Getting Started with AgentSheets

Thought Amplifier.

AgentSheets®
Contents

Install AgentSheets ................................................................. 1

Introduction .............................................................................. 2

Examples .................................................................................. 4

Tutorial: Virus Attack ............................................................... 6
  1. Create a Project ................................................................. 7
  2. Define Agents ................................................................. 8
  3. Edit Agent Depiction ......................................................... 9
  4. Create a Simulation World (Worksheet) ......................... 10
  5. Open a Behavior Editor .................................................... 11
  6. Define Rules ................................................................. 12
  7. Run the Simulation ......................................................... 15
  8. Add Simulation Properties ............................................... 16
  9. Plotting ........................................................................... 18
 10. Arcade ............................................................................. 19

Getting More Help .................................................................... 20
  Explore Actions ...................................................................... 20
  Explore Conditions .................................................................. 21
  Explore Rules ......................................................................... 23
  Explore Methods ..................................................................... 23
  Explore Behaviors ............................................................... 24
  Other Resources ................................................................. 25

End-User Software License Agreement ................................. 26

Trademarks and Copyrights
Copyright © 1996-2014 AgentSheets, Inc. ALL RIGHTS RESERVED.
The following are trademarks or registered trademarks of their respective companies or organizations:
AgentSheets® and Visual AgenTalk® are registered trademarks, Ristretto® is a registered trademark of AgentSheets Inc., Windows and the Windows logo are trademarks of Microsoft, Inc., registered in the U.S. and other countries. All other brand or product names referenced are service marks, trademarks or registered trademarks of their respective companies or organizations.
Install AgentSheets

System Requirements

AgentSheets runs efficiently on new Mac OS X and Windows-based computers and runs acceptably on older machines. The system requirements of AgentSheets 4.0 are:

<table>
<thead>
<tr>
<th></th>
<th>Mac OS X</th>
<th>Windows</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Minimum</td>
<td>Recommended</td>
</tr>
<tr>
<td>Free hard disk space:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full Installation</td>
<td>35 MB</td>
<td>120 MB*</td>
</tr>
<tr>
<td>Application</td>
<td>30 MB</td>
<td>115 MB*</td>
</tr>
<tr>
<td>Documentation</td>
<td>5 MB</td>
<td>5 MB</td>
</tr>
<tr>
<td>System RAM</td>
<td>1 GB</td>
<td>2 GB</td>
</tr>
<tr>
<td>CPU speed</td>
<td>1 GHz</td>
<td>1.5 GHz</td>
</tr>
</tbody>
</table>

* Includes Java Runtime Environment (JRE)

Installation

To install AgentSheets, please use the installer downloaded from the AgentSheets Inc. web site (http://www.agentsheets.com/).

- For Mac OS X run the AgentSheets4.0.0.pkg installer by double clicking on it and follow the installation instructions.
- For Windows run the AgentSheets4.0.0.msi installer and follow the installation instructions.

Launch

After installation, launch AgentSheets by double clicking the AgentSheets application icon.

- On Mac OS X, this is located in the AgentSheets folder within the Applications folder.
- On Windows, you can use the application shortcut created on your desktop upon installation, or go to Start Menu | Program files | Agentsheets 4.0 and click on the icon there.

Registration

To run AgentSheets, you need a temporary or unlimited registration key, which is provided separately. Online buyers and users of the trial version receive the unlimited and temporary registration numbers respectively through email, to the email address you provided.
Introduction

The purpose of the AgentSheets® Getting Started Guide is to provide you with step-by-step instructions for creating a complete AgentSheets simulation. It is assumed that you know the basics of using a computer, but no programming experience is required.

What is AgentSheets?

AgentSheets is an agent-based computational thinking tool that lets a wide range of end users (from children to professionals) create their own interactive games and computational science applications. AgentSheets is a revolutionary environment that combines agents, spreadsheets and Java authoring technologies in a single medium. AgentSheets acts like a thought amplifier that lets you build on your own understanding, and explore new ideas. Java technology built into AgentSheets – called Ristretto® – lets you share your games and simulations with the rest of the world through the Internet.

To get started, you only need an open mind and an active imagination. AgentSheets lets individual creativity flourish in a programming environment that is both intuitive and transparent.

What is an Agent?

In AgentSheets, agents are end-user programmable objects. Agents can have different looks (called depictions). They behave by reacting to mouse clicks and keyboard input, moving around, changing their appearance, playing sounds, speaking, reading Web pages, and computing formulae. Agents don’t operate alone. Dozens, hundreds or even thousands of agents interact with each other in a spreadsheet-like grid to create an AgentSheets simulation.

