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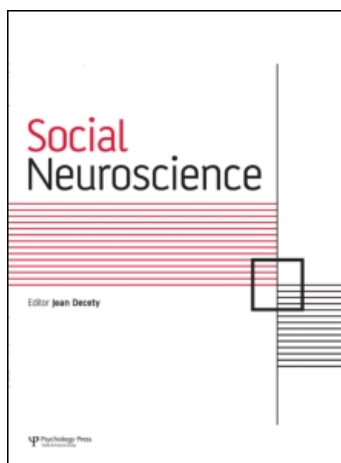
Social Neuroscience

Is it about the self or the significance? An fMRI study of self-name recognition

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Our own name, due to its high social relevance, is supposed to have a unique status in our information processing. However, demonstrating this phenomenon empirically proves difficult as famous and unknown names, to which self-name is often compared in the studies, may differ from self-name not only in terms of the 'me vs. not-me' distinction, but also as regards their emotional content and frequency of occurrence in everyday life. In this fMRI study, apart from famous and unknown names we used the names of the most important persons in our subjects' lives. When compared to famous or unknown names recognition, self-name recognition was associated with robust activations in widely distributed bilateral network including fronto-temporal, limbic and subcortical structures, however, when compared to significant other's name, the activations were present specifically in the right inferior frontal gyrus. In addition, the significant other's name produced a similar pattern of activations to the one activated by self-name. These results suggest that the differences between own and other's name processing may rather be quantitative than qualitative in nature.

Keywords: Self-recognition; Social cognition; Right inferior frontal gyrus; fMRI.

INTRODUCTION

Many recent studies in cognitive neuroscience have focused on the issue of how the brain gives rise to the sense of "self". Much of this work concentrated on self-recognition as an ability necessary for developing more complex forms of self-awareness (Zeman, 2005). Self-recognition may be based on different kinds of self-related cues, such as images of one's face (see Platek, Wathne, Tierney, & Thomson, 2008 for review), body (see Peelen & Downing, 2007 for review) or personal belongings (Miyakoshi, Nomura, & Ohira, 2006). However, apart from such tangible representations of themselves, people also have more

abstract means of self-differentiation, such as their names.

There is evidence suggesting that self-name is very closely attached to the inner sense of "self." For example, across cultures the state of namelessness is considered equal to having no honor or identity (Watson, 1986), whereas changing one's name is associated with identity change (Kang, 1972). Wentura, Kulfalnek, and Greve (2001), in turn, subliminally primed people with either their own initials or yoked participants' initials. Priming people's initials facilitated their categorization of positive as opposed to negative words. This effect was especially pronounced for participants with a high level of self-esteem. It seems that encountering own name could evoke some self-referential processes, which in turn influence evaluation of other, non-self-related stimuli (see Koole & Pelham, 2003 for a review).

The special status of self-name processing has been confirmed by many studies. Even 4- to 5-month-old infants prefer to listen to their own rather than other names (Mandel, Jusczyk, & Pisoni, 1995). The first lexical item that children learn to read and write is invariably their own name (Levin, Both-De Vries, Aram, & Bus, 2005). Demented patients, in turn, are able to recognize their own name even when their perception of time and place is greatly deteriorated (Fishback, 1977). Furthermore, after general anesthesia, reactivity to a subject's own name precedes reactivity to pain or noise (Kurtz et al., 1977).

