The following guide is for users with **Windows 10 OS**. Other versions of windows are likely similar, but may vary. Agent Analyst was last updated for ArcDesktop 10.0 so it only works with later versions of Desktop, with some massaging, to my knowledge it is not compatible with ArcPro.

Installation:

First thing is to download and install the extension software. This was a difficult enough step that it is necessary to include before talking about the data processing steps as I feel many users will have issues getting passed this point.

Navigate to http://resources.arcgis.com/en/help/agent-analyst/
The software, associated text with tutorials and data for the tutorials can all be found on this webpage. It is NOT an encrypted site (not https) and this may be flagged on some systems and browsers, dependent upon settings.

Download the **Agent Analyst Software exe file** and run it on the computer, it will download as **AA_Setup_for_10_v3**. It will default the install directory to **C:\Repast 3\Agent Analyst**
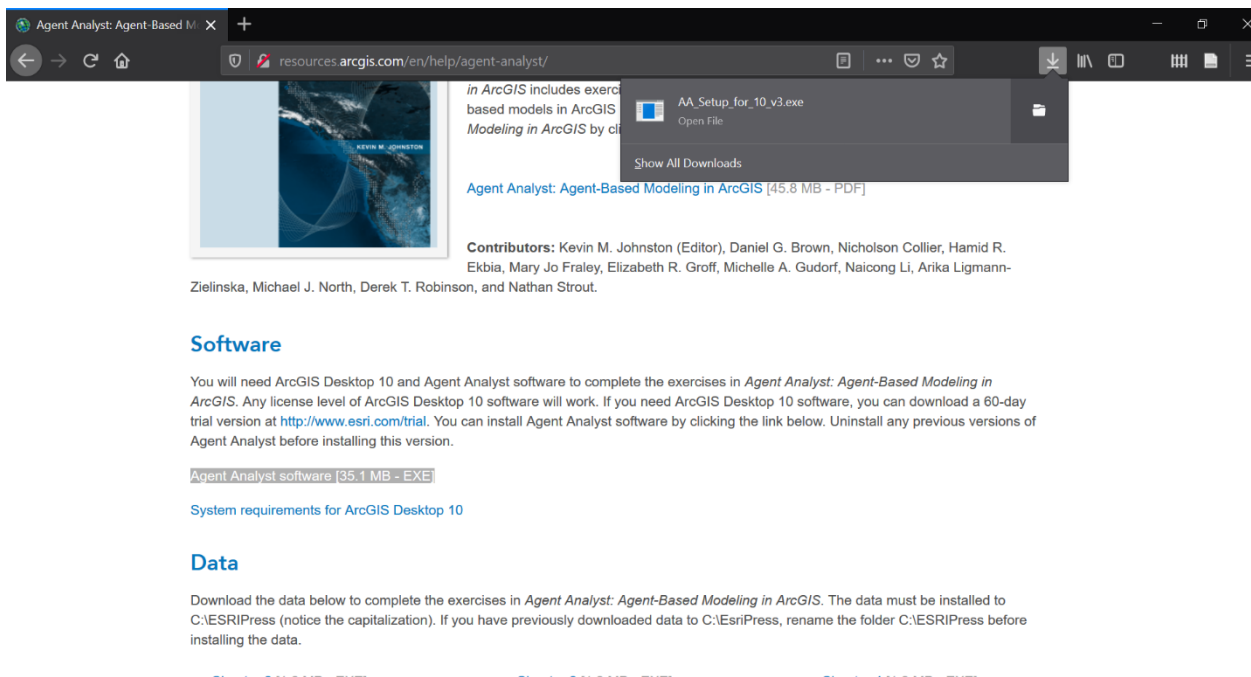
As the program was written for computers over a decade ago, you most likely need to make some changes in order for the computer to run the program. It is possible it may run without making these changes, but unlikely. It will be obvious that this step needs to be taken if the program is attempted to be ran in ArcMap. The command prompt window will flash open on screen then immediately close with no other actions.

