



Creating “Contagion” with AgentCubes Online

A virus is infecting your world. As people move randomly and come face to face with a sick person, they too become sick. Learn how illnesses can spread through this simulation.

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Vocabulary/Definitions

- Agent Attribute**.....a named value-holder or local variable belonging to an agent, which can be assigned different values. Scent and sick_clock are agent attributes.
- Algorithm**a set of instructions designed to perform a specific task.
- Broadcast**A way for agents to communicate with other agents that are not adjacent to them - agents broadcast (or send out) a method name, telling other agents to check the rules in that method. The method referenced in the broadcast must be defined in the receiving agents' set of methods.
- Diffusion**the process in which an attribute like scent that belongs to a group of agents such as ground agents changes its value, being larger near its source and smaller farther way from its source
- Immunity**to keep yourself from being affected by a disease
- Increment**to increase by one
- Hill Climbing**a specific form of searching/seeking algorithm, by which the seeking/searching agent checks the values of an agent attribute belonging to another agent.
- Method**.....a set of rules to follow when an agent must make a decision.
- Randomly**to occur in non-systematic ways
- Rule Order**the order in which rules are placed for each agent
- Simulation Property**.....an attribute (value) accessible by all agents.

Student Handout 1B: Very Basic Contagion

(No ACO Experience)


You will be modeling or simulating the spread of a disease. You will begin with a simple model and then make it more realistic.

In this first model, we have a very basic world. Healthy people and sick people walk around. If you are healthy and next to a sick person, you might get sick. If you are sick, you might recover and become healthy again.

Talk with a partner, and answer these questions:

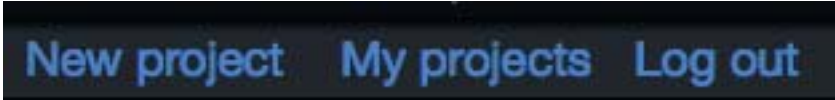
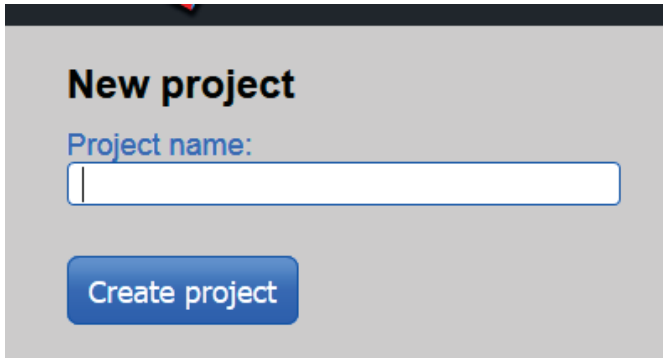
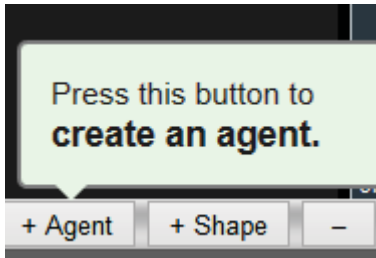
1. What agents are needed? Think about these agents. Do you need different agents for healthy/sick people, or one agent (people) with two shapes (healthy/sick)?
2. What actions will they have?

Once you have a plan, begin to make the simulation. If you need more help, look at the following pages for directions.

Once your simulation is programmed correctly, use the single step control  above the world to run it one step at a time and see what happens.

- What happens when you increase the percent chance of getting sick to 100%? What would this mean in real life?
- What happens when you decrease the percent chance of recovering to 0%? What would this mean in real life?
- What probabilities for getting sick and recovering seemed most realistic?
- Does the simulation end?
- How can you tell how many agents get sick? Die? Recover? Are there ways to use programming to help you do this?
- Do sick people move? Should they?
- In what ways is this a realistic simulation? In what ways does this simulation **not** match what really happens?

