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Short Communication

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The Relationship between Neuroticism and Modulation of Error Processing by Induction of Short-Term Affect

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Introduction

The error-related negativity (ERN) is a maximum negative deflection which reliably follows an erroneous response and peaks approximately 50-150ms postresponse over fronto-central scalp and Pe is a slow positive wave which peaks approximately 150-500ms postresponse over centro-parietal scalp [1]. Affective distress such as traits of anxiety has been demonstrated to influence the error processing in both clinical and nonclinical groups. Neuroticism refers to the tendency to experience negative emotions (e.g., anxiety). Negative affect has been shown to modulate ERN amplitude: high score group of negative affect displayed larger ERN amplitudes compared to low score group of negative affect [2]. In the present study, we examined how the effects of induced short-term effects on error processing depend on neuroticism.

Methods

Participants

Participants were pre-screened to be either high or low scorers on neuroticism scale by Korean version Eysenck personality questionnaire: high- neuroticism (n=28), low-neuroticism (n=28). Stimuli and Procedure: Thirty IAPS pictures were selected based on Korean score of valence and arousal rating [3,4], which corresponds to the neutral, positive and negative conditions, respectively. Neutral IAPS pictures had a mean valence rating of 5.08 (arousal rating of 4.79). Positive IAPS pictures had a valence rating of 7.00 (arousal rating of 6.22). Finally, negative IAPS pictures had a valence rating of 3.03 (arousal rating of 6.50).

An arrow version of the flanker task was employed in the present study [5]. Half of all trials were congruent ('<<<<<<<' or '>>>>>>>') and half were incongruent ('<<<><<<' or '>>><>>>'). The participants were instructed to respond to the central target with the left or right index finger as fast and as accurately as possible. The stimulus-response assignment was balanced across participants. The experiment consisted of five experimental blocks (100 trials per block with congruent and incongruent trials randomized within the blocks) and a 60-trial practice block. Individual response interval deadlines were determined by the performance of practice block to ensure performance levels of 80-90% accuracy (Figure 1).

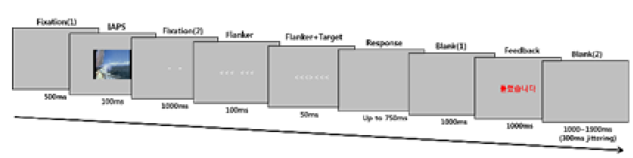

Figure 1: Example procedure of stimulus presentation.

ERP Recording and Analysis

ERPs were recorded from 27 scalp electrodes of 10-20 system with horizontal and vertical EOGs for EOG artifact correction. The impedance for all electrodes was kept below 5 kΩ. The EEG and EOG signals were amplified using a band pass filter between 0.1 and 30 Hz and digitized at 250 Hz.

Influences of eye blinks were eliminated by applying an ocular correction algorithm [6]. All data were screened for artifacts and contaminated trials exceeding maximum/minimum amplitudes of ±100μV were rejected. The continuous EEG record was transformed to average reference and segmented into epochs ranging from -100ms before, until 500ms after response onset. Also, IAPS of epochs ranging from -100ms before response onset, until 700ms after stimulus onset. A baseline period of 100ms preceding the response onset was used before averaging. Based on visual inspection of the waveforms, ERN and Pe amplitudes were defined as the mean average amplitude (i.e., time window: 30-70ms for ERN, 100-300ms for Pe) after response onset at electrode site Cz where ERN and Pe amplitude was maximal.

Results

Figure 2 shows waveforms of ERN and Pe at Cz electrode site by induced short-term affects. Two groups of neuroticisms (high/low) were examined for ERN and Pe related to error response during the Eriksen flanker task. Short-term affects were induced by presenting one of the emotional (positive/neutral/negative) IAPS pictures immediately before the flanker stimulus was presented in each trial of Eriksen flanker task. The peak amplitude of ERN and Pe was larger (more negative) than CRN (correct response negativity) and Pc (correct positivity). In particular, the effect of induced affects on ERN amplitude was different according to the level of neuroticism. For the high neuroticism group, the induced negative affect produced larger amplitude than the neutral affect, but no effect of the induced affect was observed in the low neuroticism group. In addition, the effects of positive affect were not observed in both groups.

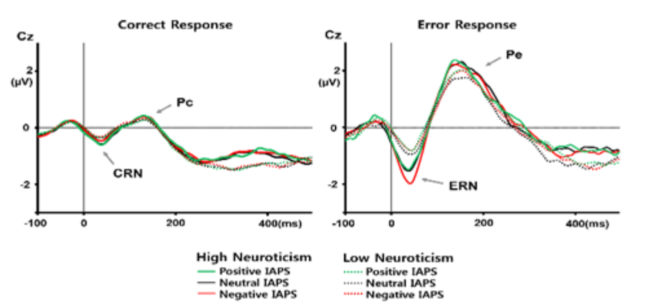

Figure 2: Grand averaged ERPs for correct and error responses at central scalp (Cz).

Conclusion

We found the effect of induced effects on the early error processing was dependent on the level of neuroticism. The high neuroticism group, unlike the low neuroticism group, showed larger ERN amplitude when negative affect was induced compared to the neutral affect. These results suggest that high neuroticism group was very sensitive to the induced short-term negative affect which influenced error monitoring. On the other hand, in the later stages of error processing, the induced affect or neuroticism did not influence the error awareness.

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