To resolve this, go to the **control panel > System & Security > System > Advanced System Settings** (which will be in the list at the left). The easiest way is to press the windows key and start typing control, open the control panel and Navigate to system settings…

On the advanced tab, at the bottom right, click to open **Environment Variables**.
The Environment Variables window will open and the area of focus is going to be the top section **User variables.** System variable should not need to be/available to be altered. However if multiple user accounts are installed on a single machine, this step must be completed for every user profile.

Note the three variables labeled **ARC_JAVA**, **ARC_JAVAW**, & **ARCOBJECTS_JAR**
Their **Value** will be blank and this is the source of the error, the directory pathway must be specified to the specific file. Note the location of the files in the default setup for a Windows 10 64 bit OS. This is likely to be where most computers have the files, but can be confirmed via a search in File Explorer.

Double click the empty Value field to open a window where the pathway text can be typed, or can be browsed through file explorer. Note that the pathway must go all the way to the **exe** file, not just the folder.
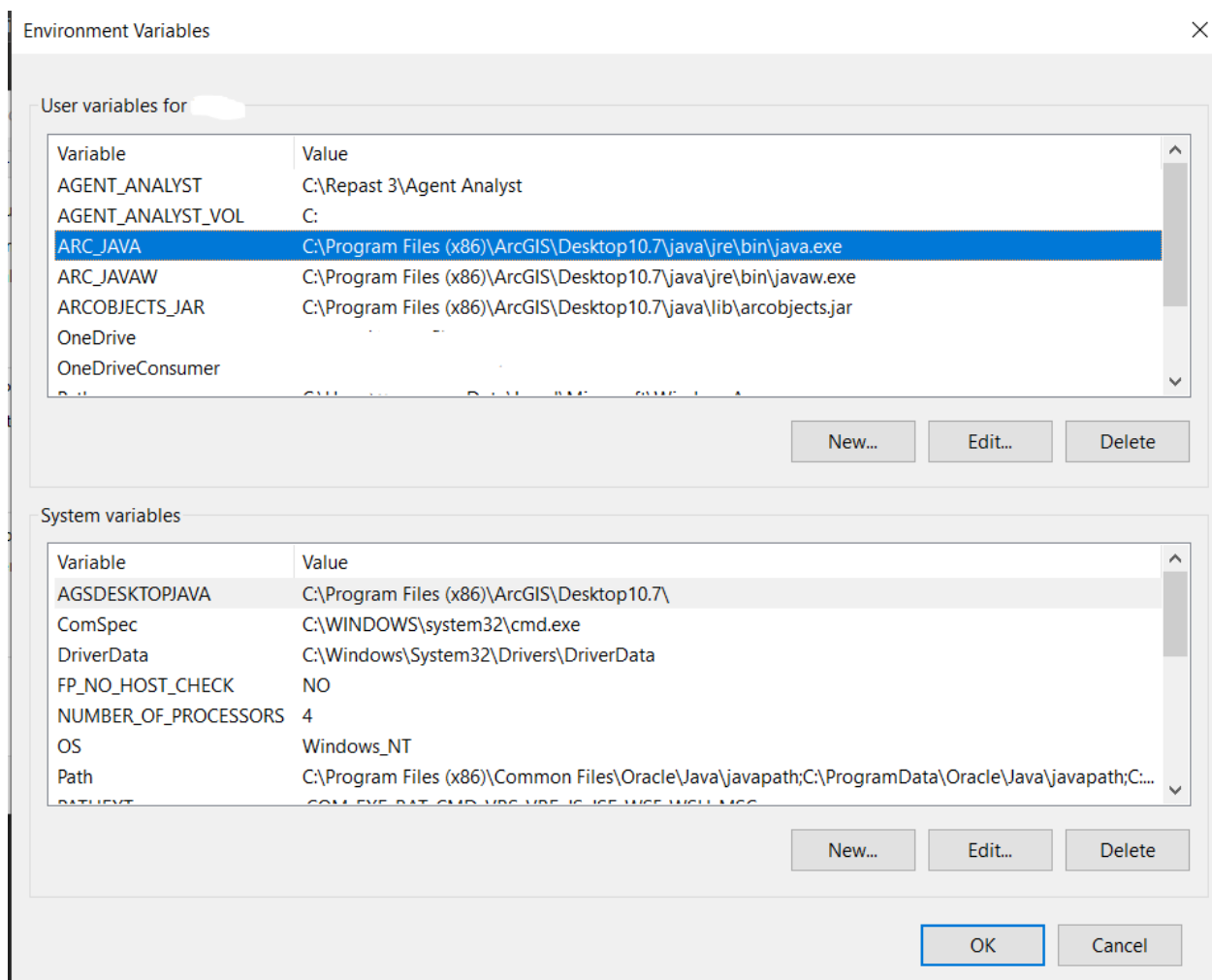
Accept the changes via all open windows and close settings.

