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Mapping the Functional Organization of the Face-responsive Regions in the Human Brain using fMRI

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Background

Despite the fact that highly disabling disorders, such as autism and schizophrenia, are associated with abnormalities in processing faces, the functional organization of face responsive regions in the brain is not fully understood. For example, although movements of the face convey a wealth of socially important information, it is not clear how this information is represented. Movements of the face are often considered to be on-rigid or rigid. Non-rigid movements give rise to different facial expressions. In contrast, rigid movements of the head create up and down movements indicating dominance or submissiveness and rotational movements that usually signal a shift in a person's focus of attention. All of these movements can be subsumed under the broad heading of changeable aspects of faces, but their implications for the perceiver are clearly quite different.

Aims

1. Are there distinct neural representations for the processing of changes in facial expression and viewpoint in the face?

2. Are topographic patterns of neural response consistent across participants?

We used multivoxel pattern analysis with fMRI to measure similarities in the patterns of neural response to changes in expression (non-rigid change), and the patterns of neural response to changes in left to right facing head direction (rigid changes).

Figure 1 Examples of stimuli from the experimental conditions: changes in expression (top: same identity, bottom: different identity); changes in viewpoint (top: same identity, bottom: different identity); Fourier scrambled images of faces.

Conclusions

1. Distinct patterns of response for facial expression and viewpoint within face-selective regions.

2. Larger responses to changes in expression were evident in the superior temporal sulcus (STS) and inferior frontal gyrus (IFG), but larger responses to changes in viewpoint were found in the intra-parietal sulcus (IPS).

3. These patterns of response to expression and viewpoint were largely invariant to changes in facial identity and were consistent across participants.

4. This data will provide a normative range with which to compare with individuals with disabling disorders such as autism and schizophrenia.

