# Recording the Tactile P300 with the cEEGrid – Good, but not yet Perfect

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***Introduction:*** Brain-Computer Interfaces (BCIs) enable their users to interact with the environment without requiring intact motor control. As such, they are particularly promising as an assistive tool for locked-in patients.

However, the conventional EEG cap setup, which is typically used in a BCI to record brain activity, is often considered too cumbersome for daily use outside the lab, which may contribute to the notable translational gap [1]. The cEEGrid, a novel and compact around-the-ear EEG [2], may offer a convenient solution for this issue. Several studies have already demonstrated that the cEEGrid reliably captured event-related potentials, including the P300, which are the basis of many BCI paradigms. This study aims to assess the cEEGrid's feasibility for the potential use in an already existing vibrotactile P300 BCI [3].

***Material, Methods and Results:*** We recorded data from two cEEGrids and 12 passive scalp electrodes simultaneously using two BrainAmp amplifiers. Healthy participants (*N*=20) performed a tactile oddball task to elicit the P300. Target and Non-Target epochs were averaged separately for data extraction and plot generation. The P300 was offline classified via step-wise linear discriminant analysis. Both EEG systems captured a clearly visible P300 deflection (Fig. 1), but amplitudes were higher at the scalp positions, with up to 4.8 µV at Cz versus 2.3 µV at the cEEGrid's bipolar channel R2R7. Accuracies calculated from the scalp EEG were significantly higher as compared to the cEEGrid (*M*=85% vs. *M*=70%).

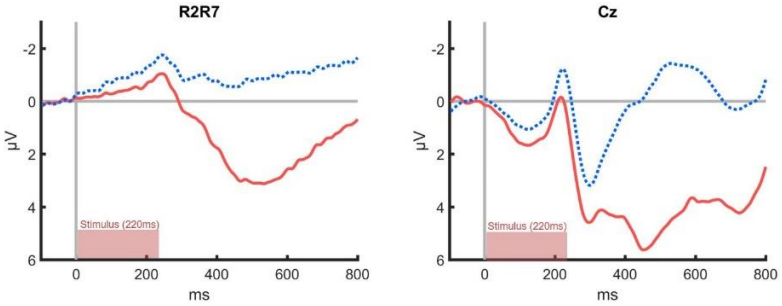


*Figure 1: Target and non-target responses (grand-average). Highest amplitudes were observed on the cEEGrid's bipolar channel R2R7 and on position Cz at the cap-EEG.*

***Discussion:*** In line with several other studies, the highest cEEGrid ERP amplitude was found in the vertical bipolar channels [2]. Overall, ERP amplitudes found at the cEEGrid are typically smaller as compared to scalp positions, but signal strength (target/non-target discriminability) is not always negatively affected [2,4], resulting in classification accuracies on par with cap-EEG systems. In this study however, cEEGrid accuracies were smaller, although still significantly above chance levels [5]. Higher accuracies would be desirable to achieve a more efficient communication.

***Significance:*** The present study adds to the growing list of list literature comparing the cEEGrid to conventional EEG-systems and provides first evidence that the cEEGrid records the tactile P300 in a quality sufficient for above-chance level classification. As such, the cEEGrid may help to establish BCIs among potential end-users.

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