

**Brain-Computer Interface:
The Neural Impulse Actuator**

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ENGL 227

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Abstract

A brain-computer interface (BCI) is a direct communication pathway between a human or animal brain (or brain cell culture) and an external computerized device. The Neural Impulse Actuator (NIA) is a product by OCZ Technology that is the first commercially available, mass-produced non-invasive BCI. It uses carbon interface fibers injected into a soft plastic as sensors to capture a combination of muscle, skin, and nerve biopotentials. The NIA measures these signals and their intensity. These signals can then be subdivided and hot-keyed to mimic keyboard input by using the included driver and configuration software.



Figure 1 - OCZ Technology (2008) - Neural Impulse Actuator

Introduction

Brain-computer interface (BCI) is defined as a communication pathway between an organic brain and an external device. The Neural Impulse Actuator (NIA) is a non-invasive BCI device that is currently marketed as a gaming device, but also has great potential for medical use. One of the key advantages of the NIA for gaming is that it dramatically reduces reaction times, most notably the reduction from 200 milliseconds for a mouse click to around 80-150 milliseconds using eyelid reflex or other facial muscle reactions. The NIA headband utilizes three laterally spaced electrodes to detect alpha and beta brainwaves, facial muscle activity, and ocular activity. These input signals are also measured by their intensity and can be divided into multiple channels to differentiate many separate “thoughts”. The user can trigger the different behaviors simply by thinking and concentrating on certain “thoughts”. Use of the NIA for practical means

requires a learning period to adapt to the interface, and the length of this learning period may differ among users.

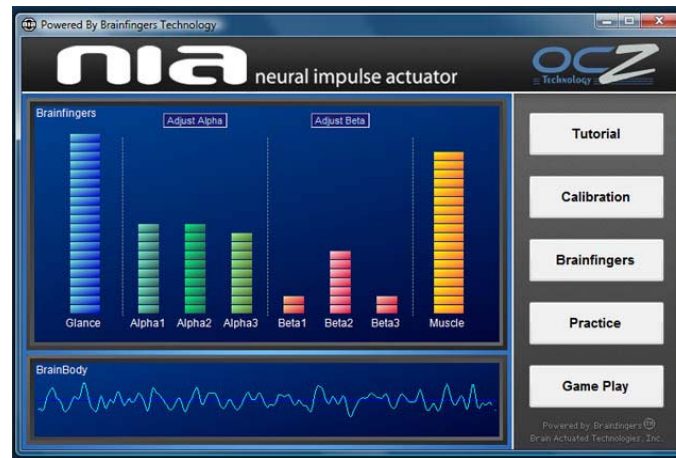


Figure 2 - OCZ Staff (2008) - Neural Signals

Technology

The NIA comes packaged with a headband, installation CD, and user manual. The NIA is completely USB-powered and the headband is one-size-fits-all. The NIA headband contains three sensors which send signals down a single cable to the NIA, where the NIA interprets those signals and outputs computer commands through the USB cable to the user's computer. The NIA driver installed on the user's computer, along with the NIA software, coordinates those signals and is able to assign them to various commands specified by the user. The software itself has several default game behavior profiles for the user to choose from, for quick and easy setup. The user-friendly software also features calibration, practice games, and custom profile management.

The NIA does not read or translate thoughts, but rather it detects the natural biopotentials (electric signals) that make up thoughts by using electroencephalography (EEG). This means that direct thoughts of “left”, “right”, “shoot”, and “duck” probably will not have the desired effects. In order to interface with the NIA correctly, the user will have to learn how to isolate and control the different signals it can detect. It is no different than learning how to flex individual muscles or fingers in the human body. After this skill has been mastered, “navigation and control within a game should seem nearly as easy as controlling your own body, except without the tactile feedback.” (Lin, 2008)



Figure 3 - OCZ Staff (2008) - NIA Tutorial

Competitors

Emotiv Systems and NeuroSky are also working on their own respective BCI devices. Emotiv has set a release date in late 2008, and NeuroSky has yet to set a release date on mass production and sale.

Conclusion

The NIA has a long learning curve, but can be effectively used as a practical input device and provides a whole new level of game immersion. The device is mainly marketed as a gaming input device, and can be successfully used in any game. The NIA's futuristic appearance of "thought reading" is widely appealing, and the device quickly goes out of stock when new shipments arrive. As a relatively cheap brain-computer interface device, the intuitive NIA has been acknowledged as a pioneering new peripheral device in its area of technology.

References

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