

## Practical 1

**AIM :** Design and develop agent based model by

- Creating the agent population
- Defining the agent behavior
- Add a chart to visualize the model output.

[Use a case scenario like grocery store, telephone call center etc. for the purpose].

### Scenario :

Here, We are going to create an Agent Population in 2D and Define there behaviour. Consumers initially are not using any products. Then eventually the growth in the use of the product is been shown visually by the use of Charts.

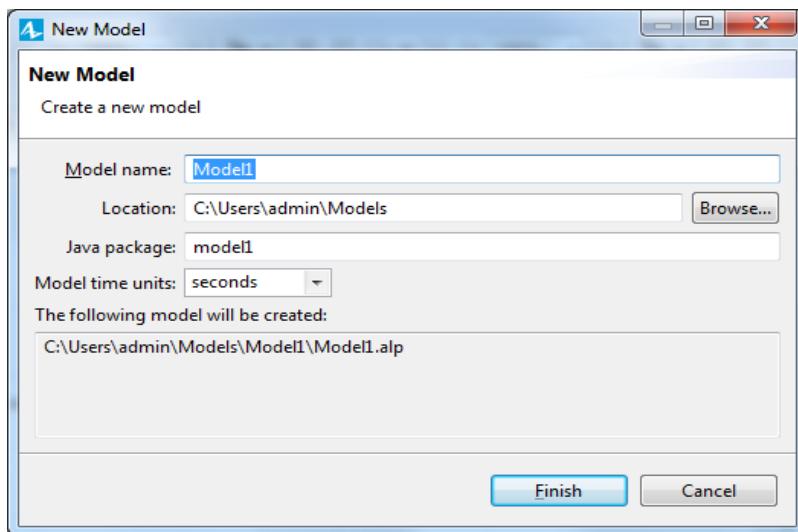
- Phase 1. Creating a simple model Market to create the Agents Populations.
- Phase 2. Define the Agents behavior & study under each circumstances.
- Phase 3. Adding a chart to visualize the use of product by the consumer.

### Solution:

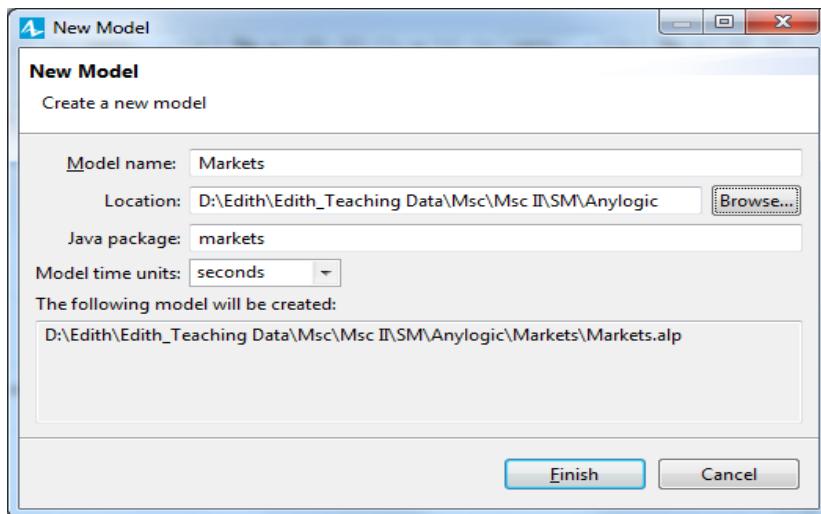
**Step 1 :** Close the Welcome page, and create a new model by selecting **File > New > Model** from AnyLogic's main menu.

**Step 2 :** The **New Model** wizard will open.

In the **Model name** box, enter the new model's name: Market.



**Step 3 :** In the **Location** box, select the folder where you want to create the model. You can browse for a folder by clicking **Browse** or type the name of the folder you want to create in the **Location** box.

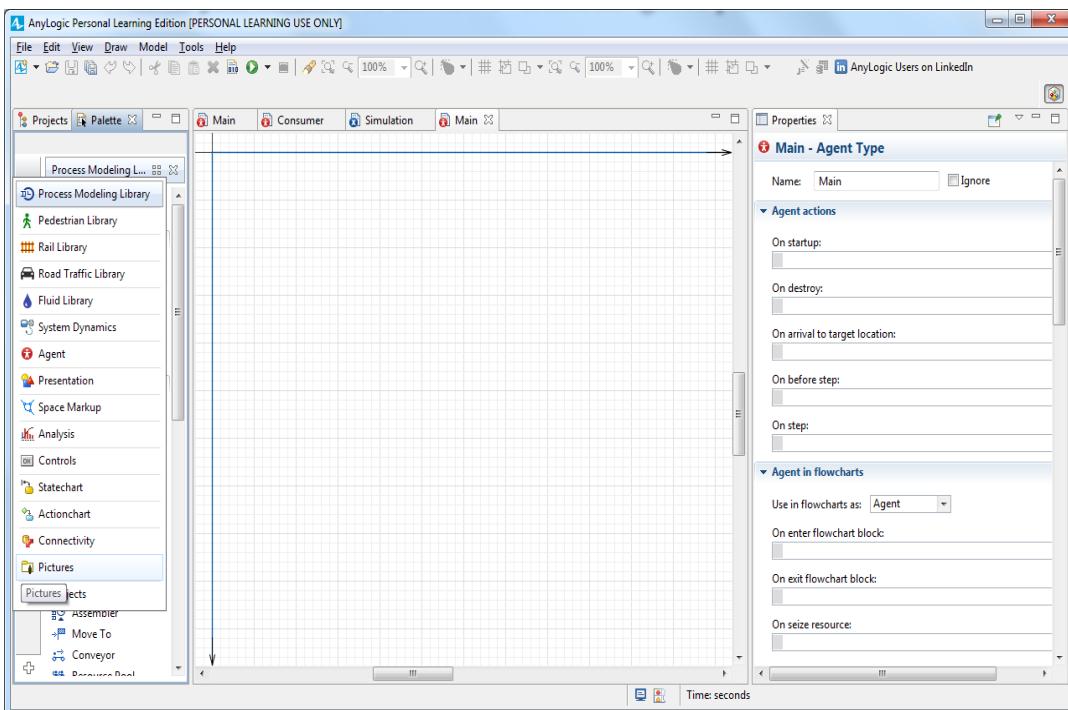


**Step 4:** Click Finish

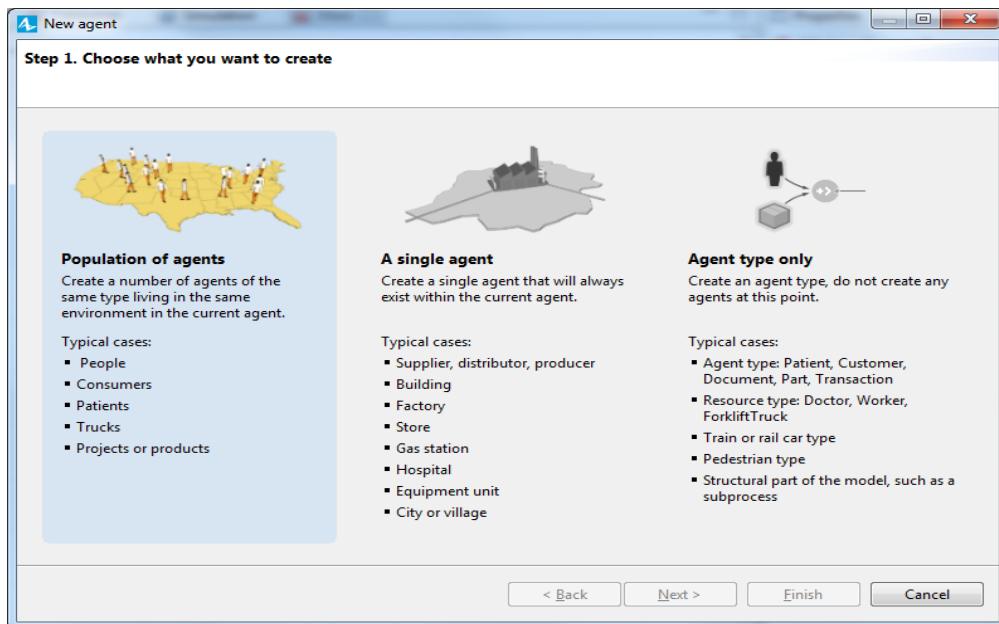
#### ➤ Creating the agent population :

Our model has one agent type, Main. To add consumers, we'll need to create an agent type to represent consumers, and then create an agent population made up of instances of this consumer agent type. With the help of **New agent** wizard agents can be created.

**Step 1 :** Click the **Palette** tab

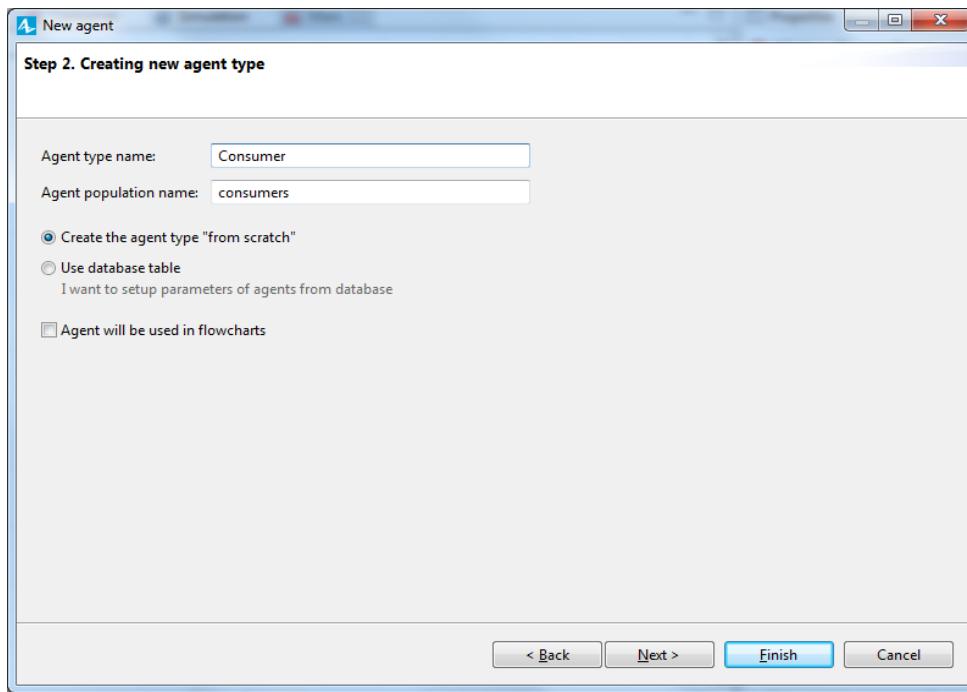


**Step 2 :** Drag the **Agent** from the **Agent** palette on to the Main diagram, and the **New agent** wizard will open.



**Step 3 : Choose what you want to create** page - select **Population of agents**, Since we want to create multiple agents of the same type and click **Next**.

**Step 4 : Creating new agent type** page - in **Agent type name** box, type Consumer. The information in the **Agent population name** box will automatically change to consumers and click **Next**.



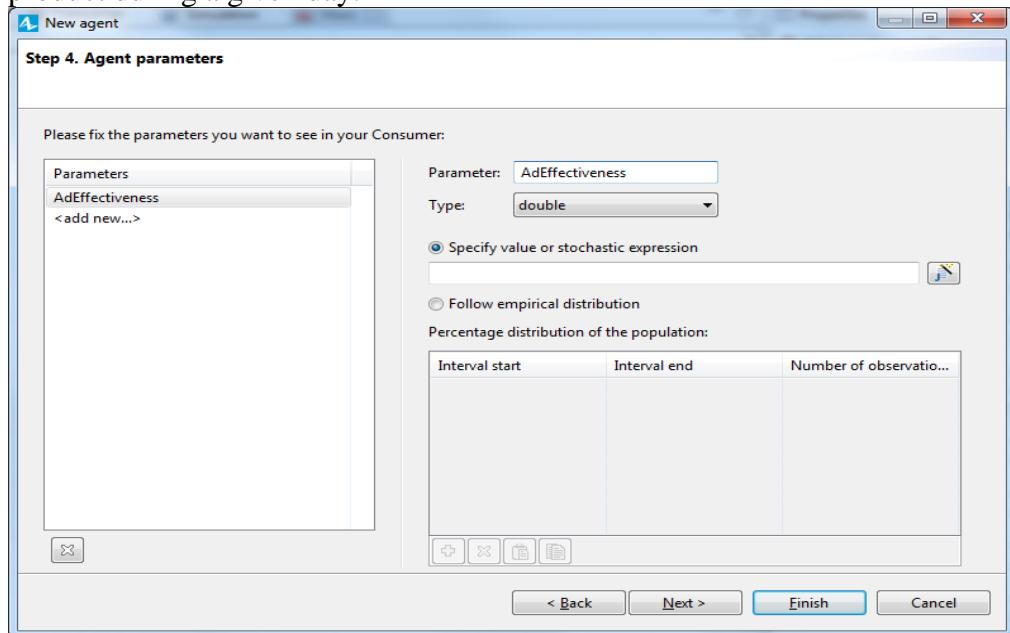
**Step 5 : On the Agent animation page,**

- choose the agent's animation shape - choose **2D**,
- select the **General** list's first item: **Person**, and click **Next**.

