# Sherlock

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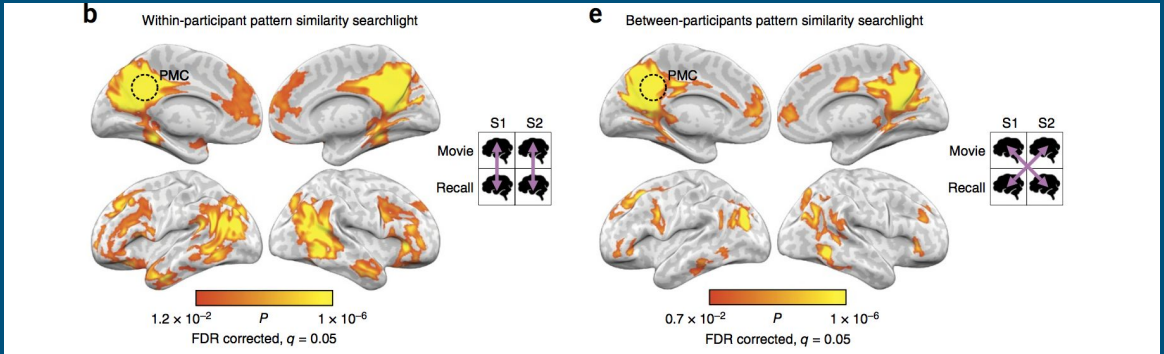
# Intro

1. Used data collected by a 2017 Chen et al. study
   a. 17 subjects watched a 50 minute movie (1st episode of *Sherlock)* and were then asked to recall what happened
   b. Scanned with fMRI during movie-watching (encoding) and during recall

2. Major findings from this initial study
   a. Correlation between brain regions active during encoding and reactivated during recall (Default Mode Network)
   b. Spatial organization of memory representations (neural activity is altered from perception to recollection in a systematic manner



When Professor Chang told us to to look at four different questions

# We looked at the following questions:

Question 1: Do participants who successfully recall a scene have different activations during the encoding period than participants who do not recall the scene?

Question 2: Are there common regions activated during encoding across subjects that are correlated with successful recall?

Question 3: How does the temporal pattern of activity in the brain throughout encoding correlate with subject similarity, based on their scene recall?

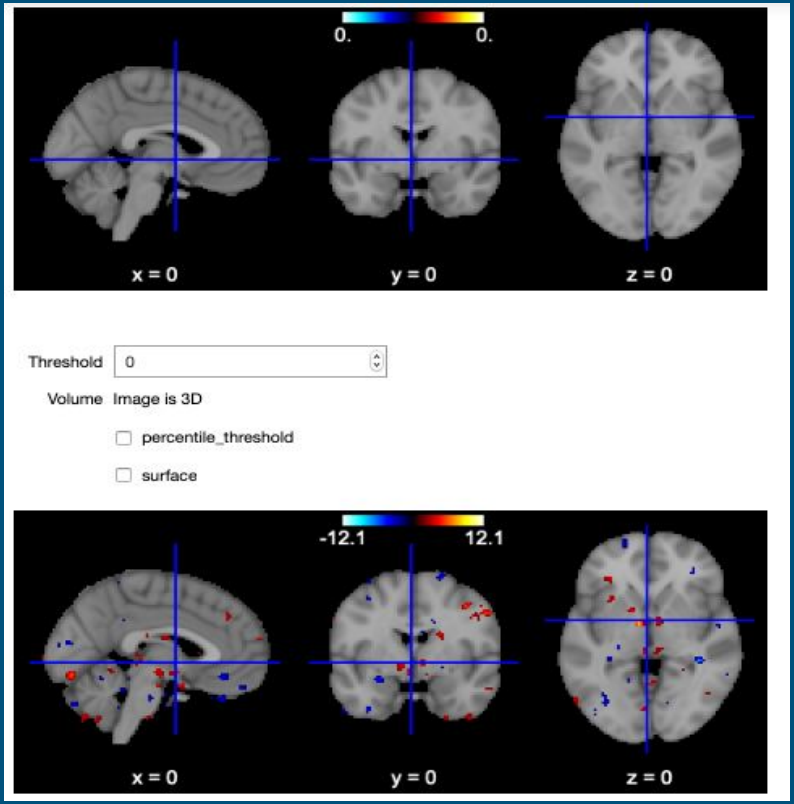
Question 4: How does the semantic similarity of scenes based on text encoding analysis correlate with the spatial representation of scenes during encoding?

