Introduction to Agent-Based Modeling

DAY 2

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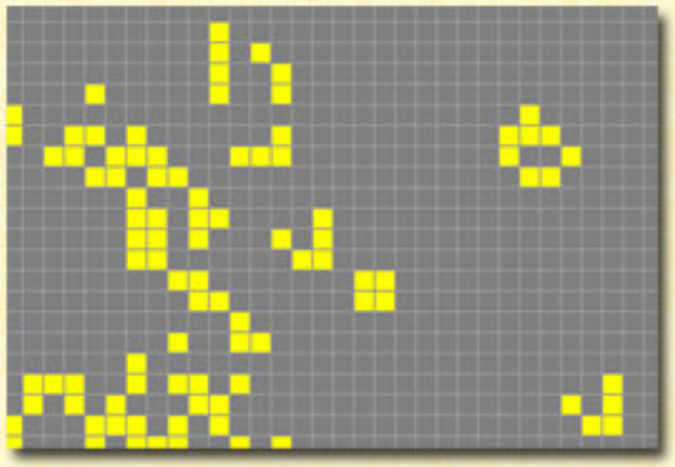
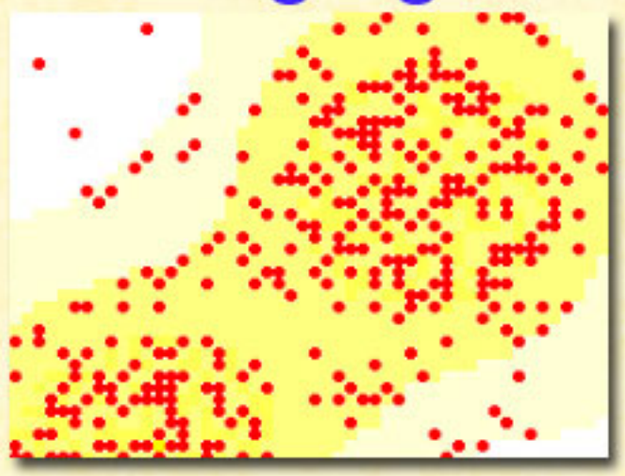
Various Flavors of Agent-Based Models

