

Dynamic bicultural brains: fMRI study of their flexible neural representation of self and significant others in response to culture primes

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Abstract This study examined the neural representation of self and others in response to culture primes in bicultural individuals. Participants were bicultural Chinese who were primed with either Chinese or English words before being asked to evaluate themselves and their mothers. Functional magnetic resonance imaging (fMRI) was used to measure brain activity in the medial prefrontal cortex (MPFC) during the evaluation process. Results showed that bicultural individuals showed a flexible neural representation of self and others in response to culture primes. Specifically, when primed with Chinese words, bicultural individuals showed a neural representation of self in the MPFC, whereas when primed with English words, they showed a neural representation of others in the MPFC. These findings suggest that bicultural individuals have a flexible neural representation of self and others in response to culture primes.

Key words: culture priming, independent self-construal, interdependent self-construal, functional magnetic resonance imaging (fMRI), medial prefrontal cortex, self-inclusiveness.

Introduction

Recent research has shown that bicultural individuals have a flexible neural representation of self and others in response to culture primes. Specifically, bicultural individuals show a neural representation of self in the medial prefrontal cortex (MPFC) when primed with Chinese words, and a neural representation of others in the MPFC when primed with English words. This flexible neural representation of self and others is thought to be a result of bicultural individuals' ability to switch between independent and interdependent self-construals in response to culture primes. Independent self-construal is characteristic of Western cultures, and interdependent self-construal is characteristic of Eastern cultures. Bicultural individuals are thought to have a flexible neural representation of self and others because they are able to switch between these two self-construals in response to culture primes.

Self-inclusiveness and self-other differentiation: Evidence from social and cultural psychology

Self-inclusiveness and self-other differentiation are two important concepts in social and cultural psychology. Self-inclusiveness refers to the degree to which individuals include themselves in their social identity, and self-other differentiation refers to the degree to which individuals differentiate themselves from others.

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Bicultural participants

(2007, 2009). In a series of studies, *et al.* (2000) and *et al.* (2000) found that bicultural individuals (those who grew up in two cultures) showed a more Western, individualistic self-concept than monicultural individuals (those who grew up in one culture). This was demonstrated by their preference for Western-style names and their tendency to identify themselves as individuals rather than as members of a group. For example, bicultural participants were more likely to identify themselves as "John" rather than "John Smith" when asked to provide a name. This suggests that bicultural individuals have a more individualistic self-concept, which is characteristic of Western cultures. This finding is consistent with the idea that culture shapes the way we think about ourselves. Bicultural individuals, who have grown up in two cultures, may have a more complex and flexible self-concept that is influenced by both cultures. This could be why they show a more Western, individualistic self-concept. The study by *et al.* (2000) also found that bicultural individuals were more likely to identify themselves as "American" rather than "Chinese" when asked to provide a nationality. This suggests that bicultural individuals have a more Western, individualistic self-concept. This is consistent with the idea that culture shapes the way we think about ourselves. Bicultural individuals, who have grown up in two cultures, may have a more complex and flexible self-concept that is influenced by both cultures. This could be why they show a more Western, individualistic self-concept. The study by *et al.* (2000) also found that bicultural individuals were more likely to identify themselves as "American" rather than "Chinese" when asked to provide a nationality. This suggests that bicultural individuals have a more Western, individualistic self-concept. This is consistent with the idea that culture shapes the way we think about ourselves. Bicultural individuals, who have grown up in two cultures, may have a more complex and flexible self-concept that is influenced by both cultures. This could be why they show a more Western, individualistic self-concept.

Western and Chinese culture primes

The study used two sets of culture primes to activate either a Western or Chinese self-concept in participants. The Western primes included the name "John" and the nationality "American". The Chinese primes included the name "John Smith" and the nationality "Chinese". These primes were used to prime the self-concept of participants before they were scanned. This was done to ensure that the self-concept being measured was the one that was being primed. The Western primes were used to prime a Western, individualistic self-concept, while the Chinese primes were used to prime a Chinese, collectivist self-concept. This allowed the researchers to compare the self-concept of bicultural individuals when they were primed with either a Western or Chinese culture. The results showed that bicultural individuals showed a more Western, individualistic self-concept when primed with Western primes, and a more Chinese, collectivist self-concept when primed with Chinese primes. This suggests that bicultural individuals have a more flexible self-concept that is influenced by the culture they are currently in. This is consistent with the idea that culture shapes the way we think about ourselves. Bicultural individuals, who have grown up in two cultures, may have a more complex and flexible self-concept that is influenced by both cultures. This could be why they show a more Western, individualistic self-concept when primed with Western primes, and a more Chinese, collectivist self-concept when primed with Chinese primes.

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Scanning procedure

The scanning procedure involved presenting participants with a series of stimuli that were designed to activate either a Western or Chinese self-concept. The stimuli were presented in a block design, with 10 trials per block. Each trial consisted of a 15-second prime (either "John" or "John Smith") followed by a 15-second target (either "self" or "non-identified person"). The blocks were randomized, so that participants could not predict the order of the primes and targets. The scanning procedure was designed to measure the brain's response to the self-concept primes and targets. The results showed that bicultural individuals showed a more Western, individualistic self-concept when primed with Western primes, and a more Chinese, collectivist self-concept when primed with Chinese primes. This suggests that bicultural individuals have a more flexible self-concept that is influenced by the culture they are currently in. This is consistent with the idea that culture shapes the way we think about ourselves. Bicultural individuals, who have grown up in two cultures, may have a more complex and flexible self-concept that is influenced by both cultures. This could be why they show a more Western, individualistic self-concept when primed with Western primes, and a more Chinese, collectivist self-concept when primed with Chinese primes.

