Spontaneous attentional fluctuations and the temporal organization of recall

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Introduction

Episodic memories are temporally organized[1,2].

Event segmentation research shows that event boundaries are an important mechanism for shaping temporal contexts[3,4].

These boundaries can be external or internal.

One type of internal event boundary could be caused by fluctuations in our attentional states.

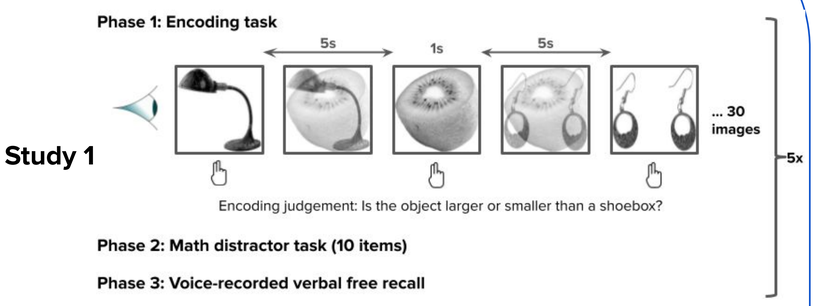
In what ways can attentional fluctuations act like event boundaries that shape the temporal organization of memory?

Conclusion

Recall is robustly temporally organized, even for items encoded during periods of relatively poor attention.

Future studies will assess the generality of these results with other measures of attention and memory[8].

Task Overview



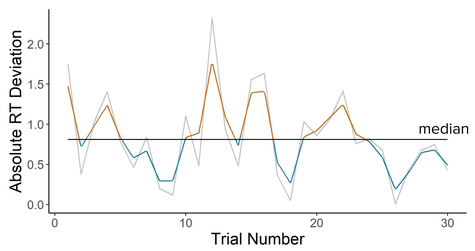
Study 2: 80 images x 3 blocks, go/no-go task (semantic judgment: food or not?), gradual transitions

Study 3: 60 images x 3 blocks, go/no-go task (perceptual judgement: color image or not?), no gradual transitions

RT variability at encoding was used to define 2 attentional states[5,6]

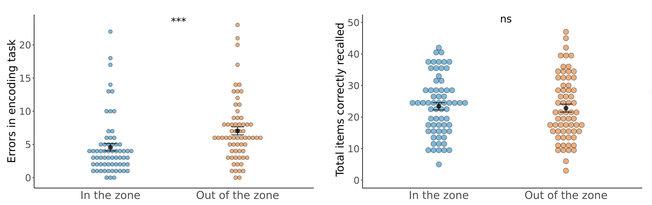
In the zone:
RTs closer to the within-block mean (less RT variability)

Out of the zone:
RTs farther away from the within-block mean, whether faster or slower (more RT variability)



Gray: Raw absolute RT deviations
Blue: Smoothed "in the zone" RT deviations
Orange: Smoothed "out of the zone" RT deviations

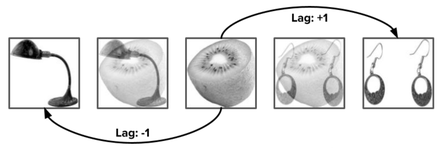
Attention related to encoding errors, but not recall



*** $p < 0.001$
ns not significant

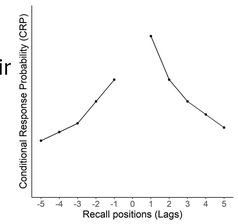
Plots show Study 1 results, which were replicated in Studies 2 & 3.

Temporal Dynamics of Recall
No consistent difference between "in the zone" & "out of the zone" states

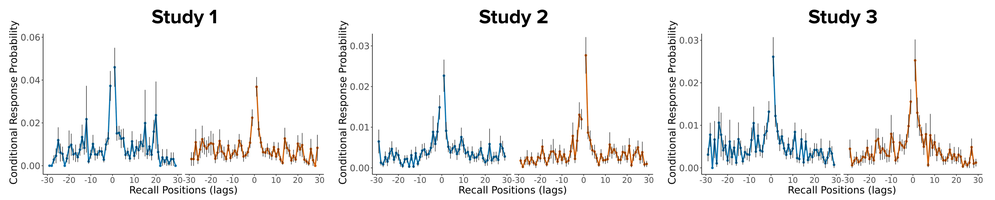


lag-CRP curve: Probability of recalling two items successively, given their distance at encoding

Two properties: Temporal contiguity & forward asymmetry



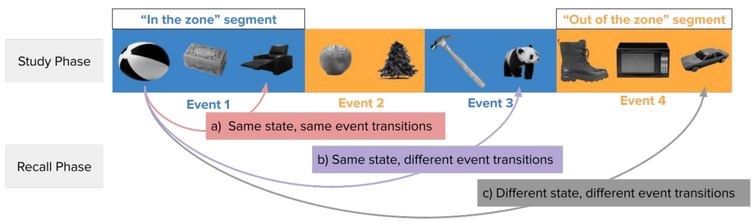
Hypothesis 1: Good (vs. bad) attentional states at encoding will be associated with better temporal organization of recall.



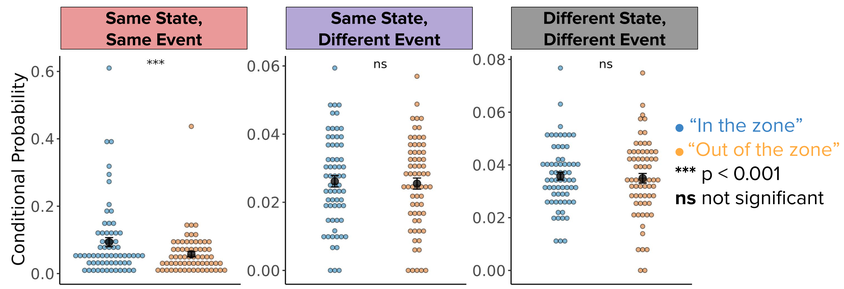
In Study 1, forward asymmetry was stronger for items encoded "in the zone" vs "out of the zone". This was not replicated in Studies 2 & 3.

Across the 3 studies, there were no consistent differences in temporal contiguity or forward asymmetry between the two attentional states.

Event Transitions at Recall
No consistent difference between "in the zone" & "out of the zone" states



Hypothesis 2: Good (vs. bad) attentional states at encoding will be associated with a) more "same state, same event" transitions and b) more "leaping" between different event segments of the same state[7].



In Study 1, "same state, same event" transitions were more likely for items encoded "in the zone". No other differences were found.

In Studies 2 & 3 (not shown), there were no differences between the two attentional states for any type of event transition.

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[3]Zacks, J. M., Speer, N. K., Swallow, K. M., Braver, T. S., & Reynolds, J. R. (2007). Event perception: A mind-brain perspective. *Psychological Bulletin*, 133(2).
[4]DuBrow, S, & Davachi, L. (2016). Temporal binding within and across events. *Neurobiology of Learning and Memory*, 134, 107-114.
[5]Rosenberg, M., Noonan, S., DeGutis, J., & Esterman, M. (2011). Sustaining visual attention in the face of distraction: A novel gradual onset continuous performance task. *Journal of Vision*, 11(11), 127–127.
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[8]Schwartz, G., Howard, M. W., Jing, B., & Kahana, M. J. (2005). Shadows of the past: Temporal retrieval effects in recognition memory. *Psychological Science*, 16(11), 898–904.