Cognitive and Neural Origins of Persistent Mental Content

preprint

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Recent experiences linger in mind

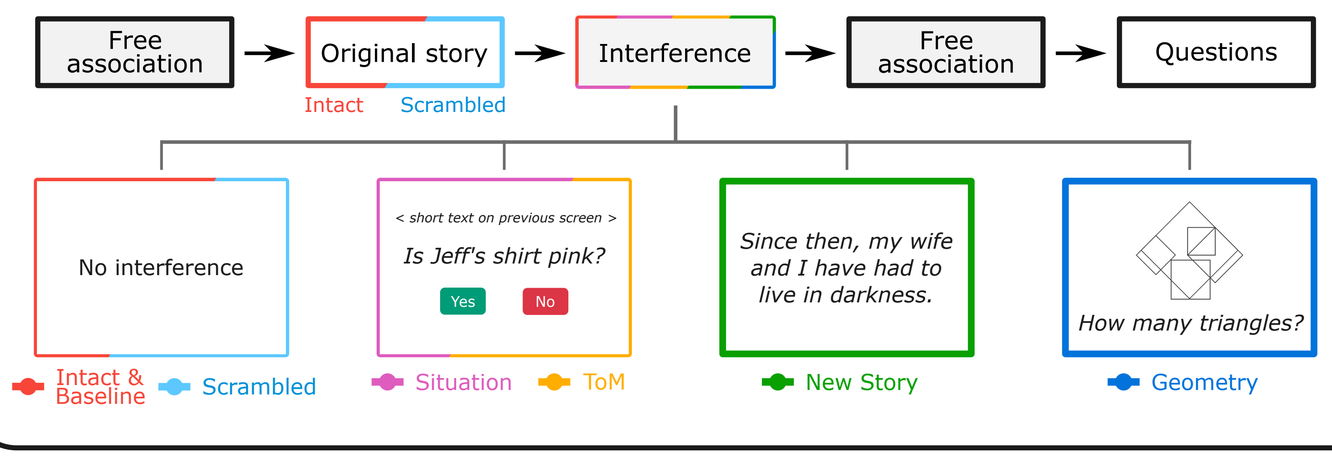
> e.g. an awkward social interaction, a stubborn problem, or an immersive story.

> May relate to rumination and anxiety[2].

> May relate to goal attainment in open-ended world[3].

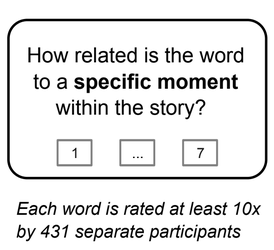
What cognitive and neural processes underlie persistence?

Paradigm

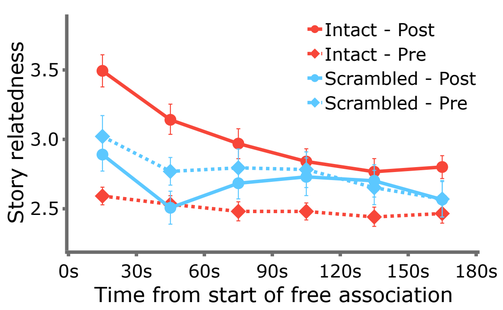


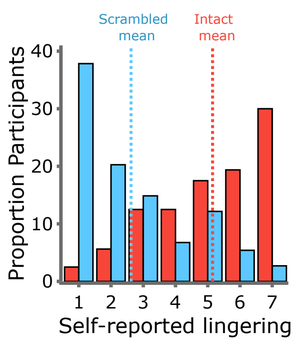
Narrative content persisted in mind after reading

Norming story relatedness

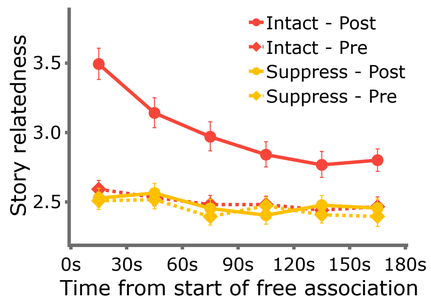


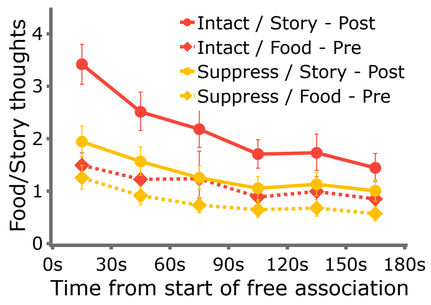
Each word is rated at least 10x by 431 separate participants