As far as the neural correlates of self-name processing are concerned, research results are rather inconsistent. The fact that different studies used different experimental designs, stimuli, and imaging methods hinders formulating a holistic interpretation of the nature of this process. For example, Carmody and Lewis (2006) in their block design functional magnetic resonance imaging (fMRI) study showed that passive hearing of one's own first name, in contrast to hearing the names of others, activated left middle frontal as well as left middle and superior temporal cortex. Another fMRI study, which also compared responses to auditory presentations of own vs. other first names (presented as sentences, e.g., "John, hey John!"), showed activations in the right paracingulate cortex, the right and left temporal cortex, as well as in the superior frontal and the inferior frontal gyrus (IFG)/insula on both sides (Kampe, Frith, & Frith, 2003). Perrin et al. (2005), in turn, in a combined event-related potential (ERP) and positron emission tomography (PET) study, tested how passive hearing of the subject's first name differs from hearing uncommon first names (of other participants in the study) and common first names (i.e., employed

more than 300,000 times during the twentieth century). It is noteworthy that five most employed first names (i.e., names of relatives and friends) were eliminated from the stimuli list. Self-name in this study activated the right medial prefrontal cortex, right superior temporal sulcus, and left precuneus. Another block-design ERP/PET study, which used the passive oddball paradigm, investigated brain correlates of the subject's own name uttered by a familiar or unknown voice (Holeckova et al., 2008). Subjects were instructed to watch a silent movie and not to pay attention to sound stimuli. When compared to standard sounds, self-name showed robust cerebral blood flow present in the temporal, frontal and parietal cortices, as well as in the limbic structures.

Investigations in patient populations also did not definitely resolve what are the neural correlates of self-name processing. For example, an fMRI study by Staffen, Kronbichler, Aichhorn, Mair, & Ladurner (2006), which compared reactions to hearing own vs. other name (presented as sentences, e.g., "Martin, hello Martin!"), showed medial prefrontal cortex activations in a patient in a pervasive vegetative state, as well as in three normal controls. Di et al. (2007), in turn, compared blood-oxygen-level-dependent (BOLD) responses to self-name spoken by a familiar voice (i.e., first-degree family member) in patients in a vegetative state (VS) and in a minimally conscious state (MCS). Two patients in VS failed to show any significant activations, while three showed activations in the primary auditory cortex. Surprisingly, two patients in VS and all four in MCS showed activations in higher order associative temporal areas. Those two VS patients improved clinically to MCS in the course of 3 months.

The data reported above seem to converge to a common conclusion: When studies contrasted own names with sounds or baseline (Holeckova et al., 2008; Di et al., 2007), a large distributed network was activated; however, when a more accurate contrast was used, as own names vs. other names (Carmody & Lewis, 2006; Kampe et al., 2003; Perrin et al., 2005; Staffen et al., 2006), more restricted activations were observed, i.e., in the medial frontal cortex (in all of them) and in the superior temporal cortex (in three of them).

One major problem in studying self-name processing is controlling for the emotional salience and over-learnedness of this stimulus (Kircher et al., 2001; Laureys, Perrin, & Brédart, 2007; Valentine & Bruce, 1986). For instance, famous and unknown names used as control conditions to self-name differ from self-name not only in terms of the "me vs. not-me" distinction, but also as regards their significance to the subject

("very important to me" vs. "not very important to me"), as well as the frequency of occurrence in everyday life (most probably one hears his or her own name more often than any other name). As a consequence, it is hard to determine whether the observed effects are due to some processes related to "self" or due to some more universal ones such as emotional vs. neutral or frequent vs. rare stimuli processing.

To address this issue at least partially, in our study, apart from famous and unknown names, we used the names of highly important persons in our subjects' lives (frequently encountered and emotionally salient) as one of the control conditions. To enable the differentiation between the categories, e.g., between famous and unknown names, we used full names (first and last name of a particular person). Apart from the methodological reasons, studying the recognition of full names seems to be interesting in itself. There are many life situations where it is this stimulus which is used to call our attention rather than the first name only, e.g., a call for passengers at the airport, checking attendance at school, being called to make a public speech. These situations might be less frequent, but they are more formal and as a result might be more self-relevant in some respects.

The aim of this study was to investigate the *uniqueness* of the neural correlates of self-name recognition when this cue was presented aurally as a full name. As control conditions we used significant other's name, and famous and unknown names. We assumed that if the nature of self-name processing was *unique*, then the self-preferential brain activity should be *stable*—its magnitude should not depend on the degree of intimacy between the participant and the person used for comparison—whereas if it was not, the opposite would be true (Symons & Johnson, 1997). Another way of investigating this issue is to trace the possible differences and/or similarities in the patterns of brain activation during self-, significant other's, and famous person's name recognition. In this paper we present the results relevant to both of these lines of reasoning.

METHODS

Participants

Twenty-four right-handed subjects (12 females, 12 males, mean age: 25.3 ± 3.6 years) were recruited and compensated for their participation. Three of them were excluded from later analyses due to errors in their sets of stimuli, errors in procedure, or excessive head movement. All participants were screened to rule out medication use, head trauma, history of neurological or psychiatric disorders, substance abuse, or other serious medical conditions. None of them had ever changed their first or last name. All subjects gave their written informed consent to the study, which was approved by the Ethical Committee of the University of Magdeburg.

Stimuli and task

First and last names (together called "names" below) were presented binaurally and belonged to six categories: (1) subject's own name; (2) significant other's name; (3) famous person's name; (4) unknown person's name sharing the first name with the subject—unknown (S); (5) unknown person's name sharing the first name with the significant other—unknown (Si); and (6) unknown person's name sharing the first name with the famous person—unknown (F). Using the same first names in Categories 4, 5 and 6 as in Categories 1, 2, and 3 was supposed to increase the task's difficulty and to maintain a high level of the subjects' motivation, i.e., the first names or even the first letters of the first names could not have become additional cues in the course of the study. Furthermore, it enabled us to investigate what the last name adds to self-name recognition.

The task was a simple familiar vs. unfamiliar discrimination. The subjects pressed one button for familiar names and another button for unfamiliar names on a two-button MRI-compatible response pad. It is noteworthy that "self" vs. "other" discrimination was not an explicit task (subjects pressed the same button for self-name as for significant and famous persons' names). This manipulation aimed to capture the possible automatic and cross-situational (task-irrelevant) preference in self-related information processing. It also eliminated any possible differences in brain activation due to different motor-response requirements. Additionally, to avoid artifacts resulting from the participants' movement, subjects were asked to give their responses after the offset of the stimulus. They were told that the accuracy of response was more important than its speed.

In order to prepare individually tailored sets of stimuli, the subjects' own and significant other names were collected 6 weeks before the experiment. The subjects were asked to single out one person who was most significant in their life (4 subjects gave the names of their mothers; 7, best friends; 7, boyfriends or girlfriends; 3, wives; and 3, brothers or sisters). The rest of the names in each six-name set were chosen individually for each subject so as to counterbalance

the gender of the names (3 female and 3 male names in each set). In the "famous name" category, 24 different names were used (12 females and 12 males—well-known athletes and entertainers). All the names were of German origin (to match the subjects' own and significant other names). Before the experiment, each subject was asked to confirm that he or she knew the famous persons' and did not know the unknown names in his or her set of stimuli.

As we did not put any restrictions on the significant other's name, namely its length (we wanted the subjects to select a person who was really the most significant for them), it was not possible to fully control the duration of the stimuli across categories. We addressed this issue by increasing the variability within categories, i.e., we used recordings from six different speakers (3 males and 3 females; the recordings were performed by professional actors). As a consequence, the stimuli length did not differ significantly between categories (self-name, 1.2 s ± 0.1; significant other's name, 1.2 s ± 0.2; famous name, 1.1 s ± 0.1; unknown (S), 1.1 s ± 0.1; unknown (Si), 1.1 s ± 0.1; unknown (F), 1.1 s ± 0.1). Moreover, using different voices enabled us to prevent habituation and to mimic real-life situations (in their everyday life people hear different names spoken by different people). The peak volume of each stimulus was normalized with the Adobe Audition® software (version 3.0, Adobe Systems Incorporated, San Jose, California).

