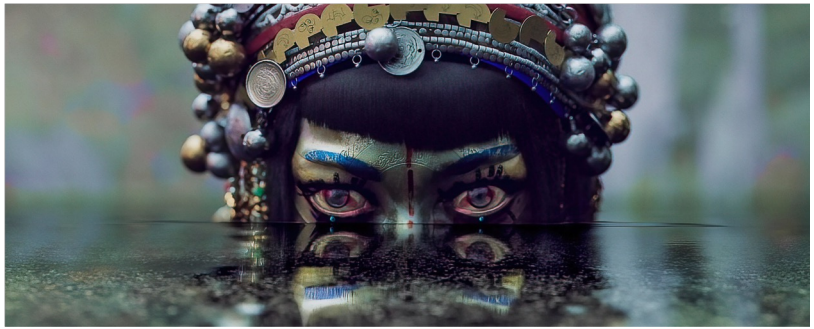
# Jibaro: Synchrony & Average Brain Activity in ROIs



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PSYC60: Principles of Human Brain Mapping with fMRI
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# Introduction

- Hypothesis
- Methods
- Data & Analysis
  - ISC, Synchrony, Average Brain Activity
- Limitations
- Conclusion
- Discussion Questions

# Background

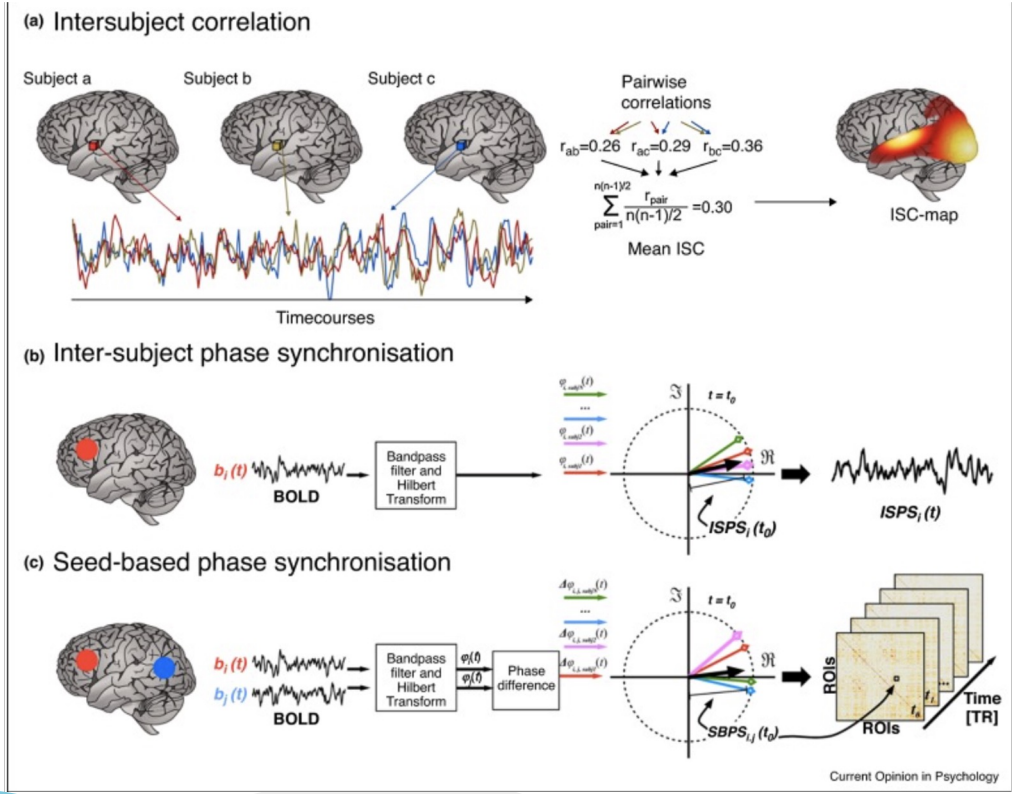
- “[Reflective thought and mind wandering] relies on a second default network subsystem, including... the dorsal medial prefrontal cortex” (Andrews-Hanna et al. 2021)
- “High arousal was associated with increased ISC in the somatosensory cortices and visual and dorsal attention networks comprising the visual cortex, bilateral intraparietal sulci,and frontal eyefields” (Nummenmaa et al. 2018)
- “The more negative emotions individuals feel, the more similar is their brain activation in the emotion circuit as well as in the default-mode network, whereas when the subjects experience positive emotions promoting free exploration, their brains process the sensory input more individually, resulting in lower ISC” - (Nummenmaa et al. 2018)
- “Negative emotions are associated with narrowed mental focus and restricted processing styles, where as positive emotions broaden the possible behavioral repertoire and promote exploration of the environment (39–41)” - (Nummenmaa et al. 2018)

# Hypotheses

- **Given that participants interpret this stimulus as emotionally jarring and engaging, we posit that:**
  - **Emotional arousal centers' activation patterns to fluctuate inversely with patterns of mind wandering (Default Mode) loci, reflecting moments of engagement/disengagement with the stimulus.**
  - **Participants will be more likely to experience greater degrees of emotional arousal on the first run than the second run due to habituation and decreased engagement with the stimuli.**
  - **Participants will experience greater degrees of activation in mind wandering centers on the second run as compared to the first because of this disengagement with the stimuli.**