# The Best and Worst of Recall

SUBJECT 11 : 47/50 scenes were recalled


SUBJECT 2 : 25/50 scenes were recalled

# Question 1:




Method

1. Create a csv of accuracy
2. Apply to each scene
3. Corrected vs uncorrected results

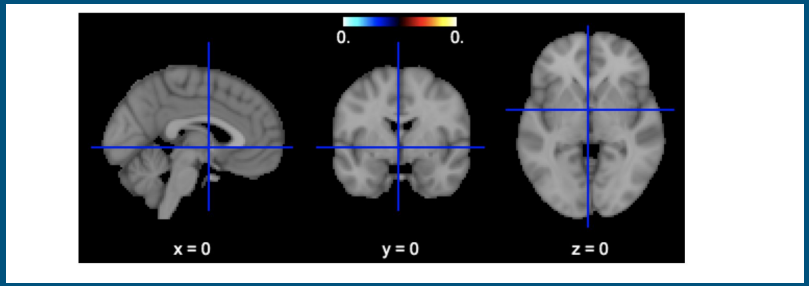
Results

1. No activation with fdr 0.05 indicates lack of power ~ only 8 scenes
2. Activation of pineal gland indicates regulation of sleep
3. Blue : orbitofrontal cortex involved in decision making
4. Red : precuneus involved in recollection, memory, and integration of perception of the environment; insula; right middle frontal gyrus for convergence of the dorsal and ventral attention networks, by serving as a circuit-breaker to interrupt ongoing endogenous attentional processes in the dorsal network and reorient attention to an exogenous stimulus; supramarginal gyrus part of the mirror neuron system.

# Question 2:

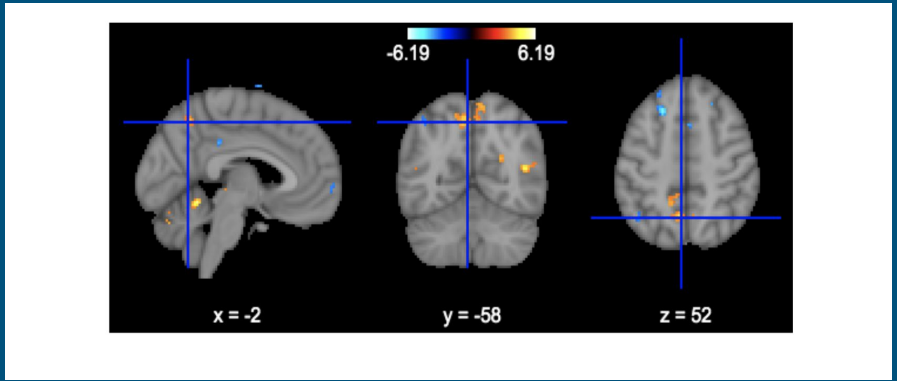
Method

1. Create a csv of accuracy (1s and 0s)
2. Create a contrast of recalled scenes vs. forgotten scenes for each subject
3. Loop over subjects and run a t-test
4. Plot corrected and uncorrected results



