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Topic: Complex Networks Preference: Oral

Memory Associativity in a Model for Conscious and Unconscious Mental Processes

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We have modeled conscious and unconscious mental processes in neurosis, by neural network mechanisms, whereby neurotic behavior is described as an associative memory process. Modules corresponding to sensorial and symbolic memories interact, representing unconscious and conscious mental functioning. We proposed an algorithm, based on known microscopic neuronal mechanisms that control synaptic plasticity, which self-organizes the complex memory network to a hierarchical, clustered structure. Memory access was first modeled by a Boltzmann machine (BM).

The power-law behavior for the node degree distributions of the topologies of the networks generated by our algorithm suggests that memory dynamics and associativity may not be well described by Boltzmann-Gibbs (BG) statistical mechanics. We thus modeled memory access dynamics by a generalization of the BM called Generalized Simulated Annealing (GSA), derived from the nonextensive formalism. We will show some properties of these memory retrieval mechanisms, with simulation experiments that measure associativity capabilities in our networks.

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