

# Neural basis of cultural influence on self-representation

<sup>a</sup> D. A. P. , P. , 5 a a, B 100871, P. . C a  
<sup>b</sup> E a , C a a N a , B , C a  
<sup>c</sup> D a P a , M a M , N , A  
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Culture affects the psychological structure of self and results in two distinct types of self-representation (Western independent self and East Asian interdependent self). However, the neural basis of culture–self interaction remains unknown. We used fMRI to measure brain activity from Western and Chinese subjects who judged personal trait adjectives regarding self, mother or a public person. We found that the medial prefrontal cortex (MPFC) and anterior cingulate cortex (ACC) showed stronger activation in self- than other-judgment conditions for both Chinese and Western subjects. However, relative to other-judgments, mother-judgments activated MPFC in Chinese but not in Western subjects. Our findings suggest that Chinese individuals use MPFC to represent both the self and the mother whereas Westerners use MPFC to represent exclusively the self, providing neuroimaging evidence that culture shapes the functional anatomy of self-representation.

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Keywords: Culture; Self; fMRI; MPFC; ACC

## Introduction

Research has shown that culture influences the psychological structure of self-representation. For example, Westerners tend to view the self as an independent entity, whereas East Asians view the self as interdependent with others (Heine, 2001; Markus & Kitayama, 1991). This cultural difference is reflected in the way individuals judge personal trait adjectives. For instance, Chinese individuals are more likely to judge themselves as "modest" or "humble" compared to Westerners (Heine, 2001).

The neural basis of this cultural influence on self-representation remains unknown. However, recent research has shown that the medial prefrontal cortex (MPFC) and anterior cingulate cortex (ACC) are involved in self-representation (Laird, 1980; Kelley, 1989; Brewer & Gross, 1979). Specifically, the MPFC is activated when individuals judge personal trait adjectives regarding themselves (Laird, 1980; Kelley, 1989; Brewer & Gross, 1979).

In this study, we used functional magnetic resonance imaging (fMRI) to measure brain activity in the MPFC and ACC during self-representation tasks. We compared the neural basis of self-representation in Chinese and Western subjects. We found that the MPFC and ACC showed stronger activation in self- than other-judgment conditions for both Chinese and Western subjects. However, relative to other-judgments, mother-judgments activated MPFC in Chinese but not in Western subjects. Our findings suggest that Chinese individuals use MPFC to represent both the self and the mother whereas Westerners use MPFC to represent exclusively the self, providing neuroimaging evidence that culture shapes the functional anatomy of self-representation.

