

Development and Testing of a Wearable Device for Neurofeedback of Physiological States

Results:

Two prototypes of a small, wearable feedback device have been developed that allow for real-time data processing, sonification and control of light sources. The first prototype was equipped with 2 analog-to-digital converters for direct read in of pulse and respiration data. EEG data can be received via a USB interface from the PC. A 32 bit microprocessor was used for data processing. Processed data were sent to a MIDI sound chip and to a light controller. The second prototype was equipped with a Bluetooth transceiver that could directly interface a small, wearable EEG amplifier measuring EEG and pulse simultaneously.

The algorithms for sonification have also been implemented in a PC-based program for improved performance reasons. The systems were able to control studio lighting systems and external speakers. Consequently, a whole feedback environment was created that allowed a person to experience the inner processes in the outer world. This feedback environment was termed 'Sensorium'.

In a pilot study, 20 participants (10 experienced meditators and 10 non-meditators) have been exposed in a meditative session to their ongoing brain and heart signals inside the Sensorium. ECG (pulse), slow cortical potentials, and different EEG frequencies were fed back in real-time. All participants were impressed and gave positive feedback. Almost all of them reported an increase in contentment, relaxation, happiness, and inner harmony which was assessed in a questionnaire . They also reported a widening of their body consciousness. In future, therapeutic paradigms will be developed and the treatment effects on people with psychological or psychosomatic diseases will be evaluated.

Published work:

Journal articles:

Hinterberger, T., (2011), "The Sensorium: A Multimodal Neurofeedback Environment", Special Issue on Advances in Human-Computer Interaction, doi:10.1155/2011/724204.

Areas of Interest:

Neurofeedback, Consciousness Research, Meditation

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