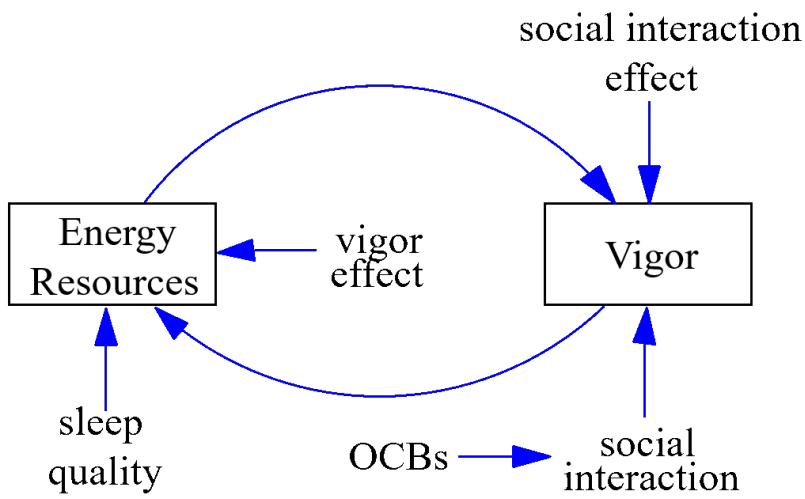
Tutorial for Building a Computational Model Using VensimPLE®[1]

We are going to be building this model, as seen in Figure 22.1, regarding Vigor and OCBs. In this tutorial you will place variables and input the equations necessary to make the simulation run.

Please note that this tutorial is intended to be used in conjunction with Chapter 22 and not in place of it, thus these are practical steps and not theoretical explanation.

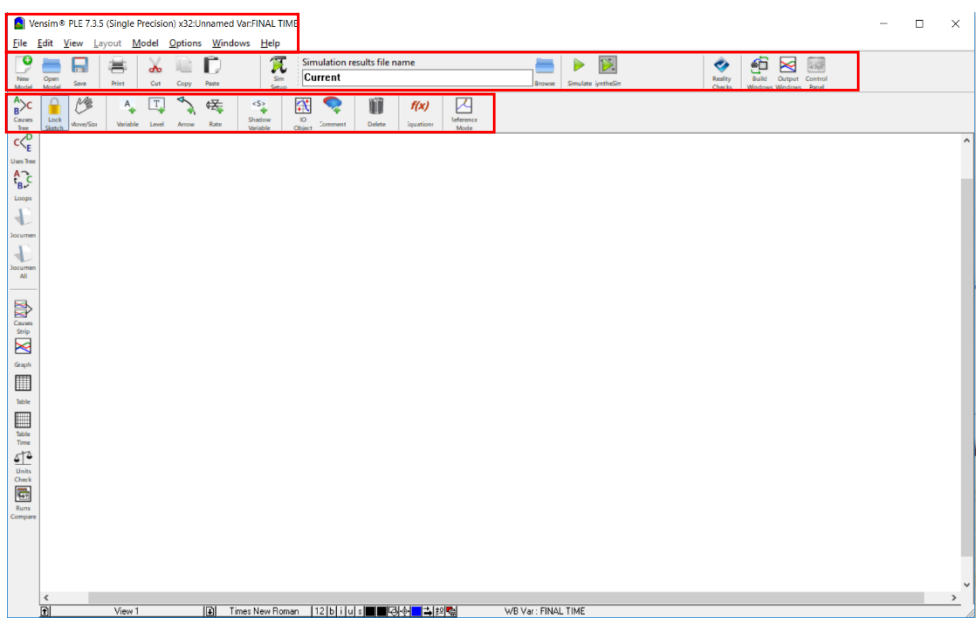


1. If you do not have the VensimPLE® computational modeling software then download it now: https://vensim.com/download/

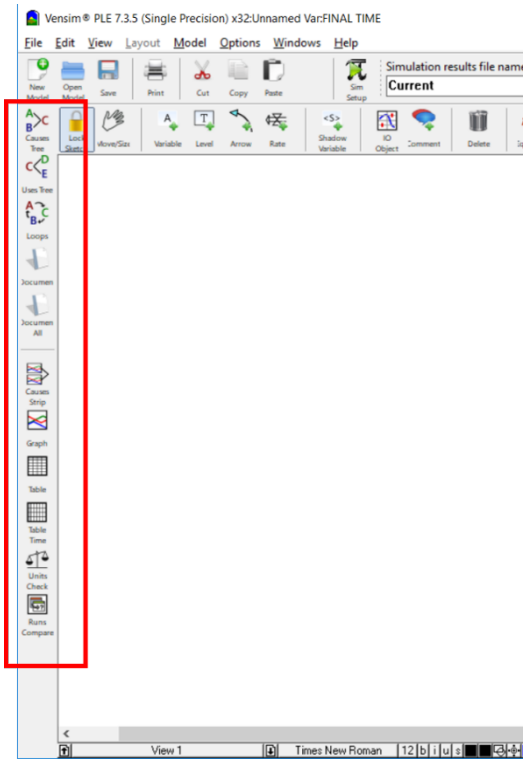
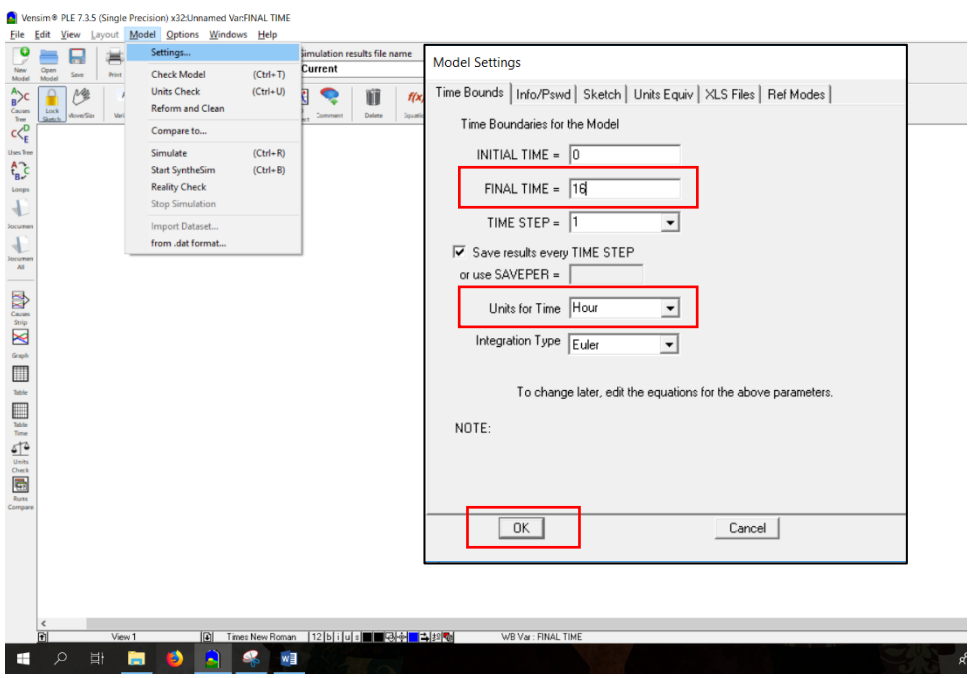
2. Open the VensimPLE® modeling platform.