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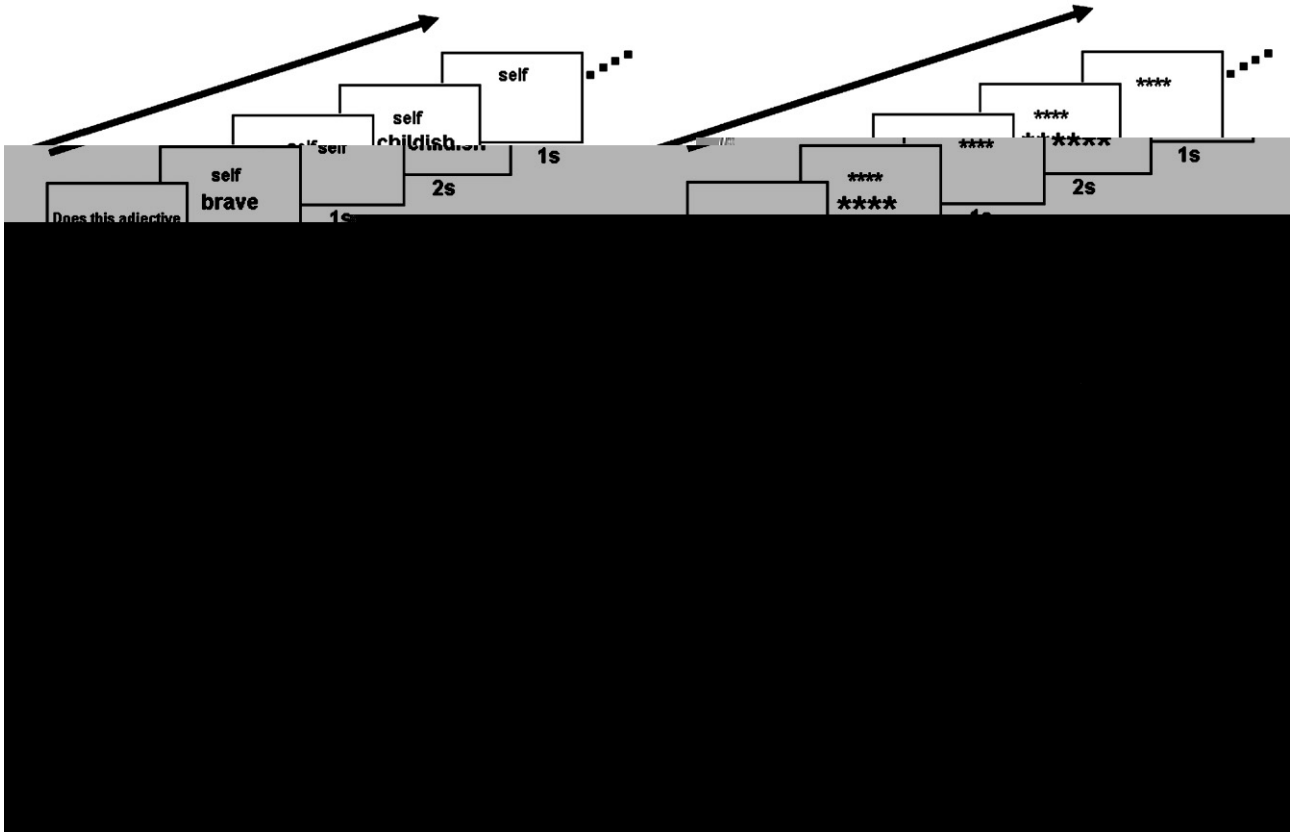
Keywords: Culture; Self; fMRI; MPFC; ACC

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.1. e e e es es e e e e e s a . es a e e ac e-, e- - a e sw ee es es se ese -  
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A<sup>+</sup>er e e r ee re, b ee ere e " r r e"  
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M I a a a

Br e r e 3- See r MR  
 e er r b r e e e Be MRI Ce er  
 r Br Re e re . P ee ere e e  
 e e . A 2\* - e e r e -ee r (EPI)  
 e e ee ( R=2000 , E=30 e=90° , 3  
 e e , A 0.75 , FO =220 , 64 64 32 r  
 3.4 3.4 3.75 re ) e e re e  
 32 ee e e . F r e e ere  
 b e . E e e r 324 . D r e e e ,  
 162 e e e ere e re e e br  
 e er e . H -re e e ere b e  
 r 3D l- e e e ee 0.9 0.9 e  
 re 1.3 ee Ae (256 256 r ,  
 R=1600 , E=3.93 ).

M I a a a a

S e P r e r e M re (SPM2, Wl e e e  
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 e ree r e e e b ee e e re ere  
 ee b ee ' e e . F e e ere r -  
 r e r e ee (2 2 2 3 r e  
 ee) b e e M re Ne r e I e (MNI)  
 e e . N r e ere e e  
 G er - (F HM)  
 r eer e 6 e e ere ee  
 b - r r e . A eer er e e e e  
 r ree e - r e (e e e  
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 e - r er - e e ere e e  
 ee b ee . ee e r e ere e  
 b e ee - e e r - ee ( re r -  
 <0.05, e ree e r ee r ) . e SPM e r -  
 e r r br r MNI e e ere e ere  
 re e r e ( re r , 1998)  
 - e r r r e ( :// . re - b e . e . A /  
 I / ee . ) .  
 A re - ere (ROI) e e e e re  
 ee r ee e re re e MPFC ACC. ROI  
 ere e e r e r e C ee Wl e er b ee  
 e e r e ee er MPFC ACC e  
 e er MRI e r b ee e er e . e  
 e MRI ere r 3  
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 e e A e e . e MRI ere  
 b ee e re e e re r ee (ANO A)

e r b e J e ( e , er, er) C re  
 (C ee Wl e er r ). e MRI e er-  
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 ee . A ANO A e r b e Re ere ee ( e . er)  
 C re (C ee Wl e er r ) e e ee  
 e ere MRI .