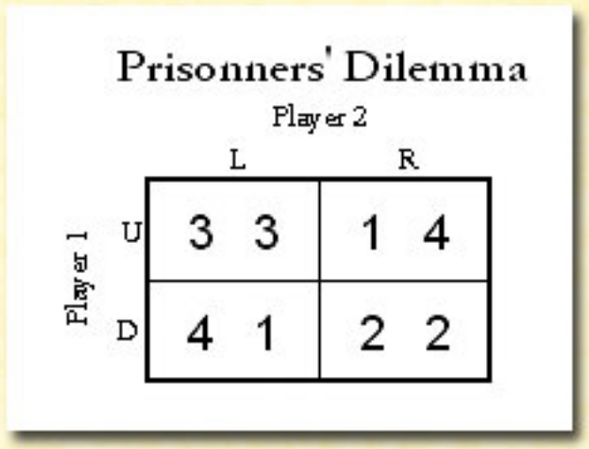
Cellular Automata



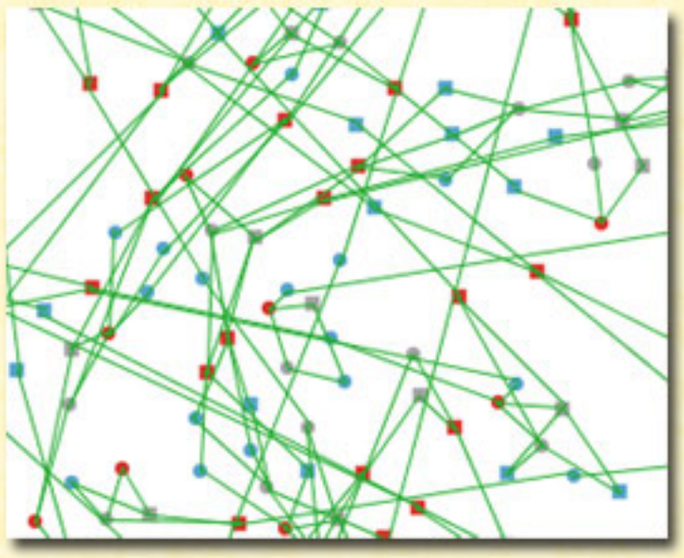
Free-Roaming Agent Models



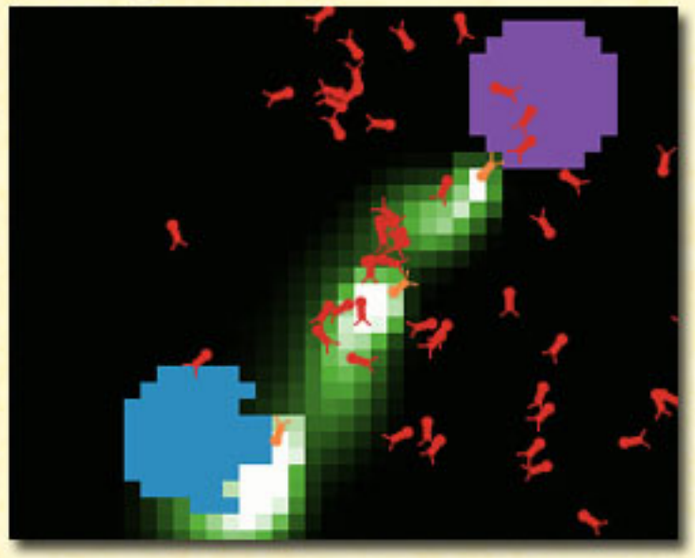
No-GUI Models



Network Models



Hybrid Models

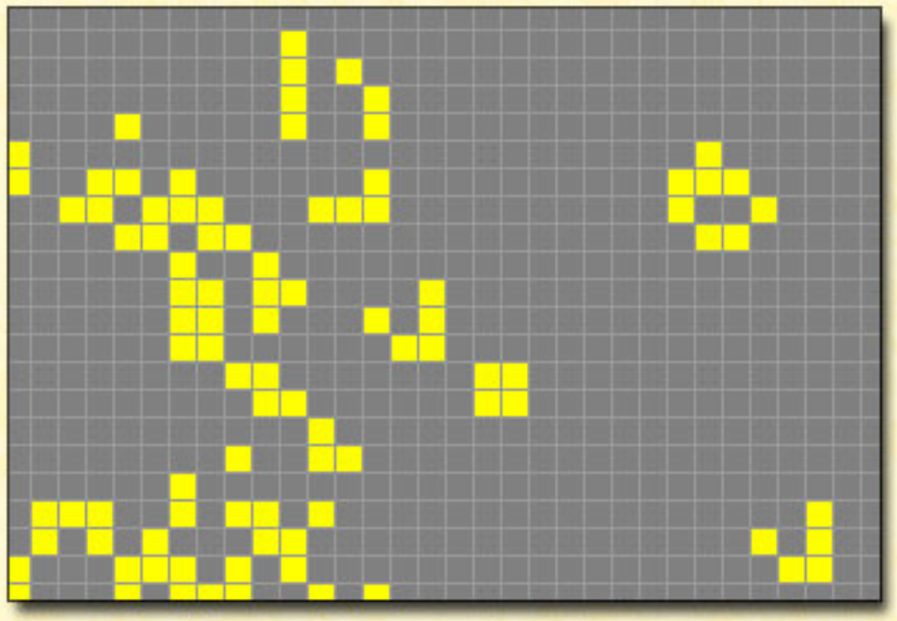


Various Flavors of Agent-Based Models

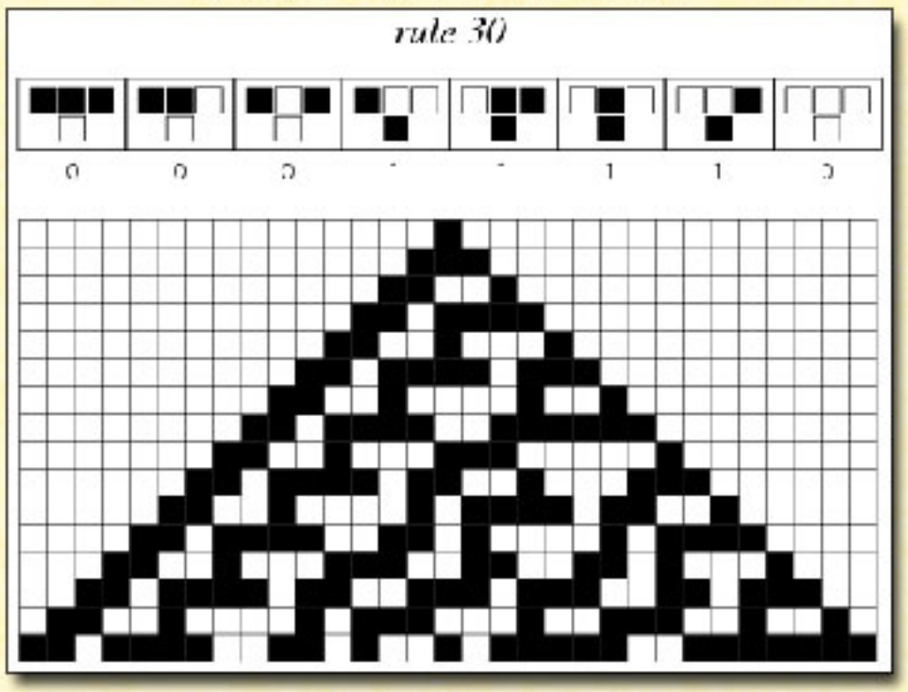
Cellular Automata

- World is Divided into Discrete-Sized Cells (Agents)
- First Kind of ABM - Invented by von Neumann
- Eg. Game of Life, Wolfram's Elementary CAs, Axelrod