# Methods

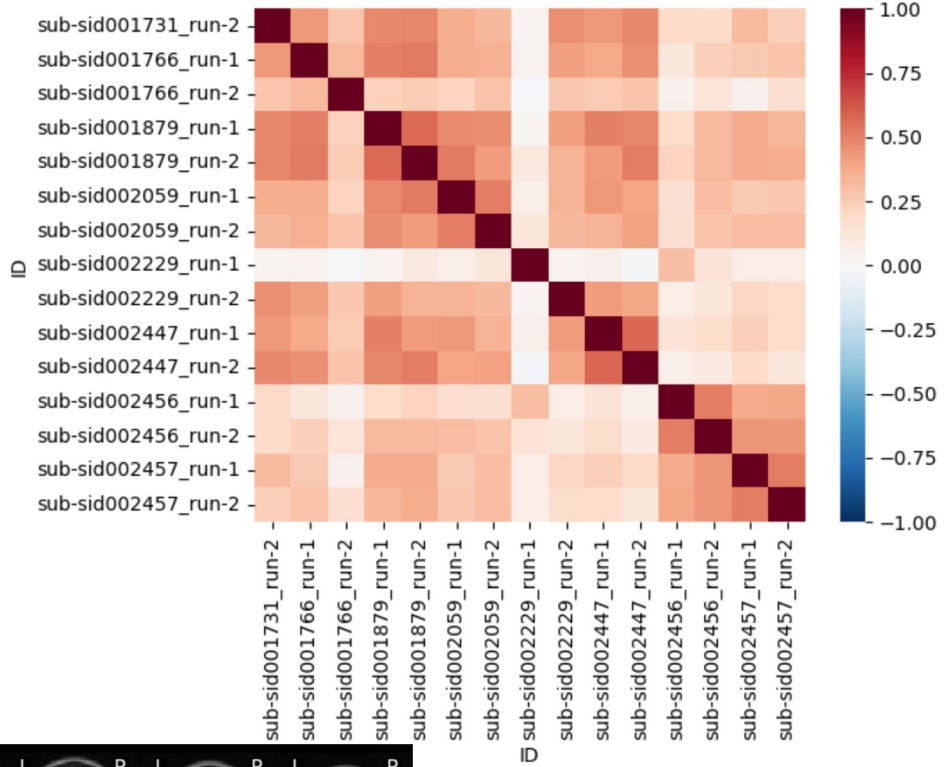
- Measured brain activity through fMRI
- Two trials, participants viewed the same video (Jibaro)
- During both runs, participants were asked to press a button if they felt like making a comment
    - We did not analyze our data in a way that concerns this aspect of the paradigm
- Looked at average activity across different regions of the brain and between runs
- Analysis
    - Created an intersubject correlation chart for the early visual cortex, amygdala, and default mode network
    - Looked at average synchrony across subjects and runs in the default mode, average brain, V1, default network, amygdala, ventral medial prefrontal cortex, and nucleus accumbens
    - Created a intersubject phase synchronization for the default mode, average brain, V1, default network, amygdala, ventral medial prefrontal cortex, and nucleus accumbens
    - Analyzed the average activity in the visual cortex, anterior cingulate cortex, posterior cingulate cortex, and amygdala

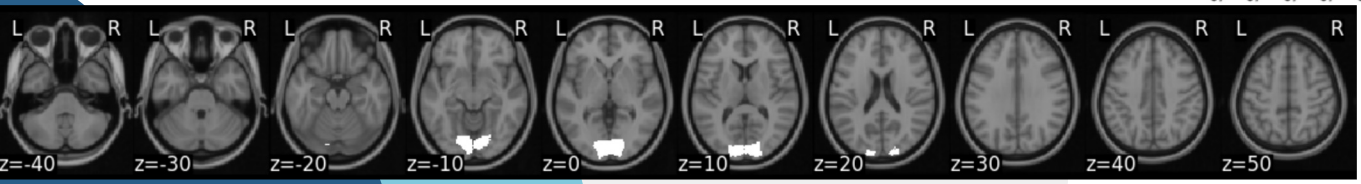



(Nummenmaa et al. 2018)

# ISC for V1 - Early Visual Cortex

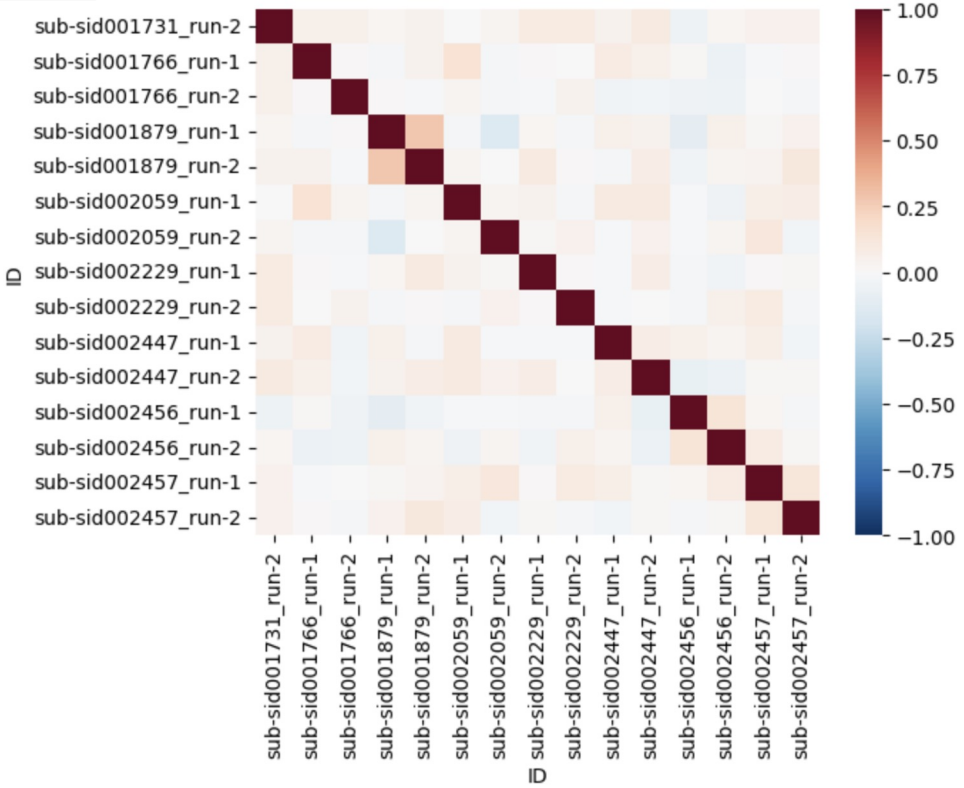
- High ISC between subjects for V1
- Visual attention
  - Can we make ISCs for other regions, ex. Emotional centers?