Results

C ree e ree e re ( e r r e e  
 r ) e ree e r e ere b ee e 2  
 (Sib ee Wl e er r C ee) 4 ( Ae : e , er, er r )  
 ANO A. C ree e ree e re ere er r e  
 e e ee e e ree ( e , er r er)  
 r - e (F(3,72)=58.41, <0.01) ere er  
 r C ee Wl e er b ee (F(1,24)=25.46, <0.01).  
 e ere Sib ee Ae (F(3,72)=9.52,  
 <0.01), e ere er e ree e re  
 b ee e r r b ee . Se re e  
 r er e ee e e e e Ae ere  
 re b ere b e er e e e er- e Ae  
 (C ee : e re: F(1,24)=4.69, <0.05; e re: F(1,24)=  
 4.87, <0.05; Wl e er er: e re: F(1,24)=4.90, <0.05;  
 e re: F(1,24)=5.71, <0.05). ee ree e ree e re  
 erb e ee e - er- e e r  
 C ee b ee ( e re: F(1,24)=1.65, >0.1; e re:  
 F(1,24)=1.10, >0.1) b , er e e- er-  
 e e Wl e er b ee ( e re: F(1,24)=  
 3.68, <0.06; e re: F(1,24)=5.80, <0.05; F . 2).  
 Se - , er- er- e re r e r e  
 - e e br re e e e e  
 ee ree . ree e e e er r, e  
 er r r ere e e e ere rb e  
 C ee Wl e er b ee ( b e 1). Wl e er b ee  
 e e e e er re r ere  
 e er re ee re .  
 e er b r e er e e - re ere ee ee  
 ere e e ere e er e e e e e  
 er- e . MPFC e e e e Ae  
 e - er- e rb C ee ( / / =8/55/6, =3.68,  
 BA 10) Wl e er b ee (0/51/3, =4.07, BA 10; F . 3 ).  
 Ae ee ACC (-6/36/20, =3.62 -2/33/  
 30, =3.76, BA32) e r r e re (-24/57/12, =4.27,  
 BA10) r C ee b ee b ACC Wl e er b ee  
 (-6/33/0, =4.70, BA24). e e r b e ee er-  
 er- e e r er e MPFC (2/55/3,  
 =3.49, BA10; F . 3 ), ACC (0/18/18, =3.50) e e  
 re r e re (-22/59/15, =3.49) r C ee b ee .  
 H e er, e ee r e e ACC (-4/  
 35/-2, =4.11) Wl e er b ee . ee r b e ee e e  
 er- e e e MPFC Wl e er  
 b ee (-4/46/-6, =3.78, BA10; F . 3e) b , r C ee e  
 b ee .  
 e ROI e e e ere e e MPFC  
 (ee ere 8/55/6 (C ee) 0/51/3 Wl e er )) re e  
 - e e b e e ( . e , e e ) . Se - e  
 ere e MPFC e ere er- e e ere e MPFC  
 e (F . 4). MPFC e e e er- e  
 ere e r C ee b ee b e ere e Wl e er  
 b ee . A re b e ere b e ee e re e