Stimuli from each category were presented 18 times (equal probability of occurrence in the experiment) in pseudorandom order (not more than 3 successive presentations of the same type of name or the same speaker). The whole experiment consisted of 108 trials. Each trial began with a "fixation" sound ("beep" sound lasting 500 ms), followed by the presentation of the target stimulus, after which the subject had time to respond (no stimuli presented). Each trial lasted for 7.5 s. The intertrial interval (ITI) ranged from 1 to 3 s, consequently the interstimulus interval (ISI) ranged between 7 and 9 s. This temporal jitter seems to optimize the BOLD response and the signal discrimination between the stimulus categories (Wager & Nichols, 2003). The software package Presentation (Neurobehavioral Systems, Albany, CA) was used to present stimuli and record responses.

fMRI data acquisition and analysis

The study was carried out with a 3 T scanner (Siemens Trio, Erlangen, Germany), equipped with an eight-channel head coil. Prior to the study phase, detailed anatomical data (256 slices) of the whole brain were obtained using a multiplanar rapidly acquired gradient echo (MP-RAGE) sequence with 1 mm isotropic resolution. Following that, in the study phase, functional volumes were collected using echo planar imaging (EPI) (TE = 30 ms; TR = 2 s; FA = 80°, slice thickness 3.5 mm, matrix size 64 × 64; FOV = 19.2 cm^2; 3.5 mm isotropic resolution). The study phase lasted 14.4 min, during which 34 contiguous, oblique-axial images were obtained with the total of 543 brain volumes.

The imaging data were analyzed using Statistical Parametric Mapping software (SPM8, Wellcome Department of Cognitive Neurology, London). First, functional images were motion and slice-time corrected. Then, structural images from single subjects were coregistered to the mean functional image. Next, the unified normalization routine was conducted (Crinion et al., 2007) with voxel size 2 × 2 × 2 mm. Finally, the data were smoothed using an 8 mm Gaussian full width at half maximum (FWHM) algorithm in 3D. Timings (stimuli onsets) and stimuli durations were entered into the design matrix. To obtain parameter estimates of event-related activity for each voxel, condition, and subject separately, we analyzed the data using the general linear model. Statistical parametric maps of differences between conditions were generated, represented by the T values in one-sample t-tests (Friston et al., 1995). The Montreal Neurological Institute (MNI) coordinates were translated to Talairach space using BrainMap, GingerALE® software (version 1.1; Research Imaging Centre; UTHSCSA; http://www.brainmap.org) based on the icbm2tal transform (Lancaster et al., 2007). Then, TalairachClient® 2.4.2 was used to identify the activated structures (Lancaster et al., 2000; www.talairach.org). Figures were performed with the use of MRIcroN software (version 15; www.mricro.com).

RESULTS

Behavioral data

The participants identified all types of names with a very high accuracy rate (mean: 97 ± 3%). The subjects correctly recognized their name in 98 ± 2%, the significant other's name in 97 ± 3%, and the famous person's name in 97 ± 3% of trials. The three unknown names were correctly identified as unknown in 98 ± 2%, 96 ± 4%, and 96 ± 4% of trials, respectively. No significant differences in the accuracy rate were found between experimental conditions. Similarly, no differences were found for the reaction times (self-name: 1.7 s ± 0.3; significant

other's name: 1.7 s ± 0.3; famous name: 1.6 s ± 0.3; unknown (S): 1.7 s ± 0.3; unknown (Si): 1.7 s ± 0.2; unknown (F): 1.7 s ± 0.3).

fMRI data

Table 1 presents the results of the whole-brain analysis for the following contrasts: self-name vs. unknown (S); self-name vs. famous; self-name vs. significant other's name; significant other's vs. famous name; and famous vs. unknown (F) name. Self-name when compared to famous or unknown name activated a widely distributed bilateral network including frontal (medial, middle and inferior frontal gyri) and temporal structures (superior, temporal, and

middle temporal gyri), as well as the insula, cingulate cortex, thalamus, and basal ganglia structures (caudate and lentiform nucleus). However, when the processing of self-name was compared to the processing of significant other's name, only the right IFG showed significant differences: 51 voxels surpassed the $p < .001$ threshold, uncorrected for multiple comparisons (see Figure 1).

