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Research paper

Brain potentials indicate the effect of other observers' emotions on perceptions of facial attractiveness

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HIGHLIGHTS

- Others' emotions would bias perceptions of facial attractiveness.
- Late positive potential was modulated by others' emotions.
- Social influence of others' emotions may be based on observational learning.

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ABSTRACT

Perceptions of facial attractiveness are sensitive to emotional expression of the perceived face. However, little is known about whether the emotional expression on the face of another observer of the perceived face may have an effect on perceptions of facial attractiveness. The present study used event-related potential technique to examine social influence of the emotional expression on the face of another observer of the perceived face on perceptions of facial attractiveness. The experiment consisted of two phases. In the first phase, a neutral target face was paired with two images of individuals gazing at the target face with smiling, fearful or neutral expressions. In the second phase, participants were asked to judge the attractiveness of the target face. We found that a target face was more attractive when other observers positively gazing at the target face in contrast to the condition when other observers were negative. Additionally, the results of brain potentials showed that the visual positive component P3 with peak latency from 270 to 330 ms was larger after participants observed the target face paired with smiling individuals than the target face paired with neutral individuals. These findings suggested that facial attractiveness of an individual may be influenced by the emotional expression on the face of another observer of the perceived face.

1. Introduction

The capacity to perceive facial attractiveness is important and fundamental for social communication and interaction. There are positive biases toward attractive individuals, which is called "beauty premium" and "plainness penalty" [1]. Furthermore, evidences have shown that phenotypic characteristics contributing to facial attractiveness include symmetry [2], hormone-dependent facial features [3], and cues of youthfulness [4]. However, little is known about whether another facial attribute–facial expressions contribute to perceptions of facial attractiveness. A study conducted by Tracy et al. [5] has examined the impact of emotional expressions on sexual attraction. They have observed that happiness is the most attractive female emotional expression and one of the least attractive in males compared with a neutral control. Also, Jaensch et al. [6] explored the modulating effect of emotional expressions on the rewarding nature of attractive and unattractive faces. They have found that males work to reduce the viewing time for all non-attractive faces. However, when an angry expression is added onto an attractive face, males reduce their viewing time for attractive angry faces and extend their viewing time for happy and neutral attractive faces. Besides, in an event-related functional magnetic resonance imaging (fMRI) study [7], it has been suggested

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that attractive faces produce activation of medial orbitofrontal cortex (OFC), a region involved in representing stimulus-reward value. More importantly, responses in this region are further enhanced by a smiling facial expression.

Although previous studies have indicated that facial attractiveness of an individual may be influenced by emotional expression of the perceived face, there is little evidence for social influence of perceived face's emotional expression of another observer on perceptions of facial attractiveness. Social influence refers to individuals' tendency to conform to the beliefs and attitudes of others [8]. It has been demonstrated that social influence is motivated by a desire to behave correctly, to obtain social approval and to maintain a favorable self-concept [9]. A three-phase paradigm has been usually employed to study social influence [8,9]. But the paradigm has been criticized by the influence of pretest effects [7]. Instead, one study [10] using a two-phase paradigm has shown that preference ratings for male faces are higher when participants observe women gazing at the male faces and smiling than when they observe women gazing at the male faces with neutral expressions. But the neural mechanism underlying this phenomenon has not been investigated.

