Building The Solar System

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Getting Started

• Today we’re going to build a working model of our solar system!
• We’ll make the planets and map them with textures to make them look like real planets.
• We’ll change the lighting so the sun is the only light source in the world.
• We’ll make the planets move around the sun by simulating a solar year.
Getting Started

• We’re going to need three things to build our solar system:
  – Planets
  – Lights
  – Movement

• First, we’ll make the planets.
Making the Planets

• Open Alice and select the “Space” world.
Making the Planets

• Including Pluto, there are nine planets in our solar system. Adding the sun gives us *ten things* we need to put into our world. To add objects into our world, click on the green “Add Objects” button.
Making the Planets

• You should notice a little bar come up at the bottom of the screen. Scroll to the right until you see a folder that says “Shapes”. Click on it.
Making the Planets

- Scroll over again until you see a folder that says “SphereHighPoly”. Click on it.
- **NOTE**: Be sure not to click on “Sphere”, or else your planets may look weird.
Making the Planets

• First, we’re going to make the sun. After you clicked on “SphereHighPoly”, it should have put a white ball in your world.

• Right now, the sun is half buried in the ground. We don’t want that!

• Instead of moving the sun up, we’re going to remove the ground. There’s no ground in space!
Making the Planets

• Look to the left side of your screen. There should be a list of things like “camera”, “light”, “ground”, and now “SphereHighPoly”. Click on “ground”.

[Diagram of an object tree with nodes labeled 'camera', 'light', 'ground', 'sphereHighPoly', and a note: 'Object Tree: The Object Tree shows all of the objects in the world. Some objects have parts.']
Making the Planets

• Did you see what happened? Underneath the object tree, in the low left part of the screen, a bunch of things popped up. Under “ground’s details” you should see three tabs: “properties”, “methods”, and “functions”. Click on “properties”.
Making the Planets

• You should see at the bottom of the details something that says “isShowing”. We don’t want the ground to be showing, so click “true” and change it to “false”.
Making the Planets

• We now have a ball floating in space! Woo-hoo! If you look, you’ll see that the ball isn’t all the way in the screen.

• Move the camera down by pressing the down arrow highlighted in the picture. Get the whole sun in the screen.
Taking a Break...

• OK. We now have this ball that looks nothing like the sun. Before we make it look like the sun, we’re going to make a *dummy camera*.

• We’re going to save our place in the world so that we can come back and look at the world from this spot.
Dummy Camera

• Click on the “more controls” button.
Making the Planets

• Click on the “drop dummy at camera” button.
Making the Planets

• Look back at the left side of the screen. You’ll see a new folder called “Dummy Objects”. Inside that folder is our dummy camera. We’ll come back to this later. For now, just click “Done”.

![Diagram showing folder structure with Dummy Objects and related files]
Back to the Sun!

• OK. So how do we get our sun to look like a real sun? We’re going to do something called *texture mapping* – we’re going to put a picture of a sun on the ball. The first thing we need to do is get our picture.

• For these next few steps, use the pictures that are listed with this tutorial on the website.

• The pictures in this tutorial come from JHT Planetary Pixel Emporium. Google it!
Back to the Sun!

• Go up to the top right of the screen. Click on “File”. Click on “Import”.
• This is where you have to know where your picture is. Find it and click on it.
Back to the Sun!

• At first glance, it looks like nothing happened! But it did. We just didn’t see it.

• Your picture is now stored in Alice somewhere. What we’re going to do now is put it on the ball that will be our sun.
Back to the Sun!

- Double-click on “SphereHighPoly” on the left side of the screen. It should turn to blue. Type in “Sun” to rename it to something more familiar.
Back to the sun!

- Look down in the bottom right part of the screen. You should see the words “skin texture”. Click on <None> next to it. You should see something along the lines of “world.something”, where something is the name of the picture. Click that.
Back to the sun!

• Ta-da! That looks a lot more like the sun.
As for the rest of the planets...

• Alice is going to make each planet inside of the already-made planets. To counteract this, move the sun 30 meters to the left before you proceed. Once you’re finished, move it back 30 meters to the right.

• Now we’re going to move the planet away from the sun! For the planet, right-click on it in the left-hand column and select “move”. Select “left”, and then refer to the chart on the next slide to figure out how far you should move it.

