Effects of motor imagery on postural control in quiet stance

nemolab
neuromotor | behavior | laboratory

Tim Naumann[1,2], Adam Zabicki[1,2], Johannes Kurz[1,2] & Jörn Munzert[1,2]

[1]nemolab – Neuromotor Behavior Laboratory, Justus-Liebig-University Giessen

[2]Department of Sports Science, Justus-Liebig-University Giessen

Introduction

According to the Simulation Theory by Jeannerod (2001), the imagination (MI) and the execution (ME) of an action share the same neural substrates. Furthermore, recent studies showed that imagining oneself executing a fast reaction task with different loads, leads to specific modulation of postural control (Boulton & Mitra, 2015). The aim of this study was to examine, whether the effect of imagined load on postural control could be verified for an imagined continuous movement. Moreover, if variations in imagined angle and velocity also lead to specific adaptations in body sway.

Methods

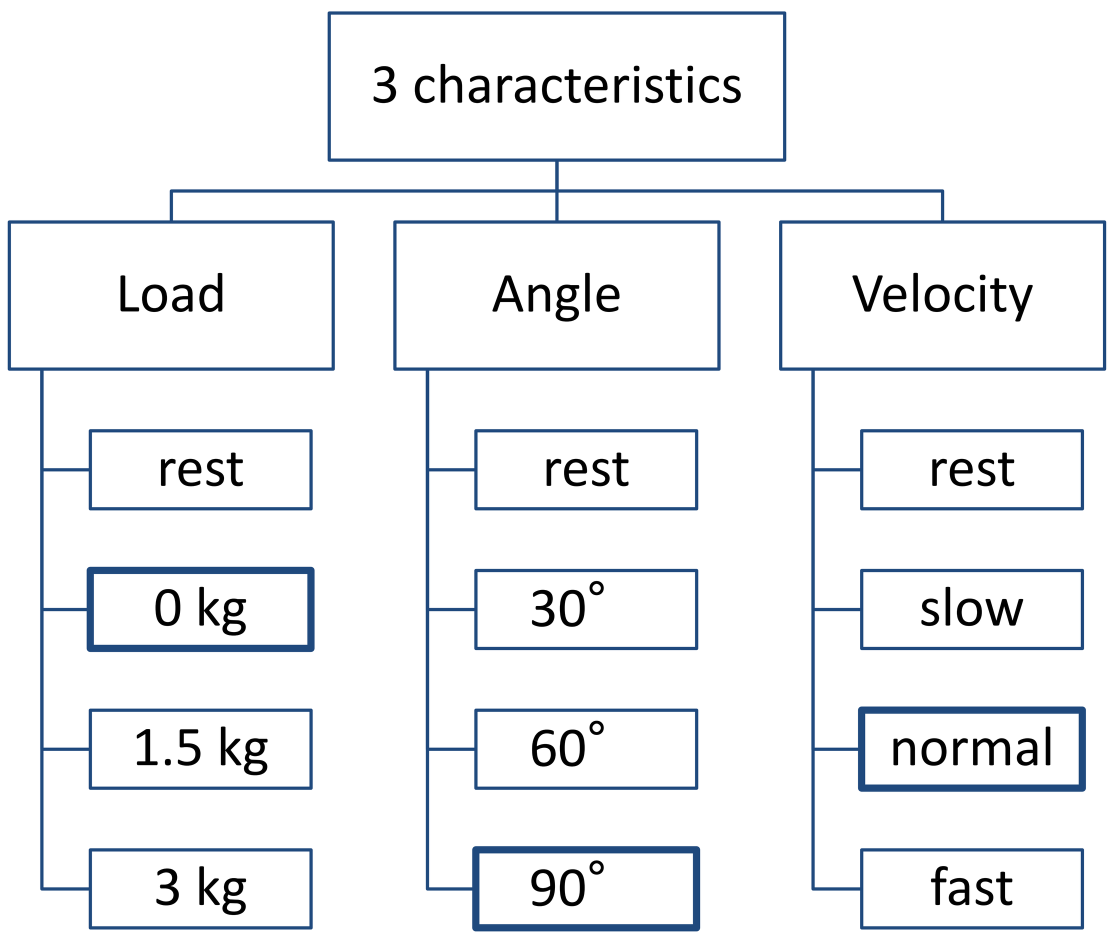

Fig. 1. Experimental conditions

Fig. 2. Experimental setup

Subjects: 16 participants (♀: 12, ø 25.0 ±4.1 years).

