

Adaptive Behavior and Objectives

EES 4760/5760

Agent-Based and Individual-Based Computational Modeling

Jonathan Gilligan

Class #12: Monday, September 29 2025

Getting Started

Getting Started

- Download the modified Business Investor model from the class web site, under “Objectives and Adaptations” on the Download page.

- Modified Business Investor Model

https://ees4760.jgilligan.org/models/class_12/business-investor.nlogo

Announcements

Announcements

- Homework assigned for Wednesday, October 1 is **optional**.
 - There will be no more required homework exercises from the textbook except the exercises for your team's team project.
 - From here on, focus on working on your team project and individual project.

Sensing

Sensing

- Options for sensing:
 - Omnisicence: `max-one-of [expected-utility] patches`
 - Neighbors: `max-one-of [expected-utility] neighbors`
 - Limited radius: `max-one-of [expected-utility] patches in-radius 5`
 - Social network: `max-one-of [expected-utility] [neighbors] of out-link-neighbors`
- Context:
 - NetLogo has **four** types of entities:
 1. Patches
 2. Turtles
 3. Links
 4. The Observer

Social Networks and Links

- Links
 - Connect turtles
 - Directed (`create-link-from`, `create-link-to`) or undirected (`create-link-with`)
 - Can have properties (color, thickness, etc.)
- Using links:
 - `my-links`, `my-in-links`, `my-out-links` report agent-sets of **links** connected to a turtle
 - `link-neighbors`, `out-link-neighbors`, `in-link-neighbors` report agent-sets of **turtles** connected to a turtle.
 - **Lots** more you can do with links (read NetLogo dictionary)

Adaptation

Adaptation and Objectives

- Making decisions:
 - Perfect rationality:
 - Pick a goal (objective function)
 - List possible actions
 - Calculate how well each will satisfy goal
 - Choose action that will best accomplish goal
 - Imperfect rationality:
 - Goal may be unclear or inconsistent
 - May not list all possible actions
 - May not calculate results of actions
 - May not act on best option
- Real-life agents may not act rationally

Bounded Rationality

- Perfect rationality and chess ...
 - Evaluating all possible moves may not be possible
 - Limited time, memory, computing power
 - Cost of rationality
 - Getting, processing information
 - It may be more rational to be slightly irrational

Satisficing

- Define goal (objective function)
- Define criteria for *good enough* result
- Evaluate possible actions until the first one that is *good enough*.
 - Do that action.

Business-Investor Satisficing

- If the utility of the current patch is greater than a certain threshold, then it's **“good enough”**
 - If the current patch isn't good enough:
 - Examine other patches the turtle can sense
 - Turtle moves to the first patch it sees with greater utility than the current patch.

More on Objective Functions

- Decisions under uncertainty
 - If you are gambling, what would you try to do?
 - Take a chance to get a very big win?
 - Try to avoid losing money?
 - Balance wins and losses finish with the most money on average?
- Behavioral economics
 - Most economists say rational people will try to get the greatest *expected* wealth
 - Actual people may be...
 - *risk seeking* (take greater chances for big wins)
 - *risk averse* (avoid taking chances)
 - *loss averse* (focus on changes instead of absolute wealth)
 - *regret averse* (try to avoid the feeling that you wish you'd made a different choice)
- Different goals may lead to very different behavior
 - Policy-makers may want to test their policies under different assumptions about people's goals and behavior

Experimenting

Experimenting

- Modified Business Investor Model:
 - You can vary the profits and risks
 - You can vary the sensing:
 - Neighboring patches
 - Patches in a radius
 - Neighbors or patches in-radius of link neighbors
 - You can vary the objective and adaptation
 - Maximize expected utility
 - Satisficing

Download Previous Experiments

- You can download a ZIP file with results from some experiments from the downloads page: [Behaviorspace Experiment Results:](#)

https://ees4760.jgilligan.org/models/class_12/business-investor-experiments.zip