Part 1: Create Agents

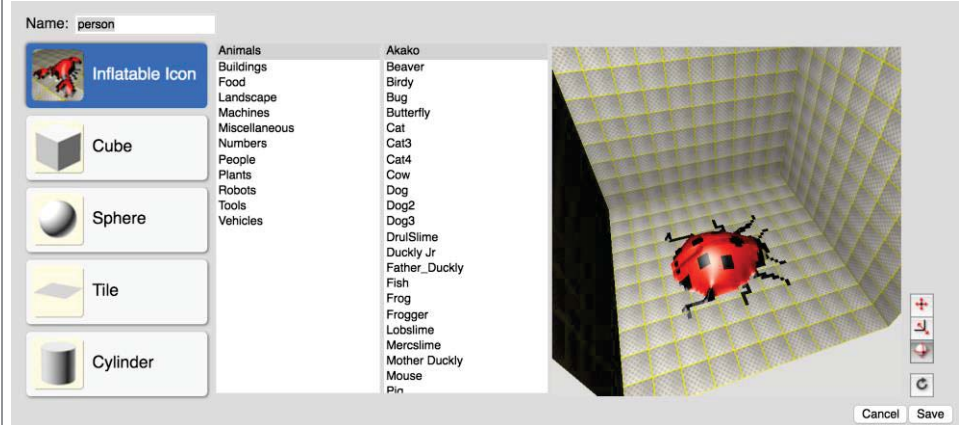
<p>Step 1: Create Simulation</p>	 <p>Go to https://www.agentcubesonline.com/ If you have an account, click on the Login link. If not, click on the Sign up link.</p> <p>After you login, click on the blue “New project” link below your login name.</p>
<p>Step 2: Name the Simulation</p> <p>Name it Contagion and click Create project.</p>	
<p>Step 3: Create Agent</p> <p>Click on New Agent at the bottom left of the AgentCubes Online window.</p>	

3D-Contagion (Continued)

Step 4:

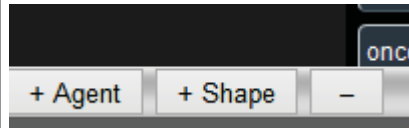
Name agent
“Person”

Simply choose any
inflatable icon and
click OK.



Step 5:

Select “Person”
from the agent list
on the left, and click
“+Shape” button at
bottom left of
window.



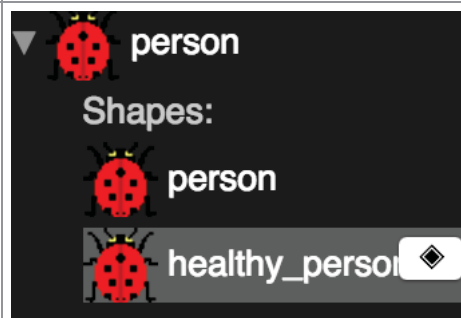
Step 6:

Now we will make
the shape for a
healthy person so
name the shape
healthy_person.



Step 7:

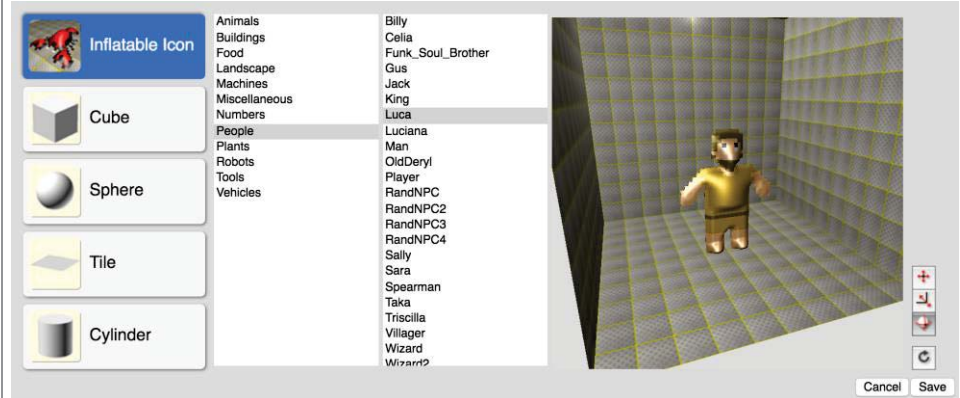
Using the drop
down menu under
“Person” on the left,
click on small box
next to
healthy_person



3D-Contagion (Continued)

