



# Cognitive and Neural Origins of Persistent Experiences

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Preprint

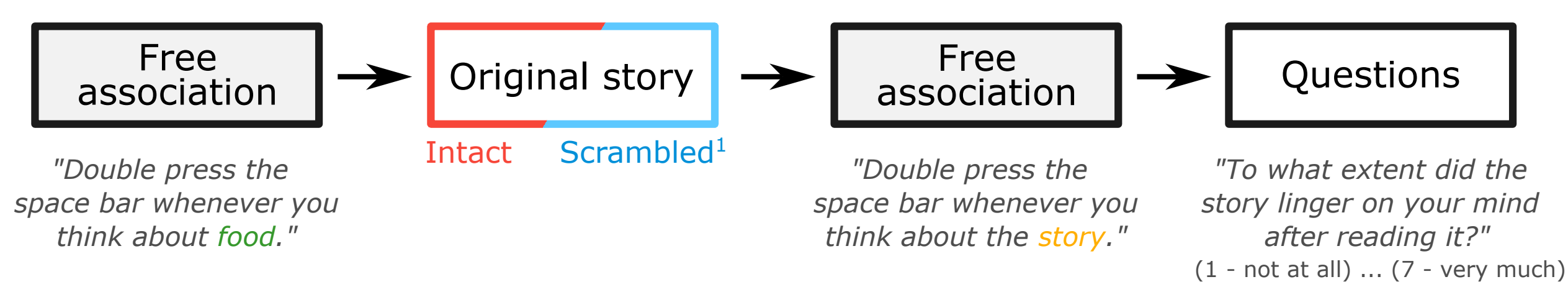


## Recent experiences linger in mind

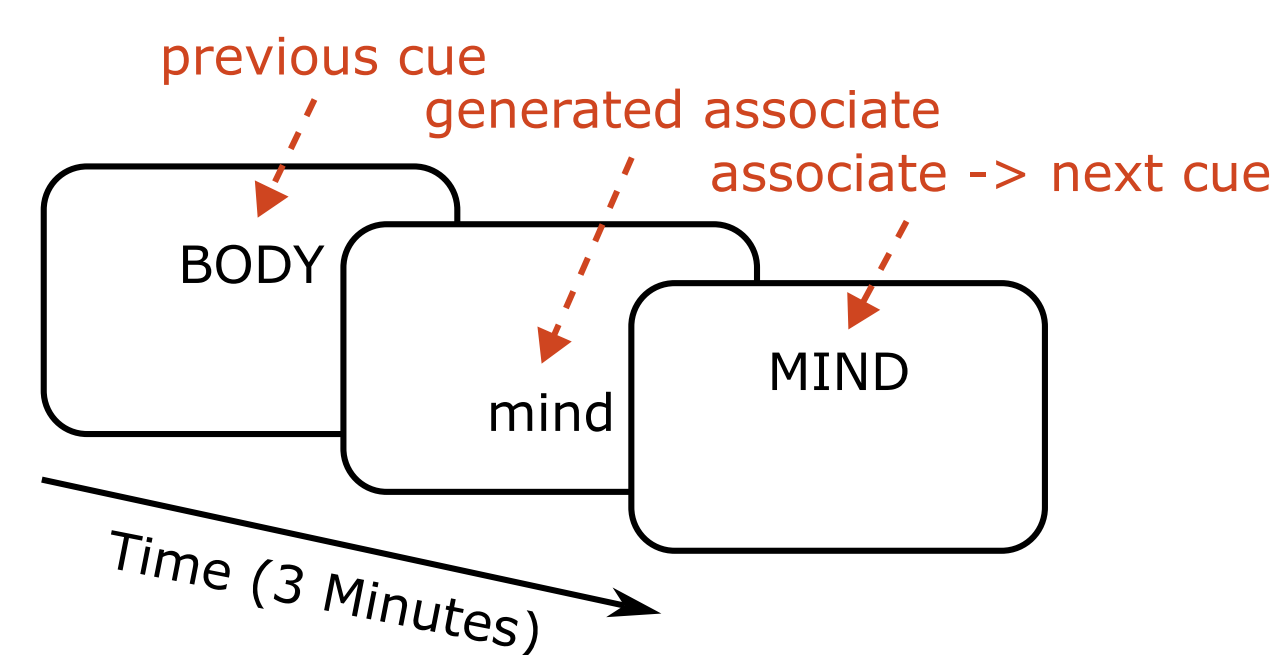
- > e.g. an awkward social interaction, a stubborn problem, or an immersive story<sup>1</sup>.
- > May relate to rumination and anxiety<sup>2</sup>.
- > May relate to goal attainment in open-ended world<sup>3</sup>.

