Personality and Individual Differences 53 (2012) 947–951

Contents lists available at SciVerse ScienceDirect

Personality and Individual Differences

journal homepage: www.elsevier.com/locate/paid

# Low self-esteem and the neural basis of attentional bias for social rejection cues: Evidence from the N2pc ERP component

Haijiang Li [a,b], Virgil Zeigler-Hill [c], Juan Yang [a,b], Lei Jia [a,b], Xiao Xiao [a,b], Junlong Luo [d], Qinglin Zhang [a,b,*]

[a] Key Laboratory of Cognition and Personality, Ministry of Education, Southwest University, Chongqing 400715, China
[b] School of Psychology, Southwest University, Chongqing 400715, China
[c] Department of Psychology, Oakland University, 111 Pryale Hall, Rochester, MI 48309, United States
[d] Department of Psychology, Shanghai Normal University, Shanghai 200234, China

ARTICLE INFO

*Article history:*
Received 25 November 2011
Received in revised form 5 March 2012
Accepted 8 March 2012

*Keywords:*
Self-esteem
Attentional bias
Rejection
N2pc

ABSTRACT

Previous studies have indicated that individuals with low self-esteem show an attentional bias toward information concerning social rejection. The present study used event-related potentials (ERPs) to investigate whether task-irrelevant rejection cues could capture the visuo-spatial attention of low self-esteem individuals during a demanding visual detection task. The N2pc ERP component was measured as an index of the allocation of spatial attention. Results revealed that rejection cues induced greater N2pc component responses among individuals with low levels of self-esteem than for those with high levels of self-esteem. These results suggest that task-irrelevant rejection cues are likely to capture the attention of individuals with low self-esteem but not those with high self-esteem. These findings provide direct electrophysiological support for the idea that individuals with low levels of self-esteem show an attentional bias for cues related to social rejection.



## 1. Introduction

Individuals with low levels of self-esteem are often extremely sensitive to social rejection (Brown, 2010; Richter & Ridout, 2011; Sommer & Baumeister, 2002). This sensitivity is believed to stem from the fact that individuals with low self-esteem have often experienced a considerable amount of social rejection during their lives compared to other individuals (e.g., Harter, 1983; Leary & Baumeister, 2000; MacDonald & Leary, 2012). This history of social rejection may provide a partial explanation for some of the cognitive patterns and behaviors exhibited by those with low self-esteem including their tendency to anticipate rejection (Downey & Feldman, 1996), devote considerable attentional resources to potential rejection cues (Dandeneau & Baldwin, 2004, 2009), exhibit high levels of cortisol activity in response to rejection (Ford & Collins, 2010), fail to engage in strategies to prevent rejection (Sommer & Baumeister, 2002), and react strongly to rejection when it actually occurs (Murray, Rose, Bellavia, Holmes, & Kusche, 2002). This pattern of findings is not surprising because it has frequently been argued that self-esteem serves as a personal resource that buffers individuals from negative experiences such as social rejection (e.g., Brown, 2010; Zeigler-Hill, 2011). That is, high self-esteem appears to provide some degree of protection from adverse experiences. Individuals with low self-esteem are believed to be more reactive to negative events because they lack the protection that those with high self-esteem derive from their positive feelings of self-worth. This vulnerability may explain why those with low levels of self-esteem display heightened vigilance for events that have the potential to threaten their relatively impoverished self-esteem resources (Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007).

Individuals with low self-esteem are often much more attentive to information concerning social rejection than are those with high self-esteem (Dandeneau & Baldwin, 2004, 2009). For example, individuals with low self-esteem have been found to be especially attentive to evaluative threats in studies using the Emotional Stroop task (Dandeneau & Baldwin, 2004) and Visual Probe tasks (Dandeneau & Baldwin, 2009). These results suggest that individuals with low self-esteem develop cognitive strategies that emphasize vigilance for social rejection cues (Dandeneau & Baldwin, 2004, 2009; Dandeneau et al., 2007). This vigilance may, in turn, increase the likelihood of these individuals perceiving ambiguous social information as being indicative of rejection which may perpetuate their feelings of low self-worth.

Previous studies concerning the attentional biases of individuals with low self-esteem have most often relied on behavioral indicators of these biases such as response times. The limitation of this approach is that these behaviors (e.g., pressing a button on a keyboard) reflect a series of processes that include everything from the earliest stages of sensation to later decision making processes. Behavioral measures are indirect indicators of attention that require inferences to connect the actual behavior with attentional

* Corresponding author. Address: School of Psychology, Southwest University, Beibei, Chongqing 400715, China. Tel.: +86 23 6825 2660; fax: +86 23 6825 3629.
*E-mail address:* qlzhang.swu@gmail.com (Q. Zhang).

0191-8869/$ - see front matter © 2012 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.paid.2012.03.004

orientation. Behavioral measures are also limited because they are—at best—only capable of providing a snapshot of the deployment of attention rather than clearly reflecting shifts in attention over time (Horley, Williams, Gonsalvez, & Gordon, 2004). To provide a more detailed account of the temporal unfolding of attentional bias for those with low self-esteem, it is important to utilize a continuous measure of attentive processing. Unlike behavioral measures, event-related potentials (ERPs) allow researchers to identify the precise time course of neural processes involved in the allocation of visuo-spatial attention (Luck, Woodman, & Vogel, 2000). ERPs are neurophysiological responses to stimuli that can be captured with electroencephalography (EEG).

Despite an extensive literature describing the connection between self-esteem and rejection, there have been relatively few studies examining the direct physiological reactions of individuals with low self-esteem to social rejection. The few studies have examined physiological mechanisms such as startle eye-blink responses (Gyurak & Ayduk, 2007) as well as activity in the ventral anterior cingulate cortex and the medial prefrontal cortex (Somerville, Kelley, & Heatherton, 2010). The existing data suggests the intriguing possibility that individuals with low self-esteem show a different pattern of neurophysiological responses to social rejection cues than are observed for individuals with high levels of self-esteem. This pattern suggests the intriguing possibility that individuals with low levels of self-esteem may differ from those with high self-esteem in terms of their neurophysiological responses to social rejection including the allocation of attentional resources.

The present study attempted to extend what is known about the physiological responses of individuals with low self-esteem to rejection cues by examining the time course of their neurophysiological responses to rejection-related stimuli using ERPs. More specifically, we examined whether individuals with low self-esteem were more likely than those with high self-esteem to demonstrate greater ERP activity in response to task-irrelevant rejection cues that were presented during a visual detection task. If rejection cues are more likely to capture the attention of low self-esteem participants than those with high self-esteem, then individuals with low self-esteem should demonstrate heightened levels of activity in ERP components that serve as electrophysiological markers for selective spatial attention. We assessed the allocation of spatial attention using the N2pc ERP component which is a negative-going deflection that occurs in the "N2" time range (approximately 180–280 ms following stimulus presentation) that is largest at posterior ("p") sites on the scale and that is contralateral ("c") to the location of the attended visual item. It appears that the N2pc component reflects the location of visual spatial attention (Eimer, 1996; Luck & Hillyard, 1994). This ERP component is computed by taking voltage differences between corresponding pairs of electrodes located on the left and right posterior scalp after taking into account the hemifield in which attention is deployed (Jolicoeur, Brisson, & Robitaille, 2008; Woodman & Luck, 2003). Source localization analyses of magnetoencephalographic recordings suggest that the neural generators of the N2pc are in the extra-striate visual cortex with the possibility that there is some degree of early parietal contribution (Hopf et al., 2000).

The N2pc ERP component has been used as a moment-to-moment index for measuring the time course of the allocation of visual spatial attention in many studies (Jolicoeur et al., 2008; Kiss, Van Velzen, & Eimer, 2008; Woodman & Luck, 2003). Unlike other attention-related ERP components such as the P1 and N1 that are linked to early location-specific sensory gating mechanisms prior to target selection (e.g., Mangun & Hillyard, 1987), the N2pc component is assumed to reflect the direct spatial attention target selection among distractors in visual displays (e.g., Kiss et al., 2008). Therefore, the N2pc ERP component appears particularly suitable for an online tracking of the allocation of attention to the visual field and for the assessment of any spatial bias created by stimuli conveying social rejection. Thus, the aim of the present study was to examine whether individuals with low self-esteem display biases in spatial attention by showing more attention to task-irrelevant social rejection cues than is shown by those with high self-esteem. According to previous research, we hypothesized that a bias in visuo-spatial attention would be observed by an enhanced N2pc component in response to task-irrelevant rejection cues in individuals with low self-esteem. In contrast, we did not expect to find this enhanced N2pc component in response to task-irrelevant rejection cues for those with high self-esteem.

## 2. Method

### 2.1. Participants

Participants were selected from a pool of 190 undergraduate students at a university in China based on their scores on the Rosenberg Self-Esteem Scale (Rosenberg, 1965). Previous research has found that Chinese participants have a different understanding of the eighth item of the scale ("I wish I could have more respect for myself") than do participants from Western cultures (Kwan, Bond, & Singelis, 1997; Tian, 2006; Zhou & Wang, 2005). As a result, this item has a low correlation with the other items among Chinese participants and is sometimes excluded when computing the composite self-esteem score. We followed this process in the present study such that we excluded this item when we computed the composite score. Scores for the Rosenberg Self-Esteem Scale ranged from 10 to 36 (Cronbach's $\alpha = 0.87$). Participants were selected for either the high self-esteem group (i.e., score on the Rosenberg Self-Esteem Scale was in the highest tertile) or the low self-esteem group (i.e., score on the Rosenberg Self-Esteem Scale was in the lowest tertile). Although we will refer to participants in the lowest tertile as possessing *low self-esteem* it is important to note that many of these participants actually reported self-esteem scores near the midpoint of the scale. That is, their self-esteem was actually somewhat moderate in an absolute sense and they only possessed *low self-esteem* in the relative sense (i.e., in comparison with the other participants in the study). This is extremely common in studies concerning self-esteem because of the distribution of self-esteem scores (Baumeister, Heatherton, & Tice, 1993). This suggests that the participants that we will refer to as possessing *low self-esteem* are likely to have relatively neutral attitudes about themselves rather than actually disliking themselves.

The high self-esteem group consisted of 13 students (7 men, 6 women; mean age = 20.08 years [range 19–24 years]) and the low self-esteem group consisted of 13 students (6 men, 7 women; mean age = 21.25 years [range 19–24 years]). These participants were randomly selected from the appropriate tertiles. By design, the high self-esteem group reported higher levels of self-esteem than the low self-esteem group ($t[24] = 8.41$, $p < 0.001$, $d = 3.43$; high self-esteem group: $M = 31.08$, $SD = 2.69$; low self-esteem group: $M = 22.62$, $SD = 2.43$). All participants were healthy, right-handed, possessed normal vision (or corrected-to-normal vision), and reported no history of affective disorder. The study was approved by the local review board for human participant research and each participant provided informed consent prior to participating in the experiment.

### 2.2. Stimuli and procedure

Facial stimuli were used to convey rejection. The facial stimuli were achromatic photographs of 12 different actors (6 men, 6 women) taken from the NimStim Set of Facial Expressions (Tottenham et al., 2009). Adobe Photoshop software was used to equate the