Internal Models of Embodied Dynamics: A Computational Theory of Learning in Routine Interactive Behavior

by

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ABSTRACT

How are human cognitive, perceptual, and motor processes organized and coordinated towards the efficient achievement of goals in routine interactive behavior? Despite the simplicity of the question, its answer is at present poorly understood. The goal of this thesis is to provide a unifying explanation for the intelligence and behavioral richness inherent to routine human activity. This explanation centers on the capacity to acquire and exploit internal models of embodied dynamics. Embodied dynamics are the recurring interactions between cognitive, perceptual, and motor processes with external tasks and environments. Internal models are formal constructs that have largely been studied in low-level sensorimotor control. The emphasis of this research is on how these two elements can be combined to generate novel and surprising predictions regarding the capacities of human performance. This thesis demonstrates, through the convergence of three empirical studies, mathematical optimality analysis, and computational cognitive modeling, the human capacity to acquire and exploit such internal predictive models.