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language. However, it is still unclear how exactly the brain controls and codes for different hand gestures. Recent studies have found that different gestures are uniquely represented by the voxel patterns in the hand area of M1. Furthermore, it has been shown that hand gestures can be decomposed into kinematic synergies, which are also represented in the hand sensorimotor area. In this study, we tested the hypothesis that hand gestures are more widely represented in the human sensorimotor system, including frontoparietal cortical areas as well as the cerebellum and basal ganglia. 16 healthy right-handed volunteers (8 F, age 22.3 ± 3.0) participated in this study and were scanned with fMRI in a 3T Philips Achieva scanner. Subjects performed 4 runs (each ~ 9 min) of a functional task where 6 different hand gestures were performed with the right hand in a block-design. In total 120 blocks were performed, 20 for each gesture type. Following preprocessing, fMRI data was modeled using GLM with gesture specific regressors resulting in beta-maps for each gesture per run. We performed multivariate support vector machine (SVM) classification to discriminate between gestures using a searchlight procedure. The searchlight analysis was performed at the group level using the beta-images from the first level and used 10-fold cross-validation and a sphere with 10mm radius. We assessed the significance level using permutation testing and set the significance level to $q < 0.01$ (FDR corrected). We found significant searchlight accuracy (ACC) in 42,465 out of 168,225 voxels. The ACC was highest in sensorimotor areas such as left pre- and post-central gyrus (41.7% ACC, chance level 16.7%), right pre- and post-central (34.6%), but also bilateral parietal cortex, SMA, and PMd contained multi-voxel activity patterns that significantly discriminated between the type of gestures (all peak voxels $> 28.1\%$ ACC). Besides the cortical areas, we also found significant classification in sub-cortical nuclei and cerebellum: bilateral putamen (28.9%), caudate (26.8%), pallidum (28.4%), thalamus (29.2%), cerebellum VI (32.3%). For comparison, using all voxels, activated by at least one of the gestures ($T > 4$ for any of the 6 gestures, 14,906 voxels), resulted in 50% ACC. Confirming previous work, the largest discrimination between gestures was expressed by the task-related multi-voxel activity pattern in left sensorimotor area (contralateral to hand movement), but also in premotor cortical regions (SMA, PMd). A novel finding was that the basal ganglia and the motor part of cerebellum showed significant classification accuracy, suggesting that these overlearned gestures also have subcortical neural representations. Acknowledgement: This work is funded by a project grants from the Lundbeck Foundation to Hartwig Siebner (grant-nr R48-A4846, R59-A5399).

2-C-42 Rambling and trembling in the analysis of postural adjustments prior to the self-selected and reaction time tasks

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This study examines feed-forward postural strategies produced prior to self-selected and reaction-time tasks. 12 young healthy male subjects voluntarily participated in this study. They performed five trials of three different postural tasks in a random order. The tasks consisted of 60-sec quiet stance (QS), maximal squat jump (MSJ) from QS under self-selected-time (SS) and reaction-time (RT) conditions. In all trials, the subjects stood on a force platform and visual feedback was provided about the remaining time. In the SS and RT, after 60-sec QS, the subjects performed MSJ either at a self-selected time or whenever they heard a beep sound. The COP trajectories were decomposed into Rambling (RM) and



Trembling (TR) trajectories and fitted ellipse-areas (E-areas) were calculated (Zatsiorsky and Duarte, 1999,2000) for two phases of the trials which correspond to early (Phase1) and late (Phase2) phases of postural adjustments. In both phases, COP, RM and TR E-areas followed the order of $RT > SS > QS$, except TR E-area in RT during Phase 1. With time constraint, the main difference was observed in Phase1 with the lowest TR E-area, whereas both RM and TR E-areas significantly increased in Phase2. During QS, however, all parameters decreased in Phase2 compared to Phase1. On the contrary, they increased in Phase2 in both SS and RT, with higher values in RT. The statistics also indicated a significant effect of task for COP and RM and significant interactions between phase and task for all parameters. The findings may be interpreted within the framework of the reference configuration hypothesis, and the notion of feed-forward postural adjustments which are associated with the observed shifts in COP prior to the initiation of a voluntary movement. During time-constraint, early and anticipatory postural adjustments have been known to alter amplitude and spatiotemporal characteristics of COP, however, the supraspinal and spinal mechanisms of the COP shifts remained uncovered. Since, the two components of COP (RM and TR) are proposed to reflect two mechanisms that the CNS is suggested to use in generation of postural adjustments, we aimed to observe supraspinal and spinal processes through the analyses of the migration of reference point (RM) and the migration around a reference point (TR), respectively. Compatible with the previous observations, when a person try to decrease postural sway, and, when attentional requirement of a task is increased, RM and TR components increased compared to QS. However, regarding the phase dependent changes in the RT, it might be speculated that the subjects were more focused on the visual feedback about the remaining time and switched their attention to the initiation of the planned movement in the Phase2. This idea is compatible with a larger increase in the TR component in the Phase2 which could be influenced by increased and covaried activation of muscles upon anticipation of approaching stimulus to initiate the planned action.

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2-C-43 Development of maneuverability via coordinated use of an acquired effector

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How do developing animals learn to effectively control their bodies to navigate their environments? Flexible control of goal-directed movement, or maneuverability, emerges and improves during development. Maneuverability develops due to many interrelated features of growth, including changes to the identity and control of effectors used for movement, as well as coordination among them. Understanding how specific features of motor control interact throughout development to influence maneuverability remains a challenge. Here we define how maneuverability develops using a simple model, the control of vertical swim trajectory by zebrafish. The larvae of zebrafish are of great utility for understanding neural control of movement, given their simple body plan, optical accessibility, genetic tractability, and rapid, external development. As larvae, zebrafish are negatively buoyant and must swim upwards to stay off the bottom. We found that young larvae do so by simply orienting their trunks towards the surface and propelling forwards. Accordingly, they rotated their entire bodies to counteract exaggerated sinking or rising under manipulated buoyancy. As they developed, larvae acquired a second