The Neural Basis of Face Recognition in Older Adults

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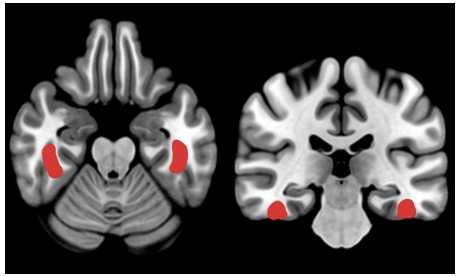
Introduction

- The neural mechanisms of facial recognition are important in understanding how we interact with others. In specific, how we recognize faces that are familiar to us, such as a loved one.
- Neurocognitive disorders, like Alzheimer's Disease (AD), can dramatically reduce facial recognition in older adults.
- Using fMRI, we examine differences in brain activity evoked by three different categories of recognition: personally familiar (PF) faces, experimentally familiar (EF) faces of strangers, and novel faces of strangers.



Fusiform Face Area (FFA)

Note: *The fusiform gyrus area is linked to facial recognition.*

Methods

- Participants used a digital camera to capture standardized images of people with whom they are personally familiar (i.e., spouses, children, close friends).
- We examined differences in brain activity evoked by recognition of PF faces, EF faces, and novel faces of strangers during functional imaging in older adults with and without indications of mild cognitive impairment (MCI), a clinical precursor to AD..
  - 7 runs consisting of 3 categories of stimuli (PF, EF, novel).

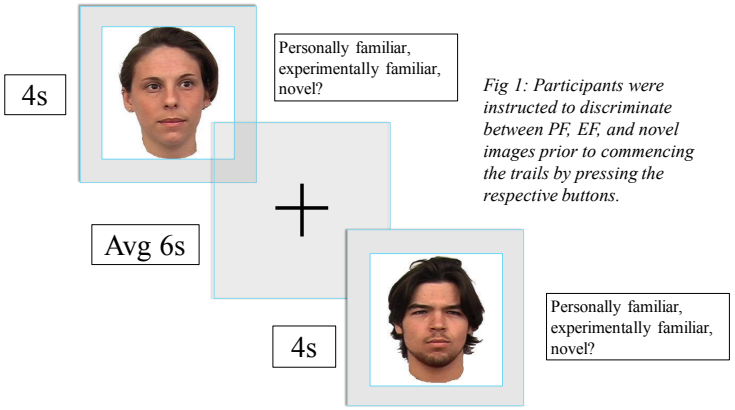


Fig 1: Participants were instructed to discriminate between PF, EF, and novel images prior to commencing the trails by pressing the respective buttons.

Expected Results

- fMRI imaging has been helpful in pinpointing which brain regions are active during specific mental tasks.
- Blood oxygen level dependent signal (BOLD) response indicates level of activity for the brain regions of interest.
- We anticipate that recognition in cognitively healthy older adults will be characterized by brain activity that reliably differentiates between each stimulus category, whereas people with MCI will show a restricted representational space such that faces from all categories evoke similar activity patterns.

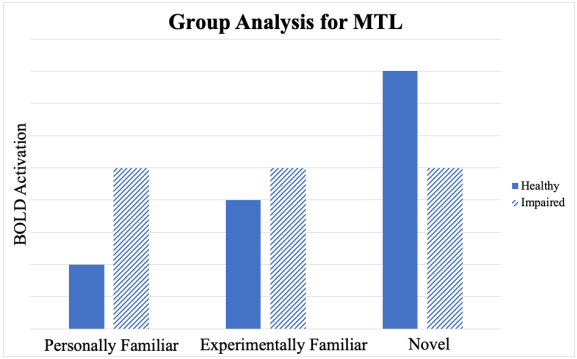


Fig 2: A group average for BOLD activation seen in the MTL with condition of photo-type on the x-axis (PF, EF, novel).

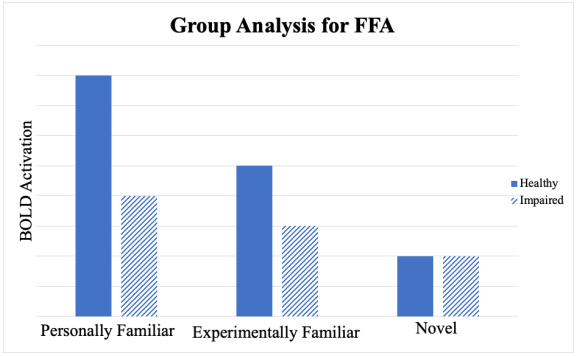
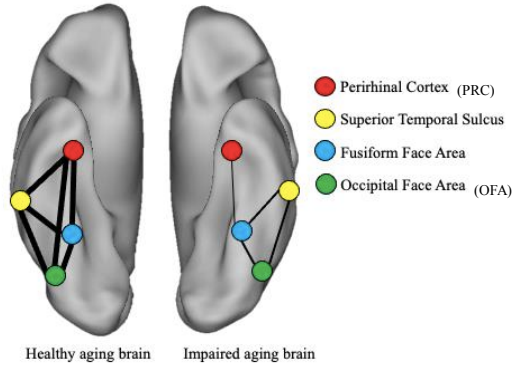


Fig 3: A group average for BOLD activation seen in the FFA with condition of photo-type on the x-axis (PF, EF, novel).

- In addition to probing for differential activity across conditions within regions, we will also look for functional correspondence between regions.
- We will quantify functional connectivity among nodes in an extended face processing network that includes FFA, OFA, superior temporal sulcus, and PRC.
- We anticipate that cognitively impaired older adults will show reduced connectivity between nodes in the face processing network.
- Our strongest prediction is that PRC, which is important for processing identity and recent experience, will be either disconnected or weakly connected to more posterior nodes.

Fig 4: Ventral view of flat brain showing the nodes of connectivity in regions of interest (ROIs).



Drawing Conclusions

- We expect to see a difference in neural activity in ROIs (FFA, OFA, PRC, ERC) for MCI and healthy controls.
  - Weakened connections between nodes in impaired aging brains as opposed to strong networks shown within healthy aging brains.
- Difference in neural activity in MTL and FFA between MCI and healthy controls, as shown in Figure 4.
- If there is a difference between cognitively healthy aging adults and those with MCI, it would help us to determine a key neural system impacted during AD progression.

References

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