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G(r)asp! Deepening timing dependency, muscle specificity, and target stimulus of motor resonance for complex movements

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Transcranial magnetic stimulation (TMS) and motor-evoked potentials (MEPs) were intensely exploited to investigate the neurophysiological properties of motor resonance during the observation of movements involving a single muscle. As for complex movements (i.e., movements involving more than one muscle), these properties are more debated since there are still controversies about, e.g., the optimal timing to record motor resonance or its muscle specificity. Nevertheless, this investigation is crucial for optimizing action observation tasks in basic research and clinical settings. In the present study, thirty-five subjects underwent blocks of TMS-EMG during a classic action observation task. Different grasping movements were visually presented in an egocentric perspective (i.e., grasping a bottle, grasping another hand, or grasping without a target). TMS was delivered over left M1 during the observation of the static stimulus or after 100/200/300 ms from the movement's frame onset. MEPs were recorded from four muscles of the right hand and forearm (i.e., FDI/ADM/ECR/FCR). Motor resonance was scored as the ratio between MEP peak-to-peak amplitude during the observation of static stimuli and the observation of movements. Results show that motor resonance is inhibited when TMS is delivered at 300 ms from movement's onset, regardless of the visual stimulus depicted and the muscle involved. Interestingly, motor resonance enhancement is found at 200 ms selectively for the visual stimulus grasping the other's hand and only from FDI MEPs. These results suggest methodological care when action observation tasks and time-locked TMS are exploited to measure motor resonance based on corticospinal measures (i.e., MEPs).