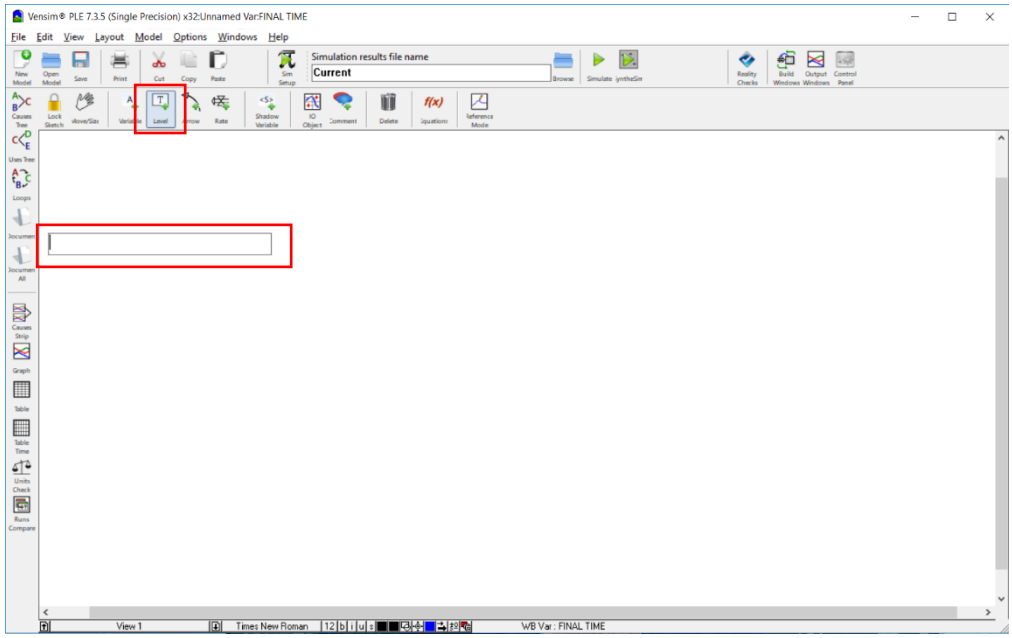
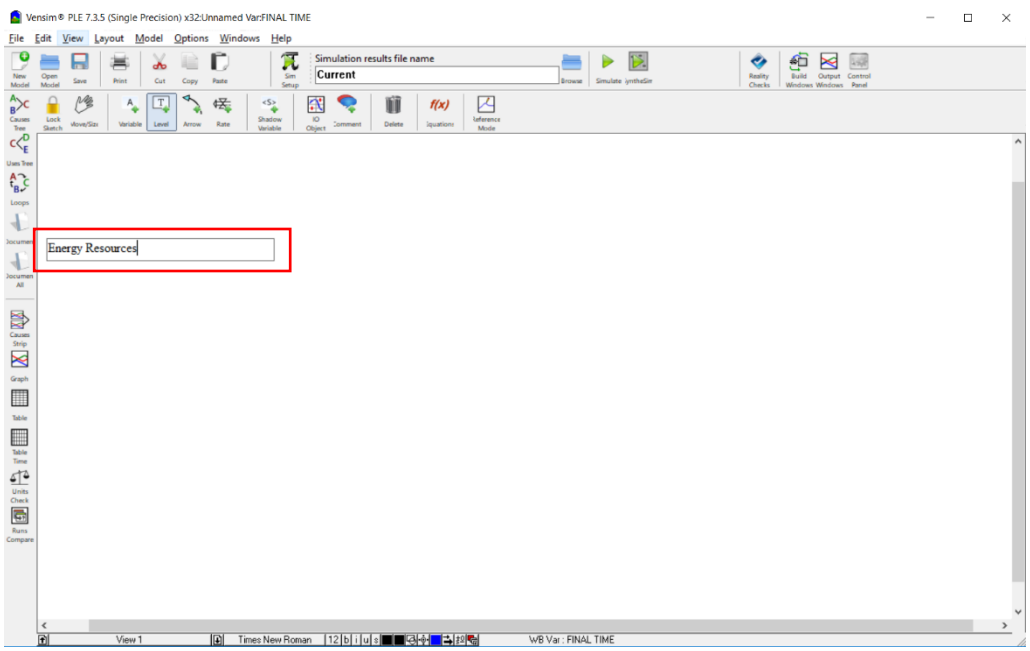
You can see the top navigation ribbon including directory options such as file, edit, etc.

Underneath this will be the overall model ribbon. This is where you can save your model, open a new model, and other general model functions. To the right of the file name text box is where you will simulate your model, and further still is where you can access your output windows and control panel.



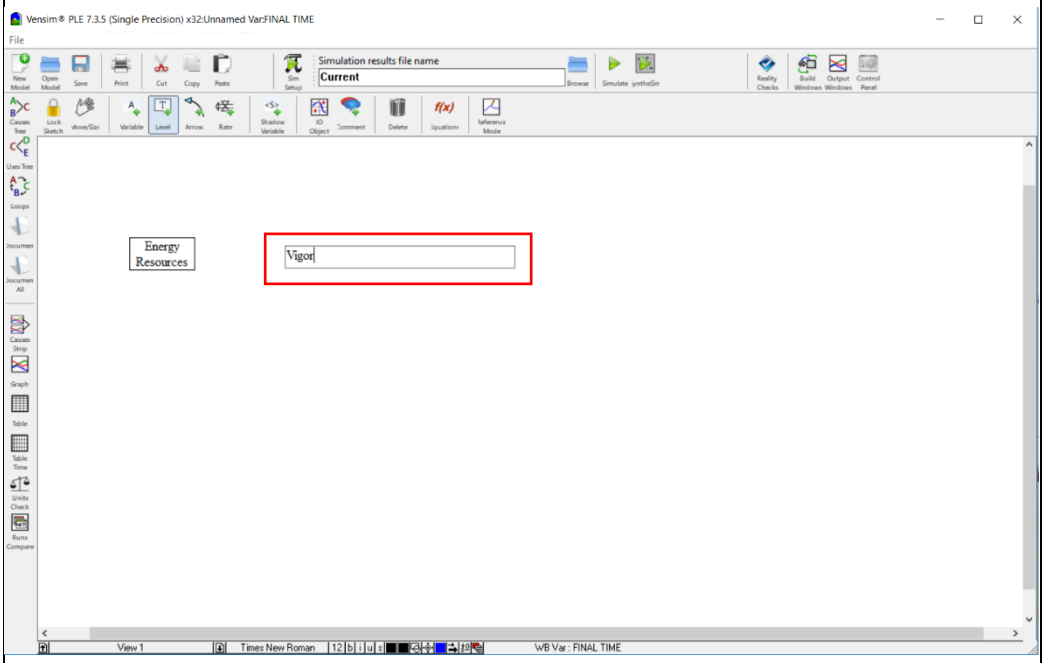
[1]We thank Ethan Schmerling for collecting the screenshots used in this tutorial.

The 3rd ribbon is specific to building the model. Here are options for adding and moving variables, arrows, and accessing your equations.	
The vertical ribbon along the left side gives you the option of viewing causes and users trees, loops, and adding graphs and tables, etc.	
Here we will change the time frame of the model to represent a 16-hour waking day. 3. From the top navigation ribbon, select Model → settings. 4. In the dialog box, enter 16 in the FINAL TIME = text box. 5. Choose "hour" from the drop-down menu attached to the "Units of Time" field. 6. Click "OK."	

Let's build the pictorial representation of the model. We will begin with level variables. 7. In the 3rd ribbon, directly above the build window, click the "T" icon labeled "Level." 8. Click on the left side of the build window to place the variable. A text box should appear.	
9. Type "Energy Resources" and then hit enter. A box with the words "Energy Resources" should appear within the build window.	

10. Move the mouse to the right of this box.

11. Click within the build window and type “Vigor” and hit enter. A new box with the word “Vigor” should appear within the build window.

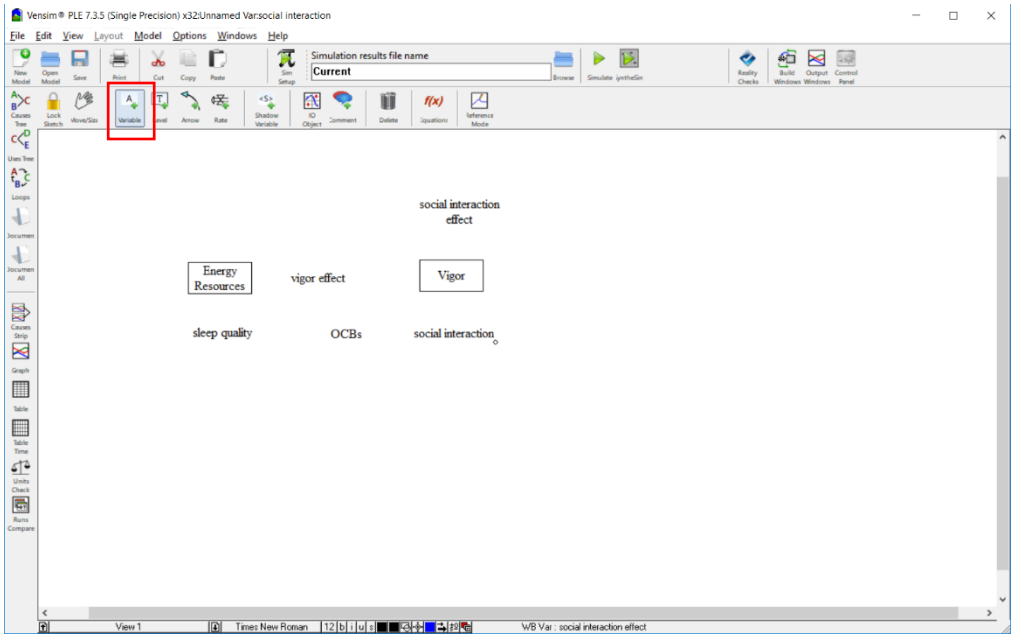


Now we will add the variables in the model that are not level variables.

