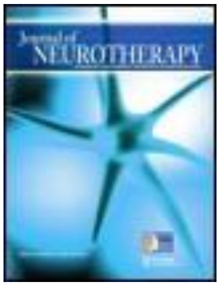

Journal of Neurotherapy: Investigations in Neuromodulation, Neurofeedback and Applied Neuroscience

ISNR Research Fund Supported Projects Presented at the 12th Annual ISNR Conference, 2004

Mario Beauregard PhD , Johanne Lévesque PhD , Mensour Boualem , Marco Congedo PhD , Cédric Arrouët ME , Anatole Lécuyer PhD & Bruno Arnaldi PhD

Published online: 08 Sep 2008.

To cite this article: Mario Beauregard PhD , Johanne Lévesque PhD , Mensour Boualem , Marco Congedo PhD , Cédric Arrouët ME , Anatole Lécuyer PhD & Bruno Arnaldi PhD (2005) ISNR Research Fund Supported Projects Presented at the 12th Annual ISNR Conference, 2004, Journal of Neurotherapy: Investigations in Neuromodulation, Neurofeedback and Applied Neuroscience, 9:1, 99-101, DOI: 10.1300/J184v09n01_11

To link to this article: http://dx.doi.org/10.1300/J184v09n01_11

ISNR Research Fund Supported Projects Presented at the 12th Annual ISNR Conference, 2004

Effect of Neurofeedback Training on the Neural Substrate of Executive Deficits in ADHD Children

Mario Beauregard, PhD (1, 2, 3, 4), Johanne Lévesque, PhD (1, 2, 5), and Mensour Boualem (6)
(1) Départment de Psychologie, Université de Montréal, (2) Centre de Recherche en Neuropsychologie Expérimentale et Cognition (CRENEC), (3) Départment de Radiologie, Université de Montréal, (4) Centre de Recherche en Sciences Neurologiques (CRSN), Faculté de Médecine, Université de Montréal, (5) Centre de Recherche, Hôspital Ste-Justine, (6) Départment de Radiologie, Centre Hospitalier de l'Université de Montréal (CHUM), Hôspital Notre Dame
<mario.beauregard@umontreal.ca>

The present functional magnetic resonance imaging (fMRI) study was undertaken to measure the effect of neurofeedback training (NFT) on the neural substrate of executive deficits in AD/HD children. Twenty AD/HD children (not taking any psychostimulant) participated in the study. Fifteen children were randomly assigned to the experimental group (which received NFT); whereas, the other five children were assigned to the control group (no NFT). NFT was based on a protocol previously proposed by Lubar and Lubar (1984). Subjects from both groups were scanned one week before the beginning of the NFT (Time 1) and one week after the end of this training (Time 2), while they performed a "Counting Stroop" task and a Go/NoGo task.

Journal of Neurotherapy, Vol. 9(1) 2005

Digital Object Identifier: 10.1300/J184v09n01_11

At Time 1, in both groups, the Counting Stroop task was associated with significant activation in the right superior parietal lobule. No activation was noted in the anterior cingulate cortex. For the Go/NoGo task, in both groups, there was no significant activity in the prefrontal cortex and striatum. At Time 2, in both groups, the Counting Stroop task was still associated with significant activation of the right parietal cortex. This time, however, there was a significant activation of the right anterior cingulate cortex in the experimental group. No such activation was seen in control subjects. For the Go/NoGo task, significant loci of activation were noted in the experimental group in the lateral prefrontal cortex, bilaterally, and the left caudate nucleus. No significant activation of these brain regions was measured in control subjects.

These results suggest that NFT has the capacity to normalize the brain systems mediating attention and motor control in AD/HD children. Given the pivotal role played by dopamine in these executive functions, we hypothesize that NFT modulates dopaminergic neurotransmission in the anterior cingulate cortex and the fronto-striatal circuits.

REFERENCE

Lubar, J. & Lubar, J. (1984). Electroencephalographic biofeedback of SMR and beta for treatment of attention deficit disorder in a clinical setting. *Biofeedback and Self-Regulation*, *9* (1), 1-23.

EEG in Real-Time: New Perspectives and a Platform for 3-D Visualization of Functional Brain Dynamics

Marco Congedo, PhD, Cédric Arrouët, ME, Anatole Lécuyer, PhD, Bruno Arnaldi, PhD
National Institute for Research in Informatics and Random Systems, (IRISA), Rennes, France
<loretabiofeedback@yahoo.com>

Introduction

Recent advances in micro-processors and graphic cards as well as recursive algorithms for digital signal processing have allowed the exploitation of EEG system in real-time. In addition to neurofeedback (NF), a considerable amount of research is focusing on the development of

Brain-Computer Interfaces (BCI). On the other hand, Virtual Reality (VR) provides a powerful framework for the construction of virtual environments (VE) that may enhance NF and BCI systems by capturing the participants' attention, raising their motivation, and providing them with more informative feedback of brain activity.

Method

Recent literature in NF, BCI, and VR focusing on real-time EEG was briefly reviewed. The OpenViBE (Open-platform for Virtual Brain Environments) project was presented. OpenViBE has been conceived to be a general platform for real-time navigation and visualization of a 3-D virtual brain. It supports key features such as the distribution of processing on a PC net and stereovision, hence it is suitable for the development of high-performance and immersive virtual brain environments. As an example, we showed how to use functional electromagnetic data (e.g., Standardized Low-Resolution Electromagnetic Tomography) to dynamically represent brain activity in the form of 3-D objects superimposed on a volumetric rendering of brain anatomy. In this application the participants can truly navigate into their brain and observe the neocortical dynamics in realistic spatio-temporal relations.

Results

Through several examples with real EEG data streams, OpenViBE was shown to be a flexible platform that can be used in very diverse EEG real-time applications which include, but are not limited to, NF and BCI.

Conclusion

The aim of this presentation is to delineate a "crossroad" to which NF, BCI, and VR may converge in future research involving functional brain data in real-time. By developing OpenViBE as open-source software, we hope to promote the development, exchange of information, and cross-publication in these fields of research.