

## Cover Letter

### Winning the Cybathlon BCI race: Successful longitudinal training and control by two tetraplegic users

Dear Dr. Orla Smith, Editor of Science Translational Medicine,

With this letter we would like to introduce our submission to Science Translational Medicine entitled “Winning the Cybathlon BCI race: Successful longitudinal training and control by two tetraplegic users”.

The manuscript reports on a longitudinal study involving two chronic tetraplegic spinal cord injury patients trained to operate an electroencephalography (EEG)-based, self-paced brain-computer interface (BCI) in order to participate in the BCI race discipline of the international Cybathlon event, the first bionic special Olympics held in Zurich Switzerland on October 8<sup>th</sup> 2016. The BCI application performances achieved by both users and, especially, their Cybathlon competition outcomes (gold medal, record setting) substantiate the main finding of our study: unique, strong evidence of considerable maturity and translational impact of non-invasive, sensorimotor rhythm (SMR)-based BCI. More than the impressive performances, our study distinguishes in that it is one of very few BCI training and control works with end-users that is longitudinal enough and has been conducted under realistic (home-use) and even adverse (crowded arena) conditions, thus justifying a claim on real translational potential for this type of interfaces. Furthermore, our work provides the most complete and reliable proof to date of the existence and efficacy of instrumental learning taking place during online motor imagery BCI training, showcasing the presence of long-lasting learning effects at the neuroimaging, interface and application level. Additionally, we show how our mutual learning protocol and user-centered BCI design can be credited with the aforementioned successful outcomes. These results touch upon issues currently in the spotlight of BCI research. Consequently, we believe that the insights provided and the conclusions reached in our work are of paramount importance to the state-of-the-art. We thus expect that this work could significantly shape the field’s future and contribute to the critical transition of BCI from the laboratory to everyday home use.

We would like to bring to your attention the existence of a draft manuscript with related content that is scheduled to appear in the IEEE Spectrum magazine in September 2017. The responsible editor is still working with us to prepare the final version. You can find the IEEE Spectrum editor’s draft attached to this submission. The two manuscripts differ entirely in scope and content. Contrarily to the manuscript we are submitting to your journal, the IEEE Spectrum manuscript focuses on the end-user experiences in the Cybathlon competition and only includes information on the competition outcomes and the average application performances throughout training. With the exception of the above summary results in the IEEE spectrum and the

competition outcomes that are publically available, none of the material has been published or is under consideration elsewhere, including the Internet.

The finally submitted manuscript has been reviewed and approved by all co-authors.

We remain at your disposal for any relevant requests. We firmly believe that our manuscript is appropriate for publication in Science Translational Medicine and hope for a positive evaluation of our work.

Best regards,

Dr Serafeim Perdikis

Prof. José del R. Millán

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