## What cognitive and neural processes underlie persistence?

### Paradigm

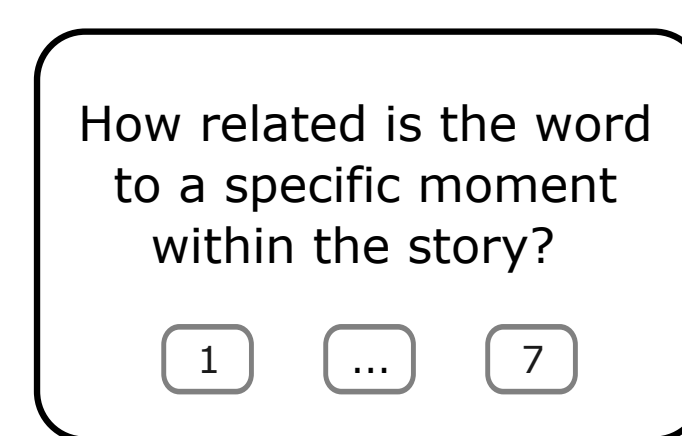


### Free association

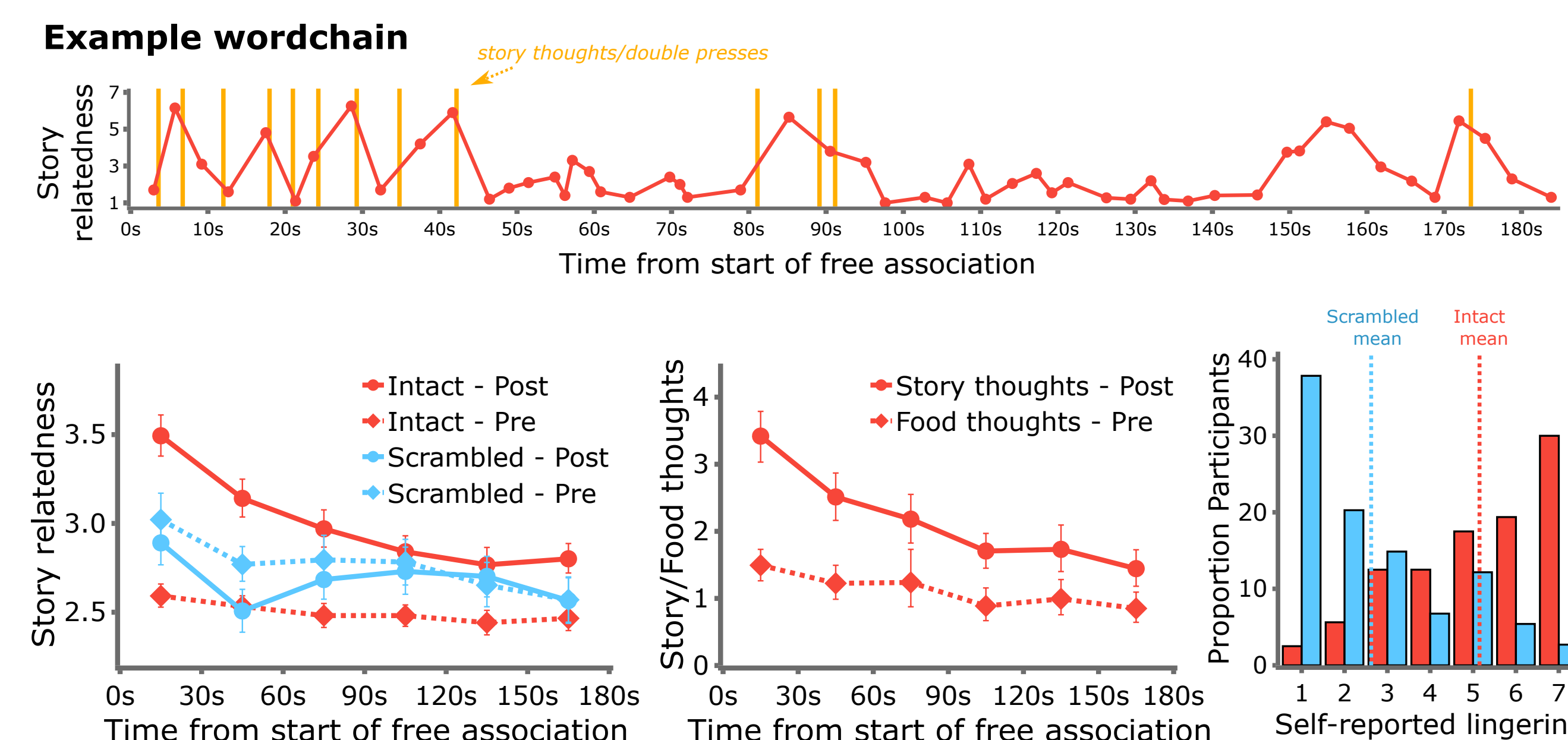


