The role of perceptual change and prediction error in the spatial boundary effect on temporal order memory

Jörn Alexander Quent, Richard N. Henson & Aya Ben-Yakov,
MRC Cognition and Brain Sciences Unit, University of Cambridge

Follow me on twitter @**J_A_Quent**
Website: https://jaquent.me/

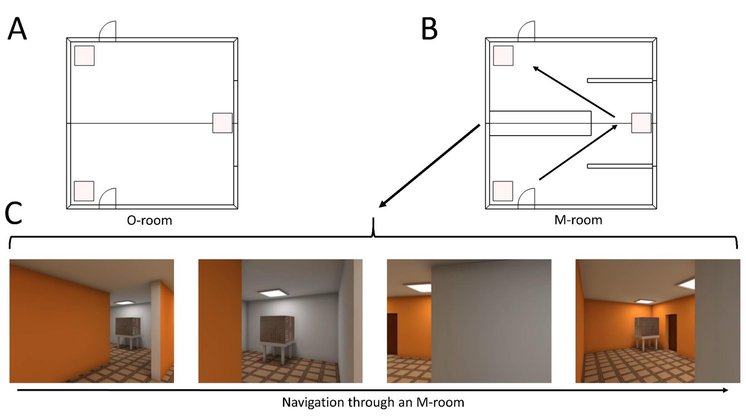
Introduction

Event boundaries

- As we experience the world through **a continuous stream** of sensory input, our brains are constantly trying to **predict what comes next**.
- **Prediction errors** (PE) can result in **"event boundaries"**, which segment our memories for our experiences.
- Walking into a new room is maybe the classic example of a boundary, and the **temporal order effect** demonstrates different temporal order memory across boundaries (Horner et al., 2016)[1].
- However, walking between rooms also typically results in large **perceptual changes** (PC). We proposed an experiment to tease apart the contributions of **PE** and **PC** to the formation of event boundaries.

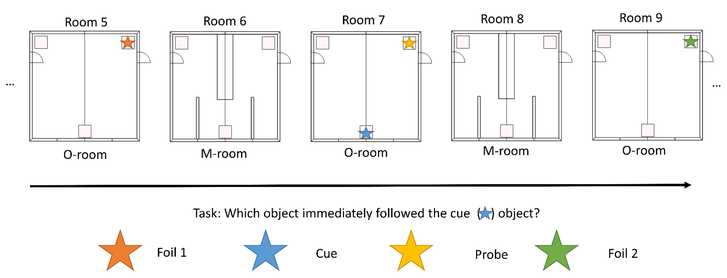
General design

Environment:

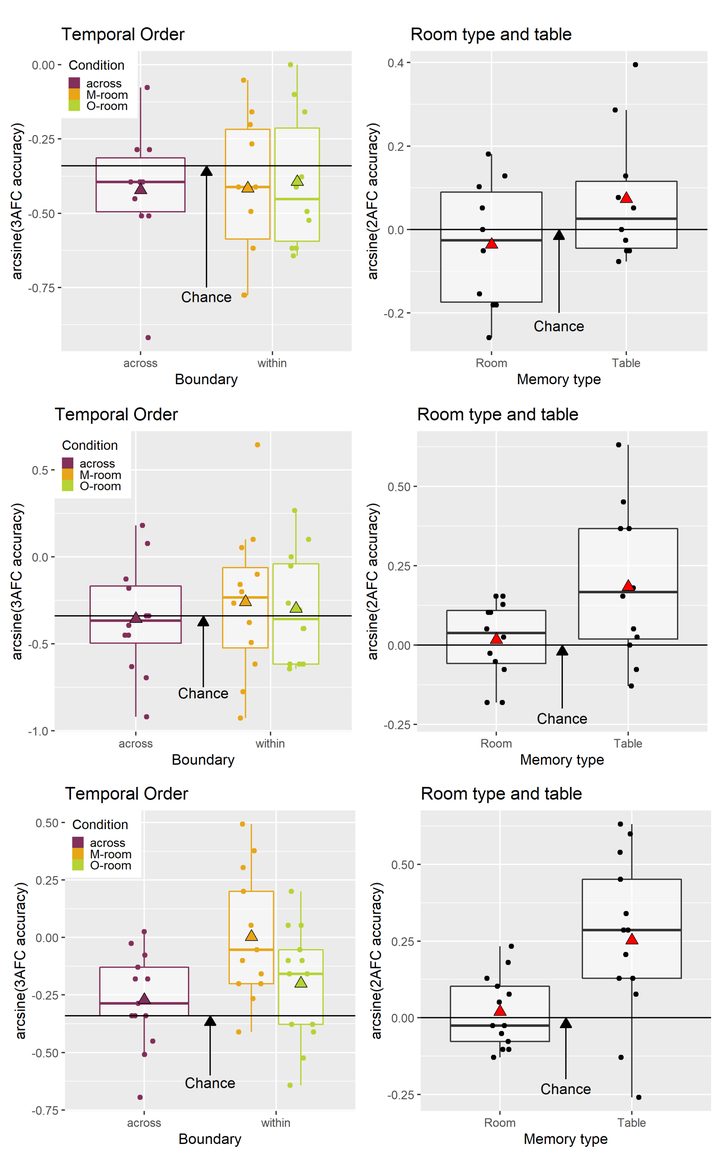


A video showing the rooms can be found here: https://vimeo.com/532276947

- We designed the M-shape room allowing us manipulate PE & PC independently.
- In the first step, we tried to replicate the memory boundary effect (within > across) that Horner et al. (2016)[1] found for M-room as we thought that O-rooms are similar to the rooms in Horner et al.
- We ran three variants of the experiment using a similar design.



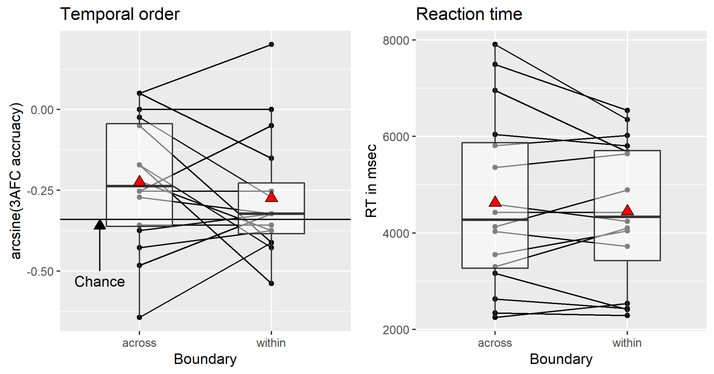
Experiment 1 (Pilot)



No boundary effect for Experiment 1 except for M-room in the last batch. In this experiment subjects saw both types of rooms

Experiment 2

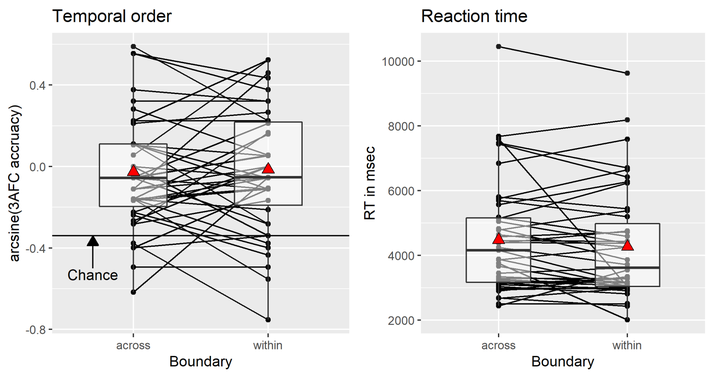
- To replicate the original effect for O-rooms, we used a **between subject** design (M-rooms vs. O-rooms), which did not find.
- N = 16 (O- rooms only)



- **No boundary effect** in accuracy or RT for O-rooms. BF_{01} = 7.14
- Since **memory performance** was **still quite bad**, we ran a new experiment to see whether we could improve performance, in case the **poor performance** was the **reason** for the **lack of an effect**.

Experiment 3

- N = 46 (O-rooms only)
- Rooms that are more **unique**.
- **Intentional** memory task with 2 study-test cycles.



- **No boundary effect** in memory performance or RT. BF_{01}= 4.72

Discussion

- We collected a total N = 97.
- Largely, **unable to replicate the boundary effect** (within > across).
- **Possible reasons** for null effect:
  - Rooms too similar (always same layout).
  - Rooms are on a linear track.
  - Passive watching vs. active navigation.

References

1 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, 154, 151–164. https://doi.org/10.1016/j.cognition.2016.05.013