12. Click the “A” icon labeled “Variable.”

13. Using the labels and placement in the figure, add “sleep quality’, “vigor effect”, “social interaction effect”, “OCBs”, and “social interaction”.

Capital letters are used to distinguish level variables, so be sure to add these variables in lower case.



14. To add the arrows, click the "Arrow" icon to the right of the Level icon.

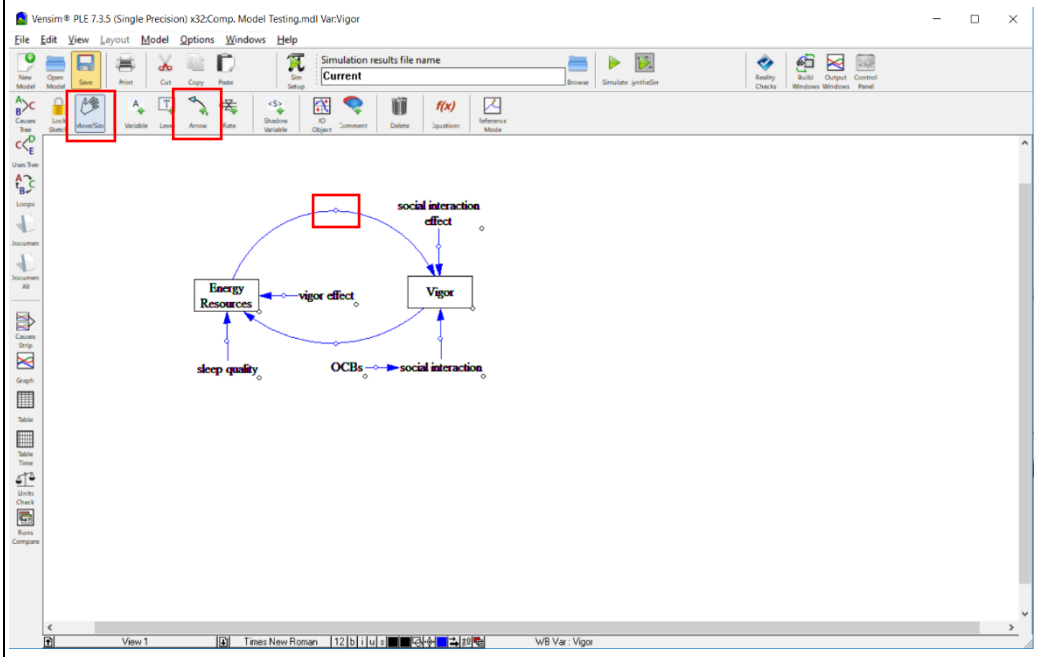
15. Click on "Vigor" followed by "Energy Resources" to create an arrow between the two.

16. Do this to recreate the other arrows shown in Figure 22.1.

17. Clicking the hand icon (labeled "move/size") will allow you to move variables around in the build window.

18. To reposition arrows, click one of the small circles on an arrow, and drag up or down to reposition.

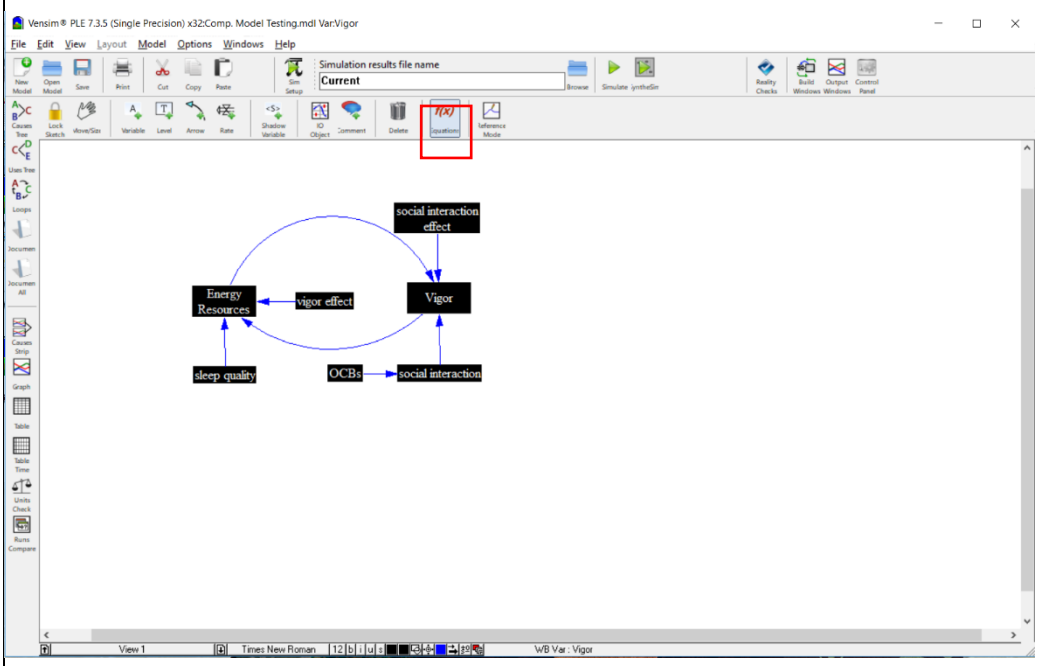
These cosmetic changes do not affect the model but can make it easier to understand.



Now we will enter the functions into each variable.

19. Click the "Equations" icon with the *f(x)* symbol. This will highlight all variables black.

20. Click on the "Vigor" variable box.



21. Clicking the “Vigor” box will bring up a complex dialog box.

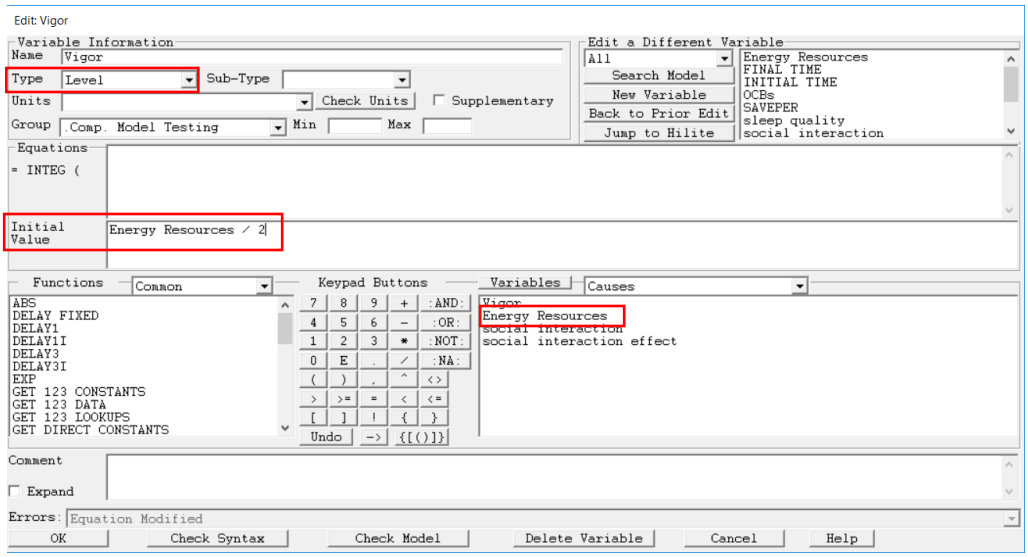
22. Because we entered Vigor as a level variable, “Level” is listed under the “Type” field.