How was AgentSheets Born?

The AgentSheets programming environment is the product of years of research. Initially, AgentSheets grew out of the idea of building a new kind of computational media that lets computer users build highly parallel and interactive simulations by replacing spreadsheet numbers and strings with behaving agents. In this initial stage, AgentSheets was an intricate simulator that required powerful machines and professional-level programming. Over time, AgentSheets evolved into a fast simulator that runs on personal computers and requires no programming experience. This evolution was made possible by a
completely different approach to programming that includes Tactile and Conversational programming paradigms.

**Tactile Programming**

Tactile Programming is the modern foundation of AgentSheets. Tactile Programming moves one conceptual step beyond Visual Programming. While most programming languages have been developed from a technological perspective, the design of AgentSheets has been driven by people's common need to visualize, understand and communicate ideas. Of these, the communication of ideas is perhaps the most important, and AgentSheets excels at this function.

Tactile Programming allows you to literally experience programming by manipulation. The AgentSheets programming language, called Visual AgenTalk® (VAT), is a rule-based language. *Conditions*, *actions* and *rules* are complete objects that you explore. At any time, you can select any condition, action or rule and test it without first having to construct a complete program. Explore questions like: is this condition true for this agent? What will happen if this agent runs this action? Will this rule fire, and if so what will be the consequences? AgentSheets promotes a more playful attitude towards programming, one that thrives on immediate feedback and promotes exploration.

AgentSheets brings the “art of programming” to artists and content developers who might otherwise be constricted by the daunting syntax of languages like C++ or Java. With AgentSheets, anyone can translate their ideas into a computer program.

**Conversational Programming**

Conversational Programming is a revolutionary patent-pending programming paradigm to help you create your programs. When enabled, Conversational Programming essentially runs important parts of your program and gives you immediate visual feedback about what will happen in your program, even before your program is finished. Is this condition true right now, in the context of a particular agent? Could this rule actually fire now? You will know before your program is complete. Using a conversational style of feedback that is informal and non-intrusive, the system can subtly point out potential problems and opportunities that may be very helpful to you as you are creating your programs. In essence, you are programming through an informal dialog with the system. Conversational Programming is a great conceptual debugging tool for computational thinking.
Examples

AgentSheets is computational thinking tool that has been used by a wide range of end users (from children to professionals) to create their own interactive simulations and games. Here are some examples:

**K-12 Education: Elementary School**

**Collaborative Learning:** Students learn about life science topics such as food webs and ecosystems by designing their own animals. Collaborative animal design takes place when groups of students put their individual animals into shared worlds to study the fragility of their ecosystems.

**K-12 Education: Middle School**

**Scalable Game Design:** an approach used in middle schools that uniquely balances educational and motivational concerns of computer education. Students begin by making their own simple Frogger-like game, which they can publish to the Scalable Game Design Arcade. They then gradually continue to learn about sophisticated topics such as Artificial Intelligence to make complex games and computational science applications.

**K-12 Education: High School**

**Interactive Story Telling:** History students create interactive stories of historical events such as the Montgomery bus boycott and the Cesar-Chavez led California grape boycott.

**Training**

**Distance Learning:** With SimProzac, patients can explore the relationships among Prozac, the neurotransmitter serotonin, and neurons. By playing with this simulation in their browsers, patients get a better sense of what Prozac does than they ever could by reading the cryptic description included with the drug.
Scientific Modeling

Learning by Visualization and Modeling: Researchers model the effects of microgravity on E. coli bacteria and glucose. This is actually an AgentSheets simulation of an experiment that was onboard the Discovery Space Shuttle with John Glenn. This particular simulation uses thousands of agents.

Educational Games

Learning Through Simulation Use: This simple voting simulation explains concepts such as clustering, migration and the stability of two party systems. Can it predict the outcome of the next election?

Non-Educational Games

Learning Through Design: Even if the finished game is not directly related to education, the construction process is very educational. The Ultimate Pacman is a complete game based on complex Artificial Intelligence algorithms and non-trivial diffusion equations.

Interactive Illustrations

How Does a TV Work? This simulation illustrates how a picture is scanned by a camera (left), transmitted to a TV set and then converted back to a picture (right). Users can paint their own pictures and play with TV signal processing parameters.

