RAVE-09 Abstract

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Virtual reality-based brain-computer interfaces as a science dissemination tool

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Abstract

Brain-computer interfaces (BCI) are developed with the main purpose of helping those that need to by-pass the connection between brain and the effector muscles, communicating directly from cerebral cortex activity to a computer or external object. Nowadays, its scope of action is expanding greatly to other areas such as business and entertainment. However, to our knowledge, the role of BCI for scientific dissemination has not been explored. Here we show the results of a demo involving BCI and virtual reality. We developed a virtual reality application exclusively for this aim, where two subjects interacted with each other by competing at what we called the *Virtual Olympic Games*. The competition consisted of a race taking place in a virtual stadium. Each participant is represented by an avatar that is controlled through a motor imagery-based BCI. Avatars moved forward following imagination of motor acts such as left hand or right foot movements. Motor imagery generated changes in mu and beta rhythms on cortical sensorimotor areas that were recorded by means of EEG (Pfurtscheller and Neuper, Neurosci Lett 239:65, 1997). Online classification of these frequencies with linear discriminant analysis was then transformed into a control signal. Data were obtained from a questionnaire completed by visitors to the science fair "The Illusions of the Brain" celebrated recently (December 19th, 2008 in Barcelona, Spain). Eight subjects competed using the BCI and twenty-seven listened to the explanations of experts of the neuroscience and computer science fields. By means of this application, insights into brain functions were given to scholars and general public. Out of the subjects that participated in the BCI plus the attendees (n=35), 74% knew well or very well that the brain works with electricity. However, most subjects (77%) had no or little idea about how the brain can communicate directly to a computer. Most visitors found BCI and virtual reality technologies viable in many application fields and showed interest in trying these technologies in the future. These preliminary results suggest that BCI and virtual environments are still unconventional and not well-known interfaces but awake the interest of students and general public. Making applications more interactive and user-friendly, these technologies can be exploited in social, educational and science popularization, playing a role in the awareness of the general public towards neuroscience and the potential applications of research in this area.

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