**Step 6 : On the Agent Parameters page**, define the agent's parameters or characteristics.

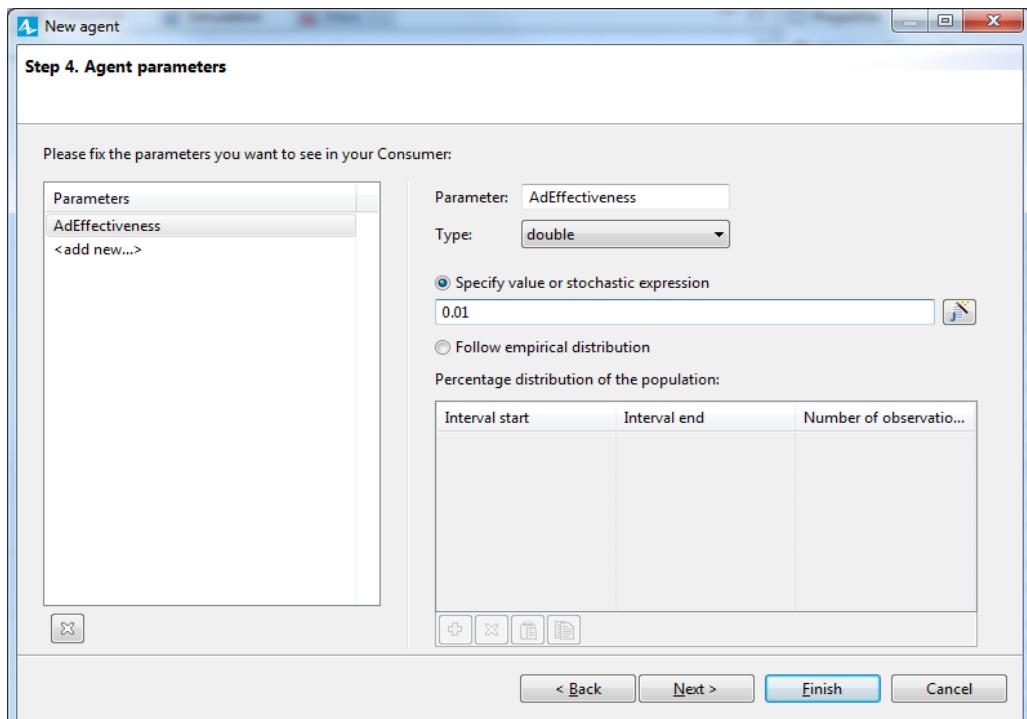
to create a parameter “AdEffectiveness” : On the left section, in the **Parameters** table, click <add new...>

AdEffectiveness - to define the percentage of potential users who become ready to buy the product during a given day.



**Step 7 :** In the **Parameter** box,

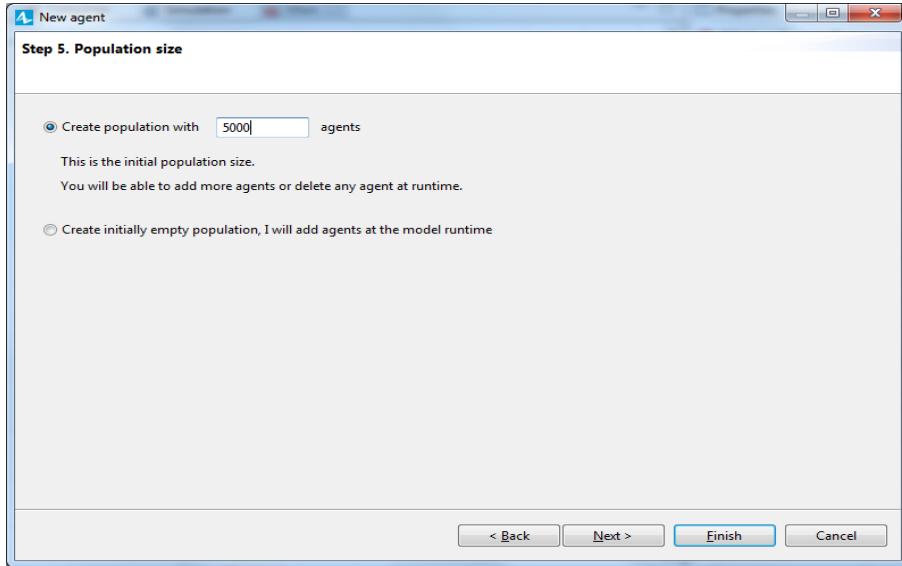
- change the default parameter’s name to AdEffectiveness,
- choose **double** as the parameter **Type**.
- specify 0.01 as the parameter’s value (We’ll assume an average of 1% of our model’s potential users will want to buy the product during a given day.)



Click Next.

### Step 8 : On the Population size page

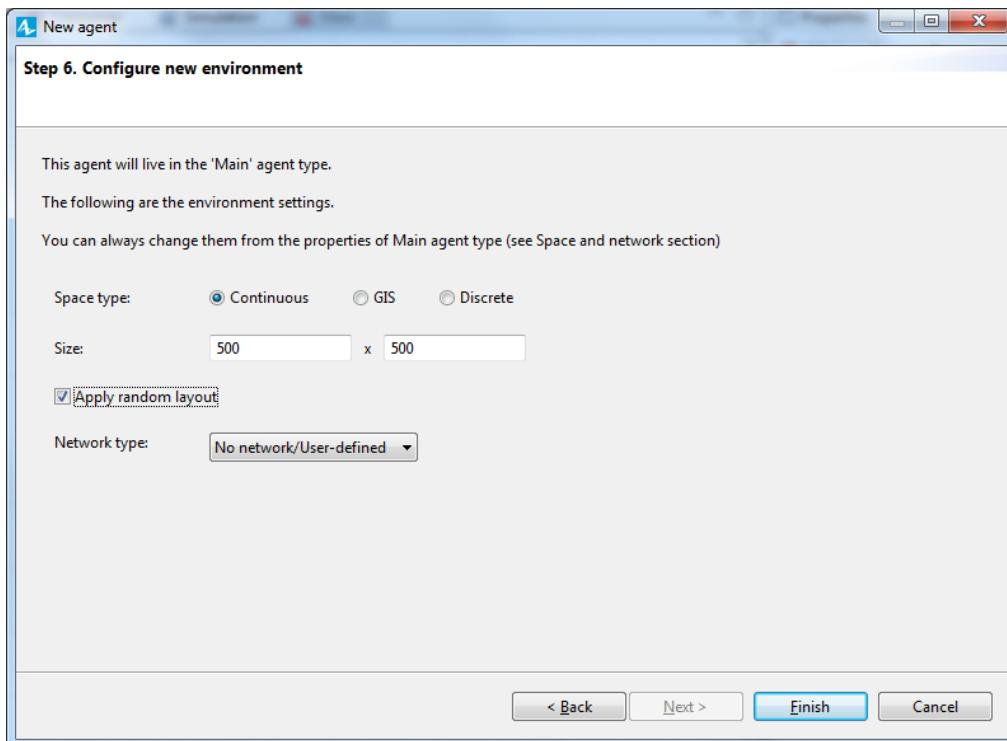
- type 5000 in the **Create population with agents** box - to create 5000 instances of the Consumer type. Each instance in the population will model a specific agent-consumer.



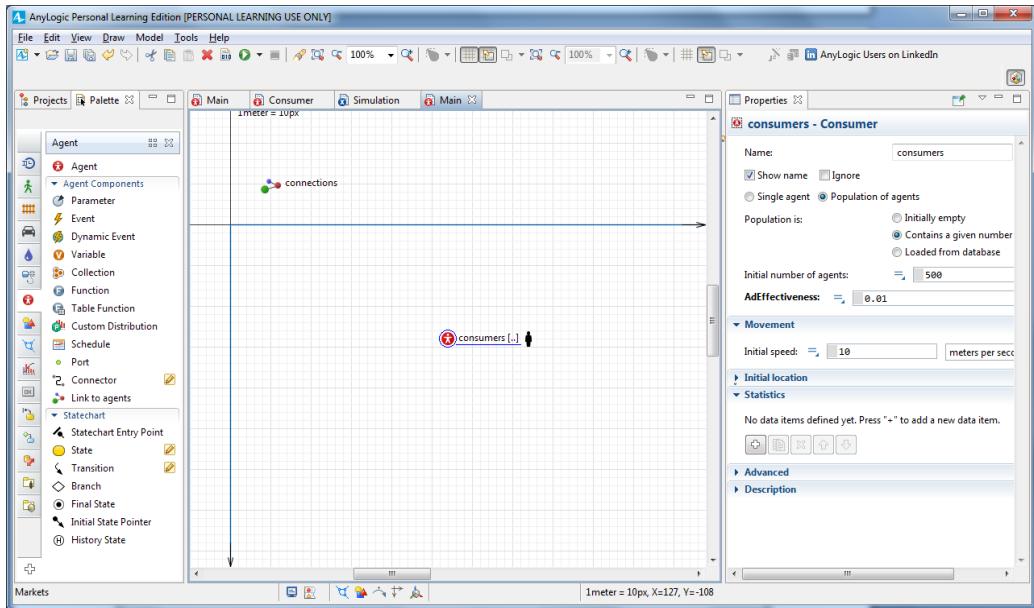
Click Next.

### Step 9 : On the Configure new environment page,

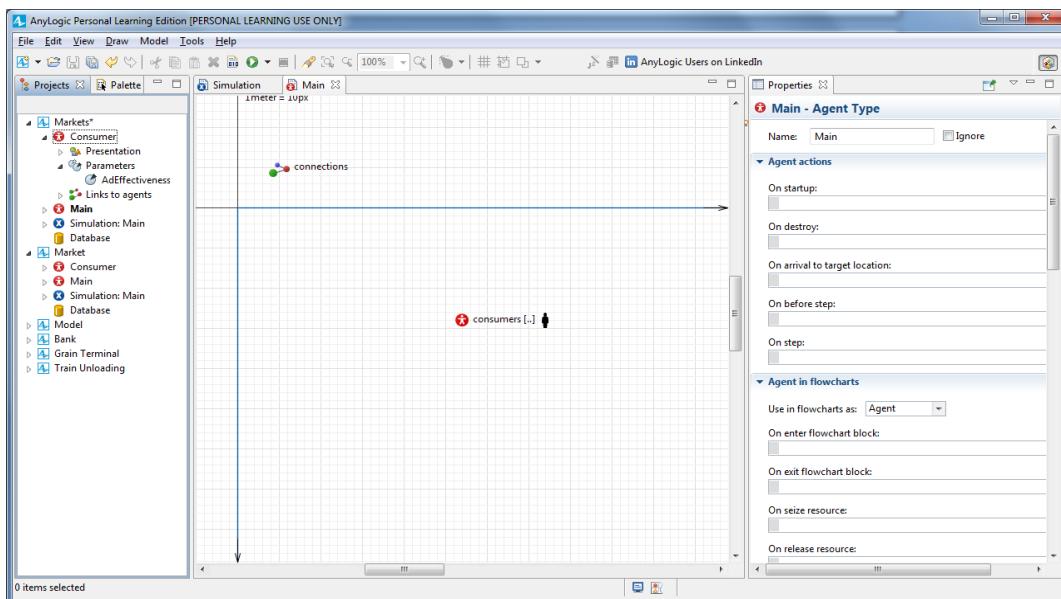
- accept the default values for the environment's space type(**Continuous**) and both its **Width** and **Height** values (500).
- Select the **Apply random layout** box to randomly distribute the agents
- accept the default **No network/User-defined** network type. (Since we don't want to create an agent network)



Click Finish.