Deconstruction Kits

Learning by Taking Apart: What makes a bridge stable? The task presented to users by this simulation is to remove as many bridge elements as possible without collapsing the bridge. Implicit learning experiences include forces, architecture, and geometric perspective. This simulation was featured on PBS Mathline.
Tutorial: Virus Attack

To illustrate how an AgentSheets simulation is created from scratch, we present a 10-step description on how to build Virus Attack, a simulation of a virus spreading through a community. If you prefer to learn by video tutorial, visit the AgentSheets support Web pages to view the Getting Started movie. In less than an hour you will have built a complete simulation and you can publish on our Arcade.

The point of Virus Attack is to understand the basic virus-spreading mechanism. Does the number of people infected by the virus increase linearly, or is there some other function behind the rate of growth? How fast does the virus spread? What can be done to contain the virus? The goal is to explore issues associated with the spread of a virus by creating, running, and studying a simulation. The principles behind this kind of simulation are not limited to virus propagation. The same laws apply to many other things that spread socially, such as rumors, fads, fashion, viral marketing etc.

In Virus Attack, a simplified virus-spreading model, simulated people (called agents in AgentSheets) move around randomly to represent the real activities of people going to work, shopping and traveling. A healthy person standing next to an infected person has a 5% chance of getting the virus. A completed version of this project is shown below.
1. Create a Project

In AgentSheets, a project consists of the set of agents organized in a gallery, the agents' behavior, and the simulation worlds (called worksheets) in which agents interact.

Create a New Project

Create a new project with the File | New Project… menu option shown in the margin.

Save the Project as a Folder

The New Project dialog will appear, asking you to specify the name of your new project and the location where you wish to save your project. Type “Virus Attack” as the name of your new project (in the File name field) and click OK. The default location to save new projects is the Desktop folder. If you wish to change that, please make sure you are saving in a location where you have full write privileges.

Define the Size of Your Agent

A dialog box will ask you to specify the size (in pixels) of the agents for this project. The optimal size for an agent depends on what you are simulating. For the Virus Attack, we will use a custom agent size of 24 x 24 pixels.

An empty Gallery window is created for you. Each project has one gallery, which is used to organize all agents that you are about to create.
2. Define Agents

Agents represent all the objects of your simulation. For the Virus Attack project, you will need agents to represent healthy people, infected people, and background tiles on which the agents move.

Choose the Gallery | New Agent… menu option or click the New Agent button in the gallery to create a new agent.

A dialog box will ask you to name your agent. Name the agent “Person” and click OK.

Use Gallery | New Agent… or the New Agent button again to create another agent called “Background”.

Each of these agents will show up in the gallery as a box labeled with the name you just specified. An agent icon is provided by default. Next, we will create an appearance for each agent.
3. Edit Agent Depiction

An agent can have one or more depictions defining how the agent will look on the screen. If the list of depictions associated with the agent is not visible in the gallery, click on the disclosure triangle on the agent (to the left of the current depiction) and it will appear.

**Edit Person and Background Agent Depictions**

To edit an agent’s depiction, use the AgentSheets *depiction editor*. To get the depiction editor, double-click the default depiction of Person (outlined in red on the right) or select the depiction and click the Edit Depiction button on the gallery.

Clear the default depiction using the Clear button in the depiction editor. Use the Pencil tool and various ink colors to draw an icon resembling the face of a person.

Note: To make the white background of the Person depiction transparent use Color | Mask Color | White.

Note: You can also import depictions you have made with third-party drawing tools.

Note: On the Mac, you can also use your own image captured with the camera as an agent depiction.

Once you are pleased with your creation, click the Done button (right). This will save the depiction and close the depiction editor.

Double-click the Background agent's default depiction in the gallery and edit its depiction to look like a large floor tile. You can just select a color and use the Fill tool to fill the entire square. Close the depiction editor and save the Background depiction.

**Create a Person_Sick Depiction**

We need a way to show that somebody has acquired the virus. A simple strategy is to create a new depiction for the Person agent representing a sick person. Select the Person agent in the gallery. Create a new depiction by using the Gallery | New Depiction… menu option or by clicking on the New Depiction button at the bottom of the gallery and name the depiction “Person_Sick”. Double-click this new depiction and use the depiction editor Fill tool with a different ink color to show a sick person. Save with the Done button.
4. Create a Simulation World (Worksheet)

Now you are ready to define a simulation world (a worksheet), where the Virus Attack simulation will take place. Use the File | New Worksheet menu option to create a new worksheet.