23. Click in the Initial Value box to enter a starting value for Vigor.

24. Choose “Energy Resources” from the list of variables below and to the right of the initial value box. Energy Resources should appear in the initial value box.

25. Add “/2” after the text “Energy Resources”.

This means that the initial level of vigor will be half of whatever level Energy Resources are at the beginning of the simulation.

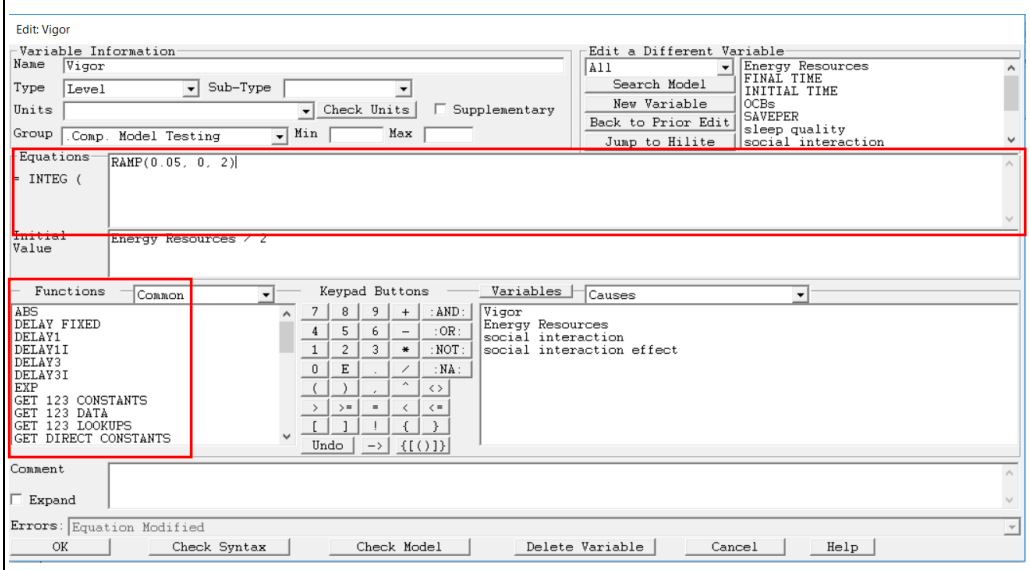


26. Click within the = INTEG (text box.

27. Choose the RAMP function from the “Functions” list below the equations boxes. You will need to scroll down the functions list to find RAMP.

28. The RAMP function requires an input, starting time, and finishing time. Type “0.05” in as the first argument (to represent a 5% increase in vigor), “0” as the second argument (starting time), and “2” as the third argument (finishing time). Your full function should read RAMP(0.05, 0, 2).

This represents an increase of 5% in vigor, beginning at time



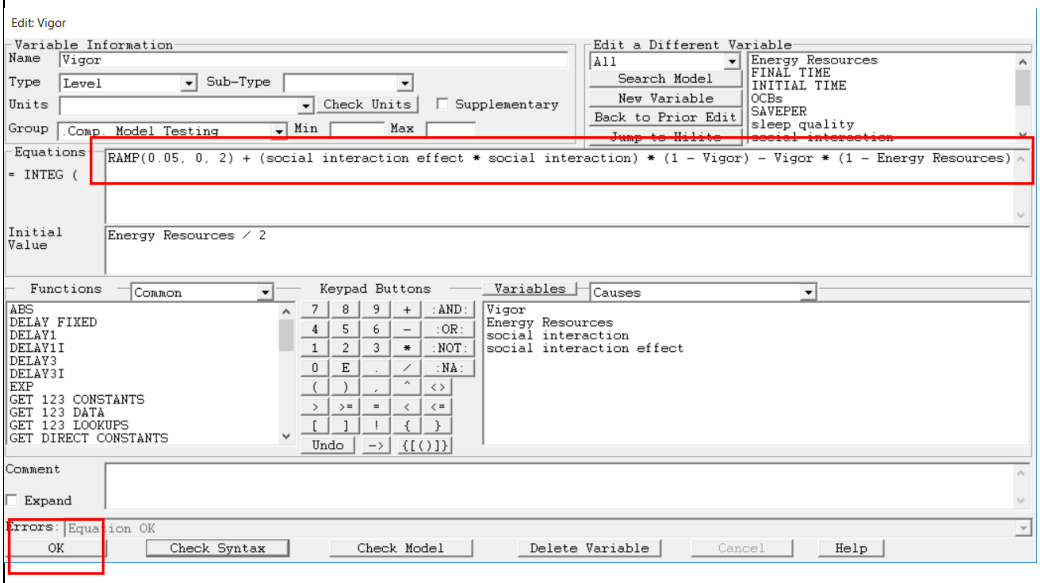
zero, and ending at time two (i.e., three hours from the start of the person's day).

We will now account for the rest of the variables that relate to vigor, including bounds for ceiling and floor effects.

29. In the Equations text box, at the end of the RAMP function, type " + (social interaction effect * social interaction) * (1 − Vigor) – Vigor * (1 − Energy Resources)".

30. Your final equation within the = INTEG (equation box should read "RAMP(0.05, 0, 2) + (social interaction effect * social interaction) * (1 − Vigor) – Vigor * (1 − Energy Resources)".

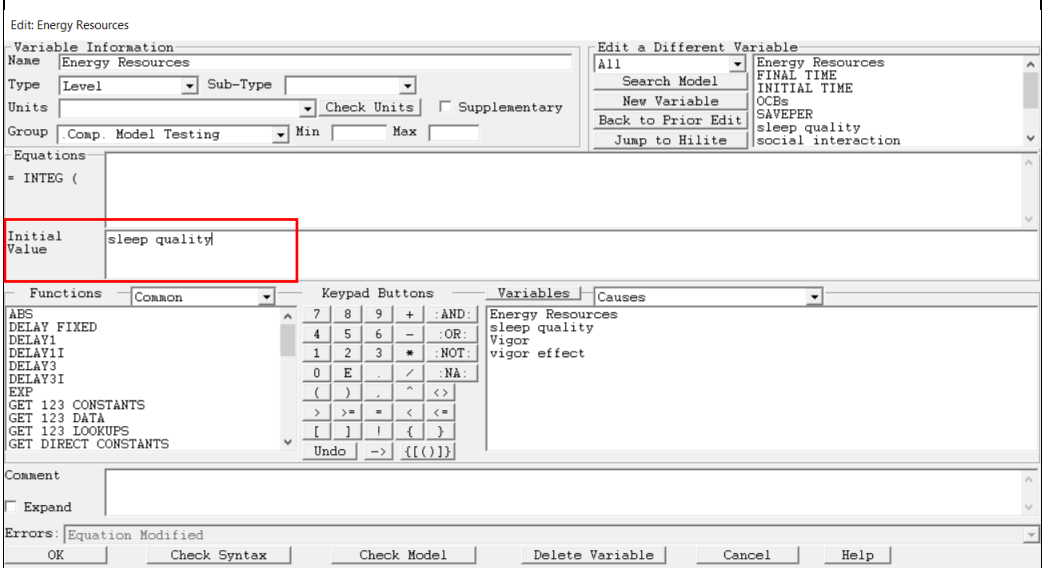
31. Click "OK". The software will automatically check the syntax of the function.



Let's put the equation in for the "Energy Resources" variable.

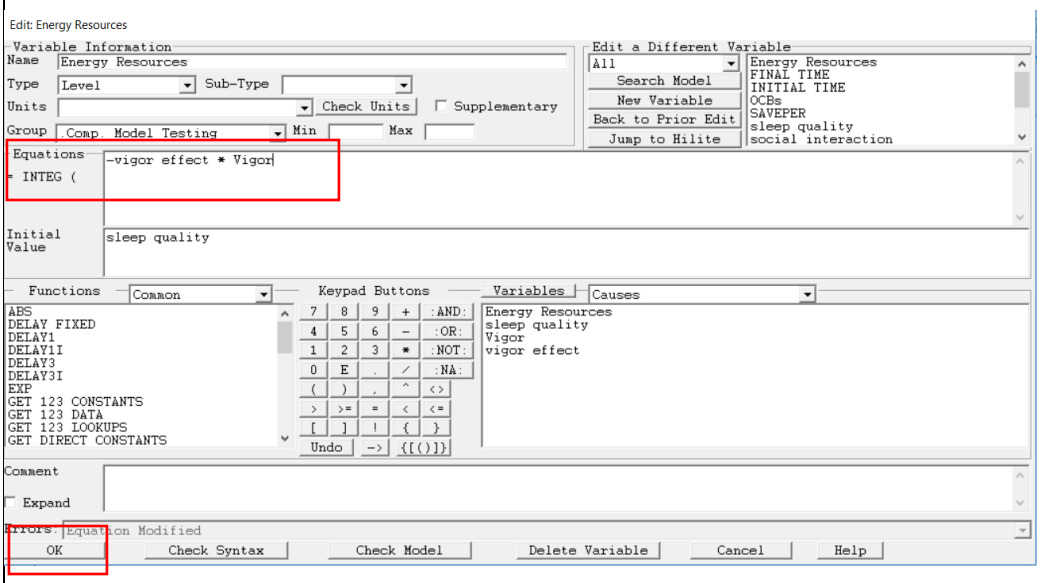
32. With the "Equations Icon" (with the *f(x)* symbol) still highlighted, click the "Energy Resources" box.

