Dataset description

The complete description of the participants, recordings, and experimental protocol are contained in the manuscript that accompanies this dataset. We below provide a summary of the methodology and a detailed description of the files contained in the dataset.

Participants and recordings

45 able bodied, right handed participants performed two self-initiated reach-and-grasp (palmar and lateral grasp) movement conditions.

- **Gel-based electrodes recordings.** Fifteen participants were measured using gel-based electrodes (g.tec USBamp/g.tec Ladybird system, g.tec medical engineering GmbH, Austria). EEG was measured with 58 electrodes (frontal, central and parietal areas). EOG was also recorded with 6 electrodes (infra and superior orbital to the left and right eye and on the outer canthi).
- **Water-based electrodes recordings.** Fifteen participants were measured using the mobile and water-based electrodes EEG-Versatile™ system (Bitbrain, Spain). EEG was measured with 32 electrodes (frontal, central and parietal areas). EOG was also recorded with 6 electrodes (infra and superior orbital to the left and right eye and on the outer canthi).
- **Dry-electrodes recordings.** Fifteen participants were measured using the dry-electrodes EEG-Hero™ headset (Bitbrain, Spain). EEG was measured with 11 electrodes over the sensorimotor cortex.

Experimental protocol

Participants were seated on a chair in front of a table and instructed to rest their right hand on a sensorized base position which was positioned in front of them. On the table, we placed an empty jar and a jar with a spoon stuck in it. Both objects were in a comfortable reaching distance equidistant to the study participants' right hand. Participants were instructed to perform reach-and-grasp actions using their right hand towards the objects placed on the table. In case of the empty jar they grasped the objects using a palmar grasp. In case of the spoon, they were instructed to grasp the spoon with a lateral grasp. Though participants performed the tasks in a self-initiated manner, we instructed them to focus their gaze on the designated object for 2 seconds before initiating the reach-and-grasp action. Once they completed the grasp, they held the object for at least 1-2 seconds. In this way we recorded 80 trials per condition (TPC) distributed over 4 runs á 20 trials. After each run, we switched the position of the objects presented on the table, so that each object was on each position equally.

We also recorded 3 minutes of rest at the start, after the second movement run (at half time) and at the end of the experiment, where participants were tasked to focus their gaze on a fixation point in the middle of the table. In addition, we recorded horizontal and vertical eye movements as well as blinks following the paradigms used in (Schwarz et al. 2019; Kobler, Sburlea, and Müller-Putz 2018).

Table 1: Tasks executed for each participant in the study.

#	**Task type**	**Duration (min)**
1	Rest recording	3
2	Visual guided paradigm (eye movements)	2
3	Reach-and-grasp task (Run 1, 20 trials/condition)	~7
4	Reach-and-grasp task (Run 2, 20 trials/condition)	~7
5	Rest recording	3
6	Visual guided paradigm (eye movements)	2
7	Reach-and-grasp task (Run 3, 20 trials/condition)	~7
8	Reach-and-grasp task (Run 4, 20 trials/condition)	~7
9	Rest recording	3
10	Visual guided paradigm (eye movements)	2

Dataset files description

All data sets are stored in mat format (Table 2).

Table 2: Filename format for every recording system.

EEG recordings	**Filename format**
Gel-based electrodes recordings	**G**XX (XX in range 1 to 15)
Water-based electrodes recordings	**V**XX (XX in range 1 to 15)
Dry-electrodes recordings	**H**XX (XX in range 1 to 15)

Each participant file can be imported into Matlab/Octave. The workspace will then contain the following variables:

- signal: data matrix (channels, samples). Contains the EEG and EOG signals
- events: struct with fields
    - codes: array of event codes (1, events)
    - positions: array of indices in the signal data matrix (1, events)
- header: struct with fields
    - sample_rate: int
    - runs: this indicates the task index and init/end of each recorded run in order of execution (10, 3)
    - device_type: hero/versatile/gtec
    - event_codes: int array of all possible codes (Table 3)
    - event_names: string array of all possible codes (Table 3)
    - channels_eeg: int array of channels (indices of Signal)
    - channels_eog: int array of channels (indices of Signal)
    - channels_labels: string array of labels
        - EEG: standard positions
        - EOG:
            - EOG-R-Top: right eye, superior orbital
            - EOG-R-Side: right eye, outer canthi
            - EOG-R-Bottom: right eye, infra orbital
            - EOG-L-Top: left eye, superior orbital
            - EOG-L-Side: left eye, outer canthi
            - EOG-L-Bottom: left eye, infra orbital

Table 3: Event codes.

Movement-related codes	
503587	palmar grasp, movement onset
501794	palmar grasp, grasp onset
534562	palmar grasp, grasp offset
503588	lateral grasp, movement onset
501795	lateral grasp, grasp onset
534563	lateral grasp, grasp offset
Resting data codes	
768	resting onset
769	resting offset
Visual guided paradigm codes	
10	vertical eye-movements, onset
11	vertical eye-movements, offset
12	horizontal eye-movements, onset
13	horizontal eye-movements, offset
14	eye blinking, onset
15	eye blinking, offset

References

Kobler, Reinmar J., Andreea I. Sburlea, and Gernot R. Müller-Putz. 2018. “Tuning Characteristics of Low-Frequency EEG to Positions and Velocities in Visuomotor and Oculomotor Tracking Tasks.” *Scientific Reports*. https://doi.org/10.1038/s41598-018-36326-y.

Schwarz, Andreas, Joana Pereira, Reinmar Kobler, and Gernot R. Muller-Putz. 2019. “Unimanual and Bimanual Reach-and-Grasp Actions Can Be Decoded From Human EEG.” *IEEE Transactions on Bio-Medical Engineering*, September. https://doi.org/10.1109/TBME.2019.2942974.