

Chapter 13

Religious Belief and Neurocognitive Processes of the Self

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Abstract Cross-cultural psychological research suggests that self-construals can be dissimilar between individuals fostered in different cultures. Recent brain imaging studies concerned the underlying neural basis of cultural influences on cognitive processing of the self. In this chapter I first review cultural difference in self-concept and research concerning cultural influence on self-construals and related neural mechanisms. I then discuss the difference in self-construals between individuals with distinct religious belief and practice. Finally, I present brain imaging evidences that help to clarify distinct neurocognitive processes of the self induced by Christian belief, which is characterized with weakened neural coding of stimulus self-relatedness, but enhanced neural activity underlying evaluative process applied to self-referential stimuli.

13.1 The Psychological Self

The significance of the “self” has been central to the study of philosophy and psychology for centuries. Western philosophy, from the time of Descartes onward, has proposed the “self” as a delimited individual that represents an entity of subjectivity and is distinct and separate from others. In addition, the self represents an agent who is responsible for the thoughts and actions of an individual to which they are ascribed. Most of the Western philosophic thoughts about the self focus on search of invariant features or characters of the self (Solomon 2002), assuming that the self consists of attributes that do not vary according to changing social situations.

The self-concept plays an important role in psychology to interpret human social behaviors (Banaji and Prentice 1994). William James (1890) recognized three distinct parts of the self, i.e., the material self, the social self, and the mental self, which

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assist to refine the self-concept for psychological research. Contemporary psychological research concerns mental representation of the self and operationalizes the psychological self in several domains. For example, when a person looks into a mirror, he/she knows that the image in the mirror is the self. Self-face recognition in contrast with recognition of familiar faces induces self-awareness (Keenan et al. 2003). When a person tries to recall his/her past experiences, the retrieval process is tightly associated with the self, which has been termed the process of autobiographical memory. Human beings can also conduct reflexive thinking of one's own dispositions. Such self-referential processing functions to define self-construals that help to describe the uniqueness of the self. A large number of psychological studies have shown evidence that the processing of different aspects of self-relevant information and self-knowledge engages unique cognitive and neural mechanisms. For example, human adults usually respond faster to the self-face than to familiar faces and this self-face advantage is more salient with left-hand responses than with right-hand responses (Keenan et al. 1999). Brain imaging studies found evidence that self-face recognition is associated with increased activity in the right frontal cortex (Uddin et al. 2005; Sui and Han 2007), suggesting the existence of specific neural mechanism underlying operationalization of self-awareness that distinguishes the self from others. The distinction between the self and others in memory, however, is mediated by distinct neural structures. Retrieval of autobiographical memory is underpinned by a set of neural structures including the temporomesial and temporolateral cortex (Fink et al. 1996). These neuroimaging findings indicate that the processing of multiple aspects of the self is mediated by distinct neurocognitive mechanisms.

13.2 Culture and the Self

Psychologists, since William James (1890), have noticed that a person may behave differently in different situations. For example, a professor may behave as an elegant gentleman when giving a serious scientific lecture. The same person may tell vulgar jokes and make fun with friends during a private party. Different situations allow presentation of different dispositions of the self. These observations lend support to the existence of multifaceted self-concept and the dynamic nature of the self (Oyserman and Markus 1993). The dynamic and flexible features of the self are also reflected in the fact that cultures produce remarkable influence on the self. For example, a representative theory of culture and self (Markus and Kitayama 1991, 2003) proposes that many Western cultures “require constructing oneself as an individual whose behavior is organized and made meaningful primarily by reference to one's own internal repertoire of thoughts, feeling, and action, rather than by reference to the thoughts, feelings, and actions of others” whereas East Asian cultures emphasize “the fundamental connectedness of human beings to each other” and “entails seeing oneself as part of an encompassing social relationship” (Markus and Kitayama 1991, p. 226, p. 227). The cultural discrepancy results in different self-construals, i.e., the independent self in Western cultures and the interdependent self in East Asian cultures.

