



Swarm And Theory

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- Metatheory
- Problems/Challenges of ABM

- Anne Elke's theory about brontosauruses.

And then There's theory

- Spatial Model of Congress.

Division of the question

Figure 6.15
Equilibrium Induced by
Division of the Question

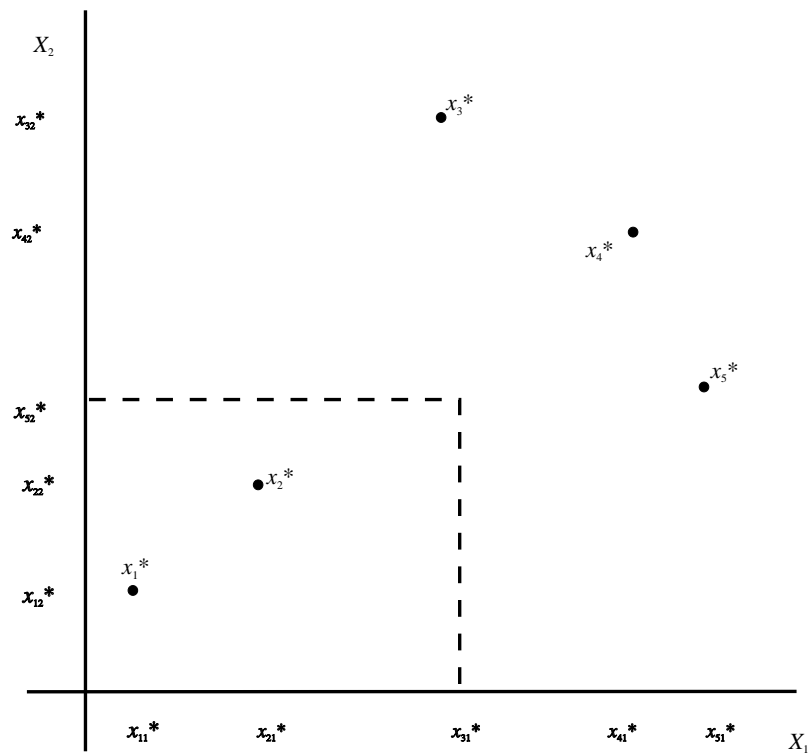
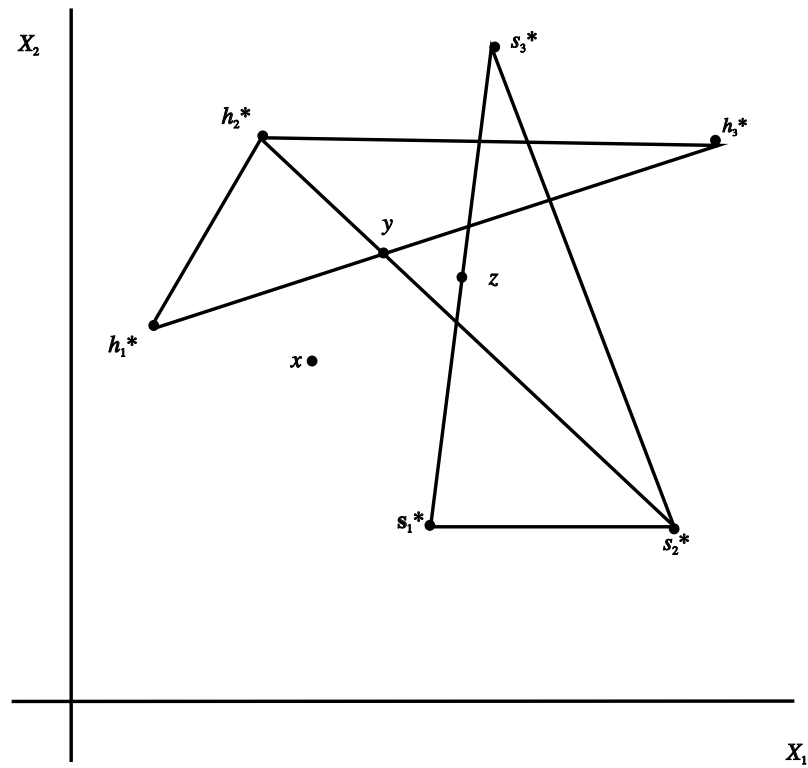