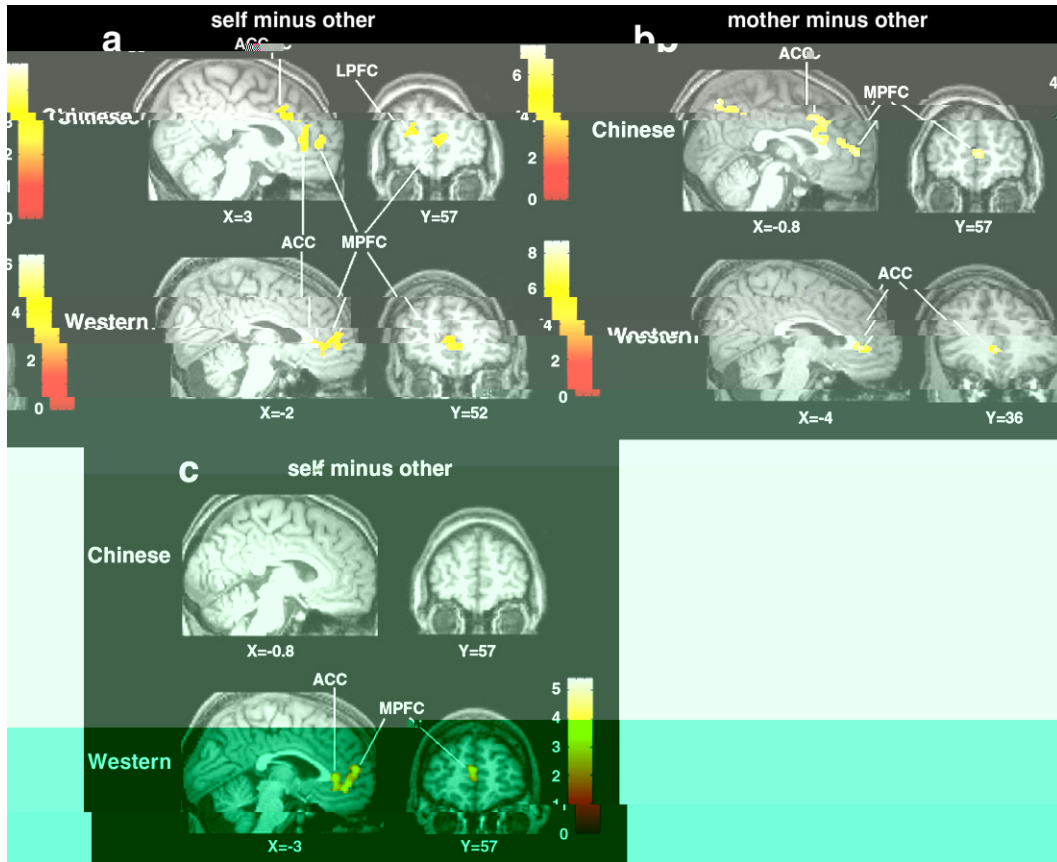


Fig. 3. Brain activation maps for 'self minus other' and 'mother minus other' comparisons in Chinese and Western participants. (a) Self minus other; (b) Mother minus other; (c) Self minus other. ACC, anterior cingulate cortex; LPFC, lateral prefrontal cortex; MPFC, medial prefrontal cortex. X and Y coordinates are in MNI space.

Western participants (Keane et al., 2002; Loefer et al., 2004). In Chinese participants, the ROI in the MPFC was significantly more active when they compared themselves to their mothers than when they compared themselves to other people (He et al., 2006). The ROI in the MPFC was also significantly more active when Chinese participants compared themselves to other people than when they compared themselves to their mothers.

Western participants, the ROI in the MPFC was significantly more active when they compared themselves to other people than when they compared themselves to their mothers. In Chinese participants, the ROI in the MPFC was significantly more active when they compared themselves to their mothers than when they compared themselves to other people. The ROI in the MPFC was also significantly more active when Chinese participants compared themselves to other people than when they compared themselves to their mothers. These findings suggest that Chinese participants have a stronger sense of filial piety and a stronger connection to their mothers than Western participants do.

<sup>1</sup> See also (Keane et al., 2002; Loefer et al., 2004; He et al., 2006). The ROI in the MPFC was significantly more active when Chinese participants compared themselves to other people than when they compared themselves to their mothers. These findings suggest that Chinese participants have a stronger sense of filial piety and a stronger connection to their mothers than Western participants do.

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Wl e er e re re  
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Re e er, e er- e  
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ee e e er r re e ee  
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re e . Re e ACC, MPFC re b re  
re re e e e, e re r e r er  
e ee b re e-re re e r e ee  
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F , e e ,be e e MPFC ACC,  
e e e e e r e re e re  
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Wl e er b ee .S r , er- e b C ee -  
e e e e e re r e re ACC,  
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ne re Ae e er- e , C ee,  
e re Wl e er , r e r er er  
e e ee r e ere e e e re b E A e re.  
I r , r MRI re e re , C ee  
b ee , re re e b e e e MPFC,

