Exploratory visual and social relationship models correlate with neural responses to facial identity during naturalistic viewing

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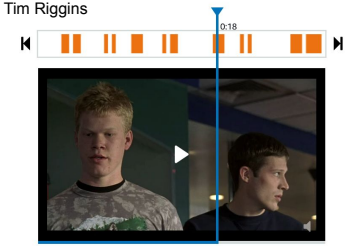
Introduction

- Naturalistic movies increase ecological validity, but the unconstrained nature of the stimuli make them difficult to model
- Previous research has used convolutional neural networks (CNNs)[1,2] and externally-generated social relationship models[3,4] to examine person perception using face images
- This project aimed to determine whether similar models would also correspond to neural activity during a 45-min episode of Friday Night Lights[5]

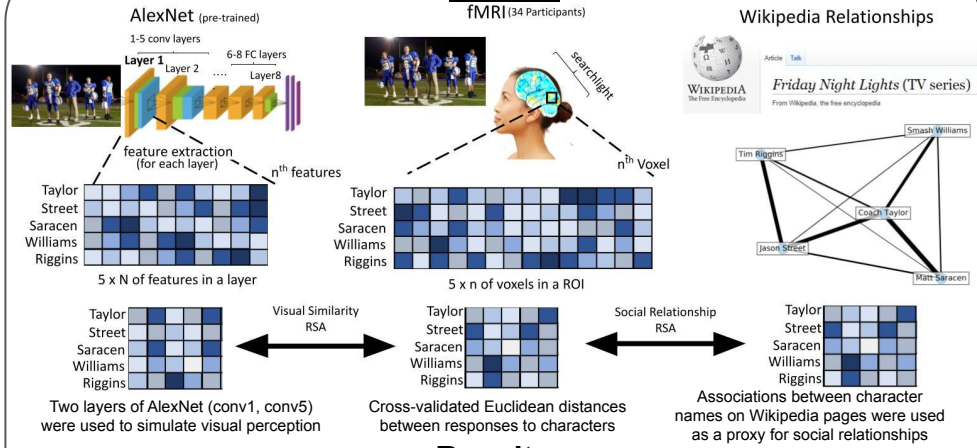
Preprocessing

- Character events were extracted using Amazon Rekognition software (focused on 5 most frequently occurring characters)
- Neural responses to character events were modeled using Least Squares-Sum estimation for independent (non-overlapping) character events, controlling for low-level features (brightness, sharpness)
- 297 events in total: 142 Coach Taylor, 48 Jason Street, 39 Matt Saracen, 34 Brian "Smash" Williams, and 34 Tim Riggins



Example: Zach Gilford (Matt Sacaren)

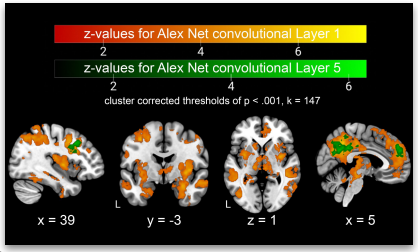
Models



Results

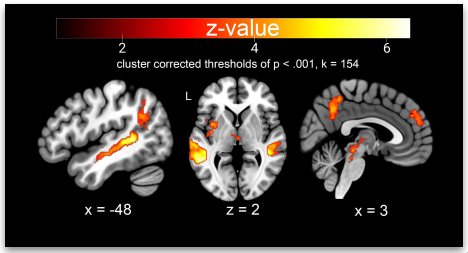
Visual Similarity

Layer 1: regions along ventral/dorsal visual stream & many other high order neurocognitive systems
Layer 5: Posterior cingulate, dorsomedial & lateral PFC



Social Relationships

Bilateral superior temporal sulcus, left temporoparietal junction, dorsomedial prefrontal cortex, left insula, posterior cingulate, precuneus, and midbrain



Conclusions

- We demonstrate one method for testing models of facial identity perception during naturalistic viewing
- Regions previously linked to social perception and cognition represented visual and social relationship information of characters in the first episode of Friday Night Lights
- Results are consistent with previous findings demonstrating that neural responses to static and more limited video face stimuli index different types of similarity structure[2,3,4]

Future Directions

- Future work should test and further validate the results discussed here:
  - Examining multiple models of different information types simultaneously (i.e., using partial correlation)
  - Comparing different types of events within-category to examine unintended effects such as duration or narrative content
- Social information such as personality characteristics, social roles, and changing relationships can be modeled over time to determine the neural underpinnings of identity formation

Relevant code and materials can be found at:
https://github.com/JunaidMerchant/CompSAN2022_DCteam

References

1. Horikawa & Kamitani. ***Nature Communications.*** (2017)
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3. Dziura & Thompson. ***The Journal of Neuroscience.*** (2020).
4. Parkinson et al. ***Nature Human Behaviour.*** (2017).
5. Chang et al. ***Science Advances.*** (2021).