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Motor Affordance for Grasping a Handrail

D. McDannald, M. Mansour, G. Rydalch, D.A.E. Bolton | Utah State University

Introduction

Mere observation of objects around us can potentiate motor action by priming specific areas in the brain. This concept, referred to as the affordance effect, suggests that humans put viewed objects into motor terms automatically. Such automated linking of observations to action offers potential advantages to interact with our environment quickly and efficiently when producing goal-directed movements.

One possible application of this affordance effect includes the rapid balance reactions needed to avoid a fall. In reactive balance control, movements must be extremely fast yet simultaneously appropriate for a given environment (e.g. quickly grasping a nearby handrail to avoid a fall).

The present study was conducted to test if viewing a wall-mounted handrail – the type of handle commonly used to regain balance – results in activation of motor cortical networks.

Hypothesis: The hand area of the brain (located in the primary motor cortex-also called M1-see Figure 1) will be facilitated immediately following visual access to a safety handle versus when the handle is covered.

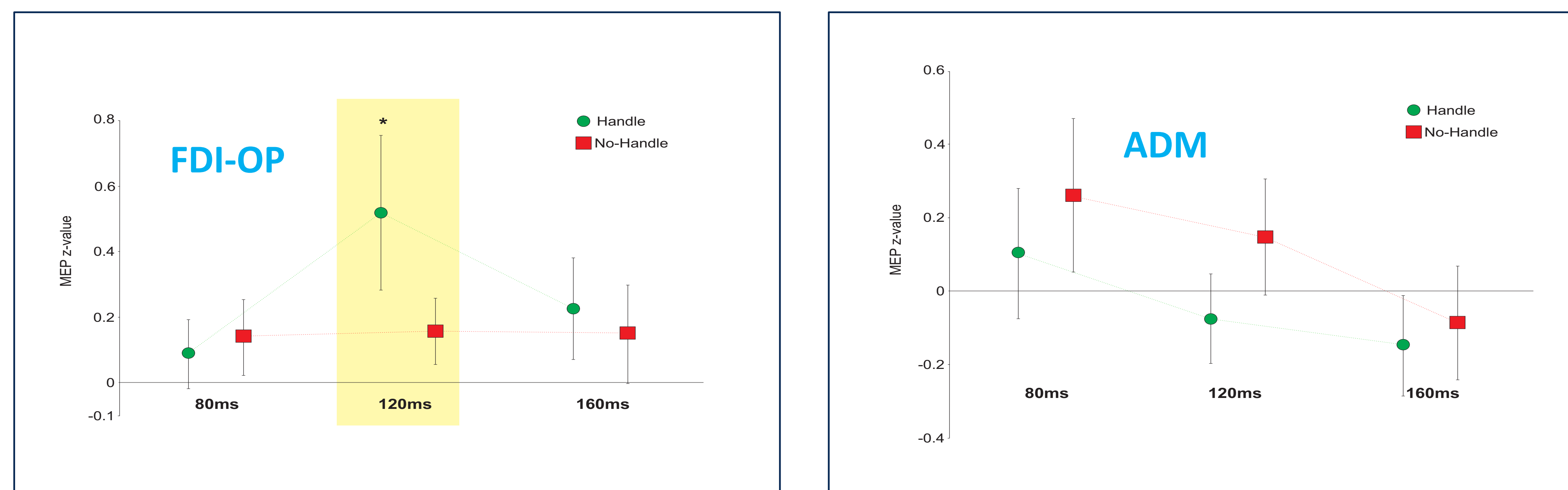
Methods

Transcranial magnetic stimulation (TMS) was used to measure excitation of the brain representation for hand muscles while participants performed a seated reach-to-grasp task. We focused on three intrinsic hand muscles; first dorsal interosseous (FDI), opponens pollicis (OP) and Abductor Digiti Minimi (ADM).

TMS pulses occurred shortly after visual occlusion goggles opened. The goggles were closed between trials and the response environment was randomly altered to show either a handle or no handle.

The main outcome measure was the amplitude of muscle response to TMS in hand muscles either with the handle (a) visible or (b) covered.