The differential self-construals in terms of cultures result in remarkable difference in psychological processes between the Western and East Asian cultures (Markus and Kitayama 1991). One psychological approach to the understanding of different self-construals is to examine the cultural difference in psychological structure of memory in association with the self and others. Psychologists used a self-referential task (Rogers et al. 1977) to investigate whether subjects were able to remember information about the self and others equally well. In this task subjects were presented with personal trait adjectives and instructed to judge whether a trait was suitable to describe the self or others. Subjects were given a “surprise” memory test after the trait judgment tasks in which they were presented with both old and new traits and asked to judge old versus new words. A typical finding of behavioral studies was that self-descriptive traits were better remembered than traits descriptive of others (Rogers et al. 1977). Subsequent research explored whether psychological structure of the memory self is independent of any others for Westerners but overlaps with that of close others for East Asians. Indeed, Keenan et al. (Keenan and Baillet 1980) found that American subjects showed better recognition performance in the self-reference condition than in the parents’ condition. By contrast, Zhu and Zhang (2002) showed evidence that Chinese subjects remembered equally well the trait adjectives that were linked to the self and mother in a trait judgment task. These observations suggest that the contents of the psychological structure of the self are essentially different between American and Chinese in that the American self excludes even close others, consistent with the independent self-style, whereas the Chinese self includes at least partially the close others, in agreement with the interdependent self-style.

The cultural influence on self-concept goes beyond the difference between Western and East Asian self-styles and self-related cognitive processing. While most philosophers believe the existence of a distinct “self,” such perspective on the self is not taken for granted by all human communities. Particularly, people with specific religious belief have radically different self-concepts. For example, while the common sense assumption of the self as an empirical entity is accepted, Christianity put strong emphasis on human contingency and dependence on God: we are made and saved by God and reflect his goodness. To highlight this relationship between human and God, Christianity advocates denial of the self who is taken as a creature and sinner in order to drastically surrender to God (Burns 2003; Ching 1984; Lin 2005). In addition, in order to grow in God-likeness, one must recognize one’s own “nothingness” and pursuit spiritual request for self-transcendence. One consequence of such perspective on the self is to blur the boundary between the self and others, because to be always told that one is nothing may be injurious to the firmness of one’s self-concept and self-identity and denial of the self may lead to weak distinction between the self and others. The Christian beliefs about the relation between the self and God may produce strong influence on the cognitive style of processing related to the self. For example, the mandate that “every one of us shall give account of himself to God” (Romans 14:12) emphasizes judgment of the self from God’s perspective rather than from one’s own perspective. Such divergent views of the self have produced enormous impact on believers’ mind and behavior (Spilka et al. 2003).

Similar views of the nature of the self can be found in Buddhism. Central to much Buddhist thought is the idea that human fulfillment comes through self-transcendence. Buddhists criticize and abandon the concept of the self that is considered as an entity that endures unchanged over time and stands external to the subjective experience. The extreme Buddhists' thought of the self is that there is no enduring and independent self underlying experience, or in other words, "there is no substantial entity underlying that flow of experience which constitutes a person's life" (McDaniel 1987, p. 219). Such a concept of the self is an illusion. Zen Buddhists used the phrase "the true self" to describe one's "immediate" experience, here-and-now and the domain of immediate experience which proceeds "without thinking." The true self "is not the entity denied in the doctrine of no-self; rather, it is the reality affirmed once no-self is realized" (McDaniel 1987, p. 221).

Although the significant difference in self-concepts between different cultures (Western vs. East Asian cultures, Christian vs. Buddhist cultures) has been noticed and discussed by philosophers and psychologists for centuries, to date, there has been no behavioral research to explore the difference in cognitive mechanisms underlying self-related processing between people with different religious beliefs and little is known about potential consequences of the religious beliefs on neurocognitive mechanisms involved in self-related processing.

13.3 Neural Mechanisms Underlying Self-Referential Processing

Since self-cognition plays a pivotal role in human social behaviors, understanding the neural substrates of self-related processing has recently become a hot topic in social cognitive neuroscience studies. One approach to this issue is to scan subjects using functional magnetic resonance imaging (fMRI) while they perform a self-referential task (Rogers et al. 1977). Brain imaging studies define neural activity specific for self-referential processing as increased activation related to self-trait judgment relative to trait judgment of a famous person. A number of studies showed evidence that activity in the ventral part of the medial prefrontal cortex (MPFC) and the perigenual anterior cingulate cortex increased in association with self-judgment (Fossati et al. 2003; Kelley et al. 2002; Macrae et al. 2004; Moran et al. 2006; Zhu et al. 2007). Further research explored the functional role of the ventral MPFC in self-related processing. For example, D'argembeau et al. (2005) found that the increased blood flow in the ventral MPFC was correlated with the amount of thoughts about the self (measured using subjective rating). Moran et al. (2006) also found that activity in the ventral MPFC increased in a linear fashion with increasing self-relevance of personal traits. These brain imaging findings suggest that a crucial role of the ventral MPFC is coding self-relatedness of stimuli.

