Decoding emotions during resting state imaging

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INTRODUCTION

Decoding the content of thought during a resting state (when a person does not have a reference stimulus or task) is a difficult unsupervised problem.

Here, we leverage pre-existing between-subject patterns of neural activation for nine different emotions to identify emotions during a resting state for nearly 330 people, across four clinical groups (suicidal ideators, bipolar disorder, schizophrenia, ADHD) and controls.

We hypothesize that these clinical groups will experience various aspects of emotions differently—specifically duration, intensity, and frequency.
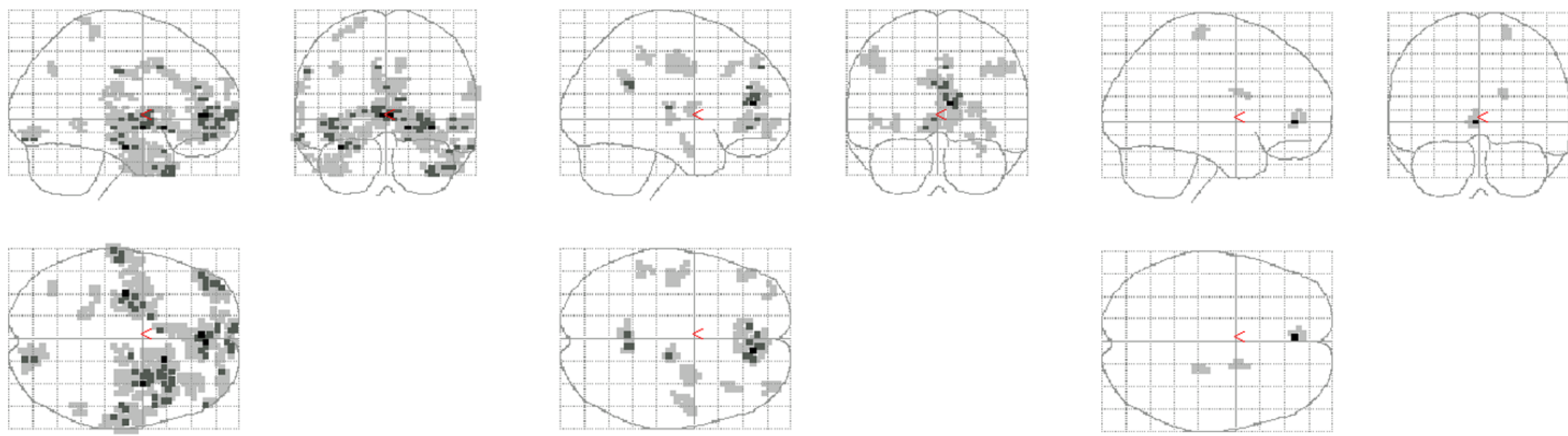
METHODS

