Neural Correlates of Autobiographical Memory Retrieval: A Seed-Based *d* Mapping Meta-analysis
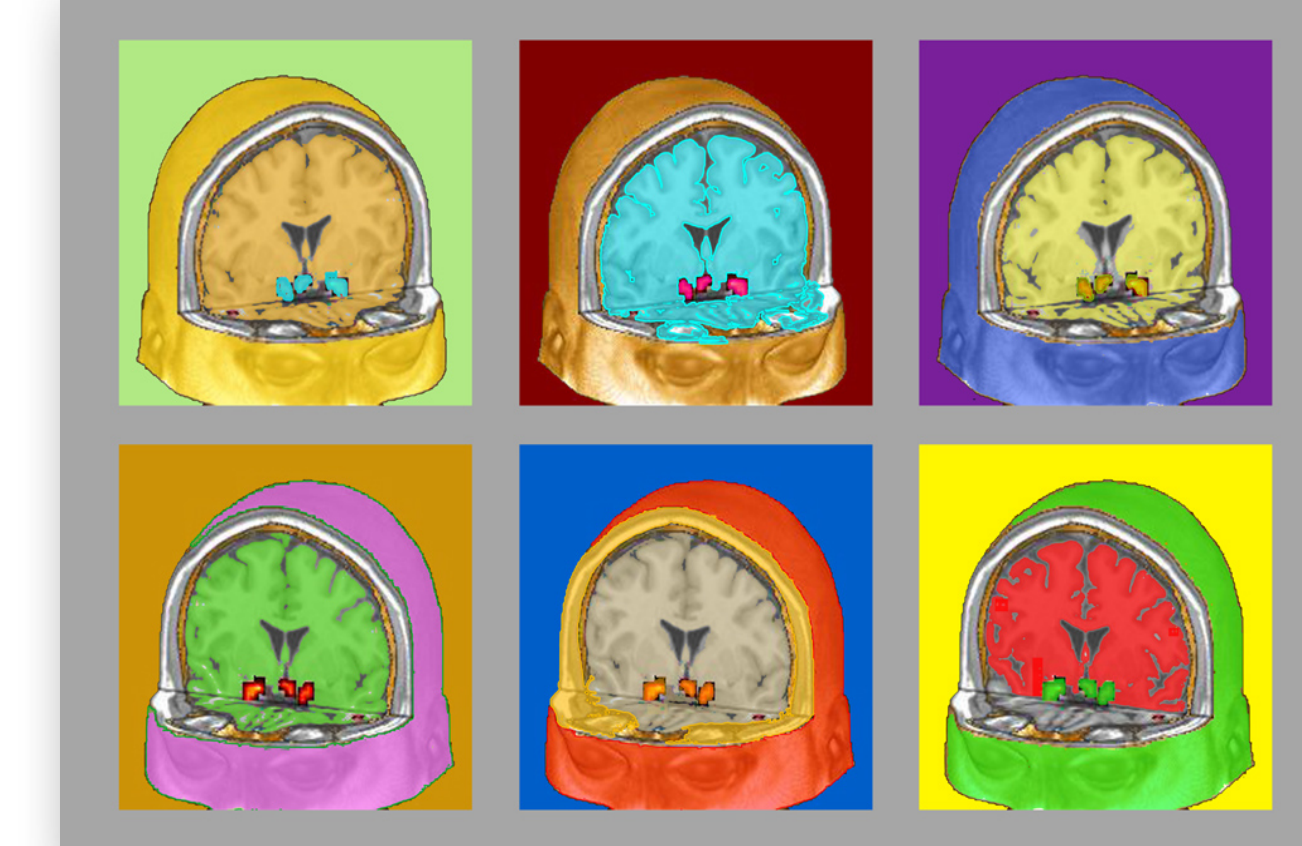
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Introduction

* Autobiographical memory (AM) is a type of episodic memory that involves the recollection and re-experiencing of personal life events.
* Many neuroimaging studies have attempted to identify the neural correlates of AM, so meta-analysis techniques such as ALE and SDM allow us to identify the most consistently activated regions across many studies.
* We examined the neural correlates of AM retrieval using the largest set of AM studies to date combined with a powerful meta-analytic method (SDM).
* We also examined the role of control tasks and whether the memories were rehearsed or spontaneous.

