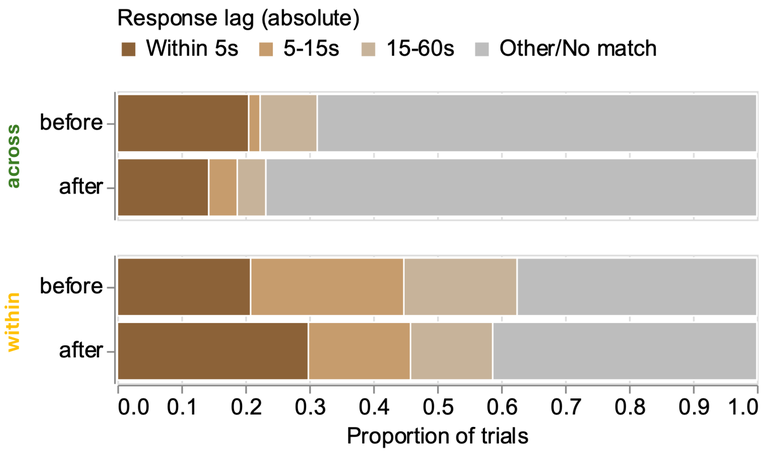


Preliminary results





- Event boundaries can break temporal associations in memory (Ezzyat & Davachi 2011; Horner et al. 2016; Davis et al., 2021).
- We test whether event boundaries modulate temporal (a)symmetries of cued recall.



Next steps

- Collect a full dataset
- Annotate responses with LLMs
- Build computational models of memory search and explain the temporal (a)symmetries

References

Manning, J. R. (2024). Context Reinstatement. In *The Oxford Handbook of Human Memory*. Oxford University Press.
Howard, M. W., & Kahana, M. J. (2002). A distributed representation of temporal context. *Journal of mathematical psychology*.
Kahana, M. J., & Caplan, J. B. (2002). Associative asymmetry in probed recall of serial lists. *Memory & Cognition*
Xu, X., Zhu, Z., Zheng, X., & Manning, J. R. (2024). Temporal asymmetries in inferring unobserved past and future events. *Nature Communications*.
Ezzyat, Y., & Davachi, L. (2011). What constitutes an episode in episodic memory? *Psychological Science*.
Horner, A. J., Bisby, J. A., Wang, A., Bogus, K., & Burgess, N. (2016). The role of spatial boundaries in shaping long-term event representations. *Cognition*.
Davis, E. E., Chemnitz, E., Collins, T. K., Geerligs, L., & Campbell, K. L. (2021). Looking the same, but remembering differently: Preserved eye-movement synchrony with age during movie watching. *Psychology and Aging*.