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Brief article

The effect of face inversion on the human fusiform face area

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Abstract

Inversion severely impairs the recognition of greyscale faces and the ability to see the stimulus as a face in two-tone Mooney images. We used functional magnetic resonance imaging to study the effect of face inversion on the human fusiform face area (FFA). MR signal intensity from the FFA was reduced when greyscale faces were presented upside-down, but this effect was small and inconsistent across subjects when subjects were required to attend to both upright and inverted faces. However when two-tone faces were inverted, the MR signal from the FFA was substantially reduced for all subjects. We conclude that (i) the FFA responds to faces per se, rather than to the low-level visual features present in faces, and (ii) inverted greyscale faces can strongly activate this face-specific mechanism.

Keywords: Fusiform face area; Face inversion; fMRI; Face perception

1. Introduction

Evidence from a wide variety of sources suggests that the perception of faces may be ‘special’ in two senses. First, the processes involved in face recognition may be qualitatively different from those involved in the recognition of other kinds of objects. This claim is supported by behavioural experiments showing that the disruption of recognition performance that results when a face is presented upside-

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down is considerably greater than the analogous inversion cost for the recognition of objects (Yin, 1969; see Valentine, 1988 for a review; but also see Diamond and Carey, 1986). Second, neuropsychological double dissociations between face and object recognition suggest that these processes are subserved by different regions of the brain (e.g. Newcombe et al., 1994).

Perhaps the most striking evidence for the specialness of face processing comes from the recently reported neurological patient CK (Moscovitch et al., 1997). Although severely impaired at a wide range of visual tasks including the recognition of words and objects, CK is absolutely normal at recognising upright faces. Further, CK exhibits a face inversion cost that is six times greater than that observed in normal subjects. Moscovitch et al. explain this result by arguing that the face-specific mechanisms preserved in CK are unable to process inverted faces (see also Farah et al., 1995).

In another line of evidence for the specialness of faces, several imaging studies (Ishai et al., 1997; Kanwisher et al., 1997a; McCarthy et al., 1997) have demonstrated a focal region in the fusiform gyrus called the fusiform face area or FFA (see Fig. 1) that responds in a highly selective fashion to faces, compared to a wide variety of other stimulus types. However, the evidence for the selectivity of the FFA is based on comparisons of the response to different stimulus types, so it remains logically possible that this area responds not to faces per se, but to some confounding low-level visual feature which is present in face stimuli.

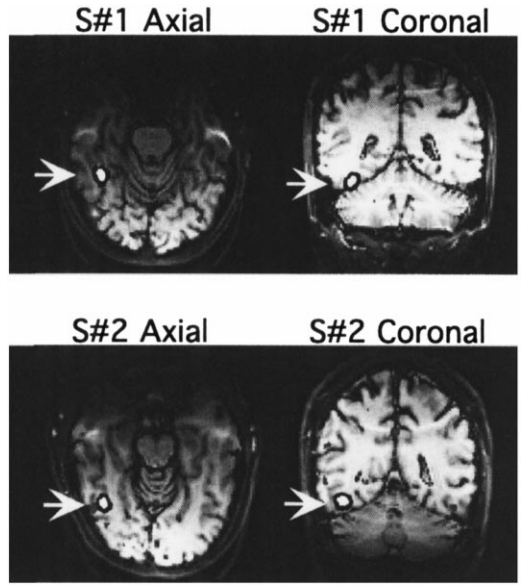

Fig. 1. An axial and coronal slice showing the fusiform face area (FFA) in two subjects. The arrow points to the FFA (the white spot outlined in black) in each image. This region responded significantly more during passive viewing of faces than passive viewing of objects in the functional localiser scan, $P < 0.0001$ (uncorrected). Right hemisphere is shown on the left in all images.