

Title: Behavioural and cerebral asymmetries of mirror movements are specific to rhythmic task

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Background: Mirror movements (MM) refer to the involuntary contractions occurring in homologous muscles contralateral to the voluntary movements, particularly in the distal upper limb muscles. In healthy adults, discreet MM can be observed during complex rhythmic or effortful tasks through electromyographic (EMG) activity. In right-handed adults, several studies indicate larger occurrence of MM on the right dominant hand during voluntary movements of the left non-dominant hand than the opposite. However, contradictory results suggest that such asymmetry of MM could depend on the characteristics of the task. We propose to test this hypothesis by comparing (1) the quantity and intensity of MM on each upper limb in healthy adults and (2) the cerebral correlates related to motor process in a rhythmic versus a sustained task.

Methods: 24 right-handed healthy participants (14 women and 10 men; mean age: 38 ± 17 years, range: 20-77 years) achieved two unimanual power grip tasks at 25% of maximum voluntary contraction. In the rhythmic task, they performed rhythmic unimanual power grip contractions in synchronization with an auditory metronome. In the sustained task, they were asked to maintain the required force level for 6 seconds. 20 contractions were performed with each hand in each task, while surface EMG of flexors and extensors of both hands and fingers and electroencephalography activity (EEG) were recorded. The number and amplitude of EMG peaks in the non-active hand were considered as “quantity” and “intensity” of MM, respectively. Repeated measures ANCOVAs Task (Rhythmic vs Sustained) x Side (Right vs Left) with Age as covariate were performed on the quantity and intensity of MM. EEG indexes of asymmetry in beta frequency band (13-30 Hz) between right and left sensorimotor regions were compared between right and left unimanual condition in each task with unilateral paired-samples t-tests.

Results: Irrespective of age, a significant Task x Side interaction was found only on the quantity of MM ($F_{1,22} = 8.10$; $p < 0.01$; partial $\eta^2 = 0.26$). The quantity of MM was significantly higher on the right hand compared to the left hand only during the rhythmic task. This behavioral asymmetry was associated with greater bilateral sensorimotor activations during the rhythmic task only ($t_{24} = 2.56$; $p < 0.01$; $d = 0.21$).

Conclusions: Behavioural and cerebral asymmetries of MM seem to be specific to the rhythmic task. Further analyses will aim to test whether the asymmetry found in the rhythmic task is related to higher attentional activations.