Models of Social Dynamics
An Introductory Module

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Unit 7:
Coda

The Three C’s

Cooperation

Communication

Coordination

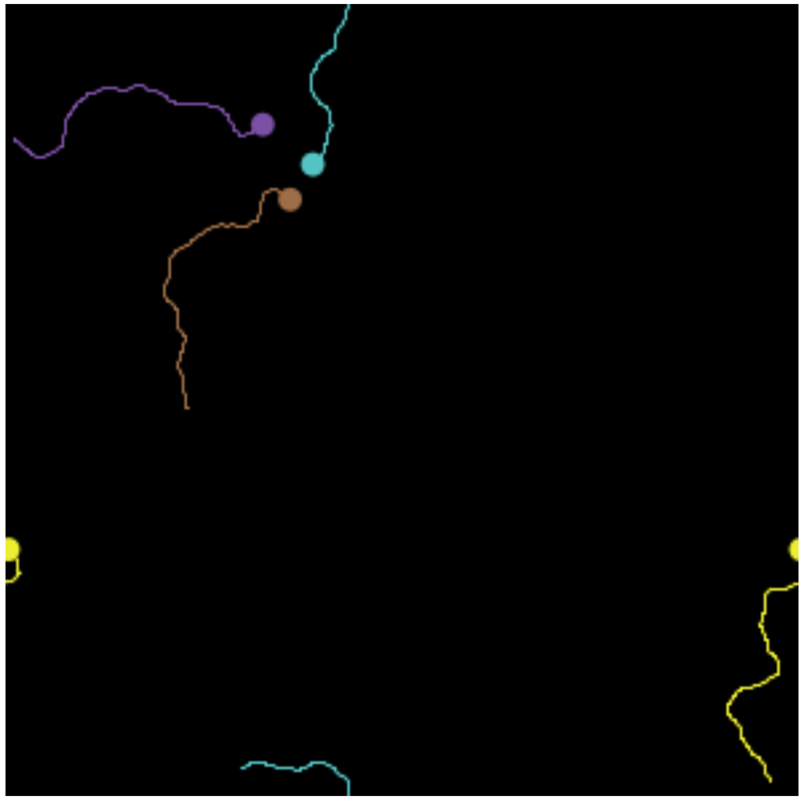
Building Models

Most models of social behavior require at least 3 kinds of assumptions:

1. How are internal states represented?

2. How are individuals influenced by their environment and each other?

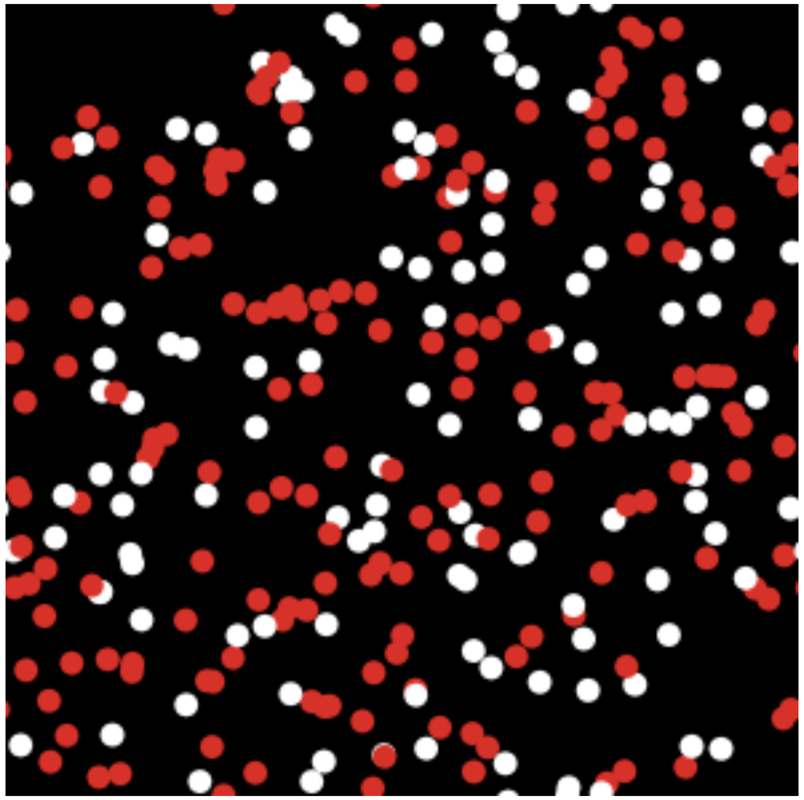
3. How are behaviors and interactions structured?