I believe this is an optional step, but is easy to do and may prevent errors later on. In order for the program to update the screen of ArcMap as the model runs, you will need to create this as a text file by using a program like notepad. Title the file **Refresh.exe.config** and insert the string of text below (from <configuration> to <configuration>). Note that the **new version=** field should contain whatever version of arc is installed on the computer throughout the entire string.

```
<configuration>
  <runtime>
    <assemblyBinding xmlns="urn:schemas-microsoft-com:asm.v1">
      <dependentAssembly>
        <assemblyIdentity name="ESRI.ArcGIS.ArcMapUI" publicKeyToken="8fc3cc631e44ad86" />
        <bindingRedirect oldVersion="10.0.0.0" newVersion="10.7.0.0"/>
      </dependentAssembly>
      <dependentAssembly>
        <assemblyIdentity name="ESRI.ArcGIS.Carto" publicKeyToken="8fc3cc631e44ad86" />
        <bindingRedirect oldVersion="10.0.0.0" newVersion="10.7.0.0"/>
      </dependentAssembly>
      <dependentAssembly>
        <assemblyIdentity name="ESRI.ArcGIS.Framework" publicKeyToken="8fc3cc631e44ad86" />
        <bindingRedirect oldVersion="10.0.0.0" newVersion="10.7.0.0"/>
      </dependentAssembly>
      <dependentAssembly>
        <assemblyIdentity name="ESRI.ArcGIS.System" publicKeyToken="8fc3cc631e44ad86" />
        <bindingRedirect oldVersion="10.0.0.0" newVersion="10.7.0.0"/>
      </dependentAssembly>
      <dependentAssembly>
        <assemblyIdentity name="ESRI.ArcGIS.Version" publicKeyToken="8fc3cc631e44ad86" />
        <bindingRedirect oldVersion="10.0.0.0" newVersion="10.7.0.0"/>
      </dependentAssembly>
    </assemblyBinding>
  </runtime>
</configuration>
```

This file should be placed into the **C:\Repast 3\Agent Analyst\Refresh** folder. The issue lies with the Refresh.exe file only being compatible for ArcMap 10.0 and not later versions.

Adding an Agent Analyst Tool:

Now the program is fully installed and should function. In order to verify, open ArcMap and try to access the tool via ArcToolbox. This is the main and most likely way to access the extension.