### Norming story relatedness

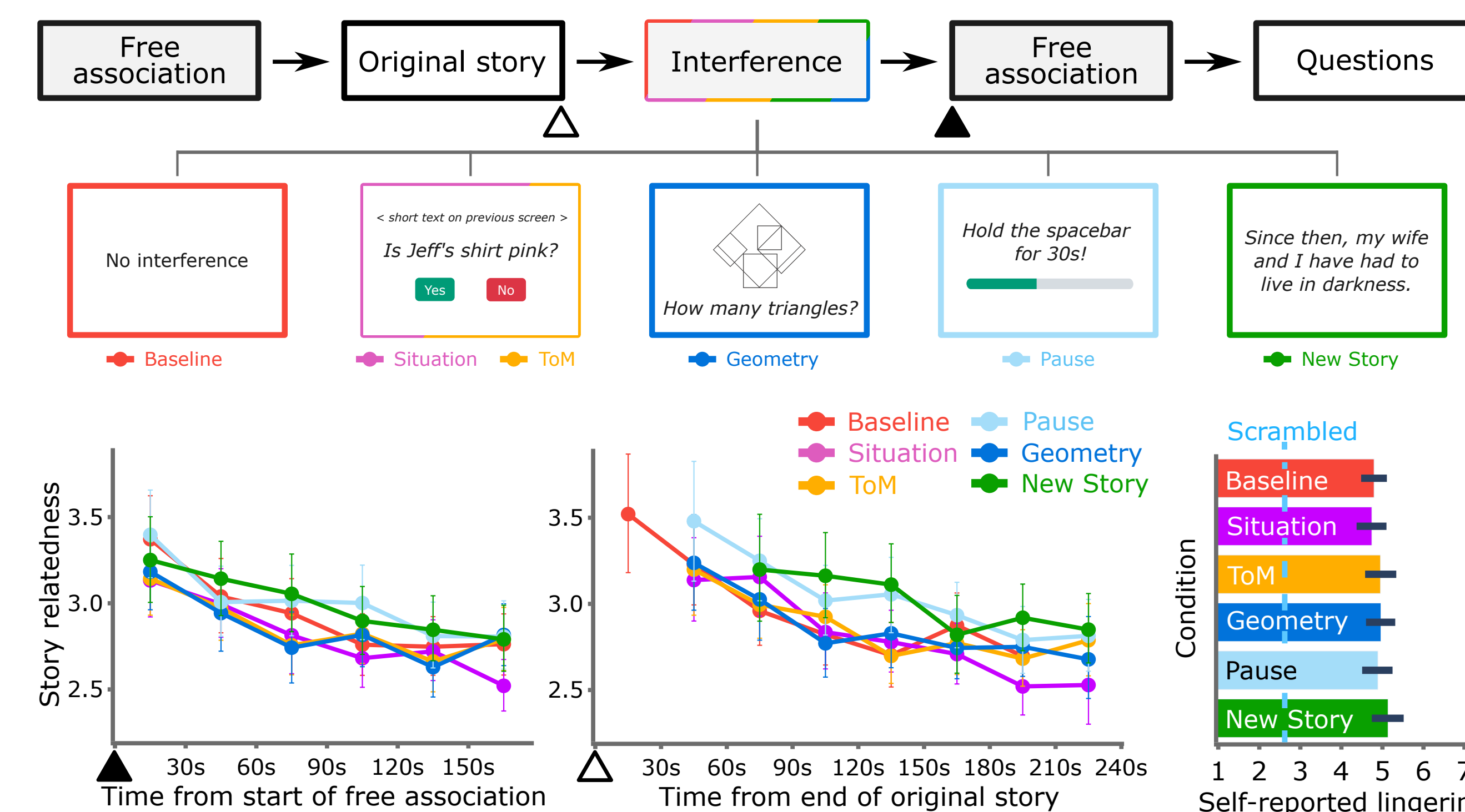
- > Each word rated at least 10 times
- > 431 separate participants