To draw Background agents in the worksheet, select the Background depiction in the gallery. Select the Draw Rectangle tool on the left of the worksheet. Click and drag to outline the region of the worksheet you want filled with Background agents, then release the mouse.

The simulation is more interesting if you don’t just draw one big area of Background agents. Instead, draw different sized, connected blocks of Background agents. Think of them as rooms and corridors.

To add people, select the Person depiction in the gallery. Select the Pencil tool and drop several Person agents into the worksheet. Then, select the Person_Sick depiction in the gallery. Now you can add one Person agent with the Person_Sick depiction into the worksheet to start the epidemic.

Save your worksheet to a file, by selecting it, choosing File | Save and then naming it “Kindergarten”. (Please note that we are now using higher quality depictions, which replaced the ones created in the previous section.)

If you run the simulation, since no behaviors are defined, the scene is completely passive at this point.
5. Open a Behavior Editor

A behavior describes what an agent does. Agent behaviors are expressed in Visual AgenTalk as IF-THEN rules containing actions and conditions. Actions and conditions are the building blocks used to define an agent's behavior. In the next two steps, we will construct complete agent behaviors by combining conditions and actions into rules and by grouping rules into methods in a behavior editor.

Double clicking the blue texture area of an agent box in the gallery or selecting the agent and clicking the Edit Behavior button opens the behavior editor for that agent.

A behavior editor can contain any number of methods. A method contains a list of rules and a trigger. The trigger defines when the rules contained in the method get checked. The behavior editor above contains one method labeled with the While Running trigger. The While Running (right) trigger will make the method check its rules once per simulation cycle.
6. Define Rules

To simulate spreading a virus, we need a vulnerable Person agent that runs around randomly on the Background. We can make the agent vulnerable by giving it some chance of becoming infected if it encounters an infected Person agent. This kind of behavior can be expressed in rules. We will now select conditions from the Conditions Palette and actions from the Actions Palette and drag them into our behavior editor to construct the desired behavior.

Open the Conditions: palette via the Tools | Conditions Palette menu option or by clicking the blue Conditions Palette button (shown at left, top). Open the Actions: palette via the Tools | Actions Palette menu option or by clicking the red Actions Palette button (shown at left, bottom).

To make the Person agent move randomly on the Background, select the Move Random On action from the Actions: palette and drag it into the THEN Part of the Person agent’s behavior editor. Make sure you select the Background depiction as a parameter to the Move Random On action. Your first rule is complete.
Let us define a second rule to spread the virus. Click the New Rule button at the bottom of the behavior editor to create a new rule.

We need to make sure that only a healthy person changes into a sick person. Drag a See condition from the Conditions: make sure to choose a healthy person (example at right, top).

A **Person** agent can get infected if it is next to at least one person carrying the virus. Drag a **Next To** condition from the Conditions: palette into the IF part of the second rule. Change the test in the **Next To** condition to “> =”, change the number of agents required to 1, and select the **Person_Sick** depiction (example at right, middle).

The virus should only spread with a 5% chance. Drag a **% Chance** condition into the same IF box below the **Next To** condition. Define the probability in the **% Chance** condition to 5 (example at right, bottom). Your rule should look like the one below:

If the agent is next to an infected agent, there is a 5% chance that the agent will also get infected and change into a sick person. To achieve that, drag a **Change** action into the second rule’s THEN part and select the **Person_Sick** depiction as a parameter (as at right).
Rearrange the Rules

AgentSheets checks an agent’s rules as follows:

- **Check** the list of rules starting at the top working towards the bottom.
- **Fire** the first rule whose conditions are all true. All actions of that rule will be executed. Rules below the fired rule will not be checked.

Given this, we have a problem with our current rule arrangement. Our rule at the top of the list has no condition and will fire immediately without giving the second rule a chance to fire. Therefore, our **Person** agent would always move randomly on the **Background** and would never check if there were infected agents around it.

Fortunately, there is a simple fix for our problem. Change the order of the rules by grabbing the second rule by clicking on the “Then” label and dragging it above the first rule. Now the agent will start by checking for infected agents in its vicinity. It will move only if this is not the case.
7. **Run the Simulation**

Once you are ready to test your agent's behavior, apply your newly created rules by clicking on the **Apply** button of the behavior editor. To start the Virus Attack simulation, press the **Run** button in the worksheet. You can then observe how the virus spreads. You can add and remove agents while the simulation is running.

If the simulation is running too fast for you to follow, stop it and use the **Step** button to run the simulation one step at a time. The **Step** button is to the right of the **Run** button.

