MindArt: Visualizations of real EEG data

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Abstract
MindArt is a computer-animated film for the Bernstein Conference 2011 that shows artistic visualizations by using real EEG data from the 2011 MusicMind[1] experiment. The field of neuroscience still uses traditional visualization methods, such as wave charts / diagrams and heatmaps, to interpret abstract data like brain waves or neuronal streams. Heatmaps are usually the most expressive and most commonly used type. However, they give only limited information on multi-dimensional data sets. The MindArt project attempts to gain new insights through the use of different types of visualizations gathered from abstract data, such as brainwaves measured via EEG technology. These visualizations were made in an iterative way with an artistic and playful touch. The visualizations deal with the local arrangement of the electrodes on the head.

Author Keywords
Brain Computer Interface; EEG; electroencephalography; physiological interfaces; experimental visualizations; neuro feedback; java processing.

ACM Classification Keywords
H.4.m. Information Systems Applications

[1] http://incom.org/projekt/1822/

Music Mind:
an EEG Experiment

Figure 1. MusicMind - Skull Cross Section

Interdisciplinary Collaboration In Summer 2011, the Potsdam University of Applied Sciences ventured an attempt to connect neuroscience and design called *Messing with our Minds*,[2] in collaboration with the "Cluster Languages of Emotion." This resulted in other novel and artistic real time visualizations of live measured brain waves (by EEG technology), which came out of different projects.

Introduction

MindArt is based on the EEG experiment MusicMind. MusicMind is an experiment that aims to examine the direct effect of music on a person's emotional state. Past experiments show that auditory signals have a profound influence on the human psyche. Sounds and music can confuse or stress, but can also provoke emotions such as joy, fear, etc. The central questions we wanted to find an answer to were:

- How variable are the reactions of people to different types of music?
- Are there any styles of music & sound that always cause the same pattern of brain activity in all test subjects?
- Is music taste imagined or can it be seen on brain scans?

Implementation

The test subject is connected to an EEG and exposed to various types of music. The selected tracks are meant to create various mental states: stress, fear, happiness, relaxation, etc. The subject is asked to close his or her eyes and concentrate fully on the music. His or her brainwaves are measured in real time by an EEG with 19 electrodes (FP1, FP2, F7, F3, Fz, F4, F8, T7, C3, Cz, C4, T8, P7, P3, Pz, P4, P8, O1, O2). A "Fast Fourier Transformation" is then created from the signal. The following frequency bands were analyzed: theta (4-8Hz), alpha (8-14Hz), and beta (13-30Hz). Each piece of music was compared to the same set of visualizations. The background music in the MindArt video[3] is not the same music that was heard by the subject.

[2] http://messingwithourminds.fh-potsdam.de

[3] http://www.bcf.uni-freiburg.de/movies/neurovision/mind-art/view

Figure 2. Presenting visualizations at LNDW at FU Berlin.

Conclusion

In order to draw scientific conclusions more test trials would be required; however, the different visualizations reveal hidden information and a clear difference between the effects of various types of music.

References

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