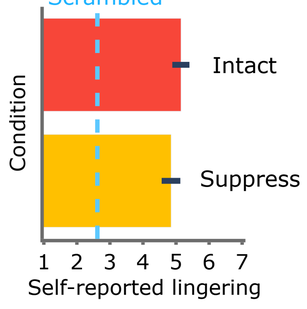




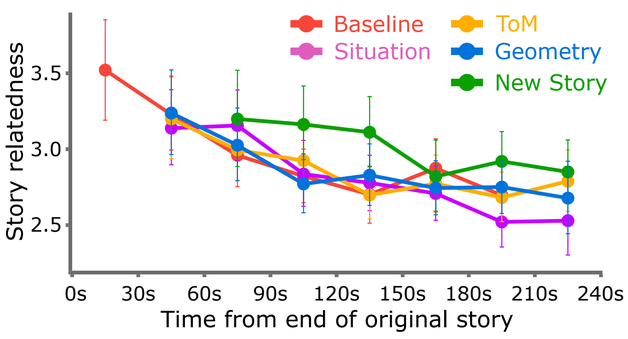
Persistence was decreased but not eliminated by volitional suppression

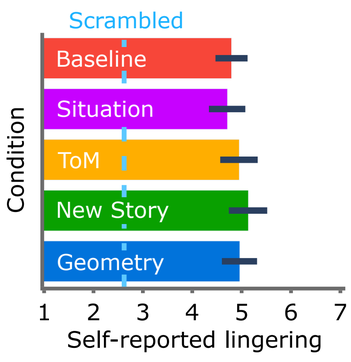




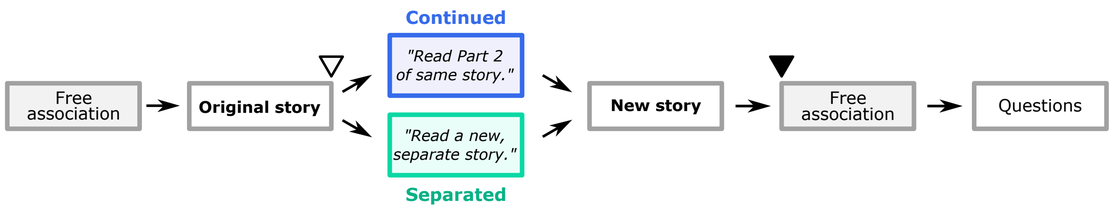


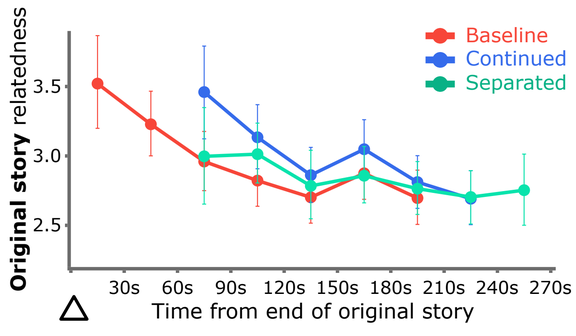
Persistence was robust to post-reading distractors