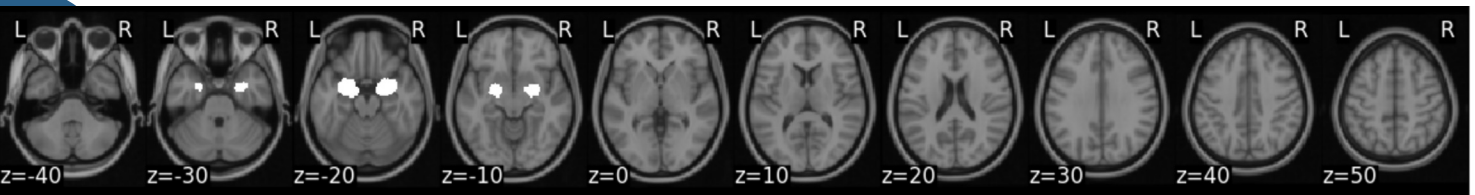


# ISC for Amygdala

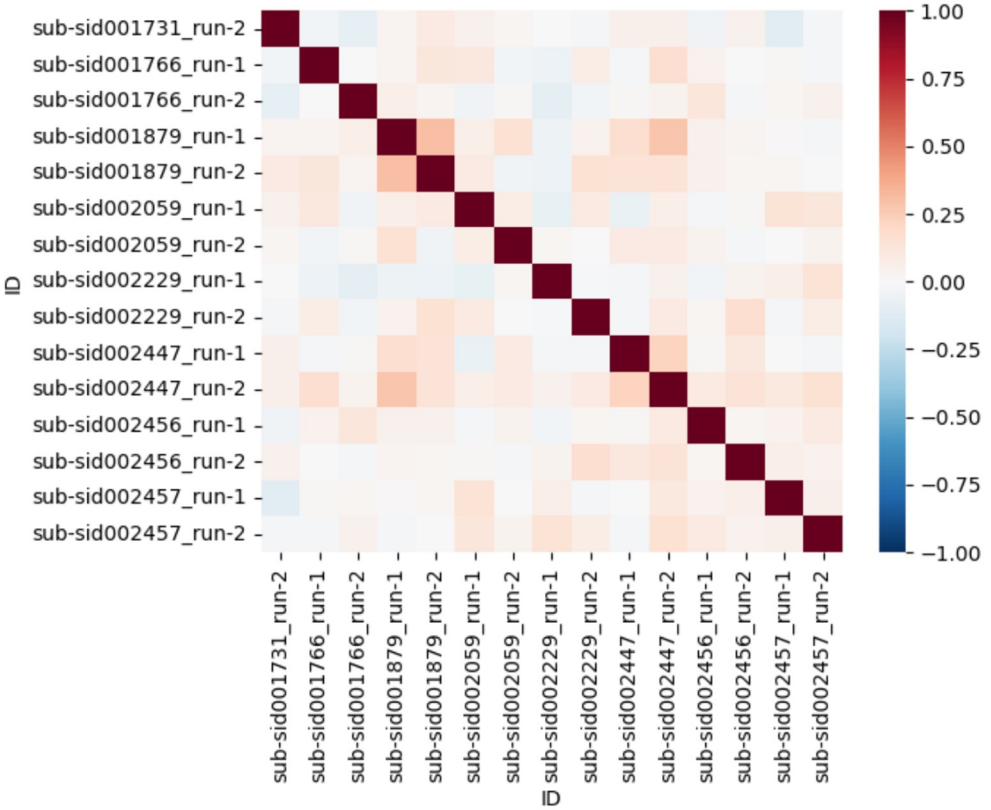
- Little to no correlation



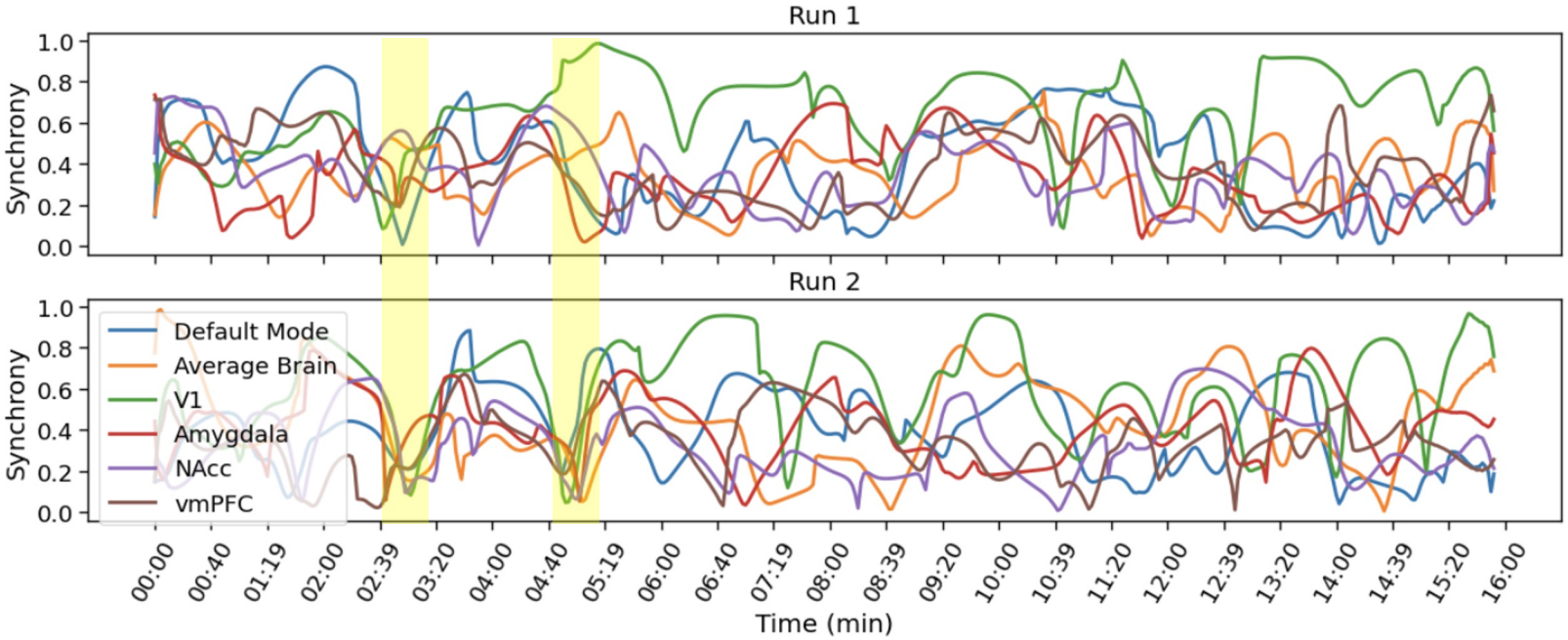



# ISC for Default Mode Network

- Little to no correlation



