

# Brain Connectivity in Emotion Processing

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Group: Emoti-Conn

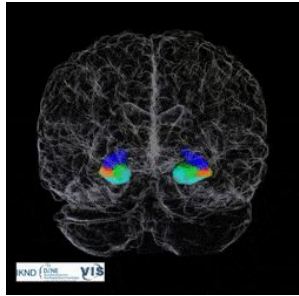
Pod: Babute

TAs : Emeka Ogbuju, Ashish Sahoo

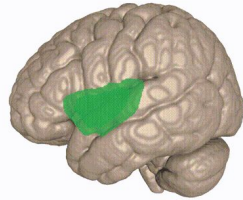
Project Mentor: Dr. Sven Bestmann

# Background:

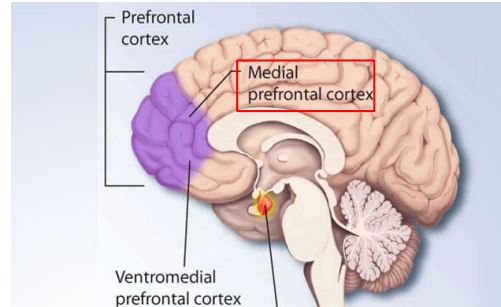
- How are the brain regions believed to be associated with negative emotion processing?
- Broadly, there are 4 regions of interest:



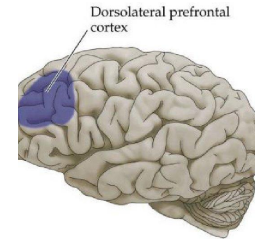
*Hippocampus*  
(1 ROI)



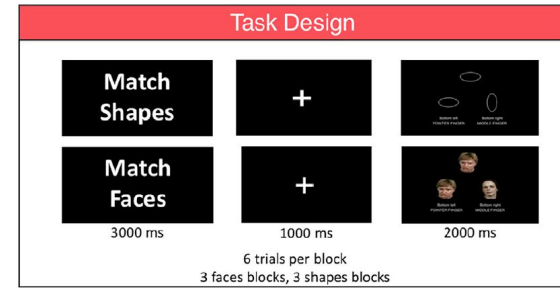
*Insula*  
(8 ROIs)



*Medial Prefrontal Cortex*  
(15 ROIs)



*Dorsolateral Prefrontal Cortex*  
(13 ROIs)



## Literature:

Hariri, A.R., Tessitore, A., Mattay, V.S., Fera, F., Weinberger, D.R., 2002. The amygdala response to emotional stimuli : a comparison of faces and scenes. *Neuroimage* 17, 317-323.

Matthew F. Glasser, Timothy S. Coalson, A Multi-modal Parcellation of Human Cerebral Cortex, *Nature* 536, 171-178 (2016)

Yasaman Shahhosseini and Michelle F. Miranda, Functional Connectivity Methods and Their Applications in fMRI Data

# Hypothesis:

Q: Does the activity in the brain regions, associated with emotion, increase during emotion processing ?