Contagion

- The time course of adoption for a disease, technology, or behavior depends on the extent to which it is socially transmitted.

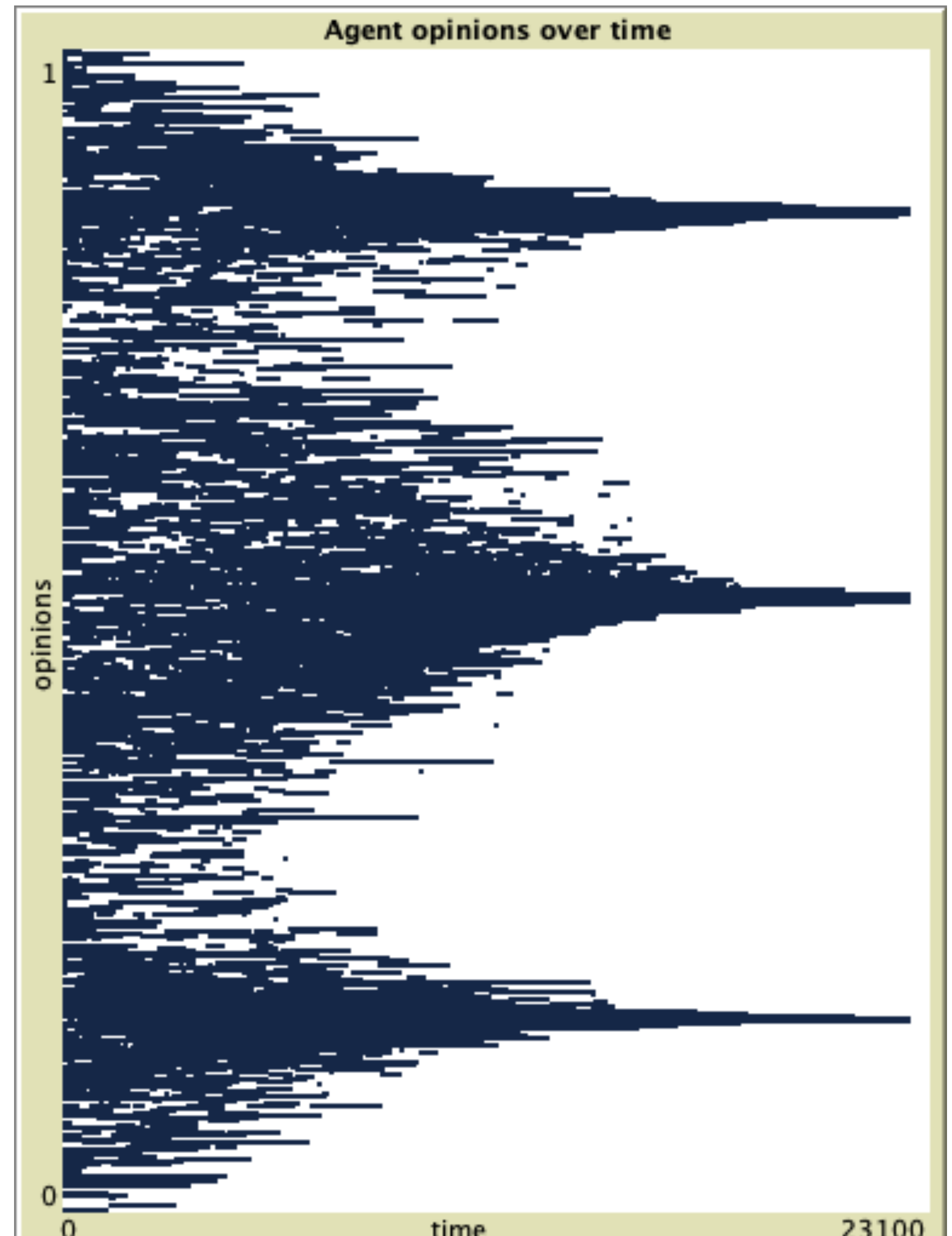
- Adoption by individual exploration will yield an r-shaped curve, adoption by social influence will yield an s-shaped curve.



