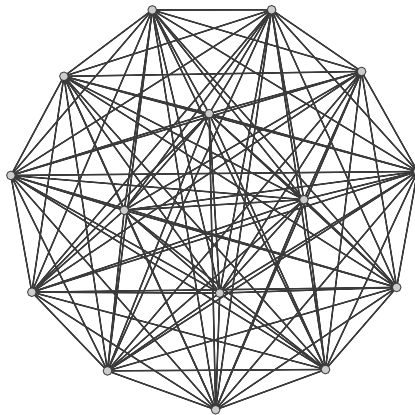


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Numerical Simulations

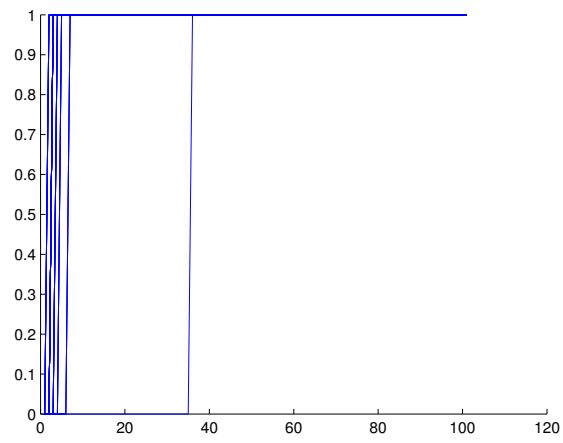
We now show how risk perception is expected to evolve over time through various numerical simulations. We utilize three types of social networks in order to simulate these evolutions - a *fully-connected* social network comprised of 15 agents (Figure 1), a 3 million node SMS network obtained from a Chinese city where agents are weakly and sparsely connected to each other (Figure 3), and a tightly-linked network of Jazz musicians (Figure 5).