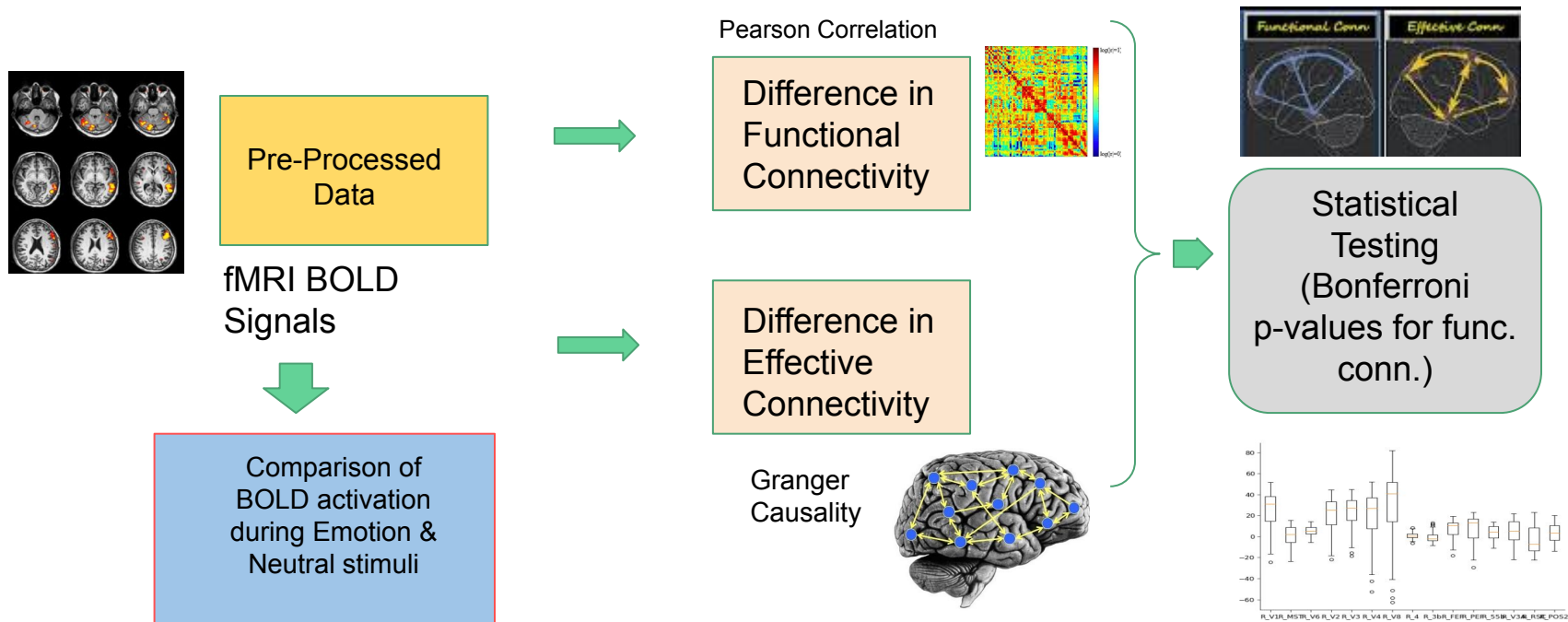
Q: Does the functional connectivity between the brain regions, associated with emotion, increase during emotion processing ?

Q: Does the effective connectivity in the brain regions, associated with emotion, strengthens during emotion processing ?

*“In this study, the BOLD activation, functional connectivity, and effective connectivity in brain regions, associated with emotions (Hippocampus, Insula, Medial Prefrontal Cortex, Dorsolateral Prefrontal Cortex), get enhanced during negative emotional (fear, anger) processing when compared with the neutral condition.”*