Use the slider to control the speed by moving the slider left to slow down or right to speed up the simulation.

Note that the **Apply** button makes the behavior specified in the editor take effect for all instances of the agent and saves changes to the agent's behavior file. The **OK** button also makes the changed behavior take effect, but in addition it closes the editor.

The blue color of the **Apply** and **OK** buttons indicate to you that the behavior of an agent was changed since the last time you hit either the **Apply** or **OK** button.
8. Add Simulation Properties

Let’s keep track of the total number of people infected by the virus. This is done best using Simulation Properties. Simulation properties are variables that are accessible to all the agents in a simulation, can be inspected and edited by the user using the Simulation Properties editor and can be plotted. Open the Simulation Properties editor using Tools | Simulation Properties. At this point, there are no Simulation Properties.

Use the New button to create a Simulation Property.

Call it "Total" for the total number of sick people.
In order to correctly keep track of what is going on in the simulation, this property needs to be incremented every time a person gets sick. To do this, you need to edit the rules of the Person agent to change the value by adding the Set action at the point where the person gets sick.

Then, change the parameter name and formula in the Set Action from “value” to “total” (see right).

Please note that the “@” before the property name is a syntactic way to differentiate between local agent attributes and global simulation properties. When you are finished, your rule looks like this below:
9. **Plotting**

Now we would like to plot the total number of infected people over time. Select the “Total” simulation property in the Simulation Property editor and press the “Plot” button. Click the Plot property check box to enable plotting and then press the “OK” button.

Run the simulation. A plot window will automatically pop up. After about 200 simulation cycles the virus has spread throughout the entire community. Stop the simulation.

Scroll through your plot by clicking the plot window and dragging the mouse left or right. Get more/less detailed labels and get a larger/smaller plot history by resizing the plot window.

Right clicking the plot window provides you with further options through a contextual menu. For instance, you can export the plot to a Microsoft Excel spreadsheet.

Plot any number of simulation properties into the same or different plot windows by using the same or different plot windows names in the Plot Simulation Property “in Window” field. If, for instance, you plot two simulation properties into the same plot window then you can easily export that window into a single Excel worksheet and chart these properties as a XY scatter plot.
10. Arcade

You have created a complete interactive simulation that runs locally on your computer. How can you share your simulation?

Click on the Arcade button

![Submit to Arcade](image)

An arcade submission ready file will be created. Choose a new destination directory if you do not want to use the default destination directory.

![Make Arcade Submission File](image)

Confirm submission

![Submit Project?](image)

You will then be directed to the Arcade website. Please register and upload your game. Invite your friends to play with your creation!
Getting More Help

Creating agent behavior would usually be the hard part, but fortunately AgentSheets helps you gradually develop complex agent behavior and learn as you go. Mechanisms such as the patent-pending Conversational Programming, the Test and Explain buttons enable users to explore the Visual AgenTalk language.

Explore Actions

Actions, which can be displayed with the Tools | Actions Palette menu option, are operations performable by agents. Actions allow agents to do things such as moving around a worksheet, changing their depiction, playing a sound, or opening a Web page.

Actions may include parameters, such as the Direction parameter and the Depiction parameter, which can be directly manipulated. Click the Direction parameter, for example, to specify a direction in which the new agent will be created in the New action and click the Depiction parameter to select what the new agent will look like.

Test Actions

Each action is a tactile object that can be directly manipulated. You can explore an action by selecting it in the Actions Palette, selecting a specific agent in the worksheet using the Arrow tool, and clicking the Test button. Testing the Move action onto a Person agent in the worksheet will make the agent move in the direction indicated by the arrow in the Direction parameter. Any action can be tested on any agent in the worksheet. You can do this anytime you are curious about an action.

Testing an action on an agent will make the agent execute the command once. The action’s consequences also depend on the context. For example, when tested on the healthy Person agent, the Change action executes, turning the healthy Person agent into a sick Person (that is a Person agent with the Person_Sick depiction). This mechanism lets you test any action to see what it does. An action that is currently executing provides visual feedback by changing its frame to a yellow and black striped pattern. This is especially useful when commands are embedded in programs with multiple commands, rules, and methods.
**Explain Actions**

If you want an explanation of what an action does, select the action in the Actions Palette and press the Explain button. A context sensitive explanation of the action is provided in an animated tool tip window below the action.

The system steps through the parts of the action being explained, while the corresponding piece of explanation gets highlighted.

