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Who's Afraid of the Boss: Cultural Differences in Social Hierarchies Modulate Self-Face Recognition in Chinese and Americans

Sook-Lei Liew[1,2]*, Yina Ma[3], Shihui Han[3]*, Lisa A. Aziz-Zadeh[1,2]

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* E-mail: sliew@usc.edu (S-LL); shan@pku.edu.cn (SH)

Introduction

"At home, a young man should be dutiful towards his parents; going outside, he should be respectful towards his elders."
-Confucius (Chinese philosopher, 551–479 BC)
"Your real boss is the one who walks under your hat."
-Napoleon Hill (American author, 1833–1970)

Cultural differences play a key role, not only in how people understand themselves, but also in how they relate to others. This is exemplified in the quotations above, with the former Chinese quote emphasizing the importance of respecting one's elders both at home and in public while the latter American one affirms one's independence and autonomy above all else. Several decades of both behavioral and neuroimaging research suggest that self-concept is largely determined by one's culture, with notable differences between East Asian and Western cultures [1–6]. In particular, people from Western countries tend to be more individualistic and have what is known as an *independent self-construal* [5]. In these cases, the self is thought of as an isolated unit that strives to be unique, autonomous, and assertive, functioning in parallel with, but not dependent upon, others. In contrast, those from more collectivist cultures, such as East Asians, tend to demonstrate an *interdependent self-construal*, in which the self is conceptualized in terms of its relationship to others, which blurs the distinction between self and other and allows the self to be easily modulated by dynamic social contexts, such as the presence of one's supervisor [5].

There are a significant number of findings that attribute differences in both cognitive processes and affective states to these noted cultural differences in self-construals [1–8]. For instance, individuals with independent self-construals tend to be more assertive and use competitive conflict tactics in group work settings, while individuals with interdependent self-construals are more likely to shy away from conflict and use cooperative tactics [6]. In addition, the interdependent self-construal was positively

correlated with ease of embarrassment while the independent self-

year (13–60 months), and advisors were of the same race as the student to avoid confounds due to the social influences of race. Written informed consent was obtained from all participants before inclusion in the study.

Questionnaire measurement

Participants were given a modified Brief Fear of Negative Evaluation (Brief-FNE) scale [21] to assess their fear of being negatively evaluated by both their advisor and another faculty member who worked for the same department but was not in the participant's lab (e.g., I am afraid that Professor XXX will not approve of me). Participants used a 5-point Likert scale (1 = not at all characteristic, 5 = extremely characteristic) in response to each item, reporting how properly each statement fit them in respect to 1) their advisor and 2) the other faculty member. In addition, participants were asked to rate each professor's (advisor, other faculty member) social status, which was defined as the individual's ability to exert influence over other people and institutions, on an 11-point Likert scale (0 = not at all dominant, 10 = extremely dominant).

Stimuli and procedure

Ten digital face images were taken from each participant, his/her faculty advisor, another faculty member, and one of his/her labmates prior to the experiment. Half of the faculty advisors and other faculty members were of the same gender as the participant, and half were of a different gender as the participant. Participants knew both the faculty advisor and faculty member for the same length of time. In addition, an advisor for one participant might be used as the other faculty member for another participant, so as to match perceptual features of the stimuli.

Five of the images of each individual were oriented to the left (varied from 30° to 90°) and the other five were oriented to the right. Participants were instructed to look directly ahead and maintain a neutral facial expression. Control images used scrambled images of the faces, which were created by dividing face images into 10×10 arrays and randomly rearranging them, using Matlab. These images were presented with a gray bar on either the left or the right. For an example of all stimuli and the experimental paradigm, see Figure 1. The participants in this figure have given written informed consent (as outlined in the PLoS consent form) to the publication of their photographs. All images were calibrated in luminance and contrast and subtended a visual angel of 2.13°×2.17° at a viewing distance of 70 cm. Images were presented for 200 ms each at the center of the screen, with a varying intertrial interval of 800 to 1200 ms during which a fixation cross was presented. Participants were instructed to indicate whether faces were oriented to the left or the right, or whether the gray bar of scrambled images was on the left or the right, by pressing two keys using the index and middle fingers. Task instructions emphasized both speedy and accuracy.

