Elaborating on the role of the hippocampus in constructing remote autobiographical memories

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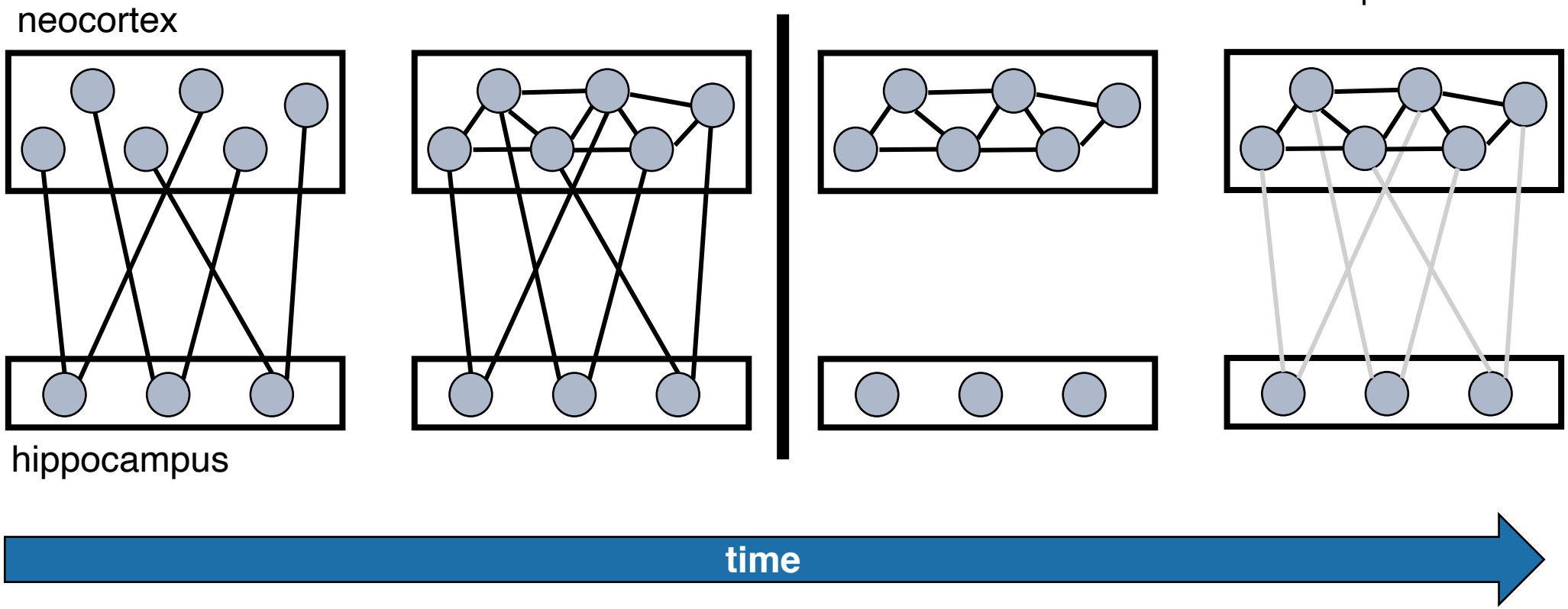
Two competing models of hippocampal involvement during retrieval of remote memories