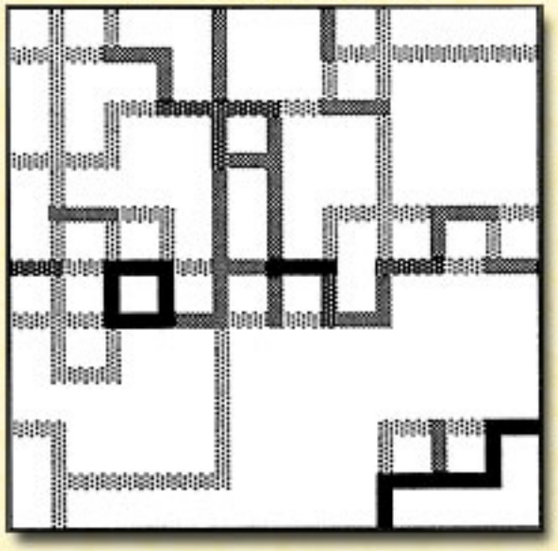
Conway's Game of Life



Wolfram's CA



Axelrod's Dissemination of Culture



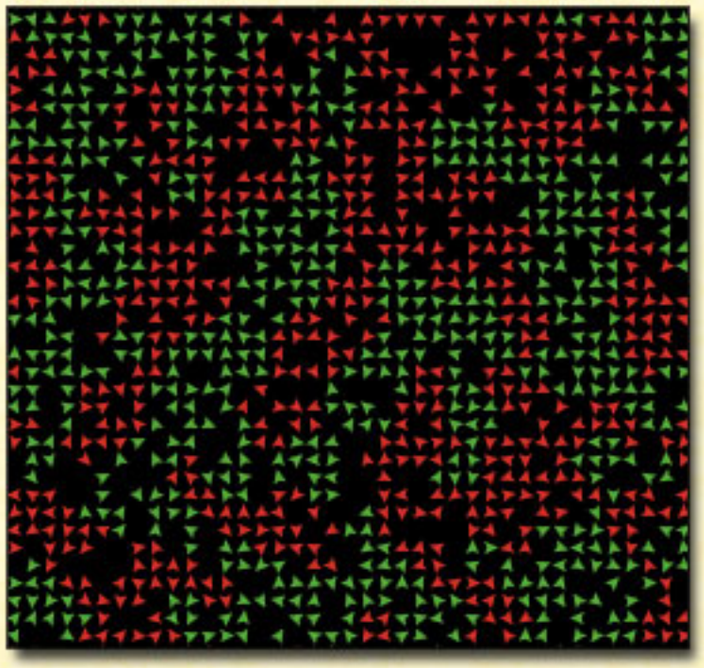
Show Model

Various Flavors of Agent-Based Models

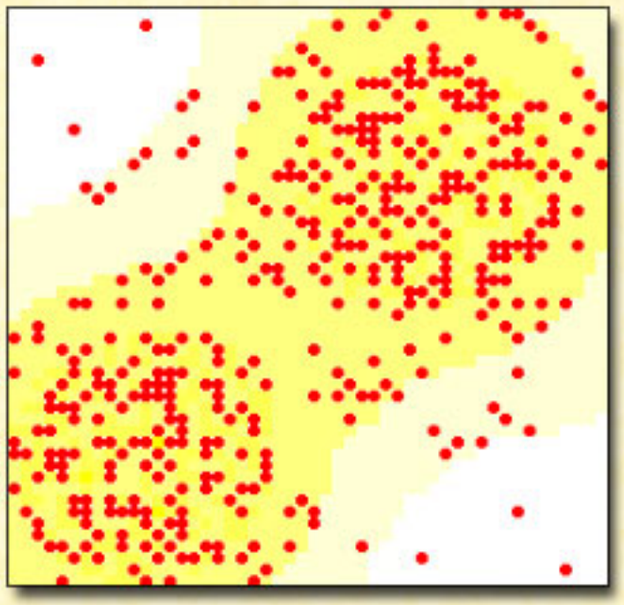
Free-Roaming Agent Models

- Mobile Agents (usually "more sophisticated" than CAs)
- Eg. Schelling's Segregation, Sugarscape, Flocks of Boids
- Live on space and distance means something