Figure 1: The Fully-Connected Network



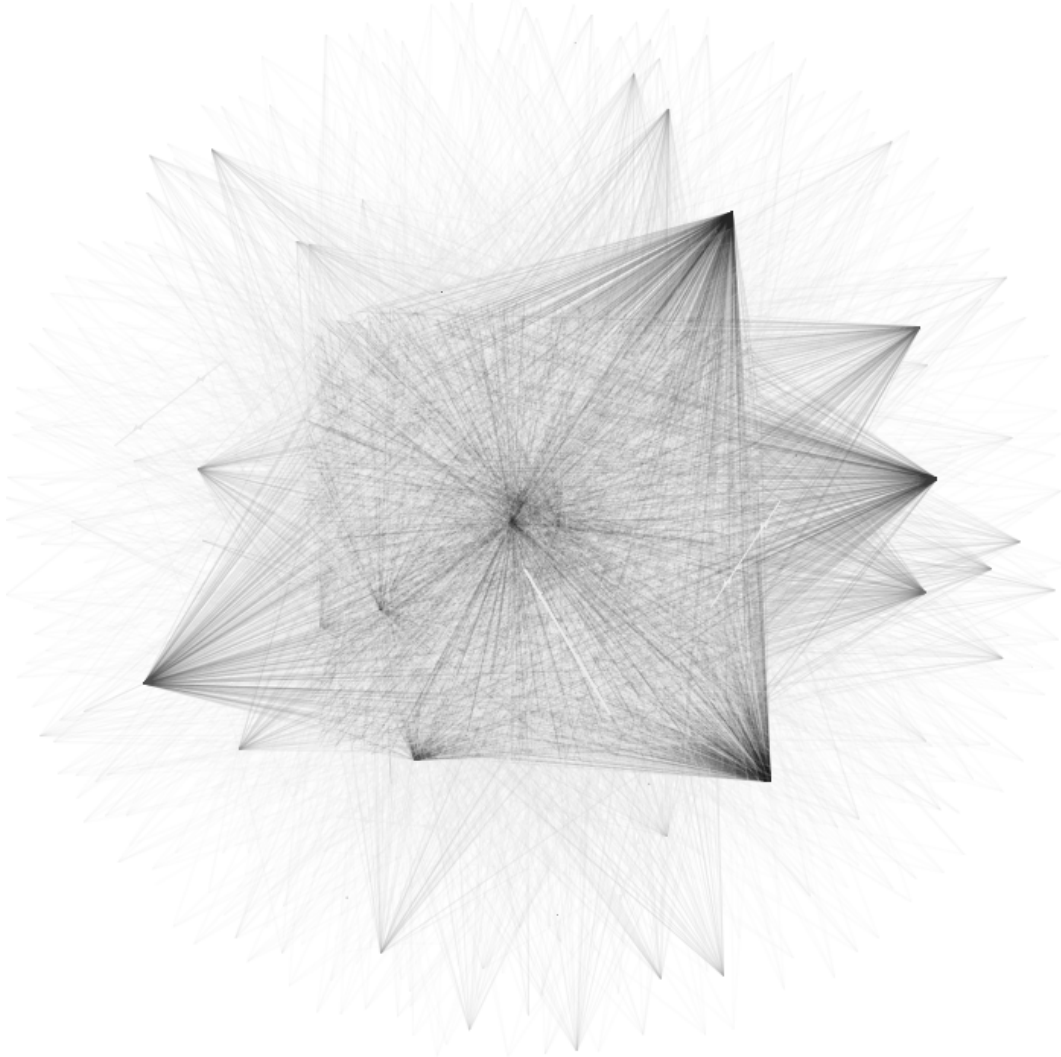
Number of nodes, $N = 15$

Figure 2: Simulation Results for Fully-Connected



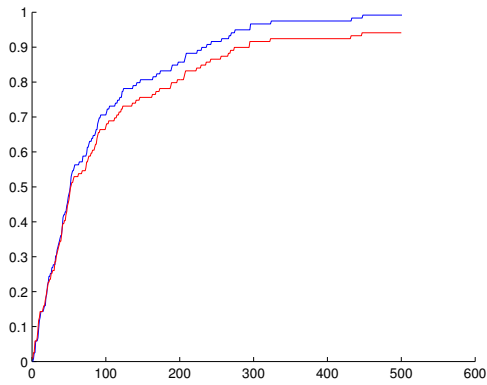
Time periods, $t = 100$; Repetitions = 50; Number of nodes, $N = 15$; $q = 0.01$; $p = 1$

Figure 3: The SMS Network

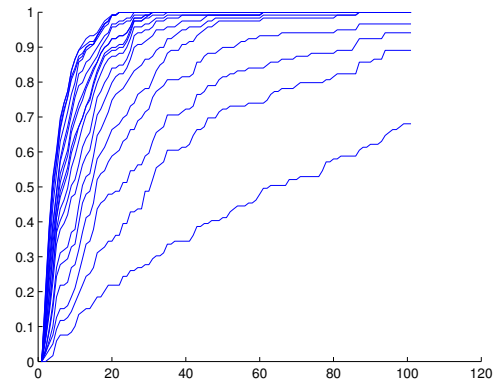


This network structure was constructed based on real data obtained from a communication network (SMS messages) in a Chinese city. This network is comprised of 3 million nodes, and the data was collected for one month. The graph is generated by Gephi (Bastian et al., 2009).

Figure 4: Simulation Results for SMS



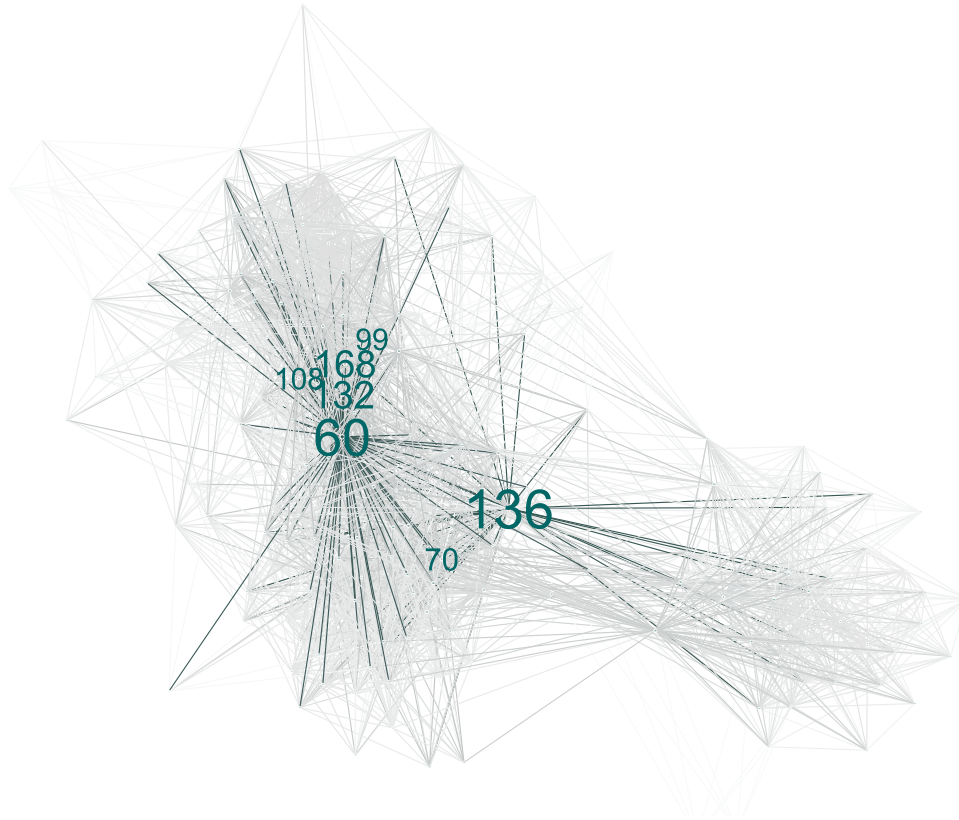
Time periods, $t = 500$; Repetitions = 1
Number of nodes, $N = 119$ (network core)
 $q = 0.01$; $p = 1$