Design: Participants imagined or executed repetitive shoulder abduction movements while standing in tandem position. The movements varied in load that had to be lifted (0, 1.5, or 3 kg), in angle (30, 60, or 90 deg.), or in velocity (1.5, 2.25, or 3 s/movement cycle). If one characteristic varied, the two other characteristics were kept constant (see Fig. 1. outlined bold). Each of the movement characteristics was tested within a single session on different days. Each session consisted of 6 Blocks (3 x execution and 3 x imagery, alternated) with 12 trials (3 x every condition).

Center of pressure (COP) path length as a measure for postural control was recorded with a force plate (AMTI, Watertown, MA).

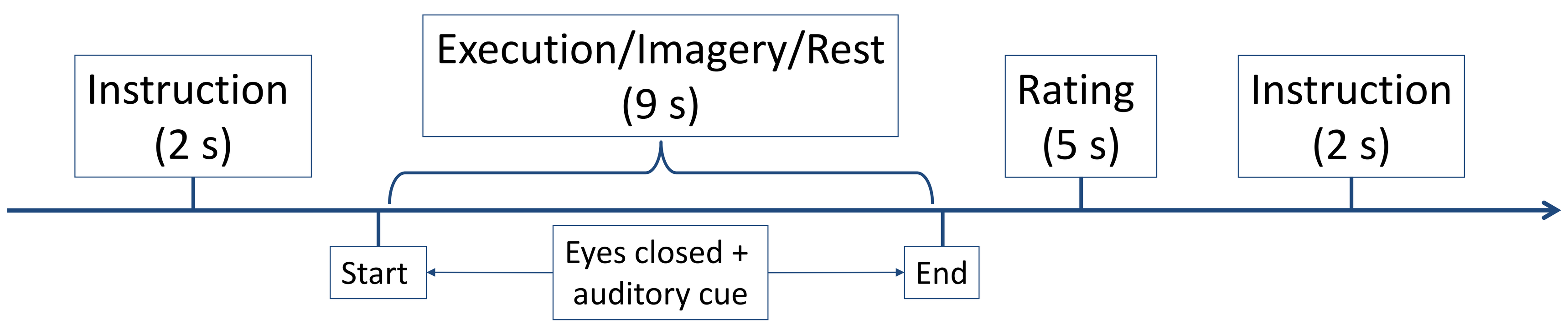

Fig. 3. Trial sequence

Statistics: In order to test the effects of the different movement characteristics on postural control, repeated measures ANOVAs were conducted for each condition (load/amplitude/velocity) and both states (ME/MI). The level of significance was set at $p < .05$.

