spm 9550: Adaptivity

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Lecture goals

- Understand adaptiveness as learning at
  - system level
  - individual level
- and how these two are related
- Understand the role of the environment
- Understand the difference of characteristic system times.

Adaptation happen over time

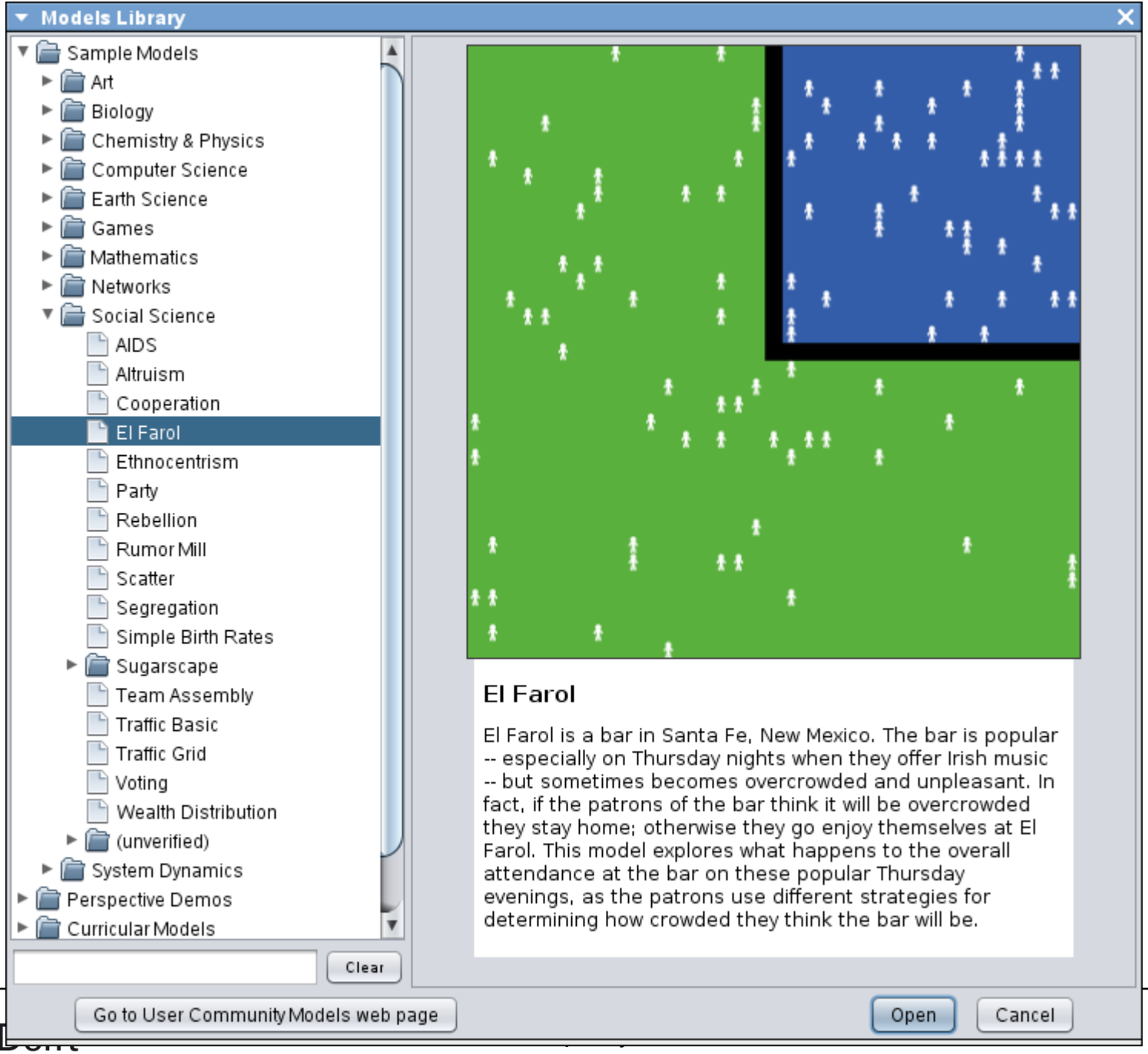
- Duh !
- But
  - There may be many different timescales involved !
    - Agent time scales
      - Individual life cycles
    - System time scales
      - Generations
    - Environment
  - Think Politics vs Global Warming (4 years vs 200 years)
- This is all related to the speed of information processing

Agent level adaptation

- Agents can learn and adapt by adding/removing/modifying
  - Rules
  - States (e.g. memory)
  - Actions

Link to novelty (innovation)