**Access Action Documentation**

For more detailed help, select an action and click the Web Help button at the bottom of the Actions Palette. This brings up a web browser presenting information relevant to the selected action. Web Help indexes directly into the AgentSheets Reference Manual.

**Explore Conditions**

Conditions, which can be displayed with the Tools | Conditions Palette menu option, are used to test an agent’s circumstances. Conditions are either true or false. Among other things, agents can use conditions to test for the presence of other agents around them, test attribute values, detect keyboard input and mouse events, and even search content from live Web pages.

**Test Conditions**

Any condition can be tested by selecting it in the Conditions Palette, selecting an agent in the worksheet using the Arrow tool, and clicking the Test button. As usual with AgentSheets, you do not have to create a complete program to test conditions. This lets you "play" with conditions to find out what they do and where they apply.

For example, testing the Next To condition on an agent will test if any of the 8 adjacent agents looks like the depiction specified in the condition.

A yellow and black striped frame around the condition indicates that the condition is being tested (see right). If the condition is true then the frame quickly disappears and a sound is played. If the condition is false, the frame begins to blink and a different alert sound is played. In
the situation above, the condition is true since there is one or more adjacent agents that looks like the one specified by the condition.

**Test all conditions with Conversational Programming**

All conditions in the Conditions Palette will be tested for the current situation by turning Conversational Programming on, by either using the toolbar drop down menu or the Tools | Turn Conversational Programming On menu option, and selecting an agent in the worksheet. Conditions get colorized green if they are true for the selected agent and red if they are false. For example, for the **Person** selected in the worksheet on the left, the **See**, **Stacked**, and **Next to** conditions are true: the agent looks like a healthy person, it is stacked immediately above background, and it is next to at least one sick person.

**Explain Conditions**

If you want an explanation of what a specific condition does, select the condition in the Conditions Palette and press the Explain button. A context sensitive explanation of the condition is provided in a tool tip window below the condition.

The system steps through the parts of the condition being explained, while the corresponding piece of explanation gets highlighted.

**Access Condition Documentation**

For more detailed help, select a condition and click the Web Help button at the bottom of the Conditions Palette. This brings up a web
browser presenting information relevant to the selected condition. Web Help indexes directly into the AgentSheets Reference Manual.

**Explore Rules**

Rules are sets of conditions and actions combined in IF-THEN structures.

**Test Rules**

At any point during the creation of a simulation, rules can be tested by running the simulation. Also, entire rules can be selected in the behavior editor and tested in specific contexts by clicking the Test button. If the rule can fire - meaning that all its conditions are true - it will execute all its actions. If the rule cannot fire, it will indicate why it cannot fire by making the unsatisfied condition blink.

**Explain Rules**

Select any rule in the behavior editor by clicking its “Then” label. Press the Explain button. A context sensitive explanation is provided by stepping through the entire rule and explaining its components in an animated tool tip window below each command of the rule.

**Explore Methods**

Lists of rules are grouped together into methods. Each method is labeled with a trigger. A full list of triggers is housed in the Triggers: palette which is accessed via the Tools | Triggers Palette menu or by clicking the Trigger palette icon.

**Test Methods**

You can test a method by selecting both the method and the agent you want to test it on in the worksheet and then clicking on the Test button. The system will step through all the rules, giving you feedback on what is being executed at each step. When the system finds a rule whose conditions are all true, it steps through the list of actions.
**Explain Methods**

Select any method in the behavior editor by clicking its trigger or its tab. Press the Explain button. An explanation for the selected method is provided in a tool tip window below the method’s trigger.

**Explore Behaviors**

Entire agent behaviors can be checked when Conversational Programming is turned on, an agent is selected in the worksheet, and that agent’s behavior editor is open. The one rule in the agent's behavior editor that can fire in the current situation in the worksheet will have a green background. The rules that cannot fire will have a red background and the ones that are not evaluated at all, their regular background. Individual conditions will also be annotated in each rule. In this case, conditions will show up as green if they are true, red if they are false, and black if they are not evaluated. This way, you can determine which condition causes a rule to fail. For instance, in the Person behavior below, the % chance condition is causing the first rule to fail, so the second one without any conditions will fire.
Other Resources

You can find more helpful information about the AgentSheets software in the following documents, found in the help menu of the AgentSheets application or online at:

- **Reference Manual**: A description of the complete menu structure of AgentSheets including all the dialog boxes, tools, action commands, condition commands, triggers, parameters and simulation properties. Format: PDF, HTML.

