

Self-Referencing with Memes

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A dark blue diagonal gradient bar that starts from the bottom left and extends towards the top right, covering the lower half of the slide.

Idea

Me: sees dope meme

My brain:

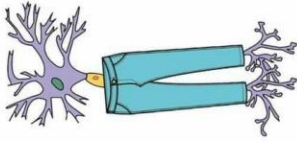


- **Self-referencing processing:** the cognitive process of relating information, often from the external world, to the self (Baladi Nejad, Fossati, & Lemogne, 2013)
- **Meme:** an idea, behavior, or style that spreads from person to person within a culture
 - Aim of conveying a particular phenomenon, theme, or meaning (Merriam-Webster Dictionary)

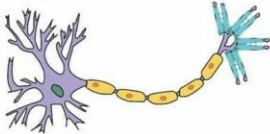
Motivating Question

If a neuron wore pants,
would it wear them

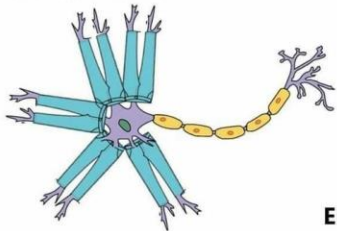
Like this



like this?



or like this?



EMFLRT

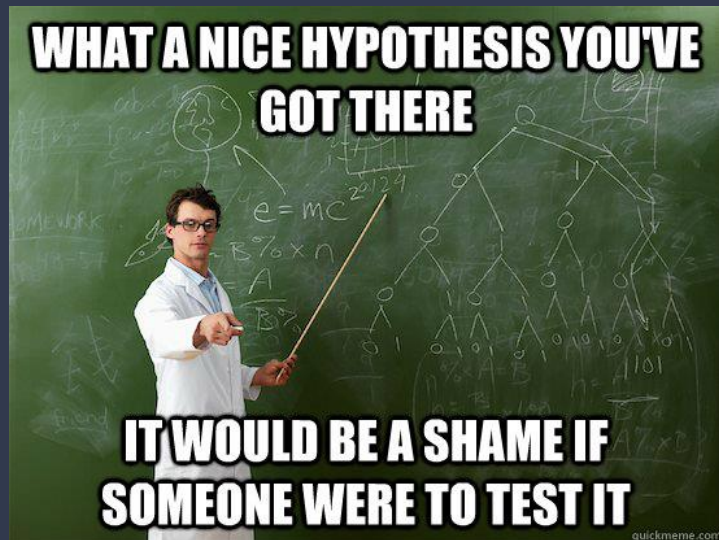
Can we use memes to study
self-referential processing in
the brain?

Background



- vmPFC activity associated with:
 - self-referential thought,
 - social cognition
 - reflection on affective state (Mitchell, Bananji, McCrae 2005)
- Self-judgments associated with more activation of vmPFC compared with other- judgments (Denny, Wager, Ochsner 2012)

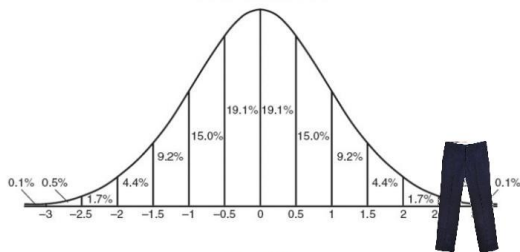
Hypotheses



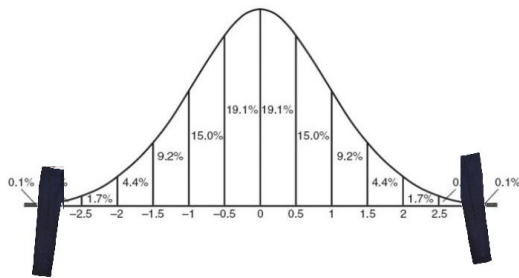
- **Behavioral:** subjects will rate Dartmouth memes as more relatable than non-Dartmouth memes
- **fMRI:** mPFC will show more activation in response to Dartmouth memes when compared to non-Dartmouth memes
 - **Whole-brain MVPA:** mPFC voxels will have greatest weights
 - **Features:** mPFC parcel will have highest accuracy of the 50 parcels

