C.E.N.T. Computer Enabled Neuroplasticity Treatment

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University of Helsinki introduces Neurofeedback to Finland. Finland is heavily invested in cutting-edge brain science, yet it has never before had dealings with neurofeedback (NFB), either in research or clinical practice. However research on ADHD in Finland has developed strongly (e.g. Helenius et al., 2011, Gumenyuk et al., 2004) and thus provides a good ground for the introduction of neurofeedback into Finland.

On par with more global estimates (Polanczyk et al., 2007), the prevalence of ADHD in Finnish 8-year-olds is estimated at 4% (DSM-III) (Alm-Helander, 2007), within which 16-18 year olds it rises to 8.5% (DSM-IV) (Smalley et al., 2007). Indeed, given that in Finland medication therapy for ADHD is lowest among all Scandinavian countries (Zoegar et al., 2011), Finland’s neurofeedback usage is often reported as an example of NFB across Europe: Brainclinics in Nijmegen, Netherlands; University of Tübingen, both in Germany.

The CENT project will conduct a study on the effects of NFB on adult ADHD within Finland. Research is being conducted by the Cognitive Science Unit at the Institute of Behavioural Sciences, University of Helsinki, with NFB conducted by trained technicians supervised by qualified psychotherapists. Software is custom-built for the project, with games sourced from local companies.

**STUDY DESIGN**

The experiment aims to test the efficacy of neurofeedback for adults with either ADHD or ADD using randomized controlled clinical trial (RCT). The persistence of the treatment effects will also be tested with a follow-up study. Additionally we will study the neurological symptoms of adult ADHD/ADD using laboratory-grade EEG to examine the Event-Related Potentials (ERP) of patients as they perform attentional tasks, and analyse the patterns of hemispheric activity that characterise them. Both latter studies will use control groups of healthy non-ADHD/ADD subjects.

Figure 2 shows the study design, with tasks interrelated in timeline format. From summer 2011 the research, design and preparation of NFB treatment for the project, with games sourced from local companies.

**HARDWARE**

The study is using Neuroelectrics’ Enobio system to feedback patient’s EEG signals. Enobio is a wireless 4-channel active-electrode EEG amplifier, which can utilise wet or dry electrodes interchangeably. With dry electrodes, uncomfortable abrasive skin preparation and messy gel is not needed, so recording can start almost immediately after the subject is ready and electrochemical equilibrium is established.

- **Sampling rate:** 250Hz
- **Frequency range:** DC-125Hz
- **Common-Mode Rejection Ratio:** 92dB
- **Signal-to-Noise Ratio:** 83dB
- **Electrodes:** active/screwed Ag/AgCl
- **Amplifier noise:** 0.5 µV
- **Driven-Right EEG reference**
- **Low-powered radio connection**

**SOFTWARE**

A new software platform was developed by the Finnish company BLStream for the study, integrating OpenVibe platform’s signal analysis capabilities with a graphical user interface designed for the project. The platform gives the researcher or clinician the option to use different neurofeedback protocols and activities, for example, different games or auditory content. The program records relevant background information on the patient’s state before each session and tracks the patient’s progress as the treatment proceeds.

The program is designed for a dual-monitor setup, with separate monitors for the therapist and the patient. In principle it is possible for the patient and the therapist to be in different locations while training, thus enabling tele-neurofeedback.

The training itself is based on thresholds calculated from baseline measurements. Currently two NFB protocols are supported, theta-beta (the default option) and SMR, one of these is chosen by the trainer at the beginning of a session.

**REFERENCES**


**RESEARCHERS**

Project Leader: Prof. Christina Krause
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**PARTNERS**

CTE: Neurology Challenging Times

**SOFTWARE**

BLStream
Ludocraft
Secret Exit
Kutarkema
Spinverse Oy