33. In the Initial Value text field, type "sleep quality".



34. In the =INTEG (text field, type “–vigor effect * Vigor”.

35. Click “OK.” The software will automatically check the syntax of the function.



The last endogenous variable in this model is social interaction.

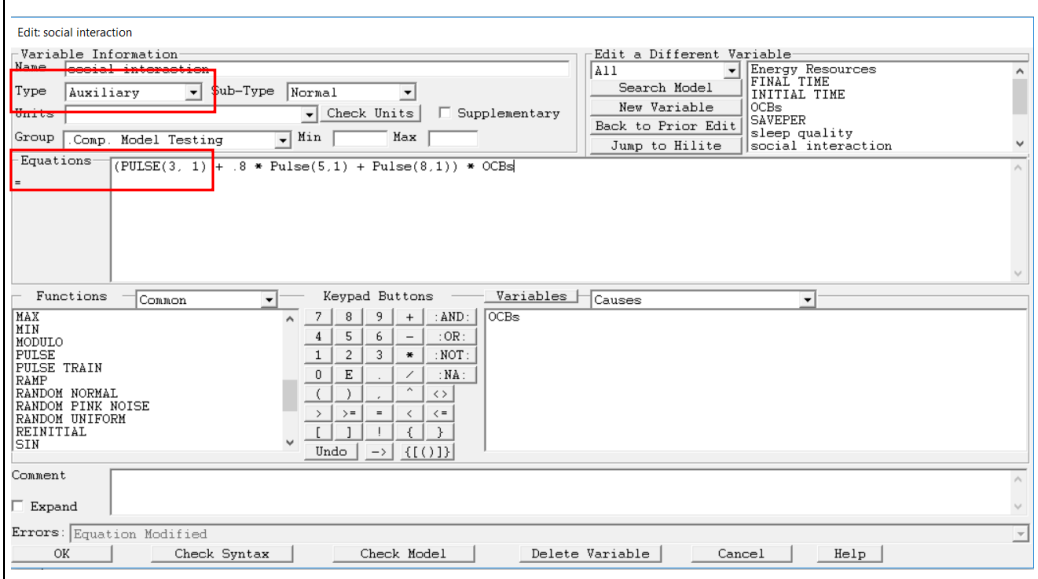
36. With the “Equations Icon” (with the *f(x)* symbol) still highlighted, click the “social interaction” box.

37. Notice that social interaction, a variable that is not a Level variable, is listed as “Auxiliary” in the Type field.

39. Click within the Equations text box.

40. Choose the PULSE function from the “Functions” list to the lower left of the equations box.

41. The PULSE function requires two arguments: the time point where the pulse will occur, and the duration of the pulse. Type “3” as the first argument, and “1” as the second.

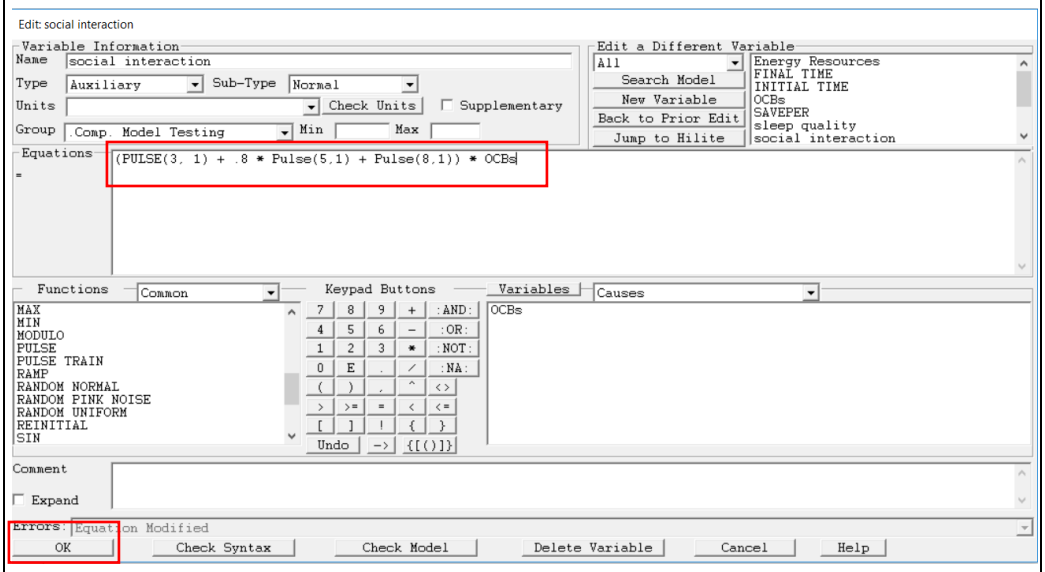


Because we want to represent more than one social interaction in a day, we will add additional PULSE functions to represent them.

42. After your first PULSE function, type in "+ .8 * PULSE(5, 1) + PULSE(8, 1) * OCBs".

43. Your full equation should read: "(PULSE(3, 1) + .8 * PULSE(5, 1) + PULSE(8, 1)) * OCBs".

44. Click "OK". The software will automatically check the syntax of the function.



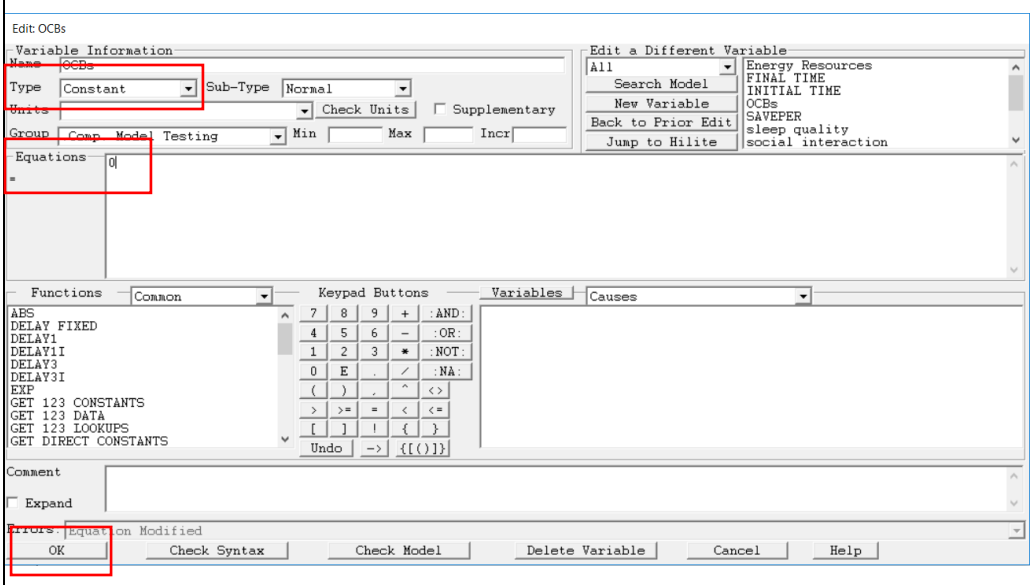
We now need to set the value for the rest of the variables in the model.