Opinions

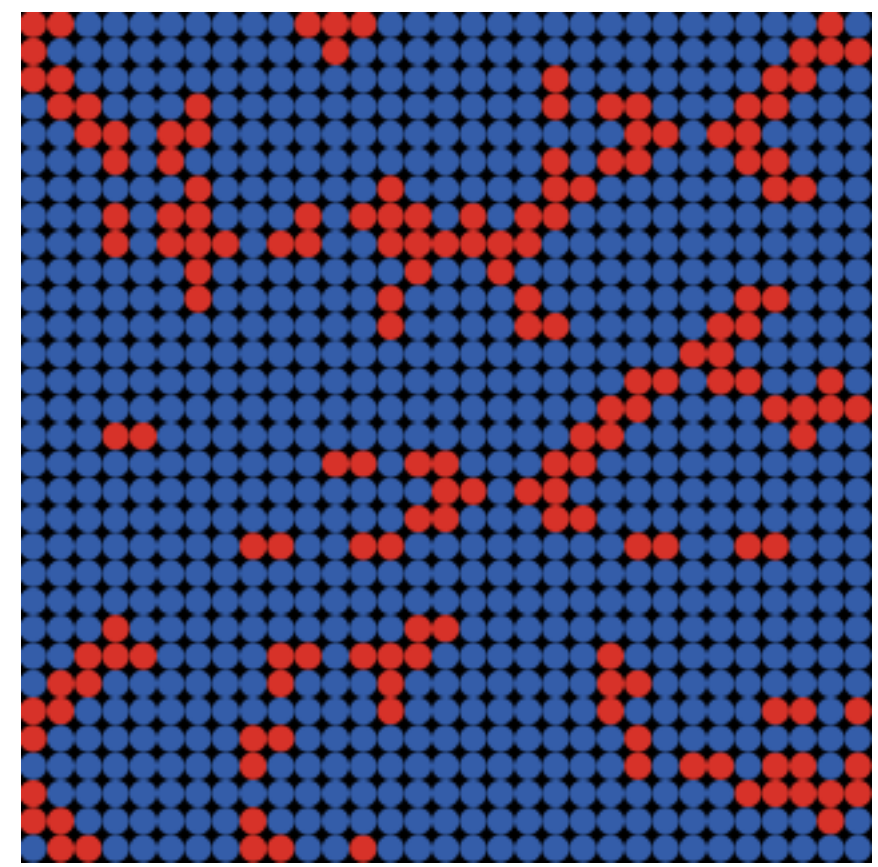
- The more people only are influenced by people already similar to themselves, the more distinct communities will form.

- If we also seek to distance ourselves from those with whom we disagree, the result can be polarization and extremism.