Schelling's Segragation



Axtell & Epstein's Sugarscape



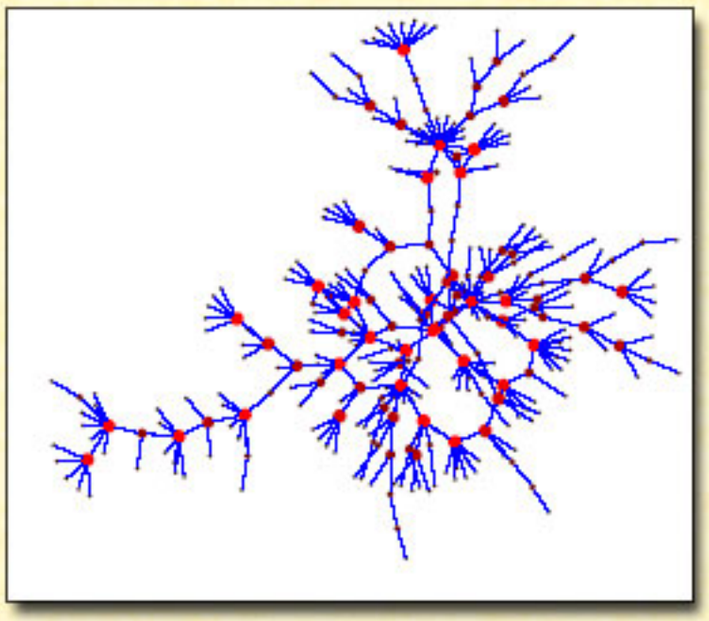
Reynold's Flocking Boids

Various Flavors of Agent-Based Models

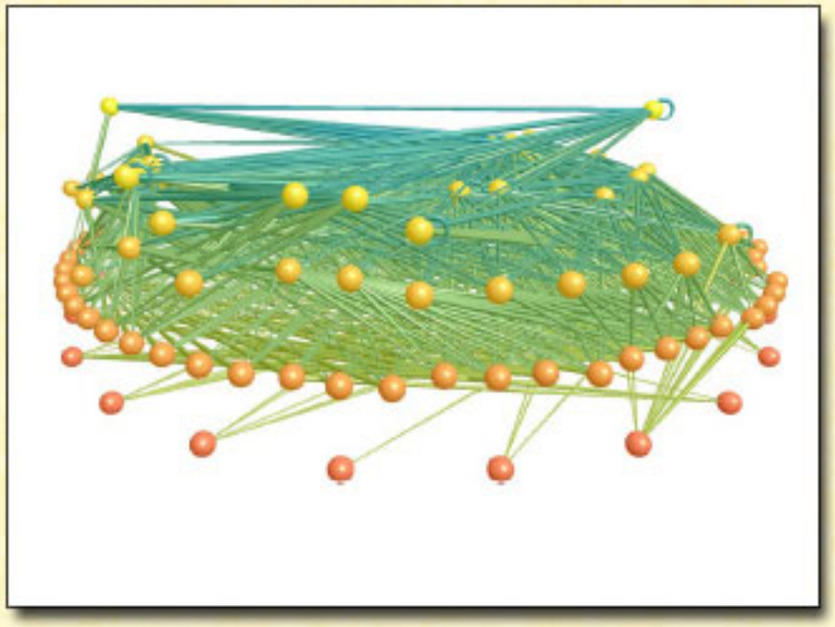
Network Models

- Agents are Connected Independent of Location
- Network Structure Provides some System Maetrics
- Container Can Represnt a Measure, But Not a Space