Select 29 regions of interest (ROIs) based on factor analysis[2] of emotion data. ROIs differentially encode emotions, creating "emotion templates".
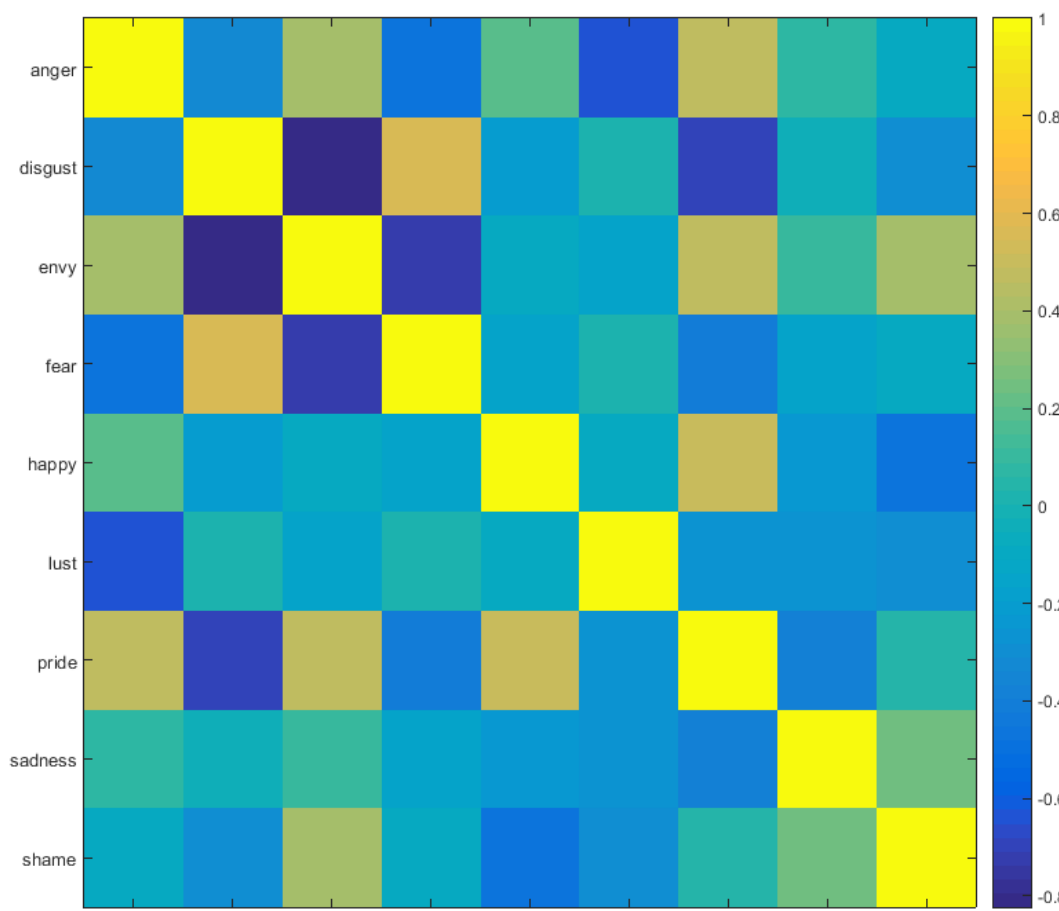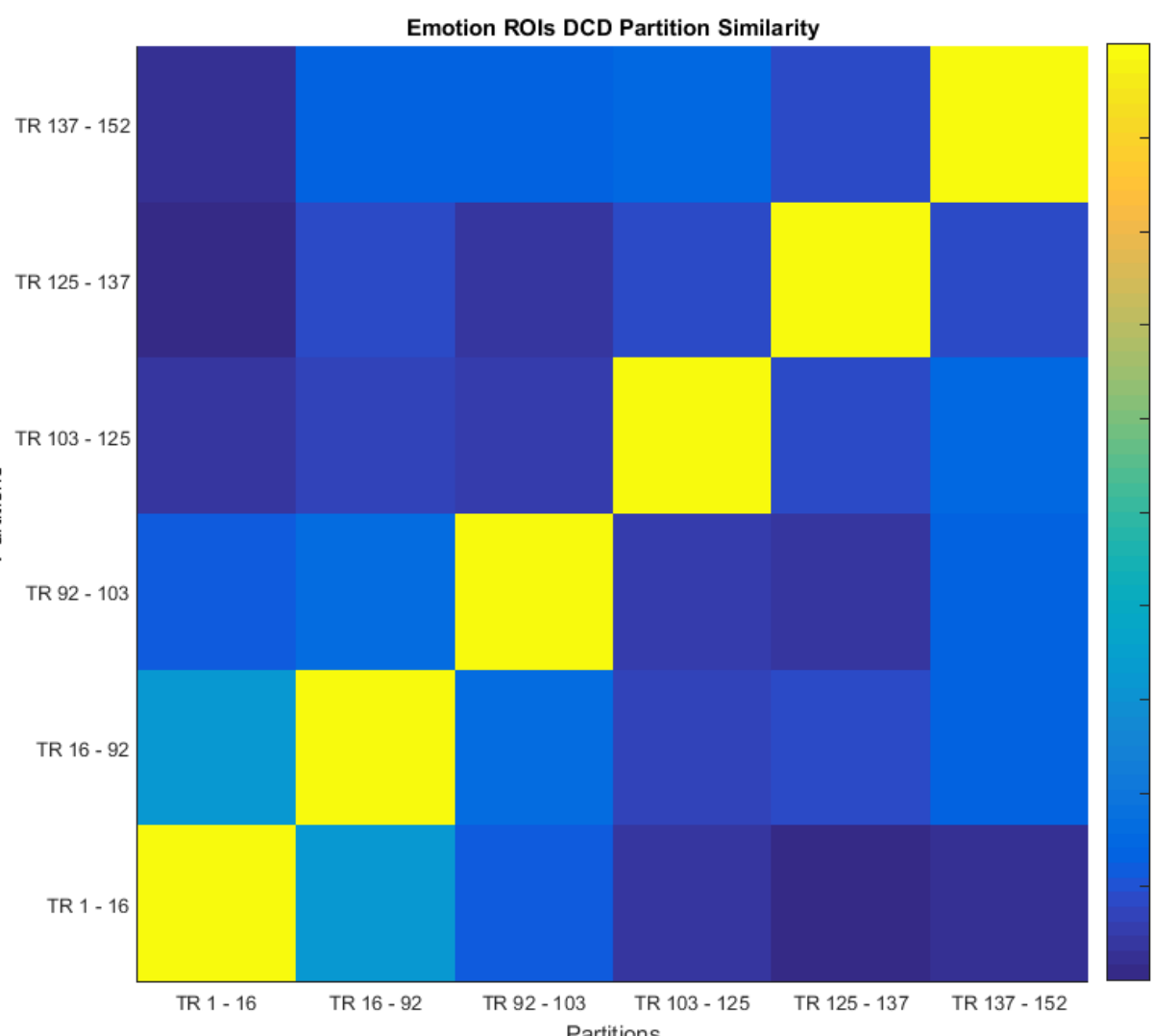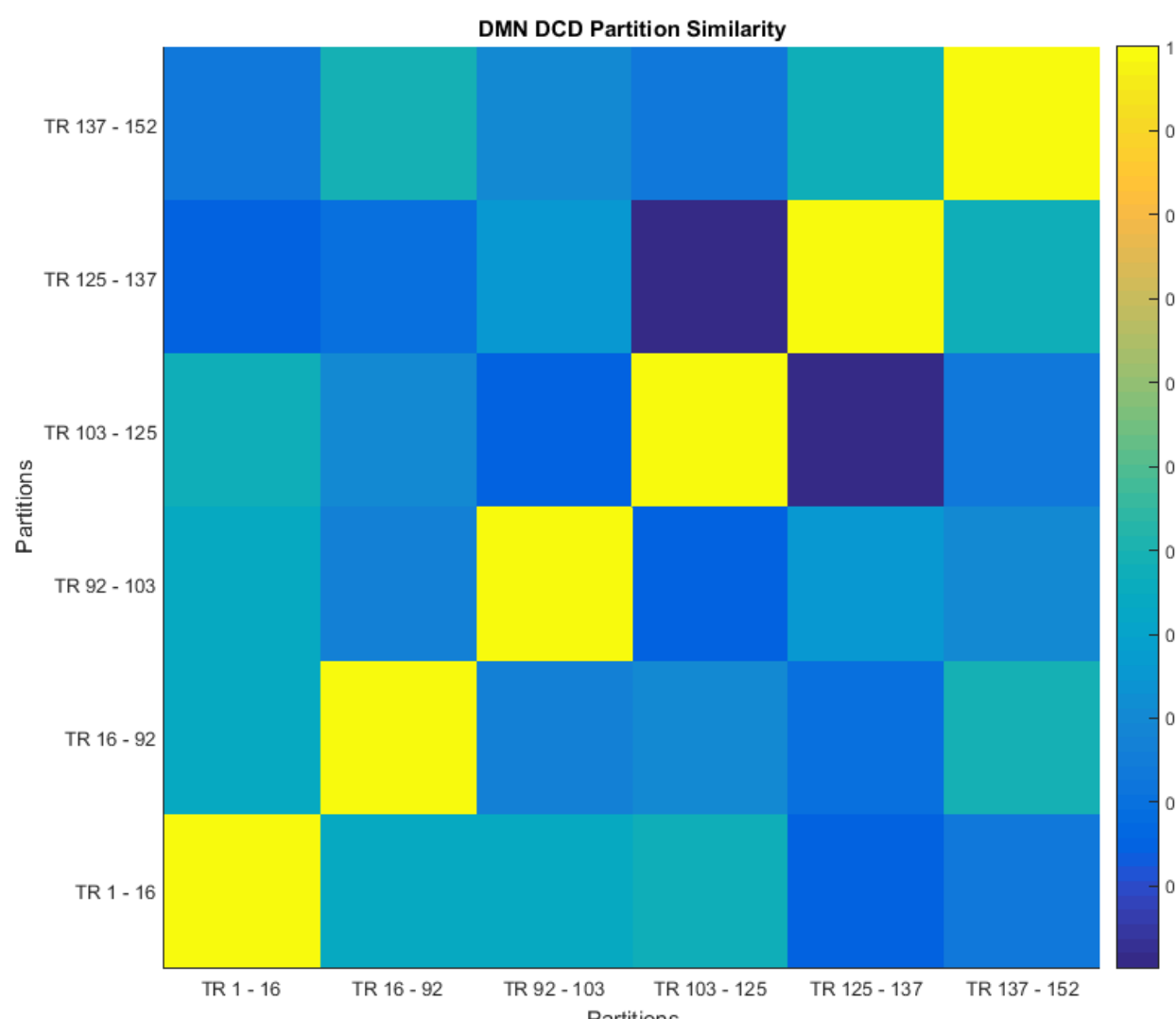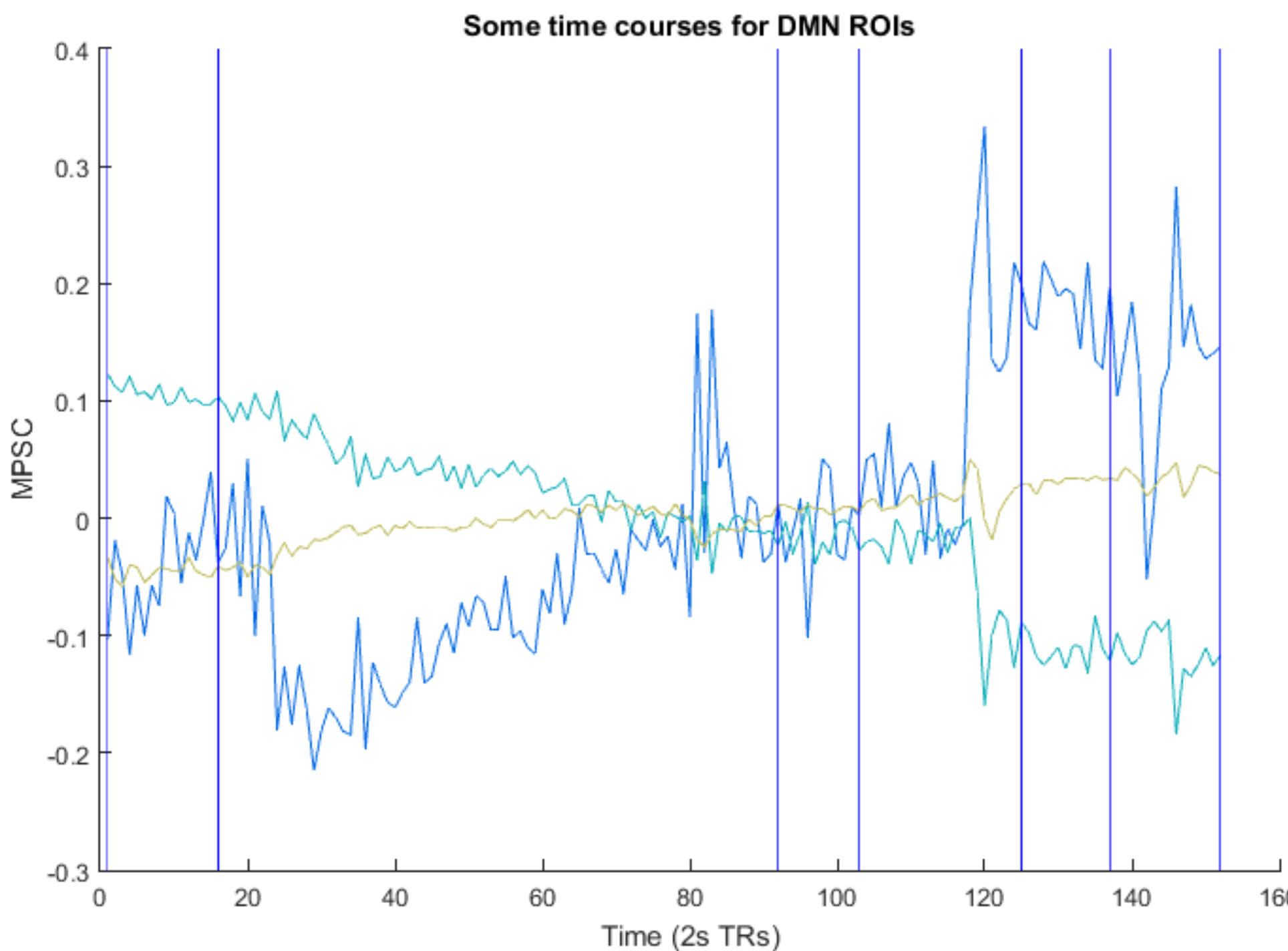

