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Authors

Faro, Simone

Pavone, Arianna

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Phase and Monitoring in Subjective Time Perception

Simone Faro (simone.faro@unict.it)¹ & Arianna Pavone²

¹Department of Mathematics and Computer Science, University of Catania

²Department of Mathematics and Computer Science, University of Palermo

Abstract

Human experience of time often diverges from physical clock time, showing distortions such as compression during flow, dilation with novelty, and expansion in dreaming and altered states. Existing models of time perception, mainly based on internal clocks or inferential processes, struggle to explain these dynamic, state-dependent effects within a unified framework. We propose a quantum-inspired model of subjective time in which experienced duration emerges from the interaction between latent phase-like dynamics of cognitive states and intermittent, measurement-like acts of metacognitive monitoring. Rather than relying on a dedicated timing mechanism, the model treats time perception as an interference-sensitive process shaped by the frequency of internal sampling. A minimal formalization distinguishes physical and subjective time, showing how variations in monitoring rate and phase variability produce compression, dilation, and expansion as regimes of a single mechanism. A simple computational prototype based on stochastic phase tracking illustrates these phenomena.