

Analysis of upper limb movements of astronauts performing motor imagery tasks on the ISS and on ground

The poster presents the research work conducted during the first six months of the PhD: after a preliminary study of the available literature regarding motor coordination, mental imagery of motor tasks and sensori-motor issues related to altered gravity conditions, an analysis was conducted on previously collected motor coordination data, available at the laboratory of Fondazione Santa Lucia IRCSS.

The data consists of the 3D positions of eight retro-reflective markers applied to astronauts engaging in a motor task involving throwing and catching an imagined tennis ball, under varying gravity conditions (on ground and on-board the ISS). The data was investigated in order to extrapolate a method of analysis that could account for possible missing information and lead to the evaluation of all the parameters of interest. The following is a report about what has been analyzed so far.

Firstly, the duration between the throw and catch of the imagined ball is notably longer when envisioning zero gravity conditions compared to normal terrestrial gravitational conditions. This behavior persists in all the tested conditions, indicating that subjects maintain internal models of object motion dependent on the gravitational imagined condition, even when experiencing actual microgravity. Furthermore, the analysis reveals a consistent trend in peak and minimum velocities: both values are lower in real microgravity scenarios, irrespective of the imagined gravity condition. Investigations into the elevation angles of the limb segments during execution of the motor task offer insights into motor coordination. Despite environmental changes, these angles show characteristics that remain consistent, indicating stable motor strategies across varying conditions.

These findings offer valuable insights into motor control in space and on Earth, leaving space for further research, for a statistical analysis on larger data samples and for future experimental protocols to be performed in the next years of the PhD.

Primary author: FINAZZI AGRÒ, Anna (University of Rome Tor Vergata)