

Psychophysiology Laboratory at MMU

The Psychophysiology Laboratory is a part of the Health, Rehabilitation, and Psychology Centre at Manchester Metropolitan University (MMU) within the Department of Exercise and Sport Science. Much of the research in the Psychophysiology Lab involves investigating the neuroscientific processes associated with motor imagery and action observation. Current studies — in collaboration with researchers from the Birmingham, UK and Paris, France — are exploring social context as a moderating factor in motor control.

The Psychophysiology Laboratory at MMU utilizes an 8 channel Bagnoli™ Desktop EMG system, which is only one of many Delsys EMG systems at the university.

Research

Investigating the human mirror neuron system

The psychophysiology lab is interested in investigating the properties of the human mirror neuron system using transcranial magnetic stimulation (TMS) and EMG. Di Pellegrino et al., (1992) first discovered the presence of 'mirror neurons' in the monkey pre-motor cortex that fired during both the execution and observation of reaching and grasping actions. Similar investigations using brain imaging techniques have provided evidence for the existence of a mirror neuron system (MNS) that is located within the pre-motor, parietal, and temporal areas of the human cortex (Rizzolatti & Craighero, 2004). MNS activity is thought to represent an action observation-execution system that simulates another person's actions, allowing us to understand the intentions of others and to learn new skills through imitation (Jeannerod, 1994).



The experimental setup: TMS causes a muscle contraction that can be recorded using surface electromyography.

The properties of the human MNS have also been investigated using the technique of TMS, which is a safe and effective, non-invasive method of activating the human brain (Fadiga et al., 1995). The application of TMS to the primary motor cortex

elicits a contraction of the upper limb muscles on the contralateral side of the body and the resulting muscle activity can be measured through surface electromyography. The lab is currently conducting a series of TMS studies that investigate the characteristics of the human MNS. Specifically, the research is addressing the following issues:

- (a) the contributory effects of visual and auditory stimuli to action representations in elite basketball players;
- (b) the benefits of live versus recorded observation techniques;
- (c) whether activation of the MNS requires the presence of goal directed movements; and
- (d) the ability to infer action during the observation of partially occluded movements.

Dave Smith, Nick Smith and Paul Holmes, together with current MMU student Christine Wilson, are conducting research examining EMG activity during imagery interventions, as part of a wider project examining the neuroscientific (including TMS) and psychophysiological responses to motor imagery. The research is helping us understand the physiological and psychological changes that occur during imagery, and will provide valuable information to those seeking to use imagery to enhance sports performance.



Psychophysiology Lab group (left to right): Dr. Craig McAlistler, Michela Loporto (PhD candidate), David Wright (PhD candidate), John Pietrazak, and Dr. Gladys Pearson.

Sandra Lewis, Neil Fowler and Paul Holmes are using the surface EMG to examine the muscle activity in spinal muscles, specifically. The team is interested in the relationship between perceived low-back pain and muscle activity. Sandra and Paul will explore the benefits of EMG-biofeedback and other cognitive-motor interventions to help alleviate low back pain symptoms.



Dr. Paul Holmes is currently a Principal Lecturer at Manchester Metropolitan University. His research is primarily in the fields of cognitive neuroscience and sport psychology. He is a member of numerous professional societies including the British Psychological Association and the British Association of Sport and Exercise Science. Dr. Holmes has also served as a reviewer for the *Journal of Sport Sciences*, *Clinical Neurophysiology*, and many more peer reviewed journals.

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