Cortical mechanisms of visual self-recognition

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Received 9 March 2004; revised 4 June 2004; accepted 8 July 2004
Available online 18 November 2004

Several lines of evidence have suggested that visual self-recognition is supported by a special brain mechanism; however, its functional anatomy is of great controversy. We performed an event-related functional magnetic resonance imaging (fMRI) study to identify brain regions selectively involved in recognition of one’s own face. We presented pictures of each subject’s own face (SELF) and a prelearned face of an unfamiliar person (CONT), as well as two personally familiar faces with high and low familiarity (HIGH and LOW, respectively) to test selectivity of activation to the SELF face. Compared with the CONT face, activation selective to the SELF face was observed in the right occipito-temporo-parietal junction and frontal operculum, as well as in the left fusiform gyrus. On the contrary, the temporoparietal junction in both the hemispheres and the left anterior temporal cortex, which were activated during recognition of HIGH and/or LOW faces, were not activated during recognition of the SELF face. The results confirmed the partial distinction of the brain mechanism involved in recognition of personally familiar faces and that in recognition of one’s own face. The right occipito-temporo-parietal junction and frontal operculum appear to compose a network processing motion–action contingency, a role of which in visual self-recognition has been suggested in previous behavioral studies. Activation of the left fusiform gyrus selective to one’s own face was consistent with the results of two previous behavioral studies. Biringer and Anderson (1992) demonstrated that children do not recognize themselves in a mirror and in live video, where there is no such contingency between the motion of the image and one’s own action, several months before they recognize themselves in a mirror. These findings may suggest that motion–action contingency plays an important role in the development of visual self-recognition, and the mechanism thus developed continues to play a role throughout one’s life.

Introduction

The ability to recognize one’s own visual image has been studied in human infants and animals, having a particular interest in its relationship with self-awareness and the concept of self (Brooks-Gunn and Lewis, 1984; Gallup, 1982). An infant usually starts to show evidence of self-recognition in a mirror in the second year of life (Amsterdam, 1972; Bigelow, 1981; Schulman and Kaplowitz, 1977; for a review, see Anderson, 1984). Except for chimpanzees and orangutans (Gallup, 1970; Gallup et al., 1971; Lethmate and Diëcker, 1973; Suarez and Gallup, 1981), no animals have demonstrated this ability even with extended periods of exposure to a mirror (Gallup, 1982). Infants can visually discriminate their parents from other adults before they recognize themselves (Bigelow, 1981), and animals that do not recognize themselves in a mirror do discriminate peers (Dasser, 1987, 1988); the acquisition of this ability appears to require a special cognitive mechanism.

In a longitudinal study of infants, Bigelow (1981) observed a sequence in the development of visual self-recognition; children recognize themselves in a mirror and live video, in which there is a contingency between the motion of the image and one’s own action, several months before they recognize themselves in a photograph or a recorded video, where there is no such contingency. Biringer and Anderson (1992) demonstrated that patients with dementia show “regression” of visual self-recognition in a sequence opposite to that in its development; the patients lose the ability to recognize their own image first in a recorded video, and then in a mirror. These findings may suggest that motion–action contingency plays an important role in the development of visual self-recognition, and the mechanism thus developed continues to play a role throughout one’s life.

To our knowledge, there is only one report of deficit in face recognition selective to one’s own face in a patient with localized brain damage (Gallos et al., 1988). This patient exhibited alexia and agnosia for colors, objects, and pictures, as well as had difficulty in recognition of her own face, in spite of a normal recognition of familiar faces and apparently possessing a preserved self-concept and autobiographical memory. She had a left posterior cerebral artery infarction, with CT showing occipital and splenial lesions. Two recent studies on the hemispheric dominance of visual self-recognition have presented results that are apparently contradictory (Keenan et al., 2001; Turk et al.,
In both studies, a morphing technique was used to “mix” the subject’s own face and a face of a familiar person and recognition bias in each hemisphere was examined. Keenan et al. (2001) presented a morphed face to presurgical patients undergoing an intracarotid amobarbital (Wada) test and showed that the right and left hemispheres selectively process one’s own face and a famous face, respectively. By measuring the motor-evoked potential induced by transcranial magnetic stimulation of the motor cortex during face presentation, they confirmed the right-hemisphere dominance of self-recognition in normal subjects by showing higher activity in the right hemisphere than in the left hemisphere during self-recognition. On the contrary, however, Turk et al. (2002) presented morphed faces to each visual field of a split-brain patient, and the results showed a recognition bias to one’s own face in the left hemisphere and that to a familiar face in the right hemisphere, apparently suggesting an advantage of the left hemisphere in self-recognition.