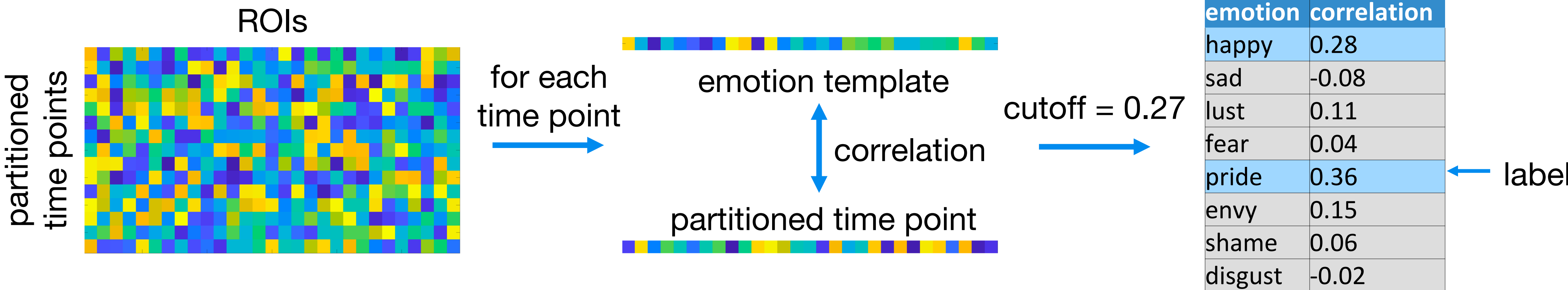Valence factor ROIs   Social factor ROIs   Arousal factor ROIs