Each block of trials contained 40 face images and 20 scrambled images. The block design is illustrated in Figure 1. Self-face was presented in a high-threat context (20 trials each of self-face, advisor's face in each block) for two blocks and in a low-threat context (20 trials each of self-face, other faculty member's face in each block) for two blocks. In addition, two blocks used 20 trials of each a labmate's face and the advisor's face in order to discern whether the advisor's face generated increased processing speed when paired with non-self faces. For each stimulus condition, participants responded with the left hand in one block and the right hand in the other block. The order of responding hands and conditions was counterbalanced across participants.

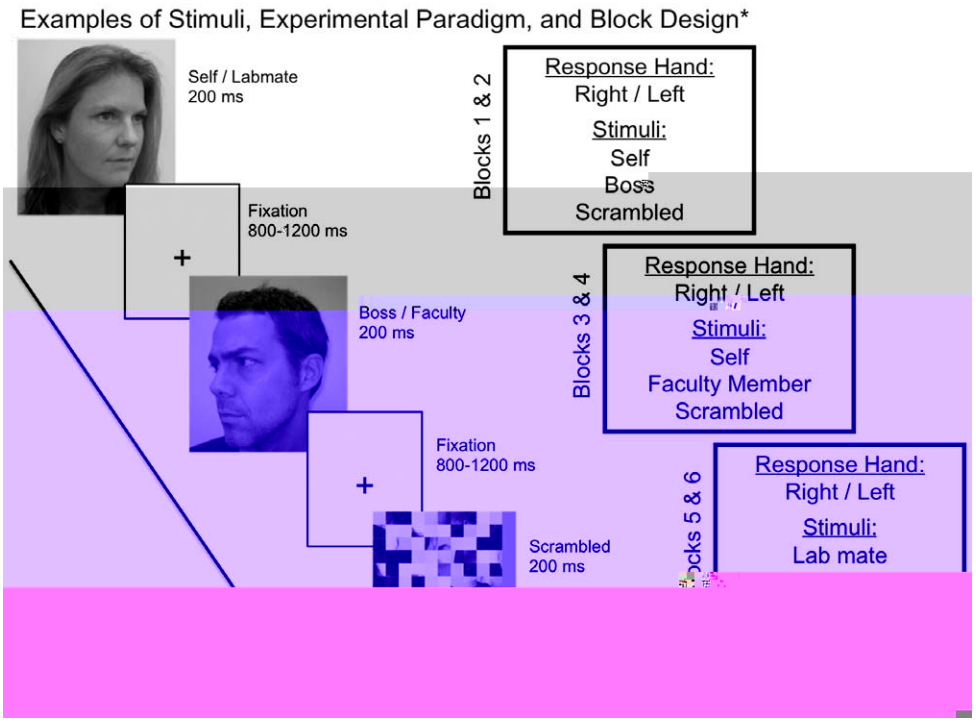

Figure 1. Examples of the stimuli, experimental paradigm, and block design. Participants were shown images of themselves/their labmate, their boss/faculty member, and scrambled images of faces for 200 ms, separated by a fixation cross that lasted between 800–1200 ms (left diagram). Blocks consisted of the following three stimuli sets (right diagram): self/boss/scrambled, self/faculty/scrambled, labmate/boss/scrambled, and were performed with both left and right hands, for a total of 6 blocks. Starting response hand and stimuli sets were counterbalanced across participants.
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Results