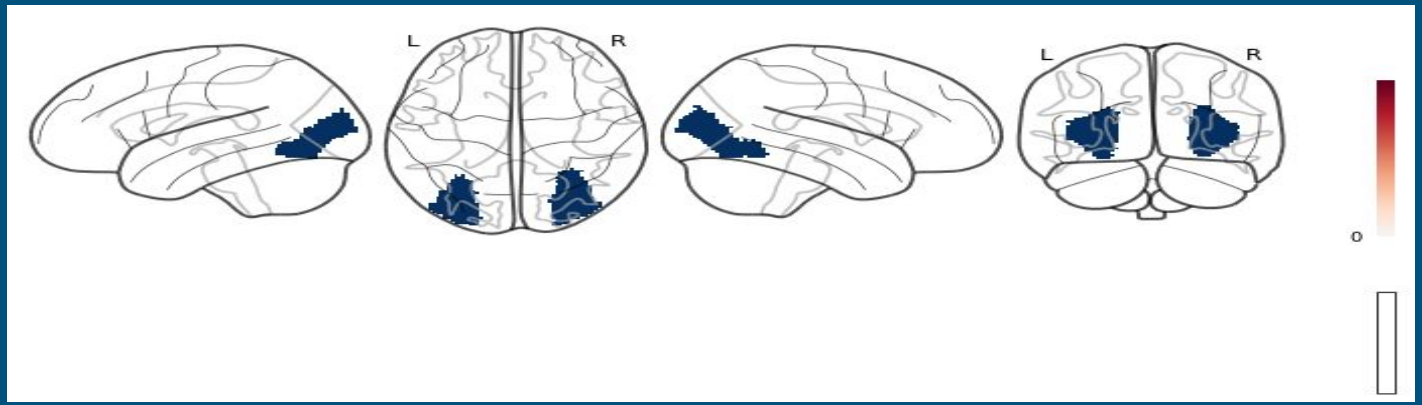

Results

1. Orange/yellow = encoding activation during recalled scenes: parahippocampal gyrus, precuneus/RSC, VTA. These regions are associated with memory functions, emotion, motivation/reward.
2. Blue = encoding activation during forgotten scenes: auditory cortex?



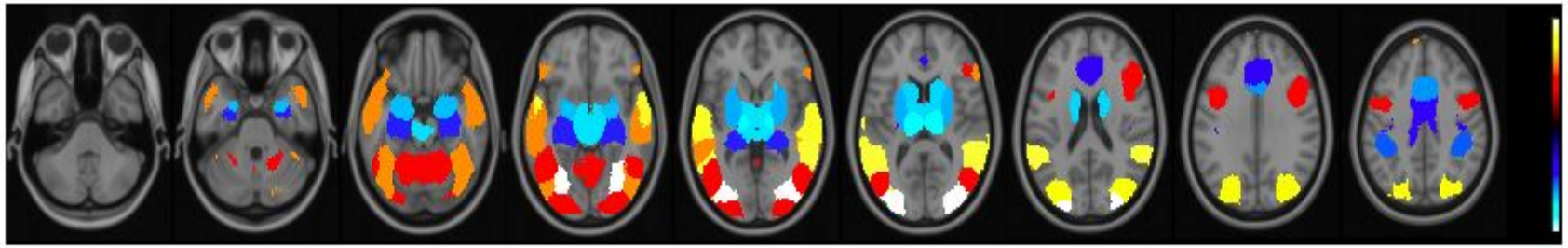
# Question 3

1) How does the temporal pattern of activity in the brain throughout encoding correlate with subject similarity, based on their scene recall?
2) Method: ISRSA = Inter-subject Rep. Similarity Analysis
3) Result: Subjects who had a similar time-course of activation in the lateral occipital area and fusiform face area while watching Sherlock tended to recall the same scenes



# Question 4

1) How does the semantic similarity of scenes based on text encoding analysis correlate with the spatial representation of scenes during encoding?
2) Method: RSA Analysis
3) Results:  Significant activation in the lateral occipital area, temporal-parietal junction (TPJ), superior temporal sulcus (STS), fusiform area



# Conclusion

In conclusion, our research aimed to better understand neural activity during encoding, and how this activity relates to recall similarity across subjects.

*Limitations*

- Small sample size
- Few scenes
- IS-RSA & RSA - no direct connection between semantic similarity & brain activity
- Unable to include/interpret negative correlations

# Conclusion

*Future directions*

- Include negative correlations in analyses
- A fifth analysis on the similarity between subjects' recall transcripts and subject's brain activity during recall
- Identify specific patterns that correlate to similarities between individuals
- Use encoding activations to eventually understand how we improve our recall ability through mentalizing, mirroring, and interpreting

One last question for Professor Chang...

# References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