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Low self-esteem elicits greater mobilization of attentional resources toward emotional stimuli

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HIGHLIGHTS

- The time course of attention deployment to emotional faces was investigated in low and high self-esteem.
- Both happy faces and angry faces elicited greater mobilization of attentional resources in low self-esteem.
- Attentional bias for low self-esteem was both on the negative information and on the positive information.

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ABSTRACT

Previous findings are generally consistent with the notion that individuals with low self-esteem tends to easily orient their attention on negative stimuli. The main objective of the present study was to further investigate the time course of attention deployment to positive (happy) and negative (angry) facial expressions in visual probe task using event-related potentials (ERP) technology in 15 high versus 15 low self-esteem participants while they viewed pairs of faces (e.g., happy face paired with neutral face or angry face paired with neutral face) shown for 500 ms and followed by a probe. Behavioral results showed that individuals with low self-esteem simply had faster manual reaction times on the entire task. ERP results showed that individuals with low self-esteem, but not high self-esteem, displayed increased P1 and N1 activity to both happy and angry facial expression. These findings suggest that emotional stimuli (angry faces and happy faces) elicited greater mobilization of attentional resources in individuals with low self-esteem

1. Introduction

Self-esteem can be defined as the overall emotional evaluation of the self, reflecting the extent to which individuals accepted and liked by themselves [19]. Numerous studies have indicated that the difference in the level of self-esteem can influence how individuals respond to certain types of information, such as information concerning acceptance, rejection, or evaluative threaten information [8,20]. For example, previous studies found that after failure, low self-esteem individuals had a tendency to blame themselves and focus on the negative outcome, while high self-esteem individuals appears to provide some degree of protection from adverse experiences, they tend to make an external attribution on any negative outcomes and increased attention toward the domains they strength [2,4].

Researchers speculate that low self-esteem derives in part from repeated experiences of social rejection and criticism, conditioning an individual to be particularly attuned and sensitive to negative social evaluations [1,4]. For these reasons, individuals with low self-esteem may be vigilant to perceive the environment with an attentional bias for information concerning rejection, tending to monitor the environment for, focus attention on, and easily orient attention on, any minimal indication of negative interpersonal feedback [5,12]. Conversely, individuals with high self-esteem, who tend to believe they are generally successful, may divert their attention away from negative information about themself or their own performance, boosting confidence and optimism [4].

Enhanced attentional processing of negative-related stimuli in low self-esteem people was evident in emotional stroop task [4]. The participants were asked to name the 'ink' color of acceptance related (e.g., 'welcomed') or rejection related (e.g., 'ignored') words that resonate with participants' emotional vulnerability created greater cognitive interference than neutral words (e.g. 'table') and produced longer color-naming reaction times. Results indicated that individuals with low self-esteem experienced more attentional

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interference on rejection words than on acceptance words, while for high self-esteem individuals, no difference was observed on acceptance or rejection words.

Negative attentional bias in individuals with low self-esteem was also evident in the visual probe task that assesses the degree of participant's attention that is drawn to and held by specific types of stimuli [15]. Researchers used rejection-neutral and smiling-neutral paired faces to explore the relationship between attentional bias and self-esteem. Results have shown that individuals with low self-esteem who were trained to practice a repetitive exercise of directing attention away from rejection stimuli exhibited significantly less hypervigilance to rejection information compared with their counterparts in the control condition. There was no training effect for individuals with high self-esteem, who, on average showed no rejection bias or acceptance bias in either condition [9].

Fine-grained information about the temporal structure of attentional processes can be obtained through the use of event-related brain potentials (ERPs). Visuospatial orienting of attention is known to enhance the stimulus-evoked neural activity reflected in enhanced amplitude of P1 and/or N1 components, reflecting electrophysiological responses modulated by spatial attention at an early sensory stage [11]. Studies using the visual-probe paradigm have shown that larger sensory-evoked P1/N1 components were elicited when probes was presented at attended locations than probes at unattended locations [13,15]. It was found that the P1 component to emotionally cued probes provides a sensitive measure to assess rapid spatial orienting toward threat-related stimuli. Specifically, researchers reported that probes replacing fearful or angry facial expression as opposed to neutral facial expression evoked greater P1 amplitude [17]. These findings are consistent with independent evidence indicating that P1 amplitudes are larger for stimuli presented at attended compared to unattended locations [9]. The N1 waves are larger for attended location stimulus than for an unattended-location stimulus, which is called the N1 spatial attention effect [10]. Authors observed that relative to targets preceded by directionally neutral cues, targets presented at validly cued locations enhanced the posterior N1 wave, which reflects later enhancement of signals from cued locations [11]. In addition, although the amplitude of both P1 and N1 were associated with visuospatial attention processing, the difference in working mechanism between them also should be noticed. For example, previous studies found that P1 amplitude may reflected the inhibition of distractors from unattended location and N1 might reflect reorientation and engagement of attention toward relevant stimuli location [7,11].