45. With the "Equations Icon" (with the *f(x)* symbol) still highlighted, click the "OCBs" box.

46. Notice that OCBs are listed as "Constant" in the Type field. OCBs do not change during simulation of the model.

47. Type "0" into the Equations text box. In this run of the model, we are saying there were no OCBs performed.

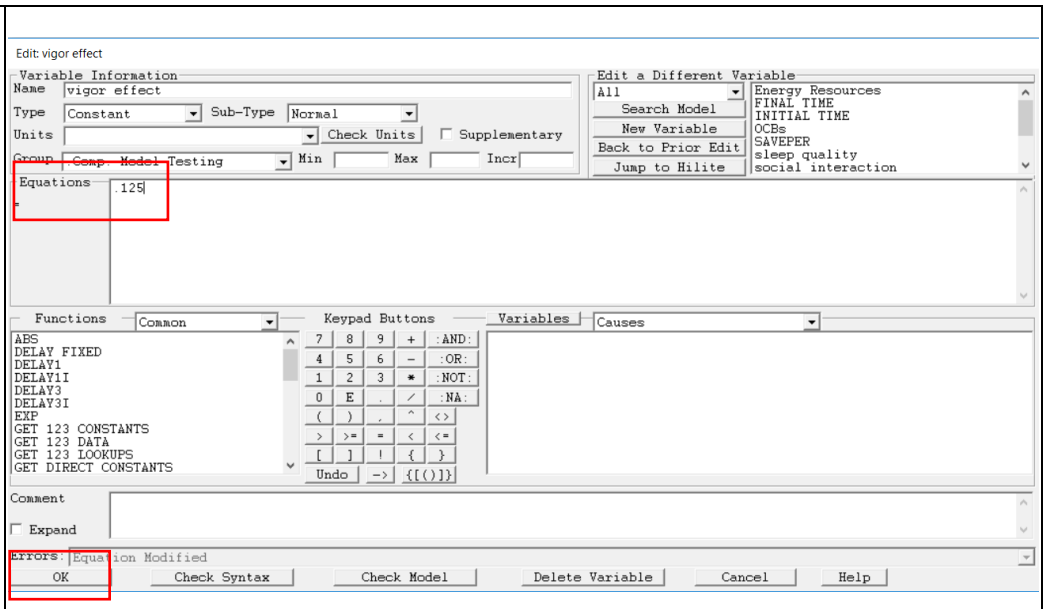
48. Click "OK".



49. With the “Equations Icon” (with the *f(x)* symbol) still highlighted, click the “vigor effect” box.

50. Enter “.125” into the Equations text field.

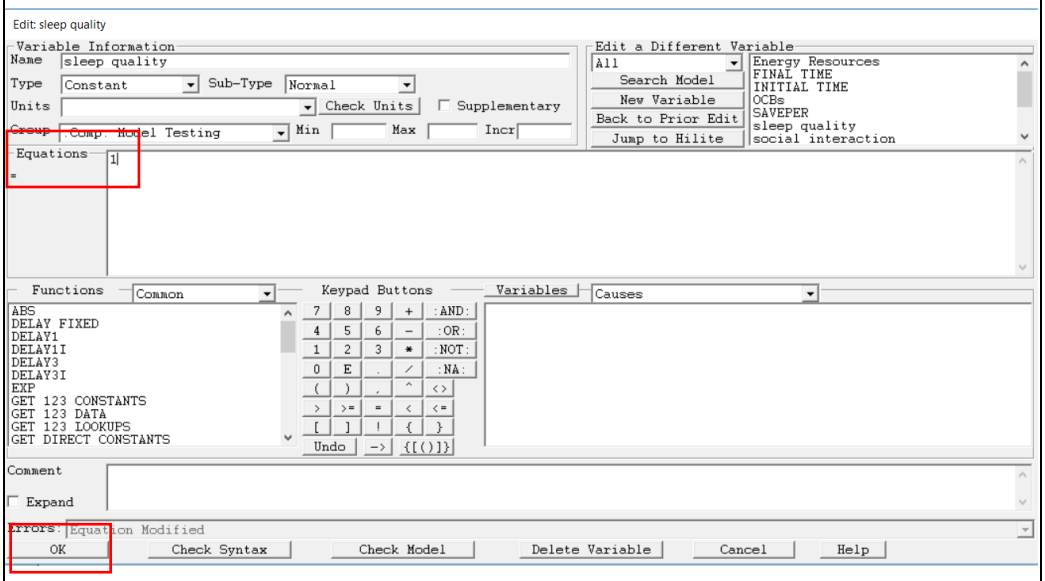
51. Click “OK”.



52. With the “Equations Icon” (with the *f(x)* symbol) still highlighted, click the “sleep quality” box.

53. Enter “1” into the Equations text field.

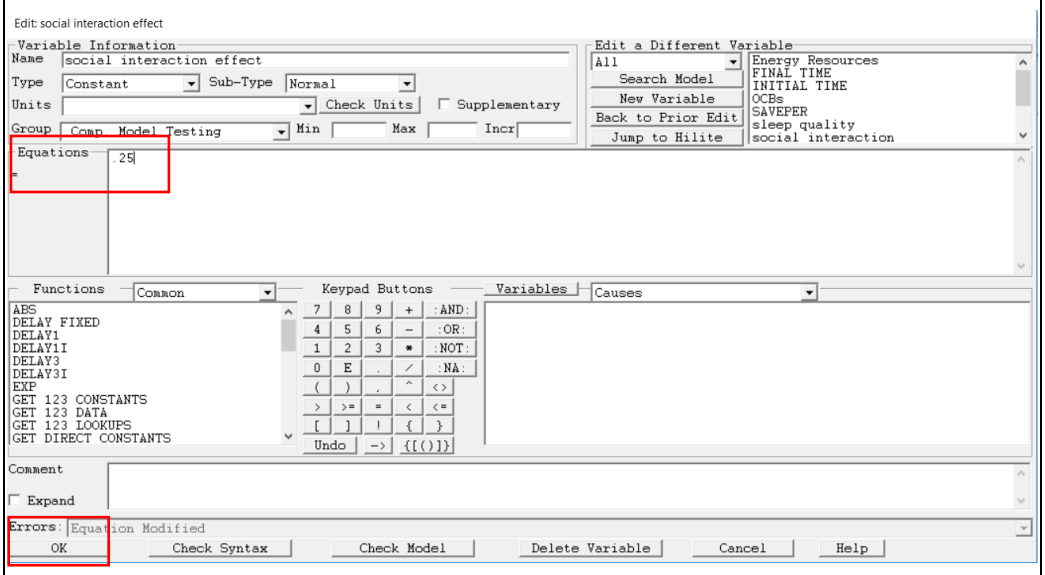
54. Click “OK”.



55. With the “Equations Icon” (with the *f(x)* symbol) still highlighted, click the “social interaction effect” box.

53. Enter “.25” into the Equations text field.

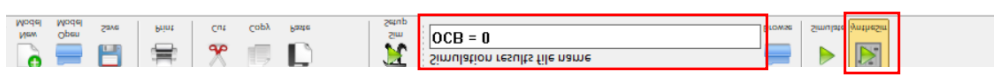
54. Click “OK”.



At this point, the model should be ready to run. The next sections discuss how to simulate your model.

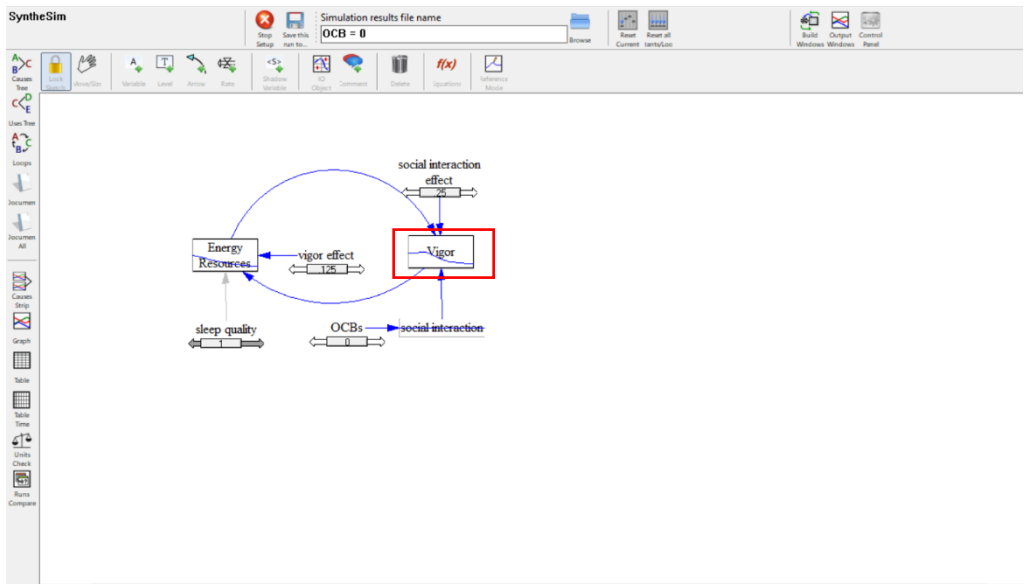
55. Indicate which run of your model you are using by typing “OCB = 0” into the “Simulation Results File Name” text field in the ribbon. This indicates that in this run, there will be no OCBs. This is the name that the data from the simulation in this run will be saved.