Acknowledgements

This work was paid for in part by funding from the National Science Foundation.

This material is based upon work supported by the National Science Foundation under award numbers DMI 9761360, REC 9804930, REC-9631396, RED 9253425, CDA-940860. Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
End-User Software License Agreement

AGENTSHEETS, INC.
End-User License Agreement
Single User and Site Licenses / AgentSheets 4.0

NOTICE TO USER(s):

THIS IS AN AGREEMENT. PLEASE READ IT CAREFULLY. BY INSTALLING THIS SOFTWARE YOU ACCEPT ALL THE TERMS AND CONDITIONS OF THIS AGREEMENT. IF YOU DO NOT AGREE WITH THE TERMS AND CONDITIONS OF THIS AGREEMENT, YOU MUST NOT USE THE SOFTWARE.

• Use of the Software.
  • You may install one copy of the Software onto a hard disk or other storage device up to the Permitted Number of Computers.
  • You may install one copy of the Software on a single file server for the purpose of downloading and installing the Software onto a hard disk or other storage device of up to the Permitted Number of Computers that are on the same network as the file server. No other network use is permitted.
  • You may make one backup copy of the Software, provided your backup copy is not installed or used on any computer.
  • HOME USE. The primary user of each computer on which the Software is installed may also install the Software on one (1) home computer. However, the Software may not be used on the home computer simultaneous to use of the Software on the primary computer.
  • SITE LICENSE USE. Software is installed on agreed upon numbers of computers and only at the agreed upon site and no other computers.
  • APPLICATIONS AND APPLETS. Unless stated otherwise in the Documentation, you may display, modify, reproduce, and distribute any of the Applications included with the Software. However, you may not distribute the Applications on a stand-alone basis, i.e., in circumstances in which the Stock Files constitute the primary value of the product being distributed. You should review the “Read Me” files associated with the Applications that you use to ascertain what rights you have with respect to such materials. Applications may not be used in the production of libelous, defamatory, fraudulent, infringing, lewd, obscene, or pornographic material or in any otherwise illegal manner. You may not register or claim any trademark rights in the Applications or derivative works thereof.

1.6 DISTRIBUTION OF CONTENT. End-user generated projects converted through the use of the Ristretto tool into Java applets can be distributed, permitted that the AgentSheets marks and links to the AgentSheets web site are left intact. The marks include references to “AgentSheets” and "Ristretto" as well as the AgentSheets logo. If these marks are removed you need to contact AgentSheets, Inc., 6560 Gunpark Dr., Suite D, Boulder, CO 80301 to negotiate a royalty-based license agreement.

2. Copyright. The Software and any copies that you make are owned by AgentSheets Inc., and its structure, organization, and code are the valuable trade secrets of AgentSheets. The Software is also protected by Copyright Law and International Treaty provisions. You must treat the Software just as you would any other copyrighted material, such as a book. You may not copy the Software, except as set forth in the “Use of the Software” section. Any copies that you are permitted to make pursuant to this Agreement must contain the same copyright and other proprietary notices that appear on or in the Software. You agree not to modify, adapt, or translate the Software. You also agree not to reverse engineer, decompile, disassemble, or otherwise attempt to discover the source code of the Software.
Trademarks shall be used in accordance with accepted trademark practice, including identifications of trademark owners’ names. Trademarks can only be used to identify printed output produced by the Software and such use does not give you any right of ownership in that trademark. Except as stated above, this Agreement does not grant you any intellectual property rights in the Software. This Agreement provides the terms and conditions under which you are licensed to use the Software. It is not an agreement for the sale of the Software to you, and ownership of the Software shall be and remain in AgentSheets, Inc.

3. Transfer. You may not rent, lease, sublicense, or lend the Software. You may, however, transfer all of your rights to use the Software to another person or legal entity provided (1) that you transfer this Agreement, the Software, including all copies, updates, and prior versions, to such person or entity, (2) that you retain no copies, including copies stored on a computer, and (3) that the receiving party accepts the terms and conditions of this Agreement and such terms and conditions shall apply to and be binding upon such receiving party.

4. Multiple Environment Software/Multiple Language Software/Dual Media Software/Multiple Copies/Updates. If the Software supports multiple platforms or languages, you receive the Software on multiple media, or you otherwise receive multiple copies of the Software, the number of computers on which all versions of the Software are installed may not exceed the Permitted Number of Computers. You may not rent, lease, sublicense, lend, or transfer versions or copies of the Software you do not use. If the Software is an Update to a previous version of the Software, you must possess a valid license to such previous version to use the Update.

