Neural Representation of Musical Contexts in High-Level Cortical Regions

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Introduction

- People segment their experience into meaningful events
- With narrative stimuli, event transitions can be detected as shifts in fMRI activity patterns (Baldassano et al., 2017)
- For musical stimuli, do transitions between songs and genres also trigger shifts in fMRI activity patterns?
- Music may offer a new window into how event segmentation occurs in the brain

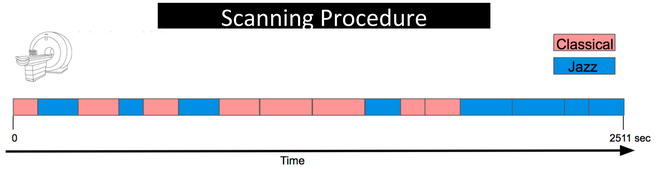
Hypothesis

We predict that:

- Distinct songs and genres will be reflected in distinct patterns of BOLD activity
- These song-specific patterns will transfer across people (Chen et al., 2017)
- Boundaries between songs will be detectable using a Hidden Markov Model
- Boundaries should found in sensory regions (i.e. A1) and higher-order regions

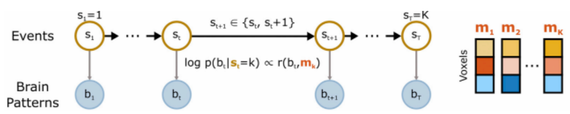
Design and Methods

Scanning Procedure



- **Day 1 & Day 2**: Participants listen to music playlist in a behavioral testing room
- **Day 3**: Participants listen to the playlist twice in the scanner (voxel = 2mm, TR = 1s)
- Playlist consisted of 16 songs
- Half classical and half jazz

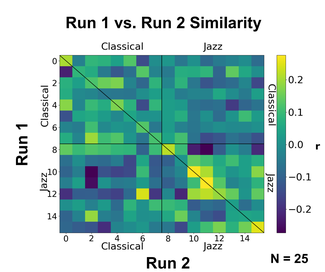
Hidden Markov Model



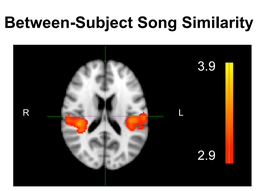
- Our model is built on two assumptions:
  1. Each song is associated with a distinct neural pattern m_k
  2. At each timepoint participants remain in current song or progress to next song
- Observed brain activity at any time point t is assumed to be highly correlated with m_k
- Input to model is brain data and output is estimated song patterns m_k and song boundaries

Results

A1 Pattern Similarity

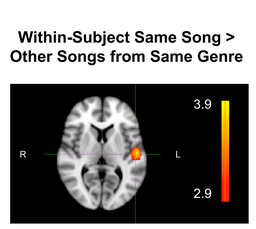


Searchlight Analyses



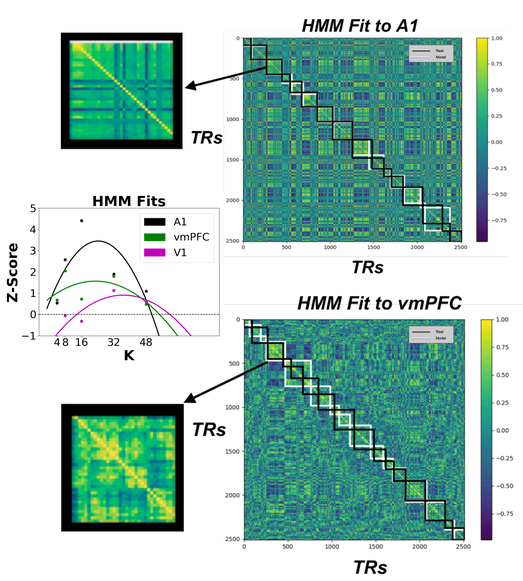
FDR-corrected image ($p < 0.05$)

Between-subject song classification = 45% (chance = 6%)



FDR-corrected image ($p < 0.05$)

HMM Fit



*Beethoven's Moonlight Sonata in magnified panes

Results Summary

- Distinct song and genre patterns are present in A1
- HMM finds song boundaries in A1 and vmPFC

Discussion and Future Directions

- Both A1 and vmPFC represent song information
- Comparisons to actual song data may reveal what this information is
- See if fine song representations are in sensory areas and coarse representations are in higher-order areas
- HMM searchlights may show other brain areas involved in representing song information

References and Acknowledgments

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