supplementary methods and results

Sociocultural patterning of neural activity during self-reflection

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Imaging Analysis

Sample size analysis

The sample size analysis was conducted to estimate how many subjects from each cultural group were required to reveal reliable cultural differences in mPFC/TPJ activity during self-reflection in the current study. To do this, we first randomly selected the same number of participants (group size n=2 to 29) from each cultural group and this resulted in 28 data sets for each cultural group. Two-sample t-tests on the contrast values of TPJ and mPFC activity (self- vs. public-figure-judgments in social blocks) were then conducted for two data sets with the same number of participants. The whole procedure including generating data sets and two-sample t-test was repeated 100 times for each group size and the mean t-value was calculated. We identified the group size at which every calculations resulted in an absolute t-value that is larger than the critical t-value for 95% confidence for that group size.

Psychophysiological interaction (PPI) analysis

A PPI analysis (Friston et al., 1997) was used to estimate increased covariation between different brain regions during a specific task. In our study the coordinates of the peak voxel in the mPFC shown in the contrasts of self- vs. public-figure-judgments of mental, social, or physical attributes were respectively used to serve as a landmark for the individual seed voxels to identify brain regions that showed significantly increased functional connectivity with the mPFC. The ROI in each individual participant was defined as a sphere with 5 mm radius centered at the peak voxel in the mPFC. The time series of each ROI were then extracted, and the PPI regressor was calculated as the element-by-element product of the mean-corrected activity of this ROI and a vector coding for differential task effects of self- vs. public-figure-judgments. The PPI regressors reflected the interaction between psychological variable (self- vs. public-figure-judgment) and the time course of mPFC activation. The individual contrast images reflecting the effects of the PPI between the mPFC and other brain areas were subsequently subjected to one-sample t-tests. The results of the group analysis identified brain regions in which the activity systematically showed increased correlations with mPFC activity during self-compared to public-figure-judgments. Two-sample t-tests were then calculated to identify if the functional connectivity between mPFC and TPJ was stronger in Chinese participants than in Danish participants. As we had a priori hypothesis for the functional connectivity between the mPFC and TPJ, a liberal threshold (p < 0.001 uncorrected and a spatial extent =100) was used to identify brain areas that showed significant functional connectivity with the seed ROI in the mPFC.

Discriminant analysis

BOLD signals from specific brain areas have been used to categorize the contents of an individual’s perception (Kay et al., 2008), the outcomes of a person’s decision making (Soon et al., 2008), and to classify persons into different religious groups (Ge et al., 2009). We used similar methods to assess whether specific patterns of neural activity in different brain regions associated with self-reflection of social attributes
could classify participants into Chinese and Danish groups with a higher than chance level accuracy. To do this, we first created a featured vector for each participant with the contrast values of mPFC and right TPJ activity associated with self-versus public-figure-judgments in the social block. A linear discriminant function was then constructed based on the vector from a sample consisting of both Chinese and Danish participants. The optimal weight and bias of the linear discriminant function were calculated using the Fisher discriminant function (Duda and Hart, 1973; Cawley and Talbot, 2003). We employed the leave-one-out cross-validation, i.e., one case was left out of the training set and then used as a test set. The discriminant function was then used to assess which cultural group the “leave-out” individual subject is associated with. Repeating this procedure for all the cases in the data set estimated the generalization accuracy of the method. The accuracy of such classification analysis helps to validate the conclusion of socioculturally patterns of neural activity in different brain regions (i.e., mPFC and TPJ) since the classification analysis reduced any bias produced by precategorization of participants in terms of cultural group.

Mediation analysis

Mediation analysis was performed to examine if individuals’ interdependence mediated the difference in mPFC/TPJ activity between Chinese and Danes. We chose a classic approach to establish mediation (Judd and Kenny, 1981; Baron and Kenny, 1986). Three different regression models were constructed, as shown below:

\[ Y = \beta_{11} x + \beta_{10} \]  
\[ \text{Mediator} = \beta_{21} x + \beta_{20} \]  
\[ Y = \beta_{31} x + \beta_{32} \text{Mediator} + \beta_{30} \]