Dynamic functional connectivity change point detection finds distinct states in the default mode network, partitioning the resting state.
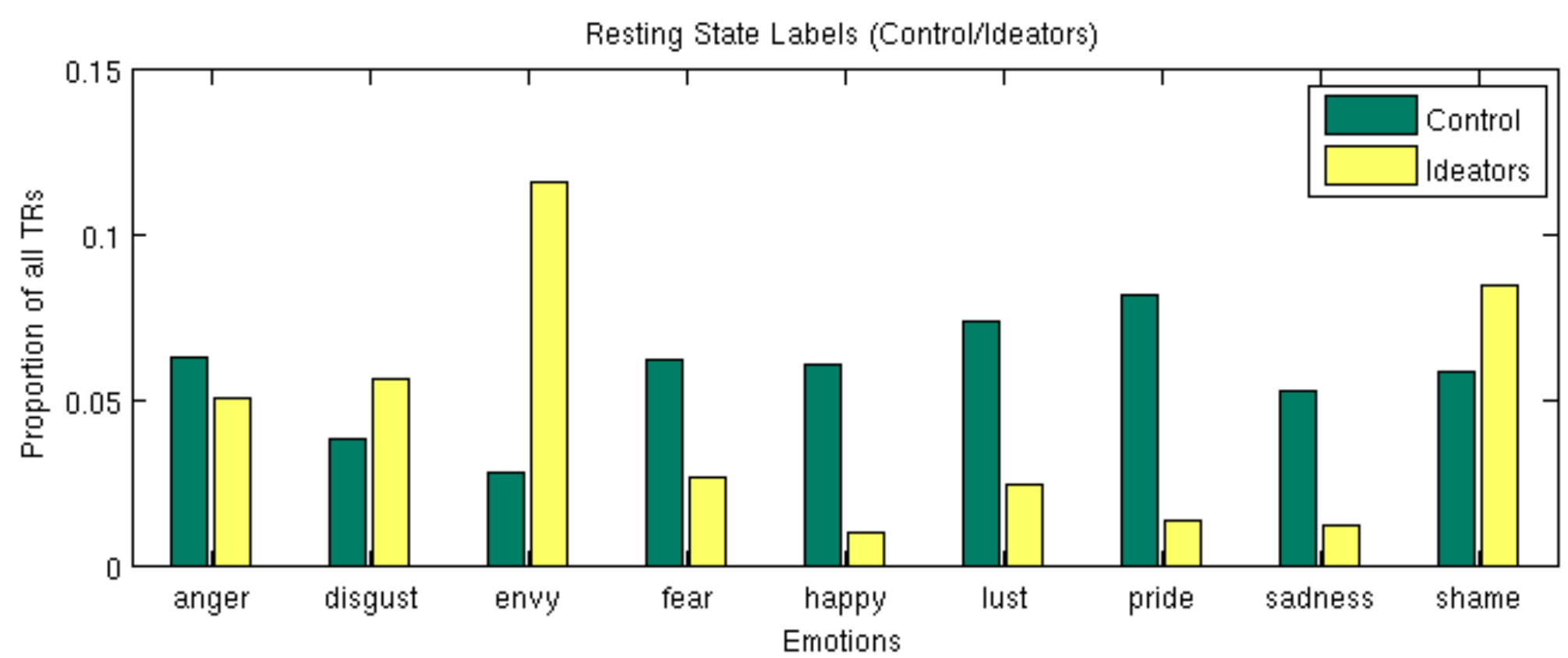

