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Fast and precise reaching after stroke: Theoretical considerations on motor control

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Objective Evaluate the fast and precise reaching capacity post-stroke over various orientations based on Fitts' law that predicts that the movement time increases linearly with the quantity of information transmitted during task performance [1].
Methods Nineteen people chronic post-stroke and 19 healthy young controls performed twice a discrete pointing task over 5 orientations with different target sizes. The parameters of Fitts, linear relationship between movement time and task diffulty as well as the corresponding kinematics were calculated.
Results People post-stroke exhibit a lower information rate, as identified by a steeper slope and the occurrence of a negative intercept showed that the relationship was influenced by non-informational aspects. Movements post-stroke were marked by an increased segmentation, a less direct trajectory and the first velocity peak occurred later in time.
Discussion Patients after stroke generally followed Fitts's law, albeit with an expected lower information rate and more variability. Additionally, we found that patients after a stroke exhibited systematic deviations from the informational predictions. We address these deviations based on the nature of the deficit. During pointing movements, healthy people combine feedforward and feedback information to successfully arrive at the target [2]. If feedforward is less reliable (because the link between the command and the output is more variable), one will depend more on visual feedback. The kinematic characteristics of the pointing movements of patients subscribed this theoretical deduction: we found a serial enchainment of submovements towards the target, indicating that patients have been waiting for feedback information before adapting and continuing their movement. This behaviour largely accounts for the deviations of the Fitts's law for patients after a stroke.
Keywords Stroke; Upper-limb; Fitts law; Motor control
Disclosure of interest The authors have not supplied their declaration of conflict of interest.
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Kinematics in the brain: The additional value of motor performance analysis during fMRI measurements

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Objective To evaluate the additional value of adding movement kinematics into the design matrix in order to gain fine-grained insight in motor control strategies.
Methods Ten healthy volunteers (age 41.8 ± 14.5, 5 males) performed a continuous elbow flexion/extension within a 1.5 MRI system. Movement kinematics were registered with the Zebris, a MRI compatible 3D motion capture system.
Results Without taking the movement kinematics into consideration we found the expected systematic activation of the primary sensorimotor network, thought to generate movement execution [1]. By adding the kinematics to the fMRI design matrix we unmasked the involvement of fronto-cerebellar circuits and of the sensory cortex, as a function of both the irregularity and the frequency of movement, highlighting underlying processes of error-control to ensure optimal execution [2].
Discussion Our results reveal the modular and hierarchical structure of rhythmic motor control within brain networks: rhythmical movement generation relies on the activation of the primary sensorimotor network and error control of that movement results from the trade-off between automatically driven intermittent control involving cerebellar-frontal loops and continuous feedback involving the sensory cortex. Motor planning and error-control are important process involved in recovery post-stroke, and the detailed kinematic analysis during fMRI measurements seems to have an additional value possibly contributing to further understanding motor learning post-stroke.
Keywords Stroke; Kinematics; Upper arm movements; Functional MRI; Rehabilitation
Disclosure of interest The authors have not supplied their declaration of conflict of interest.
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Proposal of tremor quantification method

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Introduction The diagnosis and the follow-up of pathological tremor (rest, essential or cerebellar) are difficult, especially in early stage [1]. This study defines tremor quantification indexes from a spectral analysis of EMG signals.
Methods Bilateral EMG of the wrist flexors/pronators (FlPr) and extensors/supinators (ExSu) were recorded (F_e = 1000 Hz) in one patient (50 y) with a left side tremor clinically observed. Eight conditions were tested during 10 s: at rest without any distraction (1), with cognitive distraction (2), with contralateral motor task (3), posture with the wrist pronated (4), semi-pronated (5), supinated (6), flexed elbows with proned wrist close to the thorax (7), walking (8). The EMG signal envelop is obtained by a band-pass