Figure 6.18
Bicameral Legislature with
Structure Induced Equilibrium



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- A big-T theory is a set of “working parts” such that
 - it can be “deductively interrogated”.
 - most “unknowns” are “interesting” (worth debating)
- It is a plus if a Theory
 - relates easily to observables
 - mathematically workable (allows $\frac{\partial s^*}{\partial \beta}$)

Common Problem: Too Big of a Belt

Hempel's old philosophy of science. Theory has

1. Core Elements. (Structures in which we are interested)
2. Auxiliary Elements/hypotheses. (To link/adjust Core to data and make it testable, a set of ad hoc insertions is typically necessary.)

Generally, a better theory has more 1 than 2.

Now Infamous Nash Equilibrium

Reduce a setting to

1. A list of agents, N
2. Sets of possible actions $S = \{S_1, S_2, \dots, S_N\}$,
3. A payoff function which designates for each agent a payoff function that corresponds to each possible action:

$$U : \prod_{i \in N} S_i \rightarrow \mathfrak{R}^N$$

- A “solution” or “**equilibrium**” is a vector of actions $s^* = (s_1^*, \dots, s_N^*)$ such that no individual can obtain a higher payoff by a unilateral change of action.
- Nash's theorem gave conditions under which a solution will exist and employed then-recent results in fixed-point theory to prove it.

This theorem gave:

- analytical backbone to pre-existing theories in Economics
- a clear modeling path for new projects in other fields
- tied into very useful theorems from Math
- allows comparative statics—"what if" conjectures about framework/institutions

Problems with Nash approach

“Unrealistic” (not relevant?) characterization of human

- institutions and settings
- individual information about other players
- calculation capability
- isolation of one decision from another

Problems with Nash approach

Difficulty in applying when there are large

- number of agents
- countable strategy sets
- sets of equilibrium points
- differences among agents in interest

- Promise: incorporate and test “new ideas”
- Problems:
 - Big Belt: many ad hoc model details
 - Difficulty isolating “solution” concept

Gaps in existing social theories.

- “relative inequality” or other theories do not meaningfully explain individual-level dynamics

Swarm model:

- Agents try to measure poor quality of ruler by observing the number of protesters they see inside a neighborhood.