A new Toolbox can be created, or a tool added to an existing toolbox. Adding a new tool is how to add an Agent Analyst Model.
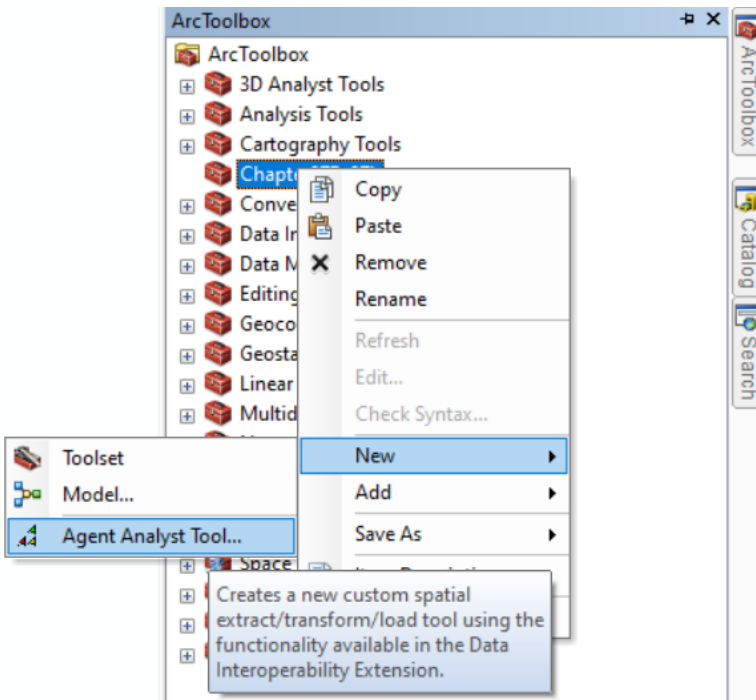
In the desired toolbox, right click >
New > Agent Analyst Tool
A command Prompt Tool should open,
followed shortly by the Agent Analyst
Graphic User Interface.

Here are two images from the Agent Analyst text, (Johnston, 2013), highlighting the main toolbar buttons.
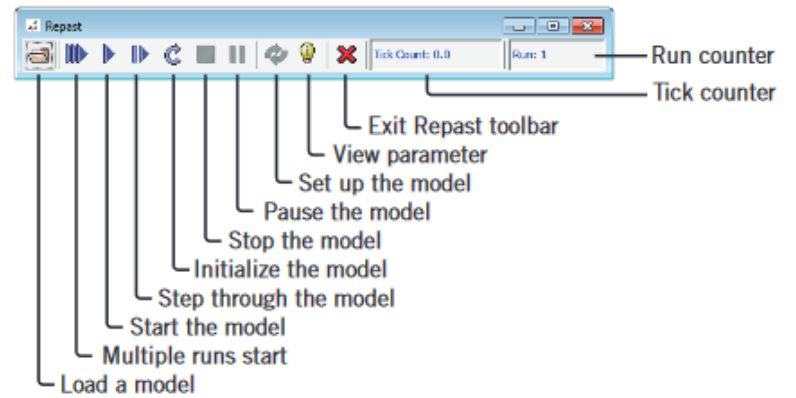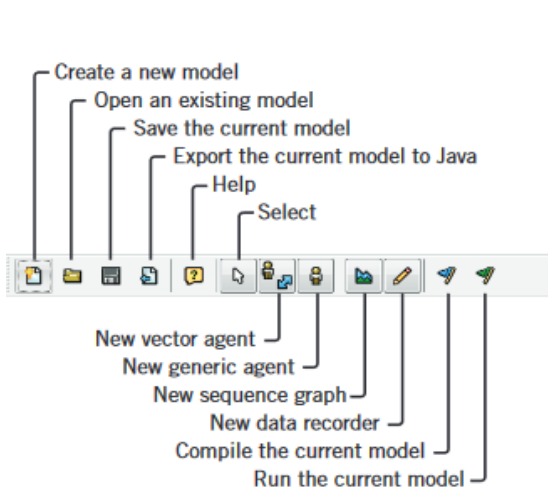
Programming/Editing Models:

A good coding dictionary and knowledge of coding is necessary in order to carry out the modeling process. The GUI helps in creation and organization, but coding script is required to determine actions and model properties. I will not be able to provide coding guides, but the pdf text has helpful tutorials that walk through how to enter basic codes and their functions so if completed models are downloaded, they can be imported and ran without much effort, once the program is installed.