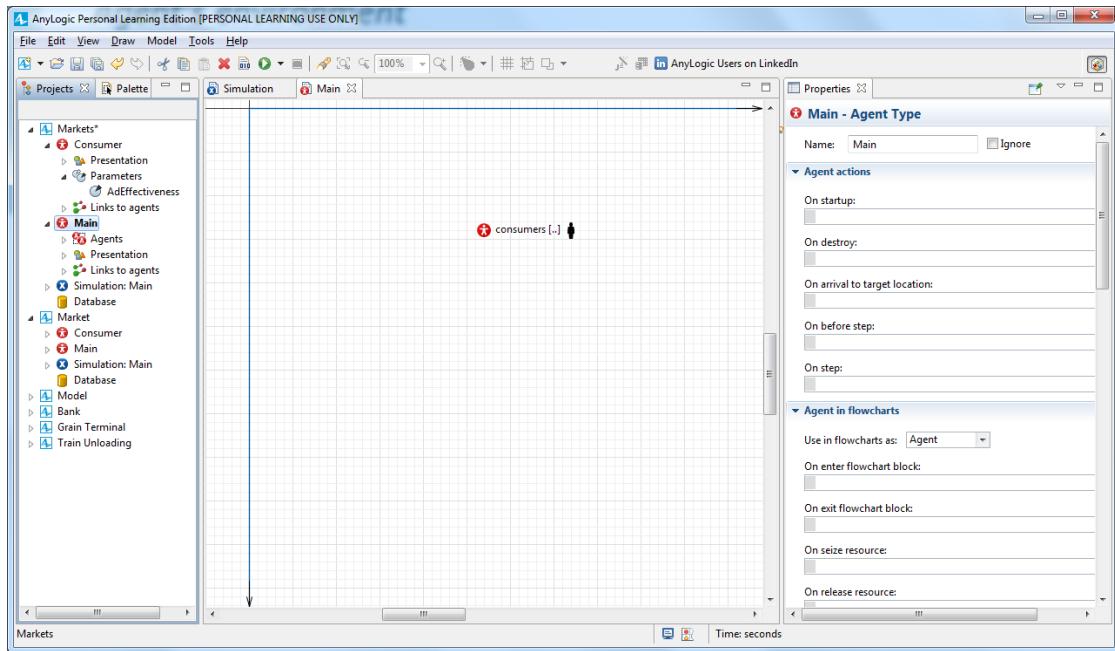
**Step 10 :** Click on **Project** tab – View and Expand the New Element created.



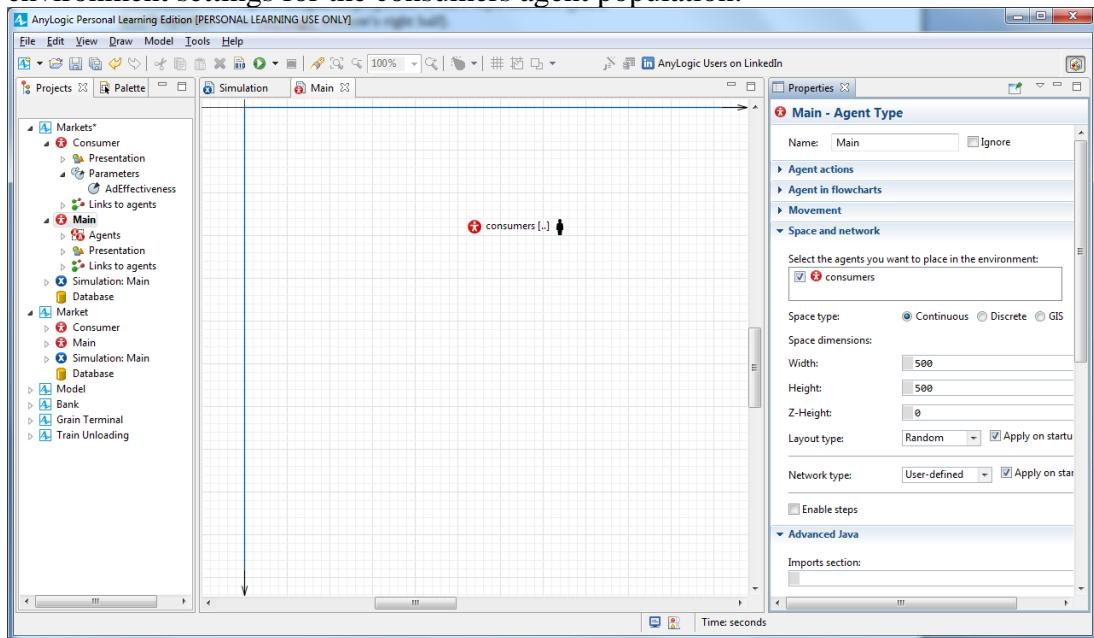
Our model now has two agent types: Main and Consumer.

- The Consumer agent type has the agent's animation shape (person, in the **Presentation** branch) and the parameter AdEffectiveness.
- The Main agent type contains the agent population consumers (set of 5000 agents of type Consumer).

**Step 11 :** Click **Main** in the **Projects** to open its properties in the **Properties** view on the right side.

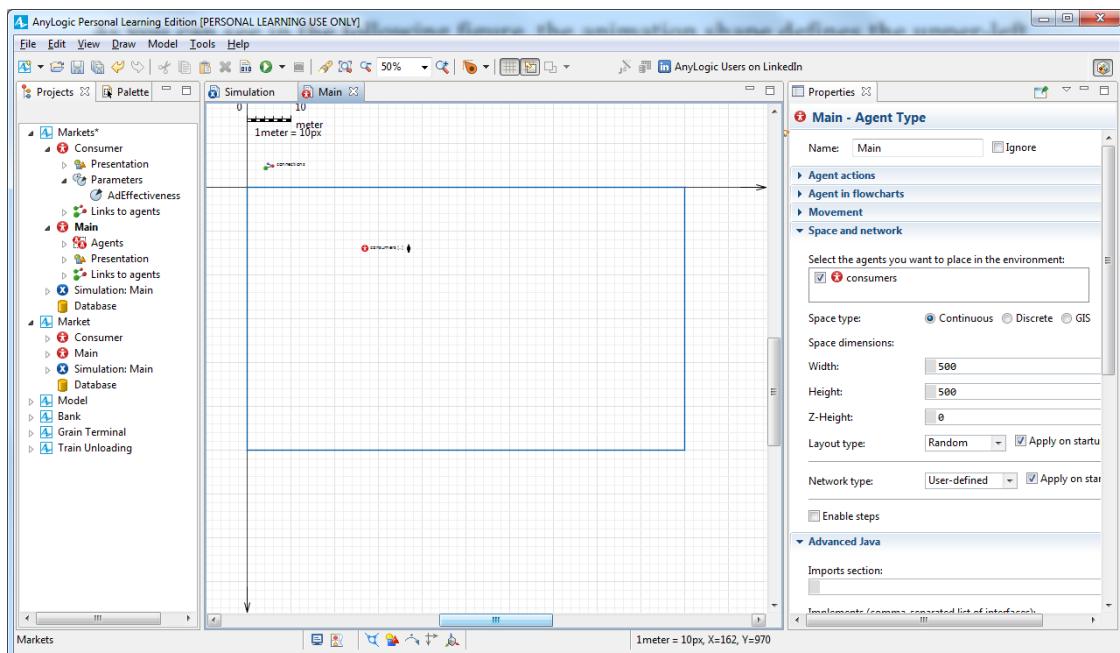
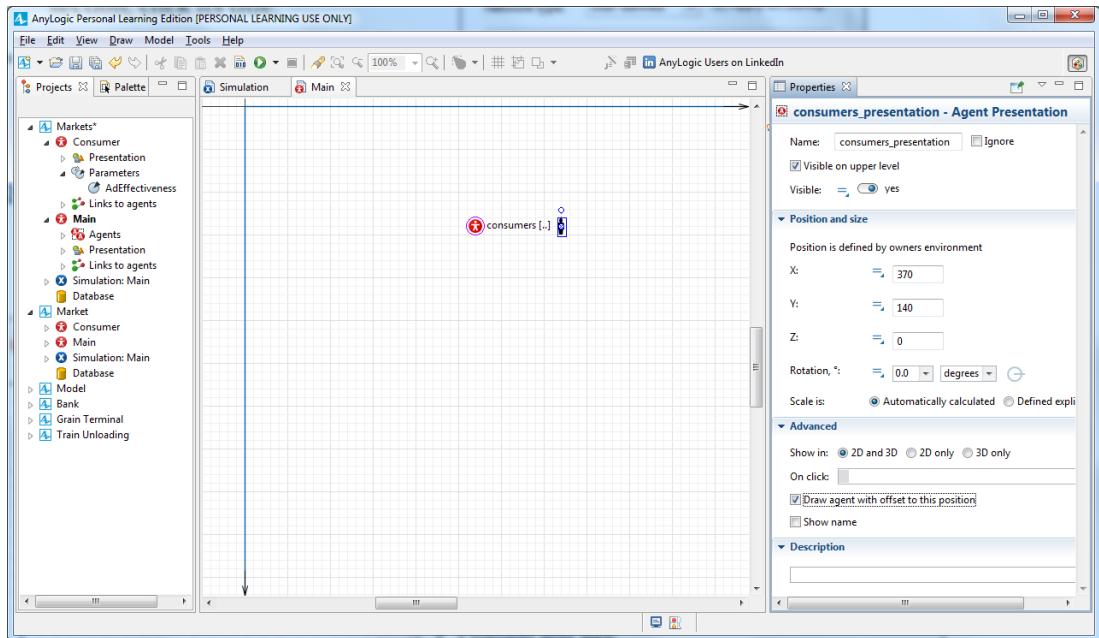


**Step 12 :** In the Space and network section of Main properties, you can adjust the environment settings for the consumers agent population.



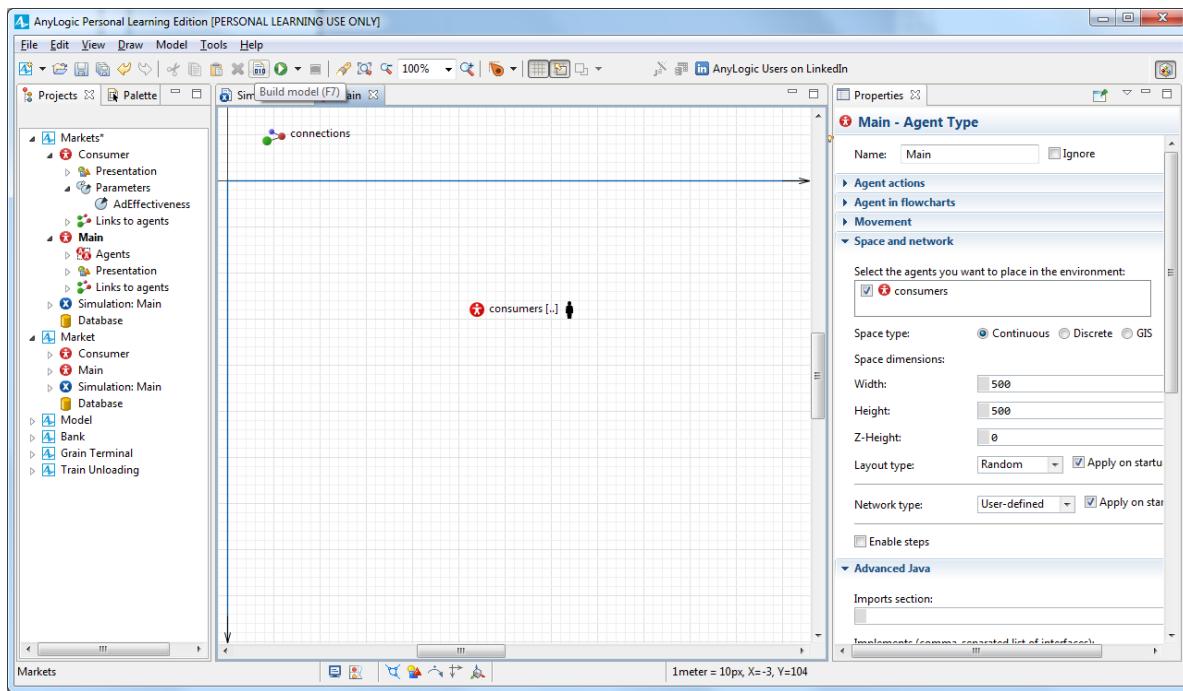
**Step 13 :** On Main diagram,

- select the agent population's non-editable embedded animation shape ,
- open the **Advanced** properties section, and
- select the **Draw agent with offset to this position** option.

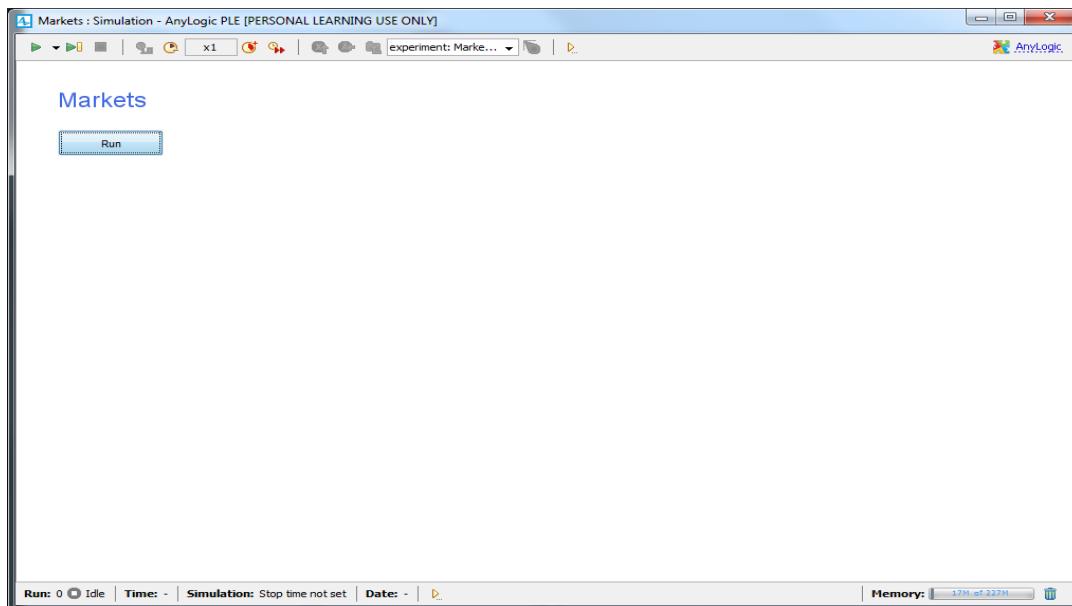


We've finished building this very simple model, and you can now run it and observe its behavior.