5. Limited Warranty. AgentSheets warrants to you that the Software will perform substantially in accordance with the Documentation for the ninety (90) day period following your receipt of the Software. To make a warranty claim, you must return the Software to the location where you obtained it along with proof of purchase with such ninety (90) day period. If the Software does not perform substantially in accordance with the Documentation, the entire liability of AgentSheets and your exclusive remedy shall be limited to either, at AgentSheets’s option, the replacement of the Software or the refund of the license fee you paid for the Software. THE FOREGOING STATES THE SOLE AND EXCLUSIVE REMEDIES FOR AGENTSHEETS’ BREACH OF WARRANTY. THE LIMITED WARRANTY SET FORTH IN THIS SECTION GIVES YOU SPECIFIC LEGAL RIGHTS. YOU MAY HAVE OTHER RIGHTS, WHICH VARY FROM STATE TO STATE OR JURISDICTION TO JURISDICTION. For further warranty information, please contact AgentSheets’ Customer Support Department.

6. DISCLAIMER OF WARRANTIES. EXCEPT FOR THE LIMITED WARRANTY SET FORTH IN SECTION 5, AGENTSHEETS MAKES NO WARRANTIES, EXPRESS, IMPLIED, OR STATUTORY, AS TO ANY OTHER MATTERS, INCLUDING BUT NOT LIMITED TO NON-INFRINGEMENT OF THIRD-PARTY RIGHTS, MERCHANTABILITY, OR FITNESS FOR ANY PARTICULAR PURPOSE. AGENTSHEETS DOES NOT AND CANNOT WARRANT THE PERFORMANCE OR RESULTS YOU MAY OBTAIN BY USING THE SOFTWARE. Some states or jurisdictions do not allow the exclusion of implied warranties or limitations on how long an implied warranty may last, so the above limitations may not apply to you. To the extent permissible, any implied warranties are limited to ninety (90) days.

7. Limitation of Liability. IN NO EVENT WILL AGENTSHEETS BE LIABLE TO YOU FOR ANY CONSEQUENTIAL, INDIRECT, INCIDENTAL, PUNITIVE, OR SPECIAL DAMAGES, INCLUDING ANY LOST PROFITS OR LOST SAVINGS, EVEN IF A REPRESENTATIVE OF AGENTSHEETS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY THIRD PARTY. SOME STATES OR JURISDICTIONS DO NOT ALLOW THE EXCLUSION
OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATIONS MAY NOT APPLY TO YOU.

8. Governing Law and General Provisions. This Agreement will be governed by the laws in force in the State of Colorado excluding the application of its conflicts of law rules. This Agreement will not be governed by the United Nations Convention on Contracts for the International Sale of Goods, the application of which is expressly excluded. If any part of this Agreement is found void and unenforceable, it will not affect the validity of the balance of the Agreement, which shall remain valid and enforceable according to its terms. You agree that the Software will not be shipped, transferred, or exported into any country or used in any manner prohibited by the United States Export Administration Act or any other export laws, restrictions, or regulations. This Agreement shall automatically terminate upon failure by you to comply with its terms, in which event you must destroy all copies of the Software. This Agreement may only be modified by a writing signed by an authorized officer of AgentSheets, although AgentSheets may vary the terms of this Agreement in connection with the licensing of any Updates to you.

9. Notice to U.S. Government End Users. The Software and Documentation are “Commercial Items,” as that term is defined at 48 C.F.R. § 2.101, consisting of “Commercial Computer Software” and “Commercial Computer Software Documentation,” as such terms are used in 48 CFR. § 12.212 or 48 C.F.R. § 227.7202, as applicable. Consistent with 48 C.F.R. § 12.212 or 48 C.F.R. §§ 227.7202-4, as applicable, the Commercial Computer Software and Commercial Computer Software Documentation are being licensed to U.S. Government end users (A) only as Commercial Items and (B) with only those rights as are granted to all other end users pursuant to the terms and conditions herein. Unpublished rights reserved under the copyright laws of the United States. AgentSheets, Inc., 6560 Gunpark Dr., Suite D, Boulder, CO 80301.

10. Compliance with Licenses. If you are a business or organization, you agree that upon request of AgentSheets or AgentSheets' authorized representative, you will within thirty (30) days fully document and certify that your use of any and all AgentSheets software at the time of the request is in conformity with your valid licenses from AgentSheets.
Sim Whatever.