If an existing model is saved to the computer, File > import can be used to load it into a new Arc Session.
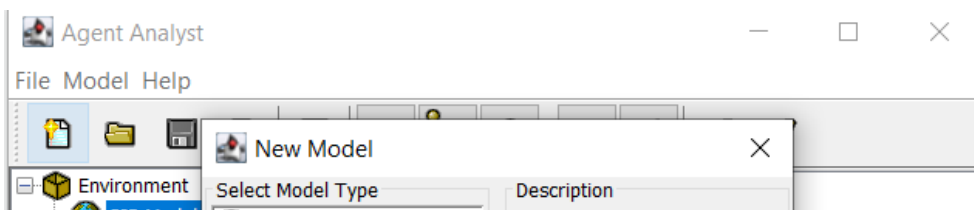
GIS, Network, and Grid are the model options the extension can create and run.

The model tree is lain out very similar to the table of contents in ArcMap. Multiple models can exist within an environment and multiple agents can be placed into each model.

Agents can be either point, polygon, or raster format. Spatial data can be prepared in ArcMap as the agent analyst extension can create agents from GIS layers.

First agents would need to be created either from GIS layers or solely via the Agent Analyst GUI. Agents can either be vector or generic. Choose the appropriate option from the AA toolbar and then click the appropriate model in the TOC. The agent will be created.
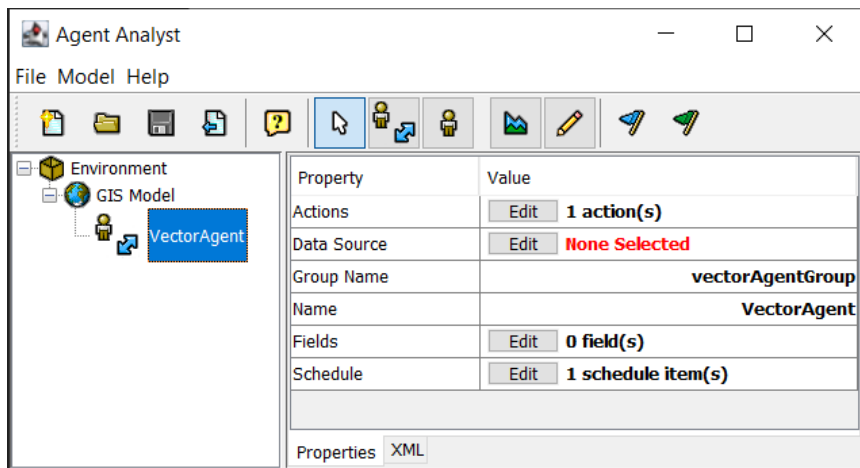

Actions can be programmed via the Edit button beside actions. For agents to be created via GIS Layers, Edit the Data source and use the file browser to point the tool to the GIS layer file. The fields can be created manually and will auto-populate based on the attribute table of the files if a data source is selected.
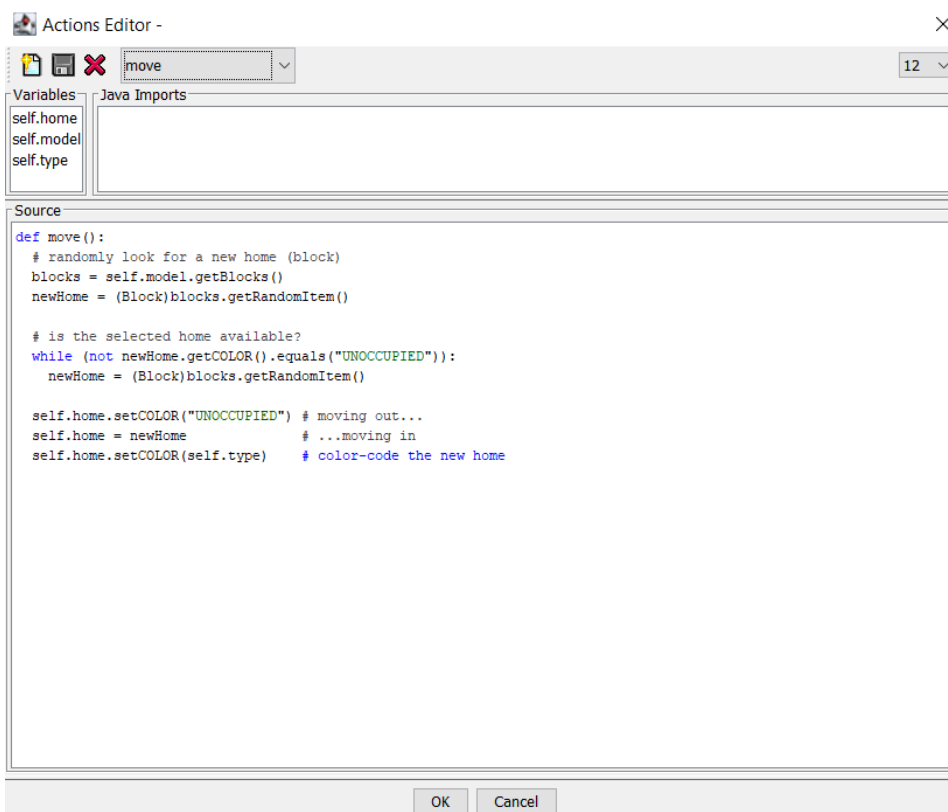
When the action editor is opened this is the window that displays. This is where actions will be coded. New actions can be created and the scripting for their actions entered into the Source field. This is the example of a code for human residents to move randomly between census blocks. It also has coding in which outputs will be generated to let the user running the model know what is happening as the model runs in real time.

