

Interpretation of fMRI Results (Faces vs. Houses)

The analysis of the Haxby dataset used standard preprocessing, GLM modeling, and functional connectivity estimation.

Experimental Timing (Design Matrix)

The design matrix heatmap shows alternating blocks of face and house stimuli across approximately 1,452 scans. The 12 face and 12 house blocks align with the block-design nature of the dataset. This structure produces strong, clean predictors for the GLM to detect category-selective visual responses (Haxby et al., 2001).

GLM Contrast: Face > House

The statistical map highlights multiple clusters in the ventral visual cortex that respond more strongly to faces than houses. Key activated regions visible in the slices include:

- Fusiform gyrus (L/R) – consistent with the Fusiform Face Area (Kanwisher, McDermott, & Chun, 1997)
- Inferior temporal cortex – part of the face-processing network (Haxby et al., 2001; Grill-Spector, 2003)
- Occipital face-sensitive regions – early visual contributions to face categorization (Pitcher, Walsh, & Duchaine, 2011)

These results support prior findings that the FFA is engaged in face perception.

Functional Connectivity Matrix

The 116x116 correlation matrix shows clear block structure, indicating that regions within functional networks are more strongly correlated with each other than with regions in other networks. In particular, the dense red bands in the visual and cerebellar regions reflect strong synchronous response during visual stimulation (Yeo et al., 2011)

Hub Regions

The script identifies the most highly correlated brain regions using summed absolute correlations. The top hubs include:

1. Calcarine cortex (L/R) – primary visual cortex (Wandell, Dumoulin, & Brewer, 2007)
2. Lingual gyrus (L/R) – visual association cortex (Mechelli et al., 2007)
3. Cerebellum (lobules 4-5) – visuomotor and timing integration (Stoodley & Schmahmann, 2009)
4. Hippocampus (L/R) – memory-related coactivation (Ranganath & Ritchey, 2012)
5. Precuneus – central node of the default mode network (Cavanna & Trimble, 2006)
6. Superior medial frontal cortex – attentional regulation (Ridderinkhof et al., 2004)

Synchronized activity across early visual regions reflects the strong, repeated visual stimulation in the experiment and block-design timing.

The results align with well-established neuroscience findings. The GLM analysis reveals selective face-preferential activity in fusiform and inferior temporal cortices. Connectivity analysis highlights visual cortices as the most synchronized and central hubs, which is expected for a visual-category task. The time-series and design matrix figures confirm that preprocessing and modeling were implemented correctly.

Works Cited

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