Subjective ratings

Both European American and Chinese participants' subjective reports indicated comparable perceived social status of their advisors and the other faculty members (European Americans: 5.90±2.29 vs. 6.0±1.89, $t(1,19) = -0.276$, $p = 0.79$; Chinese: 8.30±1.45 vs. 7.85±1.57, $t(1,19) = 1.690$, $p = 0.107$). In addition, the results of the Brief-FNE scale suggested that both European American and Chinese participants were significantly more afraid of negative evaluation from their advisors than from the other faculty members (European Americans: 2.56±0.44 vs. 2.24±0.39, $t(1,19) = 3.482$, $p = 0.0025$; Chinese: 3.38±0.73 vs. 2.41±0.66, $t(1,19) = 5.265$, $p<0.001$). However, a 2-factor mixed-effects analysis of variance (ANOVA) with Culture (Chinese, American) × Threat (Boss, Faculty Member) demonstrated an interaction effect between Chinese and American participants' reports of negative evaluation from their boss versus their faculty member ($F(1,19) = 9.536$, $p = 0.004$; see Figure 2), with Chinese participants reporting higher fear of negative evaluation from their bosses than European American participants.

RT results

Response accuracy was high for both European American and Chinese participants in face orientation judgment tasks (European Americans: 97.42%±2.21%; Chinese: 94.96%±2.43%). RTs with correct responses and within three standard deviations were analyzed. As used by two of the authors in a previous study [18], RTs were normalized by dividing RTs to self/other faces by RTs to scrambled images to rule out the influence of difference in response selection and execution between different blocks. Response accuracies and normalized RTs were then subjected to repeated measure ANOVAs with Hand (left vs. right hand), Face (self vs. other faces), and Threat (high- vs. low-threat) as independent within-subject variables. Results from Chinese participants have been reported previously [20]. Thus, here we first report results from European American participants, followed by cross-cultural comparisons with results from Chinese participants.

European American RT results

While none of the response accuracies showed significant effects ($p>0.05$), ANOVAs of normalized RTs showed a significant effect of Face ($F(1,19) = 11.403$, $p = 0.003$), with normalized RTs to one's own face being faster than RTs to other faces.

There were no significant interaction effects, and the finding of a Face×Threat interaction in Chinese subjects ($F(1,19) = 58.469$, $p<0.001$) [20] was not found with European Americans ($F(1,19) = 1.911$, $p = 0.182$), suggesting a comparable RT self-face advantage when self-face was presented with the boss and faculty member in Americans.

Normalized RTs to faces of labmates and advisors were also subjected to an ANOVA with Hand (left vs. right hand) and Face (labmate vs. advisor) as independent within-subject variables. While this analysis did not yield significant results in Chinese participants [20], it did yield a significant interaction effect between Hand and Face in European American participants ($F(1,19) = 6.618$, $p = 0.018$). A post-hoc analysis revealed that normalized RTs were significantly faster for the advisor's face on left-hand trials (0.88±0.148 vs 0.91±0.162; $t(1,19) = 1.78$, $p = 0.045$) but not on right-hand trials (0.90±0.174 vs. 0.91±0.180; $t(1,19) = -0.32$, $p = 0.38$).

Correlation analysis

To assess whether subjective evaluation of social threat from others affected these behavioral performances associated with self-face recognition, we correlated mean ratings from the Brief-FNE scale related to advisors and the differential RTs (normalized RTs to self-face minus normalized RTs to advisor's face). We did not find any significant correlations between either left, right, or combined hand responses and these scores ($ps>0.05$).

We then assessed whether subjective ratings of perceived social status correlated with differential RTs (normalized RTs to self-face minus normalized RTs to advisor's face). We found a significant positive correlation between boss's perceived social status and left-hand responses ($r = 0.475$, $p = 0.034$), as shown in Figure 3. This effect was not found for right-hand responses ($r = 0.282$, $p = 0.228$). Additionally, this effect was not found when correlating the social status of the other faculty member with differential RTs (normalized RTs to self-face minus normalized RTs to other faculty member's face) for either hand ($ps>0.05$).