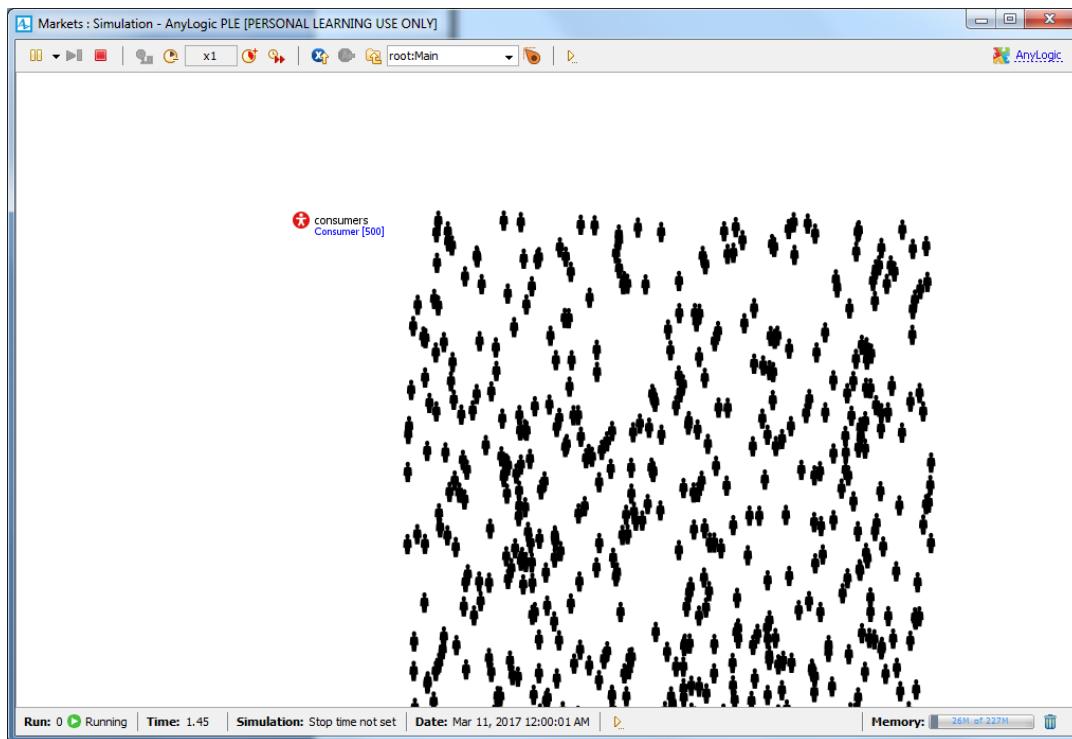
**Step 14 :** On the toolbar, click the **Build** button to build the model and check it for errors.



**Step 15 :** Locate the **Run** button, and click the small triangle to the right. Select the experiment you want to run. Choose **Markets / Simulation** from the list.



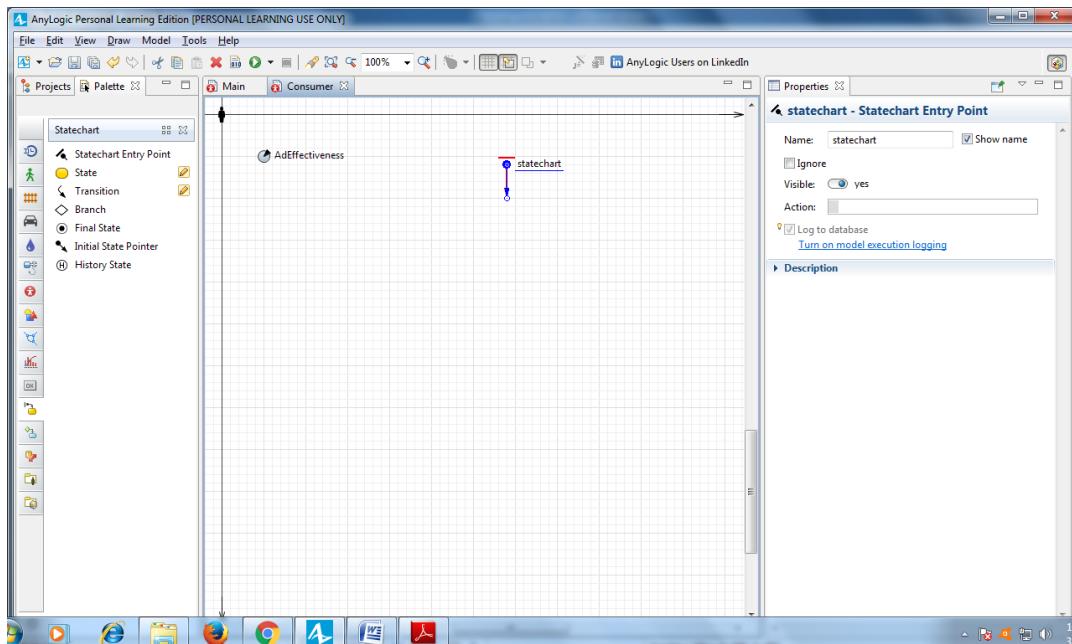
**Step 16 :** Click the **Run** button to run the model.



## ➤ Defining a consumer behavior

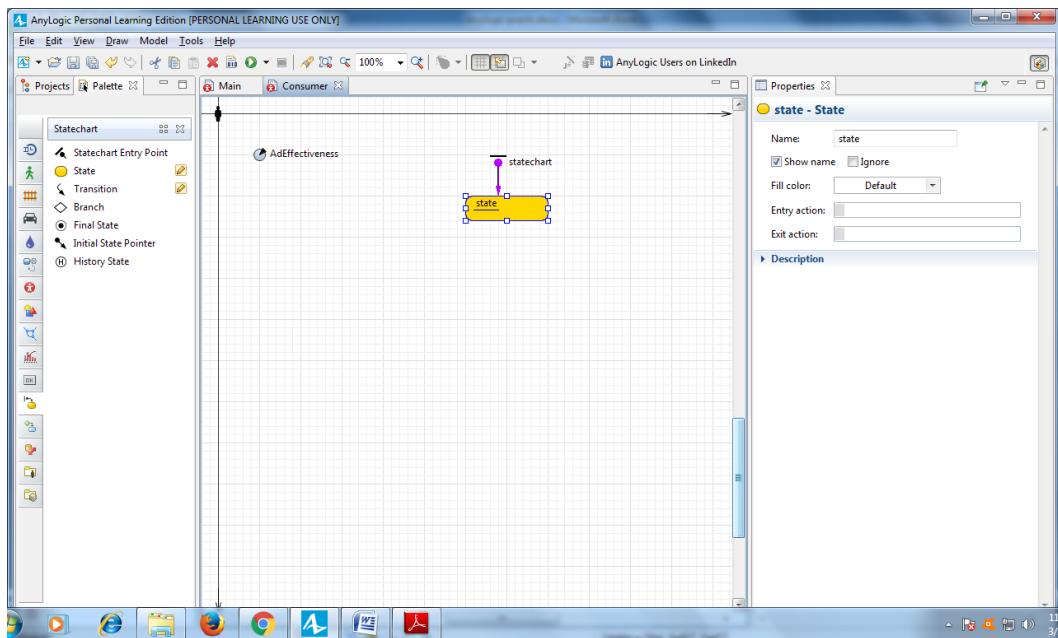
### Step 1 : from the Statechart palette

- Drag the **State** on to the graphical diagram.
- connect it to the statechart entry point.

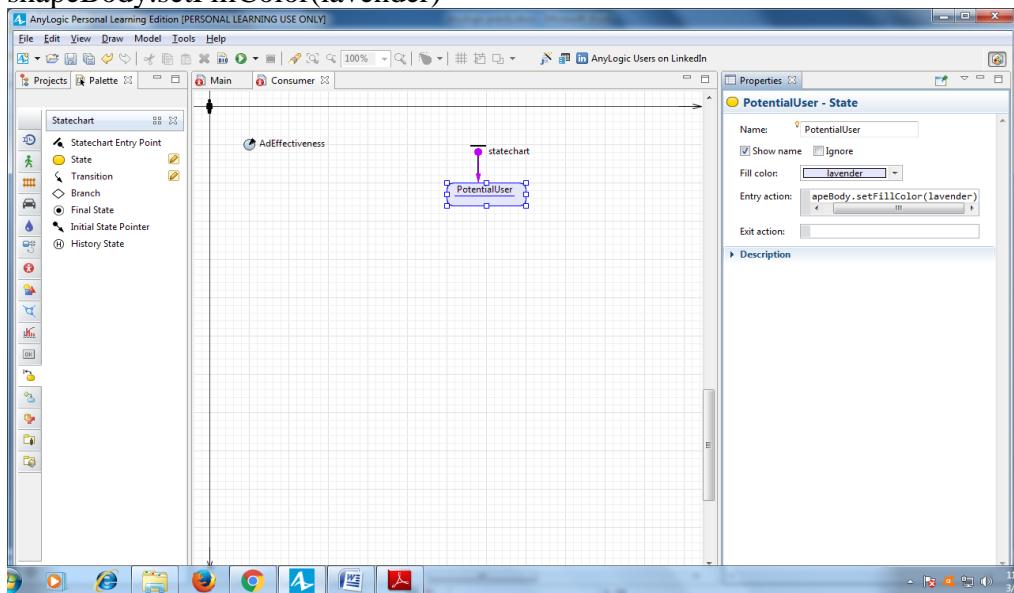


### Step 2 : Select the state in the graphical editor, and modify its properties.

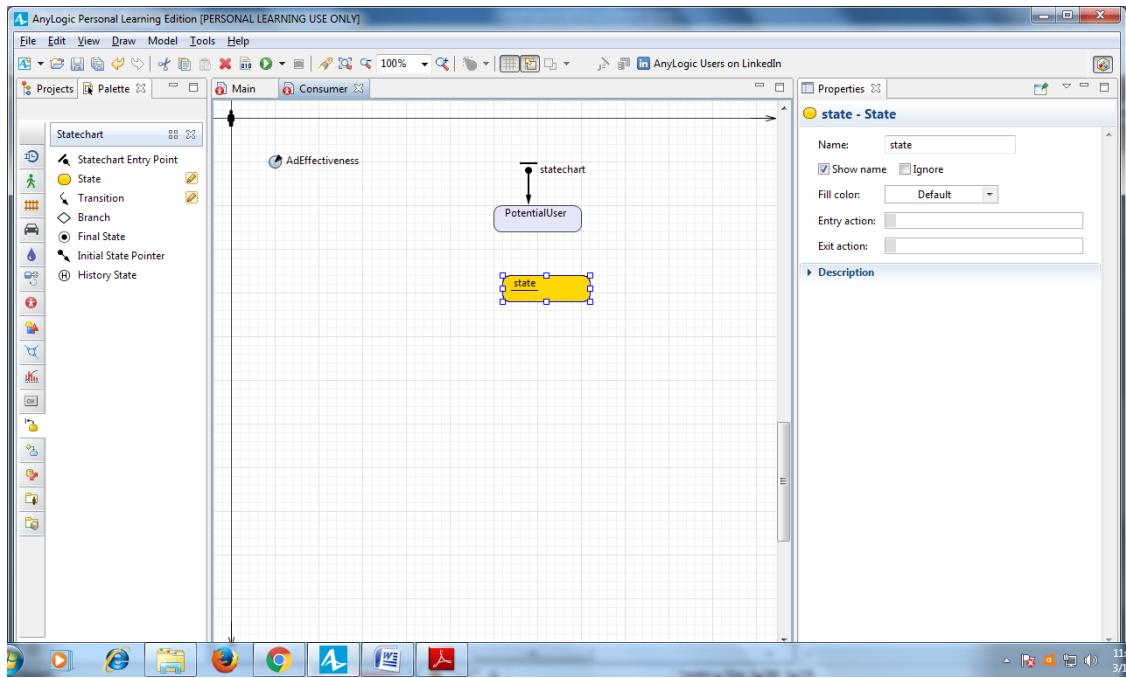
- Name the state PotentialUser.