Figure 6
Contagious Protest

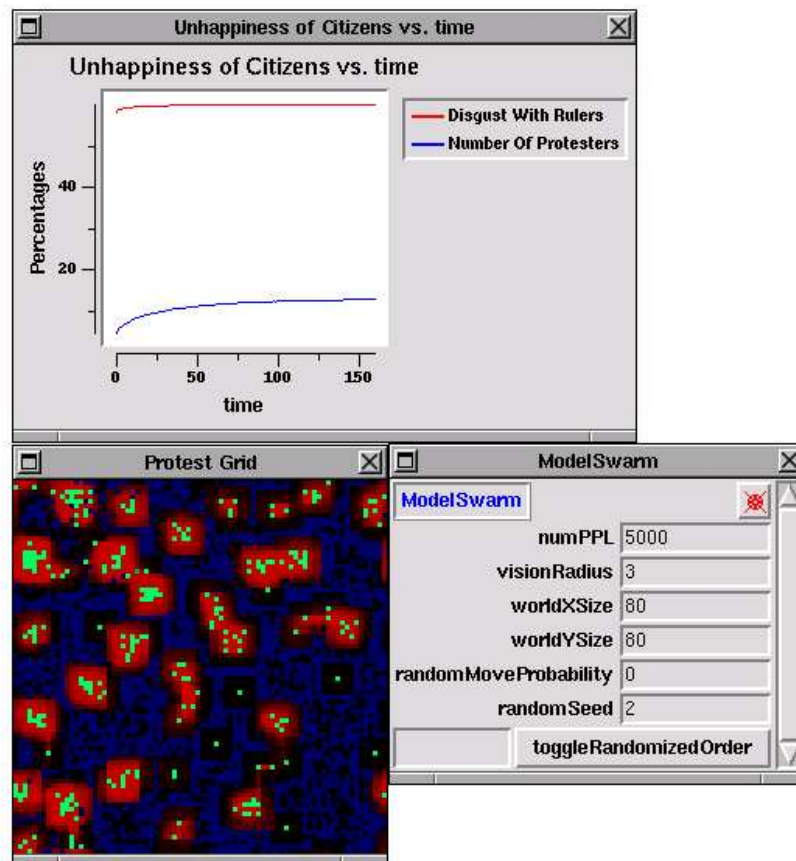
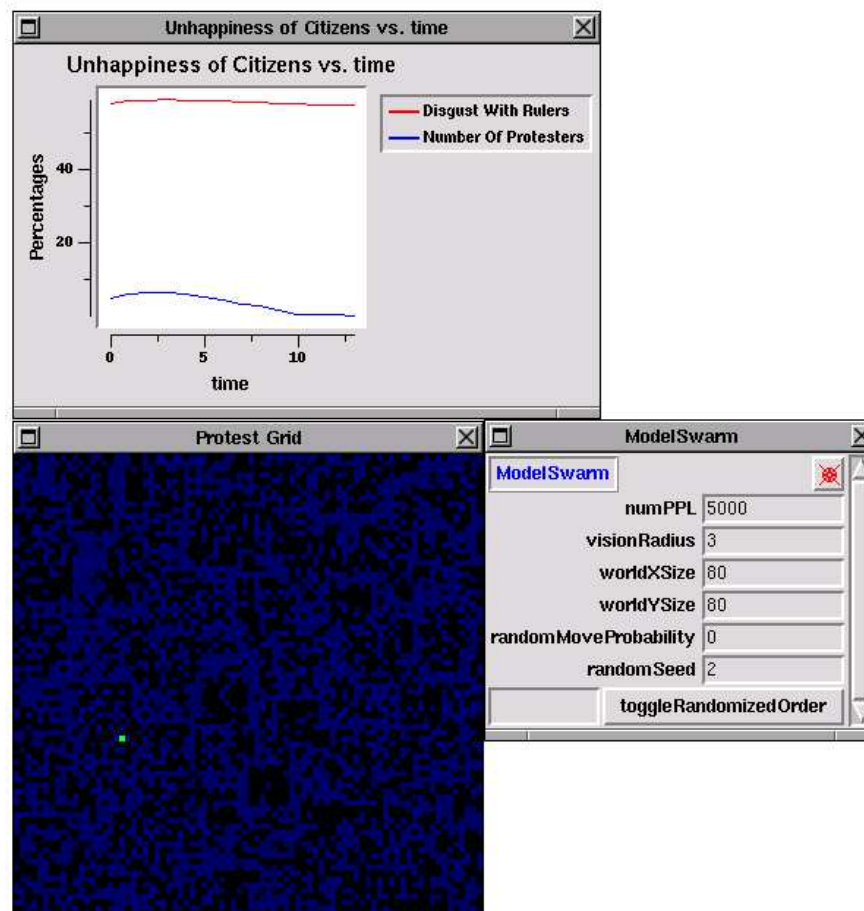