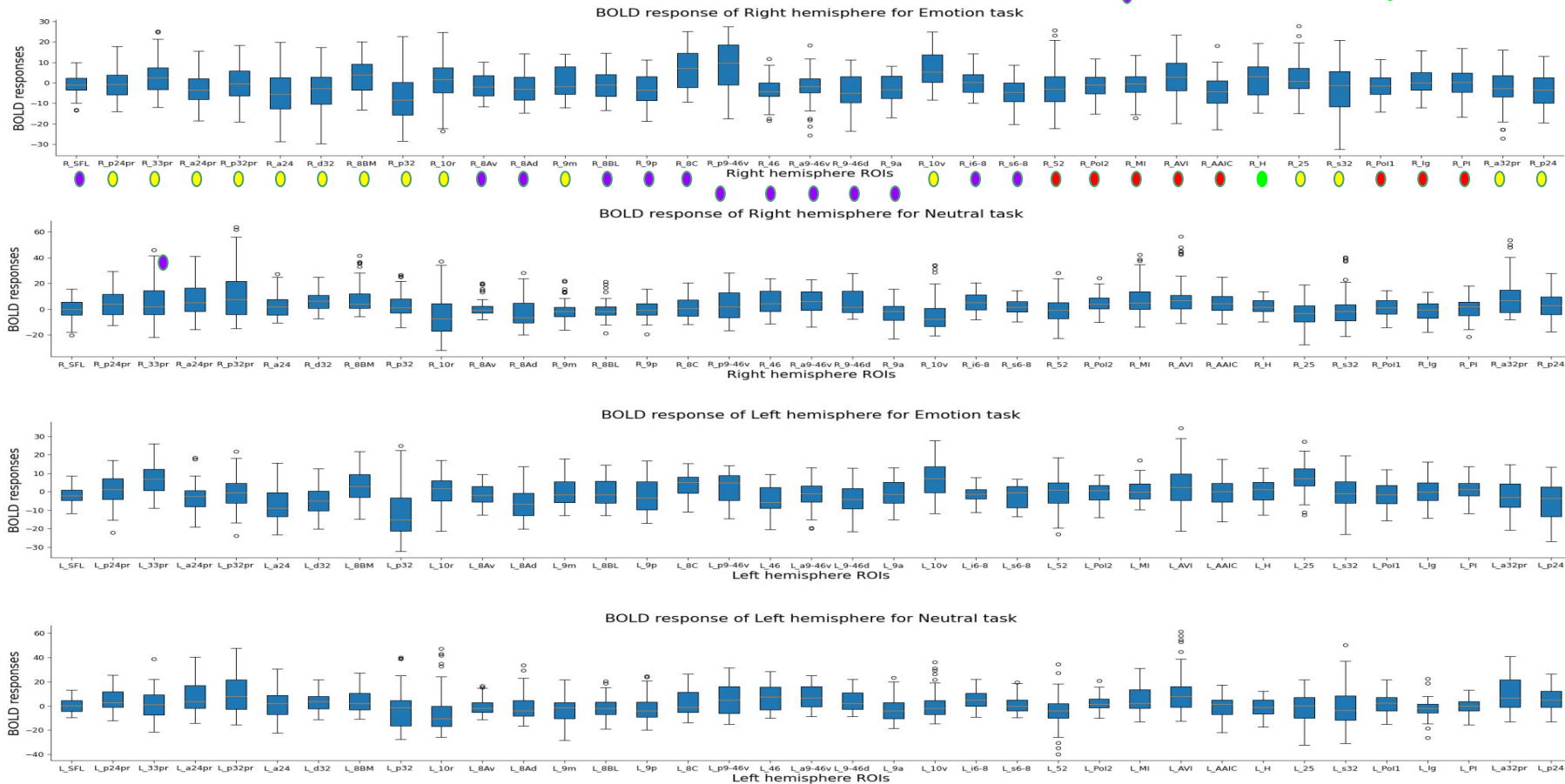


# Methods:



# Results: a) BOLD Activity

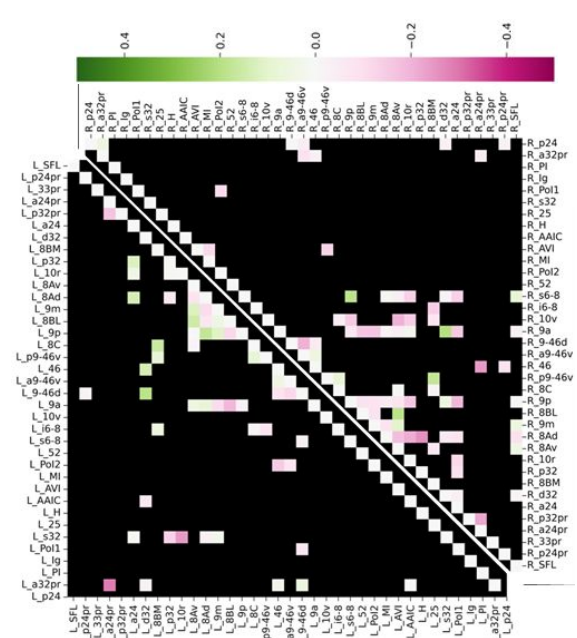