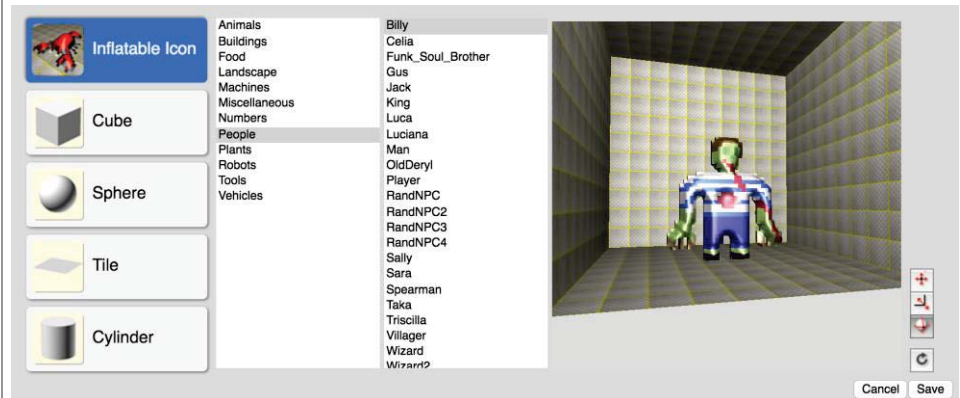
Step 8:
Pick a person from the inflatable icon people list to be your healthy person.

Luca or Sally are good choices.

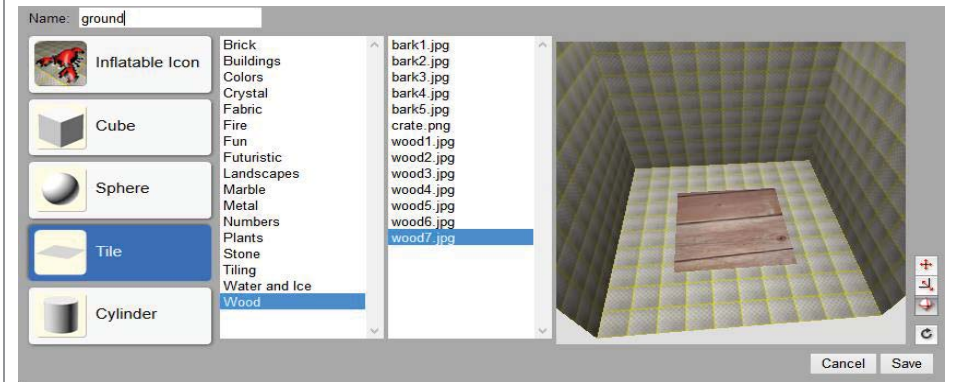


Step 9:
Make a sick person shape for your person.

Use the zombie Billy or color your healthy person green or red so you can clearly identify the sick person.



Step 10:
Click +Agent to create a new agent to be the ground. Select any Tile and name it "City".



Part 2: Create the World

Use these tools to build your world:



The Select Tool is used to move agents or check an agent attribute.



The Pencil Tool draws a single agent on the world.



The Dotted Rectangle Tool puts an agent in every grid square inside the rectangle made by selecting tool, clicking on the world and dragging.



The Eraser Tool erases agents from the world.



The Hand Tool is used to call a method created by the programmer.

The world is the simulation space where the agents perform their actions.

Step 1: Make your world.

Use the Dotted Rectangle tool to put a layer of city tiles on the world.

Use the dotted rectangle tool to draw a group of healthy people on the world.

Use the eraser to erase a healthy person in the middle of the group and then use the pencil to draw a single sick person in the middle of the group.



Click on the Save button when you have your world set up the way you like.



Once you save your world, you can use the

reset button



to return your world to the saved state.

Now that you have created a world, use the 3D tools to move your world around so that you have a 3D view of it rather than a bird's eye view looking down from above.



The ball tool tilts and rotates your world until you see a 3D view like this picture.



The pan tool moves your world around in the window.



The zoom tool zooms in and out on your world.



Save Your World again!

Part 3: Program the Agents

Click on an agent from list of agents on the left side of the AgentCubes window, and you will see the methods and rules that control its behavior in the window below the world.

<p>Step 1: Create Rule 1</p>	<p>Rule 1: If you SEE that you are healthy and you next to <u>at least 1</u> sick person with a 50 percent chance, then get sick.</p>
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Why should you use next-to ≥ 1 person?

- Should a healthy person who is next to 2 sick people get sick?
- Should a healthy person who is next to 1 sick person get sick?


