Hemispheric Effects in Fusiform Gyrus Across Face Encoding Tasks

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Introduction

Functional Magnetic Resonance Imaging (fMRI) was used to examine neuronal activation during two explicit face memory tasks. Numerous neuroimaging studies have shown bilateral activation of posterior temporal-occipital structures during processing of visually presented stimuli; preferential left-hemisphere activation has been associated with object processing, and preferential right-hemisphere activation has been associated with face processing (Sergent, 1995). Lesion studies suggest a special role for the right fusiform gyrus in the encoding of structural physiognomic information, an early stage of face processing (Sergent, 1993). It was hypothesized that intentional encoding of unfamiliar faces would be associated with preferential activation of right-hemisphere mesial temporal lobe structures, including the fusiform gyrus.

Methods

Task Design

For each of two face memory encoding tasks, healthy, right-handed volunteers viewed blocks of unfamiliar face photographs, alternating with blocks of a repeatedly presented pixelated control image (six 40s task/control blocks, 10 stimuli per block, 3.5s presentation, 0.5s ISI). Face stimuli were constructed from University of Pennsylvania ID card photographs. For the first task, full-head photographs were shown, including hair, neck, and upper shoulders. In some cases, clothing and jewelry were visible. For the second task, the same set of face photographs was used, but each photograph was cropped so as to include the brow, eyes, nose, and mouth, but exclude ears, hair, and any extraneous items. Two separate groups of six subjects were consecutively recruited for each of the two tasks. Subjects were instructed to remember the faces for a post-scan recognition test, and to attend the control images but not to memorize them. Scanning occurred during the encoding tasks but not during recognition testing.

Image Acquisition and Processing

BOLD functional imaging data were collected at 1.5 Tesla in 20 contiguous 5mm axial slices, using a GE Signa Echospeed MRI scanner. Data were corrected for motion and static susceptibility-induced artifacts, and transformed into three-dimensional space. Using SPM 97 software, a statistical parametric map was constructed for each subject. Group activation maps were then constructed for each task using the SPMt Random Effects model. Activation exceeding a mapwise statistical threshold (α=.05) was quantified within the right and left fusiform gyri, and was compared using a hemispheric asymmetry ratio (AR=R-L/R+L).

Results

Suprathreshold activation was found bilaterally during both encoding tasks. Activation associated with encoding of full-head stimuli was slightly greater left than right (AR=-0.20; Z=.91, *ns*). (See figure 1a.) Activation associated with encoding of cropped face stimuli was significantly greater right than left (AR=0.31; Z=-2.45, p<.05). (See figure 1b.)

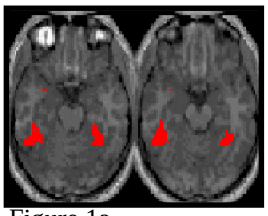

Figure 1a.

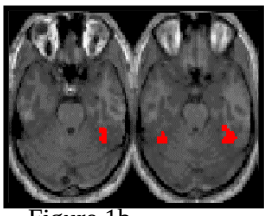

Figure 1b.

Discussion

Cropped face encoding elicited the hypothesized preferential right-sided activation in the fusiform gyrus, while full-head encoding did not. One possible explanation for these findings is that the former task constrained subjects' encoding strategies to the visuospatial domain, while the latter task allowed verbal encoding of nameable objects, as well.

References

Sergent, J. (1993), *The functional organization of the human visual cortex.* Oxford: Pergamon.

Sergent, J. (1995),*Brain Asymmetry.* Cambridge: MIT Press.