EEG applications to the measurement of memory error reactivity

Giselle Mirfallah
Department of Psychology, University of British Columbia
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Dr. Noah Silverberg

Two psychophysiological processes are thought to be associated with error processing:

1) Error negativity (Ne or ERN)

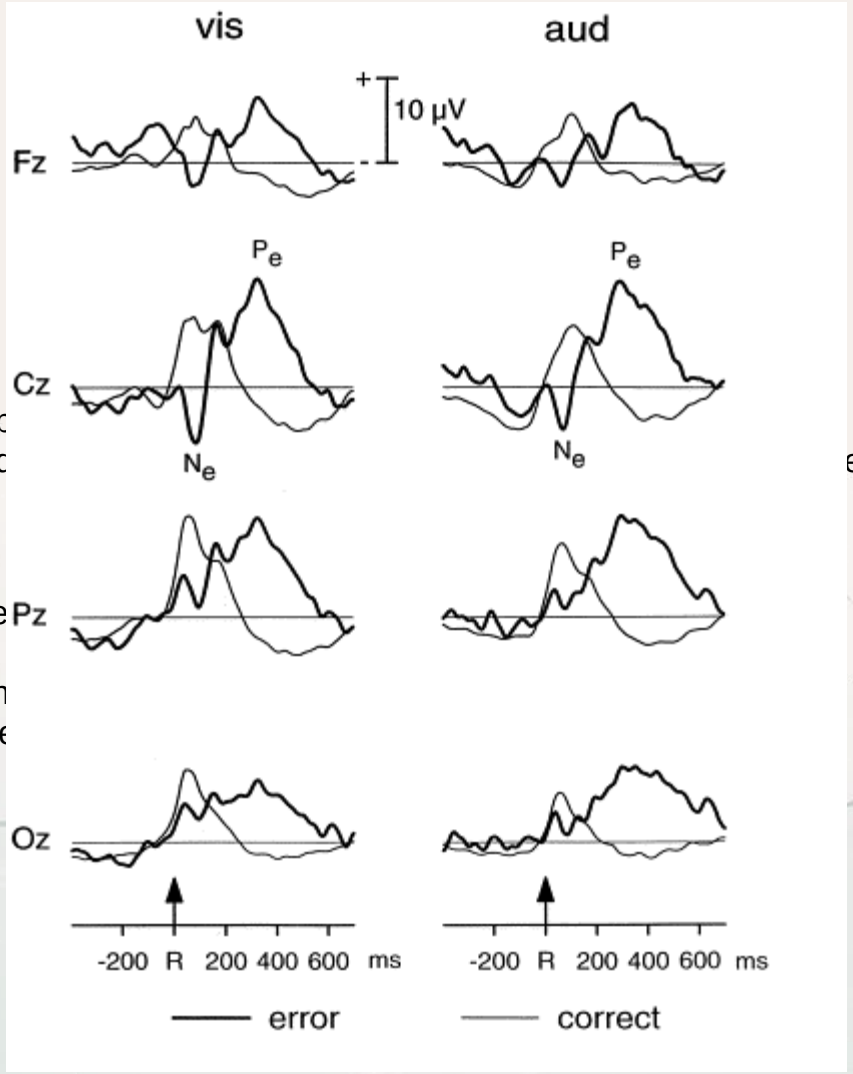
2) Error positivity (Pe)

ERN

- ERN is a sharp
- Frontocentral c ect response

Pe

- A slow positive
- Centroparietal
- Often but not n
- Less researche



(Nieuwenhuis et al.,2001)

ERN vs Pe

Most authors agree that ERN and Pe are representing different aspects of error processing

- The early onset latency of Ne with respect to stimulus → internal error-monitoring system
- In contrast, the timing of Pe with respect to the stimulus→ external error-monitoring system

Based on the timing→ make sense that they would be differently related to

subjective awareness

(Nieuwenhuis et al.,2001)

“The early error-related ERP component, the Ne, reflects a (perhaps unconscious) mismatch between response selection and execution whereas the slow-wave (Pe) reflects the conscious evaluation of the error” (Falkenstein et al,1991)

