Brain Activations during Judgments of Positive Self-conscious Emotion and Positive Basic Emotion: Pride and Joy

Introduction

Although there have been numerous neuroimaging studies on basic emotions (fear, disgust, happiness, and sadness) that have led to a better understanding of the neuroanatomical correlates of emotions (Lane et al. 1997; Phan et al. 2002), only a few studies on complex social emotions such as guilt, embarrassment, and jealousy have been reported (Shin et al. 2000; Berthoz et al. 2002; Takahashi et al. 2004; 2006).

We previously examined brain activation associated with negative self-conscious emotions, guilt, and embarrassment (Takahashi et al. 2004). Self-conscious emotions are founded in social relationship and arise from concerns about others' evaluations of self (Eisenberg 2000; Tangney and Dearing 2002, Haidt 2003; Kalat and Shiota 2006). In other words, one needs the ability to represent the mental states of others, that is, theory of mind (ToM), to recognize self-conscious emotions. Negative evaluation of self or the behavior of self is fundamental to guilt and embarrassment, whereas positive evaluation of self leads to the emotion of pride. Negative self-conscious emotions promote moral behavior and interpersonal etiquette (Eisenberg 2000; Haidt 2003). Impairment of processing these emotions could lead to amoral, socially inappropriate behaviors observed in neuropsychiatric disorders (Beer et al. 2003; Miller et al. 2003; Sturm et al. 2006).

Supporting the notion that self-conscious emotions involve inferences about others' evaluation of self (Leary 2007), judgment of guilt and embarrassment produced activations in the medial prefrontal cortex (MPFC), posterior superior temporal sulcus (pSTS), and temporal poles (Takahashi et al. 2004; Kalat and Shiota 2006), the regions implicated in ToM, social cognition (Adolphs 2001; Calarge et al. 2003; Frith U and Frith CD 2003; Gallagher and Frith 2003), and moral judgment (Greene and Haidt 2002; Moll et al. 2005).

In contrast, a positive self-conscious emotion, pride has been largely unstudied by researchers. Pride refers to self-esteem, joy, or pleasure derived from achievements. It arises when people believe that they are responsible for desired outcomes (Leary 2007). As a self-conscious emotion, pride also drives people to behave in moral, socially appropriate ways (Tracy and Robins 2004a). Specifically, the “achievement-oriented” form of pride promotes prosocial behaviors, such as caregiving and achievement (Tracy and Robins 2004b). However, the hubristic form of pride could be maladaptive, and impairment of processing pride could be related to some psychiatric disorders. Narcissistic personality disorder is characterized by a grandiose sense of self-importance and lack of empathy (American Psychiatric Association 1994). It was reported that empathy and ToM rely on common networks, the MPFC, pSTS, and temporal poles (Vollm et al. 2006). Therefore, the hubristic form of pride could be regarded as a dysfunction of ToM. Affective disorder could also be linked to impairment of the processing of pride. Manic state is a condition with inflated self-esteem, whereas depressive episode could be a condition with low self-esteem (American Psychiatric Association 1994). Studying the neural substrates associated with pride should add to the understanding of the neural basis of these neuropsychiatric disorders.

We aimed to measure brain activations associated with the judgment of pride by showing scenarios, comparing them with brain activations associated with the primary positive emotion, joy, using functional magnetic resonance imaging (fMRI). We hypothesized that joy and pride conditions would show different brain activation patterns, and specifically, that joy condition would activate brain regions involved in hedonic processing, for example, the ventral striatum (Mobbs et al. 2003, 2005; Britton et al. 2006), whereas pride condition would activate the brain regions involved in social cognition (Adolphs 2001) or ToM (Calarge et al. 2003; Frith U and Frith CD 2003; Gallagher and Frith 2003), for example, MPFC, pSTS, and temporal poles.

