

Analysis of Event-Related Potentials: Have you thought of tagging latency?

Anton Andreev¹, Gregoire Cattan²

¹*GIPSA-lab, Saint-Martin-d'Hères, France* ; ²*IBM, Krakow, Poland*

Event-related potentials (ERPs) are small potentials produced by the brain in response to an external stimulation. They usually are measured with an electroencephalogram (EEG). Differences in the onset time and amplitude of ERPs reflect different sensory and high-level brain processing functions, such as the recognition of symbols (e.g., words or figures) or of the correctness of presented information, or changes in a subject's attention [1]. For these reasons, ERPs are a useful tool for describing the processing of information inside the brain, with practical applications, for example, in the domain of brain-computer interfaces. To detect and evaluate an ERP in an ongoing EEG, it is necessary to tag the EEG with the exact onset time of the stimulus. Failing to control sequencing in the tagging pipeline causes problems when interpreting latency and can lead to contradictory conclusions [2]. In the case of visually induced ERP, number of aspects can influence latency and are not always considered in EEG analysis, such as: the refresh rate and orientation of the screen, the number and randomization of the stimulations, or subjective perception of the stimulation. Under two different experimental conditions, we showed – by using a tool designed for this purpose [3] - that the same ERP can be recorded with a difference of about 40ms, without being imputable to a different physiological trait.

[1] S. J. Luck, 'Event-related potentials', in *APA handbook of research methods in psychology, Vol 1: Foundations, planning, measures, and psychometrics*, Washington, DC, US: American Psychological Association, 2012, pp. 523–546. doi: 10.1037/13619-028.

[2] G. Cattan, A. Andreev, B. Maureille, and M. Congedo, 'Analysis of tagging latency when comparing event-related potentials', Gipsa-Lab ; IHMTEK, Grenoble, Technical Report 1, décembre 2018. [Online]. Available: <https://hal.archives-ouvertes.fr/hal-01947551>

[3] G. Cattan, *Tagging Latency Estimator*. France: IHMTEK, 2019. [Online]. Available: <https://gitlab.com/programreg/tagginglatencyestimator>