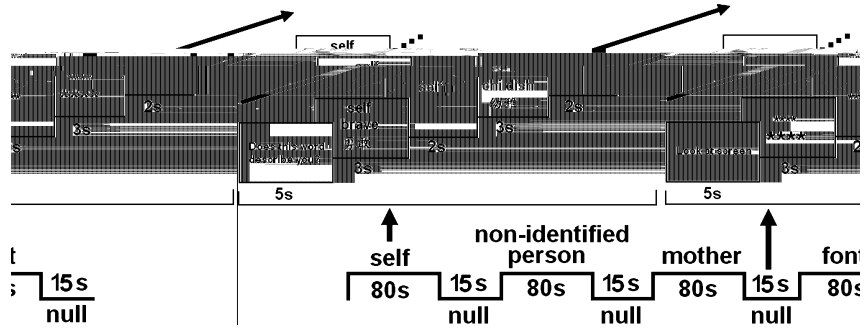


Figure 1 Illustration of the stimuli and procedure.

(1) $\int_0^1 x^2 dx = \frac{1}{3}$
(2) $\int_0^1 x dx = \frac{1}{2}$
(3) $\int_0^1 1 dx = 1$
(4) $\int_0^1 x^3 dx = \frac{1}{4}$

(5) $\int_0^1 x^4 dx = \frac{1}{5}$
(6) $\int_0^1 x^5 dx = \frac{1}{6}$
(7) $\int_0^1 x^6 dx = \frac{1}{7}$
(8) $\int_0^1 x^7 dx = \frac{1}{8}$
(9) $\int_0^1 x^8 dx = \frac{1}{9}$
(10) $\int_0^1 x^9 dx = \frac{1}{10}$
(11) $\int_0^1 x^{10} dx = \frac{1}{11}$
(12) $\int_0^1 x^{11} dx = \frac{1}{12}$
(13) $\int_0^1 x^{12} dx = \frac{1}{13}$
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(19) $\int_0^1 x^{18} dx = \frac{1}{19}$
(20) $\int_0^1 x^{19} dx = \frac{1}{20}$

(21) $\int_0^1 x^{20} dx = \frac{1}{21}$
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(23) $\int_0^1 x^{22} dx = \frac{1}{23}$
(24) $\int_0^1 x^{23} dx = \frac{1}{24}$
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(28) $\int_0^1 x^{27} dx = \frac{1}{28}$
(29) $\int_0^1 x^{28} dx = \frac{1}{29}$
(30) $\int_0^1 x^{29} dx = \frac{1}{30}$
(31) $\int_0^1 x^{30} dx = \frac{1}{31}$
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(48) $\int_0^1 x^{47} dx = \frac{1}{48}$
(49) $\int_0^1 x^{48} dx = \frac{1}{49}$
(50) $\int_0^1 x^{49} dx = \frac{1}{50}$

... ($p < 0.0$...)

... ($p < 0.01$...)

Results

Brain imaging

... (1) ...

... ($p < 0.0$...)

Table 1 Regions of significant increased activation in comparison between self, mother and NIP with font judgments (corrected, $p < 0.05$)

Region	X	Y	Z	T	Volume
...	7	7	-7	0	0
...	0	-	-7	-17	0
...	1	-	-7	-	1
...	7	-	10	-	0
...	1	7	-7	-7	1
...	11	7	-7	-	7
...	0	-	7	1	0
...	-	7	-0	1	-1
...	-	1	-	-1	0
...	-	-	-0	1	-11
...	1	1	-	0	-
...	7	17	-1	1	0
...	10	-	-	1	1
...	10	0	-	-	0

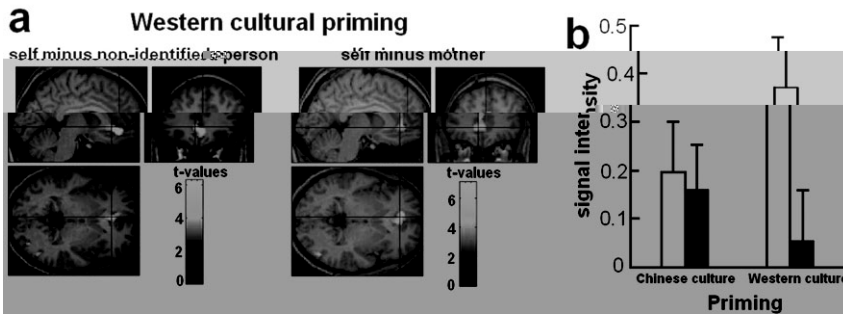


Figure 2 (a) Brain activation observed in the contrasts between self vs non-identified person and between self vs mother after Western cultural priming. (b) Results of region-of-interest analysis of the parameter estimates of signal intensity in the ventral medial prefrontal cortex. ■, non-identified person; □, self.

Table 2 Mean behavioural performances (SD) during the scanning procedure

	Chinese culture	Western culture	Chinese culture	Western culture
Accuracy (%)	77.1 (10.1)	77.1 (10.1)	77.1 (10.1)	77.1 (10.1)
Reaction time (ms)	1700 (100)	1700 (100)	1700 (100)	1700 (100)

... (F(1, 17) = 11.1, p < 0.001)

... ANOVA ... (P > 0.1) ... ANOVA ... (F(1, 17) = 11.1, p < 0.001, MSE = 0.7) ... ANOVA ...

... ANOVA ... (P > 0.1) ... ANOVA ... (F(1, 17) = 11.1, p < 0.001) ...

Discussion

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Behavioural performance

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