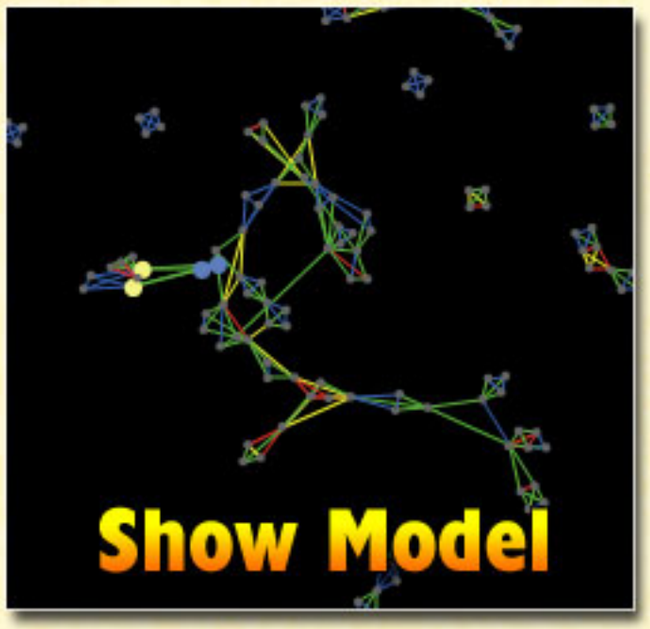
Potterat's HIV Tranmission



Martinez et al Food Web



Guimera's Team Assembly

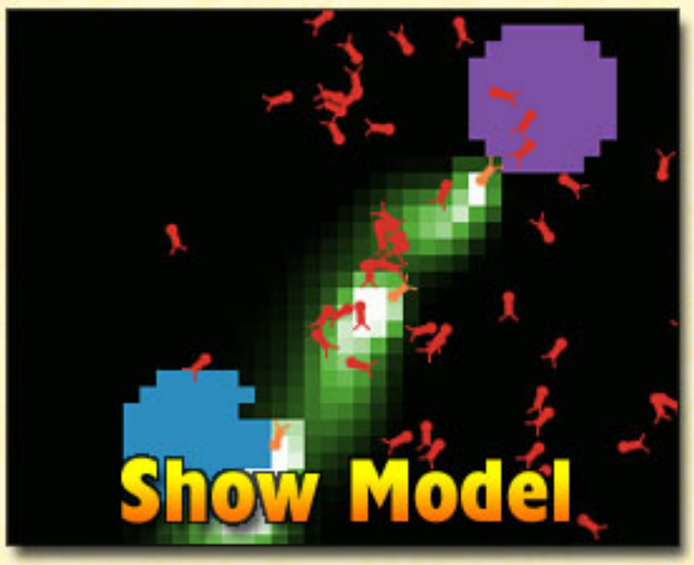


Various Flavors of Agent-Based Models

Hybrid Models: Combinations of Basic Types

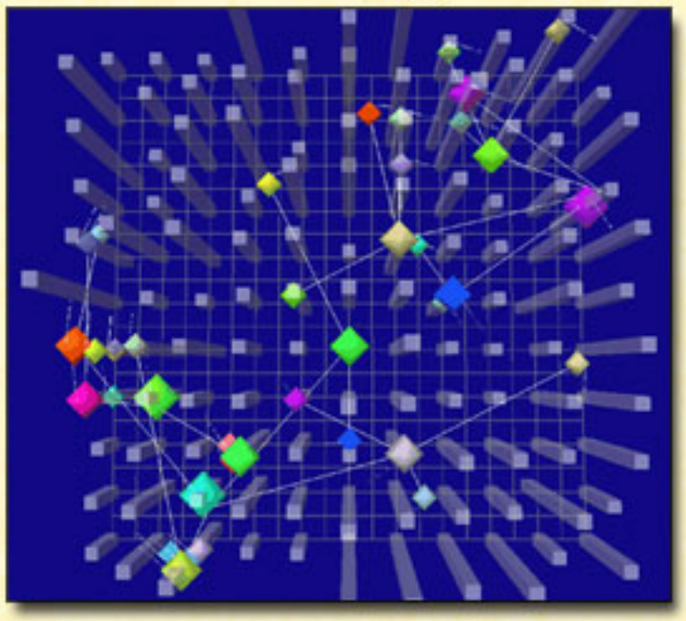
- Free-Roaming Agents on a CA Space
- Spatially Explicit World plus Social Connections
- Differential Equations Driving Agent Behavior

Ant Pheromones



Epstein's Smallpox Containment

GeoGraphs' Mobile Agents



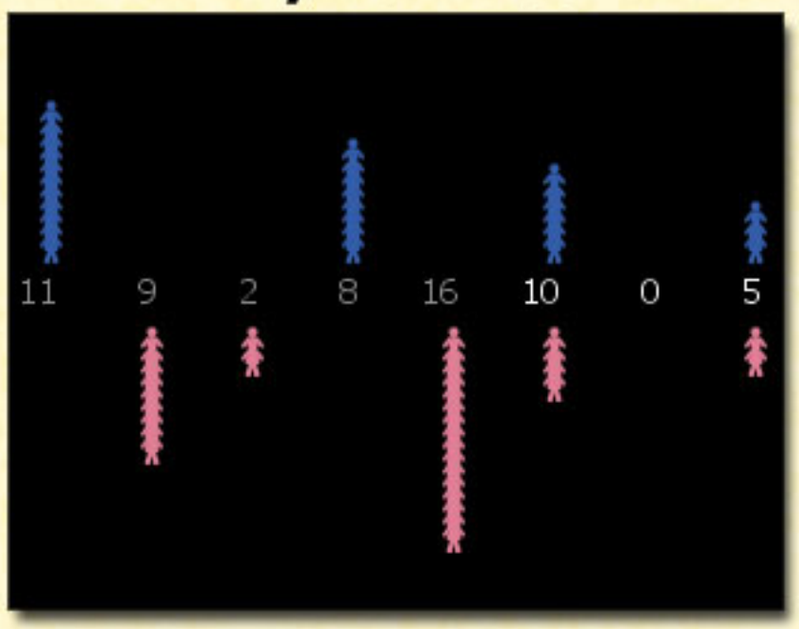
Various Flavors of Agent-Based Models

No GUI models: non-spatial but still agent-based

- Simulated Game Theory
- Display the Output Data Dynamically
- Equation Solving with Limited Information
- Use Agents to Perform Traditionally non-ABM Tasks