Behavioral Experimental Design / Analysis

If p values wore pants, would it be like this:



Or this:



Behavioral Questionnaire:

- “Is this meme about Dartmouth?”
(Yes/No)
- Relatability (0-100)

Analysis:

- Labeling
- Two-Tailed t-Test

fMRI Experimental Design / Analysis



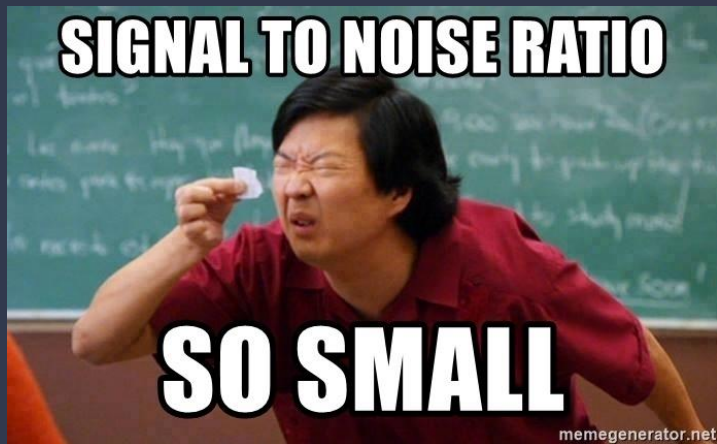
fMRI Task:

- **Run 1:** Pinel Localizer Task
- **Runs 2 & 3:** Meme Presentation
 - Randomized Order
 - Question Prompt: “Would you share this meme with a friend?”

Analysis:

- Data Preprocessing: fMRIPrep
- Beta Images
- Univariate Analysis
- Multivariate Pattern Analysis

Single Trial Model: Creating Beta Images



- **Z-score** for each voxel within run
- **Design Matrix:**
 - One regressor per meme
 - Convolved with Double-Gamma Response Function
 - High pass filter with 100s cutoff
 - Linear and quadratic trends
 - Average activity with the cerebrospinal fluid mask
 - 24 Motion parameters
 - Global spikes and frame differencing spikes
 - Ordinary Least Squares Regression for each voxel

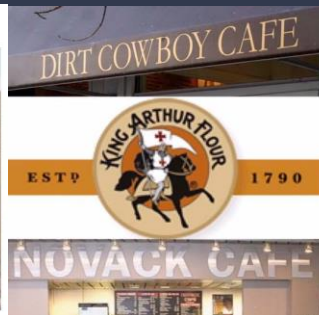
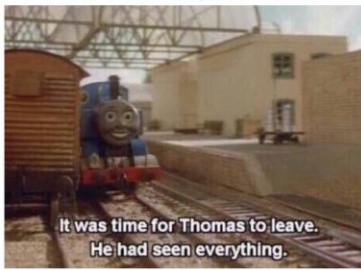
Results

your results can't be insignificant
if you don't get results



9 Dartmouth Related Memes

Takes one step into TDX



One taught me Love

One taught me Patience

One taught me Pain

parents: don't go to dartmouth it snows and it's cold
dartmouth: snows, is cold me:



"you should get the app"