In the present study, using event-related potential (ERP), we examined social influence of the emotional expression on the face of another observer of the perceived face on perceptions of facial attractiveness. ERP has been widely employed to reveal coherent stimulus-related postsynaptic activity in the cortex with high temporal resolution [11]. We tested whether perceptions of facial attractiveness would be influenced by observers with smiling, fearful or neutral expressions. Brain potentials for perceptions of facial attractiveness were compared after an individual face paired with observers with different emotions. Previous studies [12–14] have indicated that a late positive component (LPC), also termed as P3b, is elicited during perceptions of facial attractiveness. For example, Johnston et al. [12] have reported that the amplitudes of P3b are positively correlated with the beauty ratings of female faces. They have suggested that the elevated P3b activities possibly reflect task-related evaluative processes. In addition, Werheid et al. [13] have demonstrated that attractive as opposed to non-attractive faces elicit a larger late parietal positivity (P3b: 400–600 ms). But another study [14] has shown that attractive faces elicited smaller P3b amplitudes than unattractive faces. We predicted that after paired with smiling observers, target faces would be judged as more attractive compared with neutral observers. But after paired with observers with fearful expressions, target faces would be judged as less attractive than after paired with neutral observers. We also predicted that the amplitudes of P3 elicited by the target faces would be greater after paired with smiling observers compared with neutral observers. But the enhanced P3 may be reversed or disappeared when comparing attractiveness of target faces after paired with fearful observers to that paired with neutral observers.

2. Material and methods

2.1. Participants

Data for 18 right-handed participants (9 males, mean age = 22.47 years, age range = 18–26 years) were included in the analysis. Two further data sets were discarded due to excessive ERP artifacts. All participants reported normal or corrected-to-normal vision and had no history of neurological or psychiatric disorders. Written informed consent was obtained from all participants. The study was approved by the School of Management ethical committee at Zhejiang University. All participants were paid for their participation. The research was conducted in accordance with the principles of the Declaration of Helsinki.

2.2. Stimuli

FaceGen Modeller program was used to generate face images. FaceGen allowed to create realistic facial expression faces by parametrically manipulating action units portrayed on an infinite number of 3D faces [15]. FaceGen was advantageous in the flexibility of the Facial Action Coding System to represent facial expressions.

In order to avoid the effect of ethnic stereotypes, we set the faces to South East Asian. First, we generated 48 front-view face images with no hair, earrings, eyeglasses or visible make-up. Then we set the expression to be neutral. We called these face images as "target faces". Second, 48 pairs of neutral face images were randomly created as "neutral observers". In each pair, one face image had

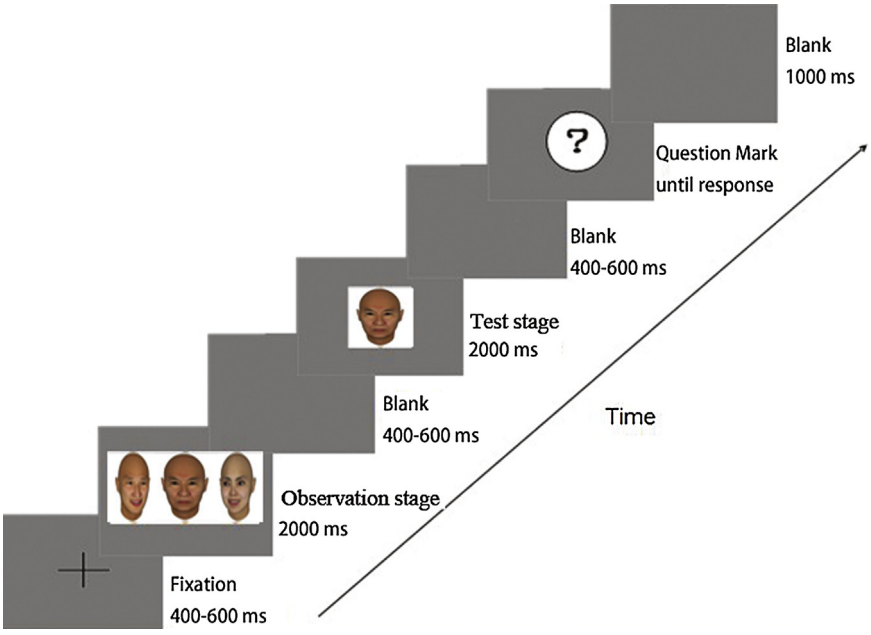

Fig. 1. Experimental procedures and design. The figure illustrates the sequence of stimuli in a trial.