Some time courses for DMN ROIs

DMN DCD Partition Similarity

Emotion ROIs DCD Partition Similarity

Calculate correlation of each time point to each emotion template, and match partitioned resting state to emotions.

emotion	correlation
happy	0.28
sad	-0.08
lust	0.11
fear	0.04
pride	0.36
envy	0.15
shame	0.06
disgust	-0.02

ROIs — for each time point — emotion template — correlation — cutoff = 0.27 — partitioned time point — label
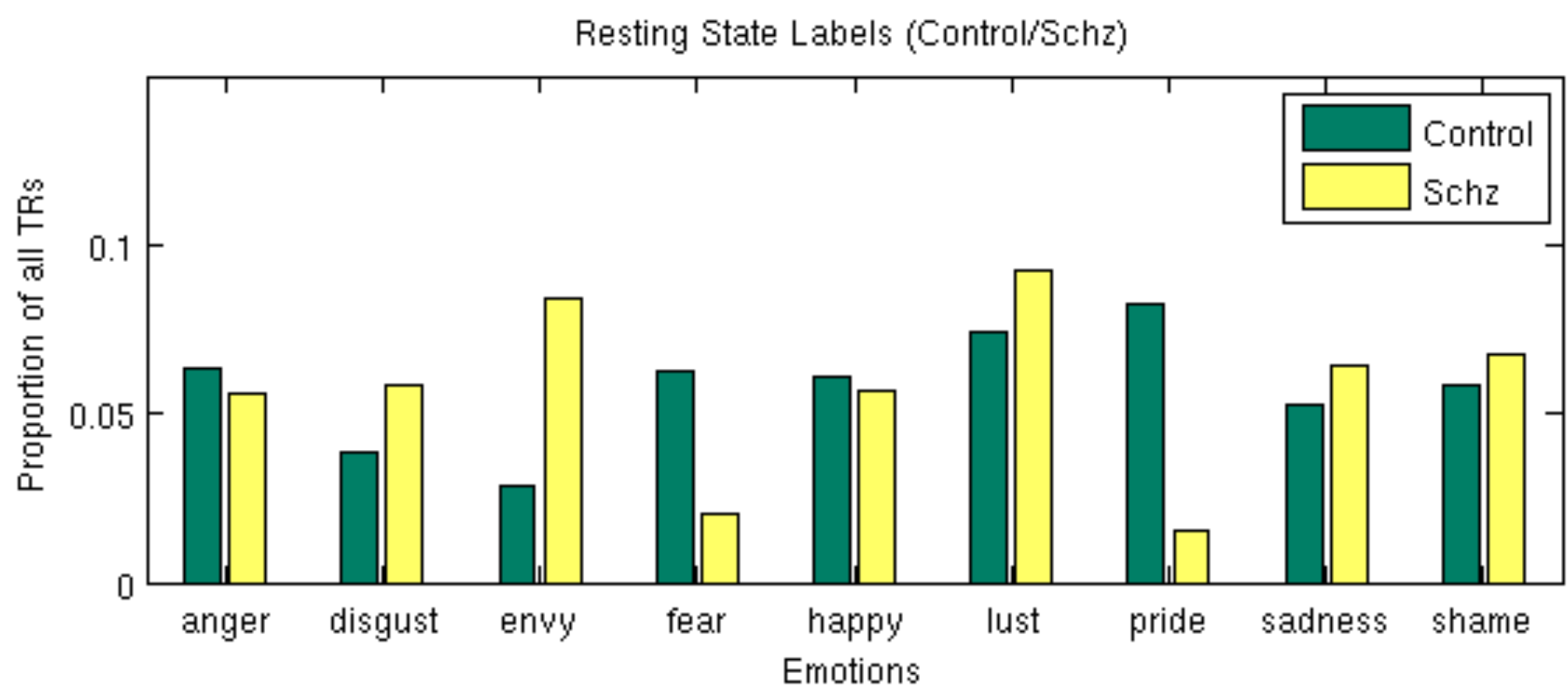
RESULTS