# ISPS Analysis

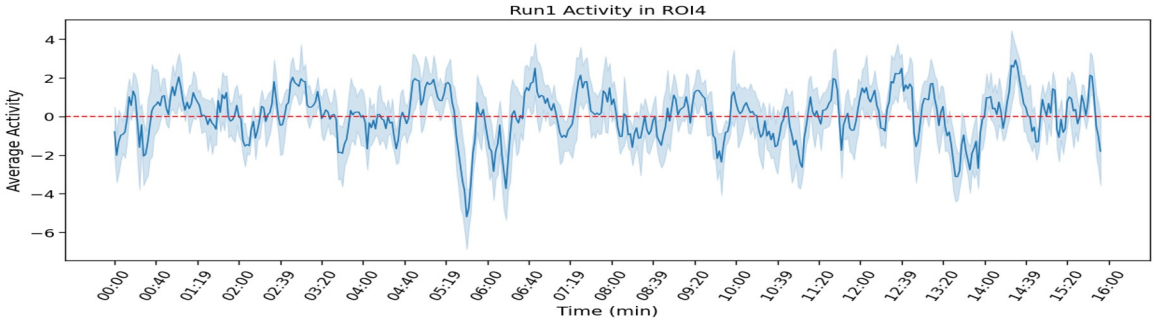


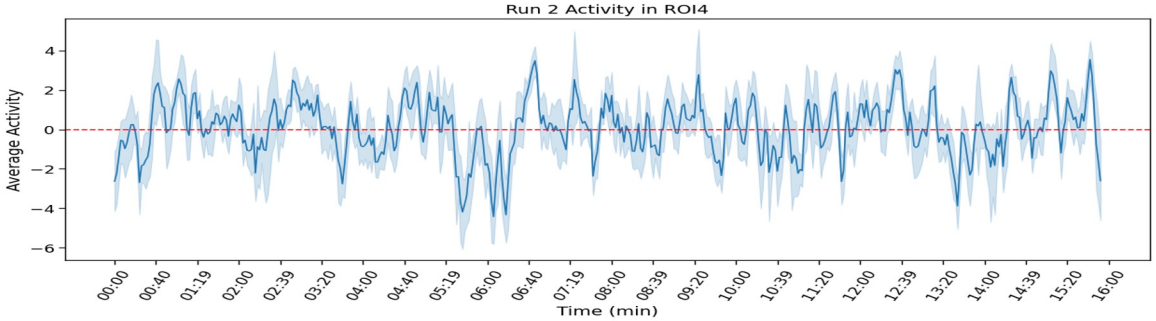
# Synchrony Analysis

~2:39

~4:40

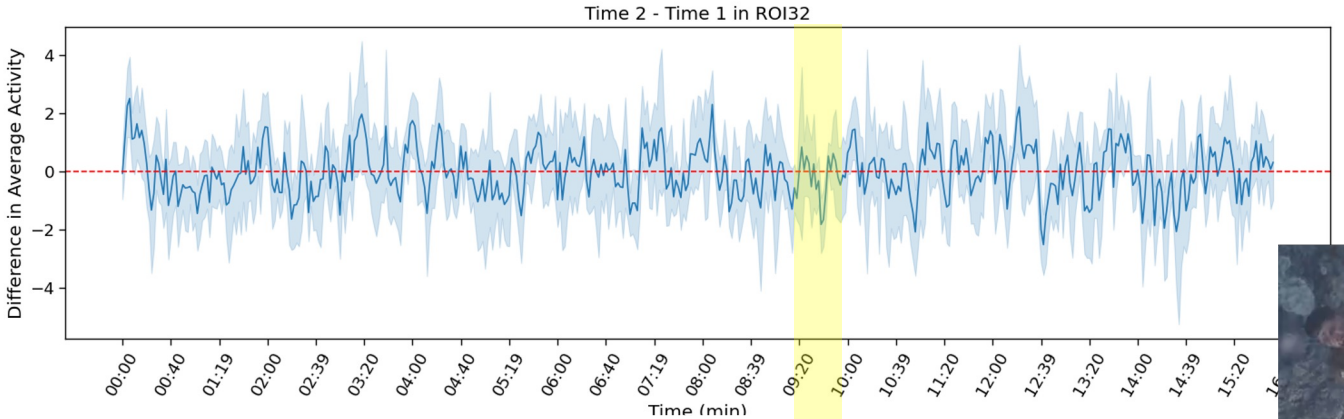
# Visual - V1

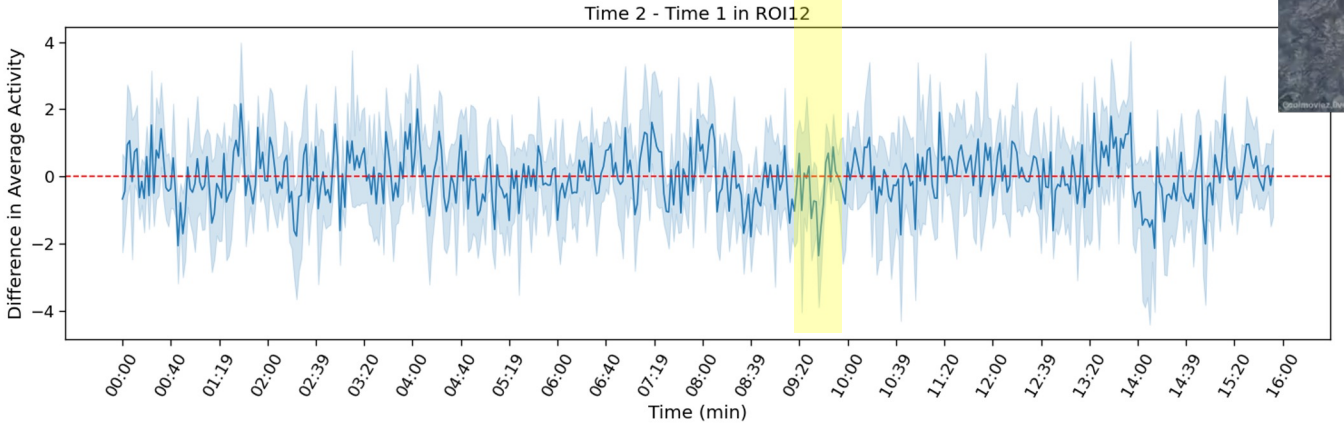


