

Network Science Online:

Theories and Experiments

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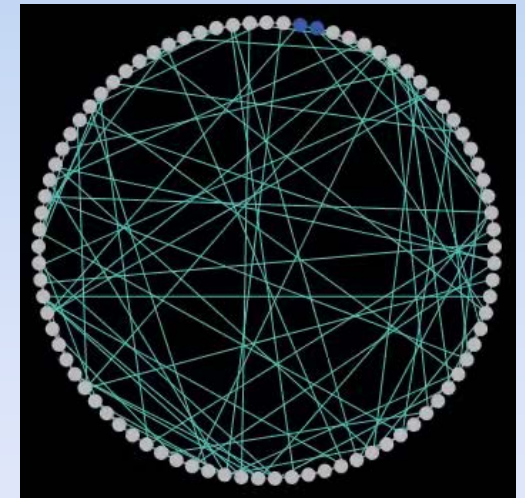
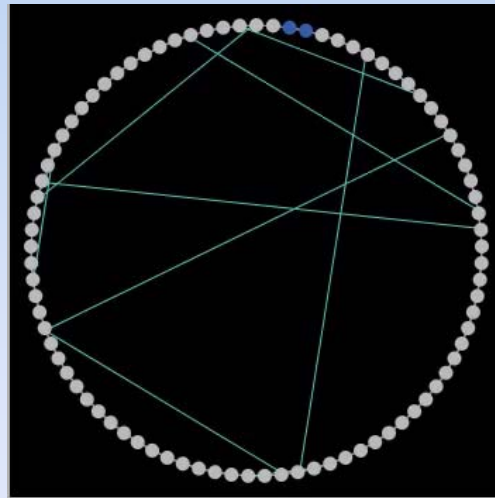
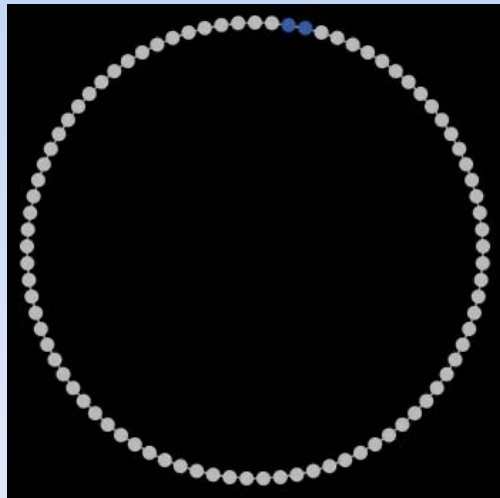


How Do Contagions Spread?

Large World



Small World



Social Reinforcement

Simple Contagions:

Single Contact is Sufficient

Complex Contagions:

Multiple Contacts are Required

Collective Behaviors

Many collective behaviors require social reinforcement

- Uncertainty or Risk: Adoption of new technologies, participation in risky behaviors, vaccinations
- Normative Validation: Appeal of *avant-garde* fashion, social norms, screenings, dieting, weight gain
- Strategic Interdependence: mobilizing strikes, recruitment to social movements, complementary technologies

Complex Contagions

If multiple social contacts needed for adoption:

- Weak ties may slow down diffusion
- Spatial networks may be better for diffusion than small worlds

Centola and Macy 2007 *American Journal of Sociology*

Centola et al. 2007 *Physica A*

Centola 2008 *Journal of Mathematical Sociology*

Empirical Question

How do we empirically evaluate the effects of network structure on behavior spreading?

Problems with Extant Methods

Studying human social dynamics

- Large group dynamics qualitatively different from small groups
- Real-time dynamics of influence and behavior change
- Controlling for leadership, unobserved heterogeneity, homophily, network effects, etc.
- Reproducibility, replication under identical conditions

Internet Experiments

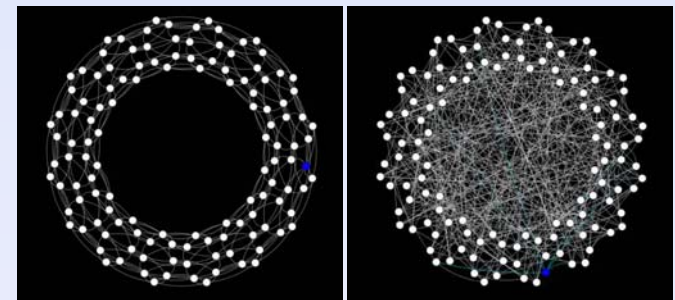
Web-based social dynamics

- Use on-line communities to create a “social petri dish” in which we can observe behavior under different structural conditions
- Embed thousands of subjects in virtual “communities”
- Provides a “virtual but natural environment” for studying the dynamics of real behaviors

1. Topology and Diffusion

Spread of behavior in online social networks Centola (Science, 2010)

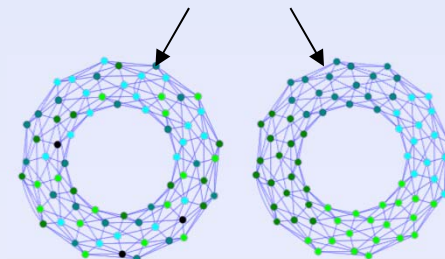
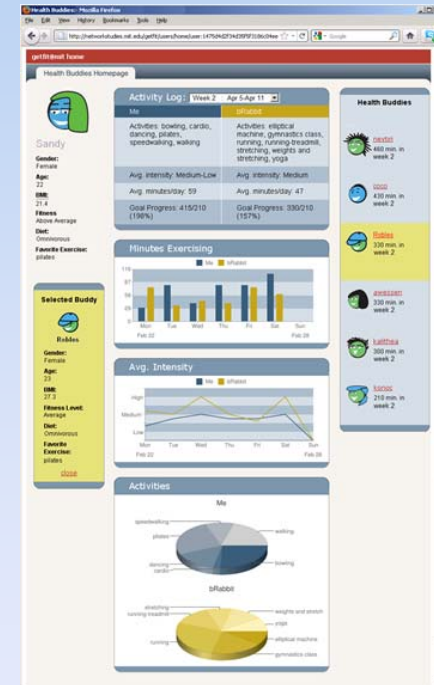
- Network structure can affect both the speed and the success of diffusion processes (Watts 1999, Centola et al. 2007)
- **Simple** contagions and **complex** contagions spread differently (Centola and Macy 2007)
- Significantly greater spread of behavior in the clustered networks than the random networks
- Behavior spread as a “complex contagion,” dependent upon social reinforcement



2. Homophily and Diffusion

Health behavior in an online fitness community Centola (Science, 2011)

- Networks can be potential sources of health influence (Pampel et al. 2010, Smith and Christakis 2010)
- Difficult to identify when networks matter, and what features of social relationships make a difference
- Significantly greater success in the homophilous networks than integrated networks
- Behavior more likely to be adopted by obese members in homophilous networks



3. Origins of Social Order

The 'evolution' of conventions

- Expectations for how others will act determine our behaviors, our emotions, and our beliefs. (Bicchieri 2006, Elster 1989)
- Linguistic conventions
- Economic conventions
- Social conventions
- Industry conventions

From Model to Experiment

The Name Game

- Participants enter into an online environment with hundreds of other anonymous people
- Given an “object” (a face), which they attempt to name
- Interact with others in the community one at a time, trying to coordinate on the same name
- Social norms emerge through the local interaction of actors embedded in social networks

Open Question

What is the scope of problems we can study with this approach?