Is the processing of facial expression and head orientation dissociated in the human brain?

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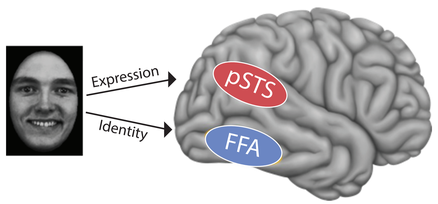
INTRODUCTION

Models of face processing suggest that fixed and changeable aspects of a face, such as identity and expression, are processed by distinct neural pathways.



Is all ***dynamic*** information processed within the same brain regions?

Orientation Changes

Global object movement => ***ventral temporal cortex***

Expression Changes

Facial motion => ***superior temporal sulcus (STS)***

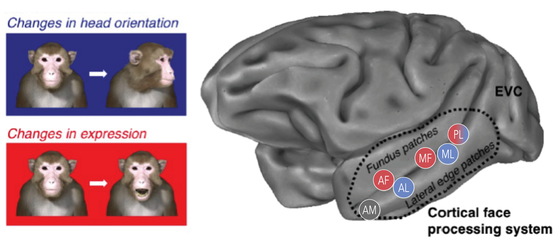
DISTINCT SENSITIVITY TO ORIENTATION & EXPRESSION IN MACAQUES

fMRI-Adaptation Paradigm

- If a neural population is sensitive to a visual feature, the fMRI signal will decrease upon repeated exposure to the same feature
- Identifies functional specialization

Results

- STS lateral edge patches were most sensitive to head orientation
- STS fundus patches and amygdala were most sensitive for facial expression



CURRENT STUDY IN HUMANS

Stimuli

- One 3D human avatar
- 400 unique stimuli created
- 5 expressions x 5 head orientations x 8 lighting conditions

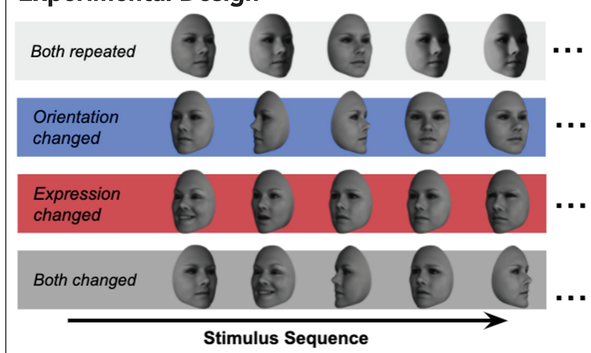
Participants

26 healthy volunteers

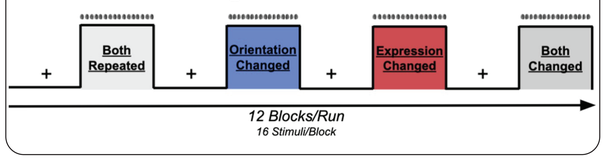
Task

Report with a button press if the fixation cross changes in size

Experimental Design



On/Off Block Design: 9 Runs



ADAPTATION INDEX

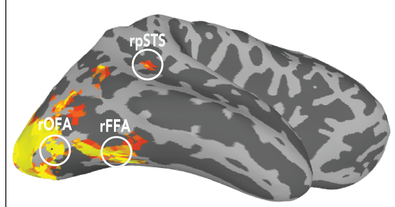
Orientation

$$\frac{(\text{Orientation Changed} - \text{Both Repeated})}{(|\text{Orientation Changed}| + |\text{Both Repeated}|)}$$

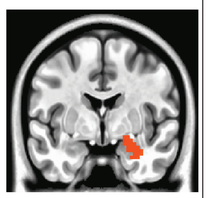
Expression

$$\frac{(\text{Expression Changed} - \text{Both Repeated})}{(|\text{Expression Changed}| + |\text{Both Repeated}|)}$$

REGIONS OF INTEREST DEFINITION



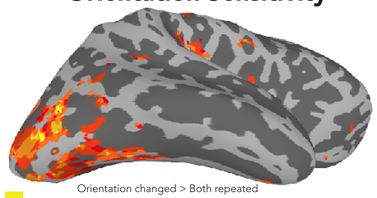
5mm sphere around peak voxel of average task activation for right FFA, right OFA, and right pSTS



