Brain-computer interaction: Preliminary results in two subjects

H. Dimassi *, N. Pattaroni , A. Al-Khdairy
Clinique romande de réadaptation-Suvacare, Physiothérapie, avenue Grand-Champsec 90, CH-1950 Sion, Switzerland

*Corresponding author.

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Introduction.– Our institution is one of the 12 members of the European TOBI (Tools For Brain-Computer Interaction) and one of the 4 clinics applying the technology with patients. We collaborate closely with the Ecole Polytechnique Fédérale de Lausanne. After giving their consent, subjects with severe upper limb deficiency train on the brain-computer interface. Once they succeed, they can choose either to drive a robot (Robotino®) or to use a text entry program (QualiWORLD®). Presently 6 subjects have been enrolled. We present the results obtained with 2 patients suffering from muscle dystrophy: S1, a 28-year-old male and S2, a 33-year-old female.

Observations.– Before each session, questionnaires evaluating motivation (VAS), mood and depression (CES-D, QCMBCI2000, VAS) were introduced. After each session, the NASA Task Load Index provided an overall workload score based on a weighted average of ratings on six subscales: Mental demand, physical demand, temporal demand, performance, effort and frustration. After the whole protocol was over, the patient’s and therapist’s satisfaction regarding the prototype was evaluated by VAS and TUEBS 1.0.

Robotino.– Both had to drive the Robotino along 3 paths, from a starting point to 4 targets and back using a) the interface, b) manual switch. The time needed to perform pathway 1 was shorter with the mental command for S1 (323.66 versus 345.37 sec) while S2 had a quicker mental command for pathways 1 and 3.

QualiWorld: S2 was asked to write mentally 1- to 5-figure numbers and 1- to 6-letter words. She made 73 mistakes to write 135 characters. She needed on average 47.83 seconds to write down one character. In spite of some disappointing results, S2 was satisfied with her performance.

Discussion.– Both subjects were satisfied to discover the possibilities to mentally control a robot (Robotino®) and a text entry program QualiWORLD®. The performances were not identical with one or the other prototypes. Two other subjects dropped-out after a few training sessions because BCI signals were altered by either bruxism or involuntary head movements. Two other subjects are undergoing BCI training. Results of the first two subjects are detailed in another communication.

Discussion.– All subjects were satisfied with their participation to the project. They expressed the feeling that BCI can offer much in the future for people with severe motor deficiency. The close collaboration between the 12 participating centres in the project has so far enabled hardware and software improvements facilitating the use of BCI.