Goals

* Characterize the brain regions consistently activated during autobiographical memory retrieval.
* Contrast neural correlates of rehearsed vs. spontaneous AM retrieval.
* Assess the consistency of AM retrieval activations across different control tasks.

Methods

Paper identification:
* PubMed search of: "autobiographical AND memory AND (fMRI OR PET OR neuroimaging)"

Paper selection:
* 624 papers screened for selection criteria:
1. Studies must involve the recollection/re-experiencing of personal and specific life events during fMRI or PET scanning
2. All contrasts must come from independent samples of healthy adult participants
3. Exclude studies reporting results of only multivariate analyses or connectivity analyses
4. All studies had to include a contrast AM retrieval to a control task and report whole brain coordinates
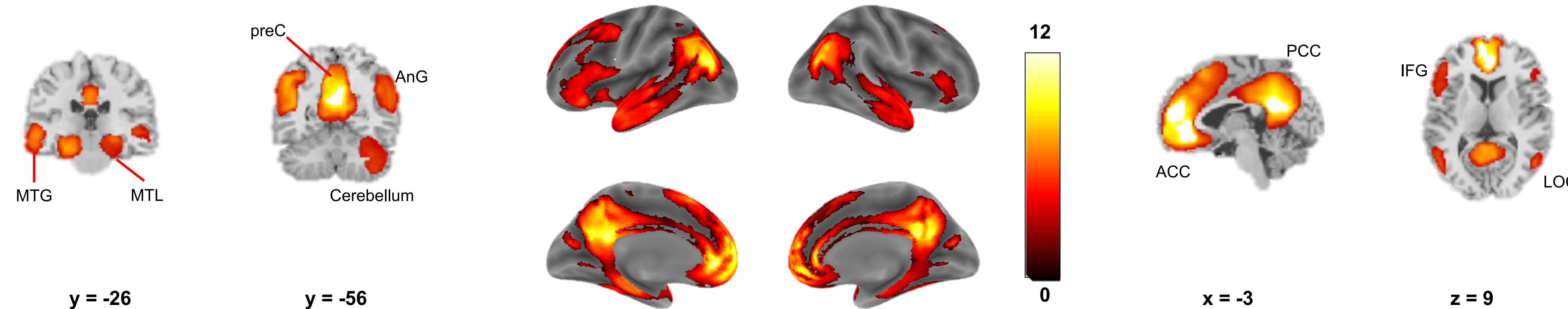
Final Inclusion
* 54 papers included

Meta-Analysis Method
* Seed-Based *d* Mapping (SDM-PSI), standard parameters[1]
* SDM uses the effect size for each peak to recreate the most likely individual subject maps for each study
* Thresholded using threshold-free cluster enhancement (TFCE), FWE, *p* < 0.05 (1,000 permutations)

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AM Retrieval Meta-Analysis Results

SDM meta-analysis of all 54 papers identified:

Areas common to AM network:
Posterior cingulate cortex (PCC)[2,3,4,5]
Anterior cingulate cortex (ACC)[3,4,5]
Bilateral medial temporal lobe (MTL)[2,3,4,5]
Right cerebellum[1,2,3]
Precuneus (preC)[2,3,4]
Bilateral angular gyrus (AnG)[2,3]
Hippocampus[1,3] and Amygdala[2,4]
Parahippocampal gyrus[2,3,4]

Areas less common:
Bilateral middle temporal gyrus (MTG)
Bilateral lateral occipital cortex (LOC)
Greater extent in the medial frontal lobe
Superior frontal gyrus
Bilateral inferior frontal gyrus (IFG)

Comparison to Previous ALE Meta-analyses

Addis, 2016 (n=32)

Boccia, 2019 (n=37)

