Physics perspective on the nature of avalanches in social systems

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The human cooperative behavior in online social systems often results in the emergence of social value, which is related to robust scaling properties observable in the extensive empirical data [1,2]. Hence, these data provide a unique opportunity to study the origin of self-organized criticality via social interactions. In analogy to physics systems in the laboratory, the ideas of the theory of collective phenomena and methods of Statistical Physics have been applied to quantitative analysis of social dynamics [3]. Contrary to the study of physical systems, the complexity arising from human participants in the process and the role of the exchanged (cognitive, emotional) contents remain elusive to the accurate theoretical modeling. Therefore, the numerical analysis and comparisons to better-understood models of the cooperative phenomena in the physical world are of great importance. Here, we present some results of avalanching dynamics in the knowledge-creation processes via Q&A, in which the cooperative social endeavor is apparent [4]. We analyze the empirical data, and simulate interactions among knowledgeable agents, modeled close to the empirical evidence. The emphasis is on the occurrence of avalanches of the agents' activity, sequences of these avalanches and their fractal properties. Furthermore, we explore the impact of the underlying stochastic processes and the role of the bipartite network connecting the agents and their artifacts, which co-evolves with the agent's interaction. The results are systematically compared with those in “standard” model of field-driven disordered ferromagnets on regular lattices [5,6].

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