Cross-Cultural RT results

To assess differences between European American and Chinese participants, a mixed-design ANOVA was assessed with Culture (European American vs. Chinese) as a between-subjects factor,

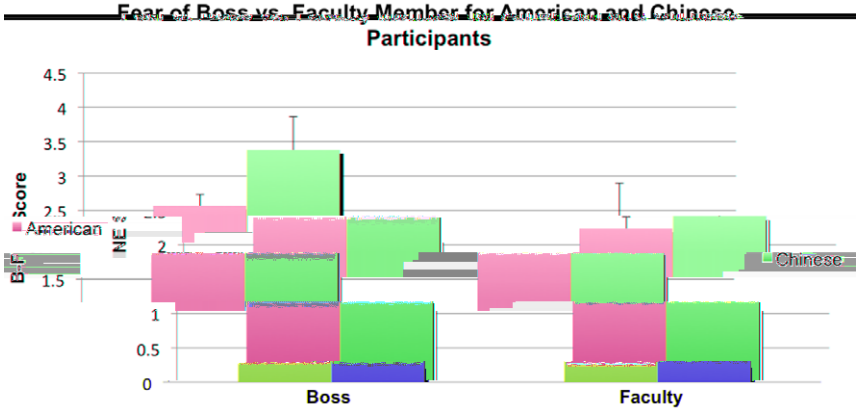

Figure 2. Chinese and American ratings of fear of negative evaluation from bosses versus faculty members. Participants ratings of fear of negative evaluation from the Brief-Fear of Negative Evaluation (B-FNE) questionnaire are presented for the boss (left; Americans in blue, Chinese in red) and for the other faculty member (right; Americans in blue, Chinese in red).
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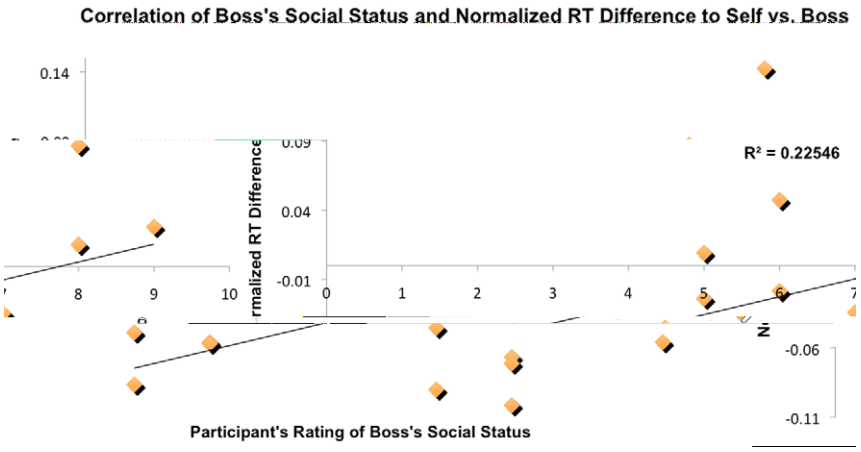

Figure 3. Correlation between boss's perceived social status and normalized RT difference in European Americans (boss-self). Participants' ratings of their boss's social status (x-axis) correlates positively with normalized RT differences (self minus boss; y-axis), $R^2 = 0.225$, $p = .034$.
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and Hand (left vs. right hand), Face (self vs. other faces), and Threat (high- vs. low-threat) as independent within-subject factors.

The four factor ANOVA revealed a marginally significant interaction effect of Culture×Face×Threat ($F(1,19) = 3.616$, $p = 0.073$), as the interaction of Face×Threat was more salient in Chinese subjects ($F(1,19) = 58.469$, $p<0.001$) than in American subjects ($F(1,19) = 1.911$, $p = 0.182$). There was also a significant interaction effect of Culture×Face ($F(1,19) = 12.409$, $p = 0.002$), with faster normalized RTs to one's own face in European Americans ($F(1,19) = 11.403$, $p = 0.003$) than in Chinese participants ($F(1,19) = 0.712$; $p = 0.409$).

Given prior findings suggesting that the self-face advantage has a more significant effect on left-hand responses [15,16,18,20], we then analyzed data from left-hand responses. Using left-hand responses only, we found a significant interaction between Culture×Face×Threat ($F(1,19) = 7.003$, $p = 0.018$). As demonstrated in Figure 4, while the normalized RTs were significantly faster to the self in the high-threat condition for European Americans, normalized RTs were significantly faster to boss in the high-threat condition for the Chinese participants. This pattern of self-face advantage persisted in European Americans during the low-threat condition, while Chinese participants regained self-face advantage during the low-threat condition.