To date, two functional imaging studies have been performed on recognition of one’s own face (Kircher et al., 2000; Sugiura et al., 2000). Both studies reported activation of the left fusiform gyrus during the presentation of one’s own face, which is consistent with the possible role of the cortical areas in the left posterior cerebral artery territory in recognition of one’s own face, raised by the neuropsychological report (Gallois et al., 1988). However, their results were far from consistent, although each study reported activation in many areas. There are three flaws common to these two studies. First, both studies were performed on a relatively small number of subjects, which may be problematic when possible interindividual variability in brain mechanisms, particularly on such a sociobehavioral issue as self-recognition, is concerned. Second, neither study paid sufficient attention to the selectivity of activation to one’s own face; at their best, a lack of activation for a single familiar face at a high statistical threshold conservative for false positive was presented. Third, neither study took account of the possible reduction in statistical sensitivity in activation detection in such cortical areas (Sugiura et al., 2001). However, their results were far from consistent, although each study reported activation in many areas. There are three flaws common to these two studies. First, both studies were performed on a relatively small number of subjects, which may be problematic when possible interindividual variability in brain mechanisms, particularly on such a sociobehavioral issue as self-recognition, is concerned. Second, neither study paid sufficient attention to the selectivity of activation to one’s own face; at their best, a lack of activation for a single familiar face at a high statistical threshold conservative for false positive was presented. Third, neither study took account of the possible reduction in statistical sensitivity in activation detection in such cortical areas (Sugiura et al., 2001).

In this functional magnetic resonance imaging (fMRI) study, we examined the cortical mechanisms for recognition of one’s own face, remedying the flaws in the previous functional imaging studies. We compared cortical activation for one’s own face, that for two personally familiar faces with different degrees of familiarity, and that for a prelearned face of an unfamiliar person. Data from 34 subjects were analyzed. To assess the selectivity of activation to one’s own face, activation that can be explained by the difference in familiarity was excluded. In data analysis, we adopted reduction models, which detect a tendency of reduction in the amplitude of responses through repeated recognition of each face (Sugiura et al., 2001) in addition to conventional constant-activation models for the detection of activation.

We expected to reproduce activation in the left fusiform gyrus during recognition of one’s own face. Activation of the occipito-temporo-parietal and posterior frontal cortices, which has been reported in previous functional imaging studies of the observation of one’s own action (Decety et al., 1997; Farrer et al., 2003; Fink et al., 1999; Peigneux et al., 2000; Rizzolotti et al., 1996; Vaina et al., 2001), was possible, considering the likely role of motion-action contingency in visual self-recognition. We were also interested in whether the areas supporting recognition of familiar faces, such as the middle temporal gyrus, temporoparietal junction, parahippocampal gyrus, and posterior cingulate cortex (Gorno-Tempini et al., 1998; Kapur et al., 1995; Leveroni et al., 2000; Sergent et al., 1992; Shah et al., 2001; Sugiura et al., 2001), are activated or not during recognition of one’s own face.

Methods

Subjects

Thirty-four right-handed normal volunteers (26 males and 8 females, aged 18–26 years) comprised the subjects. None had past histories of neurological or psychiatric illness. The handedness was evaluated using the Edinburgh Handedness Inventory (Oldfield, 1971). Written informed consent was obtained from each subject. The study was conducted according to the guidelines of the ethical committee of Tohoku Fukushi University.

