Merging Virtual Reality and Brain Stimulation to understand the neural basis of Eye-Hand Coordination in Healthy and Visually-Impaired Developmental Age

Despite apparently simple, eye-hand coordination entails complex neural loops, with visual input guiding motor response, as well as motor actions driving visual inspection. The difficulty of neurally manage such complexity is intensely evident in particularly sensitive populations, including visually impaired people, especially in developing age. It is, therefore, not surprising that visual deficit can alter the child's reading, writing, calculating, and praxis abilities [1]. The aim of this project is twofold. First, it will establish the neurological reality which governs initiation and control of spatially-coded movements in adults and normally developing age. Second, it will reveal the differences and compensatory neural mechanisms in visually impaired adults and children/adolescents. To this aim the project will combine Virtual Reality (VR) and Brain Stimulation (High Definition transcranial Direct Current Stimulation ; HDtCDS). VR will allow us to precisely control the visual input, as well as safely allow movements in a virtual space. As previous use of HDtDCS on the visual and motor cortices improved visuo-motor learning [2], in the present project it will give a better understanding, and possibly restoration, of the neural exchanges between visual and motor brain regions. The obtained results will constitute a solid base for improving rehabilitation after brain injuries in which motor execution is impaired because of deficient visual perception.

References

[1] Chokron, S., Cavézian, C., & de Agostini, M. (2010). Troubles neurovisuels chez l'enfant: Sémiologie, retentissement sur les apprentissages et dépistage. Développements, (3), 17-25.

[2] Antal, A., Nitsche, M. A., Kruse, W., Kincses, T. Z., Hoffmann, K. P., & Paulus, W. (2004). Direct current stimulation over V5 enhances visuomotor coordination by improving motion perception in humans. Journal of cognitive neuroscience, 16(4), 521-527.