Four conditions for establishing mediation are: (a) in Equation 1, the independent variable (group) must predict the dependent variable (neural responses in mPFC or TPJ), \( \beta_{11} \) is significant; (b) in Equation 2, the independent variable (group) must predict the mediator (interdependence), \( \beta_{21} \) is significant; (c) in Equation 3, when regressing the dependent variable (neural responses in mPFC or TPJ) onto the mediator (interdependence) and the independent variable (group), the mediator must predict the dependent variable (neural responses in mPFC or TPJ), \( \beta_{32} \) is significant; and (d) in Equation 3, the effects of the independent variable (group) on the dependent variable (neural responses in mPFC or TPJ) must be reduced or even eliminated, \( \beta_{31} < \beta_{11} \) (in absolute value, partial mediation) or \( \beta_{31} \) is insignificant (full mediation). The Sobel test (Sobel, 1982) was conducted to further confirm the significance of the mediator.

References


Figure S1. mPFC activity to self- and public-figure-judgments relative to font-judgments in social, physical and mental blocks.
Figure S2. Activity in the left and right TPJ to self- and public-figure-judgments relative to font-judgments in social, physical and mental blocks.
### Table S1 Complete Sets of Items Used in the Current Study

#### Social roles

<table>
<thead>
<tr>
<th>Social roles</th>
<th>Asian</th>
<th>American</th>
<th>Customer</th>
<th>buddhist</th>
<th>Emcee</th>
<th>Coach</th>
<th>Researcher</th>
<th>Politician</th>
<th>Chinese</th>
<th>Korean</th>
<th>Driver</th>
<th>Car owner</th>
<th>Skier</th>
<th>Tourist</th>
<th>Celebrity</th>
<th>Tour guide</th>
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<tbody>
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<td></td>
<td>poor man</td>
<td>scout leader</td>
<td>ads spokesmen</td>
<td>non-religious</td>
<td>undergraduate</td>
<td>house owner</td>
<td>left-winger</td>
<td>shop assistant</td>
<td>actor/actress</td>
<td>Arts student</td>
<td>museum owner</td>
<td>right-winger</td>
<td>bike owner</td>
<td>waiter/waitress</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>fan</td>
<td>European</td>
<td>idol</td>
<td>professor</td>
<td>athlete</td>
<td>Christian</td>
<td>volunteer</td>
<td>civilian</td>
<td>humanist</td>
<td>Danish</td>
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<td>passenger</td>
<td>scout</td>
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<td>self-employed</td>
<td></td>
</tr>
<tr>
<td></td>
<td>landlord</td>
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<td>African</td>
<td>salesman</td>
<td>bank customer</td>
<td>student</td>
<td>teacher</td>
<td>cyclist</td>
<td>testee</td>
<td>PC user</td>
<td>gmail user</td>
<td>football player</td>
<td>cellphone user</td>
<td>not a celebrity</td>
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<td></td>
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<tr>
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<td>technical worker</td>
<td>religious person</td>
<td>teacher assistant</td>
<td>olympic champion</td>
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<td>mathematician</td>
<td>white collar workers</td>
<td>blue collar workers</td>
<td>government employee</td>
<td>bank employee</td>
<td>table tennis player</td>
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#### Mental traits

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<th>tolerant</th>
<th>assertive</th>
<th>confident</th>
<th>lazy</th>
<th>honest</th>
<th>Humble</th>
<th>picky</th>
<th>suspicious</th>
<th>easy-going</th>
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<td>rough</td>
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<td>rude</td>
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<td>diligent</td>
<td>talkative</td>
<td>Smart</td>
<td>hostile</td>
<td>despicable</td>
<td>competent</td>
<td>arrogant</td>
<td>headstrong</td>
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<td></td>
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<td>firm</td>
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<td>open-minded</td>
<td>Slow</td>
<td>easy-going</td>
<td>Petty</td>
<td>rigid</td>
<td>intelligent</td>
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<td>earnest</td>
<td>Irritable</td>
<td>strong</td>
<td>hospitalable</td>
<td>pessimistic</td>
<td>negative</td>
<td>rational</td>
<td>Frank</td>
</tr>
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<td>warm</td>
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<td>hypocritical</td>
<td>careless</td>
<td>famous</td>
<td>warm</td>
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<td>courageous</td>
</tr>
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<td>happy</td>
<td>selfish</td>
<td>courageous</td>
<td>disgusting</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td>clumsy</td>
<td>modest</td>
<td>weak</td>
<td>dedicated</td>
<td></td>
<td></td>
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</tr>
<tr>
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<td></td>
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<td>greedy</td>
<td>patient</td>
<td>impulsive</td>
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<td>mature</td>
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#### Physical attributes