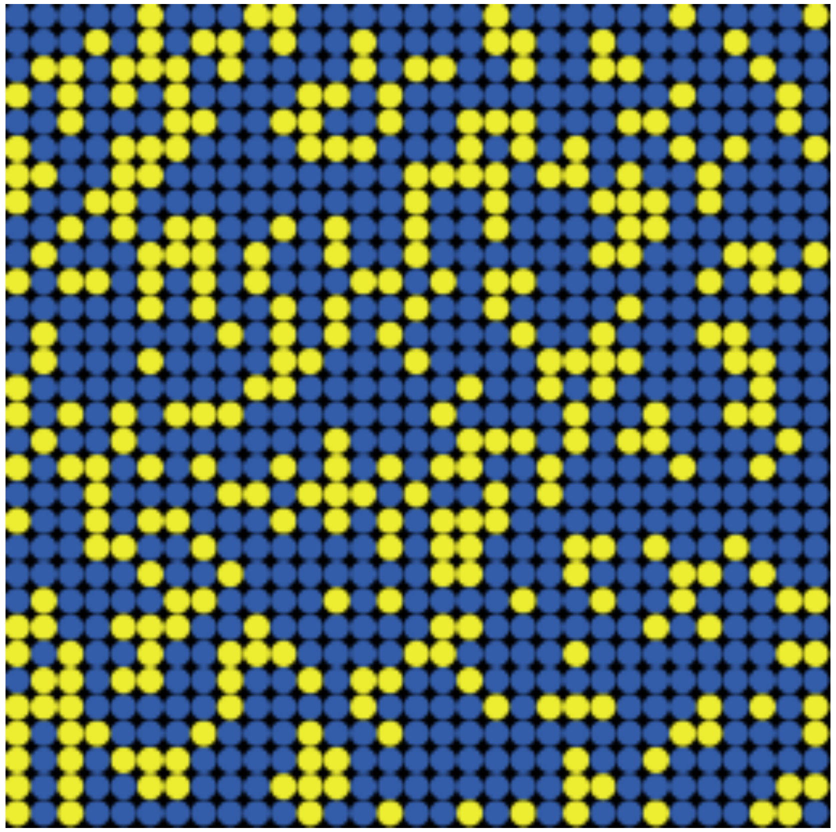
Cooperation

- Because it can be easily exploited, a strategy of naïve cooperation can only persist if group structure is highly assortative.
- A savvy reciprocating strategy can maintain cooperation as long as there are sufficient opportunities for repeat interaction.



Coordination

- When there are benefits to coordination, almost anything can become a norm.
- Rare group-beneficial norms may have a hard time spreading in a tight-knit community.
- However, even a little interaction with other communities and a willingness to adopt norms that originated elsewhere can aid the spread of group-beneficial norms.



Cycles

- Something that spreads rapidly when rare but becomes weakened by its own growth provides the foundation for cyclical dynamics.

- Counterintuitively, factors that limit growth may benefit an organism or society in the long run.