• Repeat the steps for the rest of the planets.
<table>
<thead>
<tr>
<th>Planet</th>
<th>Distance from Sun</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>15 meters</td>
</tr>
<tr>
<td>Venus</td>
<td>30 meters</td>
</tr>
<tr>
<td>Earth</td>
<td>45 meters</td>
</tr>
<tr>
<td>Mars</td>
<td>60 meters</td>
</tr>
<tr>
<td>Jupiter</td>
<td>80 meters</td>
</tr>
<tr>
<td>Saturn</td>
<td>110 meters</td>
</tr>
<tr>
<td>Uranus</td>
<td>160 meters</td>
</tr>
<tr>
<td>Neptune</td>
<td>210 meters</td>
</tr>
<tr>
<td>Pluto</td>
<td>230 meters</td>
</tr>
</tbody>
</table>
As for the rest of the planets...

- Our last step: we need to make the planets correctly-sized. Jupiter is the biggest planet in the Solar System, so we’re going to leave it as-is and make all of the planets smaller.
- The sun is ten times bigger than Jupiter, so right-click on the Sun in the left-hand side of the screen. Drag your mouse onto “methods” and then “resize”. Click on “other” and type in “10”. Your sun should grow to be really big.
As for the rest of the planets...

- We’re going to do the same thing for the rest of the planets, but use different numbers instead of “10”.
- Use the following chart to figure out which numbers go with which planets.
- This is going to make some of your planets really tiny, but that’s OK. Some planets are really tiny compared to other ones!

<table>
<thead>
<tr>
<th>Planet</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>.036</td>
</tr>
<tr>
<td>Venus</td>
<td>.088</td>
</tr>
<tr>
<td>Earth</td>
<td>.093</td>
</tr>
<tr>
<td>Mars</td>
<td>.049</td>
</tr>
<tr>
<td>Jupiter</td>
<td>1</td>
</tr>
<tr>
<td>Saturn</td>
<td>.365</td>
</tr>
<tr>
<td>Uranus</td>
<td>.838</td>
</tr>
<tr>
<td>Neptune</td>
<td>.360</td>
</tr>
<tr>
<td>Pluto</td>
<td>.025</td>
</tr>
</tbody>
</table>
Part II

We’re going to write our code!
Lights

• Now that we have all of our planets created and looking cool, it’s time to make our scene look even more real. We’re going to do this by making the sun the source of light in the world.

• Look in the left side of the screen and find “light”. Click on it. Then look in the bottom-left corner for the “Properties” tab. Click it.
Lights

• Under “properties” you should see “color”. It should be white or yellow. We don’t want this light to be light-colored, because that makes the entire world lighter. Change the color to “black”.

• This step gets rid of the natural lighting in the world.
Lights

• Now we want to make a new light. We’re going to put this light in the middle of the sun and make it really bright.

• Click on the green “add objects” button.
Lights

- Scroll to the right until you see a button called “Lights”. Click on it.
Lights

• Add a new “LightBulb” to the world.
Lights

• Now we want to make sure that we move the light to the middle of the sun and make sure it stays with the sun. In the left column of the screen, find “LightBulb” and right click on it. A list of methods should pop up. Click on “move to” and then “Sun”.
Lights

• After that, we’re going to make the light bulb light up. Go to the lower left part of the screen into “lightBulb’s details”.

• Make sure that “color” is white.

• After that, click on “Seldom Used Properties” and make sure that “EmissiveColor” is also white.

• Also, set “vehicle” to “Sun” so that the lightbulb stays with the sun.
Lights

• If you notice, this doesn’t do much. The problem is that all objects in Alice have their own light. We need to turn this off.

• For each planet in the left-hand side of the screen, go through and click on it. Click on “properties” in the lower left-hand corner of the screen.

• Click on “Seldom Used Properties”.

• Click “EmissiveColor” and “SpecularHighlightColor” and change them to black.
Movement

• Now we’re going to put the finishing touches on our world! We’re going to make the planets move around the sun and then let you fly around as they do it.

• In the bottom-middle part of the screen, you should see a big tan box. You should see something that says world.my first method. At the very bottom of the screen, you should see some colorful buttons. Find the one that says “While” and drag it into the tan box. Pick “true”. Find the one that says “Do Together” and drag it into the green “While” bar.
Movement

• For each planet, we want to make it turn around the sun. First, we’re going to do Mercury. Find Mercury in the left-hand side of the screen and click on it. Click on “methods” in the bottom-left part of the screen.