Results

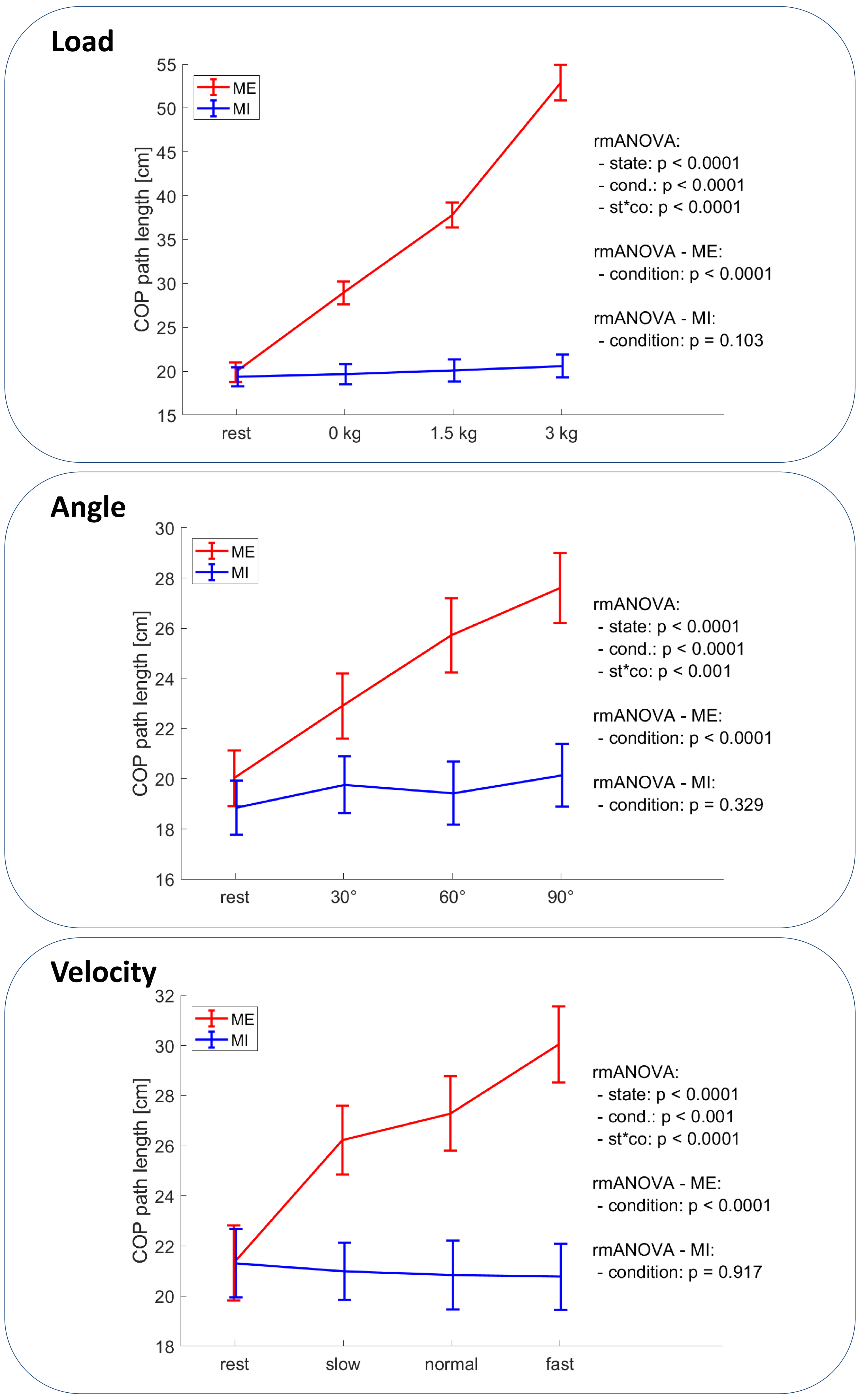

Fig. 4. Means, standard errors of the means and results of rmANOVAs for load, angle, and velocity.

Results showed that the sway increased significantly when participants executed movements with higher load, angle, or velocity. In contrast, for the motor imagery conditions none of these effects could be found (see Fig. 4).

Discussion

The findings by Boulton and Mitra (2015), that imagery of movements with different loads leads to specific adaptation of postural control, could not be verified. Furthermore, we did not find significant differences for movement characteristics like angle and velocity. One possible explanation could be that demands on postural control in repetitive movements are lower compared to fast reaction tasks that were used in previous studies.

References:

Boulton, H., Mitra, S. (2015). Incomplete inhibition of central postural commands during manual motor imagery. *Brain Research, 1624*, 321-329.

Jeannerod, M. (2001). Neural simulation of action: a unifying mechanism for motor cognition. *NeuroImage, 14,* 103-109.

Contact: Tim Naumann | Justus-Liebig-University Giessen | email: tim.naumann@sport.uni-giessen.de