Svoboda, 2006 (n=24) (effect-location meta-analysis)
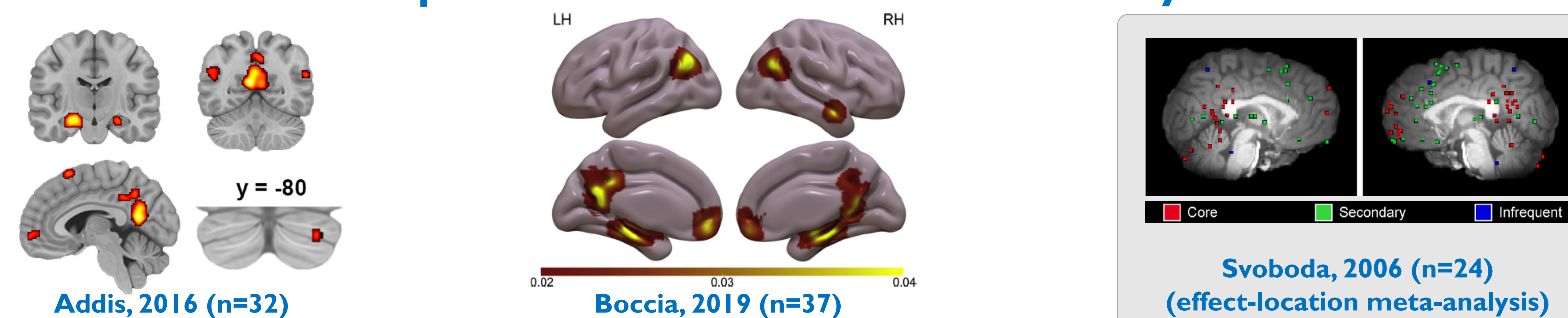
Superior frontal gyrus
Addis (medial), Spreng (left), and Svoboda (left)

Middle temporal gyrus
Boccia (right), Addis (left), and Spreng (bilateral)

Lateral occipital cortex
Spreng (left)

Inferior frontal gyrus
Addis (left) and Spreng (left)

AM Tasks

To contrast the neural correlates of rehearsed vs. spontaneous AM retrieval, we ran SDM meta-analyses on a subset of the 54 original papers.
Rehearsed AM Tasks: 15 papers had tasks where the cues were created by using an autobiographical interview at most 1 week before the scan
Spontaneous AM Task: 13 papers had tasks where novel cues were presented in the scanner

Rehearsed AM Task: 15 papers (red)   **Overlapping activation (green)**   **Spontaneous AM Task: 13 papers (blue)**
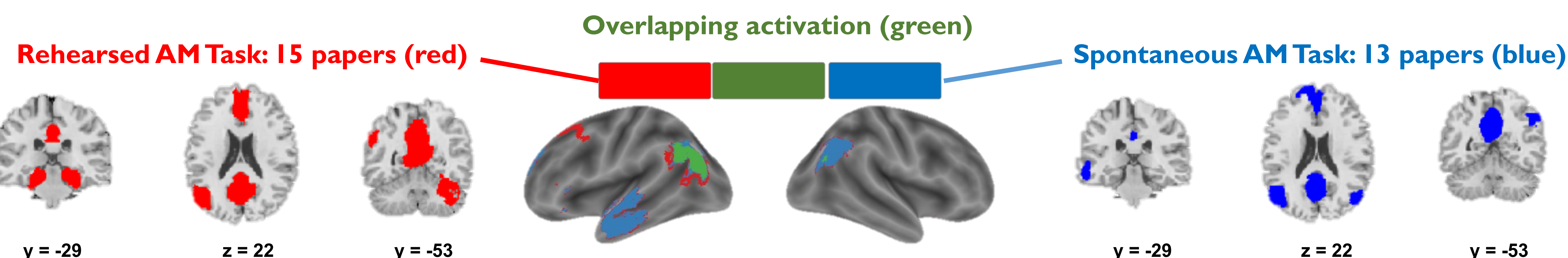
Unique activations:
Right cerebellum
Bilateral MTL
Parahippocampal gyrus
Hippocampus
Amygdala

Unique activations:
Left superior frontal gyrus
Right AG
Left MTG

The overlapping regions include those most commonly found in AM retrieval including: **PCC, ACC, bilateral LOC**, and the **left angular gyrus.**
However, at uncorrected p<0.005, there is activation in bilateral medial temporal lobe in the Spontaneous AM Task.
Lateral PFC activation in Spontaneous recall is the biggest difference which is linked to memory search[5] and difficult cognitive tasks.

