

Motor imagery is the ability of the mind to simulate movement without performing it. Thanks to this kind of imagination, athletes can predict their opponent's behavior or dancers can plan the next steps of choreography. Most people who are asked to imagine a movement - e.g. clenching their hands on a handle - see this movement in the mind's eye as if they were watching someone doing it. It is also possible to imagine movement in a different way - kinaesthetic. Kinesthetic imagery means the sensation that occurs in the body and muscles during movement, but only in the mind. This type of imagination is used in sports training and neurological rehabilitation, e.g. in patients after strokes who have lost their motor functions. It is possible because the activity of the brain during imagery and actual movement performance is similar and the theory that describes this relationship is Motor Simulation Theory (MST).

Our project aims to answer research questions in the field of theory and methodology of research on kinaesthetic motor imagery. Firstly, there is a lack of methods to measure the correctness and vividness of images. Secondly, there is a lack of research procedures which allow to separate so-called pure motor images from non-motoric strategies for solving imaginary tasks (visual, arithmetic, linguistic). Thirdly, there is still a lack of sufficient behavioural and neural evidence for the similarity between the execution and imagining of movement, as postulated by MST. Fourthly, there is a lack of data on the links between motor imagery and other cognitive processes, such as attention and memory. Fifthly, there is no answer to the question whether motor memory and motor imagery use the same neural networks.

To answer these questions, we have planned a series of experiments in which, due to modern EEG signal analysis methods, we will study brain activity patterns in terms of the dynamics of brain network oscillations and the relationship between brain areas that generate this activity. A specially designed haptic interface will be used in the research. In combination with an appropriate experimental procedure, it will allow to generate kinaesthetic imagery and to control its vividness and correctness of the task performance. As a result of the project, new research methods will be developed, claims in the area of motor imagination theory will be verified, and based on the acquired knowledge.