Multivariate neural patterns of counterfactual thinking-induced reconsolidation of autobiographical memory

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Introduction

- Counterfactual thinking (CFT): mentally simulating alternative ways in which past personal events could have occurred.
- Simulating episodic counterfactuals of autobiographical memories (AM) modifies their phenomenological characteristics.[1-2]
  - Downward (worse) CFT -> contentment or relief
  - Upward (better) CFT -> regret or guilt
- AM retrieval and episodic CFT activate many similar neural regions in the default network.[3]
- We designed this novel multi-session experiment and applied multivariate analysis on fMRI data to study the CFT-induced reconsolidation effect on the neural representation of AM.

Participants (*N*=20)

- 15 female, age mean ± SD = 22.80 ± 3.17 years, range 18-28 years.
- L1 English, right-handed, no history of psychiatric disorders.

Multi-session fMRI experiment

S1 behavioral

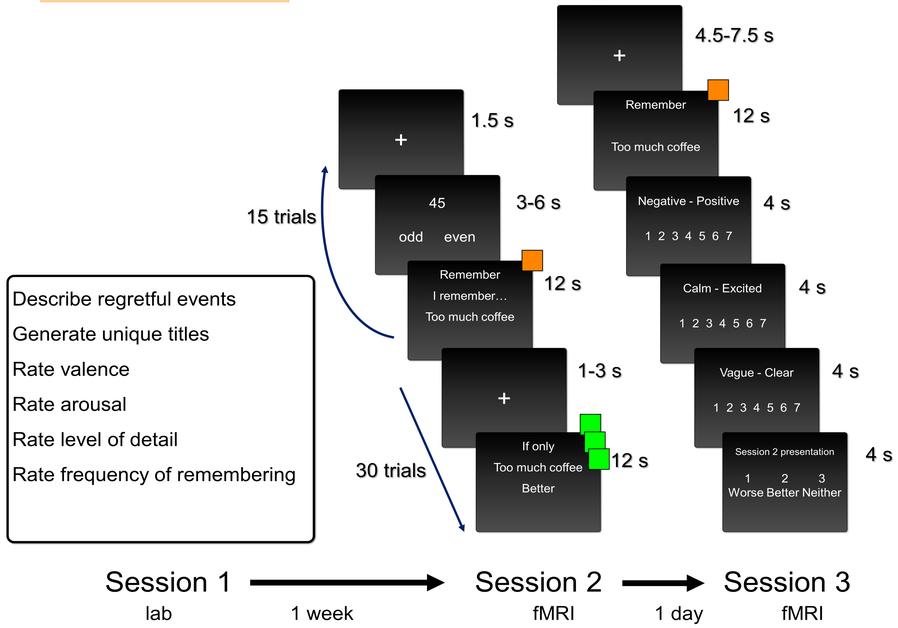
Report 45 AM and rate phenomenological experience

S2 fMRI

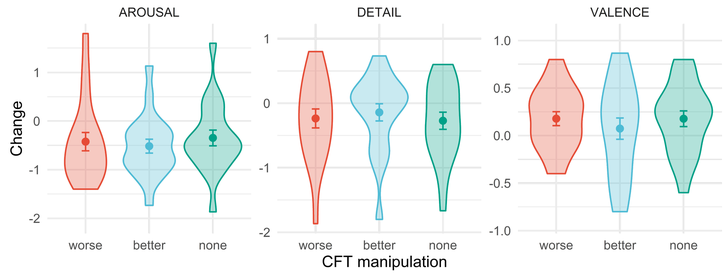
Cued-recall of AM and CFT manipulation

S3 fMRI

Cued-recall of AM and rate phenomenological experience

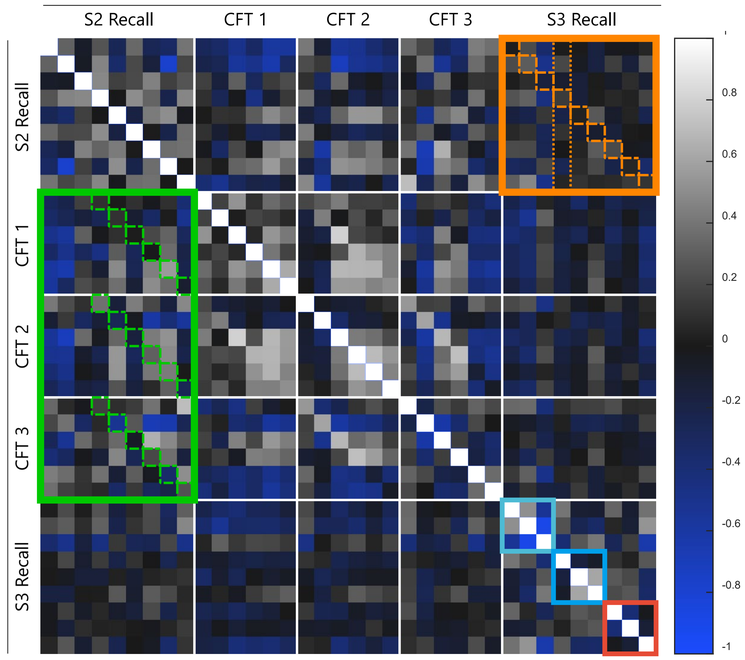


No change in subjective ratings of recollection



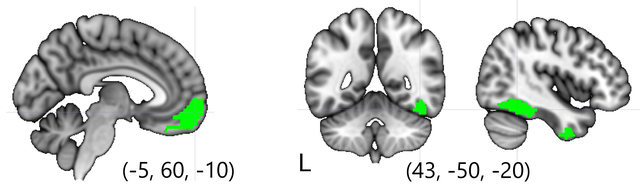
Neural Pattern Similarity (NPS) analysis

- Single-trial modeling;[4] Brainnetome atlas ROIs[5]
- Fisher-transformed Pearson's r of neural patterns
- The matrix shows NPS of 9 memories of a participant in the left precuneus, for illustration purposes only.



1. Sustained CFT engagement

- S2 Recall-CFT1 > Recall-CFT2 > Recall-CFT3
- vmPFC, right ATL, right FuG, right latOcC

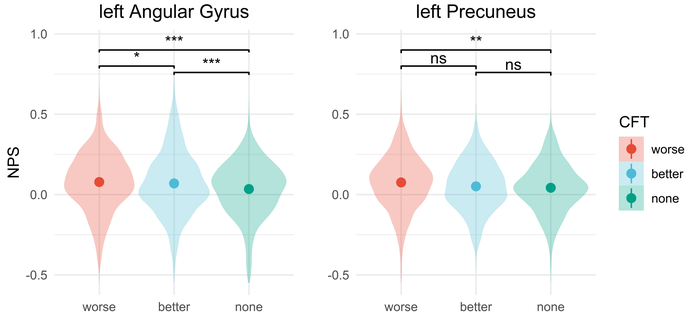


2. Representation of autobiographical details

- Same-memory NPS > different-memory NPS
- Precuneus, left angular gyrus, left ITG

3. Reconsolidation of autobiographical details

- Post-CFT memories were represented more similarly than memories that did not undergo CFT.



Take-home messages

- vmPFC: sustained engagement during both upward and downward counterfactual thinking.
- Angular gyrus and precuneus: represent details from autobiographical memories.
- Even though our counterfactual manipulations did not affect subjective ratings of recollection, they did alter the neural representation of associated autobiographical memories.

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