Figure 8
Protest Model with Exhaustion Factor

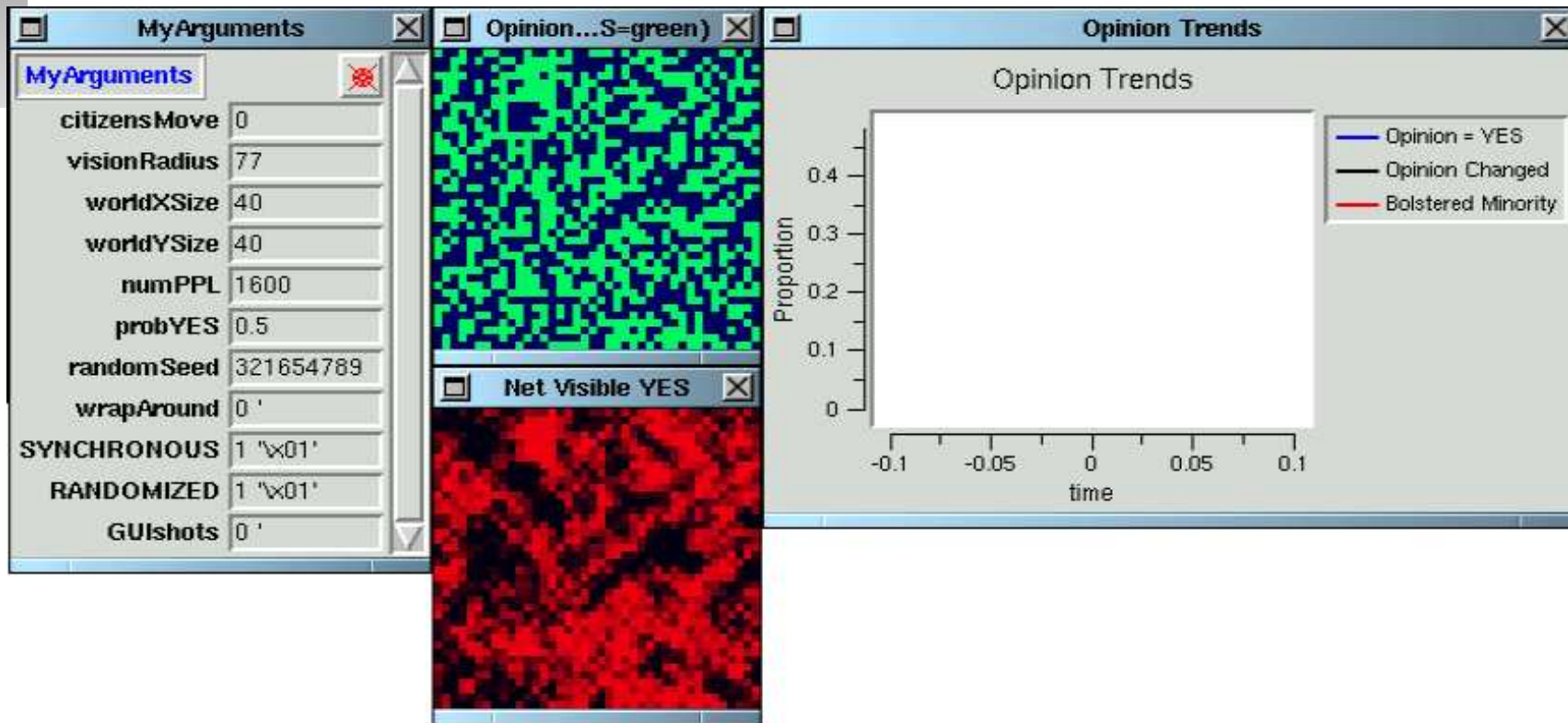


Bibb Latane (et al) model of agents in a grid who may be persuaded by social influences.