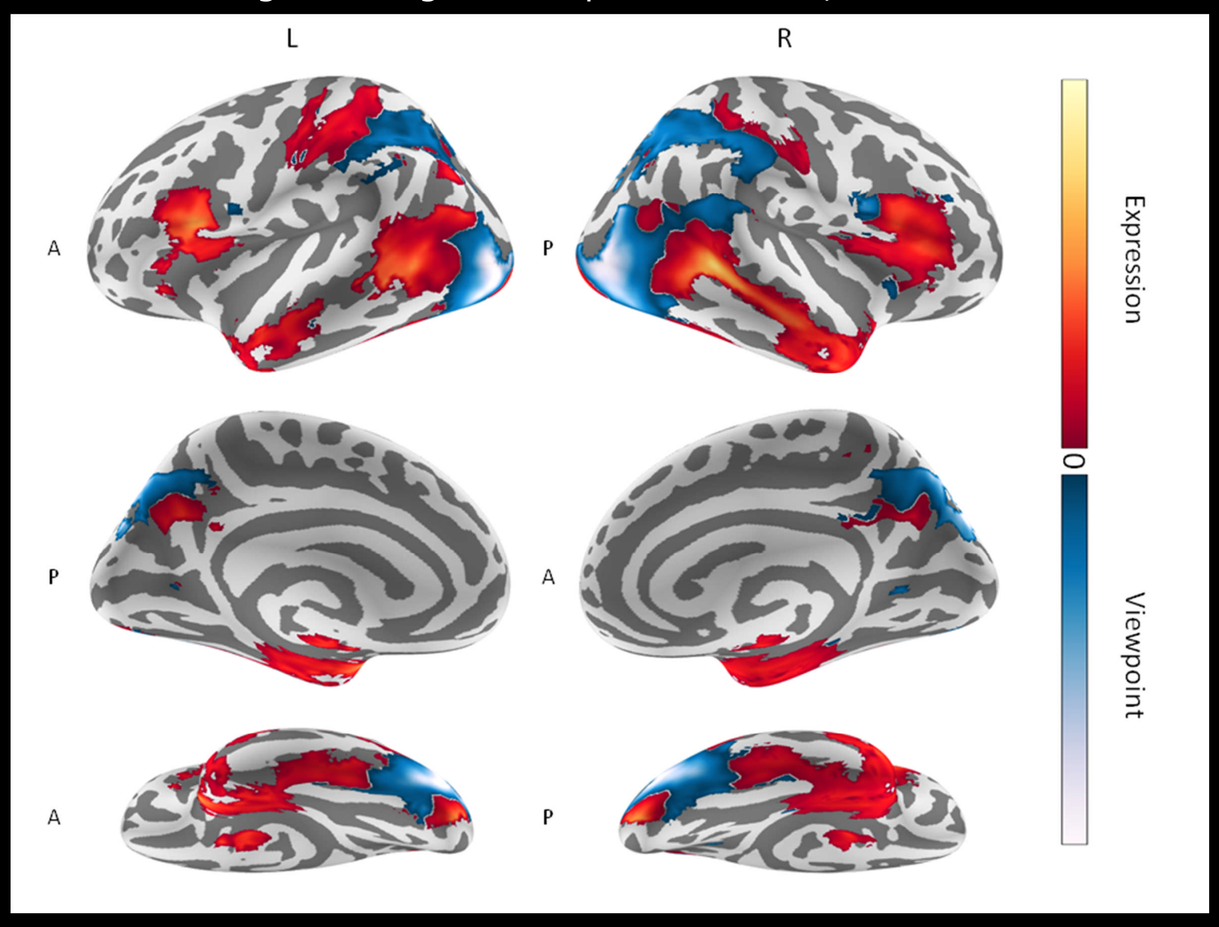

Figure 2 The response to non-rigid (expression) and rigid (viewpoint) changes across face-selective regions of the human brain. Normalised parameter estimates are superimposed on the cortical surface to show relatively larger responses to changes in expression (red) or viewpoint (blue) for same identity and different identity faces.

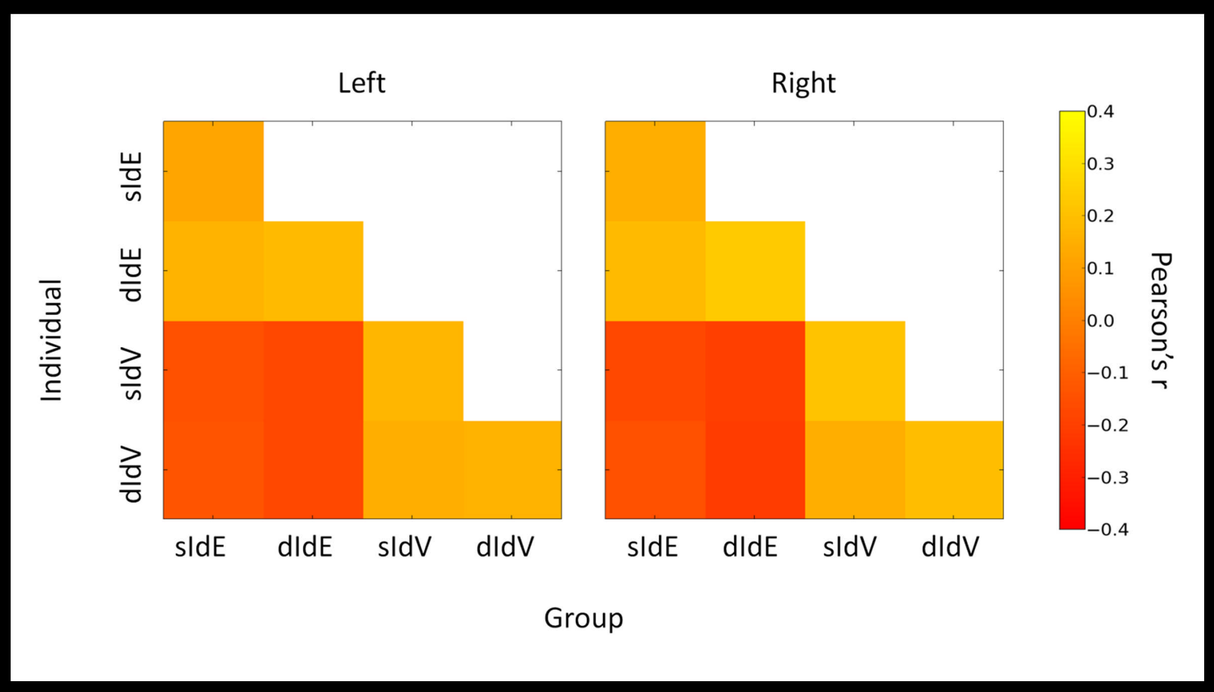

Figure 3 Matrices showing correlations between individual and group patterns of response to different conditions (sIdE: same identity, different expression, dIdE: different identity, different expression, sIdV: same identity, different viewpoint, dIdV: different identity, different viewpoint) across the face-selective regions of the human brain. The results show that there are distinct patterns of response to facial expression and viewpoint and that these patterns are similar whether the identity of the faces is the same or different.

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