56. Click the SyntheSim button, indicated by a green arrow with a grey background, to simulate your model.



57. The model will show the values simulated within the build window.

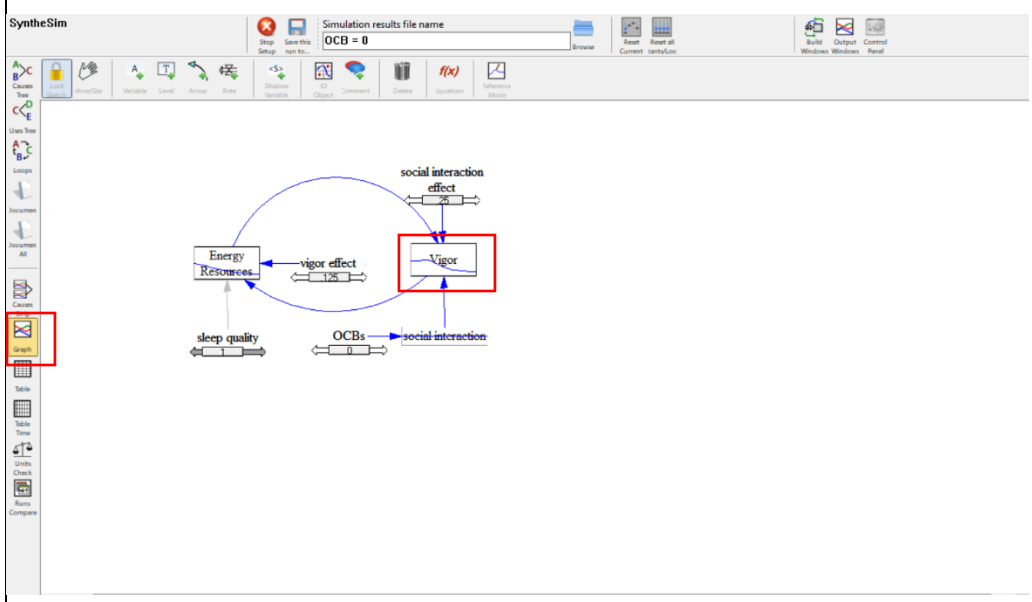
58. Effects on Level variables can be seen within the level variable boxes.



Let's create a graph to see the Vigor trajectory more clearly.

59. Without stopping the simulation of the model, click the "Vigor" variable box.

60. Click the "Graph" icon on the left-side vertical ribbon.

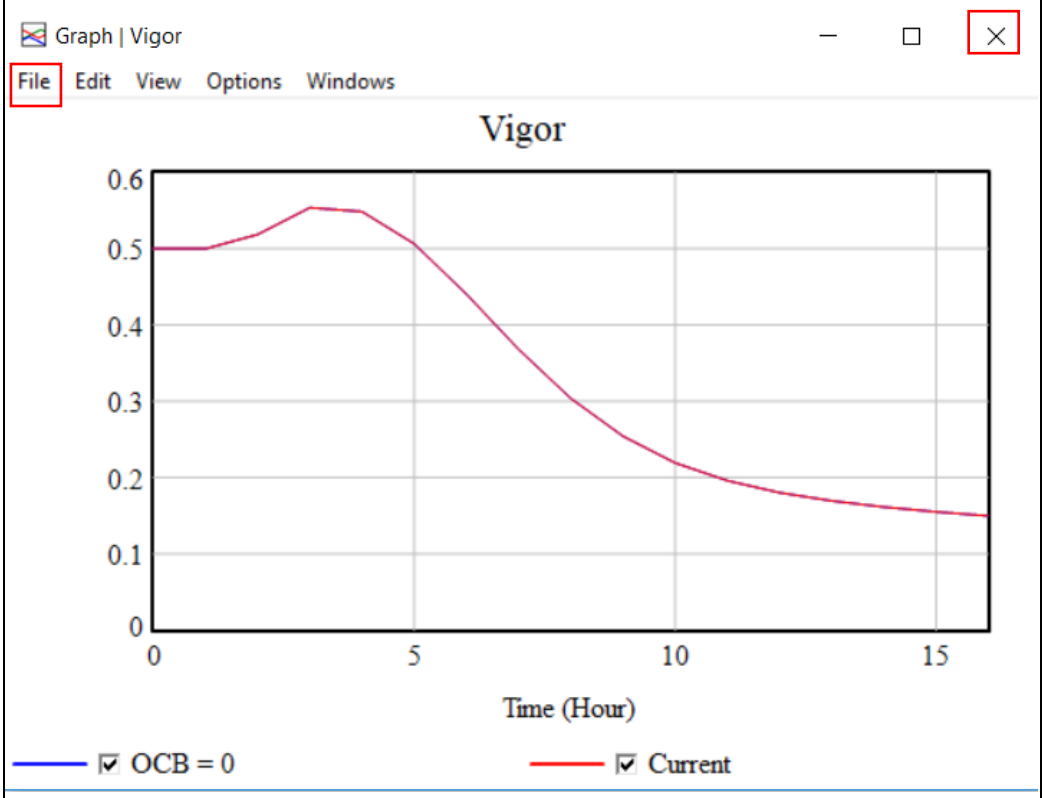


A graph pop-up window will automatically appear showing the trajectory over the simulation of whichever variable you had last selected.

This graph can be saved as an image:

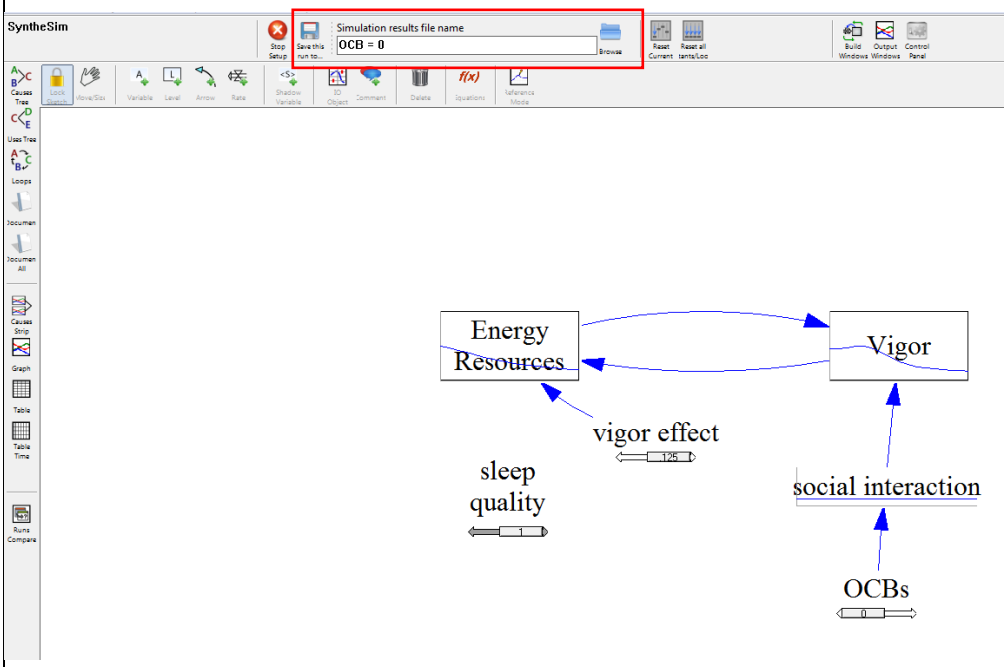
61. Select File → Save to choose a name and location.