<table>
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<th>short</th>
<th>long hair</th>
<th>flawless</th>
<th>short fingers</th>
<th>stocky arms</th>
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</thead>
<tbody>
<tr>
<td>straight hair</td>
<td>long hair</td>
<td>with no acne</td>
<td>fat</td>
<td>thin-lipped</td>
<td>heavier than 60 kg</td>
</tr>
<tr>
<td>thin arms</td>
<td>short hair</td>
<td>small eyes</td>
<td>wrinkled</td>
<td>broad shoulder</td>
<td>some acnes on the face</td>
</tr>
<tr>
<td>Appearance Trait</td>
<td>Sociocultural Patterns</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---------------------------</td>
<td>------------------------</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hyperopia</td>
<td>Bald-headed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big feet</td>
<td>Flat-chested</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black hair</td>
<td>Tufty-haired</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Choppy</td>
<td>Pierced ears</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Big ears</td>
<td>Unpierced ears</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long arm</td>
<td>Straight nose</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short neck</td>
<td>Large eyes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Green eyes</td>
<td>Buxom body</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blue pupil</td>
<td>Straight teeth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No freckles</td>
<td>Out of shape</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large waist</td>
<td>Thick-legged</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freckles</td>
<td>Crooked nose</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Short legs</td>
<td>Short hair</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Thin          - Small feet  - Asymmetrical face
- Buxom         - Thick-lipped - Lighter than 60 kg
- Tall          - Yellow hair  - Symmetrical face
- Myopia        - Small ears  - Narrow shoulder
- Slim          - Yellowish skin - Small hand
- Tattoo        - Big nose    - Hour-glass figure
- Long neck     - Tallow-faced- Long eyelashes
- No tattoo     - Bushy eyebrows- Snaggle-toothed
- Long fingers  - Boney body  - Long eyelashes
- Short arm     - Slim legs   - Ruddy faced
- In shape      - Short arm   - Short eyelashes
- Sparse eyebrows- Oval face  - Moon-faced
- Curly hair    - Big hand    - Long legs
- Light skin    - Long legs   - Light skin
Table S2 Mean Ratio of ‘Yes’ Responses and Reaction Times (SD) to Judgment Tasks during Scanning

<table>
<thead>
<tr>
<th></th>
<th>Chinese</th>
<th>Danish</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ratio of ‘Yes’ responses (%)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social self</td>
<td>43.1 (14.0)</td>
<td>45.7 (22.6)</td>
</tr>
<tr>
<td>Social public figure</td>
<td>45.3 (9.0)</td>
<td>44.6 (17.5)</td>
</tr>
<tr>
<td>Physical self</td>
<td>42.6 (11.2)</td>
<td>43.3 (11.6)</td>
</tr>
<tr>
<td>Physical public figure</td>
<td>42.7 (7.5)</td>
<td>44.9 (12.3)</td>
</tr>
<tr>
<td>Mental self</td>
<td>42.9 (9.4)</td>
<td>44.0 (9.7)</td>
</tr>
<tr>
<td>Mental public figure</td>
<td>44.3 (7.4)</td>
<td>44.5 (9.3)</td>
</tr>
<tr>
<td><strong>RTs (ms)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social self</td>
<td>1017 (143)</td>
<td>1134 (177)</td>
</tr>
<tr>
<td>Social public figure</td>
<td>1093 (162)</td>
<td>1206 (195)</td>
</tr>
<tr>
<td>Physical self</td>
<td>1293 (202)</td>
<td>1303 (174)</td>
</tr>
<tr>
<td>Physical public figure</td>
<td>1252 (191)</td>
<td>1369 (207)</td>
</tr>
<tr>
<td>Mental self</td>
<td>1060 (201)</td>
<td>1197 (146)</td>
</tr>
<tr>
<td>Mental public figure</td>
<td>1092 (180)</td>
<td>1242 (182)</td>
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</table>
### Table S3 Brain Activations in Chinese and Danish Participants Shown in the Whole Brain Analyses