Prisoner's Dilemma

Party Dynamics

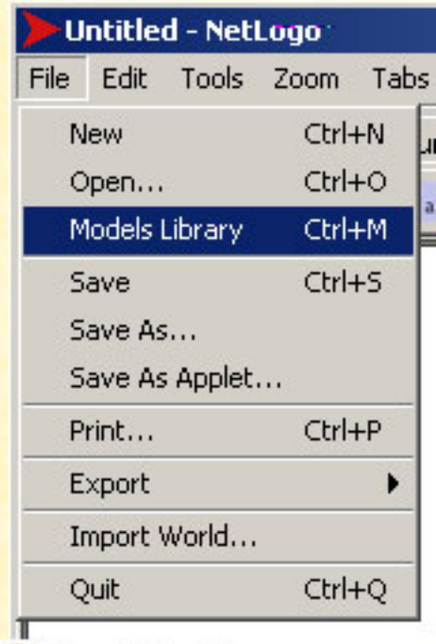


Voronoi Partitioning

Hands-On Modeling Examples

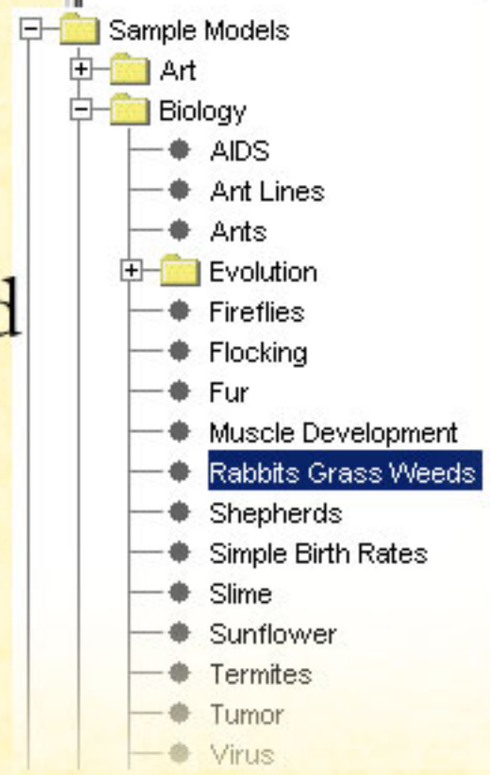
Opening and Running a Model in NetLogo

- If You Have an .nlogo File, Just Double-Click It
- Go to the File Menu, Click "Models Library"
- Search through the Models *and* Code Examples
- Double-Click One or Select It and Click "Open"

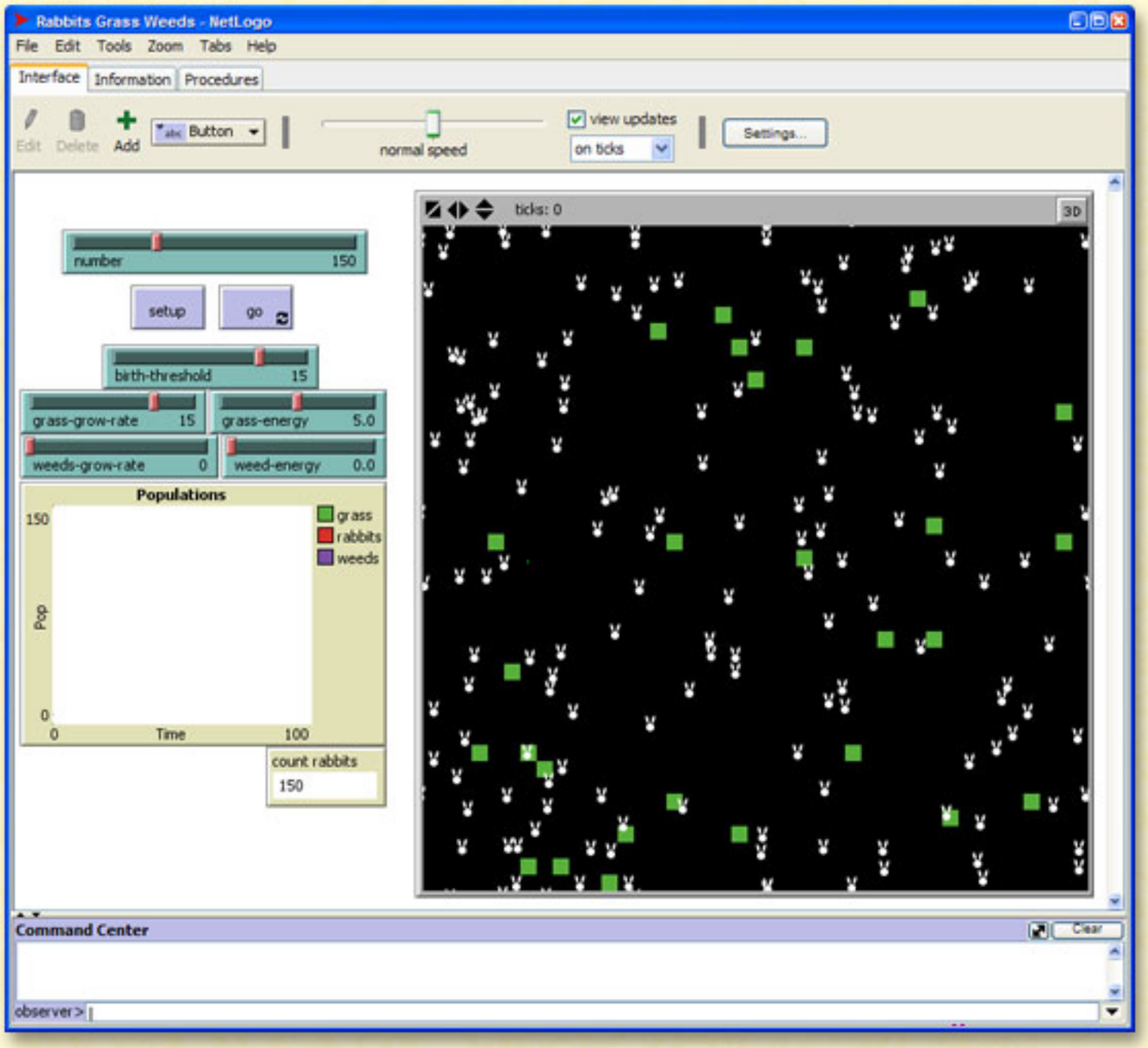


Running a NetLogo Applet

- Click the Link to a NetLogo Applet
- Wait for the Java Run Time Environment to Load
- Rejoice if it Works

