How criticality of visuo-motor control behavior depends on task objective.

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Abstract

Human closed-loop control behavior is characterized by spatio-temporal scaling, suggesting operation close to a critical point [1,2]. Control errors in (virtual) stick balancing tasks are power-law distributed. A possible explanation is continuous adaptation to local random trends [1]. This theory suggests fast adaptation optimizing for minimal mean errors. We tested this Hypothesis.

1-D Balancing with Highscore

Subjects controlled an on-screen cursor C using a low-friction slider. The computer moved a target T such that the system was linearly unstable. After each trial, a highscore was displayed. Subjects were assigned to one of two groups with different objectives [2].

Distributions on Day 4, Model Comparison

Subjects either had to minimize the mean (red) or the kurtosis (blue) of controller-target distances Y = T - C.

How criticality of visuo-motor control behavior

• Power-law control errors remain after training while minimizing mean errors.
• Pdf-exponents should increase to approximating while minimizing mean errors.

References