Buying something from DDS without checking the price tag



frat row

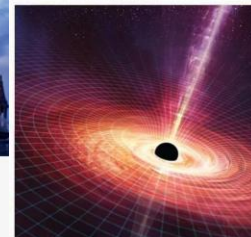
webster avenue



Breaking News: French Officials Ban Hibachi Grills

CBS-NEWS.US

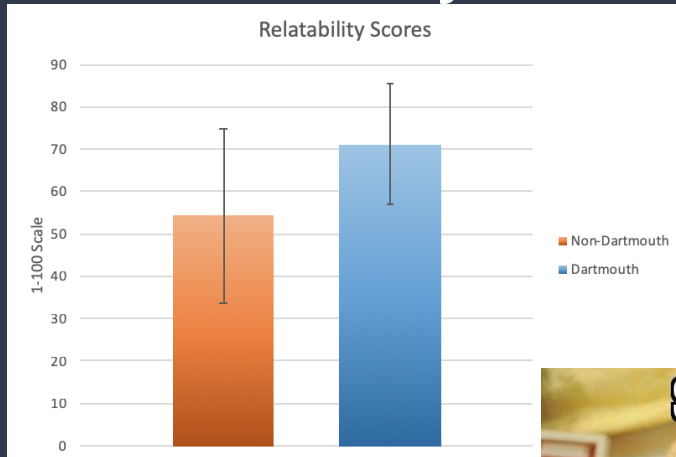
dartmouth as described at dimensions



dartmouth actually



Behavioral Results: Relatability



- **Relatability Metric:**

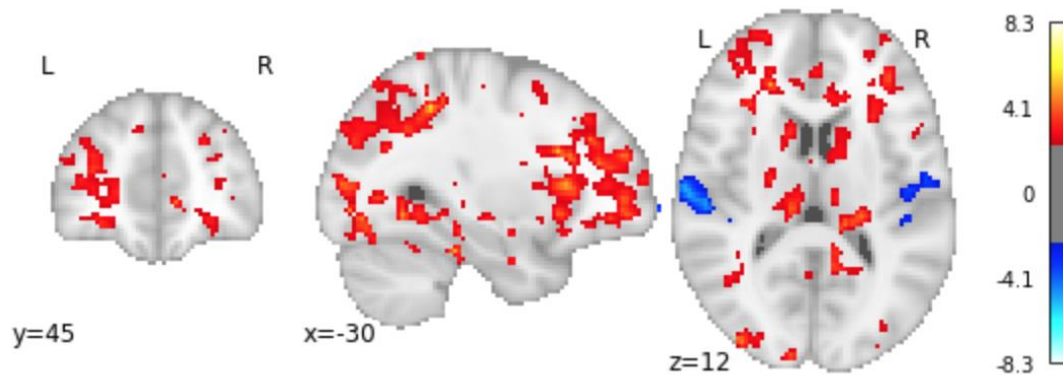
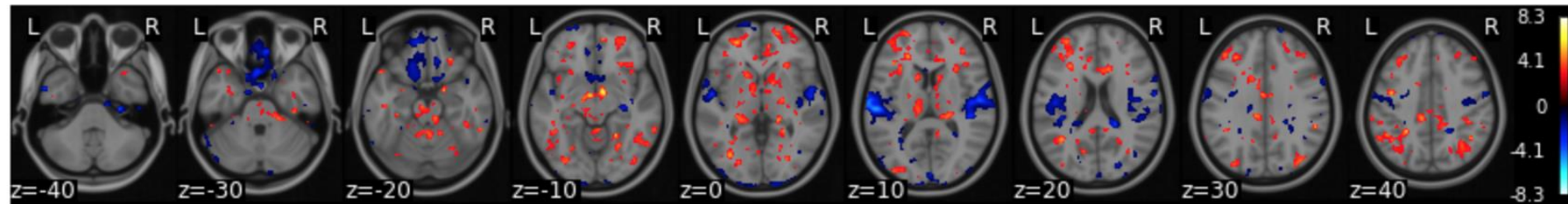
- Non-Dartmouth Mean: 54.28
 - SD: 20.66
- Dartmouth: 71.21
 - SD: 14.09