Stimuli and task

The faces of each subject, his or her friend, and the first author (MS) were photographed with neutral expression as he or she usually appears at his or her university or work place; some had beards, dyed hair, or wore glasses. Pictures were taken at 15 different angles with the deviation from the camera of 30° and 60° rightward and leftward and a frontal view, each deviated in −30°, 0°, and 30° vertically; faces at different angles were prepared to prevent habituation for the same visual stimuli during repeated presentations (see Sugiura et al., 2001). The background, clothes, and neck were masked in gray using image-processing software. The stimulus set for each subject was composed of six pictures each of the subject’s own face (SELF), a face of the subject’s friend (HLGH), a face of MS (LOW), and a prelearned face of an unfamiliar person (CONT), as well as 12 pictures each of unfamiliar faces of different people. The pictures of the SELF face were horizontally reversed. The CONT face and other unfamiliar faces were chosen from the faces of the other subjects and their friends. Each subject was first acquainted with MS a few weeks (1–4) before the experiment. The familiarization procedure for the CONT face was performed in an MRI scanner before the measurement using five pictures that would not be presented during the experiment. Thirty-six pictures in total were pseudorandomly ordered so that the expected signal changes would not cross correlate between face categories. The visual stimuli were back-projected to a semitranslucent screen attached to a head coil of the MRI scanner, and the subject viewed the stimuli using a mirror. Each picture was presented for 1 s with an 11-s intertrial interval, and each subject was required to press a button as fast as possible with the right index finger when a familiar face, that is, any of the SELF, HIGH, LOW, and CONT faces, was presented.

Data acquisition and image preprocessing

Sixteen transaxial gradient-echo images (echo time = 60 ms, flip angle = 90°, slice thickness = 8 mm, gapless, FOV = 256 mm, matrix = 64 × 64) covering the whole brain were acquired at a...
Data analysis

We excluded data of subjects who failed to respond to any of the familiar faces presented because a face supposedly familiar but to which the subject did not respond could indicate that the subject truly did not recognize or did recognize but was not sufficiently convincing. For each of the four familiar faces (SELF, HIGH, LOW, and CONT), two models of the predicted signal change were tailored convolving hemodynamic response functions provided by SPM99: one for conventional “constant activation” (SELFconst, HIGHconst, LOWconst, and CONTconst), which assumed the same amplitude of activation in every trial for each face; and the other for “activation reduction” (SELFreduc, HIGHreduc, LOWreduc, and CONTreduc), which assumed a linear decrease in response amplitude over the six presentations. In the latter, response amplitude was normalized to the mean of zero; therefore, the model was orthogonal to the constant-activation model. The construction of these two types of model was performed using the parametric modulation module of SPM99. The estimation of the effects for the eight models was performed using a general linear model for each subject, and subtraction analyses were then performed. The difference in the estimated effects was tested across the subjects (random effect model). The activated areas for and between the SELF, HIGH, and LOW faces were identified using constant-activation models, that is, SELFconst–CONTconst, HIGHconst–CONTconst, LOWconst–CONTconst, and HIGHconst–LOWconst. To identify the areas whose activation could not be detected using the constant-activation model due to activation reduction, that is, the mean amplitude of the response did not reach the conservative statistical threshold assuming a search area of the whole brain because of the decreased amplitude of responses in late trials, the effects for the activation–reduction models were compared, that is, SELFreduc–CONTreduc, HIGHreduc–CONTreduc, and LOWreduc–CONTreduc. The activation–reduction model detected the tendency of decrease in the amplitude of responses through repeated recognition rather than the mean amplitude of the responses. Because this model also detects a tendency of increase in deactivation, SELFreduc–CONTreduc, HIGHreduc–CONTreduc, and LOWreduc–CONTreduc were masked with SELFreduc–CONTreduc, HIGHreduc–CONTreduc, and LOWreduc–CONTreduc, respectively, at a region-level threshold ($P < 0.05$, without correction for multiple comparisons), which assures that the response on average was activation rather than deactivation. A statistical threshold in the voxelwise analysis assuming a search area of the whole brain was set at $P < 0.001$ and corrected for multiple comparisons in the cluster size ($P < 0.05$). Correction was not performed for the areas with a priori hypotheses. At each activation peak, significance in all other subtractions was tested at a region-level threshold ($P < 0.05$, without correction for multiple comparisons) to infer specificity.

Results

Behavioral data

The percentage of hits was 100% because the subjects who failed to respond to any of the familiar faces presented were excluded (see Methods section). The percentage of false alarms was $10.3 \pm 12.0\%$. The effect of face categories on mean reaction time was significant (two-way ANOVA, $P < 0.05$). The mean reaction time was significantly longer during recognition of the CONT face than that of the LOW, HIGH, and SELF faces, and that of the LOW face was longer than that of HIGH face (paired $t$ test, $P < 0.05$). The effect of repetition on mean reaction time was also significant (two-way ANOVA, $P < 0.05$), and a tendency for the reaction time to be longer in earlier presentations was evident in all the face categories (Fig. 1).

fMRI data

Significant activation in SELFreduc–CONTreduc is presented in Table 1. Activation selective to the SELF face was observed in the right occipito-temporo-parietal junction and frontal operculum (Fig. 2a) and the left fusiform gyrus (Fig. 2b). The posterior cingulate cortex and parahippocampal gyrus were bilaterally activated, but these areas were also activated during recognition of personally familiar faces (Table 1). There was no significant activation in SELFreduc–CONTreduc.