As far as the neural correlates of other name recognition is concerned, we found that the right IFG activation was present in the contrast involving significant other's name but not in the one involving the famous name (see Table 1). Moreover, the pattern of activations in the significant other's vs. famous name contrast was similar to the one activated in the self- vs. famous name comparison (see Table 1 and Figure 2),

TABLE 1
Brain structures and activation peaks in the most informative contrasts involving self-name, significant other's name and famous names

	T value	x	y	z		Brain structure
Self vs. unknown (S)	8.01**	4	45	28	R	Medial frontal gyrus
	7.96**	−7	−51	25	L	Posterior cingulate
	6.33*	47	23	16	R	Inferior frontal gyrus
	5.09*	−49	−4	−15	L	Middle temporal gyrus
	5*	54	−60	21	R	Superior temporal gyrus
	4.34*	−34	27	−3	L	Inferior frontal gyrus
Self vs. famous	8.02**	−38	−55	7	L	Middle temporal gyrus
	6.86*	−14	−47	23	L	Cingulate gyrus
	6.61*	6	45	23	R	Medial frontal gyrus
	6.39*	47	22	5	R	Inferior frontal gyrus
	6*	8	−9	4	R	Thalamus
	5.19*	7	26	−6	R	Anterior cingulate
	5.13*	8	−5	60	R	Medial frontal gyrus
	4.9*	−37	−2	45	L	Middle frontal gyrus
	4.31*	−16	−10	−6	L	Lentiform nucleus
Self vs. significant	4.7	51	24	7	R	Inferior frontal gyrus
Significant vs. famous	8.5**	−32	28	5	L	Inferior frontal gyrus
	8.26**	54	−34	4	R	Middle temporal gyrus
	6.8*	3	43	28	R	Medial frontal gyrus
	5.89*	29	27	−5	R	Inferior frontal gyrus
	5.84*	−44	−11	40	L	Precentral gyrus
	5.77*	−27	−20	16	L	Claustrum
	5.23*	43	−6	49	R	Precentral gyrus
	5.23*	46	11	−16	R	Superior temporal gyrus
	4.95*	0	−26	36	L	Cingulate gyrus
	4.91*	8	26	12	R	Anterior cingulate
	4.6*	16	−28	2	R	Thalamus
	4.16*	17	−40	6	R	Parahippocampal gyrus
	4.06*	−44	−33	54	L	Postcentral gyrus
	3.95*	−33	−58	20	L	Middle temporal gyrus
	3.79*	−31	10	41	L	Middle frontal gyrus
	3.94*	1	−86	3	L	Lingual gyrus
Famous vs. unknown (F)	3.57	−3	23	1	L	Anterior cingulate
	3.54	26	−86	20	R	Middle occipital gyrus

$p < .001$, $k_e > 5$ voxels. *FDR corrections; **FWE corrections. Unknown (S) and unknown (F) refer to the unknown names with the same first name as self or famous person, respectively.

Figure 1. Brain activations during self-name recognition in comparison to different baseline conditions: the unknown name with the same first name as the famous name (unknown (F)), famous name, and significant other's name. The more intimate the person used for comparison, the smaller the differences in BOLD responses between self- and other-name processing. The activation map is superimposed on a template of single subject T1 image ($p < .001$; uncorrected for multiple comparisons).
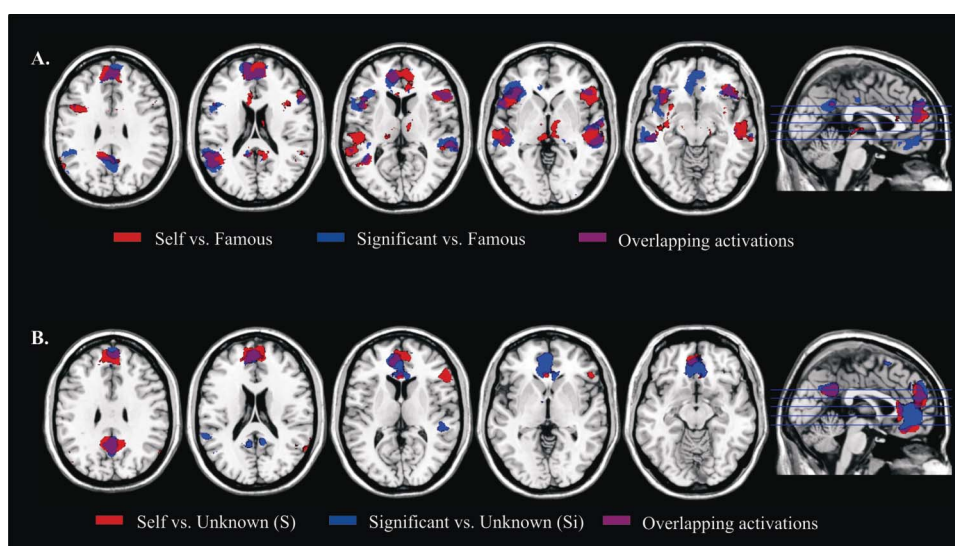
Figure 2. Specific and overlapping brain activations in the contrasts involving self-name and significant other's name in comparison to different baseline conditions (A, famous name; B, unknown name with the same first name as the subject's own—unknown (S)—or the significant other's name—unknown (Si)). It seems that self-name and significant other's name processing involved a similar pattern of activations. The activation map is superimposed on a template of single-subject T1 image (FDR correction for multiple comparisons; $p < .05$).

but markedly different to the one activated in the famous vs. unknown contrast (see Table 1).

DISCUSSION

The aim of this fMRI study was to investigate whether the neural processing of self-name is *unique*. Our findings seem to provide rather a negative answer to this question mainly for two reasons: (1) When compared to relatively neutral names, i.e., famous person's or unknown names, self-name triggered increased neural activation in a widely distributed bilateral network, whereas when compared to a name that was more emotionally charged and more frequent in the subject's life, i.e., the significant other's name,

the differences were limited to only one region—the right IFG; (2) the patterns of activations in the self-name vs. famous and significant other's names vs. famous names contrasts were similar. These results seem to relate to the issue of how much the preferential status of self-name could be explained by the general mechanisms, e.g., allocation of attention to stimuli with high emotional/adaptive value, and how much by the exclusively self-specific ones.

The widely distributed, bilateral network including frontal, temporal, as well as limbic and subcortical structures, present in the self-name vs. famous/unknown names as well as in significant vs. famous names contrasts, seems to fit well into the model of social attention proposed by Klein, Shepherd, and Platt (2009). They claimed that in order to extract key

information from their social environment as a rule humans and animals pay attention to important members of their group. The social attention is supposedly mediated by neural circuits that transduce sensory information about a person and translate that information into value signals that bias orienting. Importantly, this process likely proceeds via two distinct but integrated pathways: an ancestral, subcortical (via thalamus) route that mediates crude but fast orienting; and a more derived route involving cortical orienting circuits that mediate nuanced and context-dependent social information. In this sense, the activations in the thalamus, basal ganglia (lentiform nucleus and caudate) and limbic structures (cingulate cortex and insula) present during self-name and significant other's name processing could demonstrate the fast and crude aspect of the orienting response to these stimuli. It is noteworthy that in case of self vs. unknown (S) contrast the differences in BOLD signal in those regions were attenuated when compared to self-name vs. famous name contrast (see Table 1). This may be due to the fact that the unknown (S) name had the same beginning (i.e., the first name) as the subject's own name, and consequently, the initial (crude) reaction to both of these cues could have been similar.