1. Two-tailed t-test:

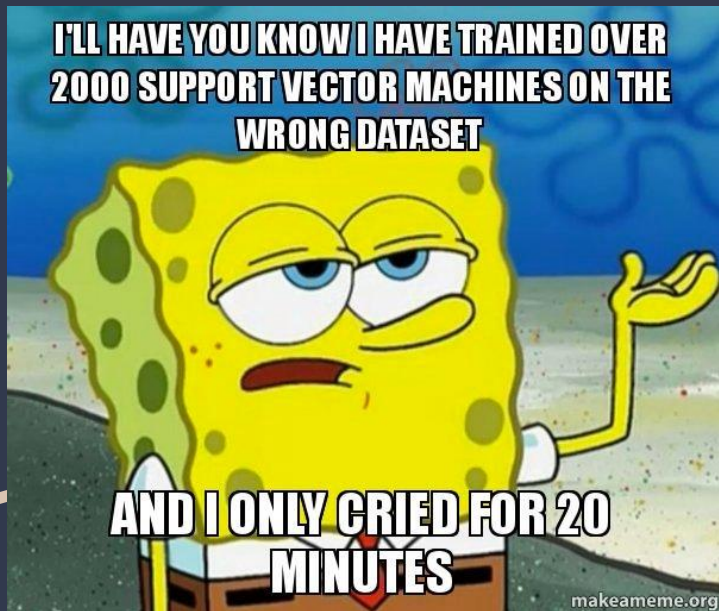
1. t-value: -4.96
2. 11 degrees of freedom
3. P-value: 0.000429

*Statistically significant difference
between the subjective relatability of
Dartmouth and non-Dartmouth memes*

Univariate Results

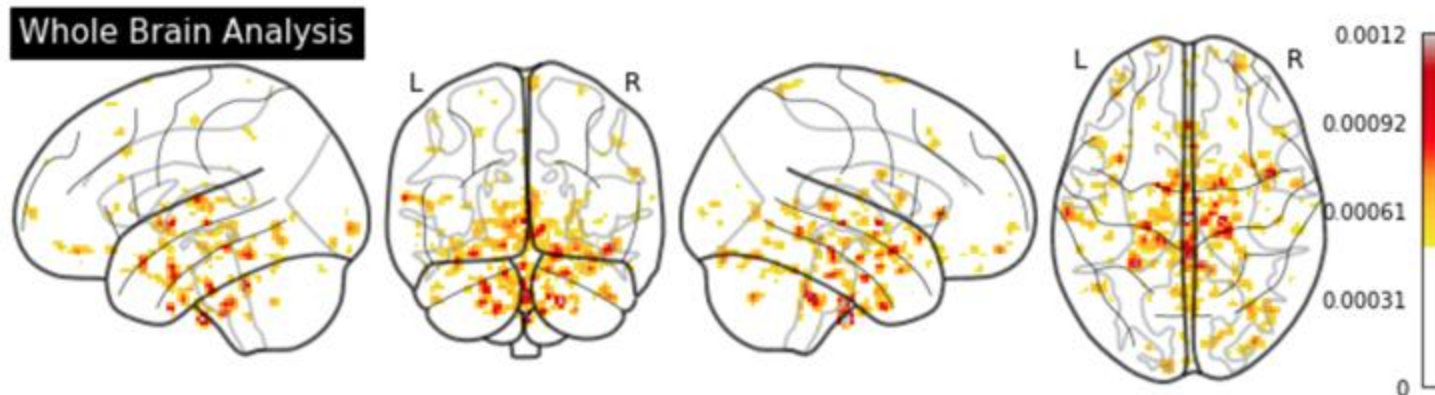


Whole Brain Multivariate Prediction



- Cross-validated accuracy was 0.34 (below chance)
- Balanced accuracy was 0.19
- Maximum value across all brain voxels was 0.0012
- No voxel of particular importance for classifying Dartmouth vs. Non-Dartmouth memes