Significant activation during recognition of familiar faces is presented in Table 2. The left posterior cingulate cortex was activated in LOWconst–CONTconst, as well as in HIGHconst–CONTconst and SELFreduc–CONTconst at a voxel-level threshold, that is, $P < 0.05$ without correction for multiple comparisons (Fig. 3a). The left temporoparietal junction was also activated in LOWconst–CONTconst and HIGHconst–CONTconst at a voxel-level threshold (Fig. 3b). The right temporoparietal junction was activated in HIGHconst–CONTconst and HIGHconst–LOWconst (Fig. 3c). Significant activation detected in terms of activation

![Fig. 1](https://example.com/f1.png)
reduction was observed in the left anterior temporal cortex in HIGHreduc–CONTreduc (Fig. 4).

Discussion

Activation selective to one’s own face was observed in the right occipito-temporo-parietal junction and frontal operculum and in the left fusiform gyrus. Activation in proximity of the occipito-temporo-parietal junction and the frontal operculum has been frequently reported in previous functional imaging studies on the observation of one’s own action (Decety et al., 1997; Farrer et al., 2003; Fink et al., 1999; Peigneux et al., 2000; Rizzolatti et al., 1996; Vaina et al., 2001). The location of the activation peak in the posterior area was particularly close to our results when the action included the movement of the body trunk (Peigneux et al., 2000; Vaina et al., 2001). During a subject’s observation of his or her action, activation in both the posterior (Farrer et al., 2003) and anterior (Fink et al., 1999) areas in the right hemisphere was enhanced when the presented visual image was experimentally modulated, that is, when there was motion–action contingency.

These two activated areas thus appear to constitute a network processing motion–action contingency, consistent with the likely role of motion–action contingency in visual self-recognition suggested in previous behavioral studies (Biringer and Anderson, 1992; Bigelow, 1981). The left fusiform gyrus was activated in both of the previous functional imaging studies on recognition of one’s own face (Kircher et al., 2000; Sugiura et al., 2000). The role of the left fusiform gyrus in visual self-recognition thus postulated is consistent with a case report of impaired visual self-recognition (Gallois et al., 1988).

It was also striking that some areas activated during recognition of other familiar faces was not activated during recognition of one’s own face. The only region activated during face recognition for both familiar people and self was the left posterior cingulate cortex, whose relationship with person familiarity has been suggested by a previous functional imaging study (Shah et al., 2001). The temporoparietal junction was activated both for the HIGH and LOW faces in the left hemisphere and only for the HIGH face in the right hemisphere. These results are consistent with those of previous studies on recognition of famous faces.

Table 1

<table>
<thead>
<tr>
<th>Structure</th>
<th>Talairach coordinates (x, y, z)</th>
<th>t value</th>
<th>Cluster size (mm^3)</th>
<th>Activation for other faces</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. occipito-temporo-parietal junction</td>
<td>38, −78, 24</td>
<td>5.11</td>
<td>4128</td>
<td>none</td>
</tr>
<tr>
<td>R. frontal operculum</td>
<td>44, 8, 12</td>
<td>5.43</td>
<td>5512</td>
<td>none</td>
</tr>
<tr>
<td>L. fusiform gyrus</td>
<td>−42, −54, −18</td>
<td>5.06</td>
<td>22320*</td>
<td>LOWconst–CONTconst, HIGHconst–CONTconst</td>
</tr>
<tr>
<td>L. posterior cingulate cortex/parahippocampal gyrus</td>
<td>−16, −52, 2</td>
<td>4.51</td>
<td>*</td>
<td>LOWconst–CONTconst</td>
</tr>
<tr>
<td>R. posterior cingulate cortex/parahippocampal gyrus</td>
<td>20, −44, 2</td>
<td>4.50</td>
<td>*</td>
<td>LOWconst–CONTconst</td>
</tr>
<tr>
<td>Midbrain</td>
<td>14, −32, −6</td>
<td>5.97</td>
<td>*</td>
<td>HIGHconst–CONTconst, HIGHconst–LOWconst</td>
</tr>
</tbody>
</table>