Standard Model

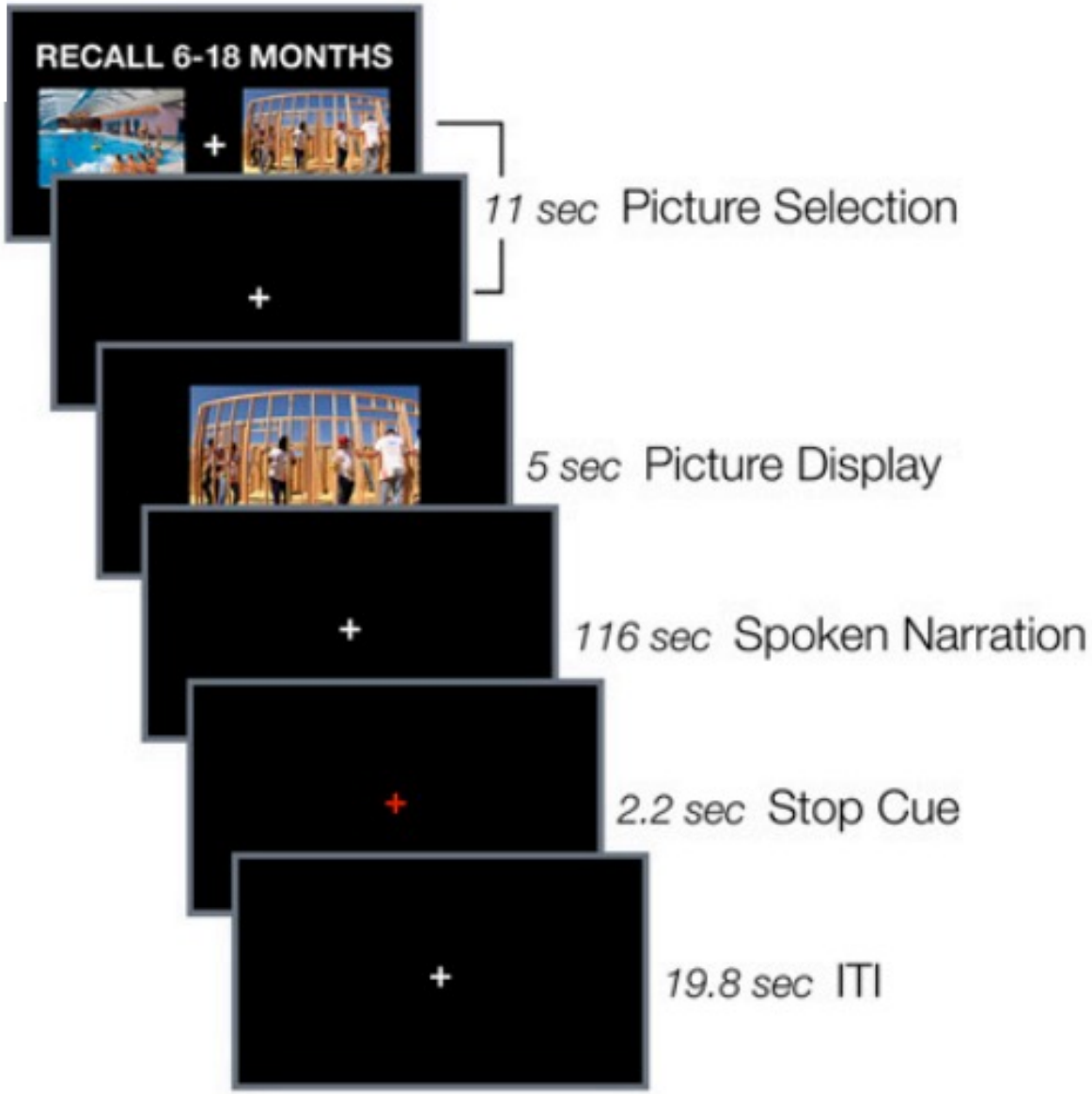
Over time, hippocampus is not required for retrieval

Multiple Trace Theory/ Trace Transformation Theory

Hippocampus is always required for the retrieval of rich, detailed episodic memories



task design



Participants (N=40) overtly retrieved autobiographical memories in response to picture cues from **3 time periods**:

- Today
- 6-18 months ago
- 5-10 years ago

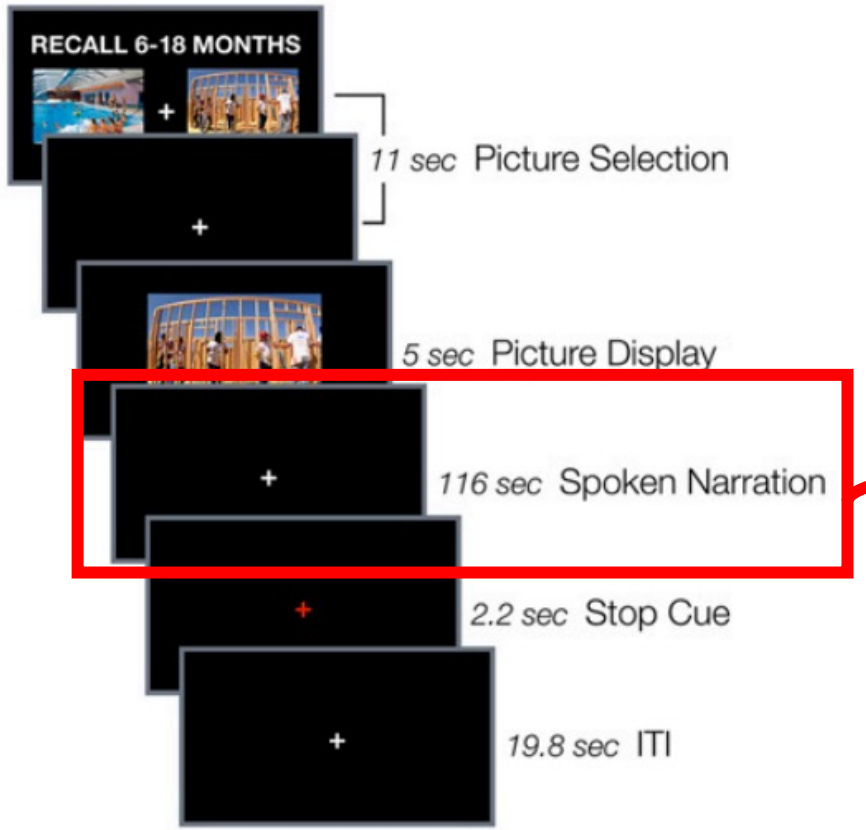
Picture selection: choose a picture to be used as a cue for recall

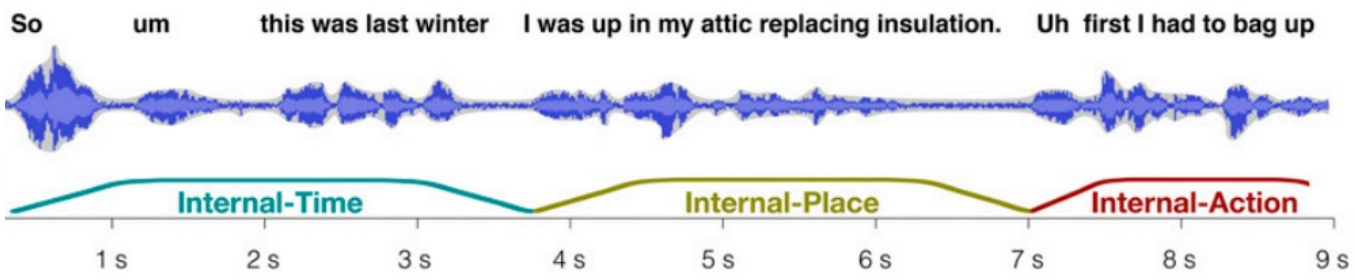
Spoken Narration: overt recall of memory in as much detail as possible

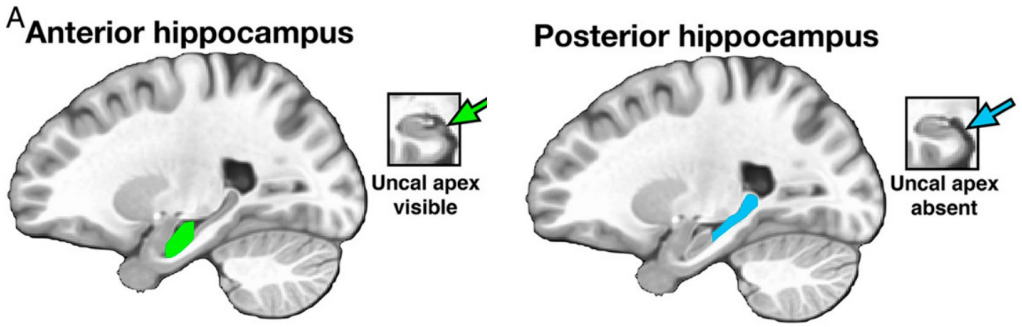
Control task: choose a picture and describe it (no long-term memory retrieved)