- Use the **Fill color** control to change the state's color to lavender
- Type the following Java code in the state's **Entry action** field:  
shapeBody.setFillColor(lavender)



**Step 3 :** Add another state in the consumer's statechart:

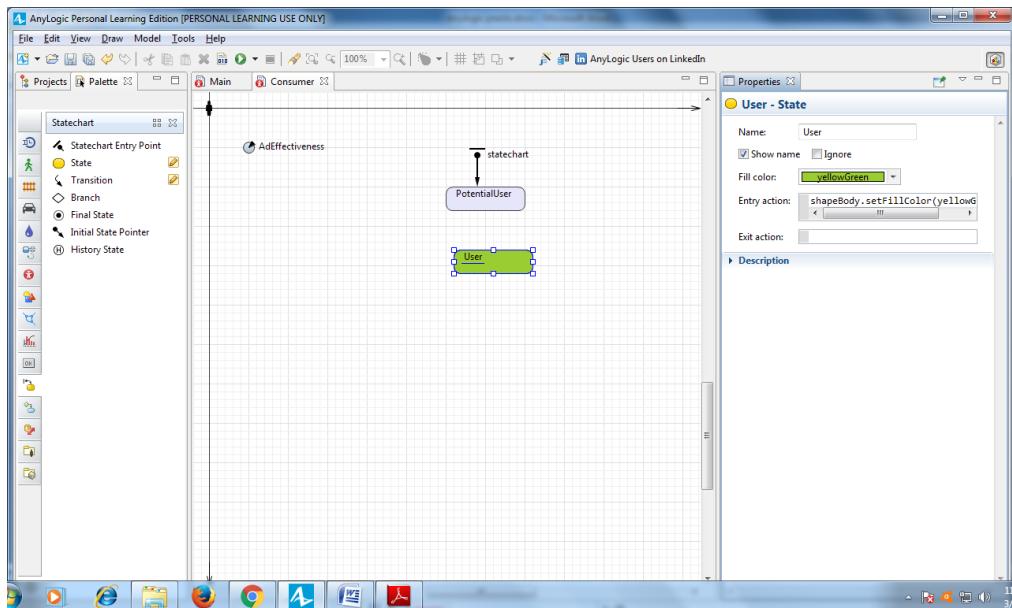


**Step 4 :** Modify the state's properties like you did earlier:

**Name:** User

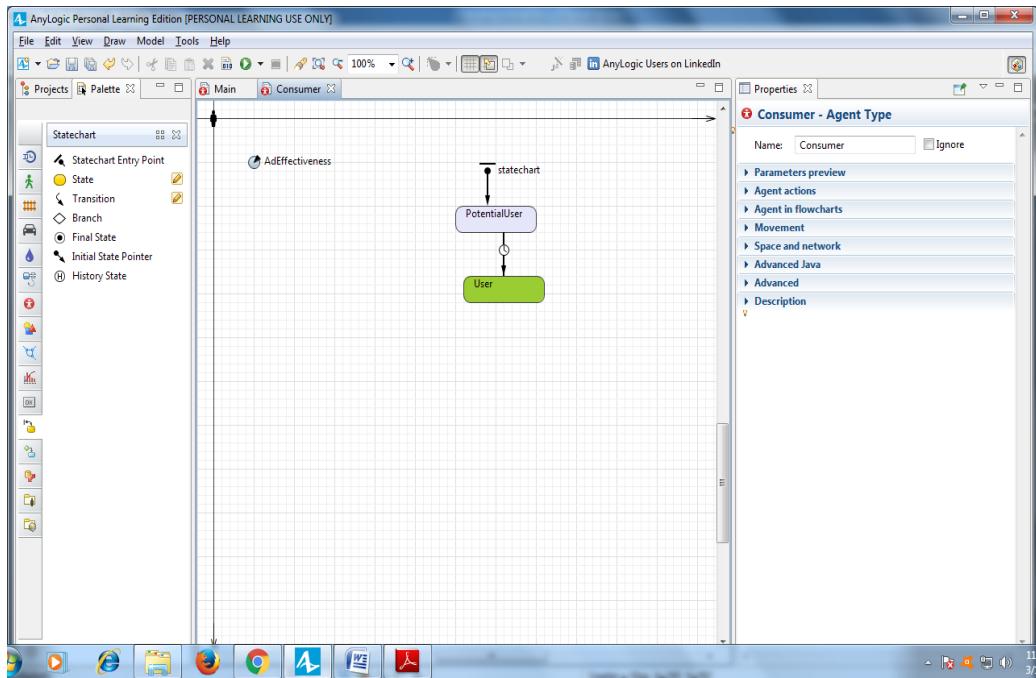
**Fill color:** yellowGreen

**Entry action:** shapeBody.setFillColor(yellowGreen);



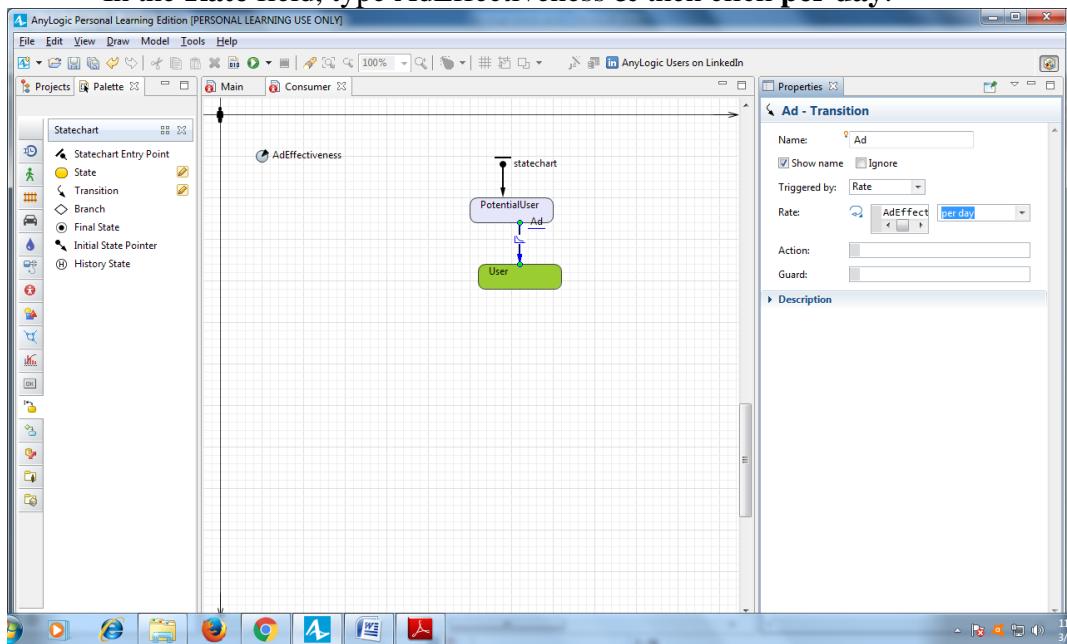
**Step 5 :** Draw a transition from PotentialUser to User

double-click the **Statechart** palette's **Transition** element - click PotentialUser state, and click User.



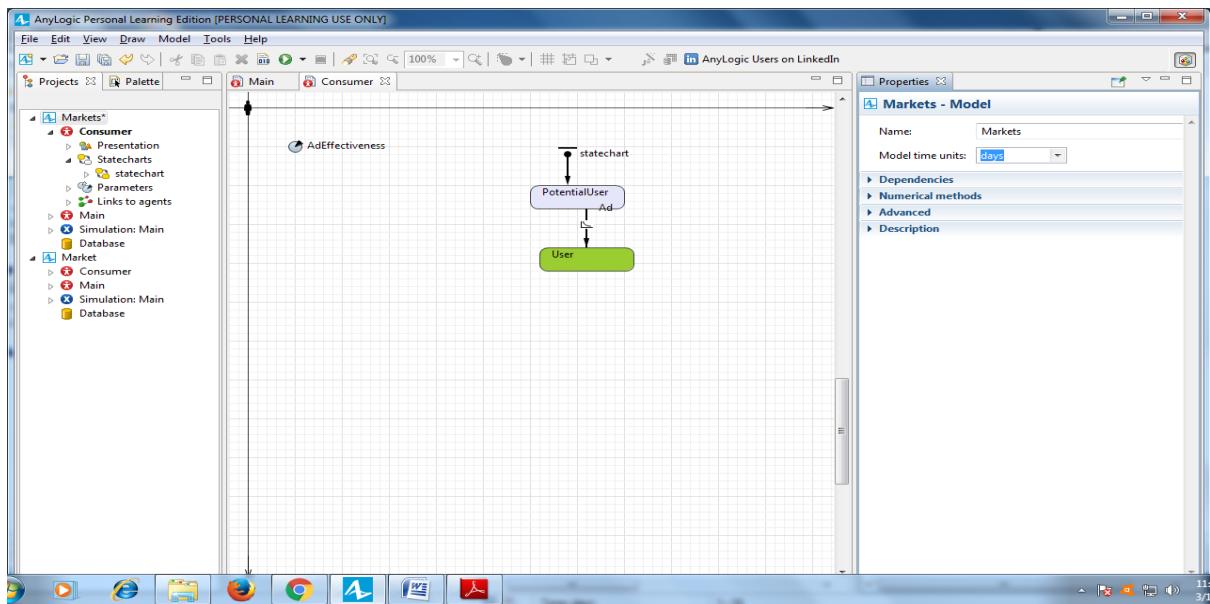
### Step 6 : Transition Properties –

- Name the transition Ad to represent “advertising”.
- Select the **Show name** checkbox to display the transition’s name on the graphical diagram.
- In the **Triggered by** list, click **Rate**.
- In the **Rate** field, type **AdEffectiveness & then click **per day****.



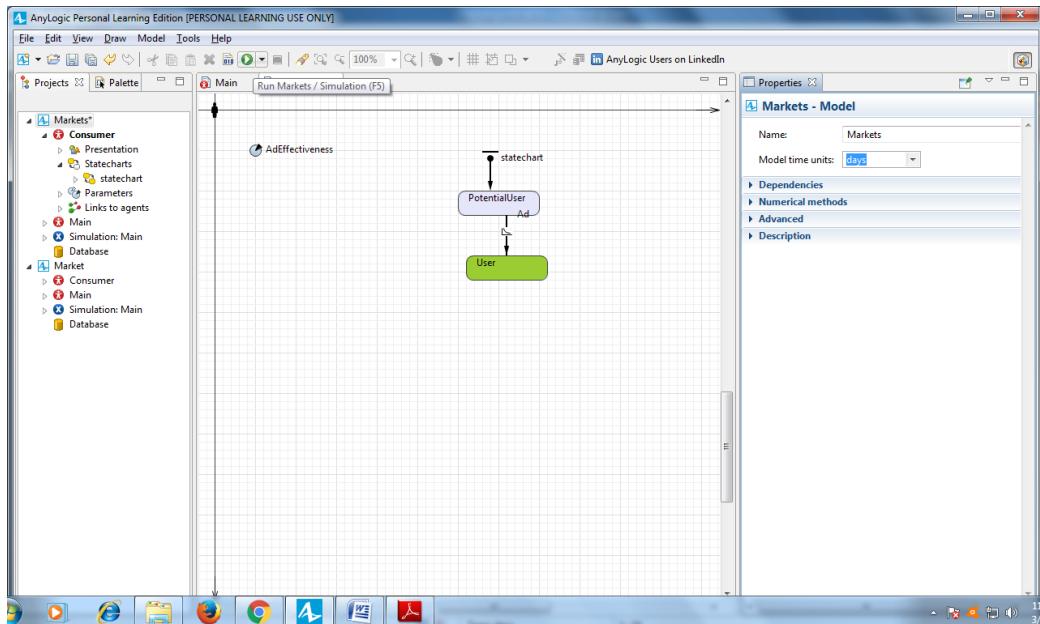
### Step 7 : set up the model's time units.

- switch from **Palette** to **Projects**
- then click the model item in the tree .
- In the **Properties** view, choose **days** as the **Model time units**.