So much still to learn

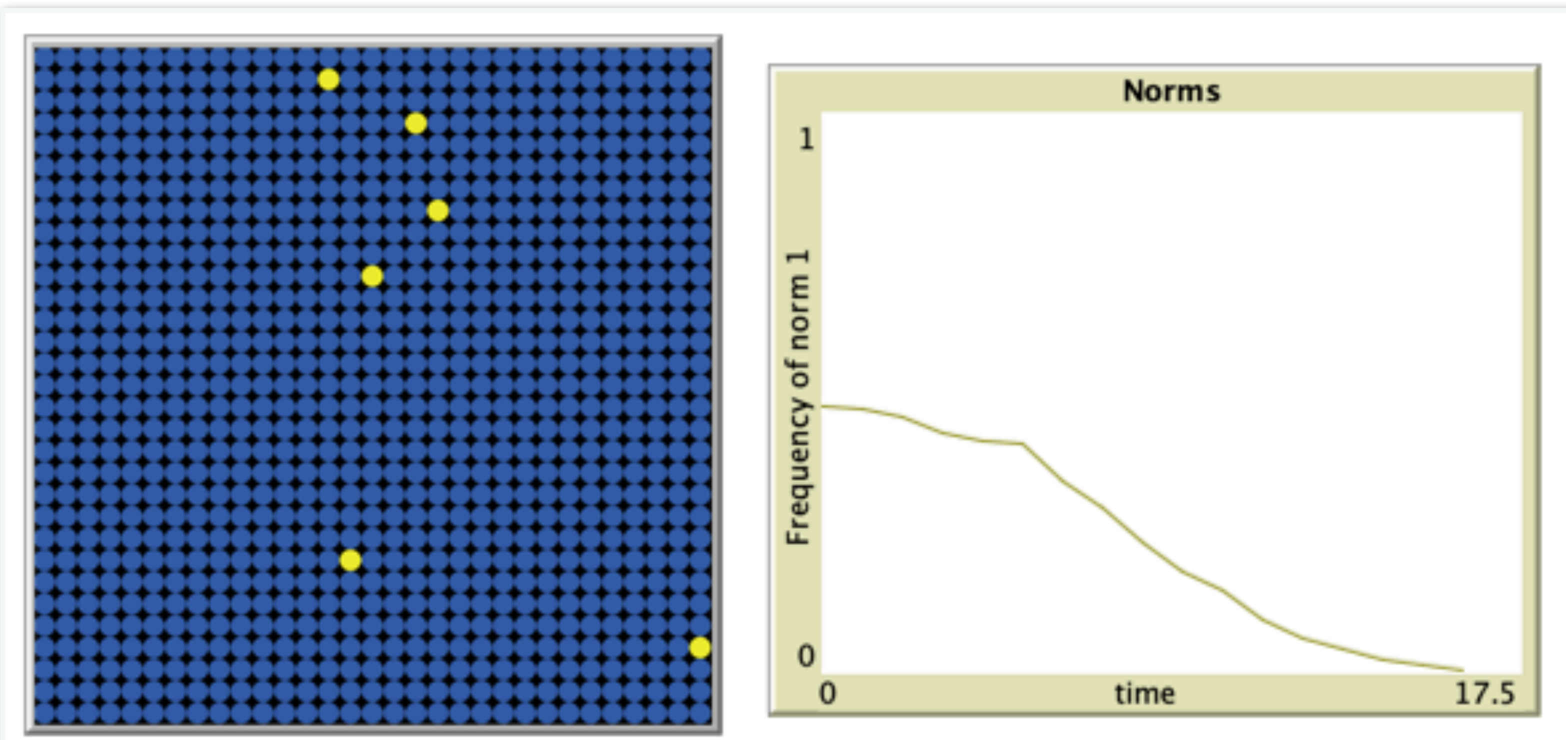
What do can models provide?

