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Visuomotor transformations impairment during manual tracking in a simulated microgravity condition

In contrast to performance in cognitive tasks, tracking performance tends to deteriorate fairly consistently during spaceflight. Whereas it is clear that microgravity has several mechanical, visual, and proprioceptive effects which may impair the motor control, it is in no way settled whether the impairment of tracking performance is indeed specifically microgravity-related, due to the variety of stressors which characterize manned spaceflight and may be involved. A better understanding of the tracking task in microgravity is fundamental to develop superior control strategies for robot-human interaction in microgravity and improve human adaption protocols to such environment. We designed an experiment where a microgravity condition is applied to the upper limb of the subject who is asked to follow a moving object with such limb. Different kinematics laws and geometries are used for the moving object. The goal of this experiment is to characterise the microgravity impairment on motor control and verify whether or not it is caused by a mis-calibration of muscular forces resulting from the underestimation of masses due to weightlessness. The effect of this underestimation should be a certain 'sluggishness' of the pursuit in following the moving target, however, corrective processes may hide this under-specification of forces. A multi-directional oscillator model has been used to measure the tracking performance of the subject and investigate the presence of possible cross-effect compensation between directions.

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