

Asymmetric neurocognitive representation of ethnic in-group/out-group faces

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To investigate asymmetric neurocognitive representation of ethnic in-group and out-group members, we recorded event-related potentials (ERPs) to faces in a perceptual task after the faces had been primed with positive or negative affective links. The affective link priming did not influence the ERPs to ethnic out-group faces. However, relative to the positive affective link priming, the negative affective link priming increased the amplitudes of an early frontal negativity (N100) and a following central negativity but decreased the amplitude of a late positive potential elicited by ethnic in-group faces. Moreover, the N100 amplitude correlated with the degree of negative attitudes towards ethnic in-group faces. The findings suggest that multiple-level neural mechanisms are involved in individuation of heterogeneous ethnic in-group faces.

affective link, ERP, ethnicity, face

Social categorization of others helps to simplify the person perception process and is of fundamental importance for humans to take appropriate actions during social interactions^[1]. Social categories are perceived differently depending on whether a perceiver is included or excluded^[2]. For example, people categorize those of the same race as in-group members whereas those of other races as out-group members^[3]. Such ethnic in-group/out-group categorization occurs independent of task and attention demands^[4]. Recent neuroimaging studies demonstrate that multiple-level neural mechanisms are involved in categorization of ethnic in-group and out-group faces. The fusiform activity increases to ethnic in-group than out-group faces^[5] whereas the amygdala activity showed a reverse pattern^[6]. Event-related potential (ERP) studies showed that amplitudes of a short-latency frontal negativity (N100) and long-latency ERP components (N2 and LPP) also differentiated between ethnic in-group and out-group faces^[7]. While the neuroimaging findings identified neural substrates involved in categorization of faces into the ethnic in-group and out-group, the neural mechanism mediating differ-

entiation of sub-categories in the ethnic in-group or out-group remains poorly understood.

Social psychologists argue that an in-group is construed more in terms of an aggregate of separate entities rather than in terms of a social category, whereas an out-group is construed more in terms of a category since all members share at least one salient feature^[8]. The asymmetric cognitive representation of in-group and out-group members is characterized respectively by a heterogeneous aggregate of individuals and a homogeneous social category. Consistent with this, ethnic in-group faces are represented by a large cloud containing many exemplars whereas ethnic out-group faces are represented in a smaller, more dense area of the space (the multidimensional space hypothesis)^[9,10], resulting in better discriminations^[9] and memory^[11] of ethnic in-group than out-group faces. The asymmetric cognitive representation of in-group and out-group members

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may lead to different emotional responses to ethnic in-group and out-group members such that people show exaggerated affective responses to ethnic in-group members but not to pictures of ethnic out-group members^[12].

To investigate whether distinct neurocognitive processes engage in the asymmetric cognitive representation of ethnic in-group and out-group faces, we recorded ERPs from Han¹⁾ Chinese when they responded to orientations of ethnic in-group (Han Chinese) and out-group (Uygur²⁾ Chinese) faces that had been primed with positive or negative affective links using video clips in which the face owners behaved aggressively or amicably towards observers. We examined whether the affective link priming, which induced individuation of target faces in terms of positive or negative attitudes, modulates neural activity underlying the processing of ethnic in-group or out-group faces. Of particular interests is whether the neural activity in association with differentiation of individual faces of ethnic in-group members is stronger than that of ethnic out-group members.

1 Methods

1.1 Subjects

Fourteen healthy college students (7 females, mean age = 20.9 ± 2.17) in Urumchi, the capital of Xinjiang Uygur Autonomous Region of China, participated in this study.

