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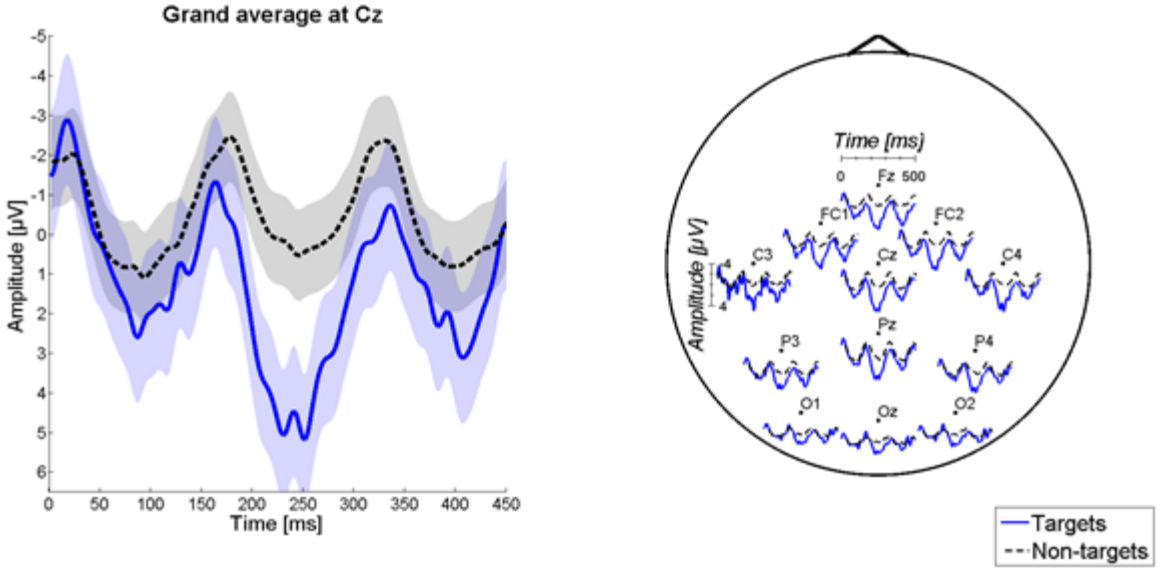
CH 40

WEBSITE SUPPLEMENT

Brain-Computer Communication: Alternative Communication Channel for Paralyzed Patients

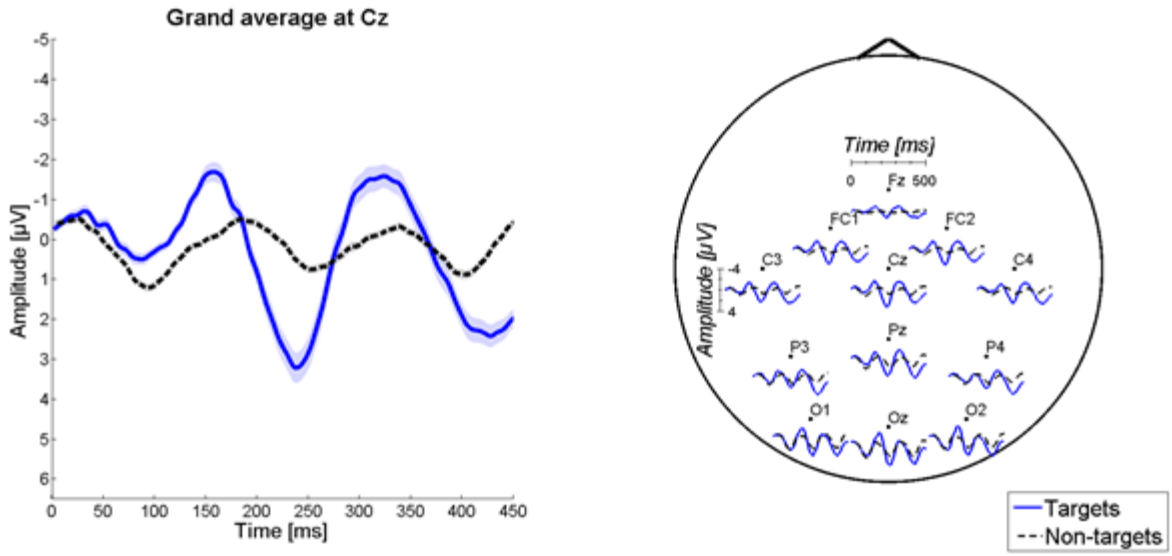
Tobias Kaufmann, Ph.D.
Niels Birbaumer, Ph.D.
Andrea Kubler, Ph.D.

Suppl.-figure 1: (A) A patient with Amyotrophic Lateral Sclerosis using an ERP-BCI spelling system. (B) Potential electrode placement. Centro-parietal electrodes cover the area of the P300 potential, whereas occipital electrodes cover the area of the N200 potential.



(A) (B)

Suppl.-figure 2: Event related potentials of a patient with Amyotrophic lateral sclerosis. (A) Average at electrode Cz across 300 target (solid line) vs. 1500 non-target stimuli (dashed line) in one calibration session. Between 200 and 300 ms, a P300 peaks after target stimulus presentation. Standard errors of the mean (SEM) are displayed transparently behind the curves (±SEM). **(B) Grand average ERPs for all 12 electrodes at positions Fz, FC1, FC2, C3, Cz, C4, P3, Pz, P4, O1, Oz and O2.** In this patient, classification of target characters is mostly based on the P300, with little contribution of negative potentials (N200) on occipital electrode sites.



(A) (B)

Suppl.-figure 3: Grand average of N=36 healthy participants using a face paradigm. Presentation of faces elicits face specific ERP components, i.e. N170 and N400f. Thus, the signal-to-noise ratio is increased and targets can be classified with higher accuracy as compared to classic character highlighting. **(A) Grand average ERP at electrode Cz**. Standard errors of the mean (SEM) are displayed transparently behind the curves (±SEM). **(B) Grand average ERP for all 12 electrodes at positions Fz, FC1, FC2, C3, Cz, C4, P3, Pz, P4, O1, Oz and O2.**

Target: BRAINPOWER		
Number of sequences	% Correct	Predicted Symbols
1	30	HM_ANPR9FR
2	40	BMRCOPMWFR
3	50	BOACHPMWFR
4	70	BRACNPMWFR
5	80	BRACNPOWE_
6	70	BPAONPOWE_
7	90	BRAINPOWE_
8	100	BRAINPOWER
9	100	BRAINPOWER
10	100	BRAINPOWER
11	100	BRAINPOWER
12	100	BRAINPOWER

13	100	BRAINPOWER
14	100	BRAINPOWER
15	100	BRAINPOWER

Suppl.-table 1: Offline estimation of classification accuracy with different amounts of sequences. From the data presented in figure 4, classification of ERPs was performed. When taking all data (15 sequences from the calibration session) into account, classification accuracy of 100% is achieved. However, flashing the matrix with such high amount of sequences in the copy- and free-spelling sessions entails slow spelling speed. Also, performance may decrease rapidly due to the high demands placed on the patient (attention to many stimuli). From offline estimation it can be seen, that accuracy may still be 100% when flashing the matrix with 8 sequences. Thus 8-10 sequences may better meet the patient's requirements of spelling highly accurate yet fast and less demanding.

There is no additional Website Supplemental content for this chapter as of 04/12/16.
Mark S. Schwartz 04/12/16