Keywords: medial prefrontal cortex, positive emotions, pride, superior temporal sulcus, theory of mind, ventral striatum

We aimed to investigate the neural correlates associated with judgments of a positive self-conscious emotion, pride, and elucidate the difference between pride and a basic positive emotion, joy, at the neural basis level using functional magnetic resonance imaging. Study of the neural basis associated with pride might contribute to a better understanding of the pride-related behaviors observed in neuropsychiatric disorders. Sixteen healthy volunteers were studied. The participants read sentences expressing joy or pride contents during the scans. Pride conditions activated the right posterior superior temporal sulcus and left temporal pole, the regions implicated in the neural substrate of social cognition or theory of mind. However, against our prediction, we did not find brain activation in the ventral striatum and insula/operculum, the key nodes of processing of hedonic or appetitive stimuli. Our results support the idea that pride is a self-conscious emotion, requiring the ability to detect the intention of others. At the same time, judgment of pride might require less self-reflection compared with those of negative self-conscious emotions such as guilt or embarrassment.

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Materials and Methods

Participants
Sixteen healthy right-handed Japanese university students (8 men, mean age 21.5 years, standard deviation [SD] = 2.2; 8 women, mean age 21.3 years, SD = 1.3) were studied. Their mean educational achievement level was 14.4 years (SD = 1.3). They did not meet any criteria for psychiatric disorders. None of the controls were taking alcohol or medication at the time nor did they have a history of psychiatric disorder, significant physical illness, head injury, neurological disorder, or alcohol or drug dependence. All subjects underwent an MRI to rule out cerebral anatomic abnormalities. After complete explanation of the study, written informed consent was obtained from all subjects, and the study was approved by the Ethics Committee.

Materials
Three types of short sentences were provided (neutral, joy, and pride). Each sentence was written in Japanese and in the first person, past tense. Each sentence was expected to express joy, pride, or no prominent emotional content. We used joyful scenarios depicting hedonic, appetitive, and survival events like eating, reproduction, and economic behaviors because these stimuli are thought to be directly related to “basic” positive emotional processing. For most of the pride sentences, we used scenarios in which the protagonist was a winner of a prize or competition as a result of achievement. In order to validate our expected results, we conducted an initial survey. Other university students (20 men and 20 women, mean age 22.5 years, SD = 3.3) than the subjects participating in this fMRI study were screened. We prepared 28–32 sentences for each of 3 conditions (neutral, joy, and pride). The described situations were rated according to how joyful or proud they were using a 7-point analog scale (0 = none, 6 = extremely intense). Based on the initial survey, we selected 18 sentences for each of the 3 conditions. The selected joy sentences were judged to express joy. The mean rating of joy was 4.3 (SD = 0.5). The selected pride sentences were judged to express pride. The mean rating of pride was 4.5 (SD = 0.3). The neutral sentences were judged to express virtually no joy or pride. The mean ratings of joy and pride for neutral sentences were 0.7 (SD = 0.3) and 0.4 (SD = 0.2), respectively. Examples of the sentences are shown in Table 1. The sentences were projected via a computer and a telephoto lens onto a screen mounted on a head coil. The subjects were instructed to read the sentences silently and were told to imagine that the scenario protagonist was himself/herself. They were also told that they should rate the sentences according to how joyful or pride instilling the situations were. After reading each sentence, the subjects were instructed to press a selection button with the right index finger, indicating that they had read and understood it. The experimental design consisted of 6 blocks for each of the 3 conditions (neutral, joy, and pride) interleaved with 20-s rest periods. The order of presentation for the 3 conditions was randomized. During the rest condition, participants viewed a crosshair pattern projected to the center of the screen. In each 24-s block, 3 different sentences of the same emotional class were presented for 8 s each. After the scan, the subjects read the sentences presented during the scan, and they were asked to rate the sentences according to how they would feel if the scenario protagonist were himself/herself. The participants rated the intensity of joy, pride, and other emotions (anger, sadness, fear, disgust, and shame) for each sentence using a 7-point analog scale.