62. Click the X to close the graph.

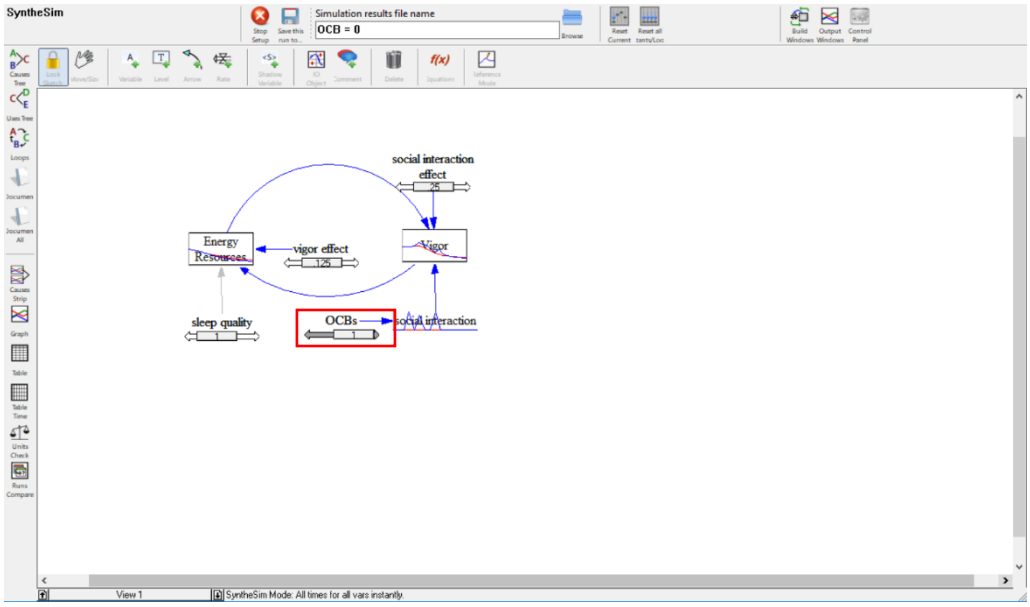


What happens if we change OCB's to 1, indicating that OCB's exist in a new run of the model? Let's compare the model results from 0–1 OCBs.

63. Without stopping the simulation of the model, make sure your current run is saved as OCB = 0 by clicking the "Save" icon next to the "Simulation results file name" text field.



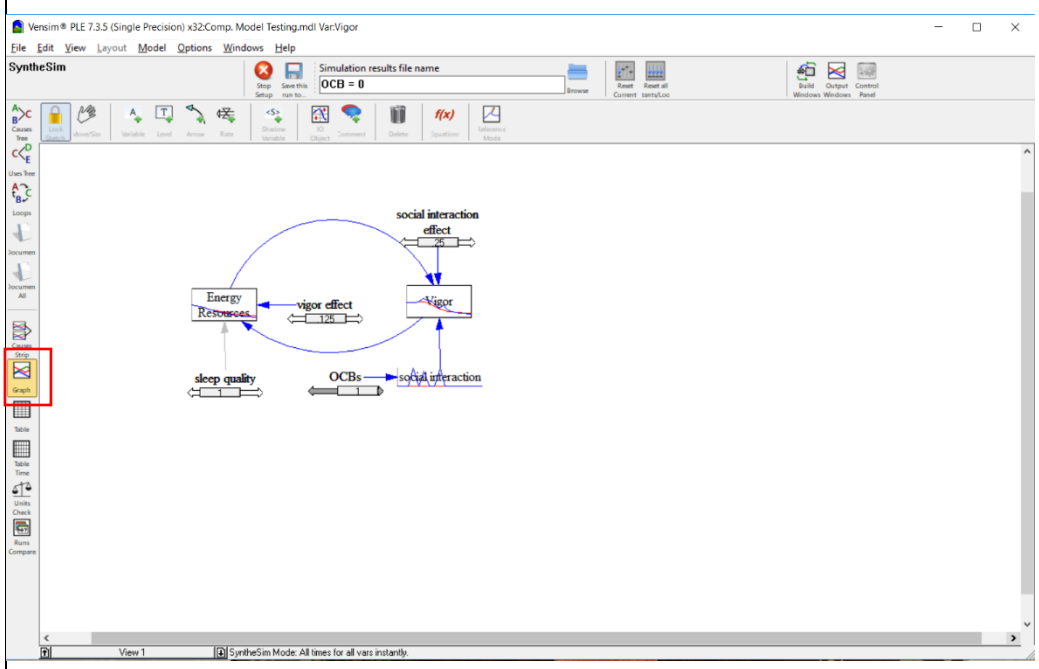
64. Now, click and drag the value bar under OCBs from 0 to 1. You can see a new line appears in the graph previews of the Level variables.



Let's create a comparison graph.

65. Without stopping the simulation of the model, click on the "Vigor" variable box to select it.

66. Click the "Graph" icon on the left-side vertical ribbon.

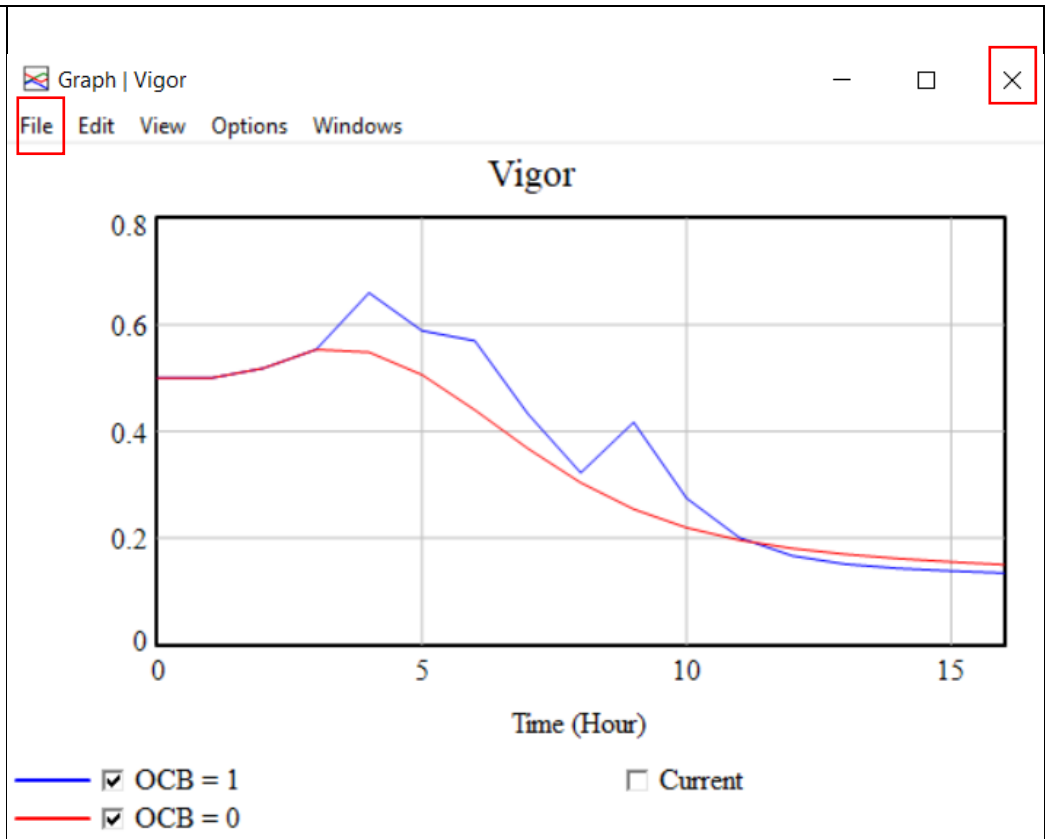


A graph pop-up window will automatically appear showing the comparison of the Vigor trajectory between your saved OCB = 0 run and the new run where OCB = 1. Notice the legend in the bottom left corner of the graph.

This graph can be saved as an image:

61. Select File → Save to choose a name and location.

62. Click the X to close the graph.



The other variables in the model can be graphed and compared in the same manner. Clicking the "Stop Setup" button with the red X icon will stop the simulation and allow you to make changes to the model.

This concludes the how-to guide for building the computational model.