The bilateral activation in the cortical regions, in turn, could reflect the responses in the context-dependent orienting pathway. Auditory word recognition in general (see Blumstein, 2009, for a review) recruits a neural system involving anterior, parietal, and temporal areas. Information is believed to pass through these areas in what appear to be functionally distinct stages: (1) acoustic-phonetic analysis in temporal areas (superior temporal gyrus); (2) mapping the sound structure to the lexicon and accessing a lexical candidate in temporo-parietal areas (middle temporal, supramarginal gyrus and angular gyrus); and (3) lexical selection in frontal regions (IFG). Both lesion and neuroimaging studies in this field emphasize that the abovementioned areas are interconnected and information cascades throughout this network as a function of the acoustic–phonetic and semantic characteristics of the auditory input (Blumstein, 2009). This last notion seems to explain why hierarchically "lower" areas could have shown increased activation to self-name and significant other's name: This could reflect top-down "facilitation" processes to stimuli with high social/adaptive value.

This "social attention" interpretation seems to be in line with studies on the so-called "cocktail party" effect (Cherry, 1953; Conway, Cowan, & Bunting, 2001; Moray, 1959; Wolford & Morrison, 1980; Wood & Cowan, 1995). They showed that even if the

participants were engaged in another cognitive task, they could still detect their own name in the unattended ear or visual field. Therefore, it was suggested that a person's name, due to its high ecological value, is more potent than other kinds of stimuli to automatically attract this person's attention (but see Bundesen, Kyllinsbaek, Houmann, & Jensen, 1997; Gronau, Cohen, & Ben-Shakhar, 2003; Harris & Pashler, 2004; Kawahara & Yamada, 2004). For the same reason, i.e., adaptive value, people may learn to react in the same (or similar) manner to the names of people that are important in their lives.

Alternatively, the similarities in neural processing of self and significant other's names could result from the common self-referential processes evoked by both of these cues. Although the time after each stimulus presentation was limited, one cannot rule out that the significant other's name evoked certain autobiographical memories related to "self," e.g., the subject's last meeting with this person. In addition, in the case of 5 out of 21 of our subjects' the "significant other" had the same last name as the subjects themselves. It is unlikely that this effect alone could have generated the main effect of our study (i.e., the similarity in processing of self-name and significant other's name); however, future experiments should control this factor with caution. It is noteworthy that interfering with the participants' choice of the "significant other" by providing instructions on their name's length or acoustic properties does not seem an ecologically valid solution.

Moving now to the differences between the neural processing of self-name and significant other's name, contrasting these two conditions in our study resulted in significant activations in the right IFG. Self-preference in this structure was also shown in studies on the recognition of one's own face (Devue et al., 2007; Platek, Keenan, Gallup, & Mohamed, 2004; Sugiura et al., 2006; Uddin, Kaplan, Molnar-Szakacs, Zaidel, & Iacoboni, 2005; see Platek et al., 2008 for review), one's own moving body parts (Sugiura et al., 2006), or one's own voice (Nakamura et al., 2001), as well as during autobiographical memory retrieval (Greenberg et al., 2005) and evaluation of one's own face (Morita et al., 2008). In the only fMRI study that used both self-face and self-voice in the same experiment, the right IFG was the only structure that showed self-preferential activation for both of these stimuli (Kaplan, Aziaz-Zadeh, Uddin, & Iacoboni,, 2008). Anatomical data, in turn, shows that IFG is one of the most heavily connected regions of the prefrontal cortex, receiving polymodal input from posterior cortical areas and communicating heavily with other prefrontal regions (Miller & Cohen, 2001). It is also one

of the last brain regions to develop in both ontogeny and phylogeny (Pandya & Barnes, 1987). Our study, together with these functional and anatomical findings, supports the hypothesis that the right IFG plays a crucial role in self-related information processing.