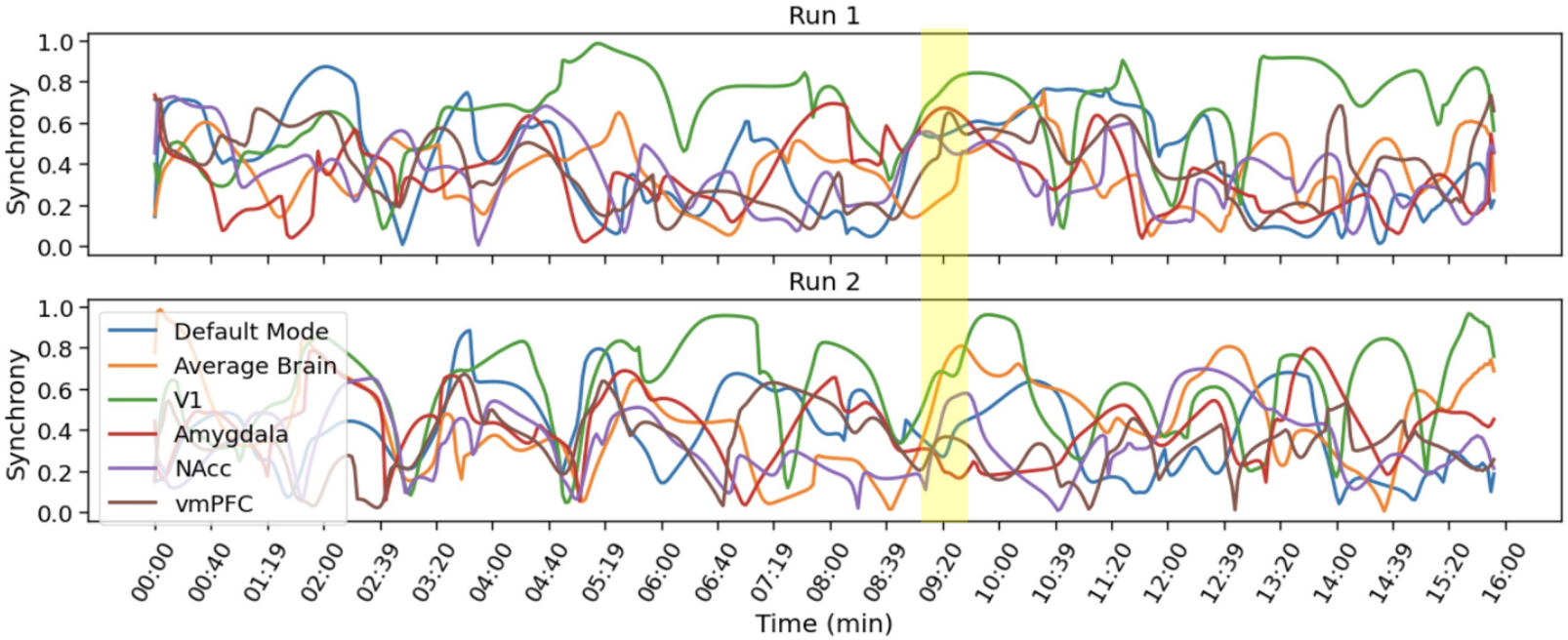

- Unclear pattern at 2:40
- Big dips in V1 at 5:19 for both runs which is a strange pattern from the synchrony from previous slide
- Similar pattern between R1 and R2