Discussion

The current study examined how cultural differences in self-construal affect one's implicit self-processing in different social contexts. We compared normalized RTs of American and Chinese participants during an implicit face orientation task and discovered that, while both groups show a self-face RT advantage when self-face was presented with a faculty member's face (low-threat condition), only Chinese participants showed a loss of self-face advantage, replaced with a boss-face advantage, when self-face was presented with the boss's face (high-threat condition). In contrast, American participants maintained a self-face RT advantage in both low and high threat conditions, in accordance with our hypothesis that self-processing in Americans is not influenced by the social threat of one's boss. Interestingly, the correlation results show a modulation of this effect in Americans by their boss's perceived social status, so that the self-face advantage decreased as the subjective feelings of the boss's social status increased. Overall, these results demonstrate that culture modulates how self-processing is affected by the presence of a social threat and that the very concept of a "boss" may hold vastly different meanings in different cultures (i.e., negative threat in interdependent cultures versus social dominance in independent cultures).

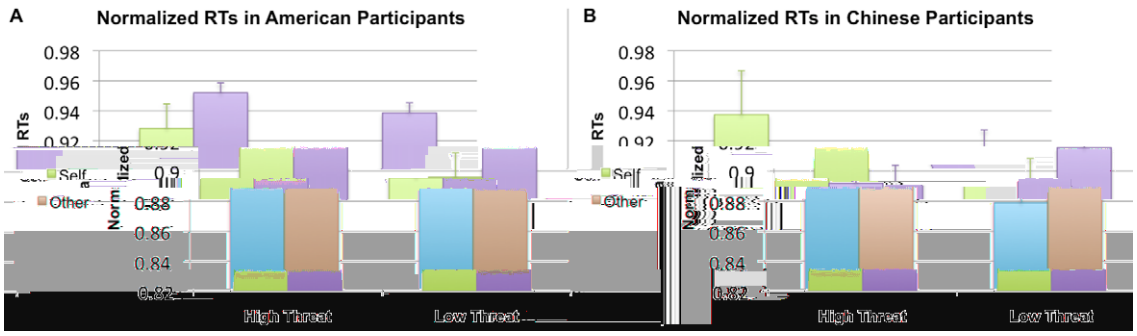

Figure 4. Bar graphs depicting Culture×Face×Threat normalized RTs (left hand only). American participants demonstrated a self-face advantage in both high threat (self and boss) and low threat (self and other faculty member) blocks shown on the left (A). Chinese participants demonstrated a boss-face advantage in the high threat block (self and boss), but a self-face advantage in the low threat block (self and other faculty member), shown on the right (B).
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Cultural Selves and Social Threats

The results of the questionnaire measurements suggest that both European American and Chinese participants reported significantly greater fear of negative evaluation from their advisor than

Asian cultures but not in Western cultures. In addition, this effect can be modulated by culture-specific priming, with priming towards more interdependent ideals enhancing the representation of close others in the mPFC and priming towards more independent ideals decreasing mPFC activity [34]. Applied to the current study, it is possible that strong neural representations of the self in brain areas such as the mPFC in American participants stand against the influence of social contexts to a greater degree compared to Chinese participants, thus not demonstrating a boss-effect on the typical self-face advantage. In addition, the right parietal region has also been implicated in self-other distinctions, as shown by repetitive transcranial magnetic stimulation to the right parietal cortex disrupting performance in a self-other face recognition task [36] and an fMRI study demonstrating right hemisphere activation in the parietal, frontal and occipital regions during self-face recognition [19]. These results are consistent with our findings of a stronger effect on left- than right-hand responses, and suggest that the right parietal region may also play a role in the cultural modulation of this effect. Finally, as discussed by Ma and Han (2010), emotion-related regions, such as the anterior cingulate and anterior insula, may also affect self-versus-boss representations [18]. Future neuroimaging research may help to better understand the neural regions responsible for these sociocultural effects.

Conclusion

The current study demonstrated the strong effects of culture on

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