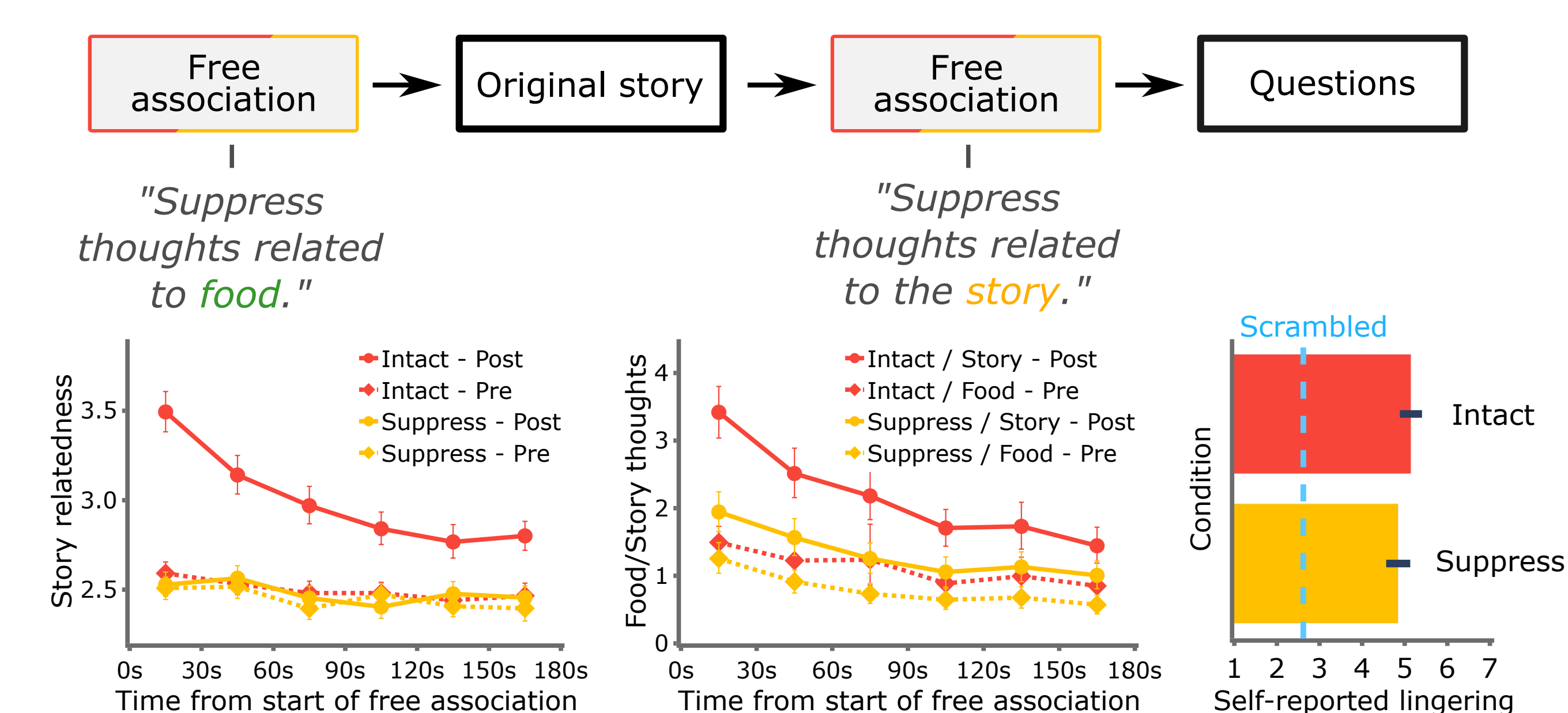
## Narrative content persisted in mind after reading



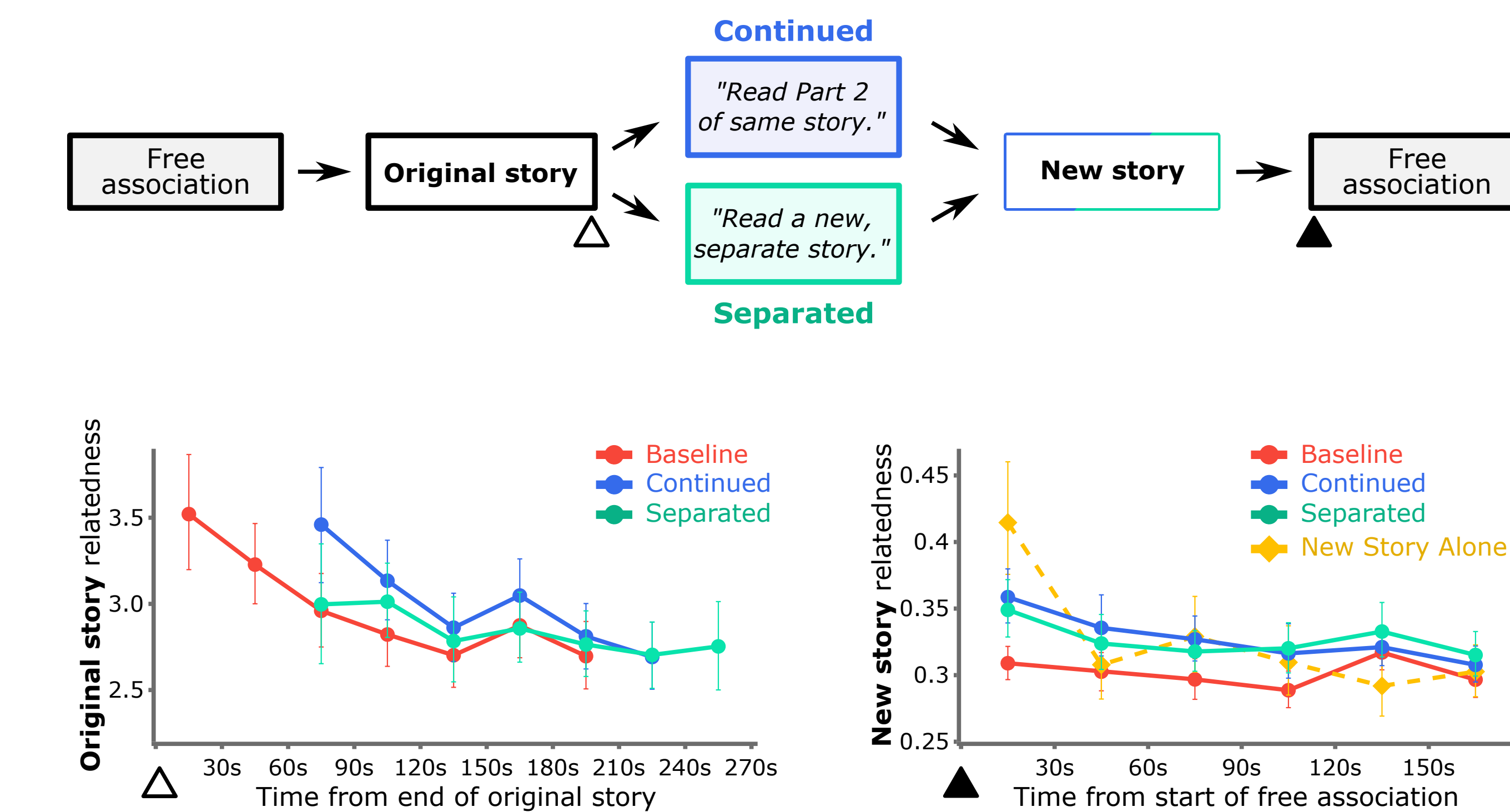
## Persistence was robust to post-reading distractors