Whole Brain MVPA Results



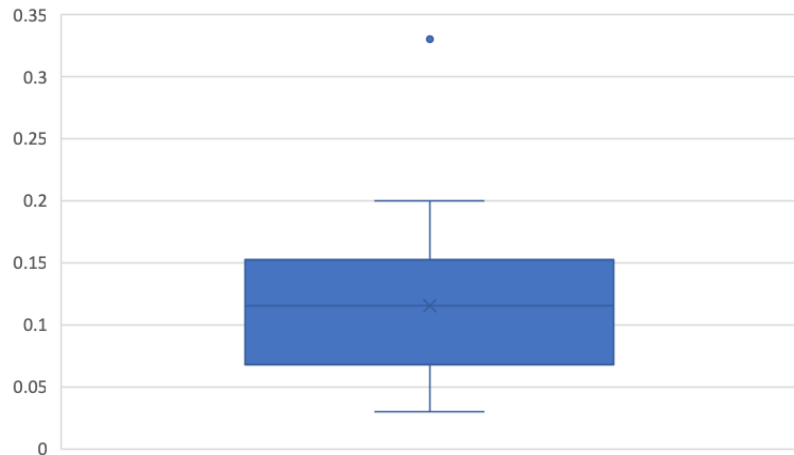
ROI Multivariate Prediction



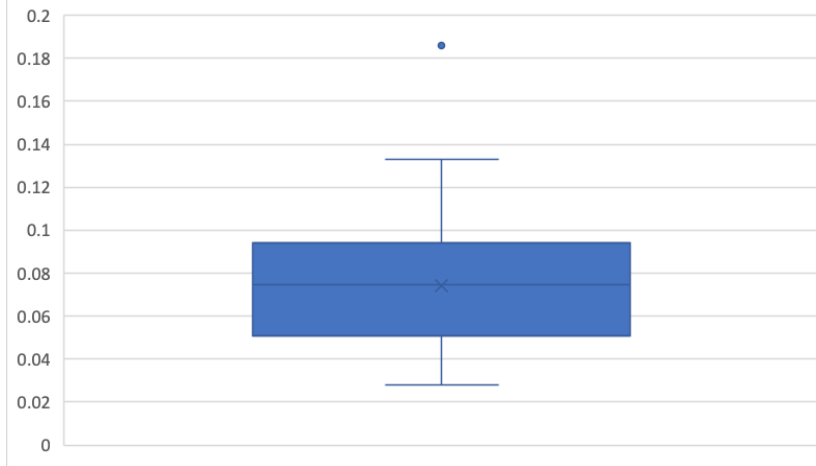
- Cross validated accuracies are all below 0.2
- Balanced accuracy scores are all 0.14
- Regions of the mPFC had extremely low accuracies
 - Anterior mPFC (0): 0.056
 - dmPFC (2): 0.053
 - vmPFC (32): 0.075
- Highest accuracies included:
 - Anterior Frontoparietal (23): 0.094
 - Anterior VLPFC (25): 0.088