Table 1

Examples of sentences

<table>
<thead>
<tr>
<th>Category</th>
<th>Sentences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutral</td>
<td>I took a class at the college.</td>
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<tr>
<td></td>
<td>I had breakfast.</td>
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<td></td>
<td>I watched the Olympics on TV.</td>
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<td></td>
<td>I recorded a baseball game on video tape.</td>
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<tr>
<td></td>
<td>I prepared for an examination.</td>
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<tr>
<td></td>
<td>I went to school yesterday.</td>
</tr>
<tr>
<td></td>
<td>I watched sports news on TV.</td>
</tr>
<tr>
<td></td>
<td>I bought a medicine for cold.</td>
</tr>
<tr>
<td>Joy</td>
<td>I won a lottery.</td>
</tr>
<tr>
<td></td>
<td>I won at gambling at a casino.</td>
</tr>
<tr>
<td></td>
<td>I ate my favorite cake.</td>
</tr>
<tr>
<td></td>
<td>I had a date with my girl/boy friend.</td>
</tr>
<tr>
<td></td>
<td>I had a delicious dinner.</td>
</tr>
<tr>
<td></td>
<td>I received a Christmas present.</td>
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<tr>
<td></td>
<td>I went to Hawaii with my friends.</td>
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<tr>
<td></td>
<td>I was gifted with a bouquet on my birthday.</td>
</tr>
<tr>
<td></td>
<td>I was awarded a prize for my novel.</td>
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<tr>
<td>Pride</td>
<td>I won the championship in a golf tournament.</td>
</tr>
<tr>
<td></td>
<td>I got a perfect score in mathematics.</td>
</tr>
<tr>
<td></td>
<td>I graduated at the head of my class.</td>
</tr>
<tr>
<td></td>
<td>I won the first prize in a piano contest.</td>
</tr>
<tr>
<td></td>
<td>I graduated from the most prestigious university.</td>
</tr>
<tr>
<td></td>
<td>I obtained a scholarship.</td>
</tr>
<tr>
<td></td>
<td>I won a prize at a scientific meeting.</td>
</tr>
</tbody>
</table>

Images Acquisition
Images were acquired with a 1.5-Tesla Signa system (General Electric, Milwaukee, WI). Functional images of 203 volumes were acquired with T₁-weighted gradient echo planar imaging sequences sensitive to blood oxygenation level-dependent contrast. Each volume consisted of 40 transaxial contiguous slices with a slice thickness of 3 mm to cover almost the whole brain (flip angle, 90°; time echo [TE], 50 ms; time repetition [TR], 4 s; matrix, 64 × 64; field of view, 24 × 24 cm). High-resolution, T₁-weighted anatomic images were acquired for anatomic comparison (124 contiguous axial slices, 3-dimensional [3D] spoiled Grass sequence, slice thickness 1.5 mm, TE, 9 ms; TR, 22 ms; flip angle, 30°; matrix, 256 × 192; field of view, 25 × 25 cm).

Analysis of Functional Imaging Data
Analysis of functional imaging data was performed with statistical parametric mapping software package (SPM02) (Wellcome Department of Cognitive Neurology, London, UK) running with MATLAB (Mathworks, Natick, MA). All volumes were realigned to the first volume of each session to correct for subject motion and were spatially normalized to the standard space defined by the Montreal Neurological Institute template. After normalization, all scans had a resolution of 2 × 2 × 2 mm^3. Functional images were spatially smoothed with a 3D isotropic Gaussian kernel (full width at half maximum of 8 mm). Low-frequency noise was removed by applying a high-pass filter (cutoff period = 192 s) to the fMRI time series at each voxel. A temporal smoothing function was applied to the fMRI time series to enhance the temporal signal-to-noise ratio. Significant hemodynamic changes for each condition were examined using the general linear model with boxcar functions convoluted with a hemodynamic response function. Statistical parametric maps for each condition for the 3 conditions was randomized. During the rest condition, participants viewed a crosshair pattern projected to the center of the screen. The statistical threshold of P < 0.05 corrected for multiple comparisons across the whole-brain was used, except for a priori hypothesized regions, which were thresholded at P < 0.0005 uncorrected (only clusters involving 10 or more contiguous voxels are reported). These a priori regions of interest included the ToM-related regions (MPFC, pSTS, and temporal poles), reward/food-related regions (striatum, insula, and orbitofrontal cortex), and emotion-related limbic regions (amygdalohippocampal regions and anterior cingulate cortex). We conducted regression analyses to demonstrate a more direct link between regional brain activities with the subjective judgments of joy and pride. Using the mean of the ratings of joy and pride for each subject as the covariate, regression analyses with the contrasts (J-N and P-N) and the covariate were done at the second level (height threshold at P < 0.001, uncorrected, and extent threshold of 5 voxels). The masks of J-N and P-N contrasts from one-sample t-test (P < 0.001) were applied to confine the regions where significant activations were observed. Using
the effect sizes, representing the percent signal changes, of the contrasts (J-N and P-N) at the peak coordinates uncovered in the regression analyses, we plotted the fMRI signal changes and ratings of joy and pride.