Gilmore et al., PNAS, 2021

previous analysis







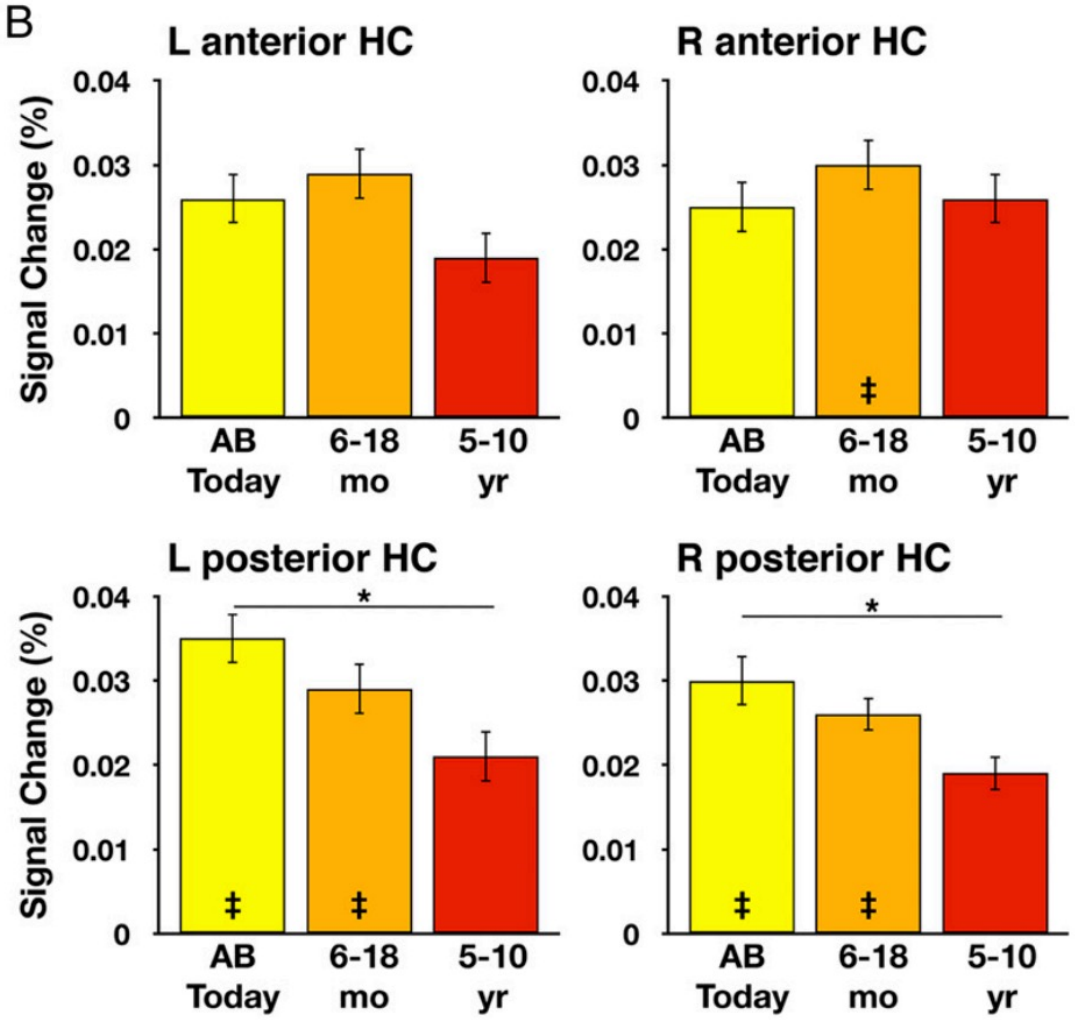
We previously analyzed **anterior** and **posterior** hippocampal activation during the **spoken narration period** of **recalled memories versus the control picture description task**

We scored and **regressed out the number of details** overtly retrieved, to control for differences in memory detail across time periods

Gilmore et al., PNAS, 2021

previous results

recall > picture description



‡significantly more active than control task

1. We found a temporal gradient in the posterior hippocampus, but not the anterior hippocampus
2. Anterior hippocampus not reliably active compared to control task (mysterious?)
3. Posterior hippocampus not reliably active at most remote time point