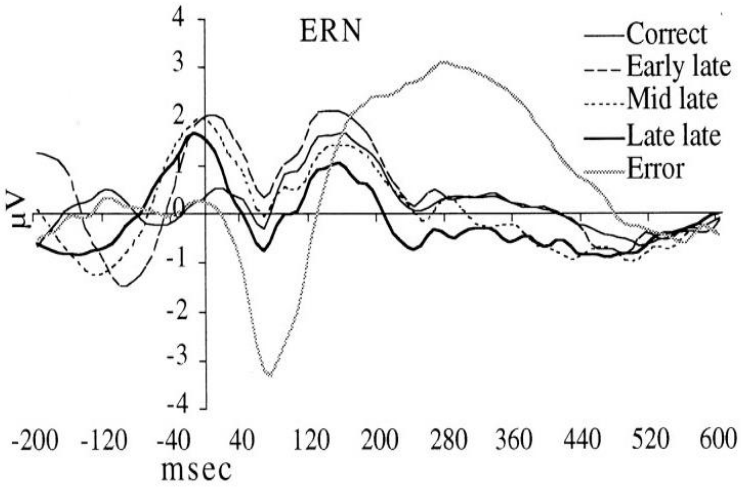
Thus Ne is a manifestation of an error detection system that checks actual behaviour against an internal goal standard

The output of this error detection system is reflected by both the cognitive and emotional significance of a deviation from anticipated result (more on this later!)

(Nieuwenhuis et al.,2001)

Evidence

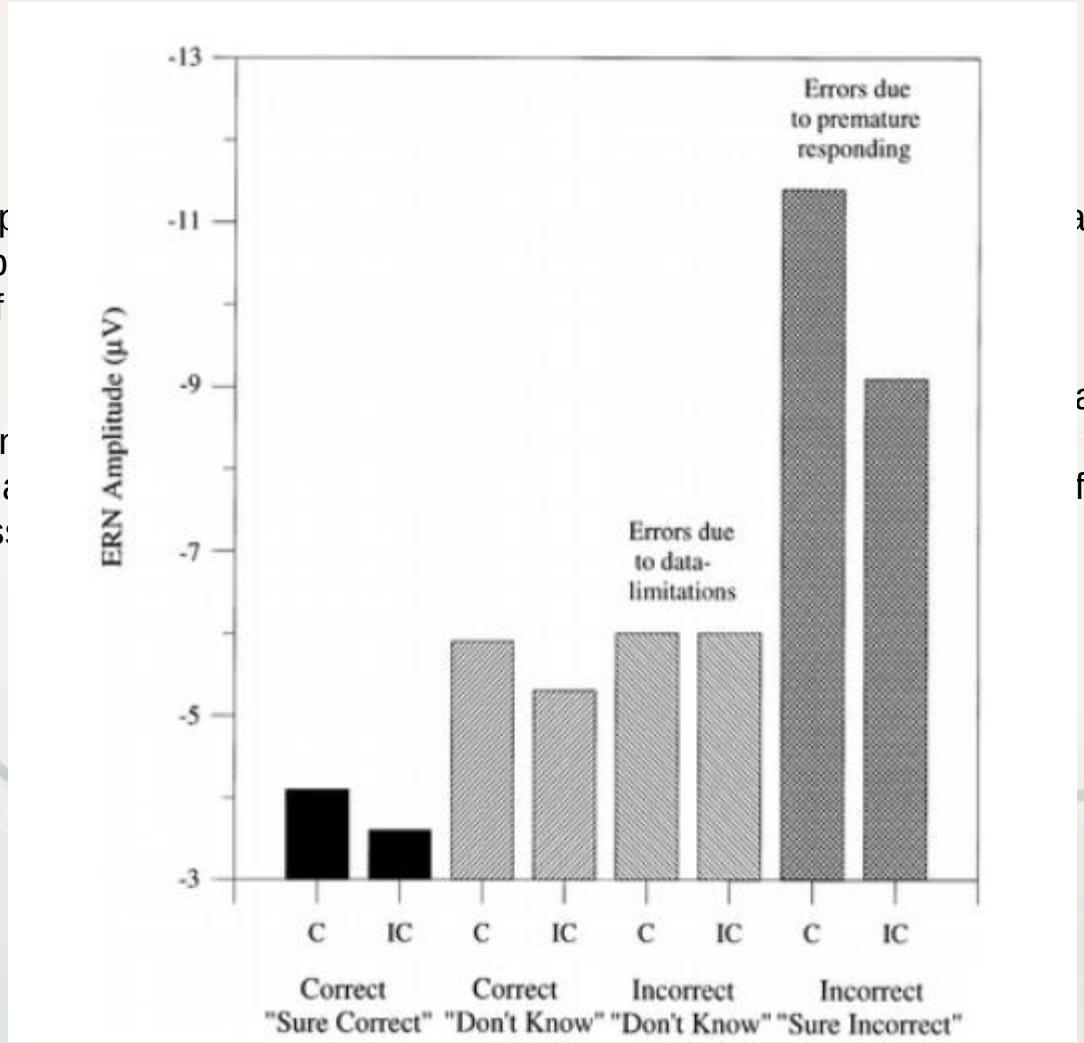
1) Positive relation between Ne amplitude and the degree of error (Luu et al., 2000)



