Title:
ON CRITICAL STATE TRANSITIONS BETWEEN DIFFERENT LEVELS IN NEURAL SYSTEMS

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Keywords:
Critical state transitions, State space, Neural systems, Statistical mechanics, Complex systems, Consciousness, Emergence

Abstract:
The framework of "Modern Theory of Critical State Transitions"\(^1,2\) considers the relation between different levels of organization in complex systems in terms of critical state transitions. A state transition between levels entails changes of scale of observables and, concurrently, new formats of description at reduced dimensionality. It is suggested that this principle can be applied to the hierarchic structure of the nervous system, whereby the relations between different levels of its
functional organization can be viewed as successions of state transitions: upon state transition, the 'lower' level presents to the 'higher' level an abstraction of itself, at reduced dimensionality and at a coarser scale. The re-scaling in the state transitions is associated with new objects of description, displays new properties and obeys new laws, commensurate to the new scale. To illustrate this process, some aspects of the neural events thought to be associated with cognition and consciousness are discussed. However, the intent is also more general in that state transitions between all levels of organization are proposed as the mechanisms by which successively higher levels of organization "emerge" from lower levels.

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