Results

Self-rating

The neutral sentences were judged as carrying no prominent emotions. The mean ratings of joy and pride for neutral sentences were, respectively, 0.7 (SD = 0.7) and 0.4 (SD = 0.4), for joy sentences 4.9 (SD = 0.7) and 1.1 (SD = 1.1), and for pride 4.1 (SD = 0.9) and 4.9 (SD = 0.6). Ratings of other emotions (anger, sadness, fear, disgust, and shame) were virtually zero. Although pride sentences were judged as containing joy, their mean ratings of pride were significantly greater than those of joy (t = 2.9, degrees of freedom [df] = 30, P = 0.007). The mean ratings of joy were significantly greater for joy sentences than for pride sentences (t = 2.9, df = 30, P = 0.007).

fMRI Result

Pride condition relative to neutral condition (P-N) produced greater activations in the right pSTS, left temporal pole (Table 2 and Fig. 1A). We did not find significant activation in the MPFC. Joy condition relative to neutral condition (J-N) produced greater activations in the ventral striatum including the nucleus accumbens, anterior cingulate cortex, hippocampal regions, and insula/operculum (Table 2 and Fig. 1B). P-J condition produced greater activations in the right pSTS (x = 42, y = −66, z = 22; t = 7.39; 92 voxels). A conjunction analysis of P-N and J-N contrasts revealed no significant activations.

Regression analyses revealed positive linear correlations between the self-rating of pride and the degree of activation in the pSTS (middle temporal gyrus, x = 44, y = −66, z = 20; t = 5.25; 14 voxels) (Figs 2A and 3A). There were positive linear correlations between the self-rating of joy and the degree of activation in the ventral striatum (nucleus accumbens, x = −12, y = 2, z = −6; t = 6.26; 6 voxels) (Figs 2B and 3B).

Discussion

This study demonstrated that the brain activations during judgments of the positive self-conscious emotion, pride, showed different patterns from those of the basic positive emotion, joy. Pride conditions relative to neutral condition produced greater activity in the right pSTS and left temporal pole, the components of neural substrates of social cognition or ToM (Allison et al. 2000; Adolphs et al. 2001; Frith U and Frith CD 2003; Gallagher and Frith 2003; Moll et al. 2005). In contrast, joy conditions relative to neutral condition produced greater activity in the key nodes of processing hedonic and appetitive stimuli, the ventral striatum including the nucleus accumbens (Breiter and Rosen 1999; Salamone et al. 2003; Cardinal and Everitt 2004) and insula/operculum (Britton et al. 2006; Porubská et al. 2006; Rolls 2006). In addition, regression analyses showed that the subjective ratings of pride and joy correlated with the degrees of activation in the pSTS and ventral striatum, respectively.

Pride, by definition, is subsumed by basic emotion, joy (Tracy and Robins 2004a). In fact, our behavioral rating results showed that ratings of joy for pride sentences were high, although they were lower for pride sentences than for joy sentences. Therefore, it was expected that activations in the regions related to basic emotions, for example, the ventral striatum, might be observed. However, significant activation in such regions was not found, and the conjunction analysis of P-N and J-N did not find common activation in these regions, suggesting that joy derived from pride scenarios was not high enough to activate these regions. We used joyful scenarios containing hedonic and appetitive events that usually motivate biological behaviors like eating, reproduction, and economic behaviors. The mesolimbic dopamine system from the ventral tegmental area to the nucleus accumbens mediates the motivation to obtain reward. In other words, dopamine systems are more necessary for “wanting” incentives than for “liking” them (Berridge and Robinson 1998). Motivational processes are important for positive emotions such as happiness and joy (Lyubomirsky 2001). In an fMRI environment, it is difficult to induce liking, but participants might have felt “wanting” for reward such as money or food, leading to activation in the ventral striatum (Breiter and Rosen 1999; Salamone et al. 2003; Cardinal and Everitt 2004). In contrast, although pride sentences were articulated as joyful, their lack of hedonic contents might account for the lack of activation in such regions.