The error-related negativity, shown at a channel ~3 cm rostral to Cz, can be observed in all types of responses, but its amplitude is largest for error responses. The time of response is marked by the *verticalline*.

2) Ne amp … al processing → thus the p … of the actual data in case of …

- Thus, … awareness of respor…
- Empha… formation neces…



(Nieuwenhuis et al.,2001)

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1)

2)

t al, 2000)

Pe

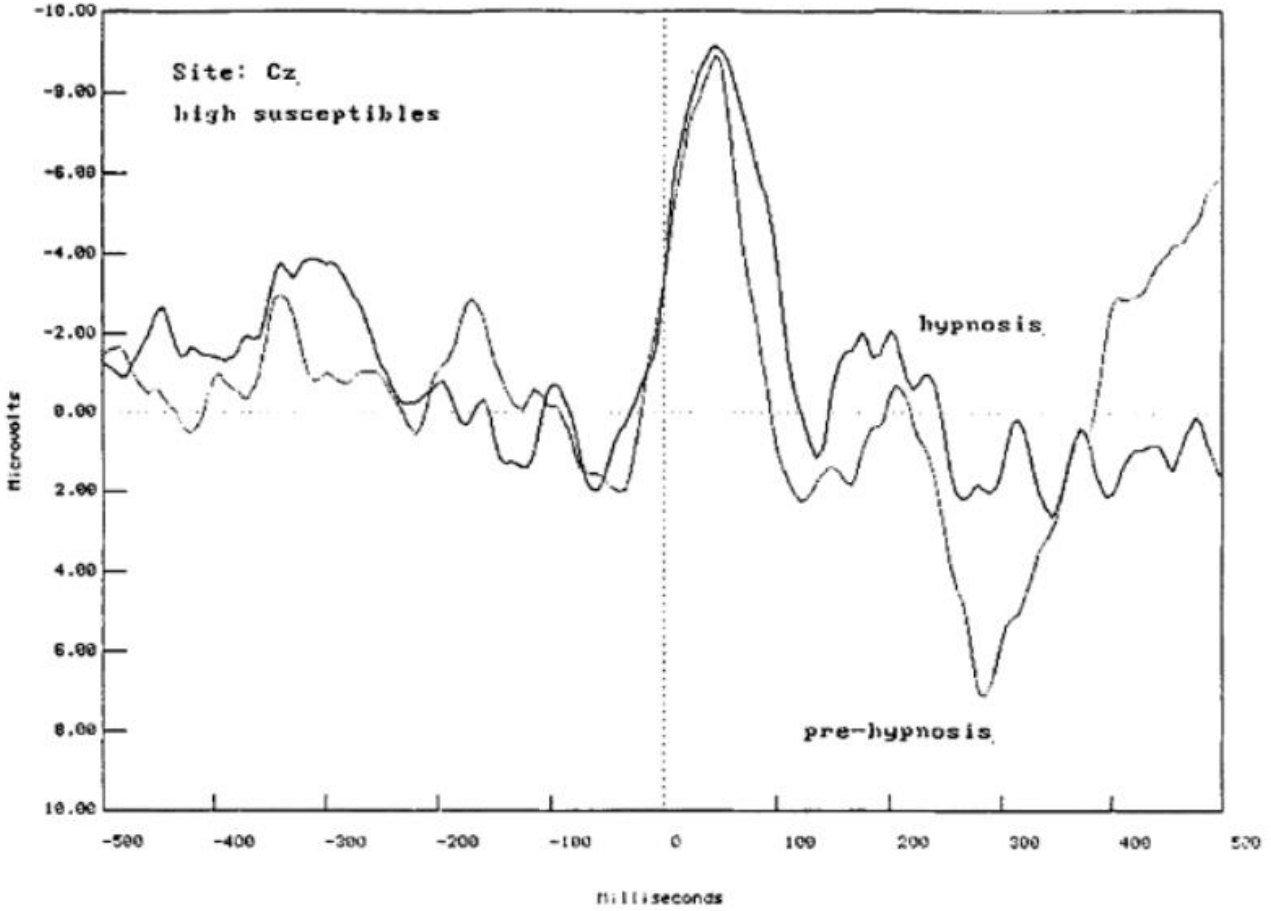

Fig. 3. Average EEG event-related potential to incorrect responses (time point 0 – mouse button press) in medium/high susceptibles during pre-hypnotic baseline and hypnosis.

(Nieuwenhuis et al.,2001)

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ERN used a psychiatric biomarker