The main objective of the present study was to further investigate the time course of attention deployment to positive and negative stimuli in individuals with high and low self-esteem using ERP technology and visual probe task. Previous studies have proved that negative bias and positive bias can be simultaneously and validly evaluated by the visual probe task [14,15], and consistent with previous studies, happy, angry and neutral facial expression were used as positive, negative and neutral cues respectively in present study. Given previous findings, we hypothesized that individuals with low self-esteem would exhibit negative attentional bias compared to those with high self-esteem. They should distribute more attention to negative information compared to neutral and positive information. Further, since low self-esteem individuals focused on the negative information and previous study found that probes presented at attended locations elicit larger sensory-evoked P1/N1 components than stimuli at unattended locations, we expected that negative stimuli will elicit greater P1/N1 amplitudes than neutral and positive stimuli and the probes in congruent trial (probe replacing negative or positive information) would elicit greater P1 and N1 amplitudes than in incongruent trial (probe replacing neutral information) in angry–neutral condition, not in happy–neutral condition, and only in low self-esteem participants.

2. Methods

2.1. Subjects

One day before the experiment, 129 undergraduates (47 males, mean age = 21.4 years) were recruited through announcements in class from a local University (Southwest University, Chongqing city, China). All subjects filled out the Rosenberg self-esteem scale [18]. The Rosenberg self-esteem scale is made up of 10 items such as "On the whole, I am satisfied with myself" and is coded on a 4-point ranging from 1 (strongly disagree) to 4 (strongly agree). It assesses a person's overall evaluation of his or her self-worth. According to the score of Rosenberg self-esteem scale and the voluntary principal, 15 high SE with the highest scores (7 males, mean score: 34.5 ± 2.4) and 15 low SE participants with lowest scores (8 males, mean score: 26.1 ± 2.9) were selected for the electrophysiological study. The average Rosenberg score for all participants in the current study was $M = 30.7$, $SD = 5.2$, $N = 30$. The significant difference (t (28) = 8.64, $p < 0.001$, two-tailed) in Rosenberg score between "low self-esteem" group and "high self-esteem" group indicated that the level of self-esteem of low self-esteem group was actually lower than high self-esteem group and the classification of self-esteem group was reasonable and acceptable. All participants were right-handed, had normal or corrected-to-normal vision and reported no history of affective disorder. The data and results described in this manuscript were obtained in compliance with the guidelines of APA requirements. Subjects gave their written informed consent prior to participation and were paid for completing the study.

2.2. Stimuli and procedure

Materials consisted of 50 identities' facial stimuli, 25 different male identities and 25 different female identities. These facial stimuli were selected from the native Chinese Facial Affective Picture System (CFAPS), a standardized facial system, developed by the Institute of Psychology, Chinese Academy of Sciences [22]. The three kind of facial expressions were significantly different in valance from one another F (2, 48) = 375.35, $p < 0.001$ ($M \pm SD$, angry: 2.87 ± 0.67, happy: 6.15 ± 0.58, neutral: 5.27 ± 0.62). For each category, 25 different male identities and 25 different female identities were used. Each pair consisted of identities portraying a neutral expression and either a happy or angry emotional expression. Each emotion expression appeared equally often to the left or right of the neutral expression. Each face was enclosed within a black rectangular frame measuring 9 cm high × 7 cm wide, and the centers of the face were 6 cm from a white fixation cross. Probe stimuli were two dots (either ':' or '.') measuring 1.2 cm, and replaced the left or right faces at a position of 5 cm from the center fixation cross. All stimuli appeared against a black background. Participants sat comfortably about 100 cm in front of a computer screen in an electrically shielded room. Stimulus presentation was controlled with E-Prime software.

The task began with one practice block of 10 trials followed by three blocks of total 320 trials (160 happy–neutral face pairs; 160 angry–neutral face pairs). The different trial types were presented with the position of the emotional face (in emotional–neutral face pairs) and the position of probe counterbalanced across trials, so that each appeared in either location with equal probability. The probe followed emotional and neutral faces equally often. All different trial types were presented in a new random order for each participant within each block. Each block was separated by a short rest break. Each trial started with a central fixation cross present