# Timepoint 9:20: vmPFC versus Amygdala

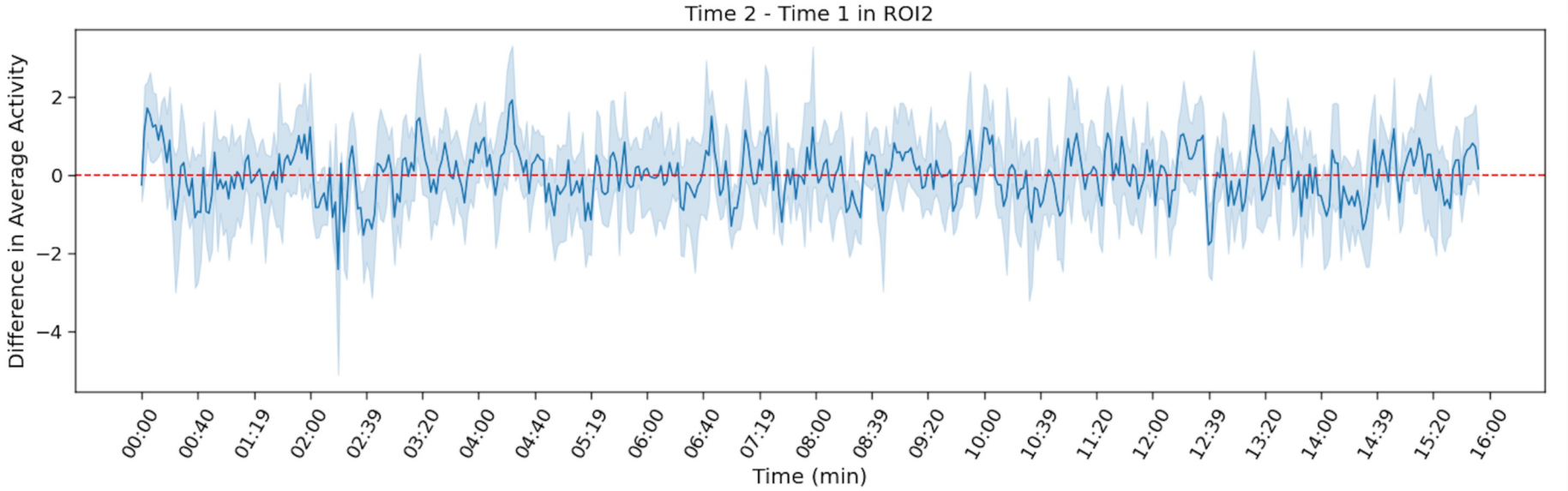



# ISPS for vmPFC and Amygdala at 9:20

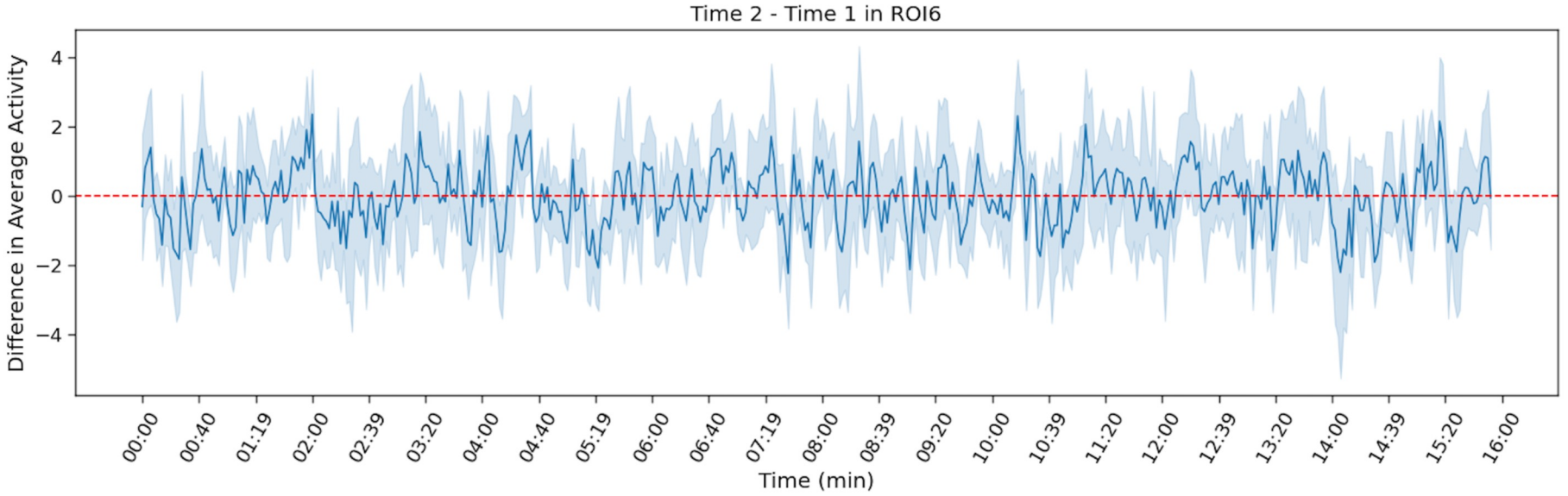


# dmPFC

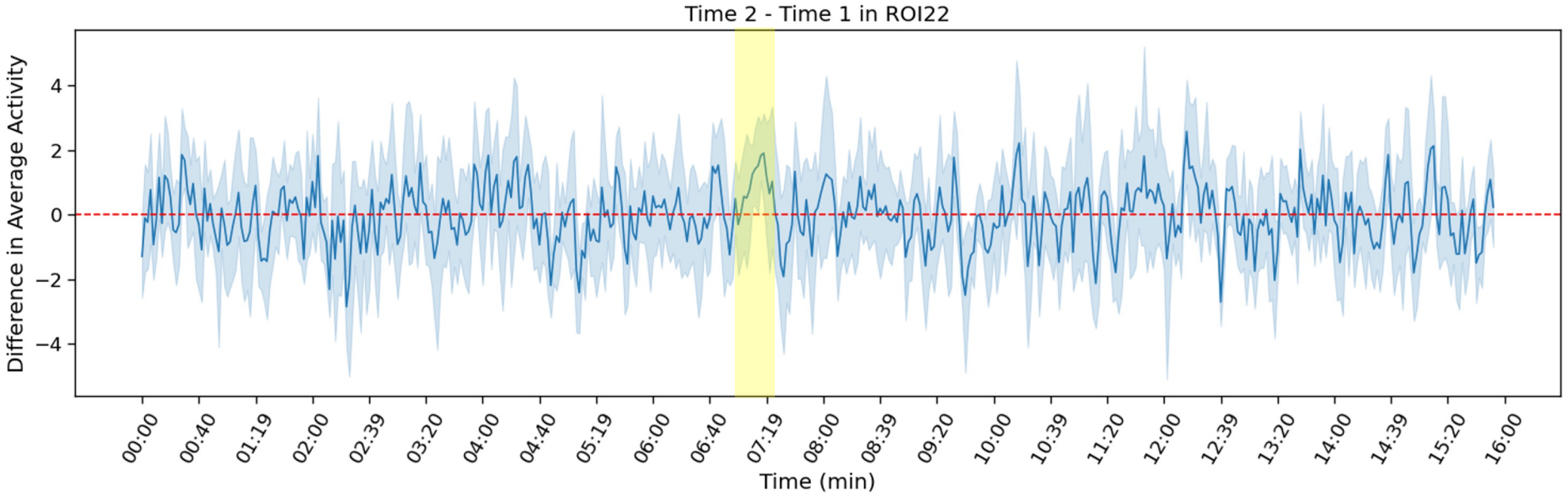

Time 2 - Time 1 in ROI2
Difference in Average Activity
2
0
−2
−4
00:00
00:40
01:19
02:00
02:39
03:20
04:00
04:40
05:19
06:00
06:40
07:19
08:00
08:39
09:20
10:00
10:39
11:20
12:00
12:39
13:20
14:00
14:39
15:20
16:00
Time (min)