Control Tasks

* To assess the consistency of AM retrieval activations across different control tasks, we ran SDM meta-analyses on each subset of papers utilizing a different control task.
* By analyzing the overlapping areas across all 3 SDM maps, we can find the areas that are most consistently activated by AM retrieval regardless of their control task.

3 different control tasks:
Visuo-Attention (Reading pseudo words) – 15 papers
Semantic (Word association judgement) – 21 papers
Imagery (Theory of mind) – 10 papers

Overlapping areas of activation across all 3 tasks
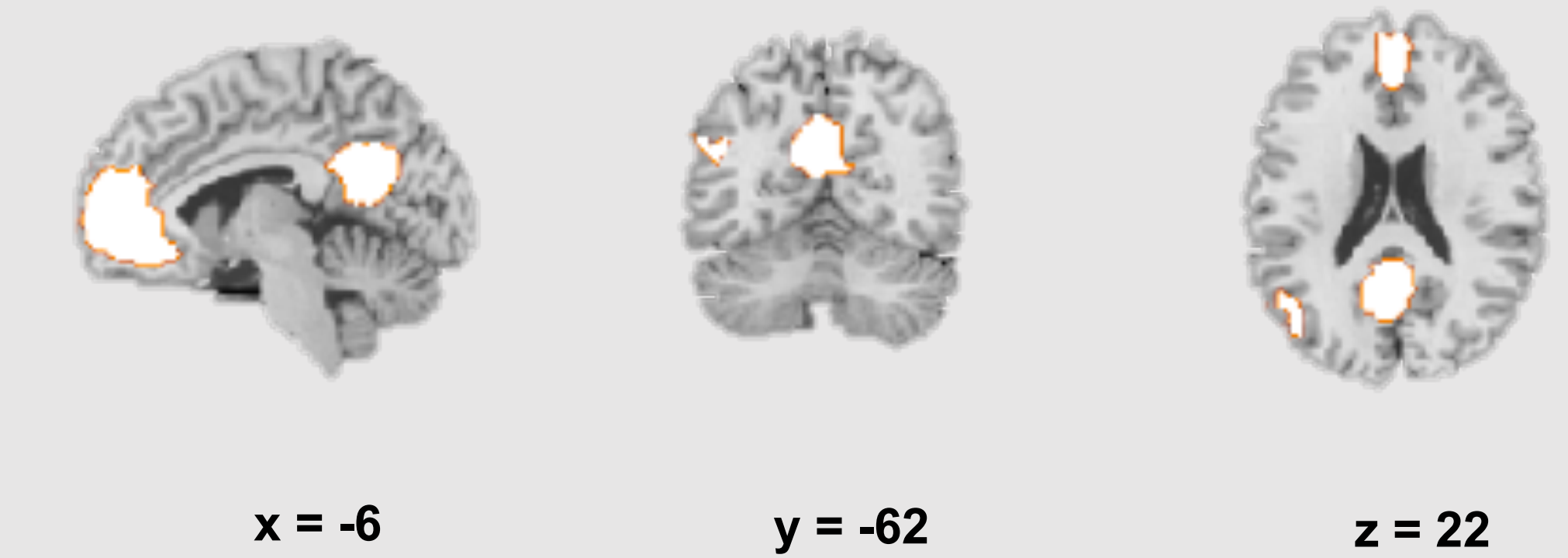
ACC
Superior medial gyrus
Middle orbital gyrus

PCC
Precuneus
Left middle temporal gyrus

Conclusions

* This SDM meta-analysis of autobiographical memory retrieval utilizes the most advanced meta-analytic method and the largest set of AM studies to date.
* This meta-analysis brings clarity to the inconsistencies identified by previous meta-analyses.
* By analyzing two separate AM retrieval tasks, this meta-analysis is the first to show that there are very few differences in neural activation between AM retrieval tasks that are rehearsed or spontaneous.
* By analyzing the overlapping areas of activation between three different types of control tasks, this meta-analysis identified the neural correlates of the most consistently activated regions during AM retrieval.

References
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