Table 2

<table>
<thead>
<tr>
<th>Brain regions</th>
<th>L/R</th>
<th>Coordinates x</th>
<th>y</th>
<th>z</th>
<th>t-score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pride-neutral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>pSTS</td>
<td>R</td>
<td>42</td>
<td>−66</td>
<td>20</td>
<td>4.30</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>−50</td>
<td>20</td>
<td>−24</td>
<td>4.62</td>
</tr>
<tr>
<td>Joy-neutral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ventral striatum</td>
<td>R</td>
<td>4</td>
<td>4</td>
<td>−6</td>
<td>4.5</td>
</tr>
<tr>
<td>Anterior cingulate cortex</td>
<td>L</td>
<td>−6</td>
<td>38</td>
<td>12</td>
<td>4.6</td>
</tr>
<tr>
<td>Hippocampal regions</td>
<td>L/R</td>
<td>−32</td>
<td>−16</td>
<td>−18</td>
<td>4.94</td>
</tr>
<tr>
<td>Insula/operculum</td>
<td>L/R</td>
<td>40</td>
<td>−28</td>
<td>18</td>
<td>5.39</td>
</tr>
</tbody>
</table>

Note: L, left; R, right. Coordinates and t-score refer to the peak of each brain region.

Figure 1. Images showing brain activation in joy and pride conditions relative to neutral condition. (A) Pride minus neutral. Activated regions were in the right posterior SFS and left temporal pole. (B) Joy minus neutral. Activations in the ventral striatum, insula/operculum, and anterior cingulate were shown. Significant differences were recognized at a height threshold (t > 4.07; P < 0.0005, uncorrected) and extent threshold (10 voxels).
Furthermore, as discussed below, unfamiliarity with some events depicted in pride scenarios might attenuate wanting for such events.

Our previous study has shown activation in the 3 key regions of ToM, the MPFC, pSTS, and temporal poles (Frith U and Frith CD 2003; Gallagher and Frith 2003) during the evaluative process of negative self-conscious emotions such as guilt and embarrassment (Takahashi et al. 2004). In addition, a recent clinical study reported that patients with frontotemporal lobar degeneration had impaired processing of negative self-conscious emotions (Sturm et al. 2006). Therefore, we expected that a positive self-conscious emotion would also recruit these regions. Although activations in the pSTS and temporal poles by pride scenarios were in agreement with our prediction, in disagreement was the lack of significant activation in the MPFC.

Although the precise roles of these 3 regions remain unclear, it was suggested that the pSTS and temporal poles are more concerned with the nature of socially relevant stimuli (Gallagher and Frith 2003; Decety and Grezes 2006). In other words, these regions are involved mainly in the early stage of social cognition, initial appraisal of socially relevant stimuli that support ToM ability, but not in ToM reasoning per se (Frith U and Frith CD 2003; Gallagher and Frith 2003).

Originally, the STS was known to be activated by biological motions such as movement of eyes, mouth, hands, and body (Allison et al. 2000), and it has been suggested to have a more general function in social cognition such as detecting explicit behavioral information that signals the intention of others (Gallagher and Frith 2003) and behavior of agents (Frith U and Frith CD 2003). The higher order association cortices including the pSTS mature in the last stage of brain development (Gogtay et al. 2004), and this might be associated with the fact that, like all self-conscious emotions, pride emerges later in the course of development than basic emotions like fear and joy (Tracy and Robins 2007). In addition, impairments in recognizing self-conscious emotions have been reported in children with autism (Capps et al. 1992; Kasari et al. 1993), in which STS abnormalities are highly implicated (Zilbovicius et al. 2006).

Bilateral temporal poles with greater effect on the left side have also been consistently recruited during ToM task (Calarge et al. 2003; Frith U and Frith CD 2003; Gallagher and Frith 2003). Although the left temporal pole contributes to the composition of sentence meaning (Vandenberghe et al. 2002), the temporal pole activation in P-N condition cannot simply be attributed to the use of sentences because neutral stimuli also require sentence comprehension. The temporal poles are generally engaged in retrieving episodic memories such as emotional and autobiographical memory (Fink et al. 1996; Dolan et al. 2000; Sugiura et al. 2006). In ToM task, the retrieval of episodic memories enables us to understand and simulate the mental state of others (Gallagher and Frith 2003). This role of memory process in understanding others’ mental state might result in activation in the temporal pole in the P-N condition. Additionally, a recent study has suggested that this region is involved in storage and recall of contextual information (Mobbs et al. 2006).