Suicidal ideators
- experience positive emotions ($p = 0.061$) for less time ($p = 0.028$)
- experience negative emotions more intensely ($p = 0.022$)
- more subjects experience envy ($p < 0.001$) and disgust ($p = 0.005$)
- experience happiness for less time ($p = 0.020$)
- more partitioned states found by DCD ($p = 0.030$)

Resting State Labels (Control/Ideators)

People with bipolar disorder
- fewer subjects experience anger ($p = 0.017$)
- more subjects experience disgust ($p = 0.074$)
- experience pride for less time ($p = 0.055$)

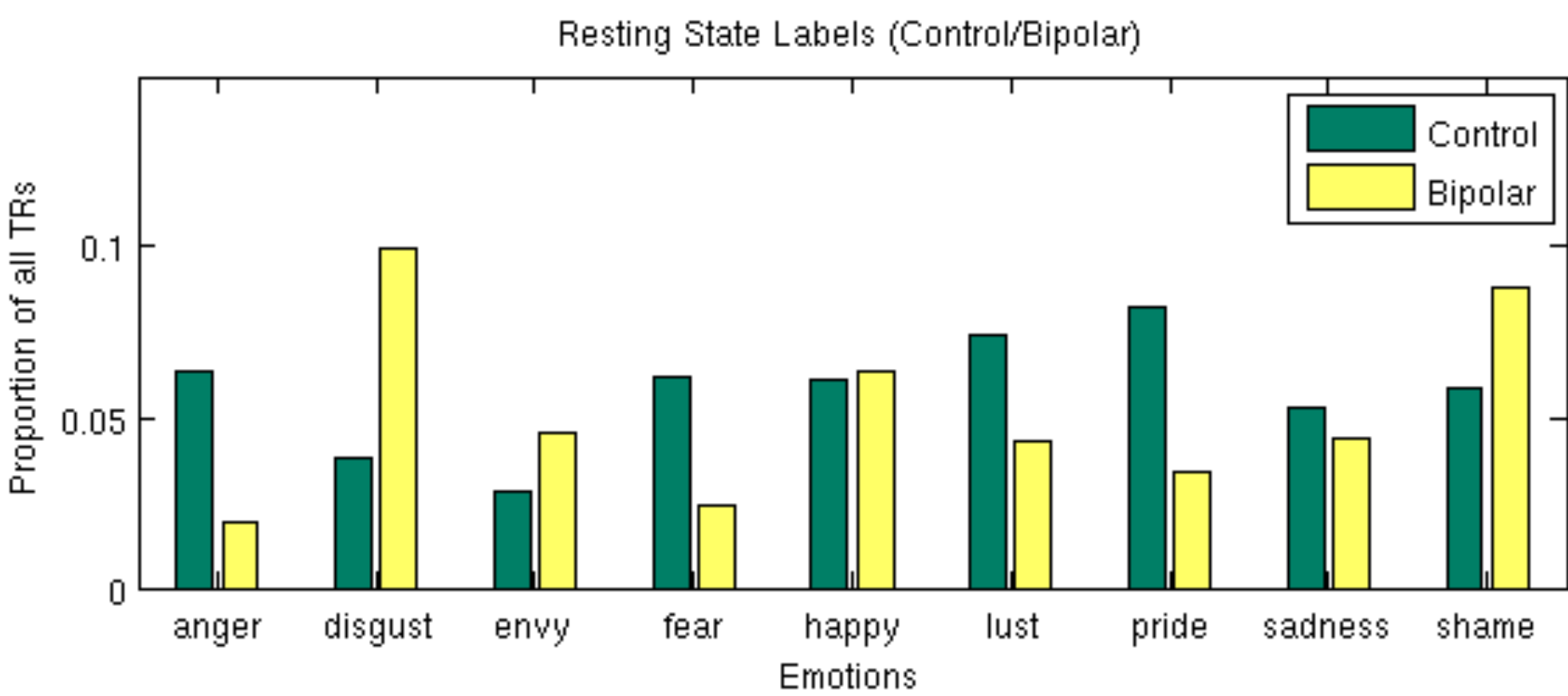Resting State Labels (Control/Bipolar)

