

## Proposition de stage Master 2 Sc. Co.

### Titre : Experimental Physiological Research of a Brain-Computer Interface Prototype based on the „Space Invaders“ Video-Game.

**Sujet:** Brain-Computer Interface (BCI) aims at computer control (and electronic equipments control in general) without any muscular control thanks to a direct communication between a computer and the user's brain. BCI exploits spontaneous and volitional production of selective brain activity as recorded by electroencephalography (EEG). The user is equipped with an EEG cap and the computer classifies certain classes of EEG signal to achieve the desired result. BCI is a rapidly growing area of research and several impressive prototypes are already available (Figure 1).

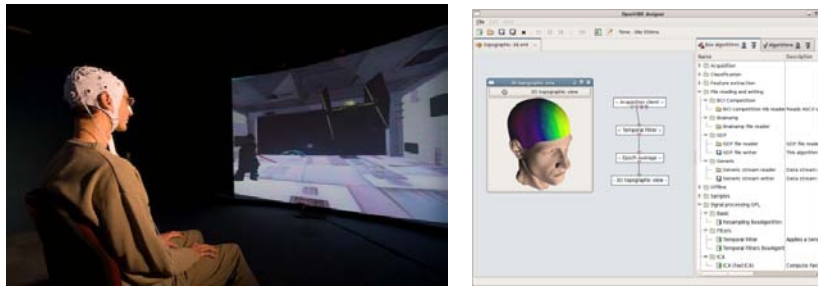


Fig. 1 – On the left, an user is using a BCI to interact with a virtual object (the “Star Wars Tie-Fighter”). On the right, the screenshot of the Open-ViBE software platform used to analyse the EEG data on-line.

Recently, several companies started proposing low-cost EEG headsets (Figure 2), which pave the way to massive applications of BCI.



Fig. 2 – Emerging EEG commercial headsets.

Example of products proposed by company EMOTIV© (left) and NEUROSKY© (right).

BCI control capabilities are still not comparable to other Human-Computer Interaction (HCI) peripherals such as joysticks or classical computer mice. The objective of ANR project OpenViBE2 is to propose a radical shift of perspective about the use of BCI. In OpenViBE2 we consider the possibility to merge a BCI with traditional peripherals such as joysticks, mice and other devices, all possibly being used simultaneously in a virtual environment. Therefore, BCI is not seen as a replacement but as a complement of classical HCI. Second, we aim at monitoring the brain cognitive functions and mental states of the user in order to adapt, in real-time and in an automated fashion, the interaction protocol itself as well as the content of the remote/virtual environment (VE). The Open-ViBE2 consortium gathers partners from the

videogame industry (Ubisoft, Black Sheep, Kylotonn) as well as a partners that develop techniques for gameplay assessment.

The aim of this stage is to conduct experimental research to test a new prototype of BCI games based on the well known „*Space Invader*“ game. The candidate will learn how to perform research with EEG and how to analyze the EEG data.



Fig. 3 – The interface of the vintage game “Space Invaders”

**Lieu:** The stage will take place at GIPSA-lab, department of Images and Signal, located in the Campus of St. Martin d’Hères (Grenoble)

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**Indemnité:** 1/3 of SMIC