Other researchers found that the dorsal region of the MPFC is also involved in self-related processing when self-referential evaluations are required. Judgment of how a picture made subjects feel engaged the dorsal MPFC relative to judgment of if a picture depicted a scene that was indoors (Gusnard et al. 2001). Evaluation

of one's own fancy to a site or a person also engages the dorsal MPFC (Zysset et al. 2002). Taken together, these findings indicate that, although the ventral and dorsal parts of MPFC are implicated in self-referential processing, the ventral MPFC seems to dominate the coding of self-relevance of stimuli whereas the dorsal MPFC appears to mediate the reappraisal and evaluation of self-related stimuli (Northoff et al. 2006).

13.4 Cultural Influence on the Neural Substrates of Self-Referential Processing

While social psychological research has shown ample evidence that the self-style is strongly influenced by cultures, it remains unknown whether such influence is limited in the domains of social behaviors and cognitive styles or may extend to the neural process related to the self. For instance, individuals in Western cultures tend to be characterized with an independent style of the self and individuals in East Asian cultures are prone to show an interdependent style of the self. Does such cultural difference in psychological structure of the self arise from distinct neural substrates underlying self-related processing in different culture groups? Our recent brain imaging study suggests a remarkable influence of Western and East Asian cultures on the neural representation of the self (Zhu et al. 2007).

The critical issue addressed in this work is, given that the representation of the self is separated from that of others in Western cultures whereas self-representation overlaps partially with the representation of others in East Asian cultures (Markus and Kitayama 1991), whether parallel cultural difference in self-concept can be observed in the neural substructure underlying self-representation. To investigate this, Zhu et al. (2007) scanned English-speaking Westerners (including British, American, Australian, and Canadian) and Chinese, using fMRI, when the participants judged personal trait adjectives regarding self, mother, or a public person. The rationale is that, though Western participants with the independent view of the self used the ventral MPFC to represent only the self (Heather-ton et al. 2006), Chinese participants with the interdependent self are likely to employ this brain region to represent both the self and intimate others, such as their mothers.

The fMRI results confirmed increased activation in the ventral MPFC in association with the self-judgment relative to trait judgment of a famous person in both Western and Chinese participants, consistent with the observations of the previous work (Kelley et al. 2002; Heather-ton et al. 2006). In addition, in line with Heather-ton et al. (2006), Zhu et al. (2007) found that self-judgments induced stronger ventral MPFC activation relative to mother-judgments in Western subjects, suggesting that the ventral MPFC activity is specific to the representation of the self. Nevertheless, in Chinese individuals, the contrast of self- vs. mother-judgments did not show activation in the ventral MPFC and mother-judgments generated enhanced MPFC activity compared with trait judgment of a famous person. It appears that the representation of Chinese mother cannot be distinguished from the representation

of their selves in terms of the ventral MPFC activity, indicating that Chinese individuals use the ventral MPFC to represent both mother and the self. While social psychological studies suggest that cultures create habitual ways of processing information related to the self and one's important others (Markus and Kitayama 1991), our fMRI results indicate that these habitual cognitive processes are accompanied by detectable parallel neural processes.

13.5 Neural Consequences of Christian Belief on Self-Referential Processing

Because Zhu et al. (2007) showed evidence that the difference in self-construals between Western and East Asian cultures resulted in differential neural processes of the self and others in the ventral MPFC, one may then ask whether religious cultures may similarly influence the neural substrates underlying self-referential processing. As mentioned above, there is essential difference in self-concept and self-cognition between Christians and non-religious people. What are the neural consequences of Christian belief and practice on the neurocognitive processes of the self? This question can be answered by examining whether Christians and non-religious people employ distinct neural substrates for self-related processing. To address this issue, we recently scanned two groups of participants (14 non-religious and 14 Christian Chinese participants) using fMRI while they performed tasks of personal trait judgments regarding the self or famous persons (Han et al. 2008).

