



“The reality of virtual limbs: does mirror technique for hand has functional consequences for the motor output?”

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Abstract

Background. Motor imagery was proven to excite the motor cortex as actual action execution. Therefore, motor imagery training was suggested as a method of facilitating the rehabilitation of the paretic limbs following stroke.

Objective. To investigate whether motor imagery brings objectively measurable effects on the motor behaviour, and whether these effects can be enhanced by the application of the mirror technique.

Methods. Three experiments were conducted involving 32 neurologically healthy participants, with strong right-handedness.

Results. Motor imagery simulation of the bimanual movement induced similar changes in terms of temporal precision as overt motor execution. The mid-sagittal mirror technique increased the subjective kinaesthetic and visual vividness of the motor imagery.

Conclusions. The source of the observed changes in motor parameters under motor imagery conditions was identified to be different during bimanual conditions. Further investigations need to be conducted to examine the mechanisms underlying observed patterns of results.

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I certify that all material in this dissertation which is not my own work has been identified with appropriate acknowledgement and referencing and I also certify that no material is included for which a degree has previously been conferred upon me.

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Introduction

The human coordination is one of the most fascinating fields of the neuropsychological investigation. Our outstanding capability to move, grasp and manipulate objects has enabled the human species to reach the highest level of evolutionary functioning (Franz, 2004). Transforming our thoughts into motor actions requires complex cortical processes involving motor programming, motor coordination and sensory guidance. These complex processes can be activated not only with the purpose of real movement, but also with voluntary motor imagery.

This discovery led to a substantial body of scientific investigations over the practical application of motor imagery as a method of rehabilitation of acquired motor impairments and enhancement of sport performance. Nonetheless, there is still a need for conclusive research work on establishing the objective influence of motor imagery on human motor behavior parameters for the sake of future improvement of these methods. This study presents a review of current neuropsychological findings contributed to this issue, with the pronounced focus on the clinical applications of motor imagery stimulation. The following sections will provide a view on methods of enhancing the motor imagery vividness by visual feedback manipulation. Finally, spatial and temporal coupling paradigm will be discussed as a robust tool of assessing motor behavior parameters within limb interaction. The purpose of this study is to propose an application of bimanual advantage paradigm as the method of investigating whether imagery stimulation have objective consequences on the motor output in neurologically healthy participants, and whether these effects can be enhanced by the virtual visual feedback manipulation technique provided by mid-sagittal mirror.