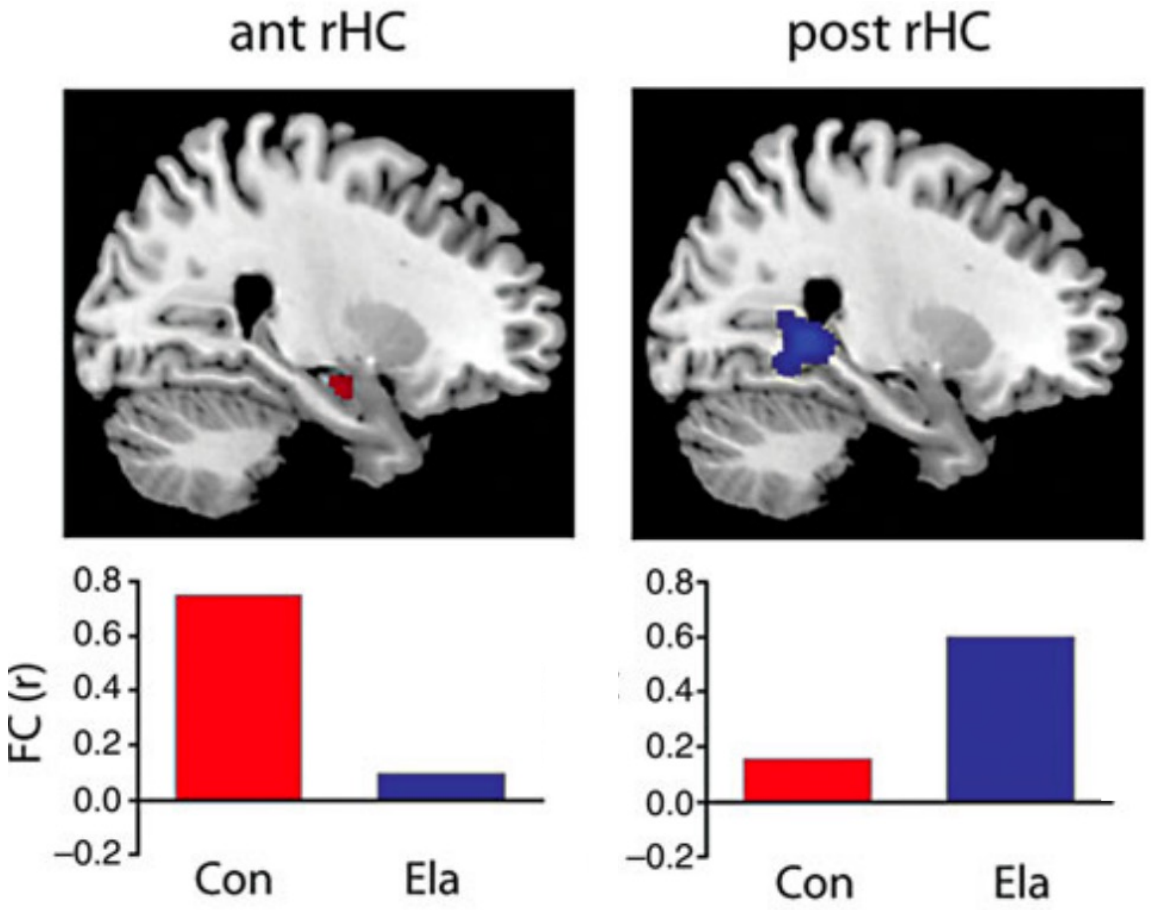
Results consistent with standard model

Gilmore et al., PNAS, 2021

a different perspective

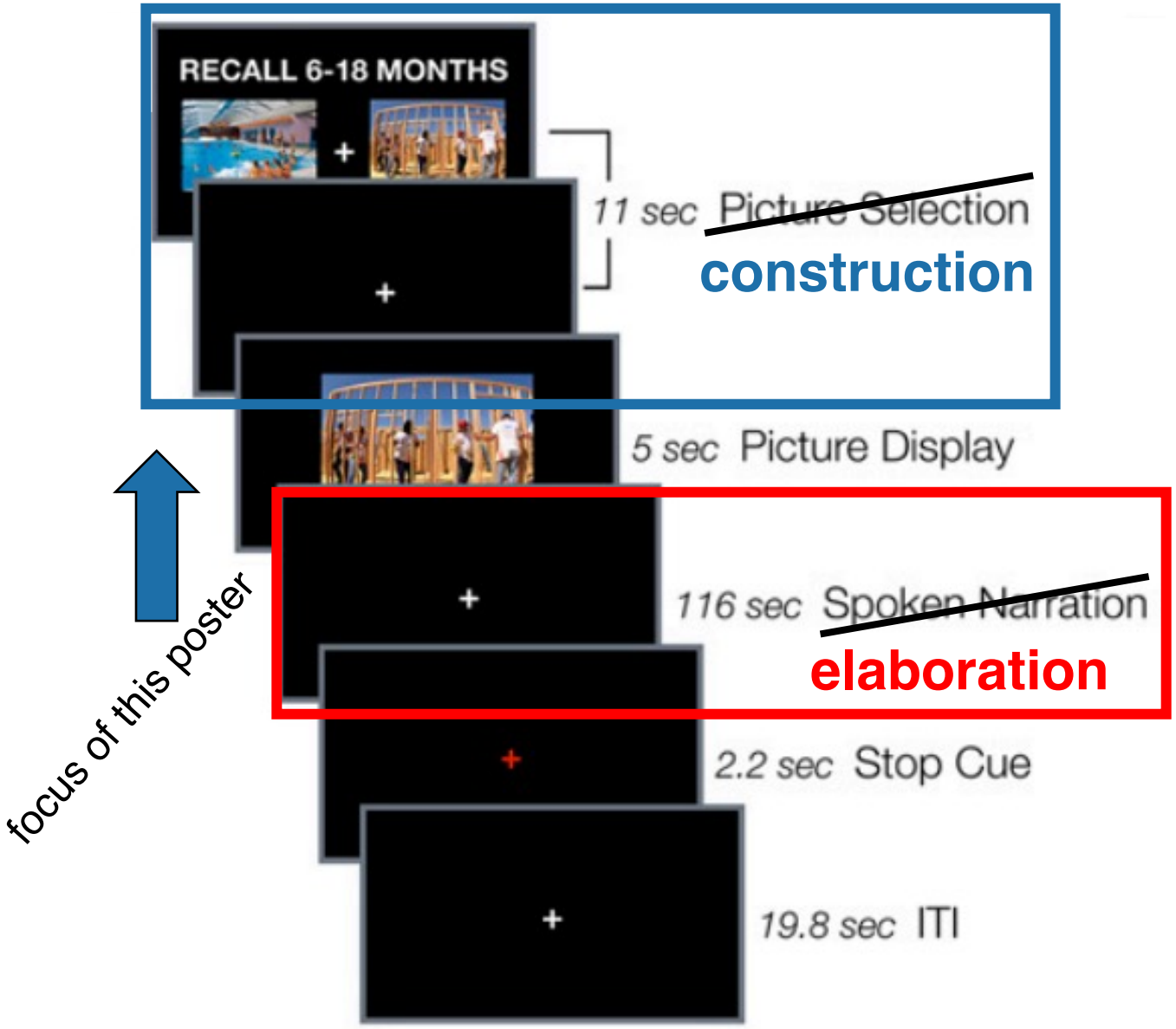
The retrieval of autobiographical memories has proven to be a *temporally dynamic process*, consisting of an **early phase of conceptual/gist-like memory construction** involving **the anterior hippocampus,** and a **later phase of detailed memory elaboration**, involving the **posterior hippocampus** (McCormick et al., 2015; Sheldon and Levine 2016)

This dynamic retrieval process has not been investigated in the context of the hippocampal temporal gradient during retrieval of autobiographical memories.



McCormick et al., 2015

current re-analysis



construction: autobiographical memory search and retrieval of the gist

elaboration: overt elaborative retrieval of the details of the memory (already analyzed)