Accuracies

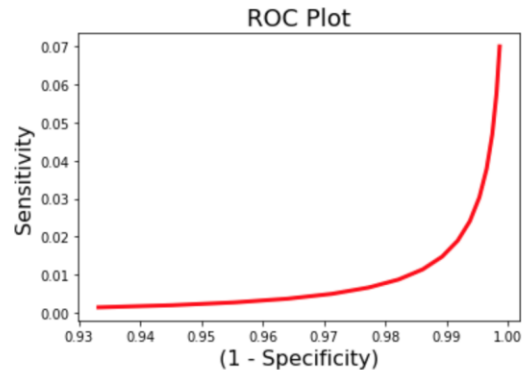
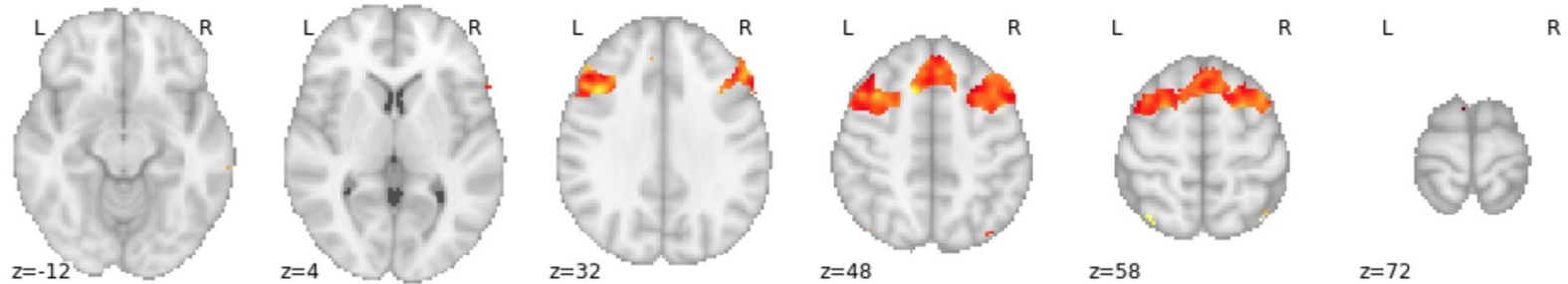
Cross-Validated Accuracies



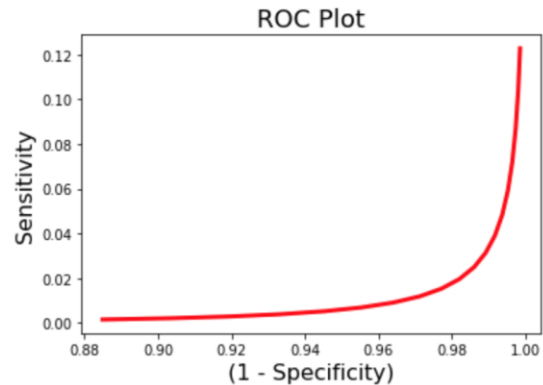
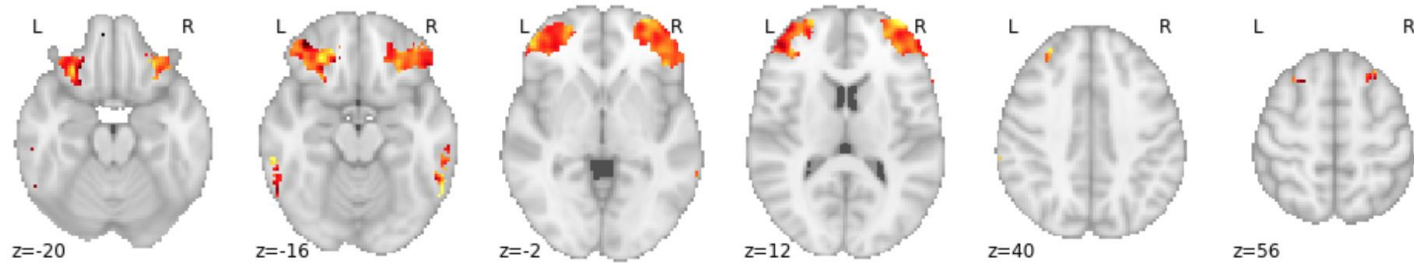
Balanced Accuracies