## Persistence was decreased but not eliminated by volitional suppression



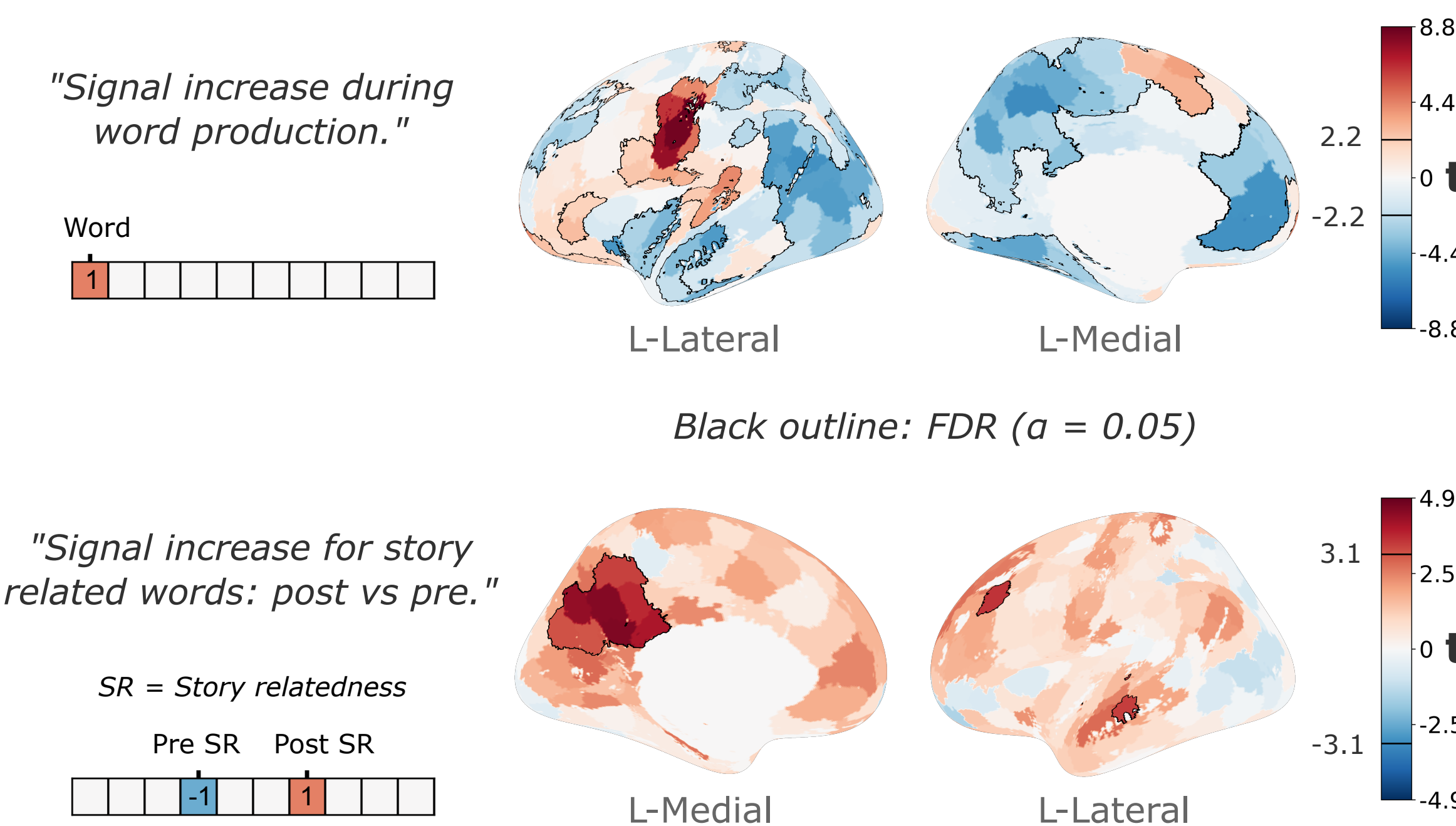
## Integrating unrelated material prolonged persistence