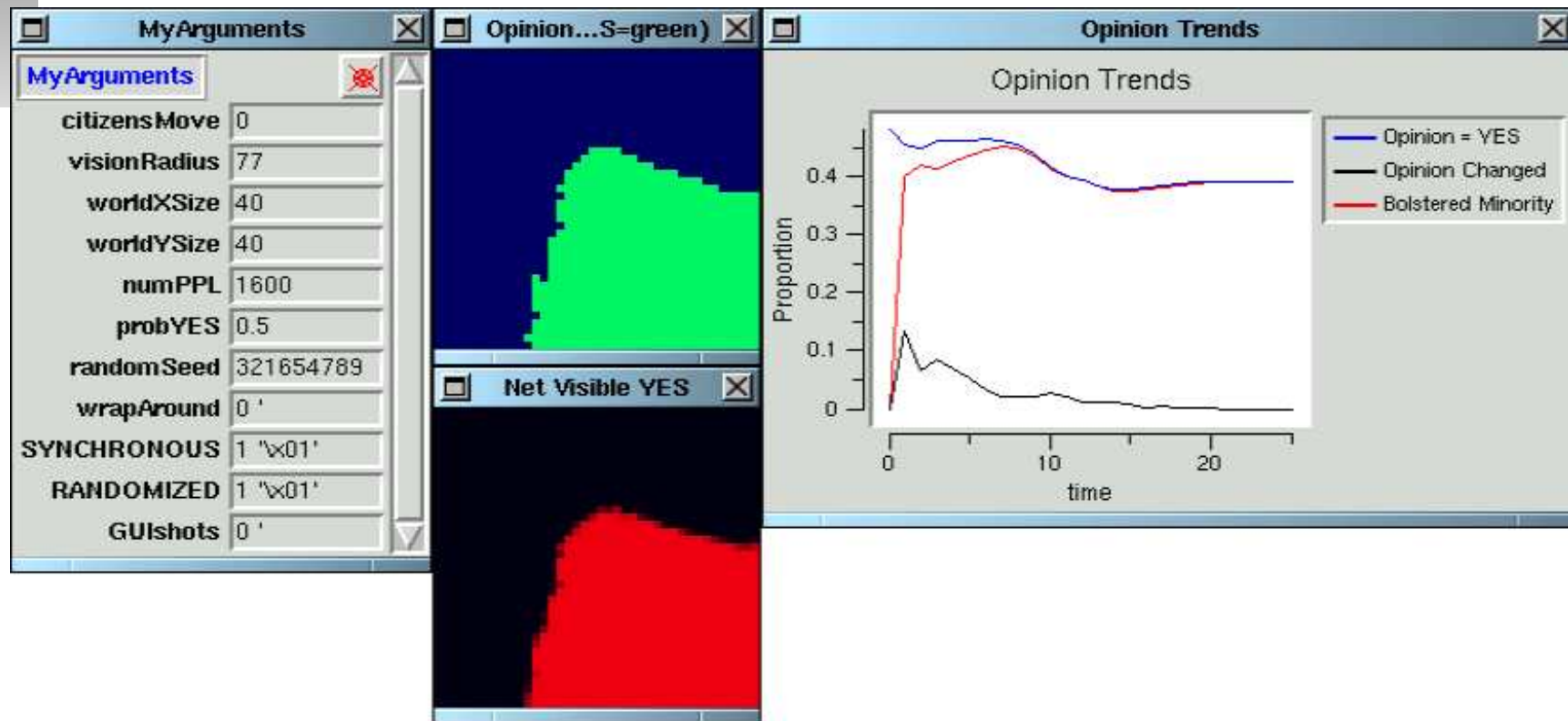
Key Features:

- Agents fixed in position, evenly dispersed
- Pressure emanates radially from each agent, stops at border of grid
- Synchronous (all update against snapshot)

Impact Snap1



Impact Snap 2



Consider Generalizing SI model

Modeling Features we can introduce

- Mobile agents
- Asynchronous updating
- Limited impact: radius X
- Impact may wrap (toroidal world)

Does Generalizing Help?

Yes:

- Undercuts previous results driven by ad hoc elements
- Fills gaps in theory that underlies model

No:

- How many angels can dance on the head of a pin?