NONEQUILIBRIUM PHASE TRANSITION DUE TO COMMUNITIES ISOLATION IN GO GAME LIKE DYNAMICS

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We investigate numerically and analytically evolution of a growing system where in the course of time new individuals are randomly placed at empty sites of a regular or random network. Individuals can belong to different communities or species and they compete as follows. If there occurs a cluster (domain) of the same individuals surrounded by members of another community then the surrounded cluster is considered as isolated and it does not influence the neighborhood similarly as in the Go game. The model corresponds to the phenomenon of defeats suffered by social groups living in isolation. At the beginning when the density of filled sites is low no isolated clusters are observed. At critical time t_c a nonequilibrium phase transition takes place and the first isolated cluster occurs. For one-dimensional systems the number of the isolated individuals Z increases with time as $Z \sim t^3$. For large number m of possible communities the critical density of filled space equals to $\rho_c = (m/N)^{1/3}$. A similar transition is observed for Erdös-Renyi random graphs and Barabasi-Albert scale-free networks.

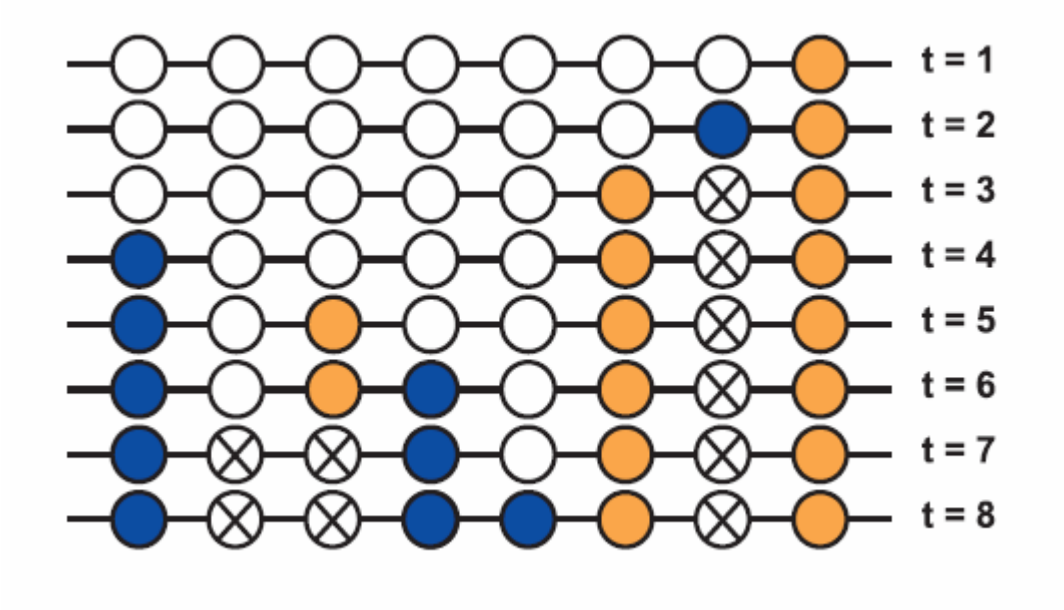

FIG. 1: An example of evolution in the chain consisting of 8 nodes. Open circles are empty sites, black and gray circles correspond to different communities. Isolated nodes are marked with a cross.

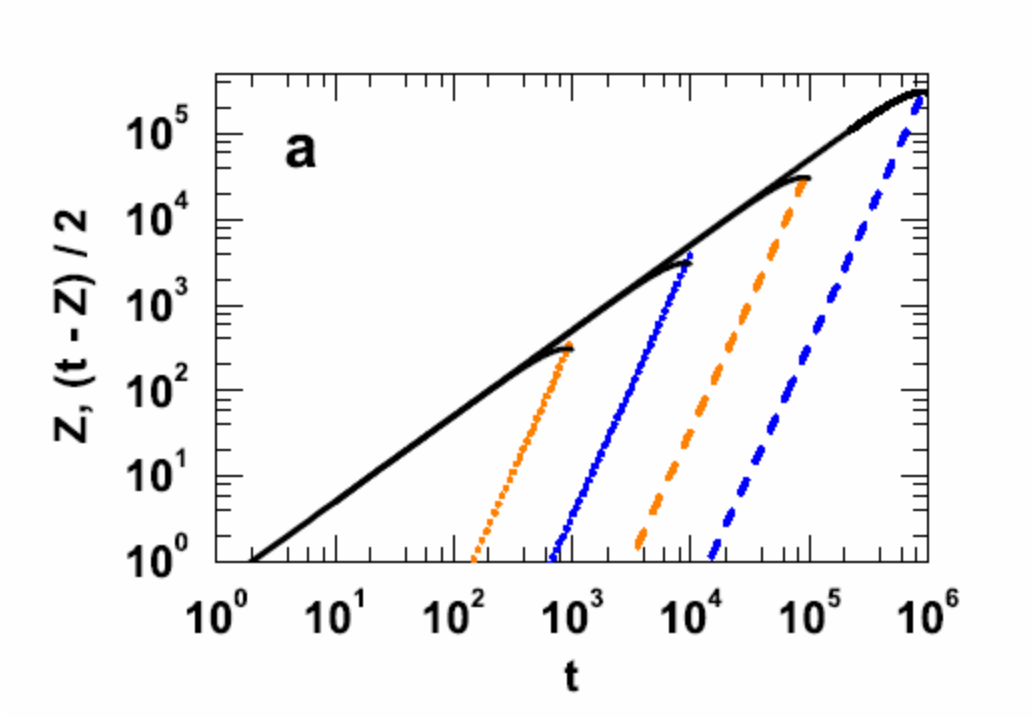

FIG. 2: Number of isolated nodes (Z, dotted and dashed lines) and not isolated nodes of each specie ((t- Z)/2, solid lines) versus the time of the simulation t for different chain sizes N (gray dotted - 10^3, black dotted - 10^4, gray dashed - 10^5 and black dashed 10^6).

Keywords
Social phenomena, phase transition, communities isolation

References

[1] J. Sienkiewicz, J.A. Hołyst, arXiv:0807.1984