Agents can be thought of in terms of X Y variables. Actions that are taking actions can be given access to data about the response agents, such as a human having access to the classification of land-use raster cells in order to make decisions on actions. This information can also be hidden depending upon the purpose of the model. This is accomplished via the field editor option in the main model. The Accessible checkboxes turn the visibility off and on for access by agents in the model. The parameter box
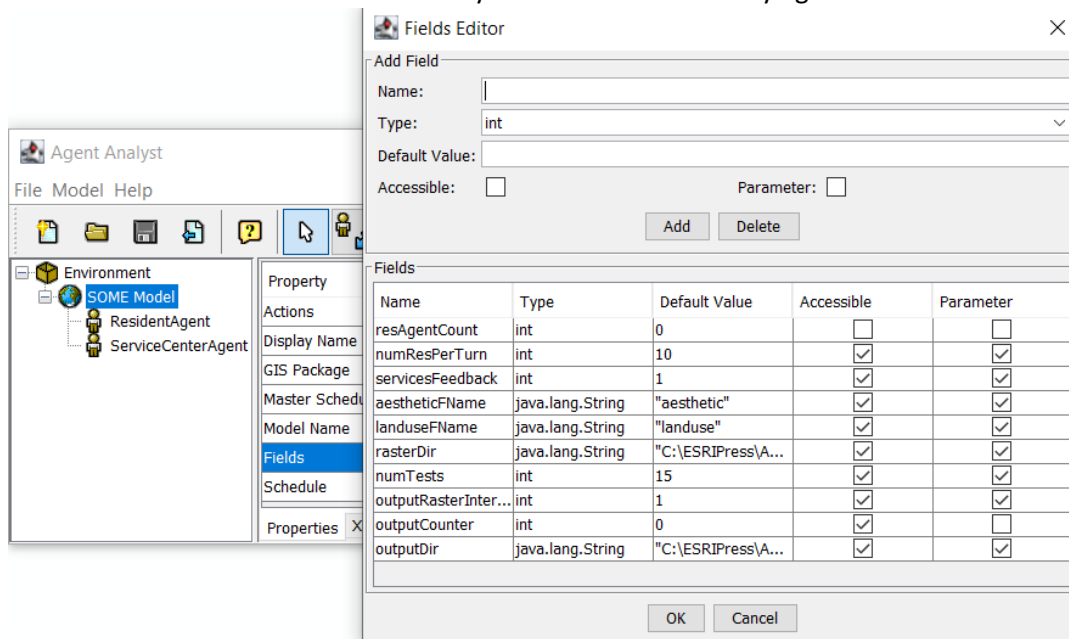
allows for edits to be made to these variables during the model running to make changes at certain stages.