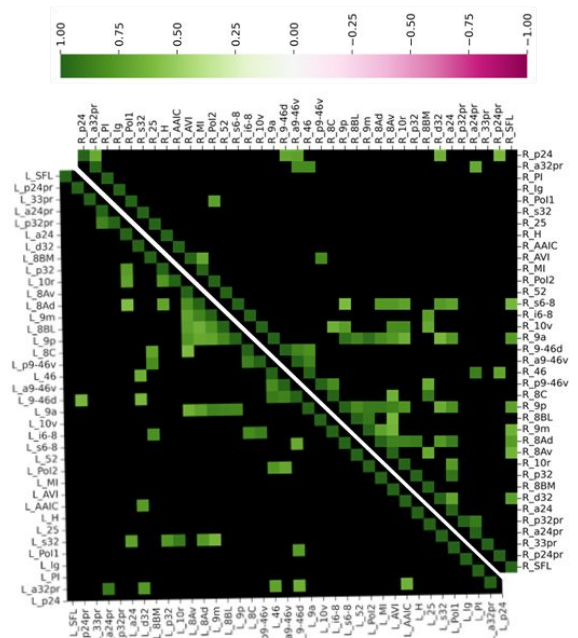
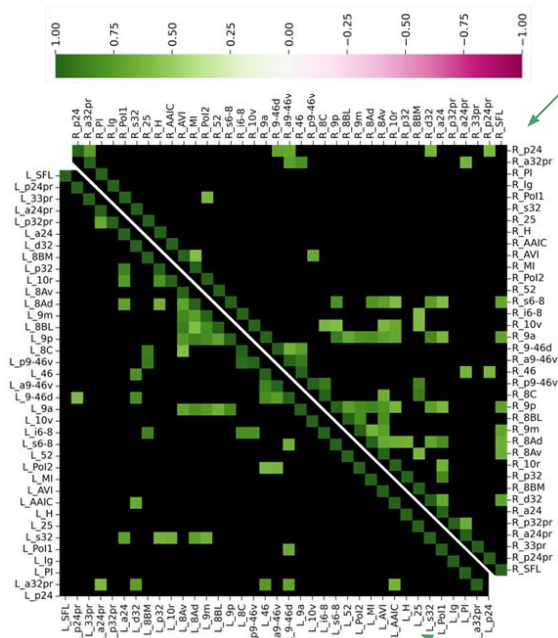
- Medial Prefrontal Cortex
- Dorsolateral Prefrontal Cortex
- Insula
- Hippocampus