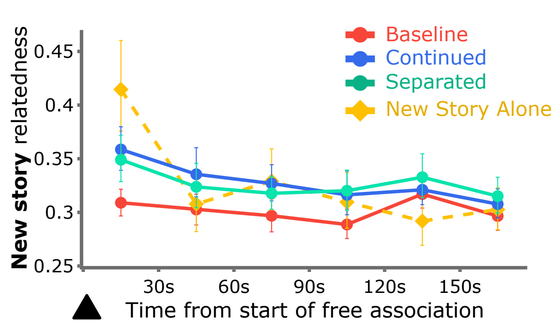




Integrating unrelated material prolonged persistence







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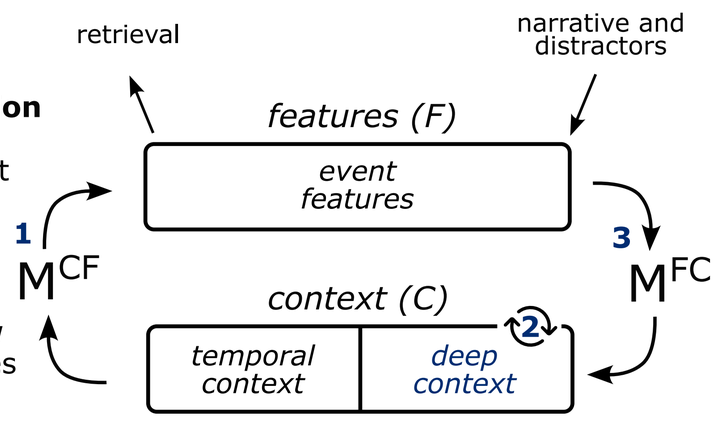
Persistence may be driven by a slowly changing, high-level context representation

"Deep" context representation

1. Biases retrieval and thought generation.
2. Slowly changing.
3. Changes dependent on how incoming information relates to preceding information.



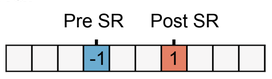
Context maintenance and retrieval model (CMR)
adapted from Polyn et al. (2009)

DMN activity increases and reinstatement linked to moments of persistence

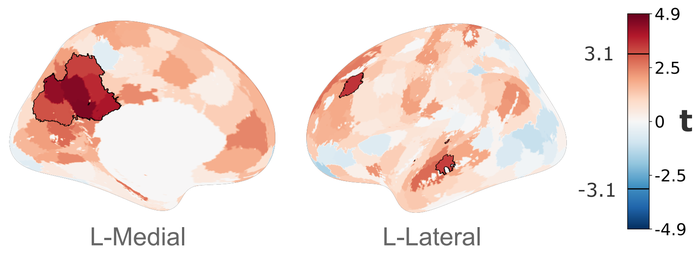
> *Generalized Linear Model*

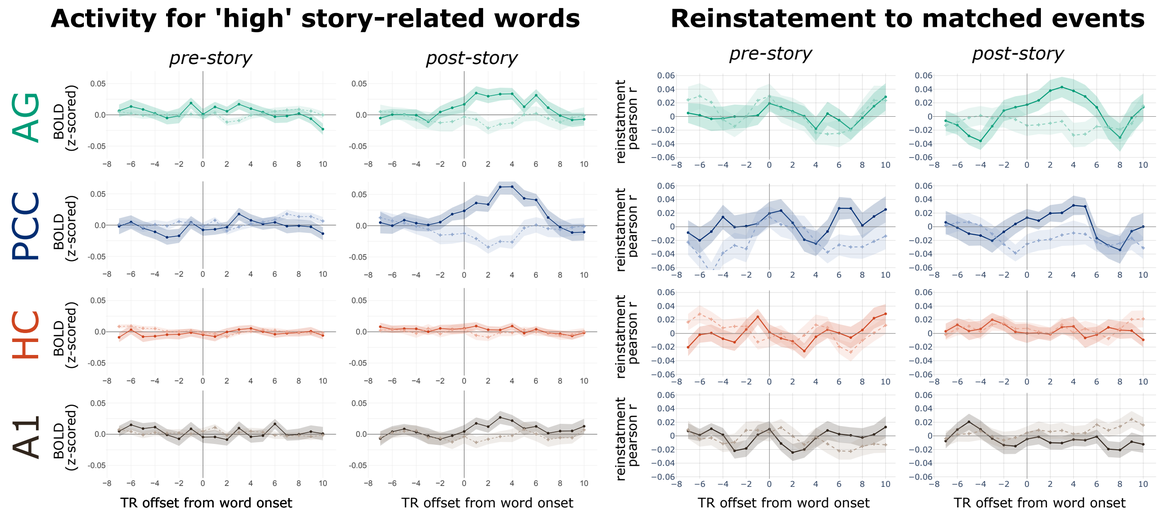
> *Schaefer-400 parcellated BOLD signal*

> *Contrast:*



"Signal increase for story related words: post vs pre."





Conclusions and next steps

> Persistence cannot be explained by intentional retrieval or with volatile short-term memory representations.

> Regions associated with episodic memory retrieval show increased activity and reinstatement of events during persistence.

> Persistence may by driven by a slowly-changing, gated representation which biases memory retrieval and thought generation.

> *Next: direct test of persistence on retrieval; implement deep context; compare neural 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)