## Moments of persistence linked to DMN activity increase and reinstatement

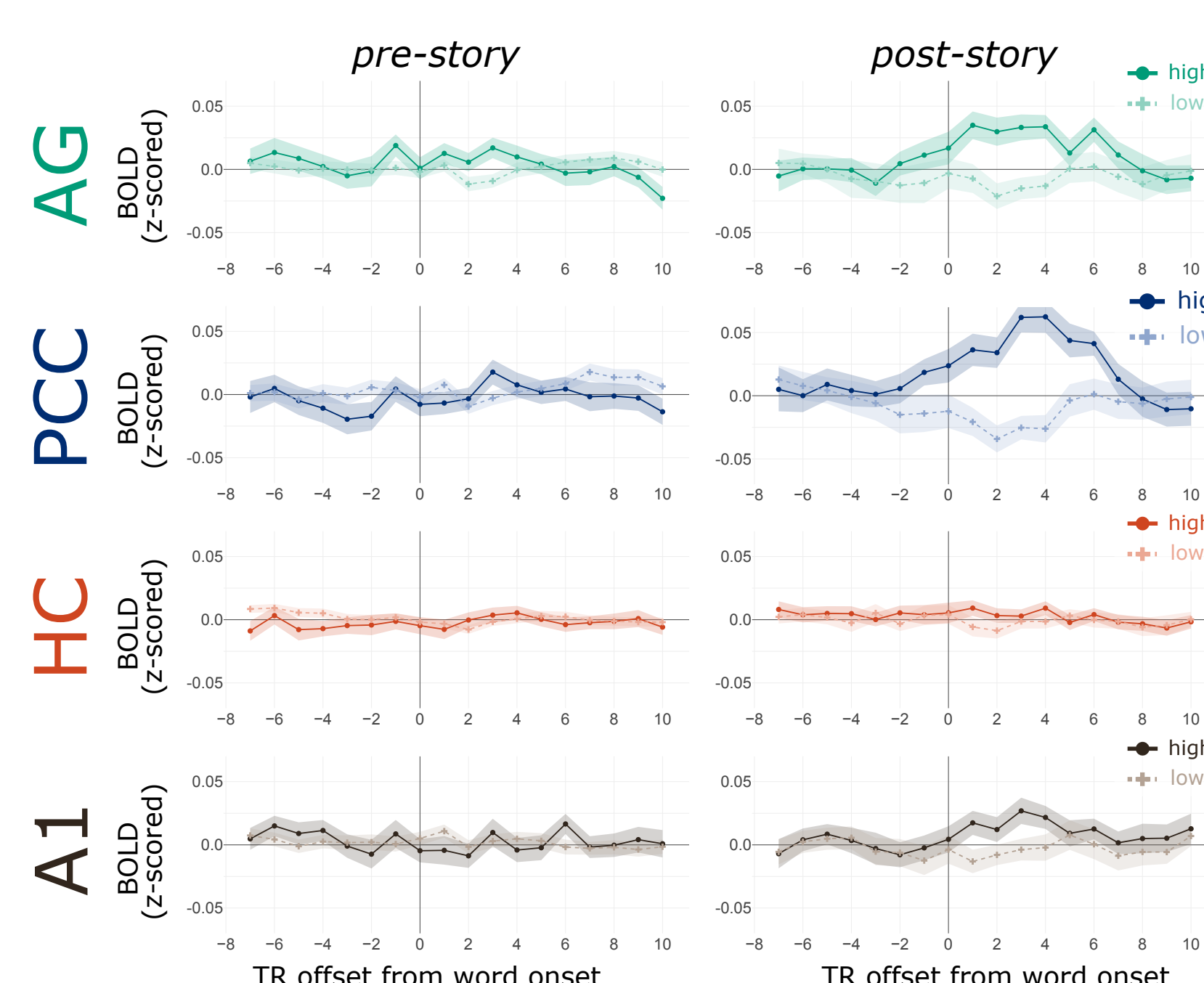
### Generalized Linear Model

- > Schaefer-400 parcellated BOLD signal
- > Use word presence as predictor, story-relatedness as parametric modulation