# b) Functional Connectivity

## Correlation Matrices

Corr. for ROIs in right hemisphere



Corr. for ROIs in left hemisphere

## Emotional Stimuli

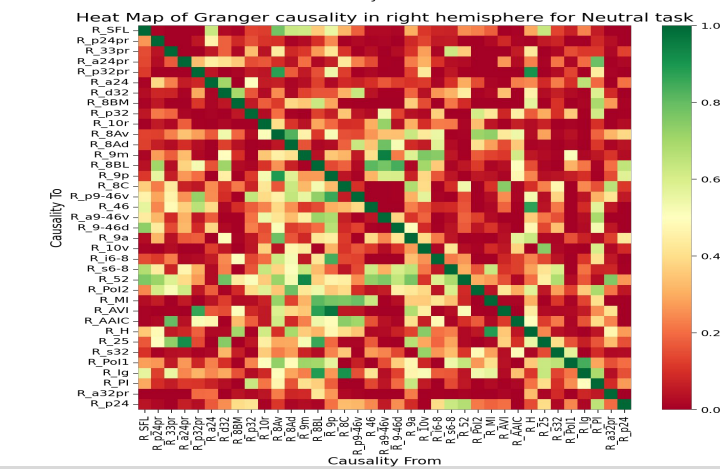
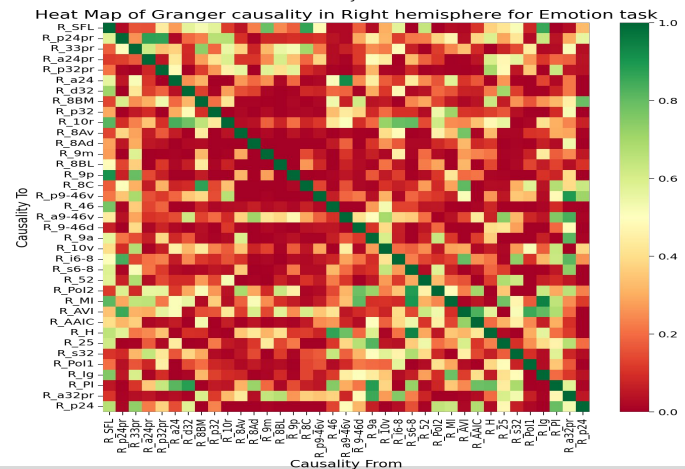
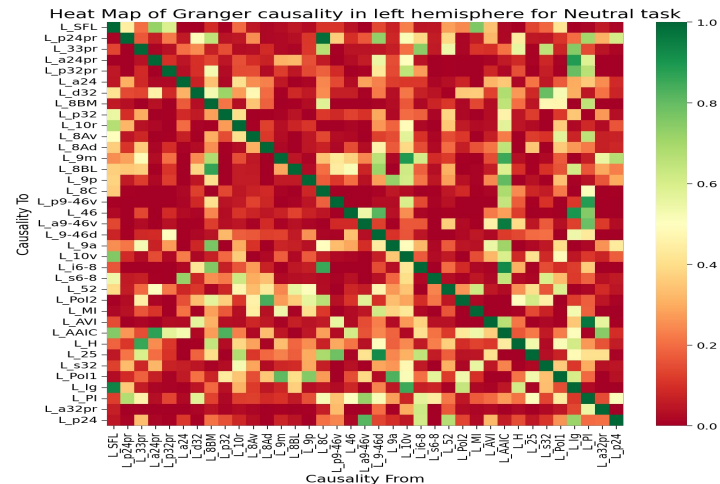
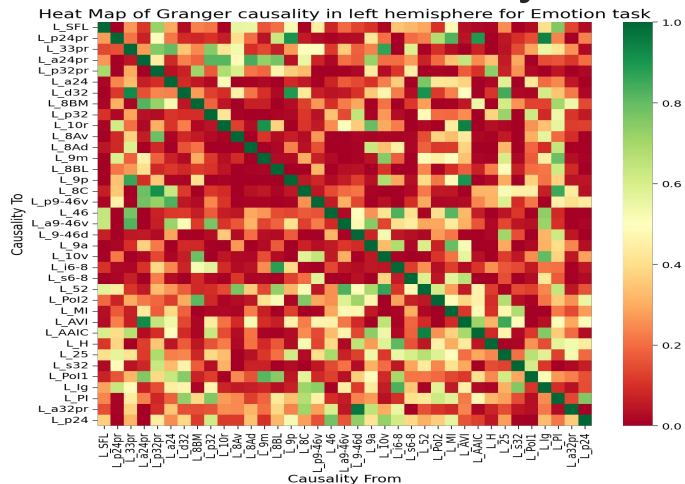
## Neutral Stimuli

## Difference





# c) Effective Connectivity



# Observation and Inference:

a) BOLD Activity: In most ROIs, BOLD activity is higher in emotion task compared to neutral task in both hemispheres:

- Left hemisphere: Hippocampus, Dorsolateral Prefrontal Cortex, Insula, Medial Prefrontal Cortex
- Right hemisphere: Hippocampus, Dorsolateral Prefrontal Cortex, Insula, Medial Prefrontal Cortex

b) Functional Connectivity:

- The difference in func. conn. of shortlisted ROIs b/n 2 conditions is not statistically significant.
- Could be attributed to assumptions of Pearson corr. and low threshold due to Bonferroni correction of p-value

c) Effective Connectivity:

- Left hemisphere: Insula → Medial Prefrontal Cortex, Insula → Dorsolateral Prefrontal Cortex
- Right hemisphere: Insula → Medial Prefrontal Cortex, Medial Prefrontal Cortex → Insula, Medial Prefrontal Cortex → Medial Prefrontal Cortex



# Conclusion and Future Scope:

- Increase in BOLD activation among ROIs in Hippocampus, Insula, Medial Prefrontal Cortex, and Dorsolateral Prefrontal Cortex during negative emotional processing;

No significant difference in functional connectivity between negative emotional processing condition and neutral condition;

Increase in effective connectivity among ROIs in Insula, Medial Prefrontal Cortex, and Dorsolateral Prefrontal Cortex during negative emotional processing

- Neuropsychiatric disorders affect emotional processing (E.g.: Autism)



# THANK YOU!!