

NEURAL CORRELATES OF SENSITIVITY TO FAILURE

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INTRODUCTION

Two event-related brain potentials, the error-related negativity (ERN) and the error positivity (Pe), have been associated with error detection and response monitoring. The ERN occurs 60-80 ms after a person makes an error in a speeded response task, and is typically followed by the Pe, which reaches its maximum around 200-400 ms after the error. Although the functional significance of both ERPs and the specific processes they index is still debated^{1,2}, one view suggests that the ERN signifies affective processing in response to errors³, and that the Pe reflects processes associated with attentional and behavioral regulation⁴. In this study, we examined the extent to which individual differences in sensitivity to failure (SIF) might modulate both components. SIF is derived from a neurobiological model of motivation and is assumed to reflect a specific outcome of overactivity in the behavioral inhibition system⁵. It is characterized by a tendency to experience distress and uneasiness and to display heightened self-awareness when anticipating or encountering a situation that implies potential failure.

METHODS

Pre-screening & grouping: 170 participants ($M_{age}=24.9$) completed a questionnaire assessing *sensitivity to failure*, *achievement goal orientations* (a tendency to select or favor certain goals and outcomes in achievement contexts), *fear of failure*, *academic withdrawal* (a tendency to give up when facing challenges), *adaptive perfectionism* (high standards and goals), and *maladaptive perfectionism* (dissatisfaction with goal attainment). Participants high ($n=11$) and low ($n=11$) in sensitivity to failure were selected for the EEG-session. During the session, participants' motivational and affective states (e.g., anxiety, interest, self-efficacy, nervousness, enjoyment) were assessed with a short survey.

Task: A Go/NoGo-task with 560 Go- and 112 NoGo-stimuli was used (Fig. 1).

EEG-recordings: Two 12-minute blocks were recorded with the Biosemi system using a 64-channel cap. Data were filtered and artifacts were automatically corrected in BESA. Data were epoched separately for correct and erroneous responses (500 ms before to 800 ms after response).

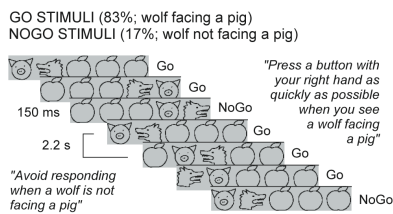


Fig. 1. Stimuli and the experimental setup.

RESULTS

Group differences on motivational factors are displayed in Fig 2. Regarding on-line assessment, the only difference was found on nervousness; high-SIF individuals reported being more nervous than low-SIF individuals ($F = 6.69, p = .018, \eta^2 = .26$).

Behavioral results

Participants tended to be faster on error trials than on correct trials ($F = 21.53, p = .000$), and high-SIF individuals were slightly faster in their responses than low-SIF individuals (see below). However, no group differences were found on the number of errors committed (i.e., erroneous responses to NoGo stimuli).

	High in sensitivity to failure	Low in sensitivity to failure	F_{group}	p
Reaction times (ms)				
Go correct	484 ms \pm 38 ms	517 ms \pm 47 ms	2.97	.101
NoGo error	420 ms \pm 21 ms	487 ms \pm 66 ms	9.24	.007
Errors (%)	9.9% \pm 5.4	11.0% \pm 7.2	.164	ns.

ERP results

A negative deflection (ERN) was found for error trials peaking 40-80 ms after the response, and this was significantly stronger for high-SIF individuals than for low-SIF individuals ($F_{Fz} = 6.72, p = .019, \eta^2 = .28$). The ERN was followed by a positive deflection (Pe), peaking around 200 ms after response, which also was significantly stronger for high-SIF individuals ($F_{Pz} = 7.68, p = .013, \eta^2 = .31$). The amplitudes of ERN and Pe correlated with each other ($r = -.66, p = .002$), but not with the frequency of errors.

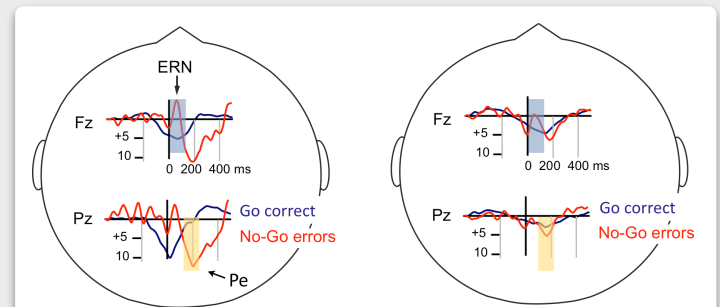


Fig. 3. Response-locked average ERP waveforms for high-SIF and low-SIF participants.

RESULTS

Group differences

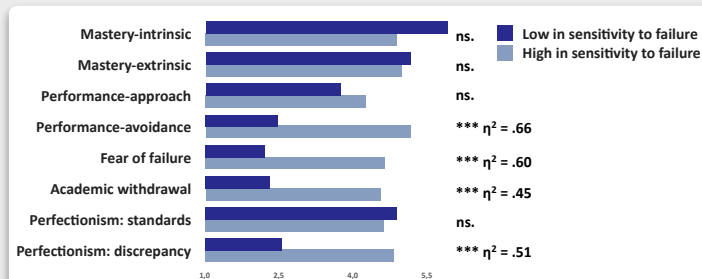


Fig. 2. Group differences on motivational factors.

CONCLUSIONS

Individuals high in sensitivity to failure displayed higher ERN and Pe amplitudes compared to individuals low in sensitivity to failure. This points out to the possibility that a defensive-type of motivational disposition modulates not only the degree of aversion individuals experience when making mistakes, but also the neural processes associated with performance adjustment and attention.

References

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