# EEG/NIRS Dataset Measured During Three Cognitive Tasks

Contact: Han-Jeong Hwang (h2j@kumoh.ac.kr)

## Experimental paradigm

Twenty-six healthy participants performed three cognitive tasks: 1) n-back (0-, 2- and 3-back), 2) discrimination/selection response task (DSR) and 3) word generation (WG) tasks. The participants sat on a comfortable armchair in front of a 24" LCD monitor. The distance between the participants' eyes and the monitor was approximately 1.2 m. The participants put their index and middle fingers on numeric keypad buttons (number 7 and 8) fixed to the right armrest. They were instructed to keep their eyes on the monitor and refrain as much as possible from moving their body throughout the data recording. The experiment consisted of three sessions of n-back (dataset A), DSR (dataset B), and (dataset C) task each. Because of the strain on the participants' attention over the course of a long recording time (approx. 3.5 h), data recording was performed in descending order according to the task difficulty (dataset A → C → B). Please see the original paper to check the details of demographic data, experimental paradigms, and basic analysis results.
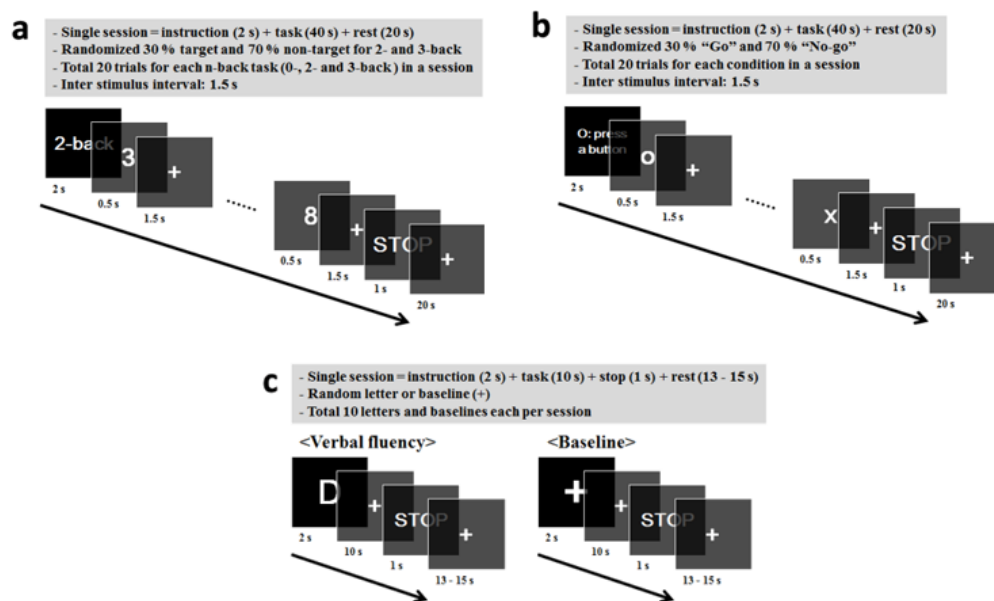


Figure 1. Experimental paradigm

## Data recording

All EEG and NIRS signals were recorded simultaneously. EEG data was recorded using a multichannel BrainAmp EEG amplifier (Brain Products GmbH, Gilching, Germany) at a sampling rate of 1000 Hz. Thirty EEG active electrodes were placed on a stretchy fabric cap (EASYCAP GmbH, Herrsching am Ammersee, Germany) according to the international 10-5 system (Fp1, Fp2, AFF5h, AFF6h, AFz, F1, F2, FC1, FC2, FC5, FC6, Cz, C3, C4, T7, T8, CP1, CP2, CP5, CP6, Pz, P3, P4, P7, P8, POz, O1, O2, TP9 (reference) and TP10 (ground)). NIRS

data was acquired with a NIRScout (NIRx Medizintechnik GmbH, Berlin, Germany) at a sampling rate of 10.4 Hz. Sixteen sources and sixteen detectors were placed at frontal (sixteen channels around AFz, AF3, AF4, AF7 and AF8), motor (four channels each around C3 and C4), parietal (four channels each around P3 and P4), and occipital (four channels around POz) areas. An adjacent source-detector pair configures a NIRS channel; 36 channels were configured. The NIRS channels, each of which was composed of a pair of a source and a detector, were created around AFpz, AFp3, AFp4, AFp7, AFp8, AF1, AF2, AF5h, AF6h, AF7, AF8, AFFz, AFF3h, AFF4h, AFF5h, AFF6, FCC3, FCC4, C3h, C4h, C5h, C6h, CCP3, CCP4, CPP3, CPP4, P3h, P4h, P5h, P6h, PPOz, PPO3, PPO4, PO1, PO2, and POOz according to the international 10-5 system.
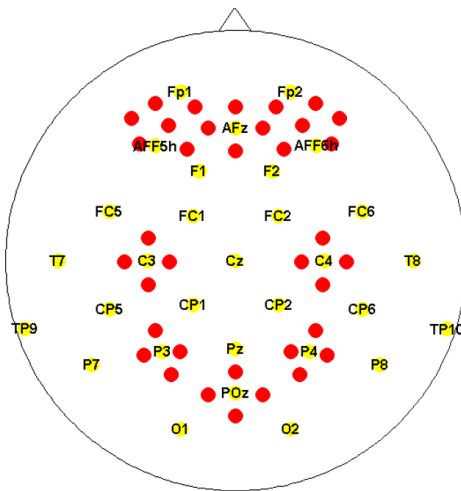


Figure 2. Locations of the EEG and NIRS channels. Yellow and red circles denote the location of the EEG and NIRS channels, respectively.

**Data file description**

The data in vendor-agnostic and vendor-specific formats are freely downloadable. The MATLAB-compatible resource (in vendor-agnostic format) consists of EEG/EOG data and NIRS data separately. The name of each zip file consists of participant code and modality, e.g., "VP001-EEG" for EEG data and "VP001-NIRS" for NIRS data. Each zip file contains individual datasets A-C, and has continuous data (cnt), marker (mrk), and montage (mnt) for datasets A-C each. Note that cnt, mrk, and mnt files have suffixes corresponding to each dataset (A: _nback, B: _dsr, and C: _wc). Each file comprises of MATLAB structure array with several fields. For NIRS data, the cnt files contain deoxy/oxy-hemoglobin data as separate fields. For data structure information, please refer to the BBCI toolbox. The description text file of the uploaded dataset explains the data structure in more detail. The rawdata in vendor-specific format are also provided without any preprocessing or conversion.