Because the subjects might not have direct experience of all the pride scenarios, the activation in the temporal pole may suggest that the subjects were reminded of contextual information of themselves or others (e.g., famous person) associated with pride scenarios (Mobbs et al. 2006; Sugiura et al. 2006).

The MPFC appears to be responsible for ToM reasoning or mentalizing, the ability to represent others’ perspective (Frith U and Frith CD 2003; Gallagher and Frith 2003; Amadio and Frith 2006). This ability allows us to infer the cause of others’ behavior, attribution. Previous studies have shown activation in the MPFC during judgments made on the basis of attributional information (Amadio and Frith 2006), and it is suggested that the MPFC is activated when cues that have been processed in an early stage of social cognition are used in a particular way, that is, to infer the intention (Gallagher and Frith 2003; Ochsner 2004) and emotional state (Aichhorn et al. 2006) of others. The lack of activation in the MPFC might stem from pride scenarios such as used in the present study. Most pride scenarios described situations in which the protagonist was a winner of a prize or competition as a result of achievement. Winning a prize or competition, by definition, is a symbol that inevitably indicates others’ positive evaluations or judgments for one’s own achievement. Therefore, in order to detect how one is evaluated by others in these situations, one might have less necessity to “infer” the mental state of others by using cues that have been processed in the early stage of social cognition. Another explanation for the lack of significant activation in the MPFC during judgments of pride might be possible. The argument regarding the role of the MPFC in ToM is mainly based on classical, explicit ToM tasks that usually used false belief stories (Frith U and Frith CD 2003; Gallagher and Frith 2003), whereas our task was an implicit ToM task in which the subjects were not explicitly instructed to represent the mental state of others, and the pSTS rather than MPFC plays a more
central role (Saxe and Kanwisher 2003). A body of psychological studies has demonstrated that people have self-positivity biases, tendencies to have a positive attitude toward self. People tend to accept responsibility for desired outcomes but to attribute negative events to external causes (Greenwald and Banaji 1995; Leary 2007). Self-positivity biases are known to operate implicitly and automatically without conscious reflection (Greenwald and Banaji 1995; Leary 2007). The MPFC is a key node of a neural system subserving explicit reflection of self (Johnson et al. 2002). Therefore, the subjects might have judged some scenarios as pride ones without elaborate self-reflection.

This study has some limitations. First, as mentioned above, a complex self-conscious emotion could be accompanied by basic emotion. Although we understand that it is not feasible to assess a “pure” form of emotion, the results of regression analysis tell us that brain activations during pride condition could not simply be accounted for by the accompanying emotion. Second, self-conscious emotions depend on society and culture (Haidt 2003). The social background of participants, such as generation, religion, and education, could be confounding factors. For example, there are some empirical studies to support the traditional view that Japanese culture is collectivistic, putting a premium on social harmony, whereas Northern American culture is individualistic, highlighting personal achievement (Kitayama et al. 2006). At the same time, individualism is increasing in contemporary Japanese society especially among the young generation (Cusick 2007). Therefore, examining the effect of generations on self-conscious emotions would be an interesting future theme, and any generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalize of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to generalization of our findings needs to be approached with caution. Finally, self-conscious emotions are more difficult to

In conclusion, we investigated the neural substrates of judgments of a positive self-conscious emotion and demonstrated a difference from those of a basic positive emotion at a neural basis level. Supporting the concept that pride could be regarded as a member of the self-conscious emotions family, judgments of pride produced activation in the components of neural substrates implicated in social cognition or ToM. At the same time, judgment of pride might require less self-reflection compared with those of negative self-conscious emotions such as guilt or embarrassment. We expect our findings regarding joy and pride to have broad implications for the neural basis of some neuro-psychiatric disorders such as depression or schizophrenia characterized by anhedonia and narcissistic personality or affective disorder, characterized by inappropriate pride, respectively.

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Notes
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