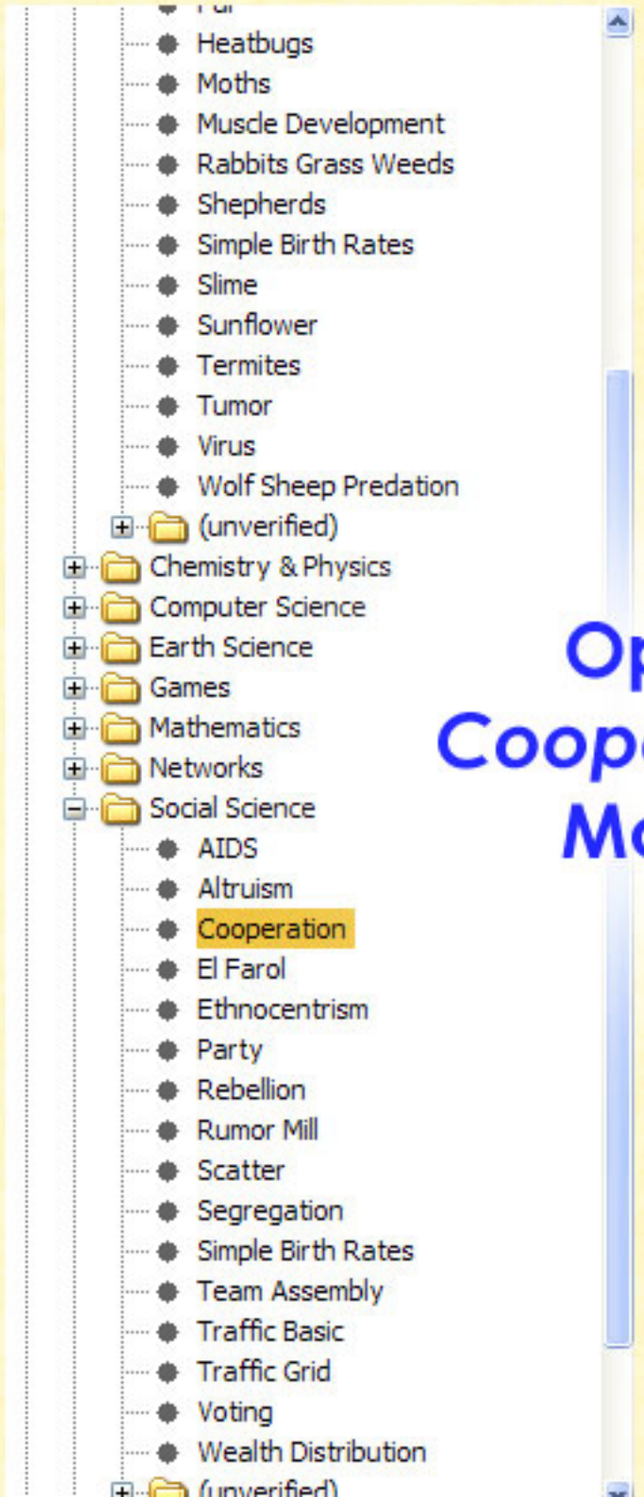


Hands-On Modeling Examples

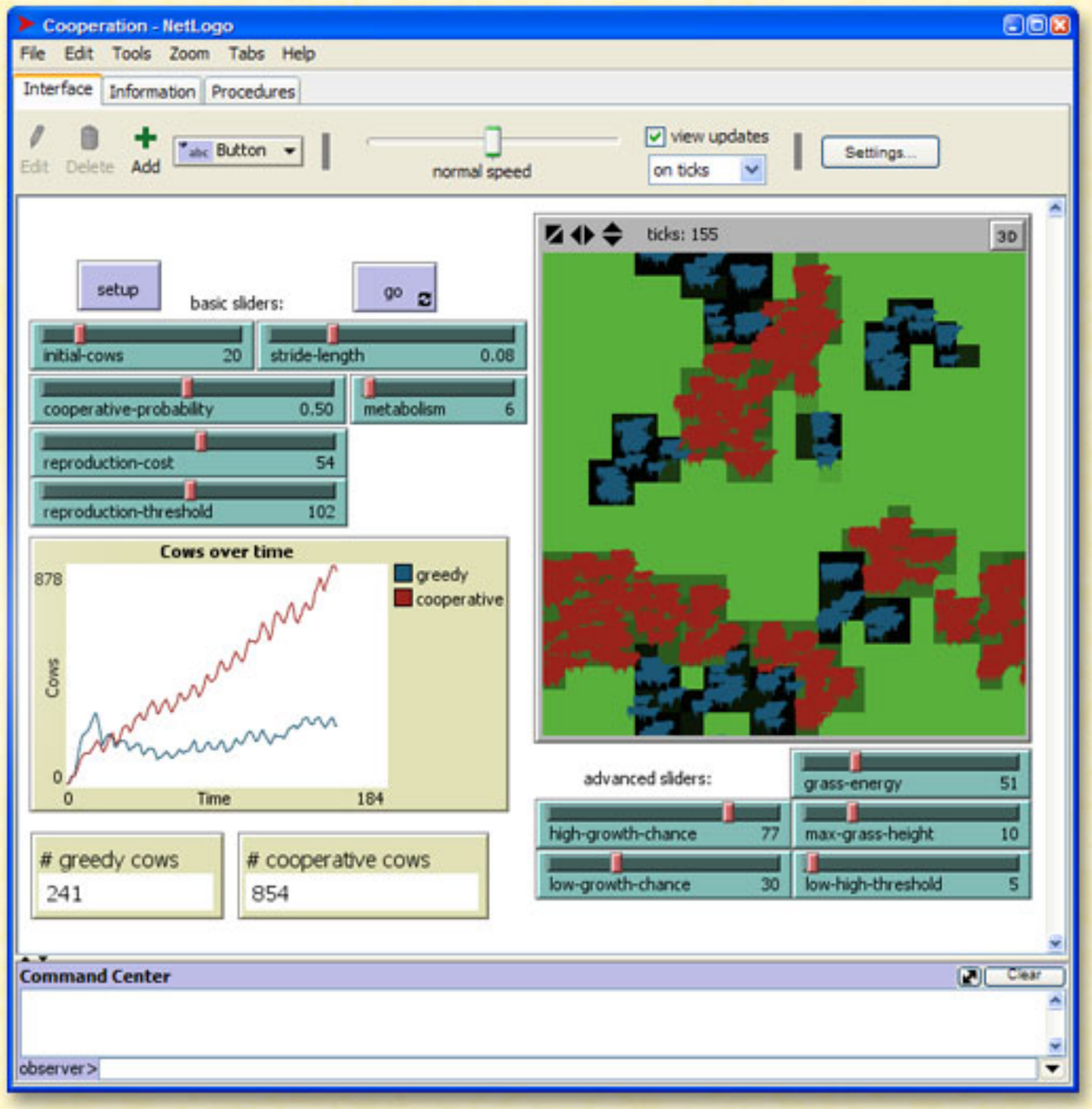


- What type of model? CA? Free Agents? Network? Hybrid ?
- What kind(s) of agents?
- How does changing the parameters affect model behavior?

Hands-On Modeling Examples



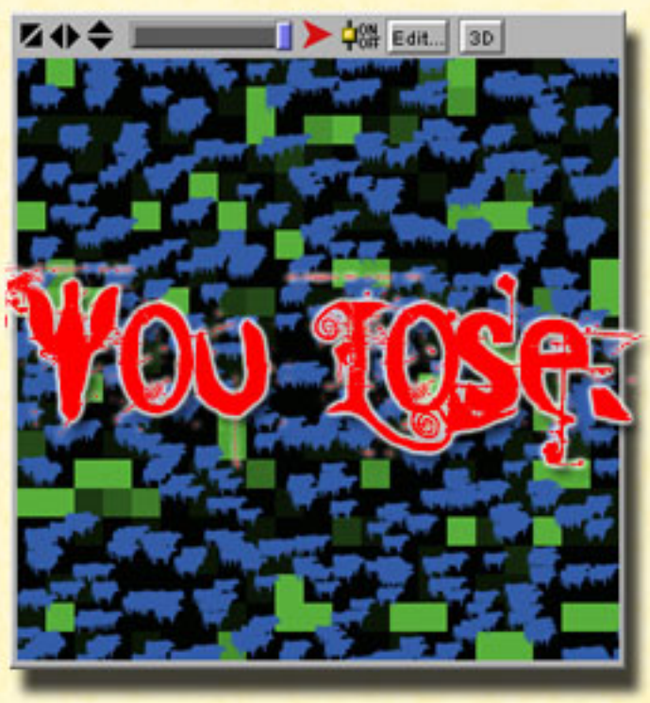
Open *Cooperation* Model



Hands-On Modeling Examples

Adjust Parameters to Achieve Cooperative Outcome

- How do the Parameters Effect Agent Behavior?
- How do the Parameters Effect World Behavior?
- Are there Long Term/Short-Term Trade Offs?
- What Set(s) of Parameters Yield the Cooperative Outcome?
- Would Looking at the Code Make this Easier?



Hands-On Modeling Examples

Optional Homework: Identify Characteristics of *Cooperation*

- What Type(s) of Models? CA, Free Agents, Network, Hybrid
- What Kinds of Agents Are there?
- Any Agent-Agent Interaction? Describe.
- Any Agent-World Interaction? Describe.
- Bounded or Toroidal World? Does the World Hold Values?
- What Are the Parameters? Any Hidden Parameters?
- What Does the Model Report?
- How Does Changing the Parameters Effect Model Behavior?
- How Does It Effect Model Performance?
- What Else Could You Use this Model for (in Whole or Part)?