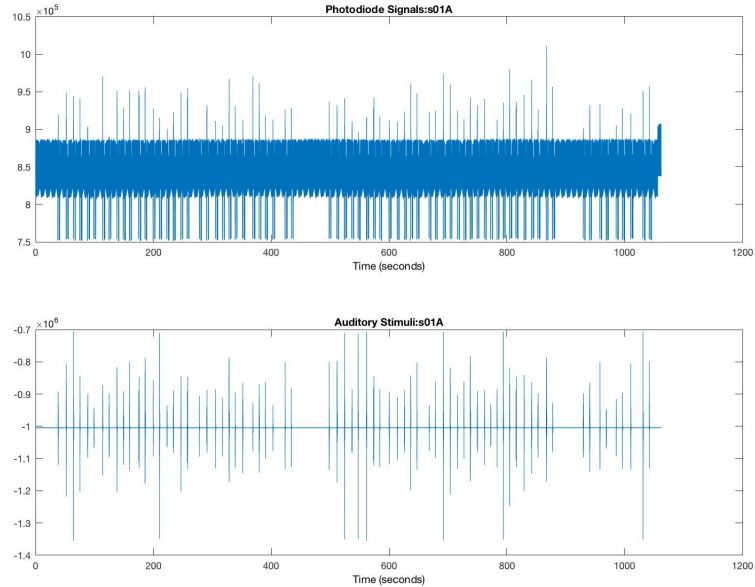


Processing of EEG Data

Extracting Auditory Stimulus and Photodiode Signal Onsets

The photodiode signal and auditory stimuli are recorded on channels 73 and 74 of the EEG via ERGO 1 and ERGO 2. To link the EEG data and the auditory stimuli as a function of time, the onsets of each auditory stimulus need to be extracted. The photodiode signals vary in duration as a function of the type of trial (Go or NoGo) and the side of presentation of the target object to permit us to distinguish both in the EEG data offline. To determine when, in time, the different trial types begin and to mark when the objects are presented, the onsets of the photodiode signals need to be extracted. To determine the duration of the photodiode signals, the onsets and offsets are extracted.



Extracting Auditory Stimulus Onsets

There are 16 auditory stimuli in total. As we already have the auditory files (in *.wav format), extracting the onset times of each instance of each stimulus in the continuous EEG can be achieved by carrying out a cross-correlation between the continuous EEG and each auditory stimulus. The lag of the maximum correlation value should yield correct onset times. However, the original *.wav files are sampled at 44.1kHz but are downsampled to 1024Hz in Biosemi. This means that certain auditory stimuli become less distinguishable, this is especially the case with "coucher" and "cacher".

Approach

The following steps were taken to extract the auditory stimuli onsets:

- Load in each of the auditory *.wav files and down-sample to 1024Hz.
- Cross-correlation between each auditory file in turn and the auditory channel of the continuous EEG.
- Determine the number of times each auditory stimulus is presented during the entire session via the stimulation file (summary file of the trial files output by Unity).
- Onset time of each auditory stimulus is determined by extracting the lags of the first N maximum correlations, where N is determined via the stimulation files.

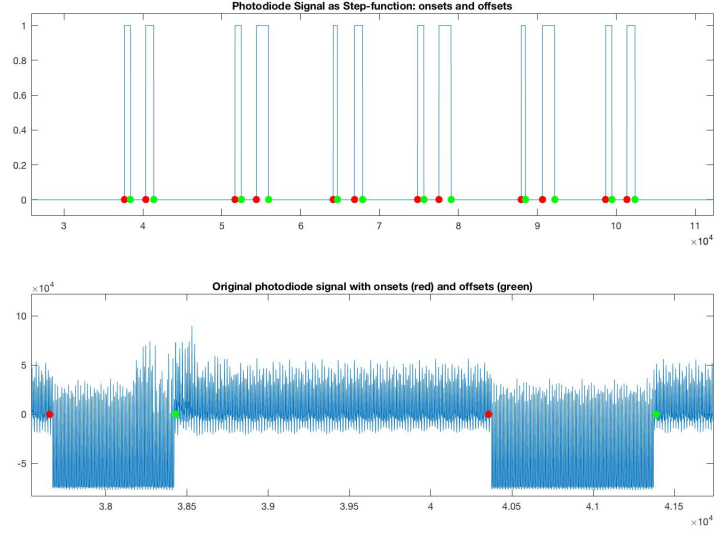
Extracting Onsets of Photodiode Signals

The photodiode signals recorded on channel 73 of the EEG is quite noisy so the signal needs to be cleaned sufficiently to allow the onsets and offsets of the signals to be determined. The onsets and offsets are extracted so that the photodiode durations can be determined, this is important as these durations make it possible to distinguish between the trial type (Go or NoGo) and the side of presentation of the target object, Left or Right.

Approach:

To determine the onset, offset and duration of each instance of the photodiode signal recorded on channel 73 of the continuous EEG, the following steps were taken:

- The 0 offset of the signal is corrected (detrend).
- The signal is half-wave rectified to extract just the negative part of the signal.
- As for some reason, the signal appears to oscillate at a frequency of about 8Hz, the signal is low-pass filtered at 8Hz.
- To transform the signal into a step function, all activity > 0 is set to 1.
- The first-order difference of the signal is calculated; values of 1 imply an onset and -1 and offset.
- The durations of each instance of the photodiode signal is calculated as offset - onset.
- Once the durations are determined, the photodiode onsets can be grouped as "go", "no-go", "right" and "left".



As the events structure of uses the onset latencies in sample points (rather than the onset times in seconds). The sample points corresponding to both the auditory stimulus and photodiode signal onset times are determined and ordered in ascending order. This latency vector is then recorded in the events field of the EEGLAB structure.