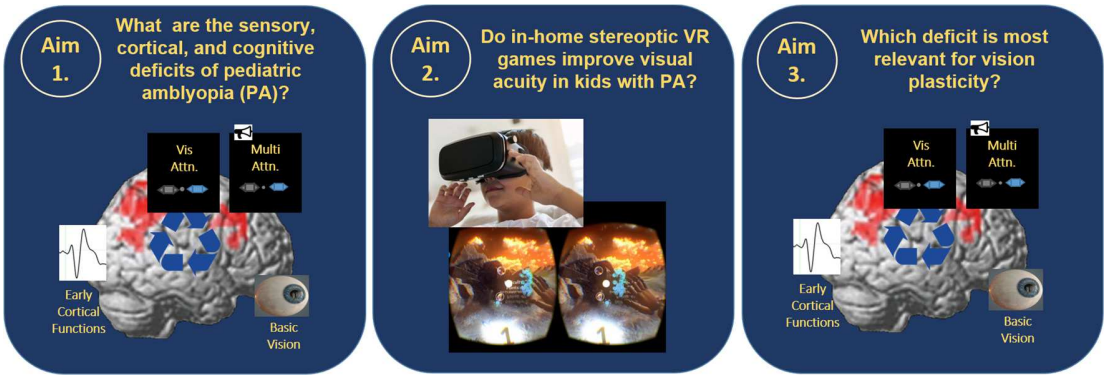
Stereoscopic Virtual Reality Video-games for Pediatric Amblyopia:
Brain Mechanisms of Attention Contributing to Vision Rehabilitation

PhD Project Description

Amblyopia – commonly "lazy eye" – is the most common and so the most socially and economically costly pediatric vision disorder. Traditional occlusion treatments are not effective in many young patients, leading to a wide range of negative cognitive, emotional, and life-outcome consequences.

This project will test a potentially novel transdisciplinary approach integrating the latest advances in experimental psychology, neuroscience, and technology computational modeling, to better understand and thus treat pediatric vision disorders, using amblyopia as a model. The project has three main objectives (see figure below). First, by combining EEG neuroimaging methods and with rigorous yet naturalistic cognitive tasks, we aim to assess the relative importance of sensory, cortical, and cognitive (mainly multisensory-attentional) deficits in children with lazy eye. Second, we will test the effectiveness of stereoptic therapeutic virtual reality (VR) videogames as alternative treatment to traditional occlusion treatments. Third, we will shed much-needed light on the role of the 3 levels of nervous system functioning in treatment response in lazy eye, by developing innovative computational approaches that combine machine learning with multi-level data modeling, such as structural equation modeling (SEM).

This way, the project should have a strong theoretical, clinical, and academic impact. It will verify the potential of a new inter-disciplinary approach to vision rehabilitation, with explicit focus on skills of attending to naturalistic information. Clinically, it will test a new potential treatment for lazy eye, and so other developmental vision disorders. Academically, it will train a new generation of transdisciplinary clinical neuroscientists. Altogether, the project has a high likelihood of success as proof of concept and potential for extension to other sensory and brain disorders.



The successful completion of a PhD project will be ensured by the student working within the Group for Real-World Neuroscience (GROWN) that is embedded within the Laboratory for Investigative Neurophysiology (LINE) in Radiodiagnostic Service of CHUV-UNIL. The LINE, headed by Prof. Micah Murray, is multi-disciplinary and inter-departmental lab composed of a wide range of experts, i.e., clinicians, neuroscientists, psychologists, physicists/computer scientists, whose aim is to improve diagnosis, treatment and prognosis of sensory dysfunction through the implementation of neurotechnology and neuroscience-guided training platforms. Within the LINE, GROWN, headed by Dr. Paul Matusz, focuses on developing new approaches to understanding brain and cognitive development in healthy children and those atypically developing through an approach that combines rigorous naturalistic paradigms, the information-rich nature of EEG as a brain imaging method and the role of technology as treatment delivery tools. The LINE likewise possesses in-house experts in computational modelling, being supported in this domain through its affiliation with the internationally renowned MedGIFT at Institute of Information Systems at HES-SO Valais, which developes machine learning approach to improve medical diagnosis and treatment. Together, this highly inter-disciplinary environment provide a highly educating milieu for a new future generation of neuroscientists.

LINE

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