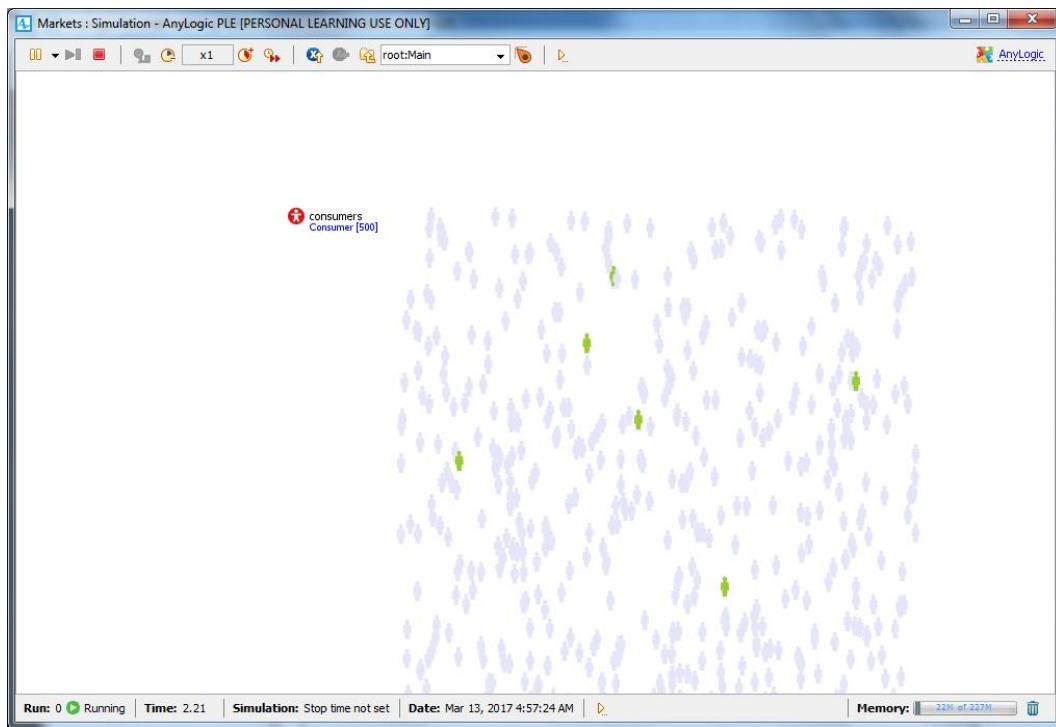


### Step 8 : Run the Model .

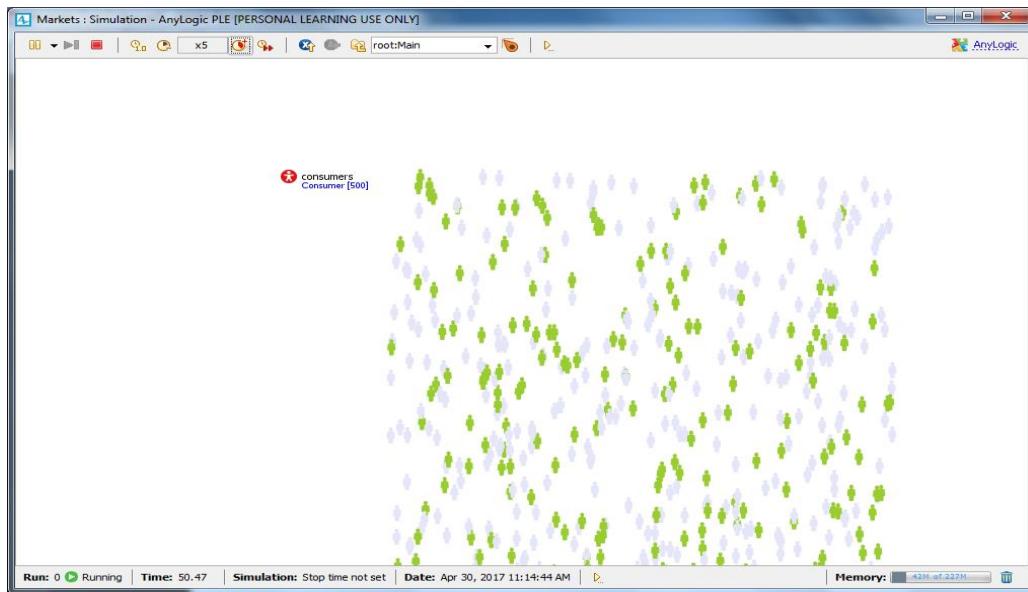
- Build
- Run

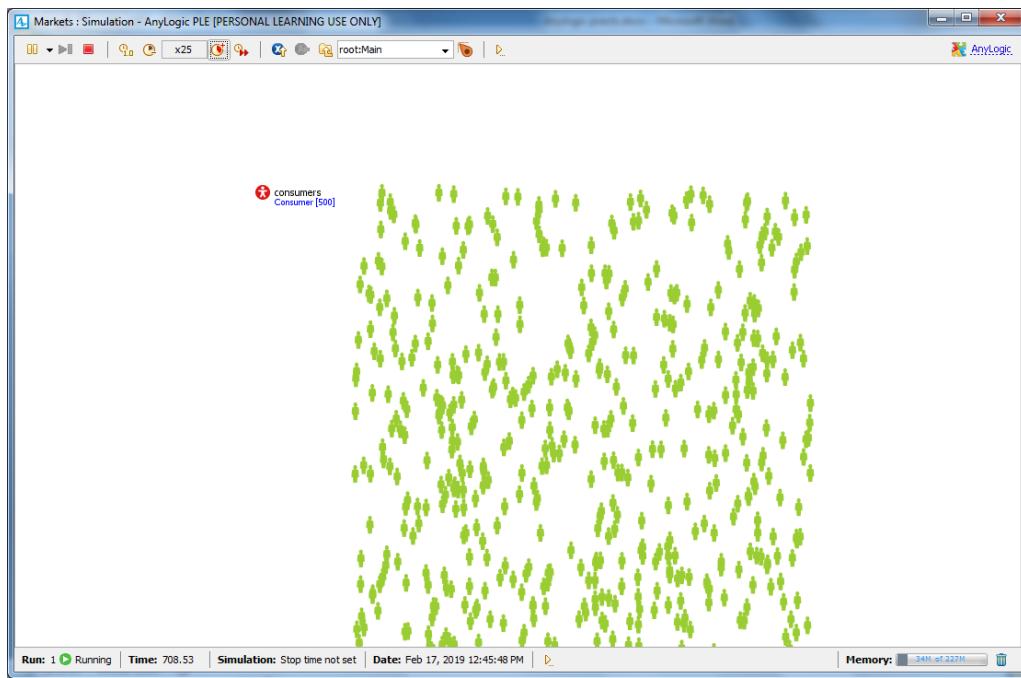


The population should gradually turn green – a change that represents the effect of advertising - until every consumer buys the product.



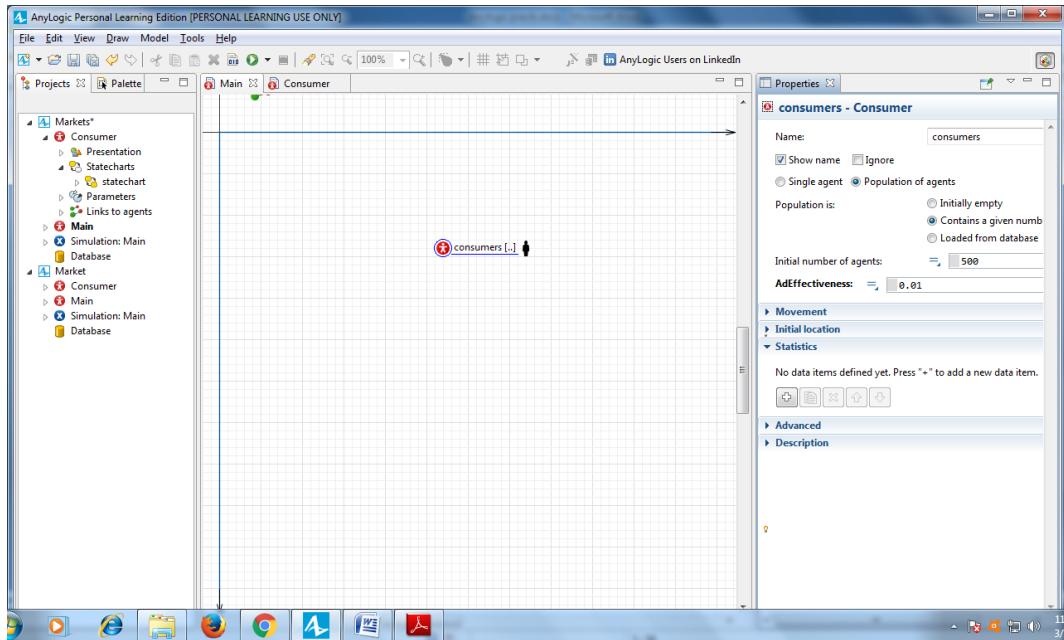
To adjust the model's execution speed, click the toolbar's **Slow down** or **Speed up** buttons. If you increase the speed to 10x – you'll see the speed at which the population turns green also increase.



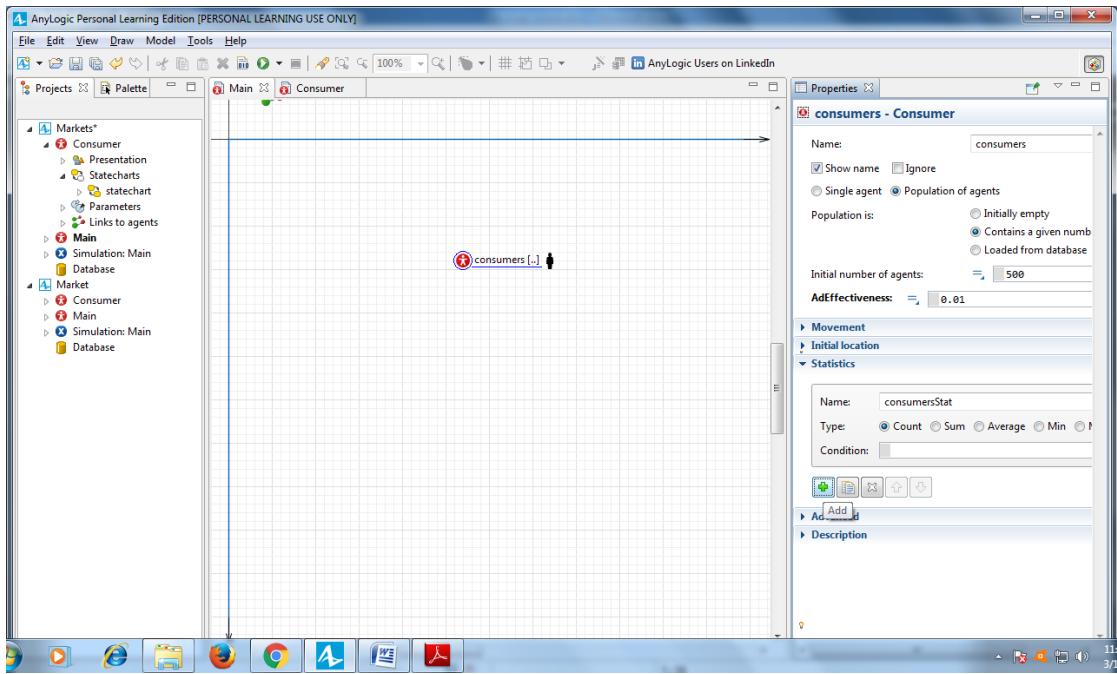


## ➤ Add a chart to visualize the model output.

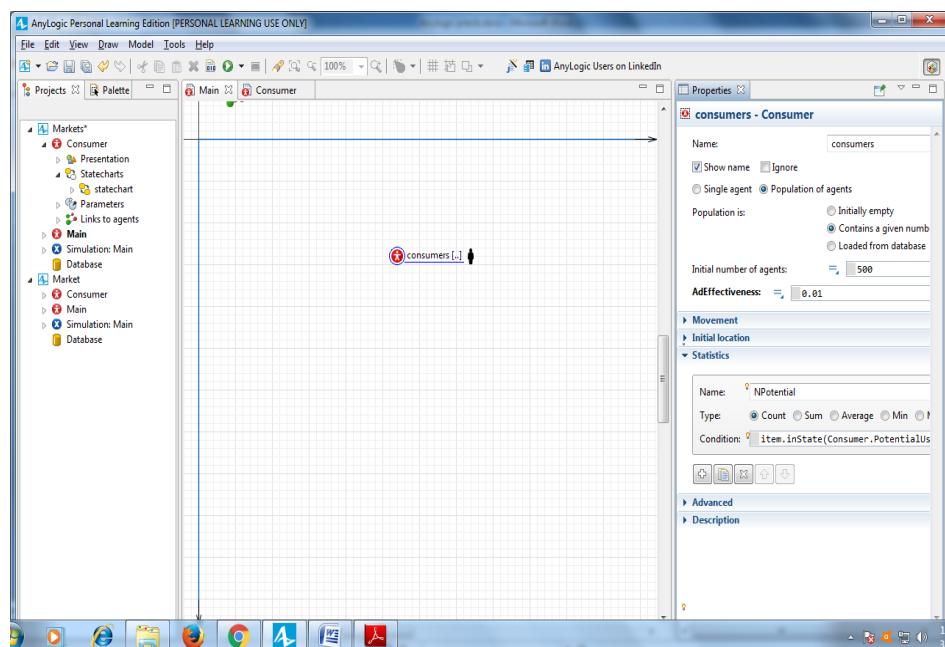
**Step 1 :** open the diagram of the agent type Main, select the agent population consumers, and go to the **Statistics** properties section.



