# EEG signals recording - Reach & Grasp Movements

## Experimental Paradigm 2:

EEG signals will be recorded from **15** healthy and right handed **subjects** (master students, PhD students, HiWi students and volunteers) using g.USBamp amplifier available at NST.
The cue-based BCI paradigm consists of upper limb reaching task of six different objects placed on the shelf with fixed positions and namely object A (class 1), object B (class 2), object C (class 3), object D (class 4), object E (class 5) and object F (class 6).
Each session will last **1.5 hours** and will comprise **5 runs** of **12 minutes** separated by short **breaks** of **10 minutes**. One run consists of **48 trials** (**8** foreach reach task of the six objects ) yielding a total of **204 trials** per session (144 trials without feedback, 24 trials with action execution and 36 with feedback).
The subject will sit in a comfortable armchair in front of a computer screen. The task is to bring the cursor (square) toward one of the **6 center-out target locations** (up-left, up-right, center-left, center-right, down-left, down-right). Each reach task (whole trial) is **15 seconds**. At the beginning of a trial (**t=0s**), **6 yellow circles** and a home (center) square are displayed on the screen.
**At (t=2s)**, one of the circles will be highlighted (becomes green), a short acoustic warning tone (1 kHz, 70 ms) will be presented **simultaneously** and the subject has to start imagining a reach movement toward that specific target. In parallel, the home cursor (square) will start moving toward the target location. Movement onset is defined as the time when one of circles becomes green.
**At (t=10s),** the square will hit the target and therefore change its color from green to red and the subject has to imagine either a grasp movement with either his left or right hand according to the target location. **At (t=13s),** second short acoustic warning tone corresponds to an end position of the imagined movement will be presented, all the circles are in their initial color (yellow) and the subject has to stop the imagination and keeps a relaxed position during this idle period. No movement execution is requested, subjects have to keep their right hands fully supported on the "home" position.

The same experiment will be repeated several times during 12 minutes before the first break. The last two runs will present a feedback.

## Data recording

The sampling frequency will be **512 Hz**. The signal will be bandpass filtered between **0.5 Hz** and **100 Hz** and a **notch filter** has to be applied to suppress power line interference at 50 Hz.

EEG signals will be recorded from **12** active electrodes located at **Fz, FC1**, **FCz**, **FC2**, C3, **C1, Cz**, **C2**, C4, CP3, CP1, **CPz** (10/10 international system). In total, we will have 16 EEG channels + 2 bipolar EOG channels.

## Data Description:

The **training data** will be stored as following "**A01T**" where A means paradigm 1, 01 means subject one and T means training.

The **evaluation data** (session 2 for each subject) will be stored as following "**A01E**" where E now means evaluation.

The data should be saved as a 3D numpy array (trials*time points* electrodes).

Data recorded during each run will contain :

| | | |
|---|---|---|
| X | Matrix | time points*electrodes |
| trial | Vector with length=number of trials in each run | contains time points (samples) when the subject starts the imagination |
| Y | Vector<br>length= len (trials) | contains the labels (classes) which are 1 for the left, 2 for the right or 3 for both hands |
| Fs | number | sampling frequency |
| gender | STRING | "male" or "Female" |
| Age | number | age of the subject |
| add_info | any specific information about the run | Example: "with Feedback" or "with no feedback" |
| F | contains the feedback value | 1 negative feedback (wrong movement of the arm)<br>0==positive feedback (correct movement of the arm) |