Since both these situations should be true, use next-to ≥ 1 sick person, which means next to AT LEAST ONE (and maybe more) sick persons.

<p>Step 2: Create Rule 2</p> <p>Program the words in bold type!</p>	<p>Rule 2: You did not get sick so If you see that you are healthy, then move random on the city tiles.</p>
<p>Step 3: Create Rule 3</p>	<p>Rule 3: If you see that you are sick, with a 50 percent chance, then get well.</p>

Student Handout: Using Simulation Properties

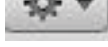
What if we want to look at different percentages to see how the model changed? For example, some diseases like colds, which are spread by coughing and sneezing, pass easily from person to person so there is a big chance that an exposed person will get sick. Other diseases are not transmitted as easily so there is a smaller percent chance that an exposed person will get sick. That's difficult to model when the percentage is built into the code. We can fix that by using simulation properties. Simulation properties (or global variables) are variables that are accessed by all the agents in the simulation. We will use these variables in the percent-chance conditions because it is easy to change the value and different diseases can be modeled.

For example, rather than include a number percent in the code, use **@Get_sick** in the percent

condition  to represent the probability of a healthy person becoming sick when next to a sick person. **Remember that the @ symbol must be used in front of the simulation property name in order to access its value.**

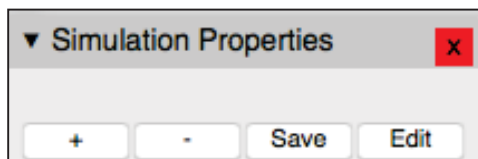
Follow these steps to create and save the Get_sick Simulation Property:

Step 1: Create a global variable.

Open the simulation properties. Click on the Gear button  in the top bar of the AgentCubes Online window, then choose Show Simulation Properties.

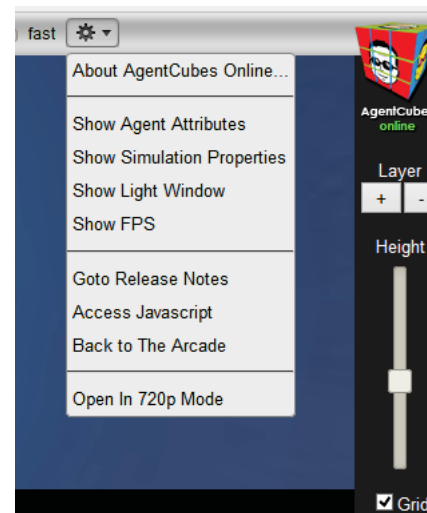
Step 2:

Click on the + button in the Simulation Properties window.



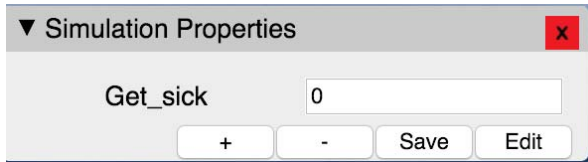
Step 3:

Name the property Get_sick.



Step 4:

Select the Get_sick property and click on the Edit button.

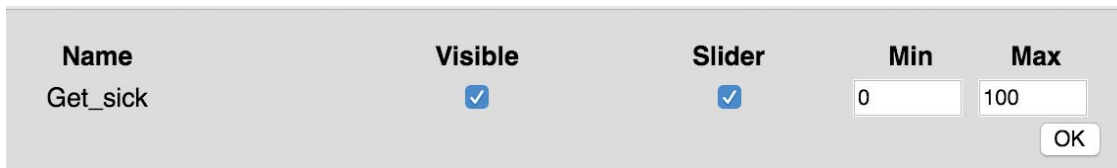


Simulation Properties:

Simulation properties are simply variables. In math, we often use x and y as our variables. Sometimes, if we are talking about girls and boys, we might use g and b as our variables to help us keep track of which item each variable represents. In programming, rather than using a letter, you can use a word, like Get_Sick. This makes it very easy to track each variable.

Step 5:

Click the slider button and set the max value to 100.



Step 6:

Now the value of Get_sick can be changed to any number from 0 to 100 by using the slider.



**Save your Simulation Property now
or it will not be there next time you open the project!**

Follow these steps to create the other simulation property that is useful in the contagion simulation:

Recover = probability that a sick person will recover.

The values of this simulation property must be between 0 and 100.