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 potential type of internal event boundary could be fluctuations in our attentional states.

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

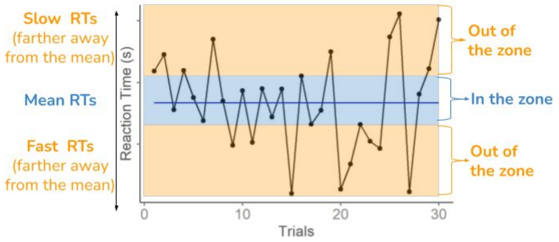
Hypothesis: Good (vs. bad) attentional states at encoding will be associated with better temporal organization of recall.

General Methods

Reaction times (RTs) measured during encoding of images; followed by voice-recorded verbal free recall.

Characterizing attentional fluctuations[5]:

"In the zone" (good state): less RT variability
"Out of the zone" (bad state): more RT variability

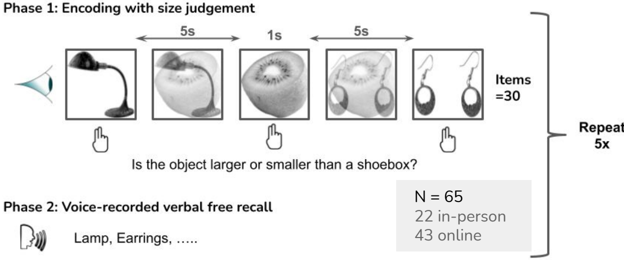


References

[1]Howard, M.W., & Kahana, M. J. (2002). A Distributed Representation of Temporal Context. *Journal of Mathematical Psychology*, 46(3), 269–299.
[2]Healey, M. K., Long, N. M., & Kahana, M. J. (2019). Contiguity in episodic memory. *Psychonomic Bulletin & Review*, 26(3), 699–720.
[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*.
[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.
[6]deBettencourt, M. T., Norman, K. A., & Turk-Browne, N. B. (2018). Forgetting from lapses of sustained attention. *Psychonomic Bulletin & Review*, 25(2), 605–611.

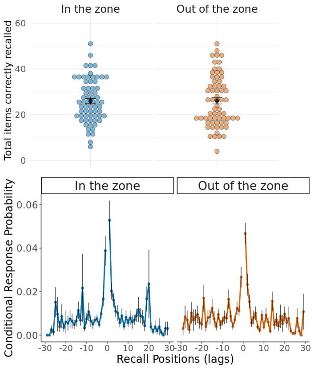
Study 1

Design



N = 65
22 in-person
43 online

Results



Recall performance did not differ between the two attentional states
(t_{64} = 0.11, p = 0.91)

We replicated the temporal contiguity effect and the forward asymmetry bias[1,2]
Main effect of absolute lags
($F_{28,1792}$ = 12.00, p < 0.001)

Interaction between absolute lags and direction
($F_{28,1792}$ = 1.98, p <0.001)

No effect of attentional state on temporal dynamics of recall
No main effect of attentional state
($F_{1,64}$= 0.27, p = 0.61)
No interactions with attentional state (all ps > 0.1)

Study 2

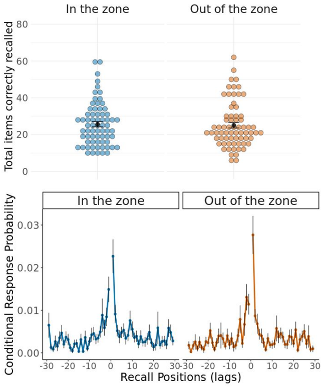
Design

Two changes to Study 1 design:

1. Longer blocks: 3 blocks of 80 items to encourage more "zoning out"
2. Go/No-Go task to make it similar to prior studies that characterized attentional states using RTs

N = 68

Results



Recall performance did not differ between the two attentional states
(t_{67} = -0.68 , p = 0.50)

We replicated the temporal contiguity effect, but not the forward asymmetry bias[1,2]

Main effect of absolute lags
($F_{28,1914}$ = 1.62, p=0.02)

No interaction between absolute lags and direction
($F_{28,1914}$ = 0.88, p =0.65)

No effect of attentional state on temporal dynamics of recall
No main effect of attentional state
($F_{1,67}$= 0.75, p = 0.39)
No interactions with attentional state (all ps >0.1)

Conclusion

Across two studies, we did not find any evidence that attentional fluctuations during encoding, as measured with RTs, were associated with differential temporal organization of recall.

Limitations:
There may be more sensitive measures of attentional fluctuations than RT (although many studies use RT to index attentional fluctuations[5,6]).

Difficulty in balancing the trade-off between long enough blocks to elicit "zoning out" and short enough blocks for good recall.

Future Directions

Study 3:
Removing the gradual transitions between objects
Using color images and a perceptual task

Pupillometry study: Using pupil diameter as an assay of attentional fluctuations (on hold during the pandemic)