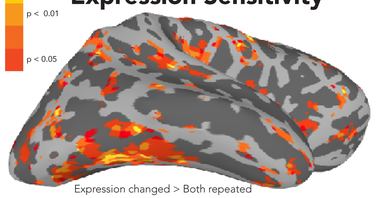
Anatomical mask of right AMG

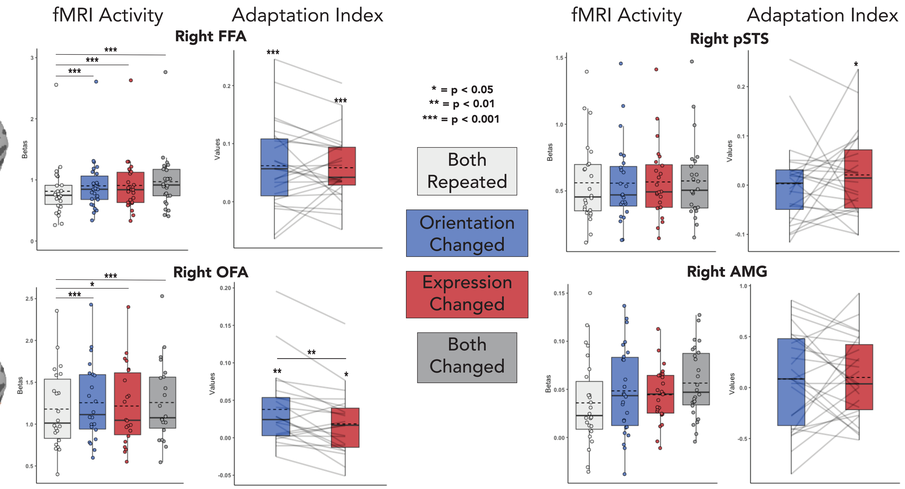
FMRI RESULTS

Orientation Sensitivity



Expression Sensitivity



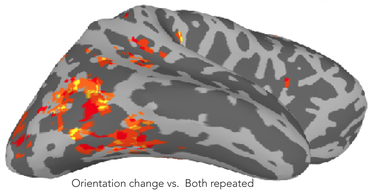


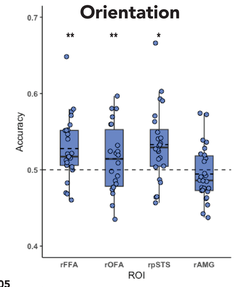
Right FFA showed sensitivity to both head orientation and facial expression
Right OFA showed sensitivity to both head orientation and facial expression, but was significantly more sensitive to head orientation

Right pSTS only showed sensitivity to changes in facial expression
Right AMG showed a trend towards sensitivity to facial expression (p < 0.06)

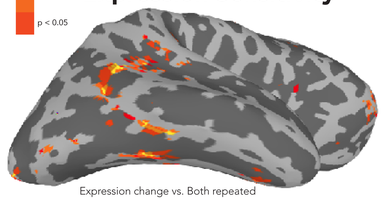
CLASSIFICATION ACCURACY

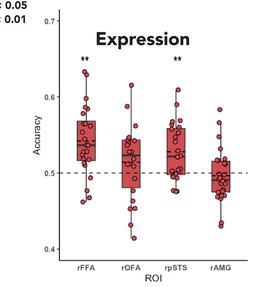
Orientation Sensitivity





Expression Sensitivity



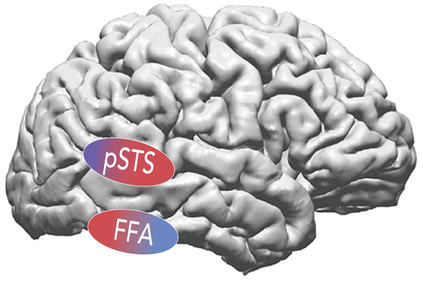


Right FFA showed sensitivity to both head orientation and facial expression
Right OFA showed sensitivity only to head orientation

Right pSTS showed sensitivity to both head orientation and facial expression
Right AMG did not show sensitivity to either feature

CONCLUSIONS

- Facial expression and head orientation processing is not dissociated in the human brain
  - Head orientation => right FFA and possibly right STS
  - Facial expression => right FFA and right pSTS
- Humans process head orientation and facial expression differently than macaques



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