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### Bedside Detection of Awareness in the Vegetative State



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Detecting signs of awareness in patients recovering from coma is still a huge challenge for clinicians. Indeed, a high rate of misdiagnosis was highlighted in this population showing that up to 40 percent of vegetative patients are in fact conscious (i.e. minimally conscious state). Clinically, the assessment of consciousness is based on behavioural responses. However, motor and verbal functions can be impaired following a severe brain injury, limiting the assessment. As early detection of signs of consciousness is crucial not only for daily management (particularly pain treatment) but also for end-of-life decisions, we suggest the use of electroencephalography (EEG), in order to detect signs of consciousness at the bedside of severely brain injured patients.

With this paradigm, we were able to detect signs of consciousness in 19 percent (3/16) of patients unable to show any motor response at the bedside. This technique offers clinicians a new tool for improving the detection of conscious patients. Moreover, on the contrary to fMRI, EEG is a cheap, portable and objective technique, which is commonly used in hospitals and can hence be easily used by clinicians.

As the detection of consciousness is usually based on behavioural assessment, this study is a real breakthrough and transforms the way diagnosis may be performed. This technique also seems more efficient than previous studies using fMRI and reporting 10 percent of "vegetative" patients showing voluntary activity. In our study, we were able to detect consciousness in nearly twice more patients (19 percent).

Working with patients with disorders of consciousness is challenging as their vigilance is fluctuating and as they are easily exhausted. In our study, we had to make sure patients were awake (eyes opened) during the recording even if we had to perform a second recording session. The EEG signal may also be influenced by ocular and motor artifacts. We had therefore to make sure the signal was clean before including it in our analyses.

With this technique, we showed that nearly one out of five "vegetative" patients are able to respond commands involving motor imagery (imagine squeezing your right hand versus moving all your toes) and, hence, are able to show high-level residual cognition. This result suggests that we currently under-estimate these patients' cognitive abilities. The next step will be to test at which point this technique may be used as a communication device. Finally, this novel technological means may change the existing behaviourally defined boundaries between the various consciousness disorders and provoke a discussion regarding the creation of a new clinical entity where the diagnosis of consciousness can be based on paramedical tool and not only on behavioural assessment.

3D glasses and mechanical gloves that are being uniquely designed by sisoft's R nd D team for pre-surgical operations in order to examine and analyse medical data and images through virtual reality. The surgeons physicians and radiologist will be able to perform early diagnosis before surgical operations with less cost and true diagnosis. Virtual reality also known as virtual reality, is a term that applies to computer-stimulated environments that can stimulate physical presence in place in the real world. Most current virtual reality environments that are primarily visual experiences, displayed either on a computer screen or through special stereoscopic displays.

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