Contribution ID: **936** Type: **Poster**

Effector-Independent Sources of Variability in Upper and Lower Limb Gestures

Saturday, September 13, 2025 2:10 PM (20 minutes)

In recent years, motor variability has been recognized as a promising factor in studying behavioral gestures. Previous studies have explored this construct separately for each motor district, implicitly assuming that most of the variability is effector-dependent. Here, we tried to challenge this implicit assumption by proposing a study design that involves a combined within-subject investigation of upper and lower limbs gestures.
16 healthy participants performed both upper (i.e., pointing and vertical arm extensions) and lower limb tasks (i.e., self-paced walking), while kinematic data were recorded using optoelectronic cameras. We focused on i) shoulder elevation and on the elbow/wrist angular velocities for the upper limb, and on ii) hip/knee/ankle angular velocities for the lower limb. Grounded on a recently developed method from our group (Manuello et al., 2025), we used Procrustes transformation for assessing motor distance, and multidimensional scaling for analysing variability patterns, ultimately describing each individual's space of motor variability (SoV) as the area covered by ellipses in a two-dimensional space. Results showed a significant within-subject correlation between upper and lower limb SoV ($r = 0.6$, $p = 0.02$). Noteworthy, SoV can be considered a reliable proxy for individual motor fingerprint.
These findings support the idea that at least a certain portion of variability depends on an effector-independent (i.e., "central") source, thereby challenging the hypothesis that motor variability can be fully understood through an effector-dependent approach. To say differently, motor variability is less "motor"than normally hypothesized, and we probably need a multi-layered model of variability (Casartelli et al., 2023).

If you're submitting a symposium talk, what's the symposium title?

If you're submitting a symposium, or a talk that is part of a symposium, is this a junior symposium?

Primary author: ARNAUDO, Alessandro (Dipartimento di Psicologia, Università di Torino)

Co-authors: MANUELLO, Jordi (Università degli Studi di Torino); Dr GUZZARDI, Giacomo (Theoretical and Cognitive Neuroscience Unit, Scientific Institute IRCCS E. Medea, Bosisio Parini (LC), Italy); CICERI, Tommaso (NeuroImaging Lab - Scientific Institute IRCCS E. Medea - Bosisio Parini (LC), Italy); Dr BIFFI, Emilia (Bioengineering Lab, Scientific Institute IRCCS E. Medea, Bosisio Parini (LC), Italy); CAVALLO, Andrea (Move'N'Brains Lab, Department of Psychology, University of Turin, Turin, Italy); CASARTELLI, Luca (Scientific Institute IRCCS MEDEA - University of Milan)

Presenter: ARNAUDO, Alessandro (Dipartimento di Psicologia, Università di Torino)

Session Classification: Lunch and poster 3

Track Classification: Action and movement