kohms. Eye blinks and vertical eye movements were

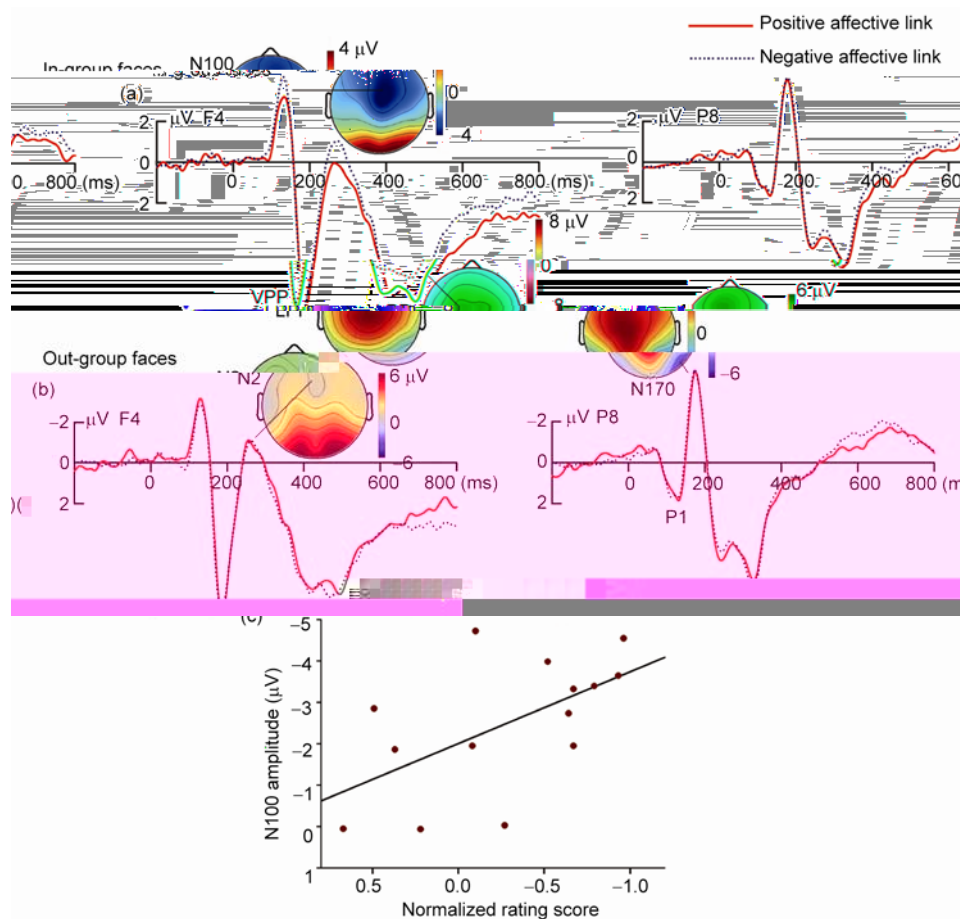


Figure 1 (a) ERPs to ethnic in-group faces primed with positive and negative attitudes at electrodes over the right frontal (F4) and right occipito-temporal (P8) sites. Voltage topographies illustrate a frontal distribution of the N100 and the central-parietal distribution of the LPP. (b) ERPs to ethnic out-group faces primed with positive and negative attitudes at electrodes over the right frontal (F4) and right occipito-temporal (P8) sites. Voltage topographies illustrate a right occipital-temporal distribution of the N170 and a fronto-central distribution of the N2. The voltage topographies of the N100 and N170 were plotted from ERPs

0.542, $P = 0.045$; C3: $r = 0.619$, $P = 0.018$; CZ: $r = 0.582$, $P = 0.029$; C4: $r = 0.600$, $P = 0.023$; Figure 1(c)). The stronger negative attitudes towards the actors, the larger the N100 amplitudes induced by the actor's face. No reliable correlation was observed between ERP amplitudes and induced attitudes towards ethnic out-group actors.

3 Discussion

Subjective ratings indicate that the affective link priming indeed induced positive and negative attitudes towards the actors. Although the attitudes indexed by the rating scores did not differ between ethnic in-group and out-group members, the effects of affective link priming on both behavioral performances and ERPs in association with the face orientation identification task were significantly different between ethnic in-group and out-group faces. RTs of the first two blocks of trials suggest that response speeds differentiated between ethnic in-group faces primed with positive and negative attitudes, whereas no such effect was observed for ethnic out-group faces. This result suggests that the affective link priming easily individuated ethnic in-group faces even when participants identified a perceptual feature of faces (i.e., orientation) that is; irrelevant to face identity. This is in agreement with the multidimensional space hypothesis^[9,10] in that ethnic in-group faces rather than ethnic out-group faces are represented as many exemplars.

Our ERP results revealed neural mechanisms underlying the asymmetric cognitive construal of ethnic in-group and out-group faces. The ERPs to ethnic out-group faces primed with positive and negative attitudes did not show any differences. However, the ERPs to ethnic in-group faces were significantly modulated by the affective link priming. The N100 amplitude recorded over the frontal-central electrodes was enlarged by ethnic in-group faces primed with negative than positive attitudes. In addition, the N100 amplitude showed a quantitative relation with the strength of primed negative attitudes towards ethnic in-group faces, being larger to the faces with stronger negative attitudes. This is consistent with the prior observation that the strength of amygdala activation to Black-versus-White faces correlated with the implicit attitude toward a target person^[13]. Our ERP results demonstrate that the process of individuation of ethnic in-group faces may take place as early as 110 ms after sensory stimulation. Previous re-

search has shown that the N100 is involved in differentiation between ethnic in-group and out-group faces. Specifically, the N100 was of larger amplitude to Black than White faces in White participants^[7], which may reflect that the social knowledge that Blacks are often associated with negative affect^[14] and faces of the racial group biased with stereotype of danger induced enhanced attention during the early time window of facial processing^[15]. Similarly, the N100 results in our study may arise from enhanced attention to faces of ethnic in-group members with the negative affective link relative to those with the positive affective link. More importantly, our findings indicate that the processing of individuation of ethnic in-group faces may take place as early as the categorization of faces in terms of ethnic in-group and out-group faces.

The long-latency ERP components were also involved in differentiation between ethnic in-group faces primed with negative and positive affective links. The negative affective link priming enlarged the N2 over the right frontal cortex relative to the positive affective link priming. By contrast, the LPP over the frontal-central-parietal area was enlarged by the positive compared to negative affective link priming. As the N2 is larger to one's own face than to others' faces^[16] and to famous faces than to unfamiliar ones^[17], the N2 has been associated with individuation and deeper processing of faces^[18]. Thus our N2 results suggest that observers may carry out extensive processing or individuation of ethnic in-group faces in terms of affective links between the observer and target faces. Similar processes may occur in real-life situations for the sake of perceivers' safety. The LPP over the central-parietal area has been shown to mediate evaluative categorizations of trait adjectives^[19] and is enlarged to pictures depicting pleasant than unpleasant events^[20]. The ethnic in-group faces primed with positive attitudes in our study were similar to the pleasant pictures used by Schupp et al.^[20] in that the stimuli with positive attitudes underwent enhanced evaluative processing. It should be noted that the effects of affective priming or prii([20]-1(0 -c.0027 (h)-cx Tf0.00tv)9(

