Supporting smartphone-based behavioral activation: A simulation study

Behavioral activation has shown to be a simple yet effective therapy for depressive patients. The method relies on extensive collection of patient reported activity data on an hourly basis. We are currently in the process of designing a smartphone-based behavioral activation system for depressive disorders. However, it is an open question to what degree patients would use this approach given the high demand for user input. In order to investigate this question, we collected paper-based behavioral activation forms from 5 patients, covering in total 18 weeks, 115 days, and 1,614 hours of self-reported activity data. In this paper we present an analysis of this data and discuss the implications for the design of a smartphone-based system for behavioral activation.

BCI inside a virtual reality classroom: a potential training tool for attention

Background: A growing population is diagnosed with Attention Deficit Hyperactivity Disorder (ADHD) and are currently being treated with psychostimulants. Brain Computer Interface (BCI) is a method of communicating with an external program or device based on measured electrical signals from the brain. A particular brain signal, the P300 potential, can be measured about 300 ms after a voluntary cognitive involvement to external stimuli. By utilizing the P300 potential, we have designed a BCI-assisted exercising tool targeting attention enhancement within an immersive 3D virtual reality (VR).
Methods: Combining a low-cost infrared camera with an "off-axis perspective projection" algorithm to achieve the illusion of 3D, an engaging training environment has been created. The setup also includes a single measurement electrode placed on the scalp above the parietal lobe (Pz). Two sets of experiments have been performed to elicit the P300 potential. One used a system which is a variant of Farwell and Donchin’s famous P300 speller and the other used a system where the user is required to search for a specific letter in a series of changing images. A non-linear optimized support vector machine (SVM) classifier has been used to automatically detect the P300 potential.

Results: Six subjects have participated in the preliminary experiment to test the prototype system, and an average error rate below 0.30 have been achieved, which is noteworthy considering the simplicity of the scheme.

Conclusions: This work has successfully demonstrated a non-intrusive, low-cost, and portable system targeting attention in a motivating and engaging environment.
BCI using imaginary movements: The simulator

Over the past two decades, much progress has been made in the rapidly evolving field of Brain Computer Interface (BCI). This paper presents a novel concept: a BCI-simulator, which has been developed for the Hex-O-Spell interface, using the sensory motor rhythms (SMR) paradigm. With the simulator, it is possible to evaluate how the model parameters such as error classifications, delay between classifications and success rate affect the communication rate. Another advantage of the simulator is that it allows us to study for more classes than most online BCI systems which are limited to only two classes. Results show that the BCI simulator is able to give a deeper understanding of the feedback systems. We also find that a 3-class system is more efficient than a 2-class system if it obtains a success rate of at least 55% of the 2-class system.
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Phd Student: Rohani, Darius Adam (Intern)
Supervisor: Kessing, Lars Vedel (Ekstern)
Puthusserypady, Sadasivan (Intern)
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