Neural Correlates in Implicit and Explicit Face Perception Tests by Event-Related fMRI

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ABSTRACT

Many studies suggest that people remember faces of their own race better than faces of other races (called same-race memory superiority). In our study, subjects performed two tasks on race-judgment and familiar-judgment during event-related fMRI. In the implicit task, they consciously made familiar-judgments (regardless of race); In the explicit task, they consciously made race-judgments (regardless of familiarity). In the implicit task the same-race memory superiority was observed from face fusiform areas. In the explicit task such memory superiority was observed from left middle temporal lobe.

INTRODUCTION

People are better at recognizing faces of their own than faces of other races (1). The same-race advantage has been demonstrated with behavioral studies involving a wide variety of protocols, face stimuli, participants and cultural settings. We investigated the neural substrates underlying the explicit and implicit difference in memory for same-race and other-race faces using event-related fMRI (ER-fMRI) widely applied in the studies of cognitive process in human (2).

MATERIALS AND METHODS

Six right-handed normal, healthy volunteer adults participated in the experiment. The stimuli consisted of gray photographs of 100 Oriental-Korean and 100 European-American and each 100 were split into 50 familiar and 50 unfamiliar groups. The faces were presented for 1000 ms, replacing a baseline of an oval checquerboard present throughout the interstimulus interval, with minimal SOA of 4.5 s and 100 randomly intermixed null events (3). Each subject were scanned during two sessions, In one session the subjects were instructed to press one of two possible buttons with either the index or middle finger of their right hand to indicate whether a face was familiar or not (Explicit task), regardless of whether it was the same race or not (Implicit). In second session they used the buttons to indicate whether a face was same race or not (Explicit), regardless of whether it was familiar or not (Implicit). Incorrect answers were ignored. A 1.5T VISION system (Siemens Corps., Iselin, NJ) was used to acquired T2* weighted transverse EPI images (TR/TE/FA = 3000ms/60ms/90^o, FOV=240 x 240mm^2, 24 axial slices, 5mm slice thickness with no gap). The acquired data were applied to SPM99 for the pre-processing such as realignment, normalization, spatial smoothing, and then statistical analysis as voxels with significant activation were determined using a students' t-test ($p<0.005$,uncorrected). The averaged single event type time courses from the activated voxels were quantitatively analyzed, after fitted with canonical hemodynamic response function (HRF)(4).

RESULTS

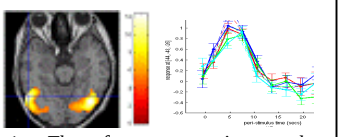

Fig.1. The face perception tasks dominantly showed the functionally defined bilateral fusiform areas. the event-related data are binned every 3s from the right fusiform region.(red is oriental familiar stimuli(OF), blue is oriental unfamiliar stimuli(OU),green is European-American familiar stimuli(EF), sky is European-American unfamiliar stimuli(EU).

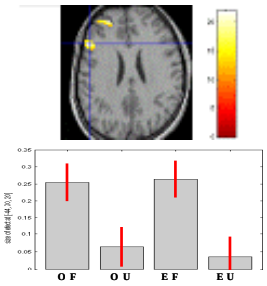

Fig.2. the explicit familiar-judgment task showed the left middle frontal gyrus(x,y,z:-44,30,20;-22,58,18,z=4.45).

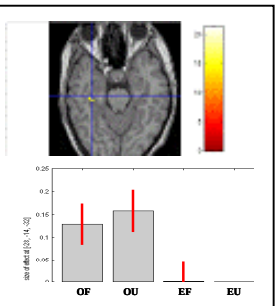

Fig.3. the explicit race-judgment task showed the MTL areas(x,y,x: -28,-14,-32;,z=4.38).

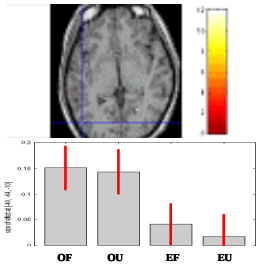

Fig.4. during the explicit familiar-judgment, the implicit race-judgment showed face fusiform regions(x,y,z : -40,-64,10;26,-48,10,z=3.12; 3.24).

The face fusiform area (Fig.1) was defined for individual participants as those voxels within the fusiform gyrus and/ or adjacent sulci that were significantly more active when viewing faces of both races compared to baseline (checquerboard). These voxels were then as a mask within which to identify brain regions sensitive to two planned, orthogonal comparisons: (Fig.2) regions showing greater responses to familiar than to unfamiliar stimuli, (OF + EF) – (OU + EU), and (Fig. 3,4) regions showing greater responses to same-race than other-race stimuli, (OF + OU) – (EF + EU).

DISCUSSION

The main finding of the present study was that greater responses in face fusiform regions were observed in an implicit race-judgment task, but not in an explicit race-judgment task. The implication of this finding is that segregating the face into categories may unconsciously happen to the face fusiform areas involved in the computation of precise metric information about faces that are essential for individual of one face from another. In this experiment, the salient categories were oriental Korean faces and European America faces. Face perception may often reflect an interplay between such individuating and categorizing process and distinct fusiform regions mediate these two kinds of face processing (1,5).

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