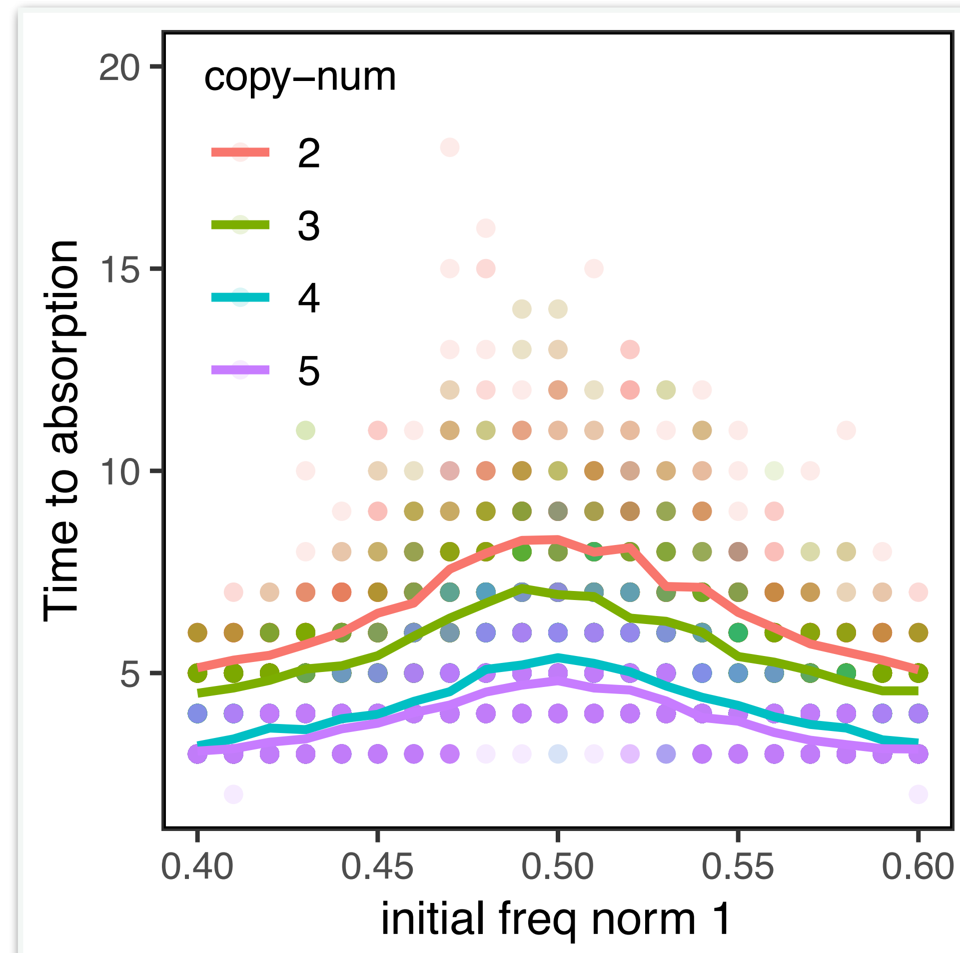
- Concrete analogies for complex systems
- Tractable systems for analysis and exploration
- Demonstration of pattern-generating mechanisms

Advanced Topics

- Analyzing agent-based models
- Mathematical proofs
- Models and data

Analyzing agent-based models





Mathematical proof

Appendix C. Proof that the population always converges when all agents have the same distinctiveness preference

Under Model 1, let all agents have the same distinctiveness preference, i.e. $\forall i, \delta_i = \delta$. Since each individual records the same population mean and standard deviation, it follows that at time t, all agents will have the same ideal position:

