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CENTRE FOR RESEARCH IN MECHATRONICS

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HUMAN MOTOR PERFORMANCE: EXPLOITING STABILITY, CHANNELING VARIABILITY, AND OPTIMIZING SAFETY MARGINS

Rehabilitation and augmentation of human movement using technology has made significant strides in recent years. While technology is being developed, it remains an open question what determines the desired “skilled” movement. Research in my lab aims to reveal the fundamental principles that underlie motor skill and learning in the healthy nervous system – as a necessary basis to understand neurological dysfunction and to develop intervention. Research of my lab has examined three interactive model skills: the discrete task of throwing a projectile to hit a target, the rhythmic task of bouncing a ball, and the continuous task of carrying a cup filled with coffee. Characteristic for our approach is to start with a mechanical model of the task and render it in a virtual environment. As such, the human interacts with a known task environment. Based on stability analyses of a dynamical model of the task, we study how the neuro-mechanical system develops robust solutions to meet the task demands. Using the three skills as model examples, we show that developing motor skill means 1) exploiting solutions with dynamical stability, 2) finding the most error-tolerant strategy and channeling sensorimotor noise into task-irrelevant dimensions, and 3) optimizing safety margins and taking advantage of small perturbations. Based on these insights into healthy function, new intervention techniques can be developed that facilitate learning and relearning of motor tasks.

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