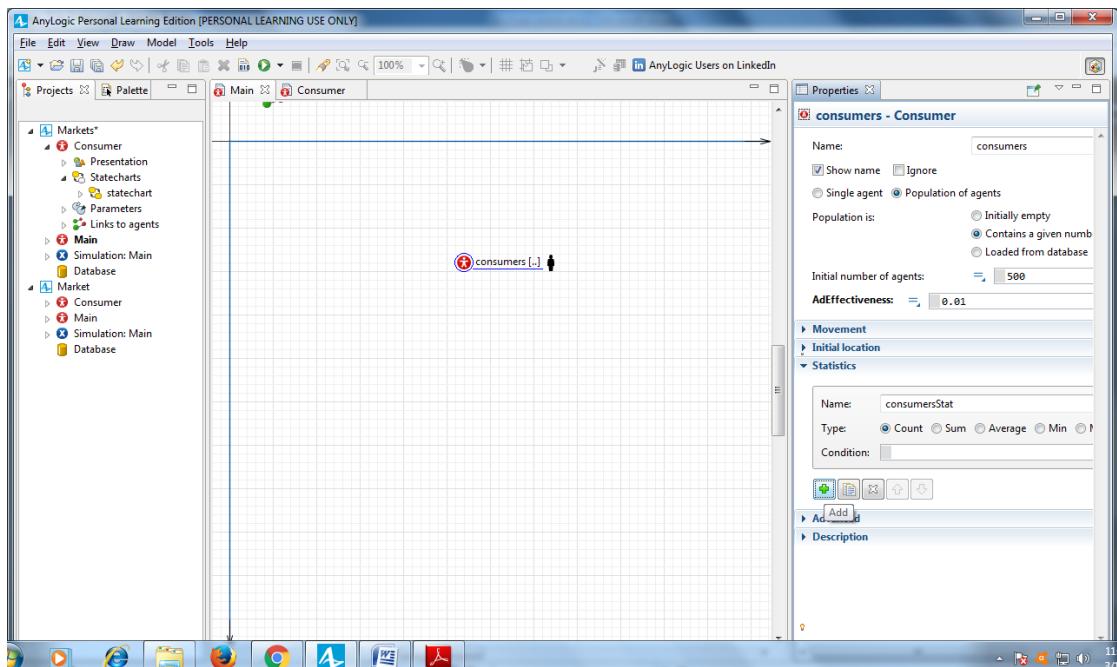
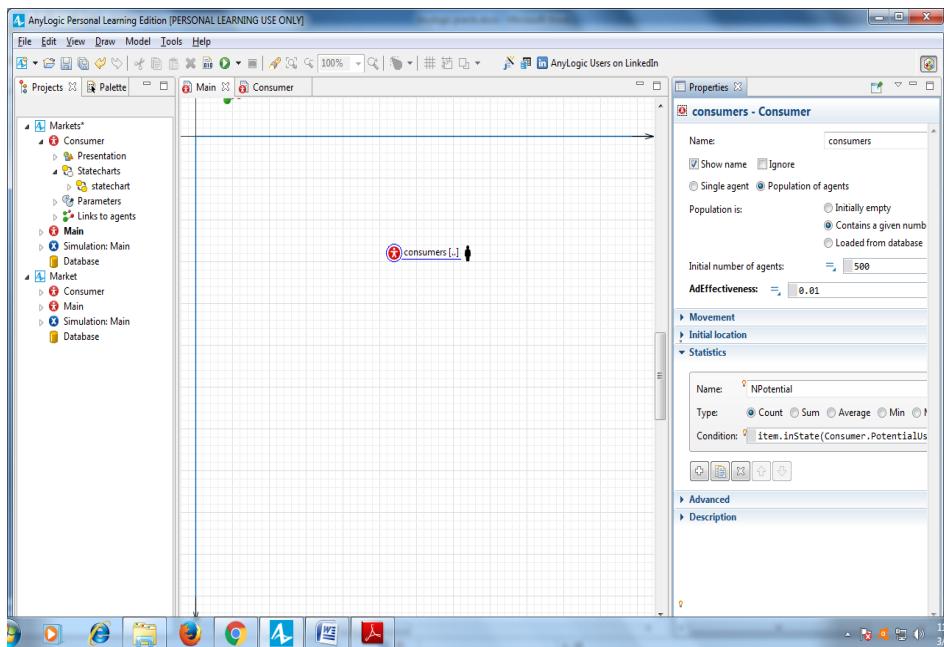
**Step 2 :** Define a statistic function in Consumer Properties –



- **Name** NPotential.
- **type Count**



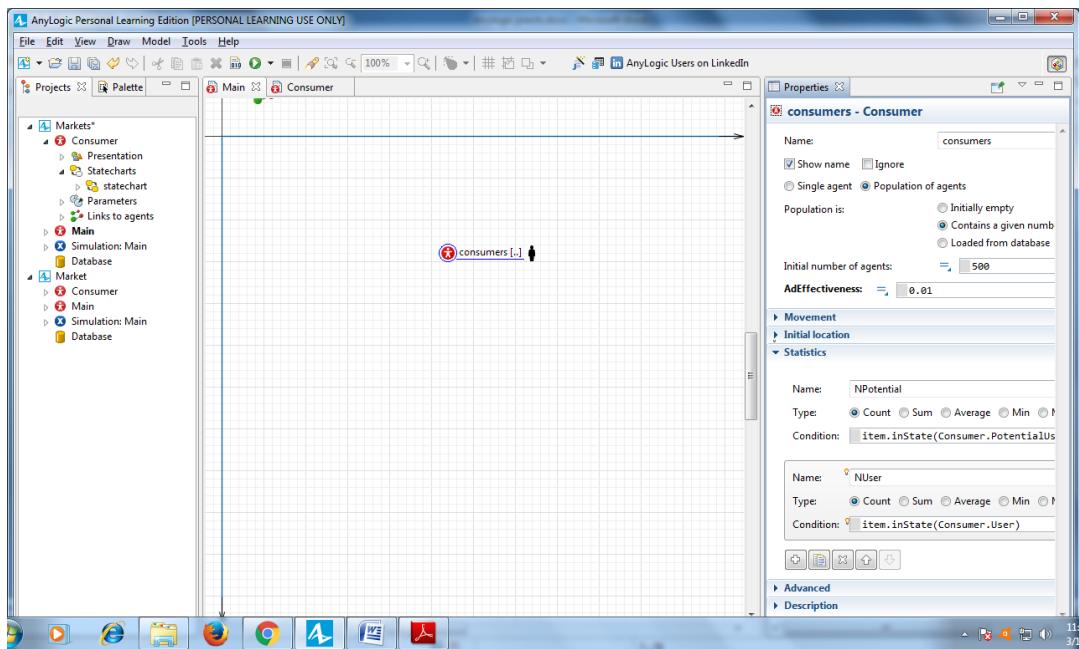
- Enter item.inState(Consumer.PotentialUser) as the function **Condition**.



### Step 3 : Define a second statistic function in Consumer Properties –

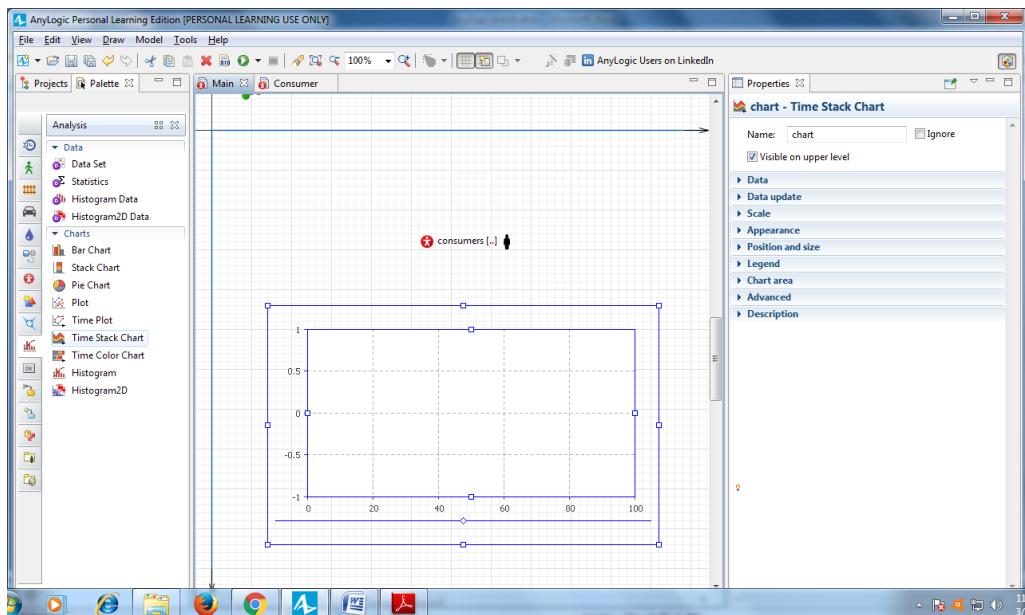
- **Name :** NUser
- **Type :** count the number of agents
- **Condition :** item.inState(Consumer.User).

You can duplicate the other statistics function by clicking the **Duplicate** button and changing its **Name** and the **Condition**.



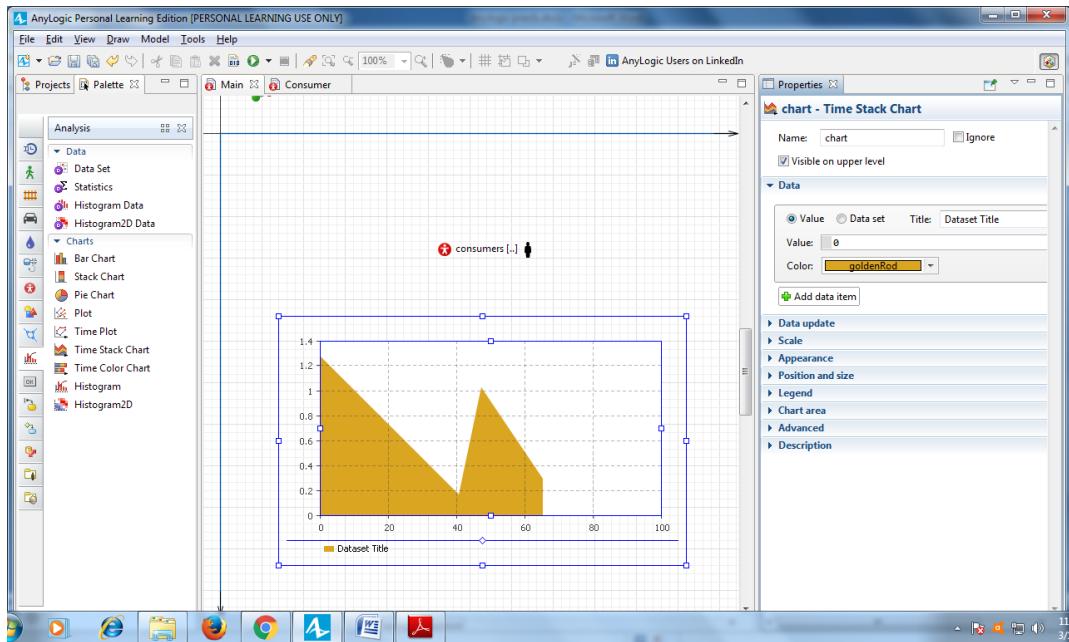
#### Step 4 : To add a Chart –

- Open the **Analysis** palette
- drag the **Time Stack Chart**



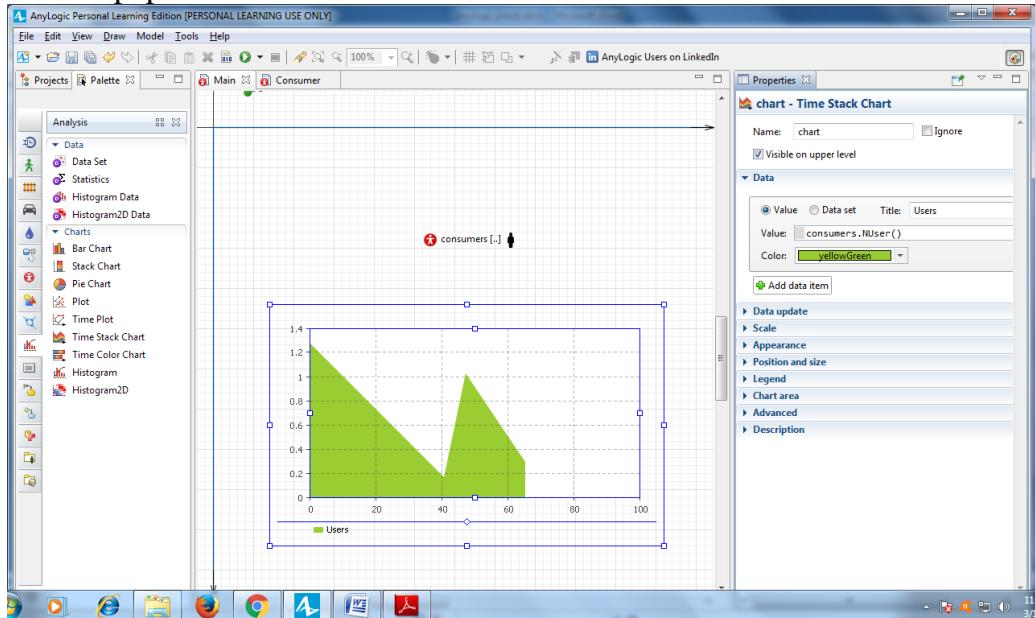
#### Step 5 : Add two data items for the chart to display.

