A Simple Introduction to Agent Modeling:
Tell a Good Story, Build a Good Model

All models are wrong; some models are useful. – G. E. P. Block (English Statistician)

The purpose of computing is insight, not numbers. – R. W. Hamming (Computer Scientist)

If you can’t trust the numbers, you won’t get much insight. – R. M. Panoff (Physicist)

This exercise has three motivations:

• To explore the mental space of expectation, observation, and reflection in science;
• To build a simple model in AgentSheets starting with a good story;
• To realize how much of Nature could have similar, and simple, generating rules.

Even though it may look like a specific recipe for a specific model (how the flu spreads), the steps here are really generally applicable: Thinking, observing, conjecturing, observing, and back to thinking.

Expectation, Observation and Reflection: The process of science comes down to these three basic and very active steps: expectation, observation, and reflection. AgentSheets offers a wonderful way to explore science in a variety of ways, offering a chance to learn how to model from limited input information, to explore emergent phenomena, and to interpret the qualitative and quantitative aspects of a dynamic, visual, interactive model.

Not everything that we will do is written in this handout. That’s because I have no idea what each of you will suggest along the way, and I suppose that it would be more fun to
do what you think of as interesting and fun, than for me to try to get you to do something I might think is fun.

Part of the motivation of this exploration is to change the “sound” of science from, “What is the answer to this question?” to “How many different ways could we explain what we observe, and what does that tell us about the world?”

In agent modeling, there are many modes of action between agents, and we will explore several of these. For example, suppose we wanted to model how a disease is spread (or how predators eat prey, or how atoms interact to become molecules, or how a fire spreads from one tree to another, or how someone’s wallet is “transferred” to another person, etc.). For a disease to spread from one person to another, the story could be:

• If I am sick and I “see” you, I could “change” your state to being sick, or,
• If I am sick and I “see” you, I could “make” you “make” yourself sick, or,
• If I am healthy and sense that you are sick and next to me –or if I see you– I could “change” my own state to being sick or,
• If I am healthy and sense that you are sick and next to me –or if I see you–, I could “make” myself be sick.

All are pathways or processes that in some ways are equivalent, but they are different enough that they support the telling of a different story. Again, the motivation here to is to understand clearly that the story is the basis for the model in science.

AGENT MODELING: The starting point in agent modeling, particularly using AgentSheets, is a well-told story, that is, a story having a rich collection –but not too rich! – of nouns and adjectives and verbs.

Our approach will be to start with the story, analyze the story for its main components, and to identify clear instances that will enable us to build the model in stages, one stage at a time. At each stage we will engage in two thinking explorations:

  a) First, we will make observations to ensure that our model meets our expectations in our story, and we will modify our expectations or our model story until they are in agreement;
  b) Second, we will reflect on how applicable our model at each stage is to serve as a model for other analogous stories in the real world or even in our imagination.

It is important to emphasize that you need to have your story, preferably written down on paper, or on a shared space such as a flip chart, marker board, or file that is projected for all to see. You shouldn’t go, or let your students go, near a computer until you have your story, until you have analyzed the story for its agents, depictions, actions, and stages. Having a written story helps with model specification, implementation, and testing.
Our Story: How Disease Spreads

We are going to explore communicable diseases, that is, a disease that spreads from the infected person to an uninfected person through direct contact, such as the flu or cold.

Here is one possible story:

If a Healthy Person in the World,
While moving randomly in that World,
Is next to any Sick Person, with some (to be defined) percent chance,
Then that Healthy Person will change into a Sick Person.

We first identify the NOUNS. In the story above, what are the “substantial” nouns?

__________________       ______________________

These will be our AGENTS.

Do any of these nouns have adjectives in our story?

____________________ and ____________________ both modify _______________

These will be the depictions (what something looks like) of our ______________ agent.

Are there any Active Verbs in our story?

___________________ and ______________________

These will define the ACTIONS of the _____________ agent.

We will build this model in stages, observing and reflecting at each stage and comparing to our expectations, and if the model needs to be improved, we’ll go back each time and change our story first. We will also think about other stories that our model models as we implement things along the way.
From Story to Model in AgentSheets:

Some of us have found it useful to explain to students, to prepare their expectations, the steps in building a model once you have a story. We want to emphasize the priority of the thinking that goes into the story that comes to life in the model.

The Basic Steps in AgentSheets:

We will create a new project.
We then select an appropriate size for the agents,
We then create each agent, and
We will make different depictions for the agents, keeping the initial depictions simple
We will then create a worksheet and place the agents in the worksheets.
We will test the model and see how it behaves, and then
We will modify the behavior of the agents and test again at each stage.

We will pause at each stage and reflect on what we have observed, how it compares to your expectations, and then go through “modify behavior, test” phase again. And again!

When we decide we want a better model, we will start by modifying our story, then implement the changes, test, and cycle again: Expectation, Observation, Reflection.

Re-sizing of the Agents:

If there is time, we will explore how the same model “looks” different based on the size of the agents, and how you can explore this variation once you have one version of the model that is working.