Models of Social Dynamics
An Introductory Module

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Unit 2:
Contagion
Things spread from one person to another.

Diseases, information, behavior, technology.

What is the time course of contagion?
A two-state model

Susceptible → Infected
Spontaneous adoption

- All agents have the same information about the product or behavior
- Each unit of time, all agents adopt with a fixed probability
a model of spontaneous adoption

**CODE:** contagion_spontaneous.nlogo
spontaneous adoption yields an r-shaped adoption curve
Rogers’ Theory

- Innovators: 2.5%
- Early Adopters: 13.5%
- Early Majority: 34%
- Late Majority: 34%
- Laggards: 16%
Social influence

• Adoption is like a contagion. More exposures makes one more likely to adopt.

• Each unit of time, every time an agent comes into contact with someone who has adopted, they increase their change of adopting.
Transmissibility

- $\tau =$ the probability of a contact leading to adoption

- What if we contact several individuals at once?

- $n =$ number of neighbors who have adopted

$\Pr(\text{adopt}) = 1 - (1 - \tau)^n$
a model of social influence

**CODE:** contagion_SI.nlogo
The social influence model fits the data better than the spontaneous adoption model.
Recovery: The SIS model

- All agents adopt via social influence, based on the transmissibility, $\tau$

- Agents who have adopted dis-adopt with probability $\gamma$
a model of social influence with recovery

**CODE:** contagion_SIS.nlogo
Further directions
Transmission biases

Social learning strategies

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In most studies of social learning in animals, no attempt has been made to examine the nature of the strategy adopted by animals when they copy others. Research in exploring the psychological processes that underlie social recording purported social learning in the field, but the context is unexplored. Yet, theoretical models used to investigate the contribution of the social environment to the conclusion that social learning cannot be indiscriminately copied under the circumstances under which they copy or the majority, and copying of both the animal and human social learning strategies may be organized hierarchically, their benefits and asocially learned strategies prove ineffective but before

Trends in Cognitive Sciences

Review
Social Learning Strategies: Bridge-Building between Fields

Rachel L. Kendall,1,4 Naefje J. Boogert,1 Luke Rendell,2 Kevin N. Laland,3 Mike Webber,3 and Patricia L. Jones4

While social learning is widespread, indiscriminate copying of others is rarely beneficial. Theory suggests that individuals should be selective in what, when, and whom they copy, by following ‘social learning strategies’ (SLSs). The SLS concept has stimulated extensive experimental work, integrated theory, and empirical findings, and created impetus to the social learning and cultural evolution fields. However, the SLS concept needs updating to accommodate recent findings that individuals switch between strategies flexibly, that multiple strategies are deployed simultaneously, and that there is no one-to-one corre-
Further directions

Complex contagion

Complex Contagions and the Weakness of Long Ties

Damon Centola
Harvard University

Michael Macy
Cornell University

The strength of weak ties in socially distant locations The authors test whether social ties can spread from simple to complex social diffusion from social networks. The authors specify the spread of high-risk social contagions, unconnected technologies. In this sense, the increase, long ties can improve their length. Wide bridges in networks, which may act as a proxy for social movements.

The Spread of Behavior in an Online Social Network Experiment

Damon Centola

How do social networks affect the spread of behavior? A popular hypothesis states that networks with many clustered ties and a high degree of separation will be less effective for behavioral diffusion than networks in which locally redundant ties are rewired to provide shortcuts across the social space. A competing hypothesis argues that when behaviors require social reinforcement, a network with more clustering may be more advantageous, even if the network as a whole has a larger diameter. I investigated the effects of network structure on diffusion by studying the spread of health behavior through artificially structured online communities. Individual adoption was much more likely when participants received social reinforcement from multiple neighbors in the social network. The behavior spread farther and faster across clustered-lattice networks than across corresponding random networks.
Further directions

Emotion contagion

Emotions as infectious diseases in a large social network: the SISa model
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Human populations are arranged in social networks that determine interactions and influence the spread of diseases, behaviours and ideas. We evaluate the spread of long-term emotional states across a social network. We introduce a novel form of the classical susceptible–infected–susceptible disease model which includes the possibility for ‘spontaneous’ (or ‘automatic’) infection, in addition to disease transmission (the SISa model). Using this framework and data from the Framingham Heart Study, we provide formal evidence that positive and negative emotional states behave like infectious diseases spreading across social networks over long periods of time. The probability of becoming content is increased by 0.02 per year for each content contact, and the probability of becoming discontent is increased by 0.04 per year per discontent contact. Our mathematical formalism allows us to derive various quantities from the data, such as the average lifetime of a contentment ‘infection’ (10 years) or discontentment ‘infection’ (5 years). Our results give insight into the transmissive nature of positive and negative emotional states. Determining to what extent particular emotions or behaviours are infectious is a promising direction for future research.

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Further directions

In-group bias and adoption
Next up:
Opinions and polarization