• Second from the top of the list should be “Mercury turn”. Drag it into the “Do Together” bar in the middle of the tan box. A list should pop up. Drag the mouse on to “left” and then “other”. Type in 4.15 revolutions.

• We also want to make the planet revolve around the Sun. To do this, click on “more” next to the number of revolutions and drag on “asSeenBy” and then the Sun. This should make your planet revolve around the Sun. It should look like this:
Movement

• Repeat these steps for the other planets. Use the table to set the number of rotations for each planet. These are rough estimates.

<table>
<thead>
<tr>
<th>Planet</th>
<th>Revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury</td>
<td>4.15</td>
</tr>
<tr>
<td>Venus</td>
<td>1.63</td>
</tr>
<tr>
<td>Earth</td>
<td>1</td>
</tr>
<tr>
<td>Mars</td>
<td>.53</td>
</tr>
<tr>
<td>Jupiter</td>
<td>.08</td>
</tr>
<tr>
<td>Saturn</td>
<td>.03</td>
</tr>
<tr>
<td>Uranus</td>
<td>.01</td>
</tr>
<tr>
<td>Neptune</td>
<td>.01</td>
</tr>
<tr>
<td>Pluto</td>
<td>.01</td>
</tr>
</tbody>
</table>
Movement

• We need to set the length of time it takes for these revolutions to happen. Wouldn’t it be nice if we could easily change the length of time to make our world go faster or slower? Well, we can!

• We’re going to use a *parameter* to do this. At the top of the world.my first method box on the right-hand corner there should be a button called “create new parameter”. Click it and a box like this should pop up:
Movement

• In “Name” type in “Year” and select “number”. Hit OK.
• You should see “Year” pop up next to the name world.my first method.
• Now, next to each planet’s turn method in our bigger method, we’re going to set the duration to this “year” parameter. At the end of each bar for each planet, there should be a downward arrow.
• Click it and drag your mouse to “duration” and pick any random value. Once you’ve done that for all the planets, drag in “year” from the top to each one.
• See the resultant code on the next page.
world.my first method

world.my first method 123 Year

No variables

[Diagram showing multiple planets with instructions:]
- Mercury: turn left, 4.15 revolutions, duration = Year seconds, style = gently
- Venus: turn left, 1.63 revolutions, asSeenBy = Sun, style = gently, duration = Year seconds
- Earth: turn left, 1 revolution, asSeenBy = Sun, style = gently, duration = Year seconds
- Mars: turn left, 0.53 revolutions, asSeenBy = Sun, style = gently, duration = Year seconds
- Jupiter: turn left, 0.08 revolutions, asSeenBy = Sun, style = gently, duration = Year seconds
- Saturn: turn left, 0.03 revolutions, asSeenBy = Sun, style = gently, duration = Year seconds
- Uranus: turn left, 0.01 revolutions, asSeenBy = Sun, style = gently, duration = Year seconds
- Neptune: turn left, (1 / 164.81) revolutions, asSeenBy = Sun, style = gently, duration = Year seconds
- Pluto: turn left, (1 / 365.26) revolutions, asSeenBy = Sun, style = gently, duration = Year seconds

[Options at the bottom: Do in order, Do together, If/Else, Loop, While, For all in order, For all together, Wait, print, //]
Movement

• Once you’ve done that, look in the top right part of the screen under “Events”. You should see that “world.my first method” now has “Year” next to it. You can set “Year” to be however many seconds you’d like and it will make your world go faster or slower!

• I’d recommend setting “Year” to be somewhere between 1 and ½ to 3 minutes. Mercury goes awfully fast if you do anything less than one minute.

• Lastly, position your camera using the arrows under the viewport. Try and get it to be exactly in line with the planets. Create a new event by clicking the button next to “Events”. Choose “let arrow keys move” and click “camera”.

PLAY YOUR WORLD AND YOU SHOULD BE READY TO GO!
Challenges

If you’re up to it, try some challenges! It’s helpful if you’ve done other Alice tutorials before you try these.

1. Can you figure out how to fly around in a spaceship? *(Hint: create a space ship object and position the camera behind it. Then set the ship to be the camera’s vehicle.)*

2. Can you make each planet ask a question when you come close to it?

3. Can you give each planet a label of big text that hovers over the planet?