Supplementary Information

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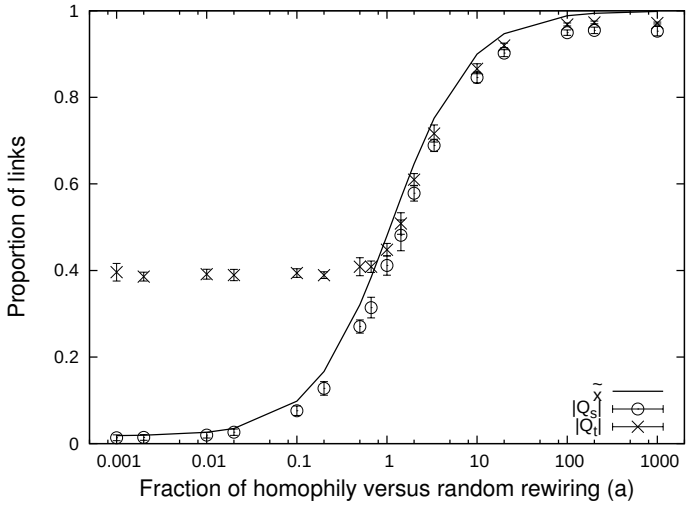

Figure S1: The relative frequency of homophilous rewiring to random rewiring, when state processes also happen ($b = 0.01$ and $c = 50$). The difference between the mathematical prediction $\tilde{x}$ of edges connecting nodes of the same state (line) and the modularities found in simulations based on node state (Q_s, circles) and topological analysis (Q_t, crosses) arises because in the mathematical analysis we do not account for within-state links created by random rewiring of the network (ϵ). Other parameters, $n = 1000$ and $m = 3000$.

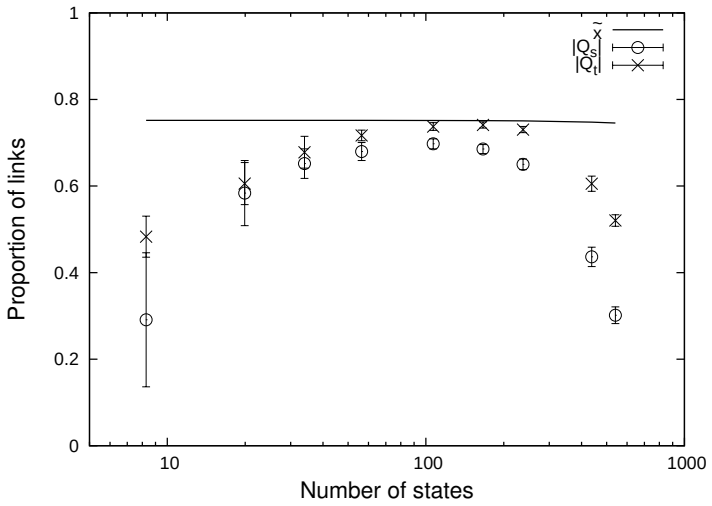

Figure S2: Changes to the relative frequency of innovation to state spread (increasing b), also changes the number of states existing contemporaneously. Shown is the mathematical prediction for the fraction $\tilde{x}$ of edges connecting nodes of the same state (line), as well as modularity found by simulations based on node state (Q_{s}, circles) or topological analysis (Q_{t}, crosses). When b is too large or too small (at the left and right of the graph), the network becomes to a random-like network at any given time. Other parameters, $n = 1000$, $m = 3000$, $a = 3.33$, $c = 50$, and b ranges from 0.001 on the left to 1 on the right of the figure.

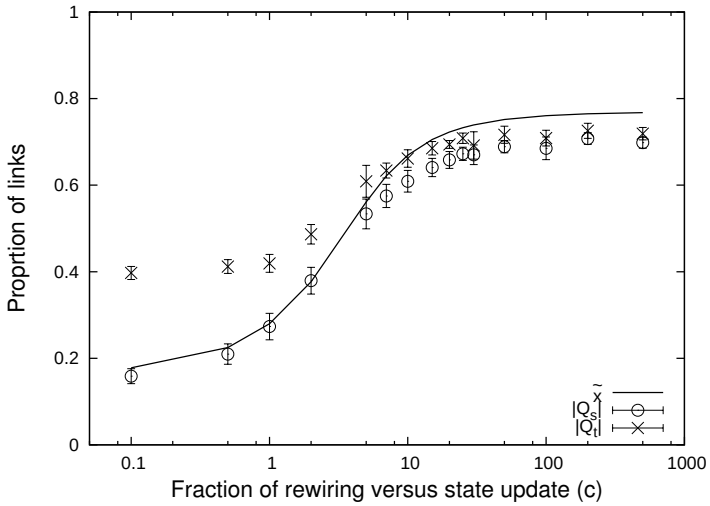

Figure S3: When varying the relative frequency of rewiring to state update, the mathematical prediction for the fraction $\tilde{x}$ of edges connecting nodes of the same state (line) is largely similar to the modularity found by simulations based on node state (Q_{s}, circles) or topological analysis (Q_{t}, crosses). When state spread is less frequent ($c > 1$), the difference between the mathematical prediction and the modularities found in simulations arises because in the mathematical analysis we do not account for within-state links created by random rewiring of the network (ϵ). When state spread is more frequent ($c < 1$) the network becomes a random-like network at any time, and the topological algorithm will find a partition with greater modularity than the state partition. Other parameters, $n = 1000$, $m = 3000$, $a = 3.33$ and $b = 0.01$.