Fig. 2. Activation during recognition selective to one’s own face. Activation is superimposed onto the horizontal slices of the mean normalized T1-weighted MRI of all the subjects. Slices 18 mm (a, top-center) and −18 mm (b, bottom-center) above the AC-PC plane, as illustrated in the top-left panel, are shown. Activation profile at the peak for each of the three activated areas is presented: the mean of the parameter estimates (arbitrary unit) and its standard error (error bar) are shown for each of LOWconst–CONTconst, HIGHconst–CONTconst, and SELFconst–CONTconst (CONTconst was regarded as the baseline).
(Gorno-Tempini et al., 1998; Leveroni et al., 2000), however, apparently contradictory with a naive assumption that one’s own face should be very familiar because he or she has been seeing it frequently for a long time. Activation detected as a significant reduction in activation was identified only for the HIGH face in the left anterior temporal cortex, replicating a previous study (Sugiura et al., 2001). Although this activation was considered to imply an important role of this area in person identification (Sugiura et al., 2001), activation in this area for the SELF face was negative compared with the baseline, that is, it was lower than for the CONT face. These results suggest that recognition of one’s own face and that of familiar faces partly depend on discrete cortical networks. One possible explanation for the lack of activation for one’s own face in the areas activated for the familiar faces is that such areas represent the name of a person; covert naming often accompanies recognition of a familiar face, but rarely occurs during visual self-recognition.

The results of our study reconcile the controversy in the hemispheric dominancy of visual self-recognition raised by two recent studies (Keenan et al., 2001; Turk et al., 2002). Because the Wada test mainly anesthetizes areas in the middle cerebral artery territory, the procedure adopted by Keenan et al. (2001) must have affected the right occipito-temporo-parietal junction and frontal operculum, but not the left fusiform gyrus, which is in the posterior cerebral artery territory. In addition, it is highly likely that the results were affected by the anesthesia of the left temporoparietal junction and anterior temporal cortex, which are responsible for the recognition of familiar faces. The measurement technique used in their second experiment is mainly sensitive to the excitability of the corticospinal motor system. The results therefore should reasonably have reflected the activity of the right-hemisphere network that processes motion-action contingency, which partially overlaps with the motor system. Similarly, it now appears no longer meaningful to draw a left-hemisphere advantage from the results of the study by Turk et al. (2002). In each stimulus used in their experiment, there was a competition between self and a familiar face; therefore, what was compared between the hemispheres was the balance of sensitivity between the network for self-recognition and that for recognition of a familiar face rather than the sensitivity of the network for self-recognition per se. This fact should now be emphasized considering the marked difference in the organization of face recognition networks for both one’s own face and familiar faces between the hemispheres. The results of their study imply the ability to recognize both one’s own face and familiar faces in each hemisphere, but with different underlying mechanisms between the hemispheres, as illustrated in this study.

One may doubt the participation of the right-hemisphere mechanism for processing of motion-action contingency during recognition of a static face. It has, however, been established in the studies of the tool observation (Chao and Martin, 2000; Handy et

Table 2

<table>
<thead>
<tr>
<th>Structure</th>
<th>HIGHconst–CONTconst</th>
<th>LOWconst–CONTconst</th>
<th>HIGHconst–LOWconst</th>
<th>HIGHreduc–CONTreduc</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. posterior cingulate cortex</td>
<td>–12, –50, 14 (4.52, 3608)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L. temporoparietal junction</td>
<td>–50, –56, 12 (6.51, 4048)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. temporoparietal junction</td>
<td>56, –60, 12 (3.51, 64)</td>
<td></td>
<td>52, –44, 18 (3.81, 680)</td>
<td></td>
</tr>
<tr>
<td>L. anterior temporal cortex</td>
<td>–48, 4, –32 (4.19, 528)</td>
<td></td>
<td></td>
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</tbody>
</table>

Talairach coordinates, as well as \( t \) value of peak activation and cluster size (mm\(^3\)) in parentheses, are shown for each of HIGHconst–CONTconst, LOWconst–CONTconst, HIGHconst–LOWconst, and HIGHreduc–CONTreduc. R.: right, L.: left.
al., 2003) and recognition of daily objects (Sugiura et al., 2004) that visual perception of an object carrying a specific motor program as an attribute activates the network for the sensorimotor transformation without intention of manipulating it. Considering the developmental process of visual self-recognition, which is at the beginning triggered by motion–action contingency in the mirror reflection, there is no reason to doubt that an image of one’s own face carries such a sensorimotor attribute.