- Click **Add data item** to add the statistics you want to draw on the chart.

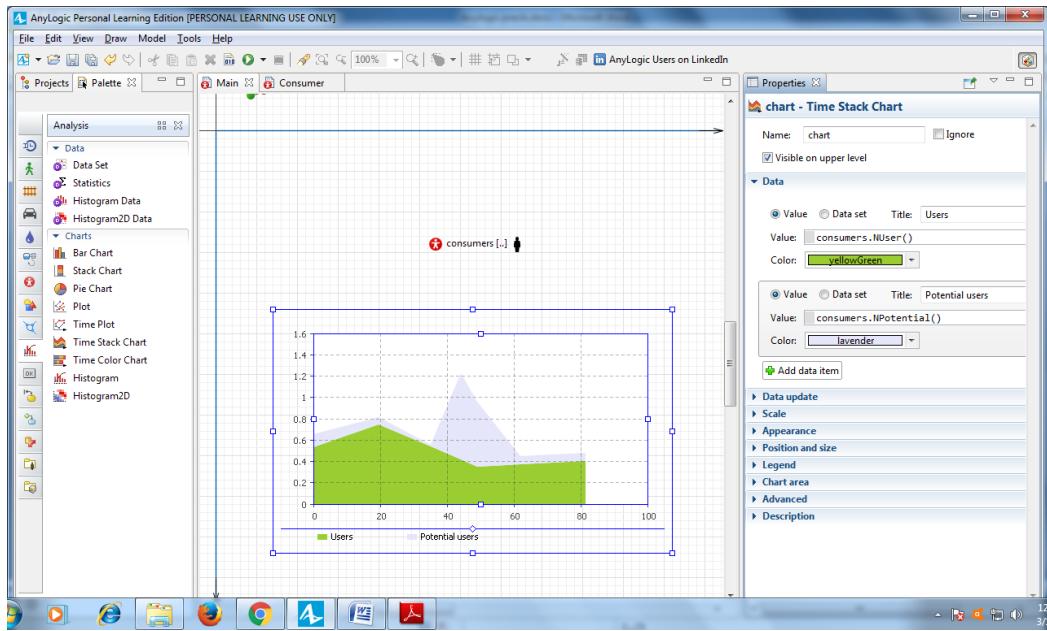


- Modify the data item's properties:
  - **Title:** Users – the data item's title.
  - **Color:** yellowGreen
  - **Value:** consumers.NUser()

Our agent population name is **consumers**, and **NUser()** is the statistics function that we defined for this population.

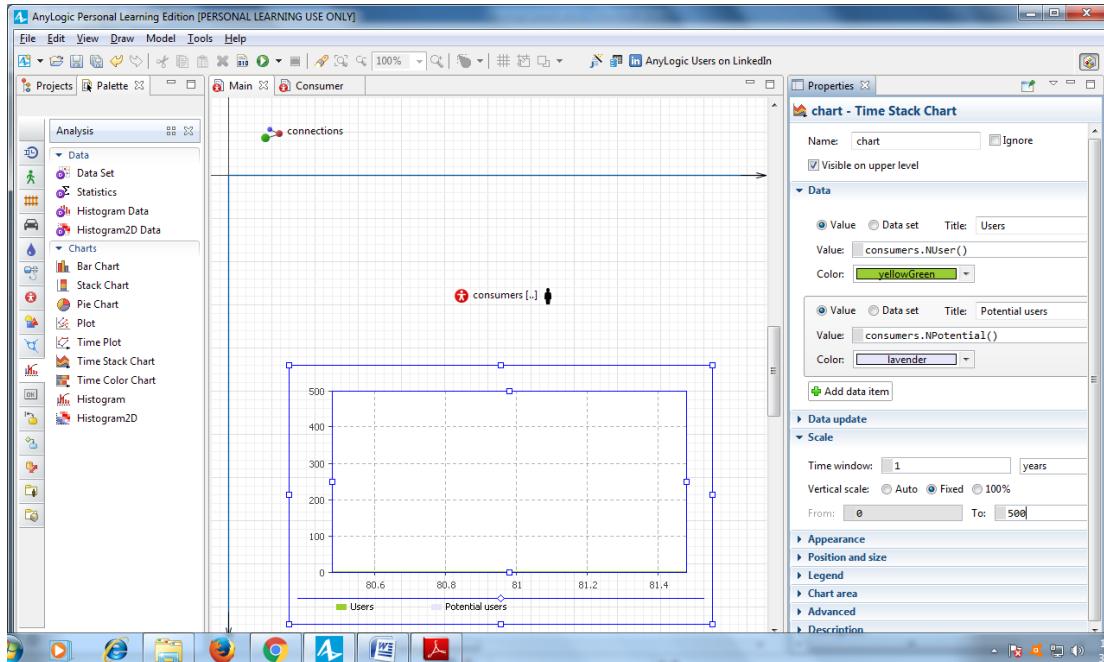


- Add one more data item:
  - **Title:** Potential users 7 AnyLogic 7 in Three Days 61
  - **Color:** lavender
  - **Value:** consumers.NPotential()



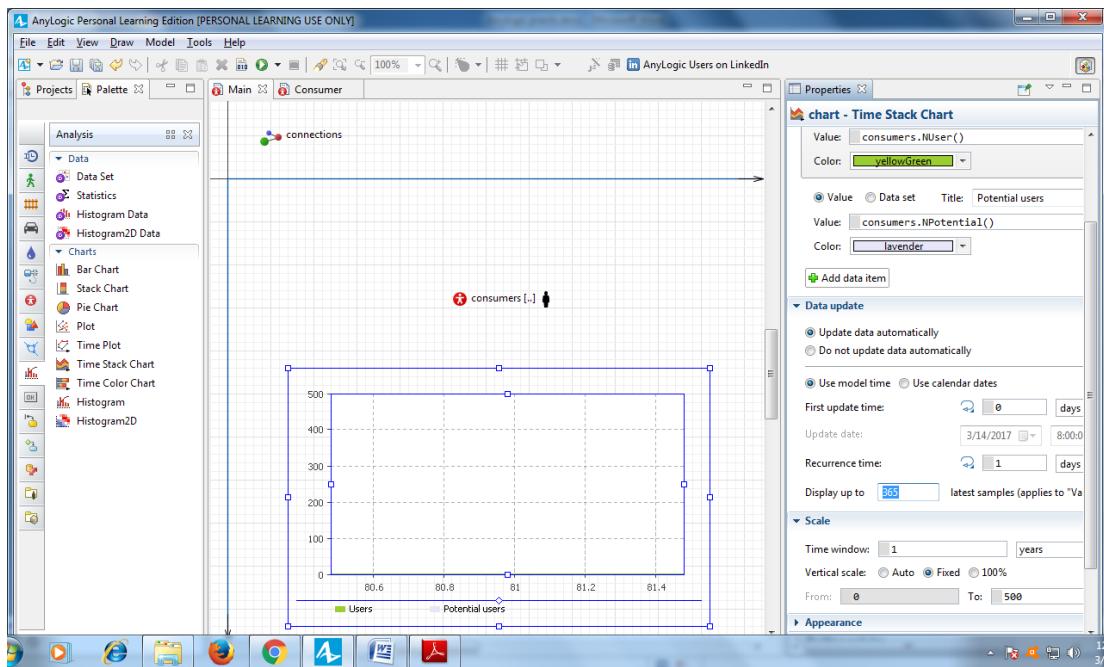
## Step 6 : Go to the Scale section

- set **Time window** equal to 1 year.
- **Vertical scale to Fixed**
- enter 5000 in the **To:** box.



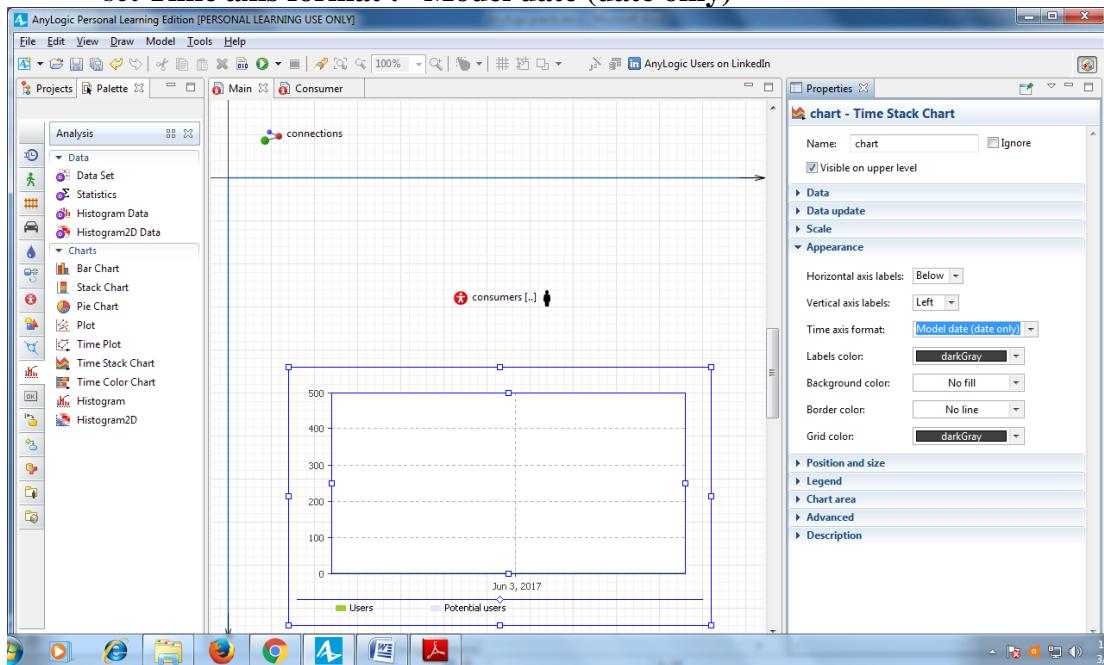
## Step 7 : change the maximum number of data samples

- navigating to the section **Data update**
- set **Display up to 365 latest samples**.

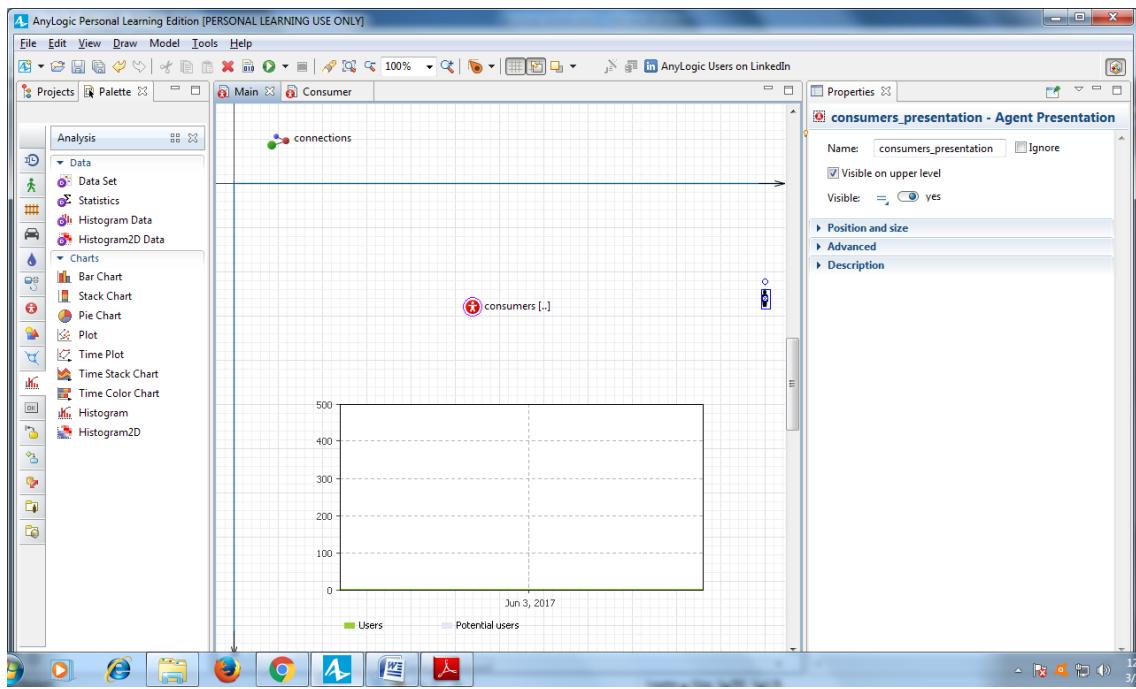


### Step 8 : Go to the time stack chart's Appearance properties

- set Time axis format : Model date (date only)



### Step 9 : On the Main diagram, move the presentation of the consumers agent population to the right.



**Step 10 :** Run the model and use the time stack chart to review the process.