After programming the desired actions into the agent(s) they should be scheduled for what interval they will perform actions. This can be accomplished by clicking the edit button beside schedule. By default, agents will be scheduled to perform the action **step** every tick (time interval cycle) of the model. The step action is the default action every agent will get and is used as a main action in which other actions can be programmed into. I.e. if animal agents were created with 3 actions, eat, move, rest; the step action can be programmed in such a way that the other actions are referenced in its code and be made to function as an either or function. Either perform this action or another during the tick. This is a good way to stay organized and allow for easy debugging of action code and simplicity of scheduling.

For the model to run and agents to have an effect on their environment, agents must also be created for the physical surroundings of the agents. These can be created from GIS layers of landcover rasters, boundary polygons, points for road intersections, etc. It will all depend upon the type of model and phenomenon being studied.

After each coding is performed, it is helpful to press the configure button on the AA toolbar. This allows the extension to examine the code for errors. If an error is found in code syntax, etc. an error window will pop up. This window displays the coded property with the error and even provides which line the error is on and a reason. This was helpful as I made some syntax errors while running the tutorial lessons in the book and it allowed for quick checks.

The open command prompt window will display activity from the model, but will also display some irrelevant errors to some models so the model can be programmed to display only relevant results or action text in a separate output window.
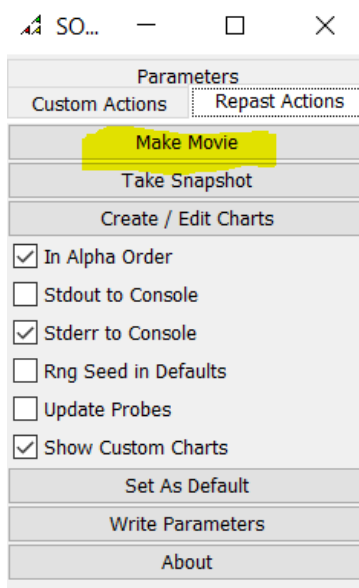
Running the Model(s):

Once the agents are created, the model can run. Clicking the run button on the AA toolbar will open two new windows. The repast model toolbar, which a guide to the buttons is also in the text, and the GIS Parameters window which will show relevant settings for the model configuration and allow for changes to parameters mid-run.

Click initialize on the Repast Toolbar

This will start the base setup for the model, getting agents to their starting points and configuring any programmed changes to the GIS layers. This will also prompt one or two other windows to open. The Repast output window, in which coded action text will display and the GIS model viewer window if the model is coded with an option to draw something in this window as it runs the steps.

The model can begin its run by clicking the play button, from there the tick count will increase every time the agents take their actions in interval. The model can be manually paused and stopped once the desired tick count is reached, it can also be programmed to cease at a certain tick count. Once stopped, the model can not be resumed for the same run, only pausing will allow this. If stopped a new run must be started from tick 0 by refreshing and reinitializing the model.

While the model is running changes to GIS layers can be visualized in the ArcMap program. Depending on the setup and coding, new layers can be created (as is the usual case for Raster Datasets so that a raster for each tick is created) The software also has the option to record, this was not utilized during the tutorials I carried out, but I imagine it can be used to record the changes to the GIS layers and be played back to watch the model run in real time which would be very helpful for later analysis and visualization of the model.

After the Model run is completed:

After the model is allowed to run for the desired intervals, changes can be made to the parameters or agents, or other models run if needed. The data produced can be displayed in ArcMap to assess produced patterns and data used for further spatial analysis methods in ArcMap.

This is an extension that takes the software capability of the standalone Repast Agent Based Modeling and integrates it into the spatial environment of ArcMap Desktop. The capabilities of this extension are wide ranging and ultimately it will be up to the user's desires and level of capability to program the model as to the power or validity of the model results.

References:

Johnston, K. M. (2013). *Agent Analyst: Agent-based modeling in ArcGIS®*.

http://resources.arcgis.com/en/help/agent-analyst/pdf/AgentAnalyst.pdf