# Analysis Plan

## About

This analysis plan pertains to the fMRI-BOLD data from a movie viewing task for the HMM Video studies. At the time of writing the analysis plan, data acquisition was completed but no statistical analyses were conducted. See GitHub link for timestamps on analysis pipeline (<https://github.com/jxli25/Video_HMM>). Analyses will only take place once this analysis plan has been uploaded, and time stamped on the Open Science Framework. If the researchers decide to conduct additional analysis, this will be stated in any publication (“post-hoc analyses”).

## Experiment Overview

The experiment involved showing participants a 4 minute video stimulus. Approximately 40 of these participants had a diagnosed psychotic illness, and 40 were controls. fMRI-BOLD scans were conducted on participants during movie viewing.

Similar papers:

[Similar experiemnt: https://www.sciencedirect.com/science/article/pii/S105381192500179X#:~:text=Utilizing%20full%2Dlength%20movies%20as%20stimuli%20in%20fMRI,brain%20networks%20and%20their%20association%20with%20cognition.&text=fMRI%20data%20inherently%20captures%20dynamic%20information%20across,to%20longer%20patterns%20of%20brain%20region%20activities](Similar%20experiemnt:%20https://www.sciencedirect.com/science/article/pii/S105381192500179X#:~:text=Utilizing%20full%2Dlength%20movies%20as%20stimuli%20in%20fMRI,brain%20networks%20and%20their%20association%20with%20cognition.&text=fMRI%20data%20inherently%20captures%20dynamic%20information%20across,to%20longer%20patterns%20of%20brain%20region%20activities).

Parcellation based on movie viewing:

<https://www.sciencedirect.com/science/article/pii/S0896627324007268#:~:text=Here%2C%20we%20used%20rich%20audiovisual,complex%20and%20dynamic%20audiovisual%20scenes>.

## Hypotheses

* 1. The time spent in defined brain states is significantly shorter for participants with psychotic illness compared to healthy controls.
  2. The time spent in brain states with high emotional valence is higher for health controls compared to participants with psychotic illness.

## Analysis Models

We will parcellate our data using the Yeo 17 thick atlas.

*Justification*

* Large scale network, broad analysis
* Functional connectivity using naturalistic stimuli
* More interpretable

We will construct an HMM-MAR model on all data collected.

*Details of Options and decisions*

We will then compare the time spent in brain states of the test compared to control groups, and transition probabilities between the different states.

Can list and explain settings for HMM model, doesn’t matter

e.g. Katharina included cut offs and didn’t explain, but did reference literature for her smoothing filter

Analysis plan include justification for defining hidden states

Output:  
- Viterbi paths

* Time spent in states
* Viterbi paths
* Phsyiological data
* Differences between groups
* Relation to aspects to the movie
* Procedure very similar to DISFA conference proceedings paper, read this
* Two level analysis
  + Viterbi paths, states
  + Compare between groups, effect of PAN scores? Gender? Physiological interaction that relate to the state and these transitions?
* Hypotheses don’t have to be too specific
  + Healthy vs control in Viterbi path for example

To do:

* Hypotheses for analysis plan
* Give draft of analysis plan to Katharina
* Start extracting demographic data on MATLAB (e.g. age, PAN scores);
* HMM tool box, Viterbi paths, fractional occupancy
* Annotating movie sections (e.g. DISFA: clips elicit certain facial expressions)
* - Make HMM loop across all participants