Predicting the Time and Place of Critical Transitions in Socio-Cognitive Systems

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Abstract

Collective behavior can change rapidly. Individuals can align their behavior suddenly, opting to cooperate or coordinate, such as in revolutions or riots. Can we predict when and where such collective shifts are about to occur? In many physical and biological systems, critical transitions from one regime to another are preceded by a variety of "early warning signals," including increased relaxation time, variance, and autocorrelation. We investigate whether these early warning signals also prefigure sudden shifts in large-scale socio-cognitive systems. Using agent-based models, we demonstrate the existence of early warning signals of both the onset (when) and origin (where) of critical transitions in social interaction. These results were robust across social networks that varied in size and structure (i.e., random vs. small-world networks). We speculate that these signals may occur for many collective social-cognitive phenomena, including transitions in teamwork, norms, and communication systems.

In D. Barner, N.R. Bramley, A. Ruggeri and C.M. Walker (Eds.), *Proceedings of the 47th Annual Conference of the Cognitive Science Society*