We hypothesized that the unique spiritual quest and practice of Christianity may produce two psychological consequences. First, to deny oneself in order to live a spiritual life as dictated by Jesus may weaken encoding process of stimuli as self-referential. Second, emphasis of evaluation of the self from God's perspective may strengthen the evaluative process of self-referential stimuli. The possible neural consequences related to these unique cognition styles may be then that, relative to those in non-religious people, the neural activity mediating the processing of coding stimuli as self-referential in the ventral MPFC may be weakened in Christians. In addition, the neural activity underlying the evaluation process of self-referential stimuli in the dorsal MPFC may be enhanced in Christians.

Similar to the previous research (Kelley et al. 2002; Zhu et al. 2007), we assessed brain activities associated with self-referential processing using the self-referential task. Participants were scanned using fMRI while they were presented with personal trait adjectives and asked to judge if an adjective was appropriate to describe the self or a public person (the former Chinese premier Zhu-Rongji). Neural activity mediating self-referential processing was indexed by the increased activation linked to self-judgments relative to judgments concerning others. Following the functional and anatomical scans, participants were given a "surprise" recognition memory test. The scores of recognition memory were recorded as behavioral index of self-referential processing.

Our behavioral data showed superior memory for self-referenced trait adjectives compared with those related to others in both non-religious and Christian participants. It appears that our participants showed promotion of elaboration and organization of information related to the self regardless of religious beliefs. To identify the neural substructures involved in self-referential processing in Christian and non-religious participants, we performed a whole- brain statistical parametric mapping (SPM) analysis to compare self- with Zhu-Rongji-judgments in both subject groups. This revealed significantly increased activation in the ventral MPFC associated with self-judgment (BA 10/32, the Talairach coordinates of the activation center are 2, 53, 7, Fig. 13.1) in non-religious participants. Nevertheless, increased activation was observed in the dorsal MPFC linked to self-judgment (BA 9/32, centered at 8, 27, 3 and -6, 32, 24) in Christian participants.

To further confirm that Christian and non-religious participants employed distinct neural structures in the self-referential task, we calculated parameter estimates