This self-preference of the right IFG has been mostly explained by its adhesion to the mirror neuron system, which is believed to play a role in mapping observed others onto the "self" (Gallese, 2003; Iacoboni et al., 1999; Rizzolatti & Craighero, 2004). It was suggested that if these neurons are sensitive to the similarity between an observed agent and the "self" then they will be most active when the agent observed is one's own "self" (Iacoboni, 2008; Kaplan et al., 2008; Uddin et al., 2007). These sensorimotor systems that respond across sensory modalities may form the basis for abstract concepts, such as the "self." Although our results could be interpreted in this manner, it is hard to define what kind of *similarity* could determine the activations that we found: Mirror neurons, especially when viewed from the "simulation theory" perspective, are believed to receive rather "raw" information, i.e., preceding the person-recognition processes (Dinstein, 2008).

In contrast, many studies demonstrated the right IFG's involvement in top-down attention allocation processes in a variety of tasks. The Eriksen Flanker paradigm, where overcoming distraction is needed—comparing incongruent trials (affording two possible responses) with congruent trials (affording one potential response)—produced activations in this structure (Hazeltine, Poldrack, & Gabrieli, 2000; Bunge et al., 2002; Hazeltine, Bunge, Scanlon, & Gabrieli, 2003). Moreover, right IFG activation was reliably stronger as a consequence of dual-task interference; that is, when the interval between one task and the next was short relative to when it was long (Herath, Klingberg, Young, Amunts, & Roland, 2001). In addition to this, increased distractibility resulting from the right prefrontal cortex's damage has been demonstrated in monkeys and humans (Aron, Sahakian, & Robbins, 2003; Grueninger & Pribram, 1969; Guitton, Buchtel, & Douglas, 1985; Woods & Knight, 1986). These studies suggest that the right IFG activation in self-name recognition could reflect the top-down attention allocation mechanisms.

The only other neuroimaging study known to us that used a similar paradigm to ours—self-faces directly compared to significant others' faces, with explicit task being familiar vs. unfamiliar discrimination—found no activation in the right IFG (Kircher et al., 2001). These results, however, need to be treated with caution, as the study examined only six subjects, all male (see Uddin et al., 2005). In addition, contrary to previous studies, we found no differences between

self-name vs. significant other's name processing in the cortical medial structures (CMS), which have usually been associated with the processing of "self" (Johnson et al., 2002; Kelley et al., 2002; for a meta-analysis see Northoff et al., 2006). However, some other studies demonstrated CMS involvement also in the referential processing of the "close other" (Mitchell, Macrae, & Banaji, 2006; Seger, Stone, & Keenan, 2004; Shmitz, Kawahara-Baccus, & Johnson, 2004; Vanderwal, Hunyadi, Grupe, Connors, & Scults, 2008; Yaoi, Osaka, & Osaka, 2009; but see Heatherton et al., 2006). It seems that the lack of CMS activation in our study could be explained twofold: (1) self-name and significant other's name engaged self-referential processes to a similar extent; or (2) activation in the CMS is not unique to "self" but applies more generally to stimuli with high social importance. Future research is needed to test these two possibilities.

To conclude, recently there has been a growing debate as to whether self-related information processing is unique (e.g., Gillihan & Farah, 2005; Legrand & Ruby, 2009). If the uniqueness is understood as a *qualitative* difference, then our study gives rather negative answer. The self-name preference was not "stable"—it depended on the degree of intimacy between the participant and the person whose name was used for comparison purposes. Moreover, the pattern of activations for self-name and significant other's name was rather similar. On the other hand, we found *quantitative* differences between neural activations to self-name and other names, i.e., self-name activated the right IFG more than any other name. It suggests that the neural representations of the "self" and the "other" could be on the same continuum (Decety & Sommerville, 2003) and the extent to which the "self" is special or shared might depend on many factors, including cultural and individual differences (Zhu, Zhang, Fan, & Han, 2007).

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