Self-organized critical control in human behavior

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Abstract
When humans perform closed loop control tasks like in upright standing or while balancing a stick, their behavior exhibits non-Gaussian fluctuations with long-tailed distributions. We investigated if they might be caused by self-organized critical noise amplification which emerges in control systems when an unstable dynamics becomes stabilized by an adaptive controller that has finite memory. We generalized the basic model of self-organized critical control and compared it with experimental data from human control behavior. Our results suggest, that the nervous system involved in closed loop motor control nearly optimally estimates system parameters on-line from very short epochs of past observations. We discuss possible microscopic implementations of this principle in neuronal networks and multi-agent models which reveal its potential for explaining power law behavior in other physical systems.