When diffusion depends on chronology

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The Internet, motorways and other transport systems, and many social and biological systems are composed of nodes connected by edges. They can therefore be represented as networks. Scientists studying diffusion over such networks over time have now identified the temporal characteristics that affect their diffusion pathways. In a paper about to be published in *European Physical Journal B*, Renaud Lambiotte and Lionel Tabourier from the University of Namur, Belgium, together with Jean-Charles Delvenne from the Catholic University of Louvain, Belgium, show that one key factor that can dramatically change a diffusion process is the order in which events take place in complex networks.

Since it is now possible to gather data on the timings at which edges of a complex network are activated or not, network dynamics can now be studied more precisely. Empirical evidence in a variety of social and biological systems has shown that the time intervals between the activation of edges are such that it occurs in bursts. As a result, there are broad distributions for the times between these activation events.

So far, a majority of works have relied on computer simulations. However, a purely computational approach is unable to provide a general picture of the problem and to identify important structural and temporal properties. Instead, the authors developed an analytical model to better understand the properties of time-dependent networks that either accelerate or slow down diffusion.

Their analytical study focused on different classes of popular models for diffusion, namely random walks—which is a mathematical description of a path that consists of a succession of random steps— and epidemic spread models, and found the way in which the temporal ordering of events matters. They expect these results to help in building more appropriate metrics to understand real-world complex network data.

More information: R. Lambiotte, and L. Tabourier and J.C. Delvenne (2013), Burstiness and spreading on temporal networks. *European Physical Journal B*, DOI 10.1140/epjb/e2013-40456-9

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