- Adaptation in models is always limited within some boundaries
- True novelty/innovation is VERY difficult to model.
- Computers are not creative (yet)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AIDS
Altruism
Cooperation
El Farol
Ethnocentrism
Party
Rebellion
Rumor Mill
Scatter
Segregation
Simple Birth Rates
Sugarscape
Team Assembly
Traffic Basic
Traffic Grid
Voting
Wealth Distribution
(unverified)
System Dynamics
Perspective Demos
Curricular Models
Clear
El Farol
El Farol is a bar in Santa Fe, New Mexico. The bar is popular -- especially on Thursday nights when they offer Irish music -- but sometimes becomes overcrowded and unpleasant. In fact, if the patrons of the bar think it will be overcrowded they stay home; otherwise they go enjoy themselves at El Farol. This model explores what happens to the overall attendance at the bar on these popular Thursday evenings, as the patrons use different strategies for determining how crowded they think the bar will be.
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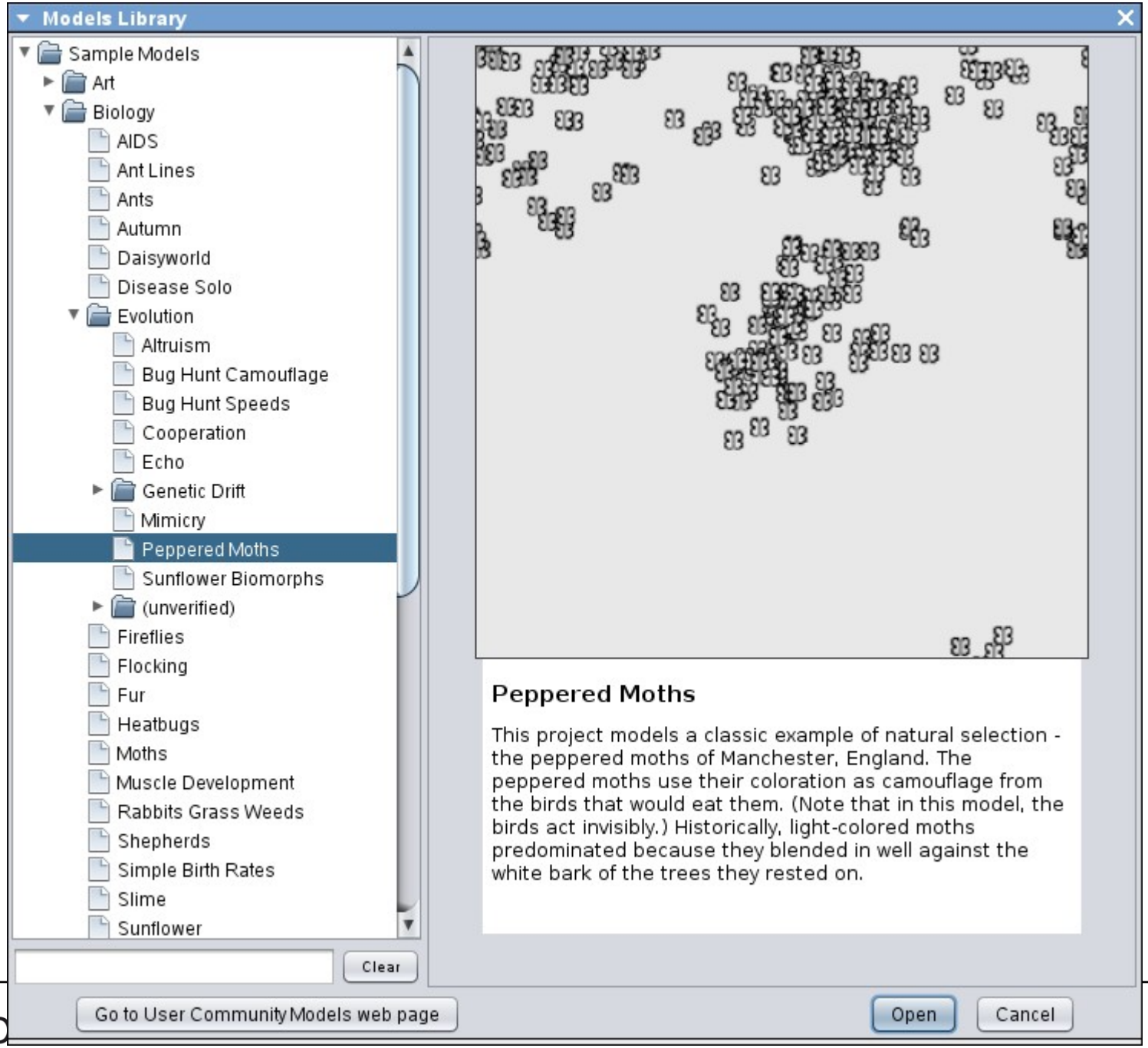
System level adaptation

