The neural basis of face pareidolia with human intracerebral recordings

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Résumé

Even in highly recognizable stimuli, such as everyday living and non-living objects, the organization of certain features evokes the impression of viewing a face. Objects that elicit such 'face pareidolia' are typically referred to as facelike-objects. Previous investigations employing brain imaging techniques such as functional magnetic resonance imaging (fMRI), electroencephalography (EEG), and magnetoencephalography (MEG) have consistently shown that both human faces and facelike-object images elicit activity within comparable ventral occipito-temporal (VOTC) regions, including the bilateral fusiform face area (FFA) and occipital face area (OFA).

However, the extent to which face pareidolia is processed by the same neural circuits as human faces remains unclear. Here we present a unique method of addressing this question with a direct measure of brain activity recorded from contact electrodes implanted in the VOTC of a large group of epileptic patients (n=42). We used a frequency-tagging visual stimulation paradigm previously validated in EEG (Rekow et al., 2022), which was optimized to measure categorical selectivity for both faces and facelike-objects. Face-selectivity was determined by contrasting, in separate runs, a large set of either naturalistic face or facelike images to a large set of non-face stimuli depicting various living and non-living object categories. High signal-to-noise ratio face and facelike-object-selective responses were objectively (i.e. exactly at the stimulation frequency) identified and quantified throughout the VOTC.

We report selective activity for facelike-objects in a large part of the human VOTC running all along the fusiform gyrus from the occipital cortex (OCC) to the anterior temporal lobe (ATL). While category-selective activity is substantially reduced for facelike objects as compared to human faces (26%), in line with findings from scalp recording studies, it largely spatially overlaps with face-selective activations in regions that are thought to form a highly interconnected face-selective network.

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We further show that these two face-selective neural signals are highly functionally related, as indicated by their strong amplitude correlation across regions and recording contacts. Finally, their concurrent onset timing contradicts the view that facelike-objects would be specifically (re-)interpreted as faces following top-down processes. Altogether, our observations support the view that face pareidolia is processed by the same neural circuits as human faces.

Mots-Clés: face pareidolia, intracerebral recordings, fast periodic visual stimulation