Time periods, $t = 100$; Repetitions = 20
Number of nodes, $N = 119$ (network core)
 $q = 0.01$; $p = 1$

Red: proportion of nodes that are being infected
Blue: average risk perception in the network

Figure 5: The Jazz Musicians' Network

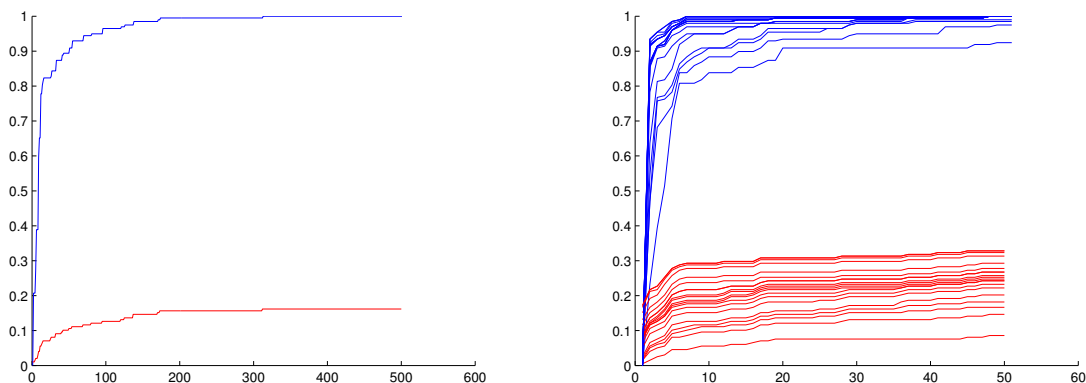


Number of nodes, $N = 198$. The indicated values represent key musicians.

Data source: Gleiser and Danon (2003).

The graph is generated by Gephi (Bastian et al., 2009).

Figure 6: Simulation Results for Musicians



Time periods, $t = 500$; Repetitions = 1
 Number of nodes, $N = 198$

Time periods, $t = 50$; Repetitions = 20
 Number of nodes, $N = 198$

Red: proportion of nodes that are being infected

Blue: average risk perception in the network

Given the simulation results above, we observe that in Figure 2, information is transmitted perfectly throughout due to the fully-connected nature of the network; thus, when an agent becomes infected with HIV, the whole network's risk perception immediately escalates to the upper bound of 1. On the other hand, when the network is sparsely connected, agents' risk perceptions evolve at a slower rate, eventually converging to 1 over time, as shown in Figure 4. In this case, we may also expect that the number of individuals who will subsequently contract HIV would be higher than in the fully connected model, since all agents do not internalize an infection in the network at once. Finally, we see that in the tightly-linked network of Jazz musicians, the convergence results lie in between those obtained from the sparsely connected SMS network and the fully-connected network, as depicted in Figure 6; as in the previous simulations, the overall level of perception ultimately converges to 1 at a faster rate than the SMS network, though not as expeditiously as the fully connected result. By the same token, we may expect there to be a relatively intermediate level of infected agents when overall network perception has entirely converged to the upper bound.

References

Bastian, M., S. Heymann, and M. Jacomy, "Gephi: An Open Source Software for Exploring and Manipulating Networks," 2009.

Gleiser, P. and L. Danon, *Advanced Complex Systems*, Vol. 6 2003.