

Invitation à la soutenance publique de thèse

pour l'obtention du doctorat en Sciences de l'Ingénieur

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Ingénieur civil en mathématiques appliquées

The gravitational forces as fundamental input for sensorimotor coordination

To achieve any movement, the brain must continuously decode sensory information, estimate the state of the body and send motor commands generating muscular forces and joint torques in order to bring the movements to the intended goal. Various sensory modalities are influenced by the action of gravity on the body. Notably, proprioception informs the Central Nervous System (CNS) about the forces acting on the body, of which the gravitational forces. Therefore, the gravity plays a fundamental role in sensory perception and in the processes underlying the control of movement. Indeed, muscular forces and joint torques must adequately compensate for the effect of gravity on the body and on the objects that we manipulate.

The objective of the present work is to understand this role by using experimental and modeling approach. A series of experiments involving simple motor tasks were conducted with human subjects during exposure to hypergravity and microgravity induced by parabolic flights. The adaptation to hypergravity condition suggests that the CNS takes advantage and exploits the gravitational forces in order to drive the movements. To the contrary, the microgravity condition appears as a singular condition, in which the external guidance provided by the gravitational forces is lost. In this condition, a mechanism is proposed to explain how the CNS achieves stable movement performance despite an inaccurate internal representation of dynamics.

This thesis supports the fact that the action of gravity on the body is essential on a single movement basis and that muscular forces are adjusted based on an internal knowledge of the environment dynamics. In addition, our ability to perform movement in absence of gravity shows to which extent the strategies developed by the brain for sensorimotor coordination are unbeatable.

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Monsieur F. DELANNAY, Doyen sera le président de la cérémonie.

Mercredi 17 mars 2010 à 16h30

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