Experimental platform for real-time communication and control of Unity 3D virtual environments using the Emotiv EEG headset

Robin T. Bye

Main goal: Create an experimental platform for real-time communication and control of Unity 3D virtual environments using the Emotiv EEG headset.

Challenges:

1. Establish communication and control between the EEG headset and Unity
2. Study literature on EEG experiments involving 1D, 2D, or 3D tasks on screen
3. Create one or several test environments ("games") in Unity for performing experiments
4. Get a number of people to do an experiment, collect the data, and do a simple data analysis
5. Provide documentation and modularity of software for future work

1. Establish communication and control between the EEG headset and Unity
There exist already an Emotiv EPOC Unity3D™ Developer Support Pack that I will provide for you. It can be used for this task so you do not have to develop this from scratch. You will need to familiarise yourselves with the software and test it.

I note that the support pack above says "EPOC" and we have the "EEG" version of the headset, but I think/hope this will work fine anyway.

I have attached a screen capture of software add-ons for the Emotiv EEG and SDK.

2. Study literature on EEG experiments involving 1D, 2D, or 3D tasks on screen
You should read literature and see what experiments have been performed using EEG and tasks on screen. We are especially interested in 3D tasks, since we have a nice 3D game engine to play with. In particular, check out papers such as those on the Emotiv website that actually use the Emotiv equipment, and even better, see if you can find papers from people who are doing the same thing as us: Using Emotiv EEG + Unity.

3. Create one or several test environments ("games") in Unity for performing experiments
When you have studied the literature, see if you can think of an experiment that you can do that has not been done before. A good idea may be to just extend somebody else's work in one or more directions, e.g., if someone did something in 2D, can you do it 3D? Can you combine two experiments into a new one? Can you combine EEG measurements for control with mouse/joystick/keyboard control? You can also consider just using the EEG for measurements and data analysis during some manual (hand) task.

The experiment will require you to make "games" or "tests" in a Unity virtual environment. Discussion with me about how to implement and what experiments to implement is imperative.

4. Get a number of people to do an experiment, collect the data, and do a simple data analysis
This task depends on how far you get in your project. With good progress and time permitting, we could have your entire class do an experiment. The data collected can then be used for analysis.

5. Provide documentation and modularity of software for future work
This is very important. Your code must be clear, easy to read, and with much documentation. Your report must be at such standards as to make it easy for future people to continue your work.

What's next?

- I will make a list of the Emotiv equipment and have you sign a form that you have received it, then you will borrow it.
- I am thinking of setting up a VMware computer (remote login) where you can install all software and do your development. We can both be admin users on this virtual computer. This would make it easy for other students to continue the work later, and can be helpful if software licenses are locked to a particular computer (we don't want the licenses locked to your personal computer).
- You can think about the project description and ask me questions or give me comments if you want.

Emotiv software:

Application	Rank		Serial
EmoStore	★★★☆	DOWNLOAD	
EPOC Control Panel - MAC	★★☆☆	DOWNLOAD	
EPOC Control Panel - Windows	★★★☆	DOWNLOAD	
Spirit Mountain Demo Game - MAC	★★★★	DOWNLOAD	
Spirit Mountain Demo Game - Windows	★★★☆	DOWNLOAD	
Research Edition - Windows	★★★☆	DOWNLOAD	
Research Edition - Linux Ubuntu(Software Only)	★★☆☆	DOWNLOAD	
Mindala	★★☆☆	DOWNLOAD	
FaceMouse	★★★☆	DOWNLOAD	
Epoc Simulink EEG Importer	★★★☆	DOWNLOAD	
Emotiv EPOC Unity3D™ Developer Support Pack	★★★☆	DOWNLOAD	
Emotiv EPOC Brain Activity Map	★★★☆	DOWNLOAD	
Emotiv EPOC 3D Brain Activity Map - Premium Edition	★★★☆	DOWNLOAD	
Research Edition	★★★☆	DOWNLOAD	
Research Edition - Linux Fedora(Software Only)	☆☆☆☆	DOWNLOAD	
Research Edition - Linux Ubuntu(Software Only)	☆☆☆☆	DOWNLOAD	