ERN as a psychiatric biomarker

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cor…

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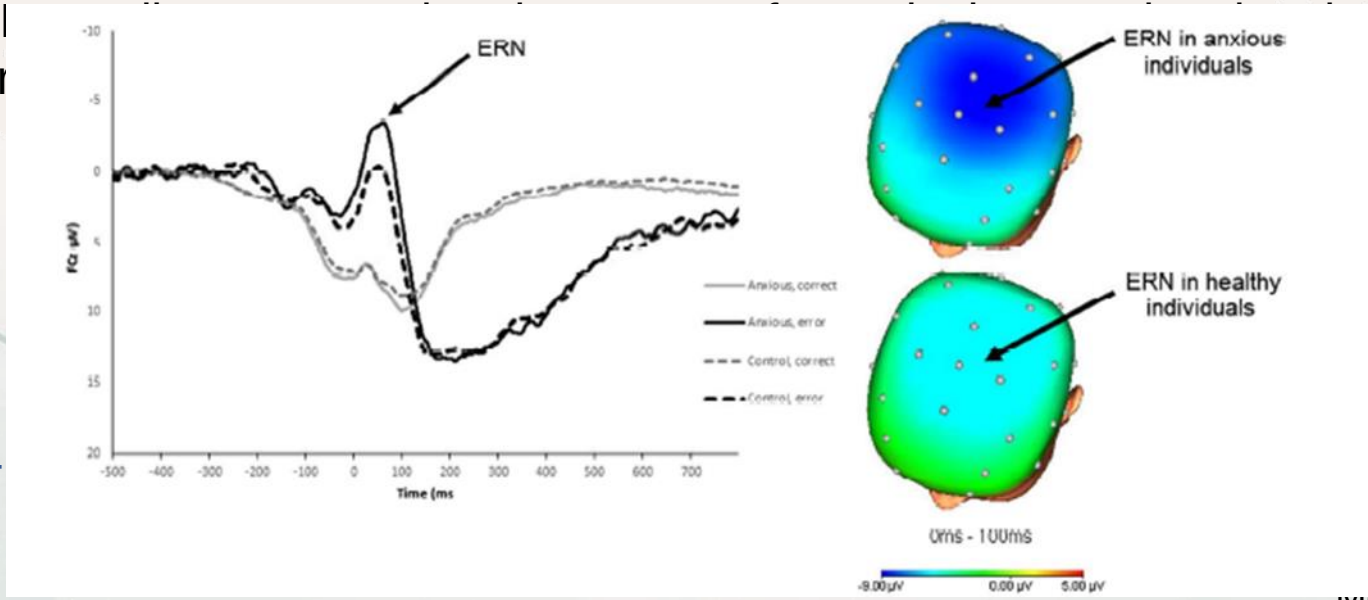
…al.,2004)

T… …iatric

…Meyer, 2016



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Application to our study

Functional Cognitive Disorder after Concussion

We hypothesize that participants with heightened concern over their memory ability will show heightened ERN in response to errors in their memory recollection.

- Multiple studies have demonstrated that such impairments are not detectable three months post-concussion

Higher amplitude of ERN but no noticeable difference in Pe

Thank you for listening

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