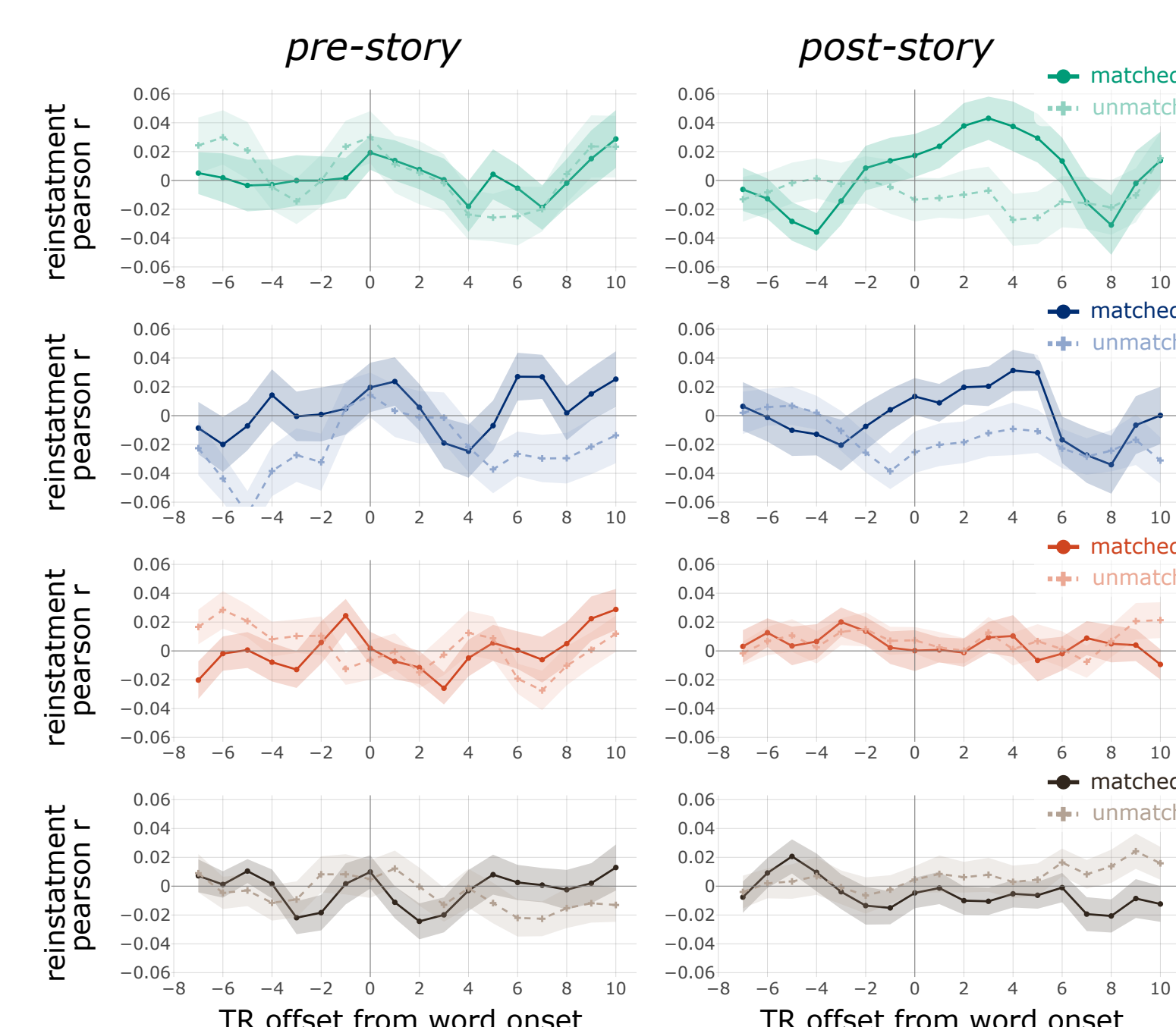
### Activity for 'high' story-related words

- > 'High': story-relatedness > 4.5
- > 'Low': story-relatedness < 2.5
- > no surrounding 'high' words



