

Preliminary findings

- An SMR EEG paradigm could identify CMD in DOC patients.
- Evoked EEG during multisensory integration suggests awareness-dependent modulation.

Background

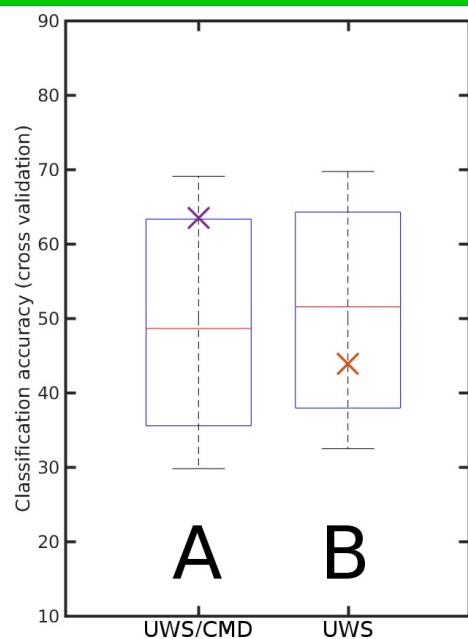
- Disorders of consciousness (DOC) are common after brain injury.
- Diagnosis/prognosis in acute phase of DOC are critical for informed life decisions.
- Current validated clinical scales, like the Coma Recovery Scale - Revised (CRS-R) do not take into account motor and drive deficits, potentially underestimating awareness, like in case of Cognitive-Motor Dissociation (CMD).
- The Motor Behaviour Tool (MBT) is a novel clinical scale designed to alleviate this caveat.
- Neuroimaging and brain-computer interface (BCI) have also been proposed to improve the diagnosis and prognosis of these patients.

Objectives

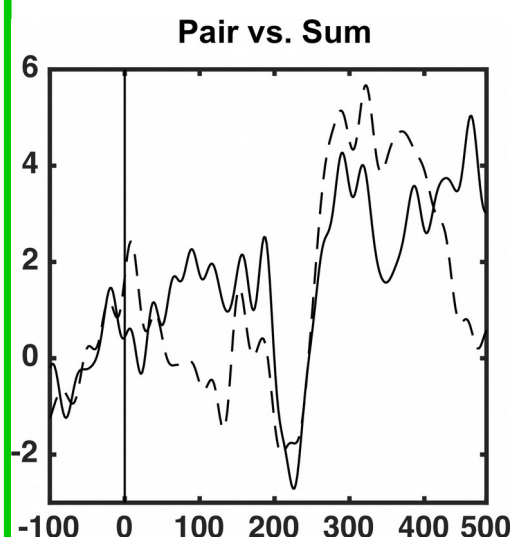
- Investigate the diagnostic and prognostic value of two electroencephalography (EEG)-based paradigms in DOC patients, i.e., allow classification of patients into coma, Unresponsive Awareness Syndrome (UWS) or Minimally Conscious State (MCS).
- Employ the independent neuroimaging evidence to assess the added value of the MBT instrument over CRS-R.

Results

- Patient A
 - CRS-R: UWS
 - MBT: UWS/CMD
 - SMR EEG: Above chance accuracy.
- Patient B
 - CRS-R: UWS
 - MBT: UWS
 - SMR EEG: Chance level accuracy.



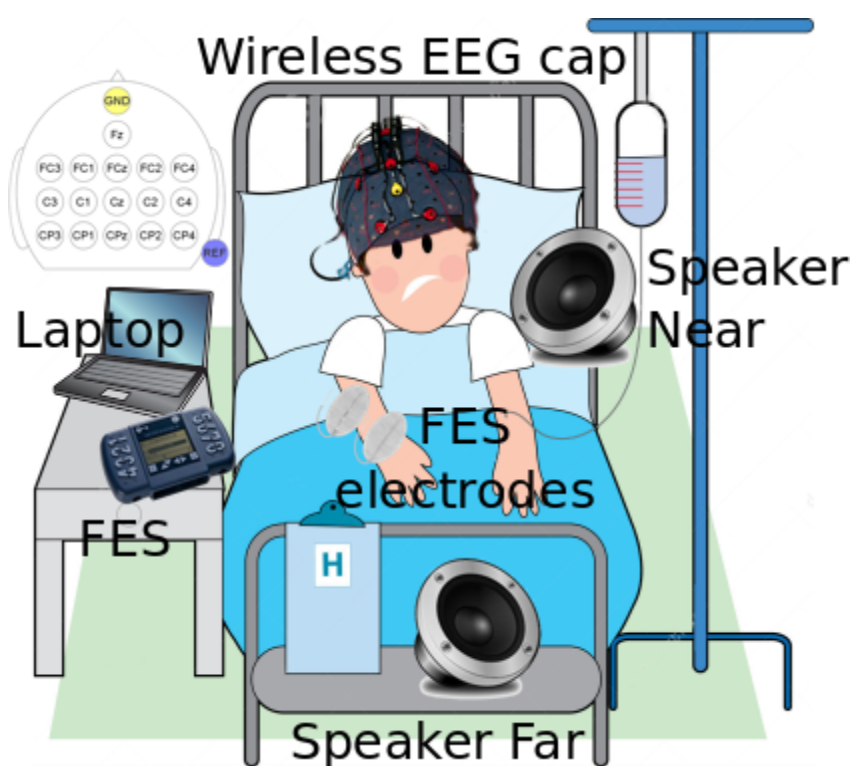
- SMR paradigm confirms MBT tool about CMD diagnosis and complements CRS-R.
- PPS paradigm suggests awareness-dependent modulation in 8 DOC patients.



- Average evoked EEG potentials over 8 patients.
- Audio-tactile sensory integration within-PPS (solid line) significantly different from outside-PPS (dashed line) ~100 and ~350 msec.

Methods

- Patients
 - Acute DOC (< 3 weeks from injury)
 - Acute Neuro-Rehabilitation Unit, CHUV
- Experimental apparatus



- Sensorimotor rhythm (SMR) paradigm
 - 15 motor attempt + 15 "rest" trials per run, randomized, auditory cue.
 - Functional Electrical Stimulation (FES)-actuated hand extension movement, only after motor attempt trials.
- Peri-personal space (PPS) paradigm
 - Random FES-driven tactile, auditory and multi-modal (audio-tactile) stimuli.
 - Stimuli randomized inside (near) or outside (far) the patient's PPS (actionable space).
- Concurrent CRS-R and MBT clinical testing.
- Neuroimaging analysis
 - Above-chance SMR classification.
 - Non-linear addition of within-PPS sensory stimuli in evoked potentials.

Conclusions

- EEG paradigms are promising tools for the diagnosis of CMD in DOC patients.
- Neuroimaging could complement standard clinical tools to eliminate misdiagnosis.
- Such paradigms can be used to assess the validity of novel clinical instruments.