<table>
<thead>
<tr>
<th>Group</th>
<th>Region</th>
<th>x/y/z (MNI)</th>
<th>t-value</th>
<th>cluster size</th>
</tr>
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<td><strong>Chinese</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>Precuneus (R)</td>
<td>2/-86/34</td>
<td>6.91</td>
<td>639</td>
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<tr>
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<td>Temporoparietal junction (R)</td>
<td>62/-56/30</td>
<td>6.02</td>
<td>466</td>
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<tr>
<td></td>
<td>Temporoparietal junction (L)</td>
<td>-56/-60/20</td>
<td>4.78</td>
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</tr>
<tr>
<td></td>
<td>Anterior Cingulate (R)</td>
<td>8/30/4</td>
<td>4.35</td>
<td>242</td>
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<tr>
<td>Mental</td>
<td>Anterior cingulate (L)</td>
<td>-2/34/22</td>
<td>7.10</td>
<td>2006</td>
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<tr>
<td></td>
<td>Medial prefrontal Cortex (L)</td>
<td>4/24/40</td>
<td>5.36</td>
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</tr>
<tr>
<td></td>
<td>Left frontal (L)</td>
<td>-24/42/38</td>
<td>5.78</td>
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</tr>
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<td>Physical</td>
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<tr>
<td><strong>Conjunction of contrasts of Public-figure- vs. Font-judgments across three dimensions</strong></td>
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<tr>
<td><strong>Chinese</strong></td>
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<tr>
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<td>Region</td>
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<td>Middle cingulate (R)</td>
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<td>-44/18/-2</td>
<td>11.57</td>
<td>1976</td>
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</tr>
<tr>
<td>Caudate (R)</td>
<td>14/2/16</td>
<td>7.57</td>
<td>242</td>
<td></td>
</tr>
<tr>
<td>Cerebellum (R)</td>
<td>30/-78/-36</td>
<td>7.84</td>
<td>374</td>
<td></td>
</tr>
<tr>
<td>Cerebellum (R)</td>
<td>6/-58/-44</td>
<td>7.13</td>
<td>101</td>
<td></td>
</tr>
<tr>
<td>Thalamus (L)</td>
<td>-6/-18/14</td>
<td>10.89</td>
<td>653</td>
<td></td>
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</tbody>
</table>
Table S4 Brain Regions with Stronger Functional Connectivity with the mPFC Associated with Self-reflection of Social Attributes in Chinese than in Danish Participants

<table>
<thead>
<tr>
<th>Region</th>
<th>x/y/z (MNI)</th>
<th>t-value</th>
<th>cluster-size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occipital</td>
<td>8/-76/-4</td>
<td>5.33</td>
<td>632</td>
</tr>
<tr>
<td></td>
<td>-12/-82/-8</td>
<td>3.97</td>
<td></td>
</tr>
<tr>
<td>Superior parietal (R)</td>
<td>30/-56/66</td>
<td>5.03</td>
<td>461</td>
</tr>
<tr>
<td></td>
<td>42/-34/64</td>
<td>4.27</td>
<td></td>
</tr>
<tr>
<td>Dorsal Medial prefrontal Cortex (L)</td>
<td>4/46/30</td>
<td>4.33</td>
<td>424</td>
</tr>
<tr>
<td></td>
<td>14/58/26</td>
<td>4.24</td>
<td></td>
</tr>
<tr>
<td>Occipital (L)</td>
<td>-14/-94/6</td>
<td>3.93</td>
<td>160</td>
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<tr>
<td></td>
<td>-28/-90/14</td>
<td>3.64</td>
<td></td>
</tr>
<tr>
<td>Temporoparietal junction (R)</td>
<td>54/-42/38</td>
<td>3.79</td>
<td>187</td>
</tr>
<tr>
<td></td>
<td>56/-52/36</td>
<td>3.61</td>
<td></td>
</tr>
<tr>
<td>Temporoparietal junction (L)</td>
<td>-56/-50/34</td>
<td>3.60</td>
<td>130</td>
</tr>
<tr>
<td></td>
<td>-60/-40/30</td>
<td>3.56</td>
<td></td>
</tr>
</tbody>
</table>