$$x^*(t) = \bar{x}(t) + \delta\sigma(t). \tag{C 1}$$

By equations (A 2) and (C 1), the update rule for each agent is given by

$$x_i(t+1) = x_i(t) + k[\bar{x}(t) + \delta\sigma(t) - x_i(t)]. \tag{C 2}$$

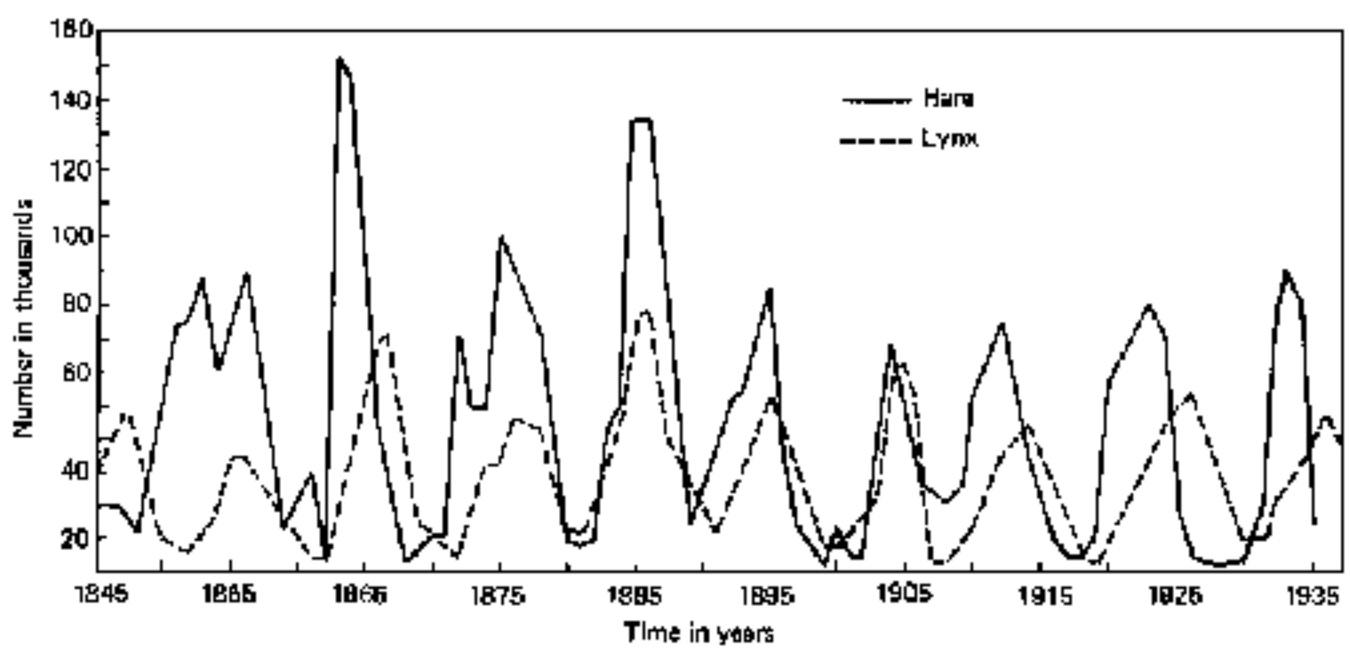
We will prove that this rule leads the population to converge by showing that the variance of agents' positions at time $t+1$ is always less than the variance of agents' positions at time t. Recall that the equation for variance is

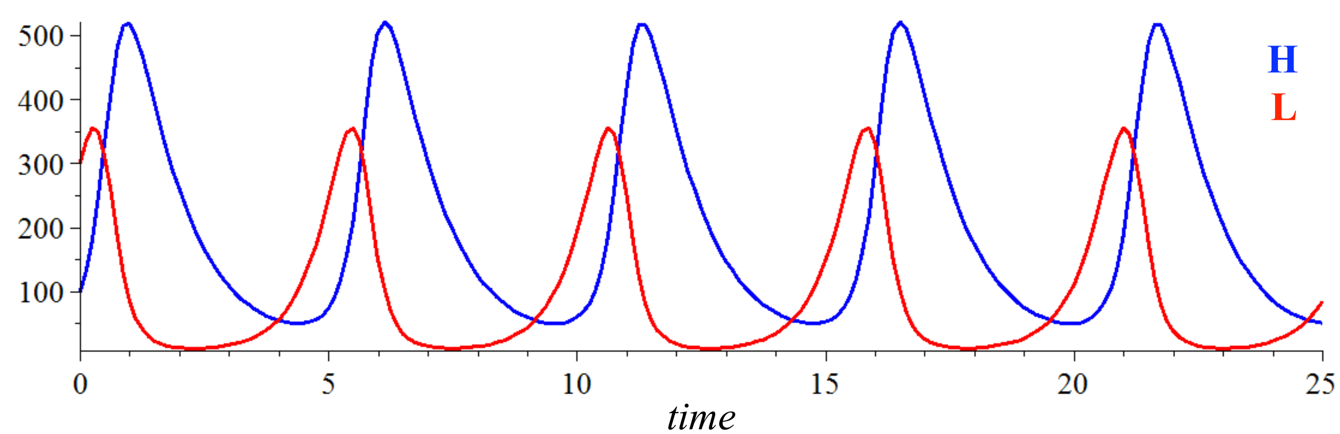
$$\sigma^2 = E[(x^2)] - \bar{x}^2. \tag{C 3}$$

At time $t+1$, the variance is given by

$$\sigma^2(t+1) = \frac{1}{N}\sum_i \underbrace{x_i^2(t+1)}_{P} - \underbrace{\bar{x}^2(t+1)}_{Q}. \tag{C 4}$$

Models and data





Thanks!

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