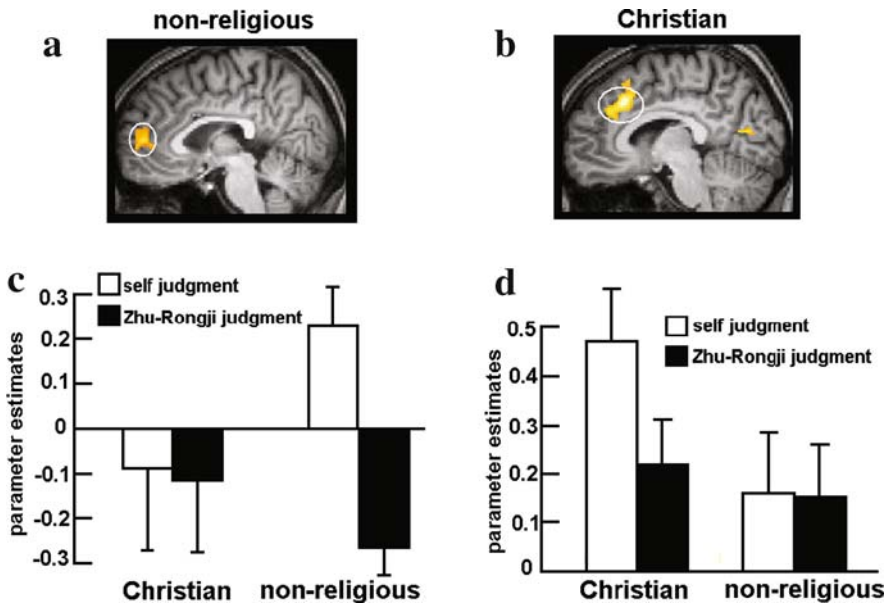


Fig. 13.1 Increased brain activations associated with self-judgments. Illustration of the fMRI results of Han et al. (2008). (a) Increased brain activations associated with self-judgment relative to Zhu-Rongji-judgments was identified in the ventral MPFC in non-religious participants. (b) Increased brain activations associated with self-judgment relative to Zhu-Rongji-judgments was identified in the dorsal MPFC in Christian participants. (c) Parameter estimates of signal intensity in the ventral MPFC linked to self- and Zhu-Rongji-judgments in non-religious and Christian participants. The signal intensity in the ventral MPFC was significantly greater in associated with self- than Zhu-Rongji-judgments for non-religious participants but not for Christian participants. (d) Parameter estimates of signal intensity in the dorsal MPFC linked to self- and Zhu-Rongji-judgments in non-religious and Christian participants. The signal intensity in the dorsal MPFC was significantly greater in associated with self- than Zhu-Rongji-judgments for Christian participants but not for non-religious participants

of signal intensity related to self- and Zhu-Rongji-judgments in both the ventral and dorsal MPFC so as to compare the results between two subject groups. A repeated measure analysis of variance with Participant (non-religious vs. Christians) and Judgment (self vs. Zhu-Rongji) as main effects showed a significant interaction between Judgment and Participant, suggesting divergent activation in the ventral MPFC linked to the dissociation of self- and Zhu-Rongji-judgments between the two participant groups. One-sample t-tests confirmed that signal intensity of the ventral MPFC was significantly larger to self- than Zhu-Rongji-judgments for non-religious participants, but did not differ between the two judgments for Christians. Similar analysis of the signal intensity calculated from the dorsal MPFC also revealed a reliable interaction of Judgment and Participant. One-sample t-tests confirmed that signal intensity of the dorsal MPFC was greater to self- than to Zhu-Rongji-judgment for Christians but did not differ between the two judgments for non-religious participants. These results indicate that Christian participants utilized the dorsal MPFC to differentiate the self from others in the trait-judgment tasks whereas non-religious participants employed the ventral MPFC to distinguish the self from others when judging personal traits.

These findings indicate that, although the behavioral performances of both Christian and non-religious participants showed self-advantage in memory of trait adjectives, the neural process of self-trait judgment is essentially different between the participant groups. Previous brain imaging studies have linked self-referential processing of personal traits to the ventral MPFC activity (D'argembeau et al. 2005; Heatherton et al. 2006; Kelley et al. 2002; Macrae et al. 2004; Zhu et al. 2007) that subserves the process of self-relevance of stimuli (Moran et al. 2006). Our fMRI results, however, provide the first piece of neuroscience evidence that the ventral MPFC activity linked to self-judgment was eliminated in Christian participants. This is the first neural consequence of Christian belief and practice on self-referential processing, i.e., the coding process of stimulus self-relatedness was weakened. In addition, we observed increased the dorsal MPFC activity linked to the self-referential processing in Christian participants. This is the second neural consequence of Christian beliefs and practices on self-referential processing, i.e., Christian beliefs and practices enhance the evaluative process of self-related stimuli mainly from God's perspective, which is consistent with the functional role of the dorsal MPFC in reappraisal and evaluation of self-related stimuli (Northoff et al. 2006) and in inference of others' mental states (Grèzes et al. 2004; Mitchell et al. 2005).

13.6 Conclusions

While it is widely acknowledged that religious beliefs influence humans' social behaviors substantially, the underlying neurocognitive mechanisms remain poorly understood. In addition to the recent neuroimaging studies that examined the neural correlates of religious experience (Azari et al. 2001; Beauregard and Paquette 2006), we explored possible difference in functional anatomy of social cognition

(i.e., self-referential processing) between Christian and non-religious participants. Our brain imaging results indicate that religious culture (e.g., Christianity) that repudiates the distinctness of the self but underscores the evaluative process of the self by God results in stronger involvement of the dorsal MPFC relative to the ventral MPFC in self-referential processing, providing further evidence for the dynamic and culture-sensitive characteristics of the neural mechanisms underlying self-referential processing. Further research may explore if the characters of the neurocognitive processes of the self observed in our work are specific to Christian participants. Our studies also raise questions for neuroscience research, i.e., at which level of neural structures we must consider cultural difference in neural activity underlying human cognition.

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