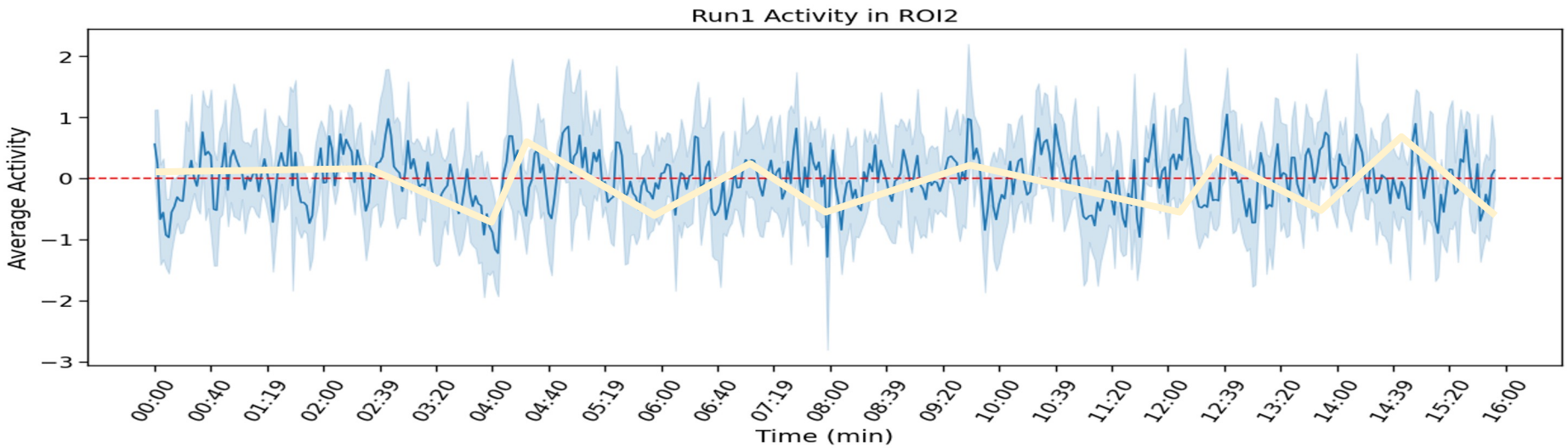
# Analysis
# ~12:39

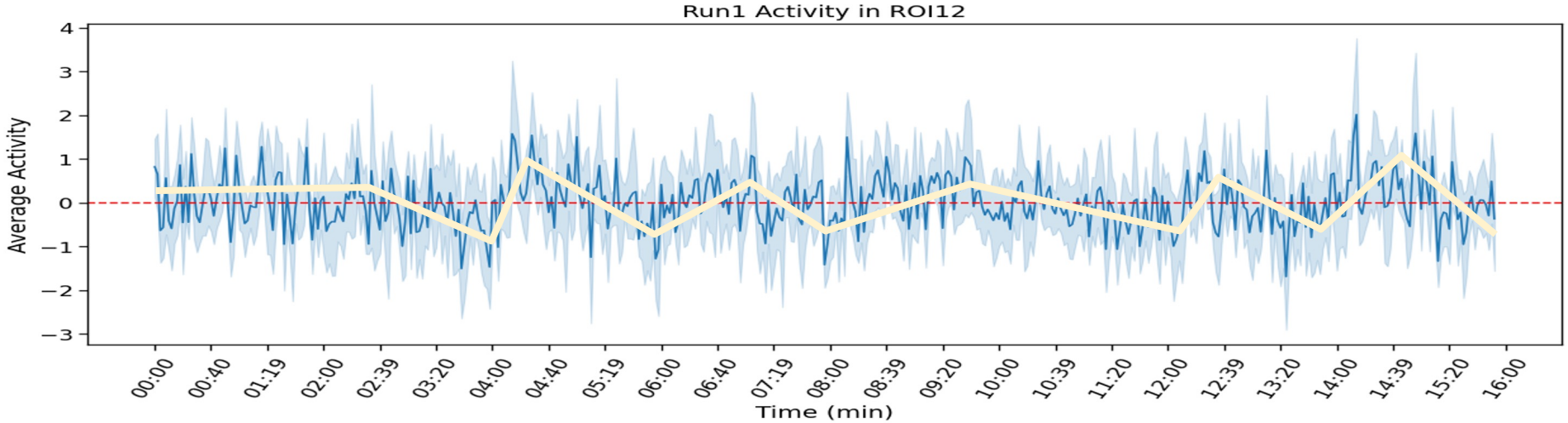
# PCC

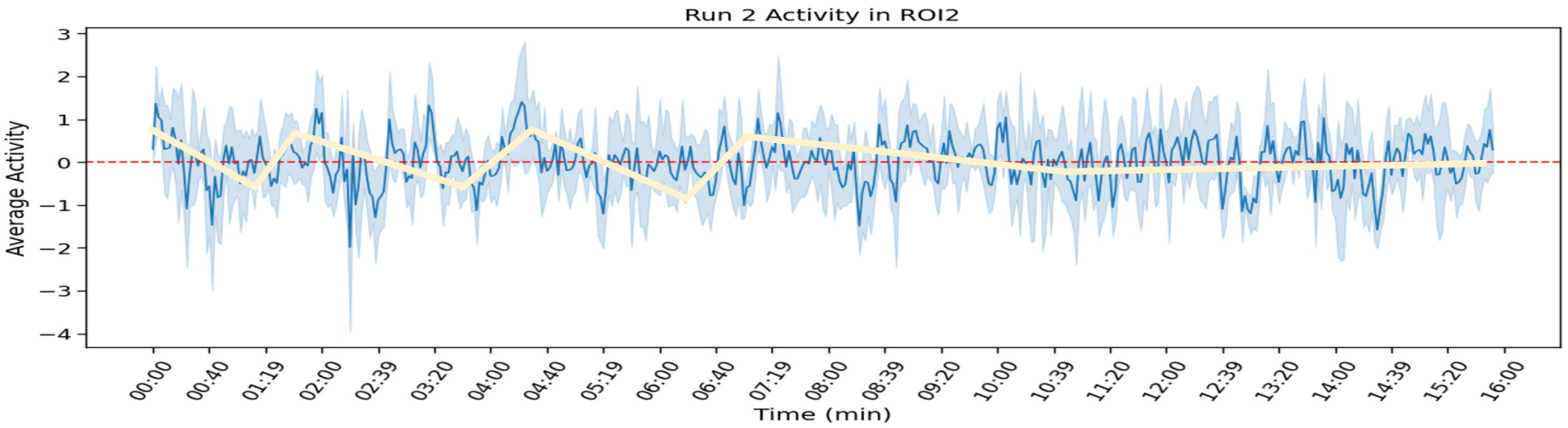

Time 2 - Time 1 in ROI6
Difference in Average Activity
4
2
0
−2
−4
00:00
00:40
01:19
02:00
02:39
03:20
04:00
04:40
05:19
06:00
06:40
07:19
08:00
08:39
09:20
10:00
10:39
11:20
12:00
12:39
13:20
14:00
14:39
15:20
16:00
Time (min)