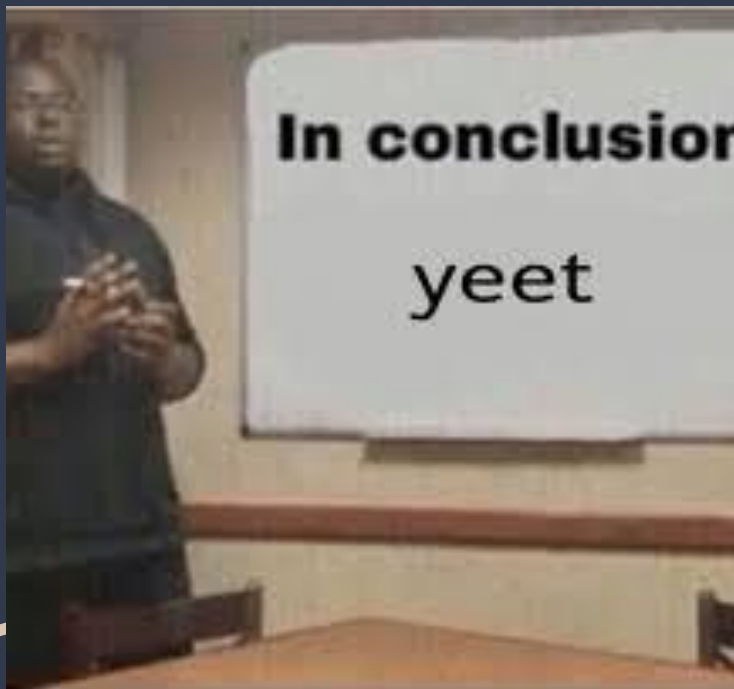
Anterior Frontoparietal (23)



Anterior VLPFC (25)



Conclusion



- 9 Dartmouth memes, 67 non-Dartmouth memes
- Significant difference in relatability
- DMPFC and hippocampus survive thresholded univariate analysis
- No individual region seemed to drive the classification result
- Two regions with relatively high accuracies:
 - Anterior fronto-parietal (23)
 - Anterior VLPFC (25)

Limitations & Future Directions

when you have a small n but you bootstrap 10,000 times and just say you now have population standard deviation and use z tests



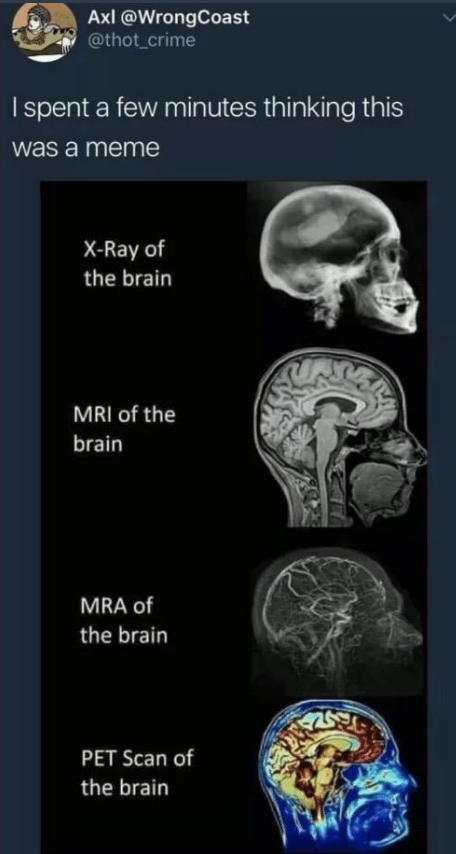
Limitations

- Only 10 subjects, only 76 trials
- Artifact: acquisition, motion, preprocessing, etc.
- Unbalanced number of trials for each stimuli class
- Meme comprehension & visibility

Future Directions

- Investigating the sharing response
- Rating the meme's relatability in the scanner
- Include general college memes
- Investigate memes related to social situations/interactions

Discussion



- vmPFC: self-referential tasks; dmPFC: other-referential tasks (Cook 2014). Given that part of the fMRI experiment was having subjects determine whether or not they would share the meme, this could be a possible explanation
- mPFC activation might not have been particularly high due to its potential role in the default mode (Gusnard et al., 2001).
- Anterior fronto-parietal (DLPFC, dACC) - sensory attention network (Ptak, 2011). Perhaps people paid more attention to memes that they felt were more relevant to them.
- Anterior VLPFC - implicated in limbic and sensory input (Kohno et al., 2015).

Thank you!

Submitting an assignment like



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