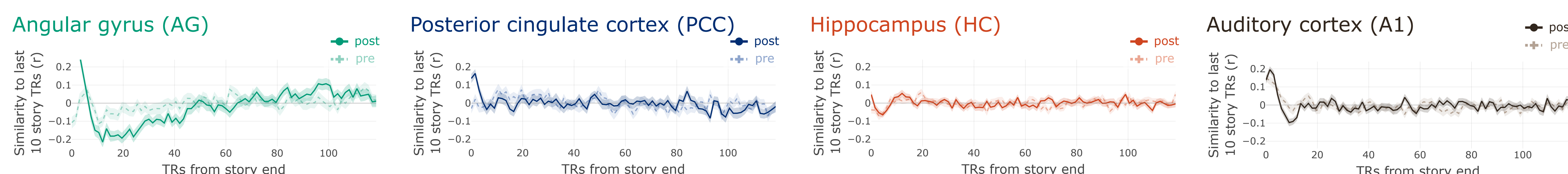
### Reinstatement to matched events

- > Divided story into events [1, 2, ..., 18]
- > Match word if it appears verbatim in event-transcript

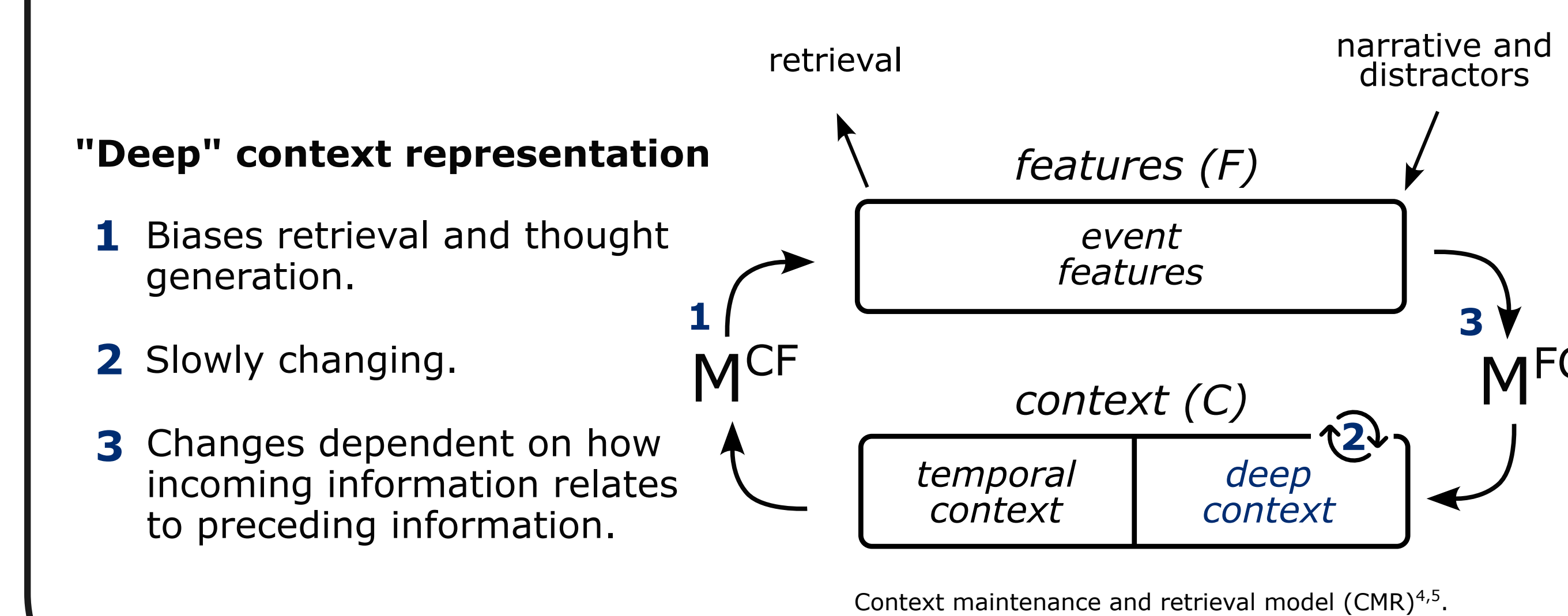


## Multivoxel story-pattern persisted in inverted format in angular gyrus

- > Compute mean pattern over last 15 TRs of story and average across participants
- > Correlate with each TR during free association



## Persistence may be driven by a slowly changing context representation



## Conclusions

- > Persistence cannot be explained by intentional retrieval or by volatile short-term memory representations.
- > Regions associated with episodic memory retrieval show increased activity and reinstatement of events during persistence.
- > Persistence may be driven by a slowly-changing, gated representation which biases memory retrieval and thought.
- > Next: direct test of persistence on retrieval; implement deep context; compare activity during persistence with episodic retrieval.

## References

1. Bellana et. al (2022), 2. Andrews-Hanna et al. (2022), 3. Honey et al. 2023 (2024), 4. Polyn et al. (2009), 5. Mildner & Tamir (2019)

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