control task: choose a picture and describe it

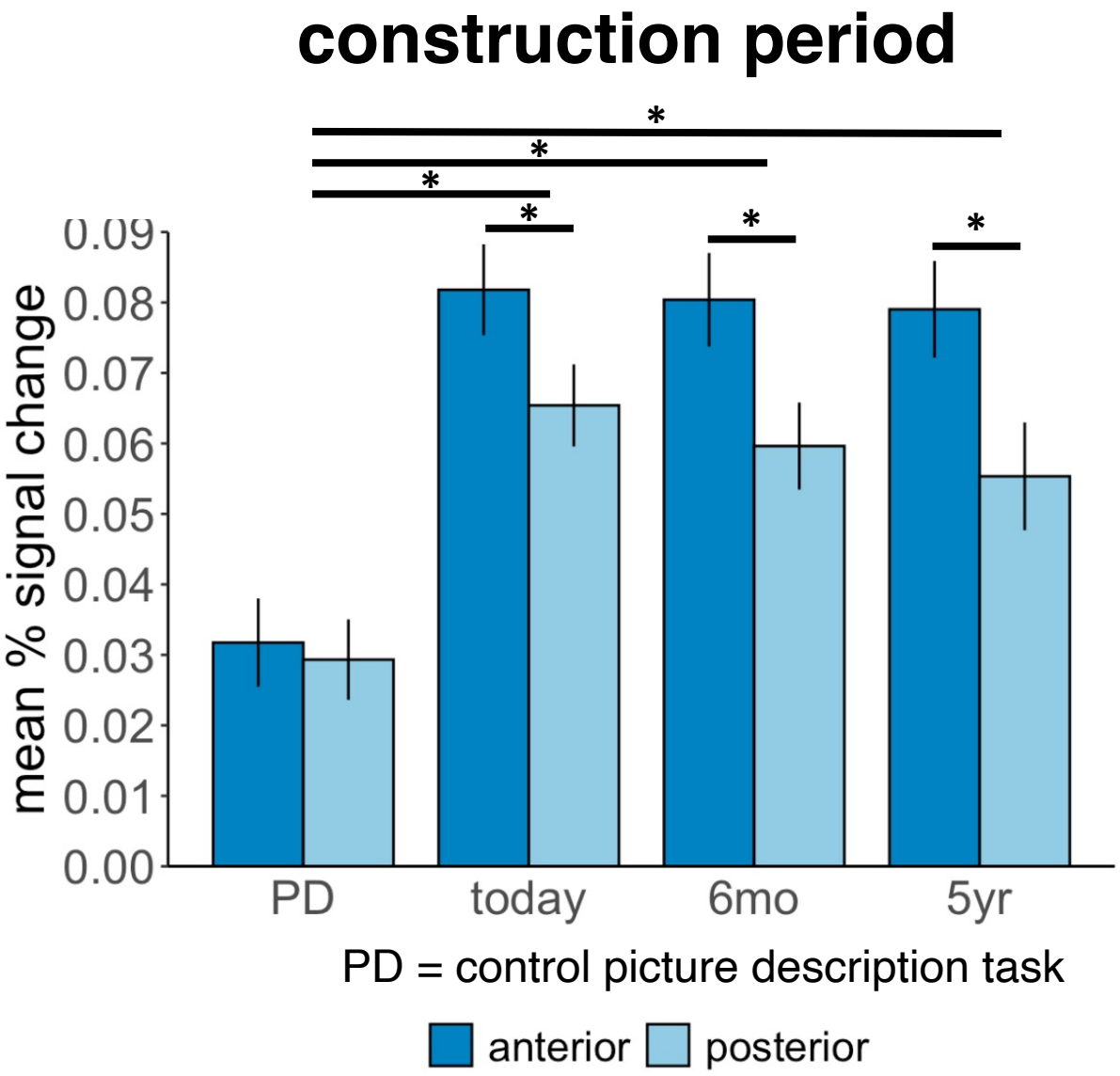
Questions: 1. Is the anterior hippocampus reliably active during the earlier construction timepoint, and **2.** does it show a temporal gradient of activation?

Gilmore et al., PNAS, 2021

results

- during the construction period, greater anterior than posterior hippocampal activation at all timepoints
- reliable activation at even the most remote timepoint
- no temporal gradient

Results consistent with MTT/TTT



take-home messages

1. The anterior hippocampus can support autobiographical memory search and construction in perpetuity
2. The phase of autobiographical retrieval analyzed as well as the location along the long-axis of the hippocampus can lead to differing conclusions regarding the involvement of the hippocampus in retrieval of remote memories

Thank you!

Original paper: Gilmore, A. W., Quach, A., Kalinowski, S. E., González-Araya, E. I., Gotts, S. J., Schacter, D. L., & Martin, A. (2021). Evidence supporting a time-limited hippocampal role in retrieving autobiographical memories. *Proceedings of the National Academy of Sciences*, *118*(12)