Figure 1 – Muscle Response to TMS



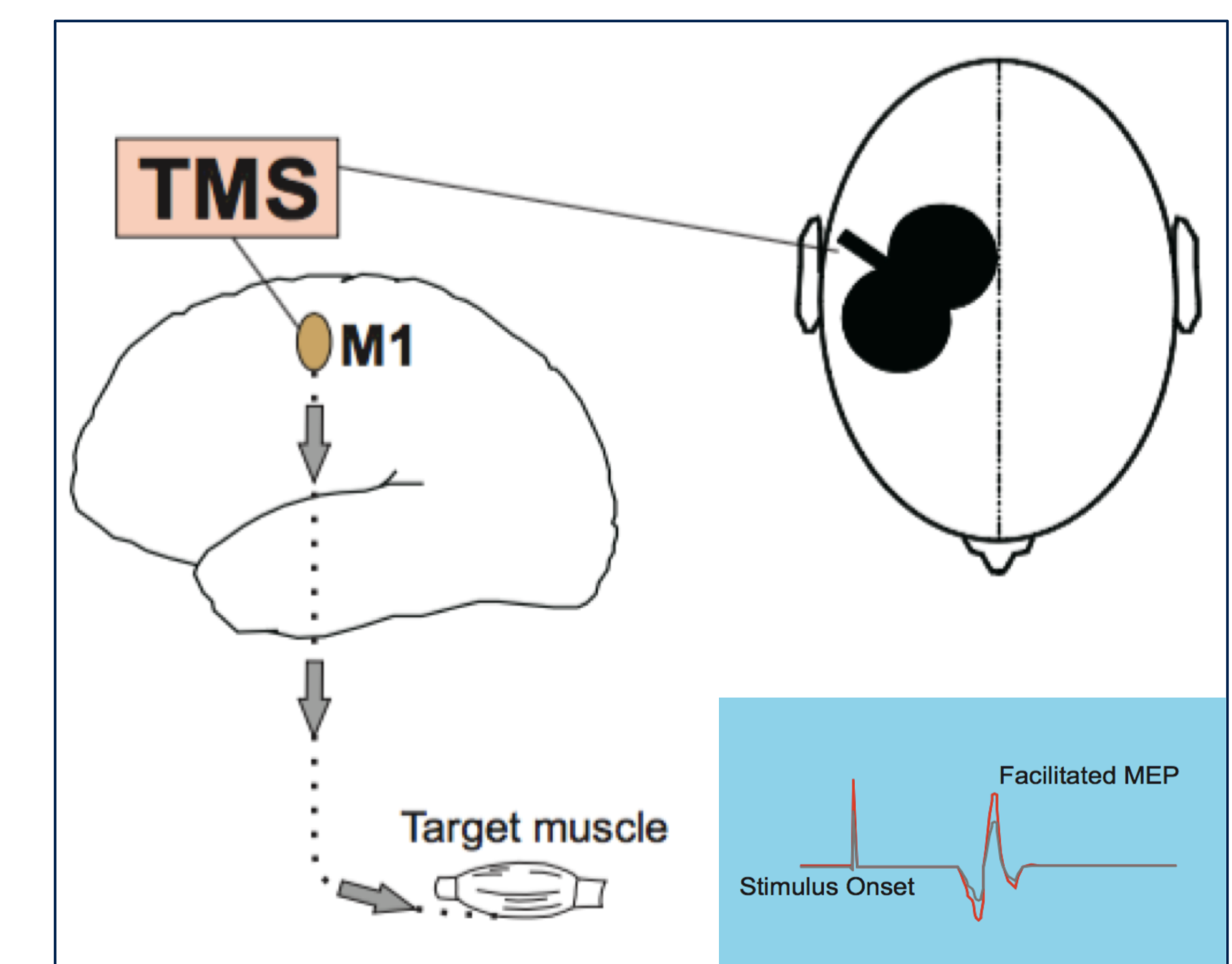
Results

We found evidence of rapid motor facilitation in hand muscles when viewing a wall-mounted handle vs. trials where the handle was covered.

This effect was selective to the muscles activated and the timing at which it emerged. FDI and OP muscles (synergists to hand opposition) were facilitated 120ms after viewing the handle

By contrast, ADM (which abducts the little finger and is an antagonist to hand opposition) was reduced across time for trials when the handle was present.

Figure 2 – Experimental Methods



Conclusions

We found rapid and selective engagement of muscles suitable for grasping the handrail based on vision.

Our results were consistent with concept of affordances where vision automatically translates viewed objects into appropriate motor terms.

The affordance effect was present for a wall-mounted safety handle - implications for priming balance reactions, even without awareness of an imminent fall.