- Elephant and moth populations learn from environment, individual elephants or moths do not
- Elephants can learn, but not how to grow smaller tusks.
- Populations adapt and "learn"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Genetic Drift
Mimicry
Peppered Moths
Sunflower Biomorphs
(unverified)
Fireflies
Flocking
Fur
Heatbugs
Moths
Muscle Development
Rabbits Grass Weeds
Shepherds
Simple Birth Rates
Slime
Sunflower
Clear
Peppered Moths
This project models a classic example of natural selection - the peppered moths of Manchester, England. The peppered moths use their coloration as camouflage from the birds that would eat them. (Note that in this model, the birds act invisibly.) Historically, light-colored moths predominated because they blended in well against the white bark of the trees they rested on.
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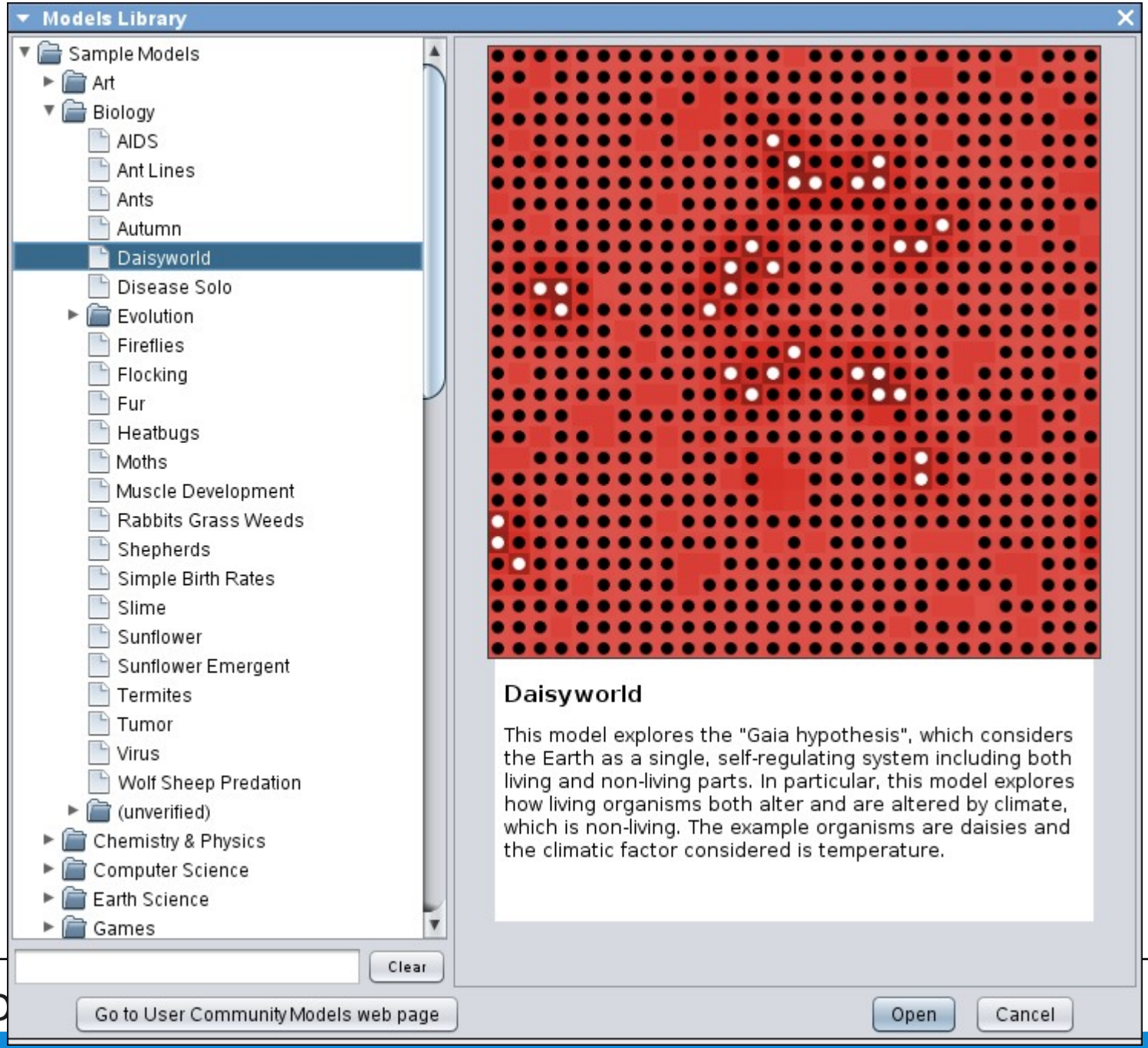
Role of the environment

- Context of the system that steers/shapes adaptation
- Has its own timescales
- Environment is normally considered not to adapt to its content
- At the extreme level however, Lovelock and Gaia theory may suggest otherwise.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Rabbits Grass Weeds
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Simple Birth Rates
Slime
Sunflower
Sunflower Emergent
Termites
Tumor
Virus
Wolf Sheep Predation
(unverified)
Chemistry & Physics
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Daisyworld
This model explores the "Gaia hypothesis", which considers the Earth as a single, self-regulating system including both living and non-living parts. In particular, this model explores how living organisms both alter and are altered by climate, which is non-living. The example organisms are daisies and the climatic factor considered is temperature.
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