People with schizophrenia
- experience pride for less time ($p = 0.019$)
- experience emotions more intensely overall ($p = 0.053$)
- experience sadness ($p = 0.044$), envy ($p = 0.036$) and positive emotions ($p = 0.010$) more intensely

Resting State Labels (Control/Schz)

People with ADHD
- fewer subjects experience lust ($p = 0.017$)
- fewer subjects experience fear ($p = 0.098$)
- experience shame for longer ($p = 0.040$)

Resting State Labels (Control/ADHD)
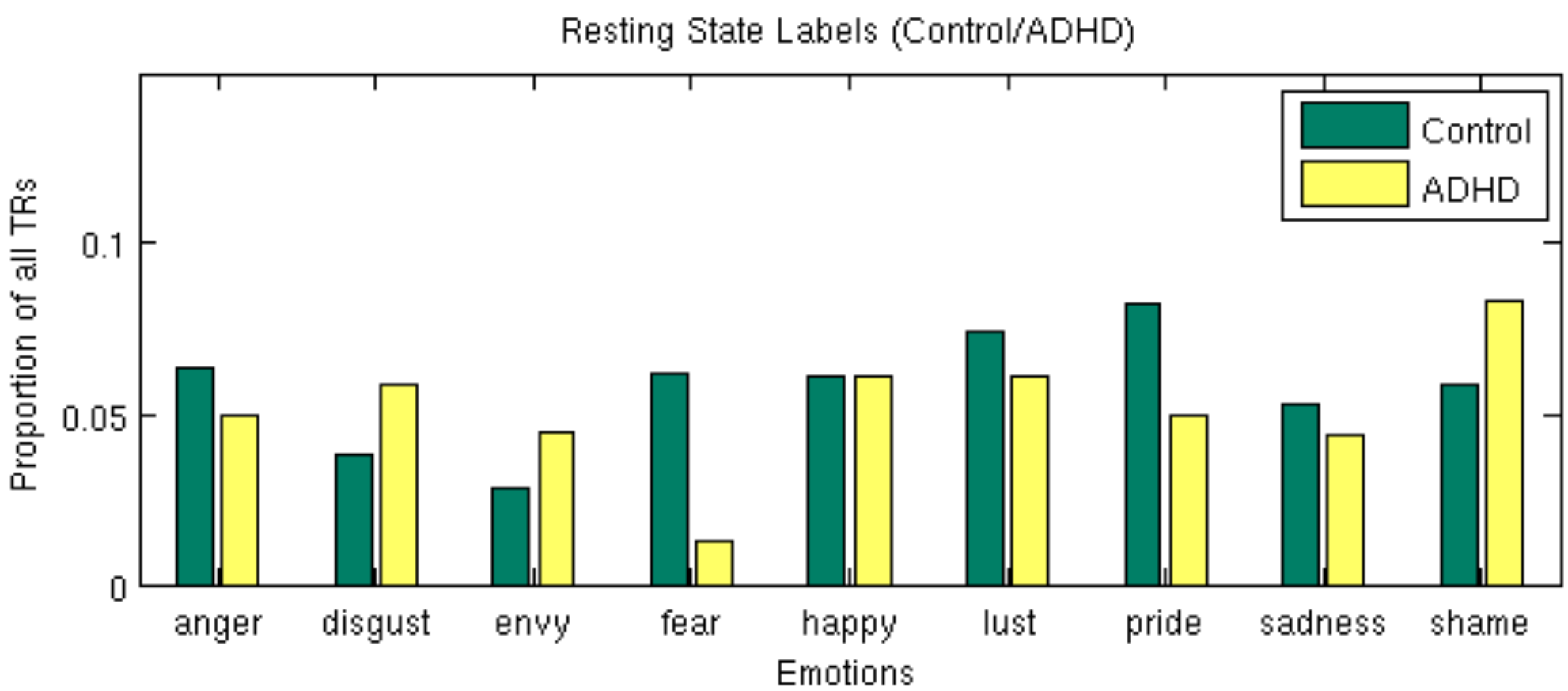
DISCUSSION

We were able to determine which emotions participants were experiencing during a resting state, and found significant differences in experienced emotion between controls and 4 different clinical groups.

In future work, we hope to investigate other concept representations, besides emotion, during the resting state and explore different methods for detecting change points in neural states.

REFERENCES & ACKNOWLEDGMENTS

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