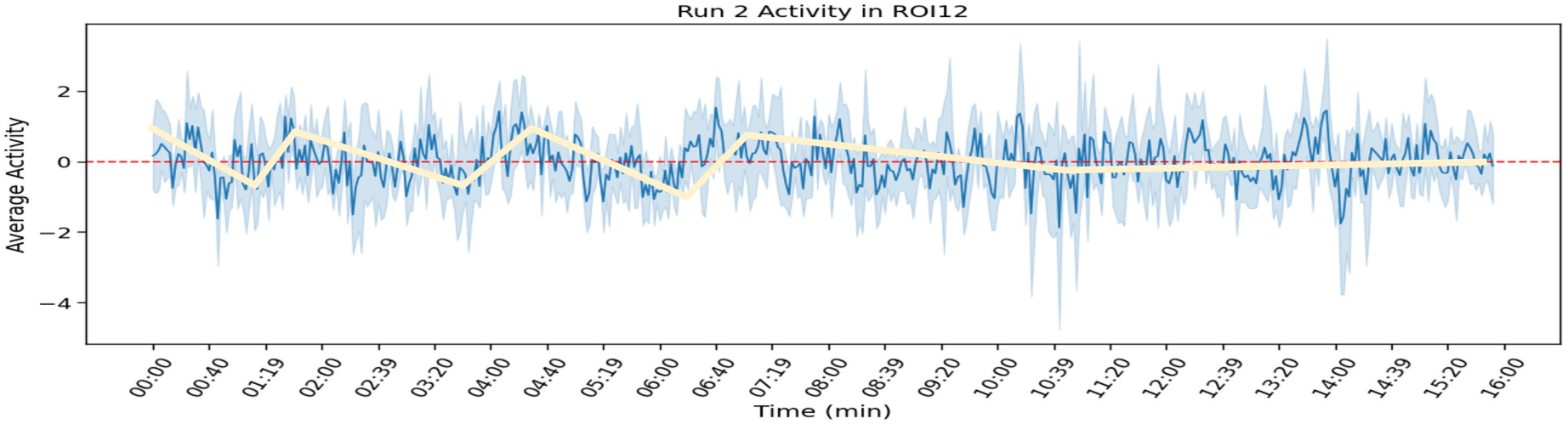
# Intriguing Result - dACC



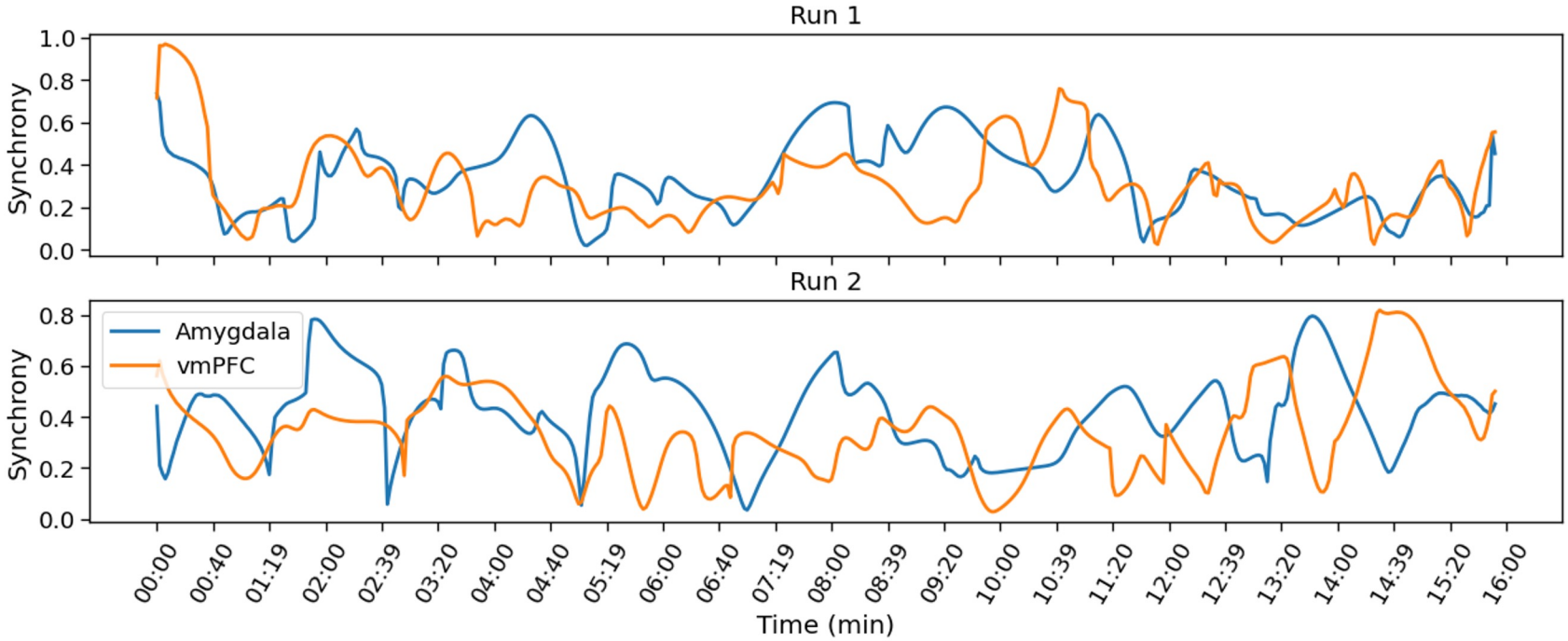

Run1 Activity in ROI2
Average Activity
2
1
0
−1
−2
−3
00:00
00:40
01:19
02:00
02:39
03:20
04:00
04:40
05:19
06:00
06:40
07:19
08:00
08:39
09:20
10:00
10:39
11:20
12:00
12:39
13:20
14:00
14:39
15:20
16:00
Time (min)


Run1 Activity in ROI12
Average Activity
4
3
2
1
0
−1
−2
−3
00:00
00:40
01:19
02:00
02:39
03:20
04:00
04:40
05:19
06:00
06:40
07:19
08:00
08:39
09:20
10:00
10:39
11:20
12:00
12:39
13:20
14:00
14:39
15:20
16:00
Time (min)


Run 2 Activity in ROI2
Average Activity
3
2
1
0
−1
−2
−3
−4
00:00
00:40
01:19
02:00
02:39
03:20
04:00
04:40
05:19
06:00
06:40
07:19
08:00
08:39
09:20
10:00
10:39
11:20
12:00
12:39
13:20
14:00
14:39
15:20
16:00
Time (min)


Run 2 Activity in ROI12
Average Activity
2
0
−2
−4
00:00
00:40
01:19
02:00
02:39
03:20
04:00
04:40
05:19
06:00
06:40
07:19
08:00
08:39
09:20
10:00
10:39
11:20
12:00
12:39
13:20
14:00
14:39
15:20
16:00
Time (min)

# Synchronization of Amygdala and dmPFC



# Limitations

- Small Sample Size
    - Only college aged individuals
- Previous viewing of video
- Ambiguous video
- Naturalistic and difficult to isolate brain activity
- One trial experienced three videos
- Default mode is involved in lots of things (social etc...)

# Conclusion

- We have some evidence to support the hypothesis outlined by Nummenmaa that ‘The more negative emotions individuals feel, the more similar is their brain activation in the emotion circuit as well as in the default-mode network.’
    - 9:20 Timepoint
    - Similarity between dmPFC and Amygdala
- Significant activity in certain ROIs at timepoints that seem to make sense, but not specific scenes that have overwhelming effects or significance in multiple regions
- With this kind of engaging/confusing video, might be difficult to draw conclusions
    - The lack of dialogue, character interactions, and expositional details creates an uncertainty within the video that may lead to confusion or disinterest in the video
    - Additionally, the presence of supernatural actions and lack of situational information could cause misunderstandings.

# Discussion Questions & Future Recommendations

- Would any explanation/discussion before or in between runs influence activity differences?
    - Synchrony on Run 2?
- How might the default mode network synchrony differ with a longer video?
- How would functional connectivity influence the synchronization results?
- How might an ISRSA analysis influence the results? (Chen, et al; Nummenmaa et al)
    - Default mode network?
    - Synchrony?
    - ROI activation?

# Works Cited


Andrews-Hanna, J. R., & Grilli, M. D. (2021). Mapping the imaginative mind: Charting new paths forward. *Current Directions in Psychological Science*, *30*(1), 82–89. https://doi.org/10.1177/0963721420980753

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Nummenmaa, L., Lahnakoski, J. M., & Glerean, E. (2018, March 8). *Sharing the social world via Intersubject Neural Synchronisation*. Current Opinion in Psychology. Retrieved November 17, 2022, from https://www.sciencedirect.com/science/article/pii/S2352250X1830023X

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