Contrary to the likely relationship of the right-hemispheric network with motion–action contingency, the precise role of the left fusiform gyrus in visual self-recognition is unknown. It is interesting to note that the major deficit of the patient with impaired visual self-recognition reported by Gallois et al. (1988) was alexia and that the left fusiform gyrus has been considered to play an important role in lexical processing (Cohen et al., 2000; Simons et al., 2003). Although the fusiform gyrus occupies a considerable extent of the ventral occipitotemporal cortex, the location of the activation peak in this study closely corresponded to that of the area postulated to support lexical processing (Cohen et al., 2000; Simons et al., 2003). Although it is possible that the functional unit for lexical processing and that for self-recognition separately exist in this area, it is also reasonable to assume that the visual self-recognition share a neural mechanism with lexical processing. One’s own face is likely to share some properties with written words; one’s own face is unique and carries considerable sociobehavioral significance free from specific episodes, which is in contrast with other familiar faces. On the other hand, it may also be possible to assume that the left fusiform gyrus plays a role not only in lexical processing but also in semantic processing related to the concept of “self.” It is noteworthy that the left fusiform gyrus was activated during decision about psychological trait adjectives describing their own attributes (Kircher et al., 2000).

The results that cortical areas selectively supporting visual self-recognition exist in both the hemispheres are reasonably followed by a question how these areas cooperate or interact each other. Although the fact that the split-brain patient recognizes his own face presented to either visual field (Turk et al., 2002) suggests that the self-recognition mechanism in each hemisphere can independently function, there is no evidence that it is also the case in normal subjects. The effect of the visual field, the attribute of the self-image that each mechanism responds, and functional connectivity between the areas are the issues that have to be addressed in future studies.

One may suppose the areas selectively involved in visual self-recognition to play a role in self-awareness or sense of self. We are, however, cautious of associating the visual self-recognition with a general concept of self. Phillips et al. (1996) reported a case of a patient with probable Alzheimer’s disease, who insisted that her own mirror reflection was her friend, although she used a mirror when washing and grooming, which behavior is regarded as a sign of self-recognition in animal and infant studies. We consider that as far as the cognitive neuroscience is concerned, the concept of self should be regarded as dependent on cognitive domain and the context where the self or other differentiation is required.

Technical consideration regarding the sample size may be necessary. Although we included a larger number of subjects compared with those used in conventional fMRI studies, the number of trials for each face category in each subject was six, which is small and may yield a large variance in parameter estimates. In the two-level fMRI experimental design, there is a trade-off between the number of subjects and number of scans per subject (Friston et al., 2002), and the former has a larger impact on statistical power than the latter as far as the range of parameters dealt with in fMRI studies is concerned (Desmond and Glover, 2002). Therefore, it seems reasonable to consider that the statistical power of our experiment was better than that of a similar experiment with a sample size of four times larger numbers of trials and scans (24 trials during 864 scans) and four times smaller number of subjects (8.5 subjects) than those in the current study, which is in the range of a conventional sample size.

In summary, the right occipito-temporo-parietal junction and frontal operculum were activated selectively to one’s own face and considered to compose a network processing motion–action contingency, the role of which in visual self-recognition has been suggested in previous behavioral studies. Activation selective to one’s own face in the left fusiform gyrus was consistent with the results of two previous functional imaging studies, and a neuro-psychological report, possibly implying the relationship between visual self-recognition and lexical processing. Several areas activated during recognition of personally familiar faces, such as the temporoparietal junction and anterior temporal cortex, were not activated during recognition of one’s own face, suggesting that recognition of one’s own face and that of familiar faces partly depend on discrete cortical mechanisms.

Acknowledgments

We would like to thank Ms. Y. Satoh for operating the MRI scanner and Mr. A. Harada and Mr. K. Satoh for support in data analysis. This study was supported by the JST/RISTEX, R&D promotion scheme for regional proposals promoted by TAO, a Grant-in-Aid for Scientific Research on Priority areas (C)—Advanced Brain Science Project—from MEXT, and the 21st Century Center of Excellence (COE) Program (Ministry of Education, Culture, Sports, Science and Technology) entitled “A Strategic Research and Education Center for an Integrated Approach to Language and Cognition” (Tohoku University).

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