USC Viterbi School of Engineering
Ming Hsieh Department of Electrical and Computer Engineering

Seminar

Criticality supports thalamocortical information processing during conscious states

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Abstract: Mounting evidence suggests that during conscious states, neural electrodynamics are poised near a critical point or phase transition, and that this near-critical behavior supports the vast flow of information through thalamocortical networks during waking states. We identify a mathematically specific critical point near which waking neural electrodynamics operate, which is known as the edge-of-chaos critical point, or the boundary between stability and chaos. Our evidence suggests that both the information-richness of cortical activity and the transfer of information between the cortex and thalamus is disrupted during diverse states of unconsciousness because of a transition of low-frequency thalamocortical electric oscillations away from this critical point. Conversely, we show that psychedelics may increase the information-richness of cortical activity and enhance communication between the thalamus and cortex by tuning low-frequency thalamocortical electrodynamics closer to this critical point.

Bio: Daniel Toker, PhD is a post-doctoral fellow in UCLA's Departments of Psychology and Neurology. He uses human and animal electrophysiology, mathematical modeling, and human brain organoids to study mechanisms underlying the loss and recovery of consciousness from anesthesia, generalized seizures, and coma.

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