

# Modeling with MicroWorlds EX – Gravity

Professionals in all walks of life use computers to create numerical or visual models of real-world phenomena. Models in which particular variables may be changed are known as simulations. In this tutorial, you create a simple model of gravity and its relationship to velocity.

Remember to save your work frequently.

Step 1: Setting up

Step 2: Add a gravity slider

Step 3: Add a Velocity Slider

Step 4: Using sliders as controllers

Step 5: Add additional information

Step 6: Show What You Know

Step 7: Putting it all together

Step 8: Challenges

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## Step 1: Setting up

Name your project and remember to save often.

Hatch a new turtle



Open the Painting/Clipart palette by clicking on its icon on the Toolbar. Click on the Singles shapes button:



Click on one of the rocket shapes. Then click exactly on the turtle to set it to this shape.



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## Step 2: Add a gravity slider

Create a slider. Click on the slider tool on the Toolbar.



Then click on the page. The following dialog opens:

Dialog box for creating a slider. Fields include Name (slider1), Minimum (0), Maximum (99), and Value (50). Checkboxes for Show Name, Visible, and Vertical are present. OK and Cancel buttons are at the bottom.

Name the slider `gravity`

Dialog box for naming the slider. Name field contains 'gravity'.

Set the minimum to 0

Set the maximum to 100

Dialog box for setting minimum and maximum values. Minimum field contains 0, Maximum field contains 100.

Click OK.



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## Step 3: Add a velocity slider

Create a second new slider by clicking on the slider tool on the Toolbar and then clicking on the page.

Name the slider `velocity`.

Set the minimum to `-100`.

Set the maximum to 100.

Click OK.



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## Step 4: Using sliders as controllers

Open the turtle's backpack



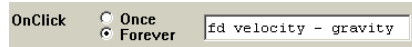
Select the Rules Tab



The name of a slider is also a reporter. It reports the value currently selected with the slider.

Type the following instruction in the OnClick instruction line:

fd velocity - gravity



Select Forever.

Click on the turtle to start its OnClick instruction.

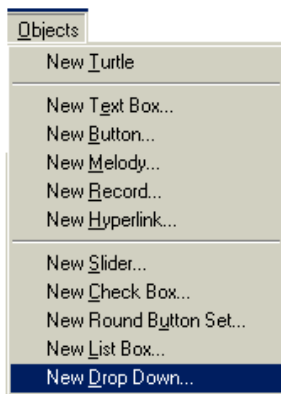
Adjust the value of the velocity and gravity sliders

What happens when gravity equals zero or when gravity is greater than velocity?

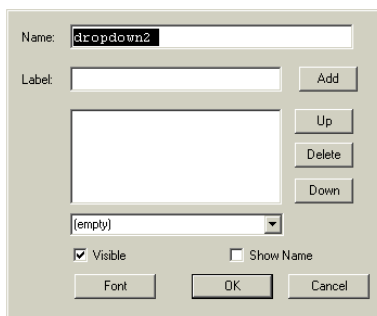
### Step 5: Add additional information

Although this is an exploration, you may also want to provide short explanations of gravity, velocity, and what is happening to the rocket. One way to do this is by adding a drop-down menu containing some topics and a button to trigger the display of the appropriate information.

Select **New Drop Down** in the Objects menu.



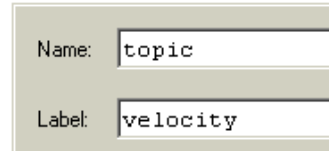
The following dialog opens:



Give the drop down menu a meaningful name, such as topic.

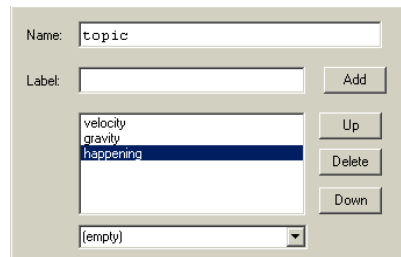


In the Label field, add the first item for which you'd like to provide an explanation. For example, it may be "velocity".



Click the Add button to add it to the list.

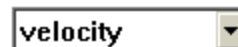
Repeat these two steps until all the items that you'd like to describe have been added to your list.



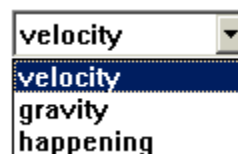
Instead of (empty) in the bottom field, select one of the items in your list. This item will be showing when the box is displayed on the page.

Click OK.

Your drop down menu box will look like this on the page:



And this when it's opened:



If you cannot see the complete list, drag around the drop down list box with the mouse to select it. Then, drag on one of the corner's to enlarge it.

When you create a drop down menu, its name becomes a dynamic primitive available only in your current project.

This new reporter, which, in this example, is `topic`, reports the position in the menu of whatever has been selected. It reports the position as a number, so:

- 1 means the first choice is selected (in this case, velocity)
- 2 means the second choice is selected (in this case, gravity)

...and so on.

Select one of the items in your drop down menu. In the Command Center, type:

```
show topic (use the name of your list)
```

You'll see:

```
1 (or whatever number corresponds to your selection)
```

The `show` command prints its input in the Command Center. In this case, it prints whatever `topic` reports. You should see a number printed in the Command Center.

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### Step 6: Show What You Know

Once a person selects one of the choices in the drop down menu, there needs to be an explanation for each item and a way to display this explanation.

First, prepare a short explanation for each term in the drop down menu.

Once you have all your explanations prepared, write a procedure for each of them.

Open the project Procedures Tab and create each procedure. Use the `announce` command to display each explanation. For example:

```
to vel_define
announce [Velocity is the rate of
motion in a direction.]
end
```

```
to grav_define
announce [Write your explanation here]
end
```

```
to hap_define
announce [Write your explanation here]
end
```

You cannot use `velocity` and `gravity` as procedure names because these words are already being used as names of sliders.

(Important! Remember to add the text of your explanations in each procedure.)

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### Step 7: Putting it all together

Use a button to display the appropriate explanation.

Start by clicking on the button tool on the Toolbar:



Click on the page. The following dialog appears:

Name: button1  
Label: nothing  
Instruction: nothing  
Do It:  Once  Forever  Visible  
OK Cancel

In the Label field, type something like "What is".

Click OK. (You have not added an instruction yet, but you will, once you place the button.)

Place the button next to the drop down menu. Your screen should look like this:



The goal is to have the right explanation appear when someone clicks on the button labelled What is.

Select the first item in your drop down menu. Try the following instruction (remember to use the name of your drop down menu after the word `if`):

```
if topic = 1 [fd 100]
```

The turtle should jump forward a little.

What this instruction says is *if* the item selected in the drop down menu called `topic` is in the first position in the list (if `topic` reports 1), then run the instructions in the square brackets.

The `if` command takes two inputs. The first is a condition that outputs (reports) either "true" or "false". The second is a list of instructions that must be enclosed in square brackets `[]`. If the first condition reports "true", then the list of instructions is run. If the condition reports "false", nothing happens (the instructions in the square brackets are ignored).

In this case, instead of having the turtle move, you want to display the appropriate information for each topic.

In the project Procedure tab, create a procedure that checks what topic is selected in the drop down menu and displays the appropriate information by running the procedure with that topic's explanation.

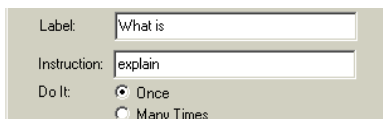
Your procedure might look like this:

```
to explain
if topic = 1 [vel_define stop]
if topic = 2 [grav_define stop]
if topic = 3 [hap_define]
end
```

Remember to use your own procedure names, if different from these.

The `stop` command stops whatever procedure it is contained in. Although this particular procedure would work correctly without adding this command, it's a good habit to think about the places where you may want a procedure to stop and use a `stop` command in these places. If `topic = 1` reports "true, for example, once the explanation for velocity appears, there is no need for the procedure to continue and check if `topic = 2`.

Once your procedure is complete, right-click on the button and select **Edit**. In the Instruction field, type the name of this procedure (in this example, it is called `explain`). Leave Do It set to Once.



Label:	What is
Instruction:	explain
Do It:	<input checked="" type="radio"/> Once <input type="radio"/> Many Times

Click OK.

Now, test your procedure. Click on the `What is` button. You should see an announce box that gives the explanation for the topic you selected. Test all your explanations.

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## Step 8: Challenges

Here are a few ways to extend your project:

- Create a graph showing how gravity affects velocity.
- Create a similar model demonstrating other concepts in science or other subjects (for example, economics).