

POSTER PRESENTATION

Open Access

# Brain-Computer Interface (BCI) combined with Virtual Reality Environment (VRE) for inferior limbs rehabilitation in post-stroke subjects

Berthil Longo\*, Javier Castillo, Teodiano Bastos

From 5th Congress of the Brazilian Biotechnology Society (SBBIOTEC)  
Florianópolis, Brazil. 10-14 November 2013

More than 10 million people in the world live with some kind of motion handicap caused by a Central Nervous System (CNS) dysfunction. Stroke is the major cause of this disability in the adult population. Due to the increase of elderly in the world's population, such index tends to increase. The proposal of this research is to provide a tool for rehabilitation, useful for subjects that suffer from lower limbs movement handicap, acquired by stroke. This tool carries a 3D Virtual Reality Environment (VRE), which emulates the movement of a healthy person, using the immersion of the subject through an avatar. The subject's brain generates commands to control the avatar while conducting the rehabilitation process. The brain waves are captured by an Electroencephalography (EEG) equipment, that information is sent to a computer for processing, which sends the information to the virtual environment to control the avatar, completing, thereby, the Brain-Computer Interface (BCI) tool. This system asks two different tasks for the subject: move the left or right leg, stimulating brain's areas responsible for each one of those motor activities, implying thereby, in the rehabilitation process. The VRE provides, for the subject, a feedback of his/her motion intentions. The system works as an attractive environment, which motivates the subject to use it, and, at the same time, is useful to evaluate his/her treatment evolution.

Published: 1 October 2014

## References

1. Cheron G, Duvinage M, Saedeleer C, Castermans T, Bengoetxea A, Petieau M, Seetharaman K, Hoellinger T, Dan B, Dutoit T, Sylos Labini F, Lacquaniti F, Ivanenko Y: **From Spinal Central Pattern Generators to Cortical Network: Integrated BCI for Walking Rehabilitation.** *Neural Plasticity* 2012, **2012**:1-13.

2. Donnan G, Fisher M, Macleod M, Davis SM: **Stroke.** *Lancet* 2008, **371(9624)**:1612-1623.
3. Leeb R, Lancelle M, Kaiser V, Fellner DW, Penguin G: **Thinking Penguin: Multimodal Brain-Computer Interface Control of a VR Game.** *IEEE Transactions on Computational Intelligence and AI in Games* 2013, **5(2)**:117-128.
4. Wang PT, King CE, Chui LA, Do AH, Nenadic Z: **Self-paced brain-computer interface control of ambulation in a virtual reality environment.** *Journal of Neural Engineering* 2012, **9(5)**:056016.

doi:10.1186/1753-6561-8-S4-P18

**Cite this article as:** Longo et al.: Brain-Computer Interface (BCI) combined with Virtual Reality Environment (VRE) for inferior limbs rehabilitation in post-stroke subjects. *BMC Proceedings* 2014 **8**(Suppl 4):P18.

## Submit your next manuscript to BioMed Central and take full advantage of:

- Convenient online submission
- Thorough peer review
- No space constraints or color figure charges
- Immediate publication on acceptance
- Inclusion in PubMed, CAS, Scopus and Google Scholar
- Research which is freely available for redistribution

Submit your manuscript at  
[www.biomedcentral.com/submit](http://www.biomedcentral.com/submit)



UFES Universidade Federal do Espírito Santo, Vitória, Brazil



© 2014 Javier Castillo et al.; licensee BioMed Central Ltd. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated.