FIRST Tutorial – Where on Mars is "Robot Vehicle"?!

A tutorial for FIRST people new to 3DSMAX. You'll use these skills when you started with your own robot video, but remember that this introduction does not cover all you need to know! For instance, use a storyboard to develop your robot's character or to plan a memorable story line to help the judges choose *your* animation over the others.

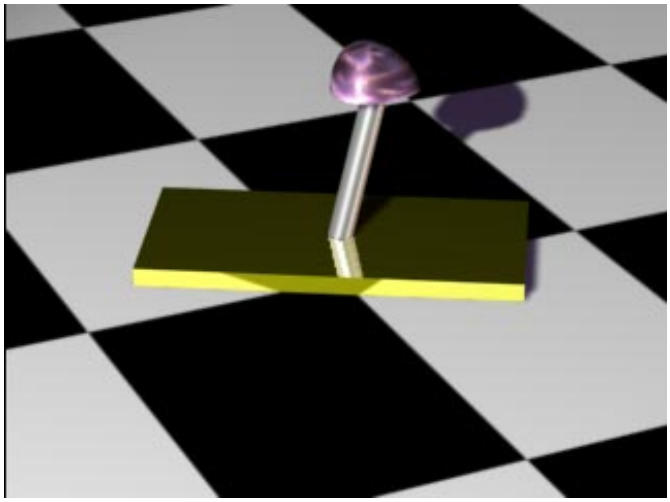
Let's go to Earth to the Robot manufacturing plant and create a Robot.

Introduction

This 3DSMAX 3 Tutorial introduces many basic techniques to create a Robot Vehicle. These techniques can be used whether you are on Earth or Mars.
The tutorial will take a couple of hours to complete, and will furnish you with techniques so helpful that your robot video can't help but win the Autodesk competition!

The following areas are covered

- Drawing in 3D
- Saving your work / file management
- Creating and Moving
- Animating
- Modifying
- Materials
- Linking



The scene consists of a Sphere cut in half, a cylinder to act as a neck for the Sphere, and a Box to act as a body for the robot.

Should you make an unscheduled mistake, use the Undo and Redo options up on the Main Toolbar.

Right-click to Cancel an operation: *Most operations require you to use the left mouse button (e.g. create, move). If you right-click while you still have the left-mouse button pressed down, you cancel the action.*

For instance, if you want to create a Box, but left-click in the wrong place, you can cancel your box by right-clicking before you let go of the left mouse button.

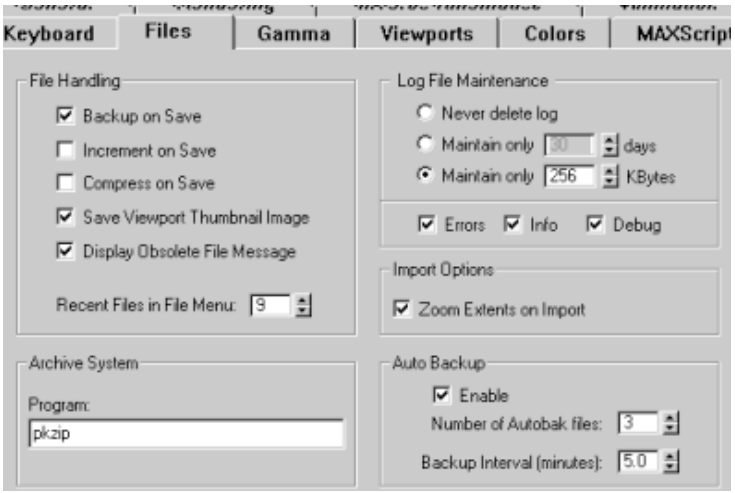
This cancel trick also works when using the mouse to perform a Move, Rotate, or Scale transform.

☞ One other thing: when the instructions send you to the Modify panel and you do not see the specified options, make sure you have first selected the object you wish to modify.

1. Set Backup Options

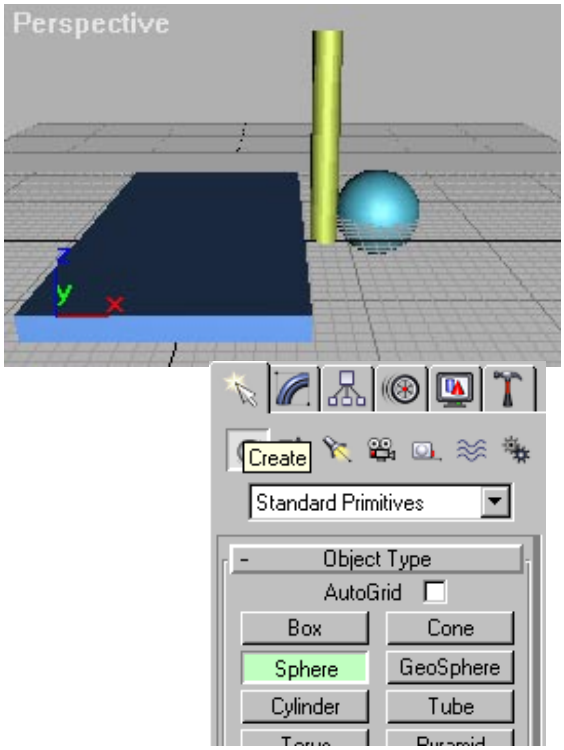
Make sure you have backup copies of your work. This will come in handy when you're in a tight deadline and something goes wrong.

- **Customize** pulldown menu > **Preferences**
- Click the **Files** tab
- Under **File Handling**, select **Backup on Save**
- In the **Auto Backup** section, select **Enable.**



We discuss this further in the last section of the **Animating the Robot** section.

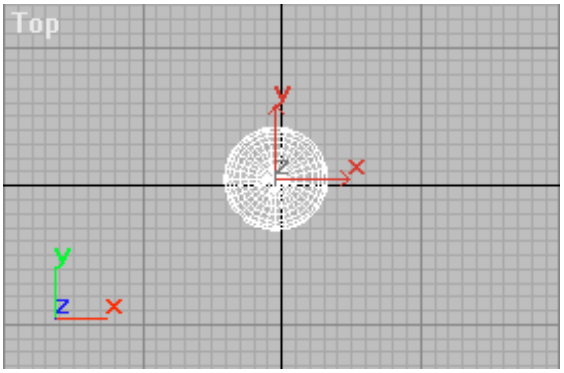
1. Create the Robot parts



In these next steps, we create a Sphere, a Box, and a Cylinder. Unless otherwise noted, all clicks use the **left** mouse button.

- In the **Create Panel**, click on **Sphere**.

In the **Top view**, ***click and drag***, then let go to create **Sphere01**. Make it about the size you see in the illustration. We'll come back to these objects and you'll see how to give them specific sizes.



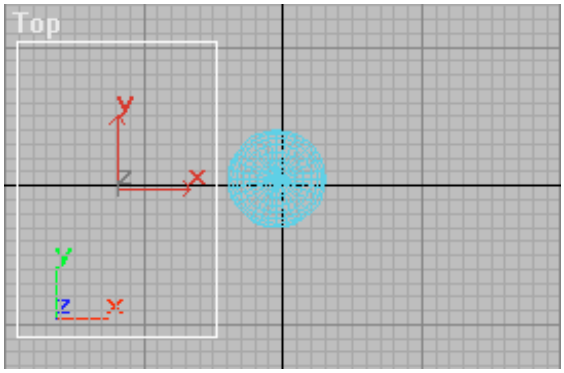
✔

✓ In the **Create** panel, click on 

Box.

The steps to create a box are different from creating a Sphere so hang on! First you'll create the radius of the cylinder, then with a separate mouse click you'll specify the height.

In the **Top view**, ***click and drag*** to create the base of the box, then **let up** on the mouse button. Now **move** the mouse up *with no buttons pressed* to create the height. **Click** when you've given the box some height. It should look a little thinner than a deck of cards.



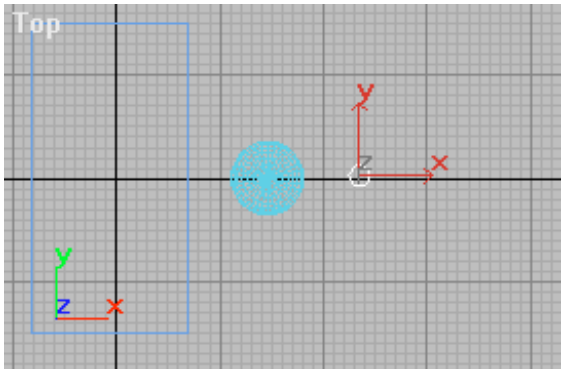
Remember the Undo and right-click-to-cancel tricks! This may take several attempts. Take the time to learn these steps since you'll be using them to create your own robot in 3DSMAX.

Ready to continue?

✔ Finally, click on **Cylinder**.

The steps for creating a cylinder are a little like creating a box. First you create the size, then the height.

In the **Top view**, ***click and drag*** to create the radius of the cylinder. **Let go** and **move** your mouse up to create the height. Then **click** to complete the command.



✘

✘ When you've finished, click **Select object** button in the Main Toolbar. We're clicking this so we don't create any more cylinders by mistake!

✗ **File** > **Save.** Name the scene **Robot,** and click **Save.**

Review

We've learned how to create some simple objects. We've also observed that 3D objects require several views to keep an eye on height, width, and length. For example, creating the box and the cylinder required that you watch other viewports to see the height.
The 3DSMAX Reference gives a good explanation of 3D Space, explaining how each Axis (X, Y, and Z) is used to locate objects you create or move. Look for "Home Grid" in the Online Reference Index.

1. Let's get Precise! - Modifying the Robot Parts

The parts we've created have been placed and sized by eyeball – and vary from user to user. Let's get precise and give specific sizes to the objects, name them, and modify the Sphere before we start moving things around (on Mars, or Earth).

✎ Click on **Cylinder01**.

Remember Step 4 above? We clicked on *Select object* in preparation for this step. You knew that, right?

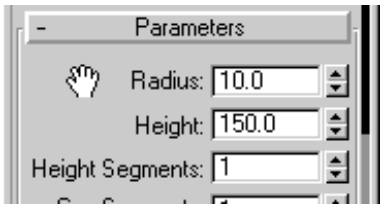
Select the **Modify** panel, **click** in the space where the object is named **Cylinder01** to highlight it, and rename it **Neck**.

Naming objects: *When you create a scene that has many objects, it's easier to work if each object has a descriptive name. It's easy to keep track of three objects, but it's a good habit to name objects when you create them. Don't you agree?*

Observe that over blank areas in the Modify panel, the cursor turns into a hand that can be used for grabbing the Modify panel and sliding it up or down. You may need to slide the panel up or down to complete these steps.

Make the following changes in the Parameters rollout:

- Radius = **10**
- Height = **150**
- Segments = **1**



The reason we're changing the Height Segments to 1 is because we don't need 5, the default value. The more segments, the more work for the computer.
If we had plans to bend the cylinder, then we would leave, or perhaps increase, the height segments. (Also, if we change our mind we can always go back and add them.)

✎ Click on **Box01.**

In the Modify panel, rename it **Body.**

Make the following changes in the Parameters section for the Box:

- Length = **300**
- Width = **150**
- Height = **15**

The Body may go off screen.

✎

✎ Click on **Sphere01**.

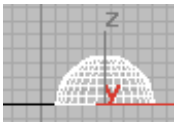
Rename it **Head**.

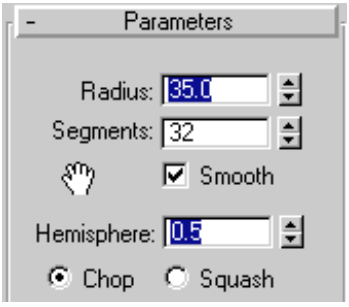
The **Modifier Stack** allows adjustments other than renaming for the original Sphere. This **Modifier Stack** provides exceptional flexibility for modeling adjustments. Let's see how it works.

First off, note the commands Bend, Taper, Twist, *etc., which appear in the Modify panel under the Head. Now, use your mouse to click in an empty space back in the viewport. By doing so Head is no longer selected and… Whoops! The Bend, etc. commands are no longer available. Select the Head again. The commands return. The nice thing is that 3DSMAX grays out Modifiers like Extrude or Lathe that are not appropriate for the selected object.*

✓ Scroll down the Modify panel to the Parameters rollout and change the **Radius** of the Head to **35**.

Change **Hemisphere** to **. 5** and notice what happens to the Head.

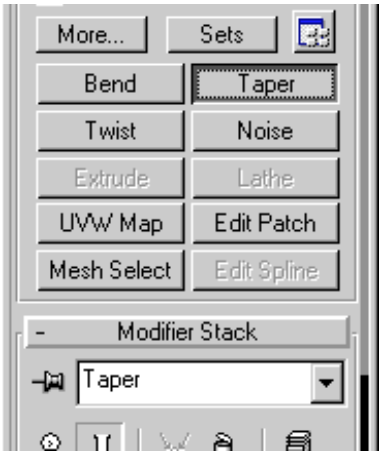




Our next step will use the Taper modifier to change the Head into a more Martian-looking Head. (No, that's not a *Tapir* modifier!)

✔

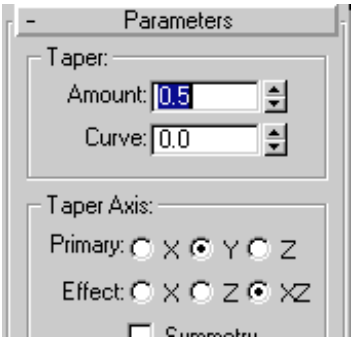
✖ Scroll the Modify panel so you can see the Taper modifier button. **Click** the **Taper** button once and observe the display next to the pushpin icon in the Modifier Stack. It now says Taper.



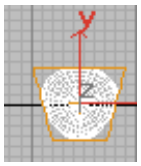
3DSMAX changes the Head's options so that they're relevant for the Taper modifier. Notice that the Parameters rollout no longer displays the Head's *Radius = 35* information.

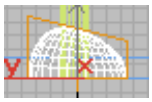
✖ Let's change some values in the Parameters rollout:

- **Taper Amount = . 5**
- **Taper Primary Axis = Y.**



Depending on the view, the Head will look like this:





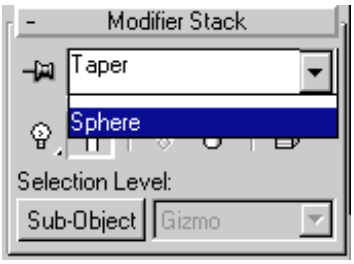
That's all for this section. Better **File > Save** now. Congratulations! (Particularly the part where you modified the Sphere.)

Review

We want to get into the habit of naming objects that we create.
The Modify panel will only activate when you've selected your object.
The Modify stack will display commands appropriate to whatever is displayed in the Modify stack.

Extra Credit

If you like, click on the dropdown list next to the pushpin. The original Sphere information is still there. If you select Sphere and make it current, the Parameters rollout will display the information about the Sphere. You can change your mind about the size, alter the Hemisphere value, etc., as you wish. Very nice!



1. Assembling the Robot

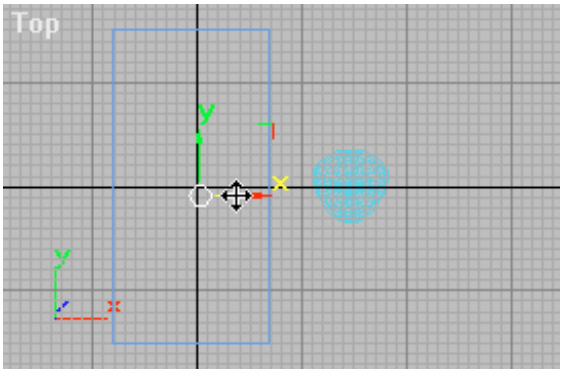
We've created 3 objects, and resized and named them. Now we're going to assemble them into the robot by moving them into alignment.

✎
✎ **Zoom Extents All.** Click on the icon located near bottom right corner.  This will cause all 4 viewports to relocate your view so all the objects in your scene are visible.

✓ **Click Select and Move** from the Main Toolbar. 

Click on **Neck** to select it and **Move** the Neck so it's centered over the box.

Here's a chance to check out something that will be very useful as you Transform (i.e. Move, Scale, or Rotate) objects.



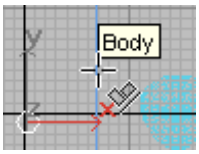
When you click on an object to Move it, a bold X / Y icon gets displayed. If you position the cursor on one of the arrows of this icon, your movement of the object will be restricted to that axis. In this Top view picture, the X axis has been selected, so the Neck can only be moved left or right along the X axis.

Is the Neck precisely centered over the Body? Let's make sure with the Align tool.

✔
✕ **Select** the **Align** tool from the Main Toolbar. (Make sure the *Neck* is selected when you do this.) 

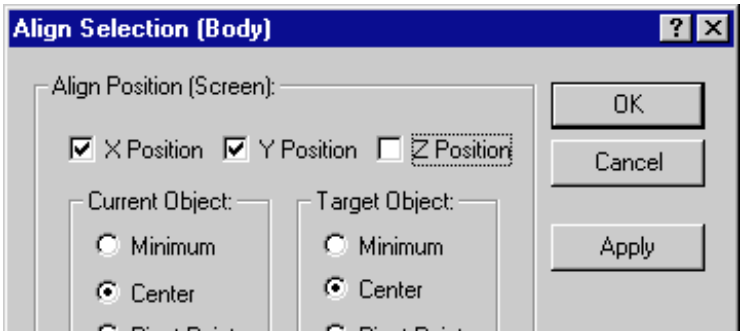
You may have to slide the Toolbar to the left in order to see the Align tool. Use the little hand to grab the bar. The cursor will turn into the hand when placed over blank areas of the Toolbar.

Choose the **Body** to bring up the **Align Selection** dialog.



In the dialog, choose:

-
- **X** Position
- **Y** Position
- **Center**, and **Center**



See what happens if you click the Z Position also. After you see that the center of the Neck aligns with the center of the Body, uncheck it to get to the correct elevation..

Click **OK** to close the dialog.

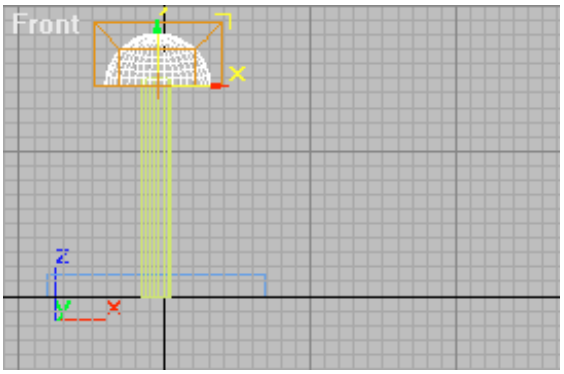
- **Click Select and Move** from the Main Toolbar.

The following step is easier in the Front viewport.

Click on the **Head** in the **Front** viewport.

Move the **Head** onto the Neck.

We'll use the Align tool again for proper placement.

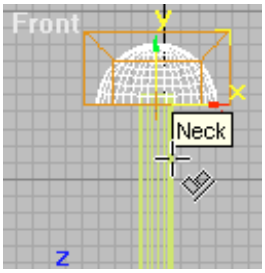


- **Select** the **Align** tool from the Main Toolbar.

Select the **Neck** as the Aligning object.

In the Align Selection dialog, make the following selections:

- **X** Position
- **Z** Position
- **Center**, and **Center**



Click **OK** to close the dialog.

Notice that we choose the *Z Position* this time, not the Y Position, because we used the Front viewport. In the Front viewport, the X Axis is left and right across the face of the monitor, the Y Axis is up and down, and the Z Axis moves out of the monitor towards you and back into the monitor. When you make a viewport active

by clicking in it, left and right become the X Axis, and up and down the face of your monitor become the Y Axis. This is for convenience when modeling.

If this seems confusing to you, remember that Canadian and British users have to call the Z Axis the “Zed” Axis, so you have it easy!

✎ **File > Save**.

Review

We were introduced to some keen 3DSMAX tools for moving and precisely aligning objects. We also discovered that the X and Y Axes seem to change depending on your viewport.
And that we’re lucky compared to Canadians and British folks, even without considering fruitcake.

1. Animating the Robot

We'll learn how to move the Robot around, use the Animate button, and Link objects together.

✐

✐ **Zoom Extents All.** Click on the icon located near bottom right corner. 

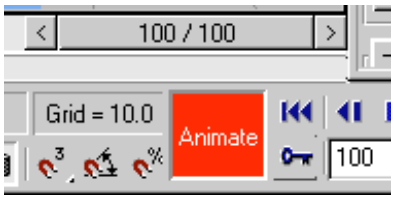
✓ Find the **Time Slider** in the Status bar, and **Move** it ("scrub it") back and forth.

Notice that the total animation is 100 frames, and the slider takes you to the specific frame of the animation. Even though we've moved several objects around, there is no animation in the viewports. When you're preparing your 30 second Robot Animation, you will need to increase the length of your animation to 900 frames. It takes 1 second to play 30 frames on video, so 30 seconds needs 900 frames.

Let's add some animation.

✔

✕ **Move** the **Time Slider** to Frame **100**, all the way to the right.



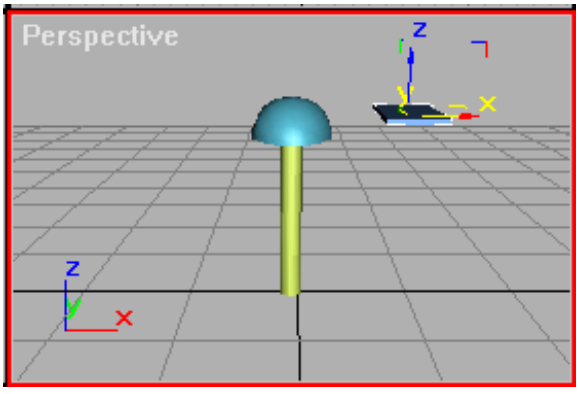
✘ **Click** the **Animate button** to turn it on.

Notice that the Active viewport is now selected with a red outline.

✗

✘ **Click** on the **Body** in the **Perspective** view to select it.

Move it back into the distance.



- **Turn off** the **Animate** button.

Slide the **Time Slider** back and forth.

The Body moves back and forth (yay!). Unfortunately, it leaves behind the Neck and the Head. We need to Link everything if we want to convince the competition judges that we know what we're doing.

Move the **Time Slider** to **Frame 0.**

The Assembly should line up correctly.

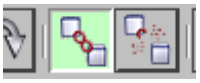
The next steps can be a little confusing, so let's get introduced to the "Hold" habit.

When you are about to try something that might not work, you first "Hold" your file. If you try your experiment and then decide it didn't work, you "Fetch" your work from your "Hold." You'll get back to where you were before your experiment.

From the **Edit** pulldown menu, select **Hold.**

A special copy of the file has just been saved.

Click the **Select and Link** button in the Main Toolbar.



Click to **Select the Head**, and keep holding down the mouse button. **Drag** the cursor onto the **Neck** and let go.
The Head is now linked to the Neck.

Click to **Select the Neck** again, and **drag** the cursor onto the **Body** and let go.
The Neck is now linked to the Body.

Click the **Select object** button in the Main Toolbar. This will end the Linking session.

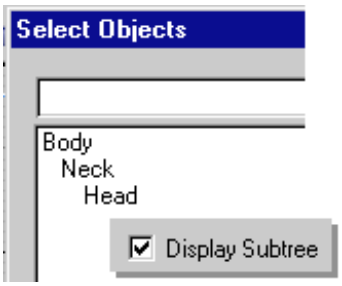
Link cursor: *When you select the first object, the cursor looks like 2 attached gray boxes. When you drag and select the second object, the cursor changes to a white box attached to a gray box.*

✍ **Move** the **Time Slider** back and forth.

This time the entire assembly should move. If not, then you might wish to **Edit** > **Fetch**, and repeat Step 10 again.

Extra Credit

You may wish to confirm the hierachy of your Linking by clicking on the *Select by Name* button in the Main Toolbar, and viewing the objects in the dialog.



Make sure the "Display Subtree" option at the bottom of the dialog is selected. This image shows the Body as the Parent object, and the Neck and Head as Children objects.
When the Parent moves, the Children move too!

What do you think would happen if you tried to move the Neck? Could it be moved? Would the Head move too?

Close the dialog when through. Later, when you least expect it, we'll delve into animating a little further. We'll see how each object you create has 2 controllers automatically assigned to it. These determine how the object will move.

✍ **File > Save.**

Let's take a moment to understand the files that you have created with all your saves and Holds. If we use Windows Explorer to look in the 3DSMAX3\AUTOBACK folder, we see the following:

- Autobak1.mx
- Autobak2.mx
- Autobak3.mx
- maxhold.mx
- MaxBack.bak

The *Autobak1*, *2*, and *3* files were created by automated saves performed by 3DS MAX in the background, as a result of our backup settings created at the beginning of the tutorial.
The *maxhold.mx* file was created when we did the Edit > Hold command.
The MaxBack.bak gets incremented every time you File > Save. The actual file you save is in the 3DSMAX\SCENES folder, and has the name we gave it at the beginning of the tutorial, Robot.max.

Review

Moving objects does not create an animation unless the Animate button is on.
One way to move an assembly of objects is to Link them together. When you move the Parent of the Linked objects, the Children obediently move along too.

1. Applying Materials to the Robot

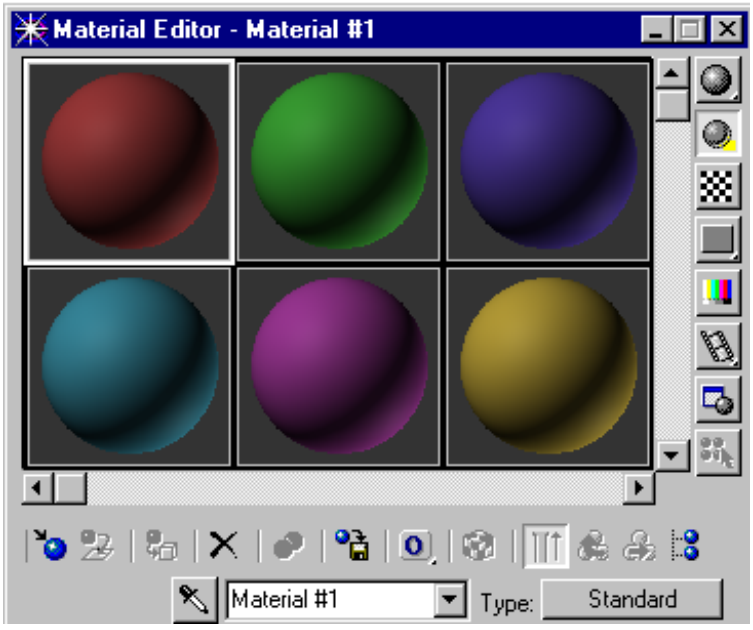
A large component to a good animation is the materials applied to the objects. Let's see how 3DSMAX handles materials.

There are several components to any 3DSMAX material. There is the general appearance, which could be a plain color, or a bitmap or scanned image. It could have characteristics of transparency, or could be highly reflective. We'll keep things simple (just kidding!) and stick with the sample materials that come with 3DSMAX.

There are a number of shortcuts offered by 3DSMAX to help speed things up, so let's use one of them to launch the mighty Material Editor.

✐ **Click** the letter "**m**" on the keyboard to open the **Material Editor**. (If this doesn't seem to work, you can use the Tools > Material Editor command.)

The 6 sample spheres allow you to view the materials before you apply them to the objects in your scene.
The white rectangle indicates the current material, which is this case is labelled Material #1.



✓ **Click** the **Select object** icon on the Main Toolbar. (You may have to move the Material Editor out of the way.)

Select the **Head** object in the viewport.

✔
✔ **Click** the **Assign Material to Selection** button. 

The Head should become the color indicated by the Sample Sphere – Material #1 in this case.

You might think of a Material as a structure which can have many attributes. The Material we applied to the Head so far has a color, and certain specular, reflective, and opacity values.

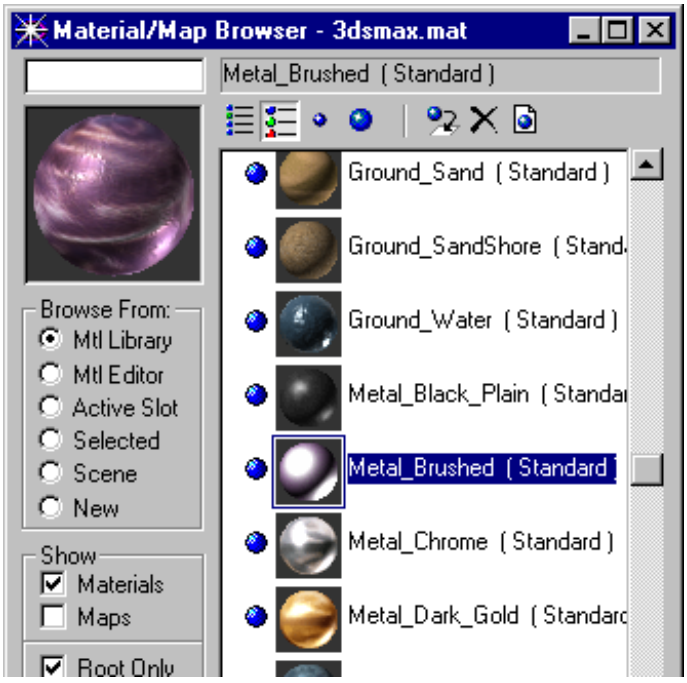
Let's look at applying something more complicated – a Material that incorporates a bitmap (this could be your scanned image if this were an advanced tutorial).

✔
✔ **Click** the **Get Material** button to launch the **Material/Map Browser**. 

✔ **Change** the settings in the **Material/Map Browser** to help select the material.

- Browse From = **Mtl Library**
- Show = **Materials**
- **Root Only**
- **View List + Icons**
- **Metal Brushed (Standard)**

Your settings should match the screen capture.



✎ **Slide** the enlarged **sample** from the upper left corner of the Material/Map Browser **onto** the **Material Editor** sample slot.

Take a quick look at the Perspective view. Notice that the Head did not acquire the new material. There's some interesting logic behind this, and once you understand it you will have some powerful knowledge about the Material Editor. Listen:

What happened to Material #1?
Well, the Head is still assigned Material #1. The Material exists in the scene, assigned to the Head. However, in the Material Editor, the sample slot is now occupied by Metal_Brushed.
It's still around, but the sample sphere we were using has been co-opted by the new material. We want the Head to have the attributes of the new material, so let's assign it.

The Material Editor is similar to the artist's palette. The color is mixed and created there, and applied to the painting. At this point, the color is in two places.
The 3DSMAX analogy, if you're following, is that the Material is in the Material Editor, as well as in the Scene.
The artist may need to mix new colors on the palette, and since there isn't room on the palette might replace the color for a new one.
What we've done in 3DSMAX just now is similar – we've got the Material in the scene, but it's no longer in the Material Editor. In Step 7 we assign a new material to the Head. This means that Material #1 is no longer in the Material Editor nor in the scene. It's gone.
3DSMAX does allow you to save materials into Material Libraries, however, so if you really didn't want to lose Material #1 we could preserve it.

OK, that's boring

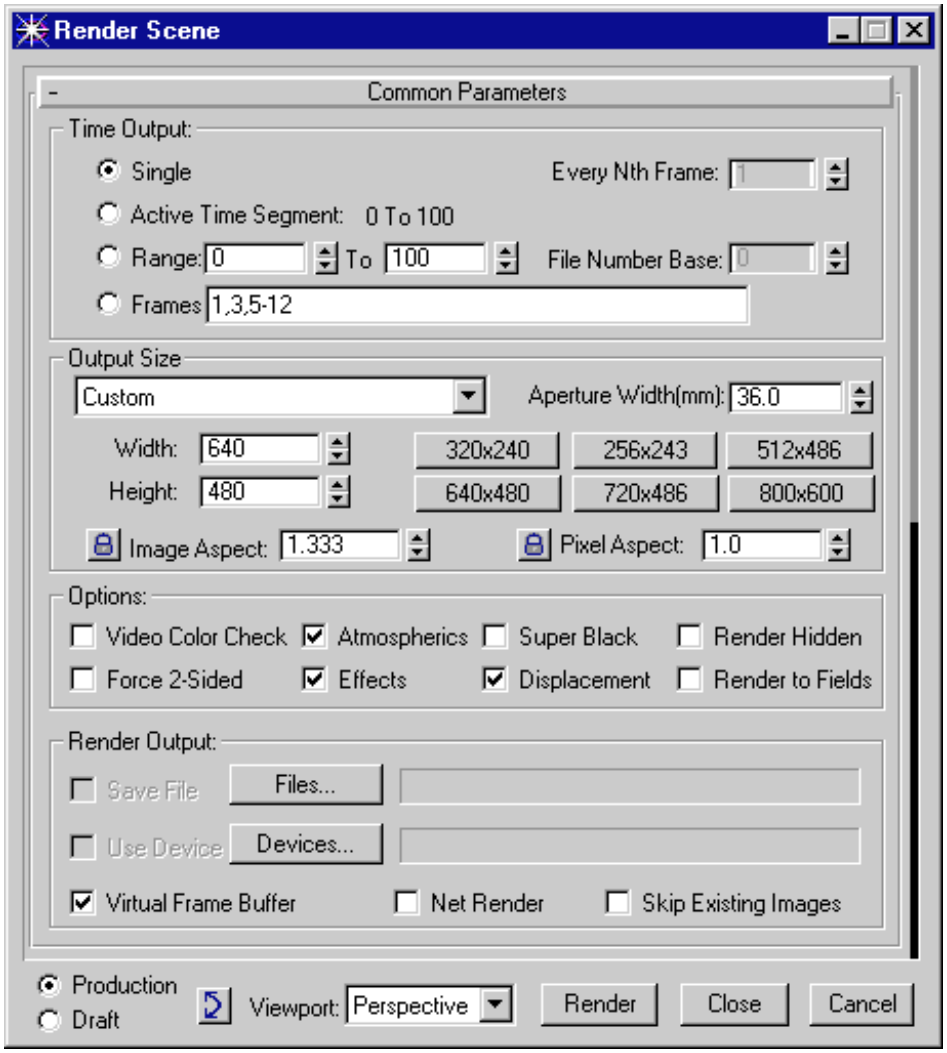
✔

✓ **Click** the **Assign Material to Selection** button. 

The Head should now show a purplish color in the Perspective viewport. Let's take a look at what we've got so far.

✔ Select **Rendering > Render** to bring up the Render Scene dialog.

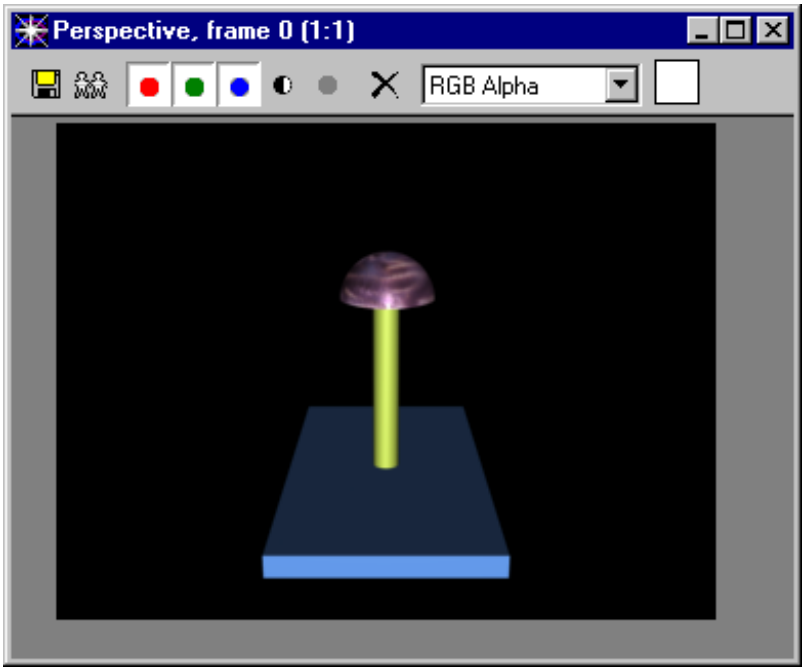
Make sure the Viewport dropdown at the bottom of the screen shows **Perspective**.



✘

✘ Click **Render**.

Not bad! Here's what it looks like so far.



***Competition Tip**: The image is rather dark – so we'll have to make some adjustments for the lighting. When submitting your animation for the contest, be aware that the darkness which looks "intriguing" on the computer monitor will become less distinct when tranferred to video. This will cause the judges to miss what you're trying to show. Bad!*

Let's get some materials on the other parts and render to see the results.

✗ **Close** the **Virtual Frame Buffer** (the rendered image of your model) to make room. You may have to move other windows out of the way.

✘ **Click** to select the **Neck**.

✙ Scroll through the **Material/Map Browser** and select **Metal_Chrome (Standard)**. This should be right below your previous selection.

Drag the enlarged **Sample** from the upper left of the **Material/Map Browser** onto a fresh sample slot of the **Material Editor**.

Click the Material Editor's **Assign Material to Selection** button to assign the **Metal_Chrome (Standard)** to the **Neck**.

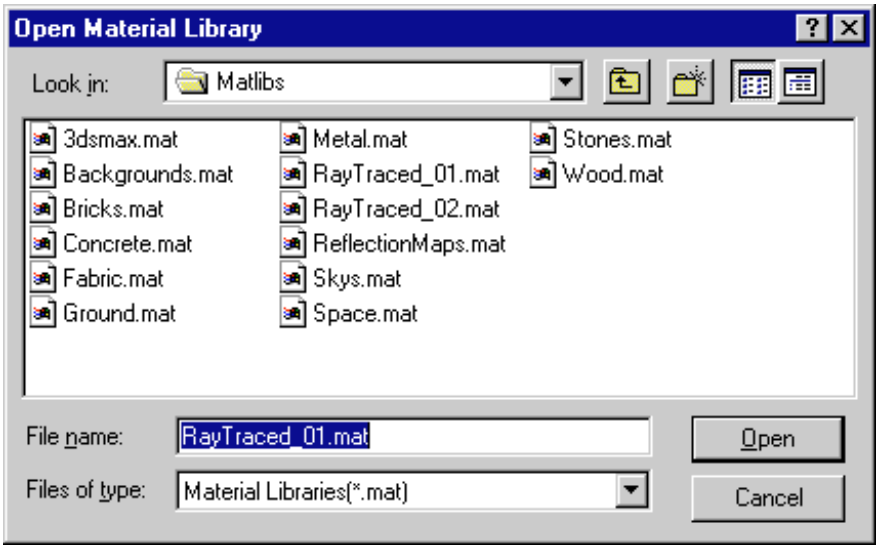
Click the **Body** object to select it.

We are going to change to a different Material Library for the Body material.

Click the **Open** button near the bottom left corner of the **Material/Map Browser**.

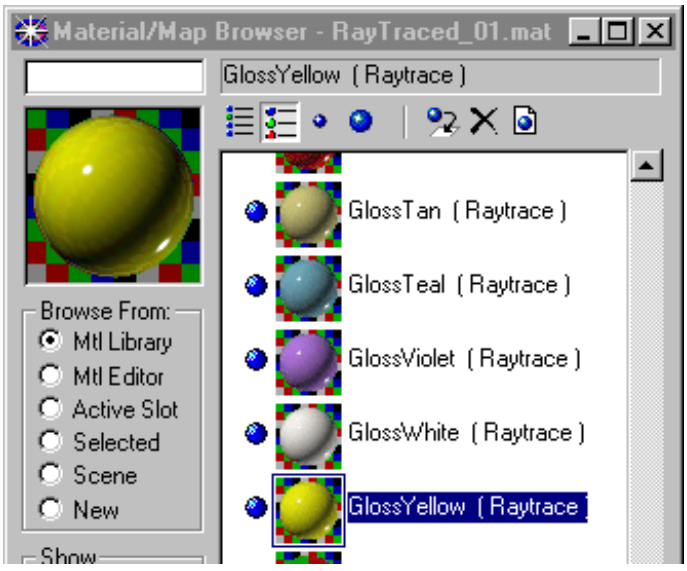
Choose the **Ray Traced_01.mat** Material Library, and click **Open**.

Raytracing! The bane of quick rendering times! Our excursion will be light-duty though, so don't worry.



Scroll down the **Material/Map Browser** and choose **GlossYellow (Raytrace)**.

Drag the enlarged sample image onto a sample sphere in the Material Editor.



✔
✘ Assign the GlossYellow (Raytrace) Material to the Body.

Somewhere along the line our (3DSMAX) windows are going to have to get closed so we can see the original viewports. Feel free to close or move any 3DSMAX windows that are getting in your way.

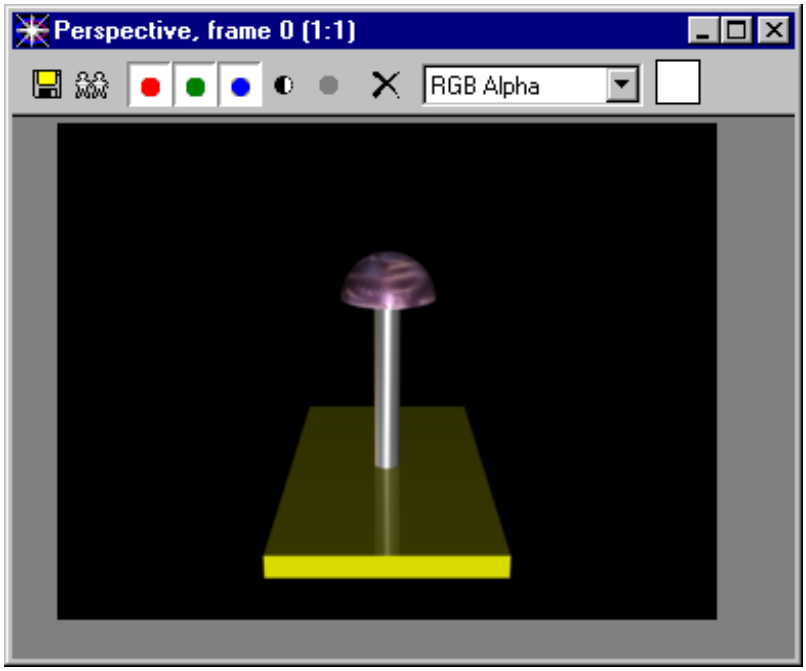
✎✗ Select **Rendering > Render** (or move the dialog so you can access it).

Confirm that **Perspective** is the viewport to be rendered.

Click **Render**.

Congratulations! This is looking even better!

You should be aware that raytracing is time-consuming, and is something to avoid when you're on a deadline. As you can see from your rendered image, extra calculations must be performed to reflect the other objects in your scene. But it's a nice effect isn't it?



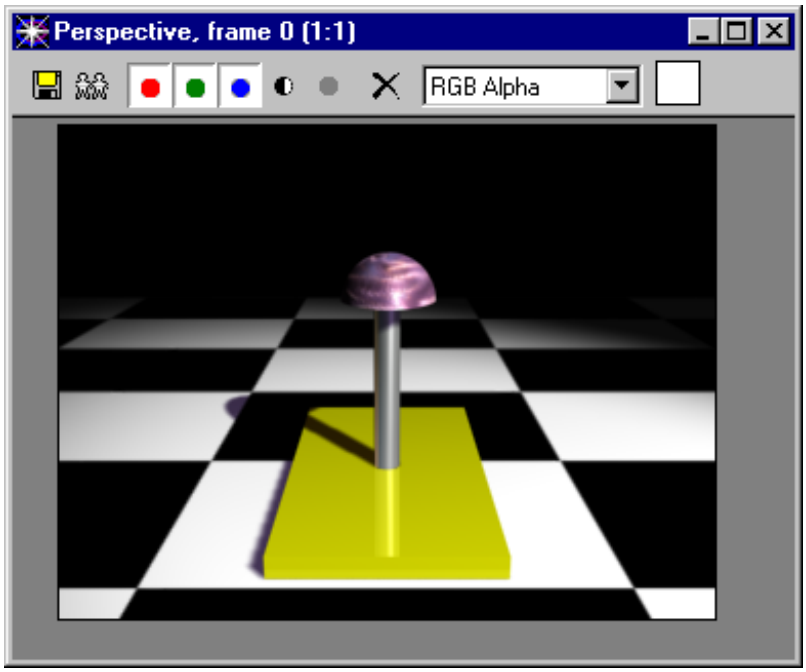
Rendering Tip: *It's always a good idea to save your file before doing any rendering. Video drivers, low computer resources, etc., can cause MAX to crash. It's better to crash with the file backed up than not*

Whoops! We're playing with fire by not saving before rendering. Let's do it now.

✎✗ **File > Save.**

Review

Materials help your models look real.
The Material Editor and Material/Map Browser are very powerful. Consider yourself lucky to have seen only a portion of their features.
It's usually a good idea to Save your file before Rendering.
The default lighting may be too dark for your Competition video.
Remember your video is only only 900 frames long.



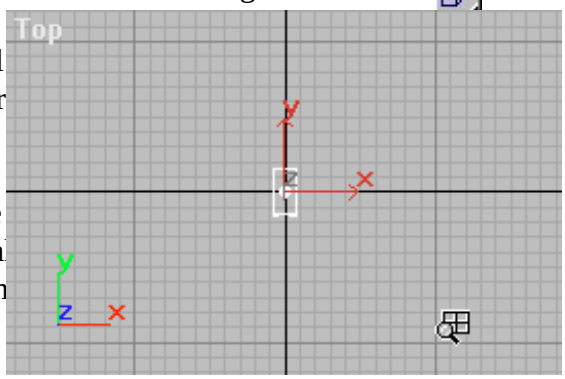
1. Lighting the Robot – and One More Thing About Materials

3DSMAX has a default light to illuminate the scene. We'll create some lights to make the scene a little brighter. This'll show a little better if we create a surface for the robot.

✐

✐ **Zoom Extents All.** Click on the icon located near bottom right corner. 

Our next step is a zoom command that will
that we can create a nice-sized platform for



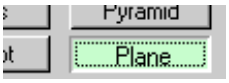
✓

✔ **Zoom All.** Click the icon located near the
happens until we use the mouse in a vertica
viewports. Click and Drag far enough so th
the same size as a pea. (see the picture).

This will allow us to have enough space to draw a nice floor, or arena surface for the robot.

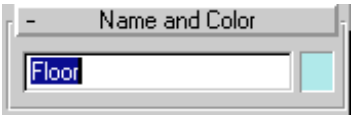
✘

✘ In the **Create** Panel, under Standard Primitives, click **Plane**.

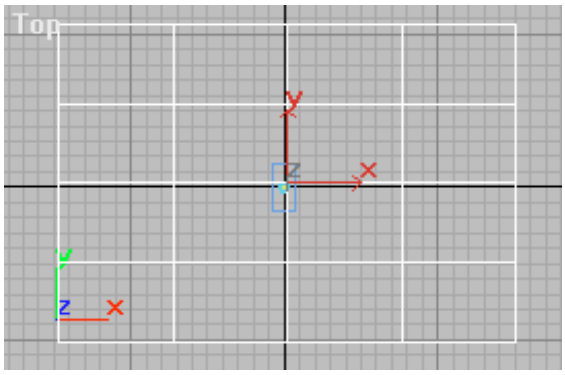


Before we create the Plane, let's name it Floor.

In the **Name and Color** rollout, replace the Plane01 name with **Floor.**



In the **Top** view, **click and drag** to create a rectangle that takes up most of the Top view. This will be the robot's playground.



We need one more visit to the Material Editor. We could have done this in the Materials section of this tutorial, but the Material section was getting too long. We thought we'd be able to sneak this in the lighting section and you wouldn't notice.

✘ **Click** the letter "**m**" on the keyboard to open the **Material Editor**.

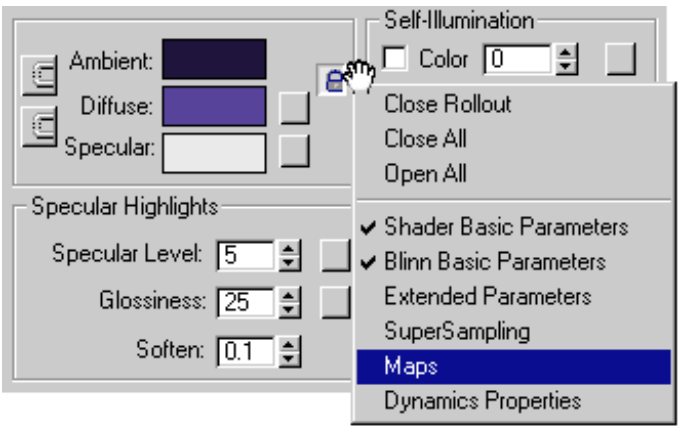
✘ **Click** on a new **Sample Sphere** to select an unused material slot.

Let's delve into the Material Editor a bit more, and see how to add a checker pattern to the floor. We'll also adjust the size of the checkers too.

Move your cursor to a part of the Material Editor where it turns into a hand.

Right-click to bring up the menu, and choose **Maps**.

3DSMAX has a lot of useful right-click functions. This one helps you manage your view the Material Editor options.

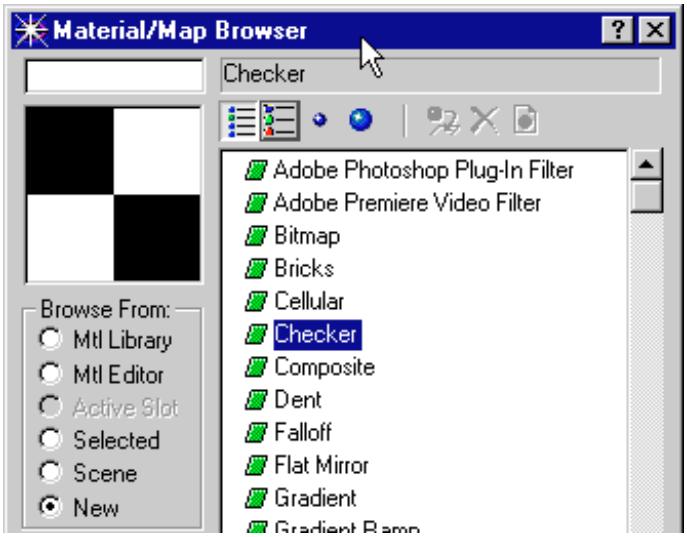


Now **click** the button "**None**" next to the **Diffuse Color** to bring up the Material/Map Browser.

The Material/Map Browser should be set to Browse from **New**. Choose **Checker** from the right-hand list.

OK your selection to return to the Material Editor.

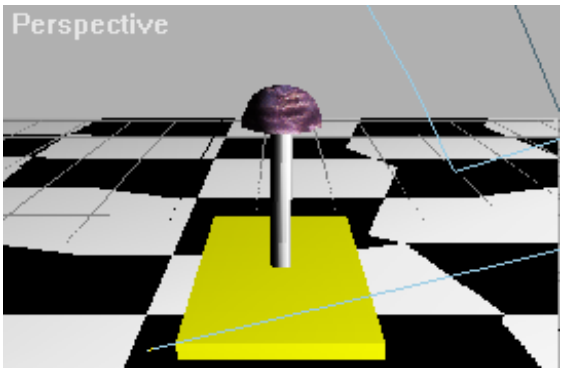
Make sure the Plane is still selected in the viewport.



Click the **Assign Material to Selection** button to give the checker pattern to the Plane. Observe the Floor to see whether or not the checker pattern was applied.

Click the **Show Map in Viewport** button in order to display the checker pattern.

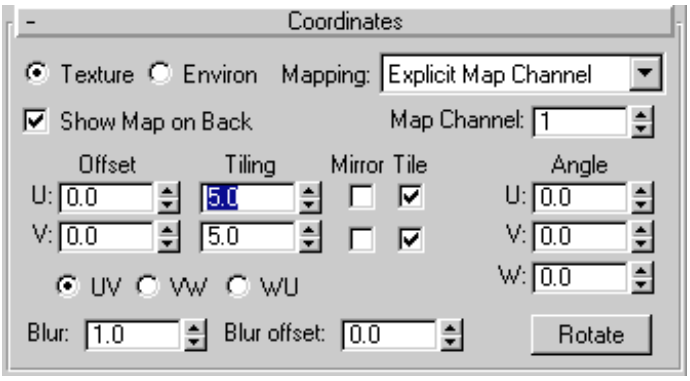
Depending on your graphics card settings, your view of the checker floor may appear jagged. Although this will not render the zigzag appearance, it can be disconcerting to see it in the viewport. To fix this, right-click the label of the viewport (i.e. "Perspective") to bring up the menu, and choose **Texture Correction**.



The Texture Correction setting and the Show Map in Viewport button are sometimes overlooked when trying to figure out why the bitmap does not display properly in the viewport.

Before we dismiss the Material Editor, let's adjust the tiling to make the floor pattern more interesting.

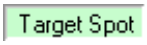
Change the **Tiling** value for **U** and **V** to **5** and observe the results.



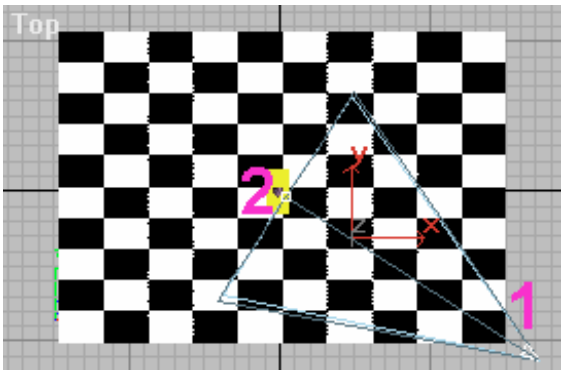
Now Let's get on with the lighting.

Go to the **Create panel** and **click** the **Lights** button.

Click the **Target Spot** light.



We will create this spotlight in the Top view, by clicking and dragging. The place you click first will specify the position of the light, and the place you drag to and let up on the mouse button will specify the target that the light is pointing at.



Click at the point corresponding to the "**1**" in the picture, and **drag** the mouse to the robot (point "**2"**) and **release** the mouse button to create the location of the target.

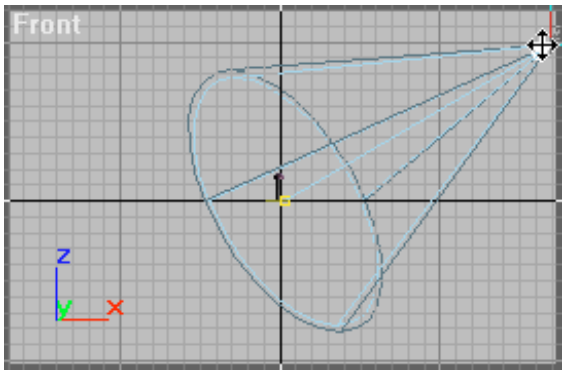
The top view floor goes black. What happened? Well, these kinds of things happen all the time in other areas of life, so why not in 3DSMAX too? Luckily we can explain this.

If you look in the Front or Left viewport, you can see we created the light on the ground, so the top of the floor does not get any light. The lighting that was automtically provided by 3DSMAX at the beginning is switched off because the program assumes you want complete control over the lighting.

We need to lift up the light. Let's do that in the Front viewport.

Click Select and Move.

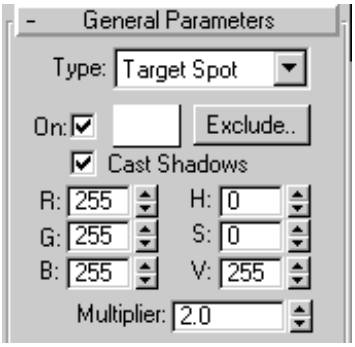
In the **Front** viewport, **click** on the **light** at the edge of the view and hold the mouse button down. **Drag** the mouse up to place the light about **half way up** and **release** the mouse button.



The Top view begins to look a little better lit, but still a little dark. Let's crank up the light.

Open the **Modify panel**. Since the Spotlight is still selected, the options you see apply to the spotlight. Scroll or **Pan** down to the **General Parameters**. Here:

- **Cast Shadows**
- **Multiplier = 2.**

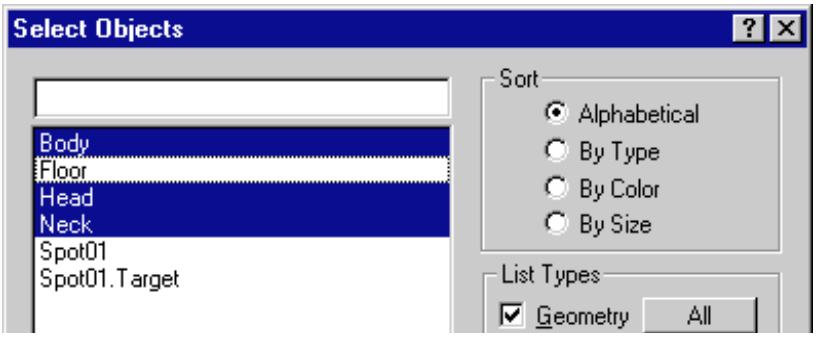


Before we render to check our work, let's zoom in on the robot.

1. **Click** the letter **"h"** on the keyboard to bring up the **Select by Name** dialog**.**

The keyboard short "h" is one of the most commonly used shortcuts in 3DSMAX.

Choose the **Head**, **Neck**, and **Body**, and click **Select**.

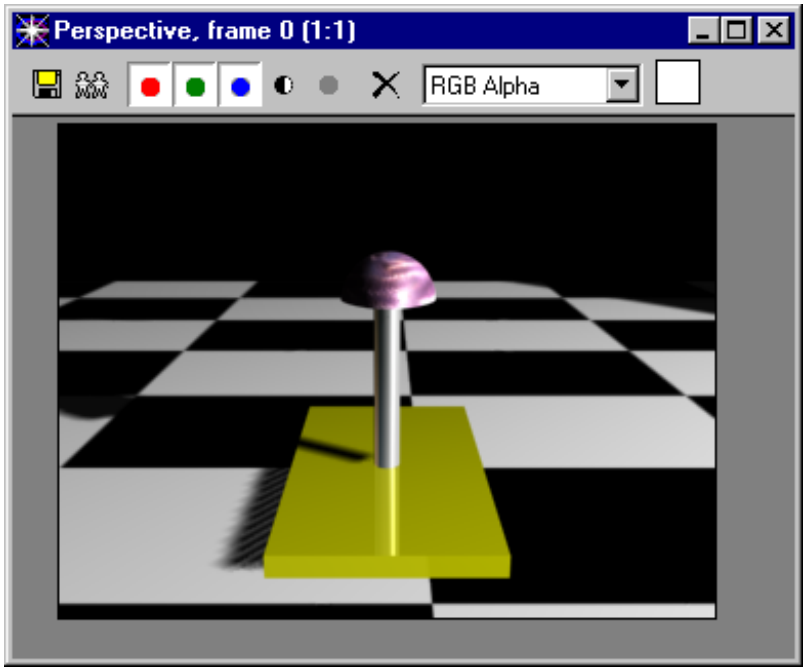


2.
3. **Click** and **hold down** the **Zoom Extents All** button to display the flyout.

4. Choose the **Zoom Extents All Selected** button (the one with the white box) to zoom in on the robot.

5. **Render** the **Perspective** view.

Not bad. But there's something about the shadow that would cause the video competition judges to you down. Notice how the shadow of the Neck does not seem quite attached? Also, the shadow is a bit fuzzy. Let's correct this.



The controls we'll need to do this are further down the Modify panel.

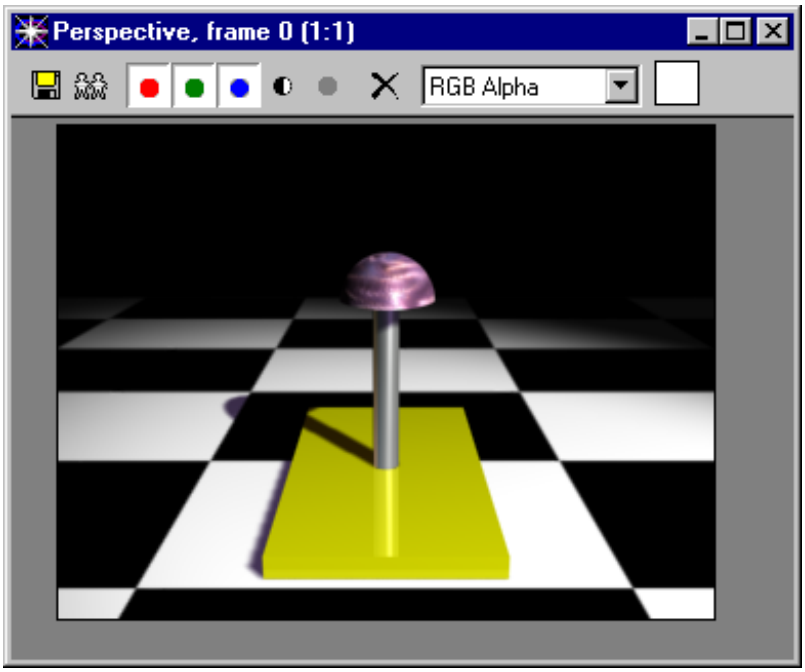
Expand the **Shadow Map Params** rollout. (You can right-click on the panel, and select the rollout from the menu instead.)

Change the **Bias** to **0.** This will connect the shadows towards the body as well as the base of the Neck.

Set the **Size** to **1024** and **Render** the scene again. This does the trick!

The picture at the beginning of the section shows the scene after the light has been moved a little more overhead, and the Falloff and Hotspot adjustments have been made to limit the area illuminated.

- **File > Save.**



Review

Lighting requires some experimenting to get the results you're looking for. The default lighting is switched off when you create your own lights.
Even though the section is called lighting, there were some things about Checkers sneaked in. It was worth it though, since it brought up some troubleshooting for Texture Correction and Showing Map in Viewport.

1. Animating the Neck

Your US FIRST robot will be moving arms or pistons while it is performing in the competition. Let's create some Neck movement for this tutorial. On the way we'll learn that objects you create have 2 controls automatically assigned that govern the type of animation your objects have.

We'll start by creating setting up a Named Selection Set and a Zoom button for easy closeups of the Robot. Now that we've created a Floor, our zooms need to distinguish when we need to see the Floor and when we need to close in to the Robot.

✎ Click the letter "**h**" to bring up the **Select by Name** dialog, as we did in **Step 8** of the previous section.

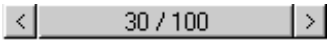
Select Body, Head, and **Neck**, and click **Select** to close the dialog.

Locate the **Named Selection Set** drop down on the Main Toolbar, and type the word **Robot** and hit <***enter***>.

This will allow you to select the components of the robot whenever you want. We will use this to help differentiate when we want to Zoom into the Robot instead of a Zoom that includes the Floor. Although the tutorial does not reference the Named Selection set again, you might wish to do so if you have instructions to "select the Robot."

Use the 2 Zoom buttons at the bottom of the screen to practice zooming a couple of times.

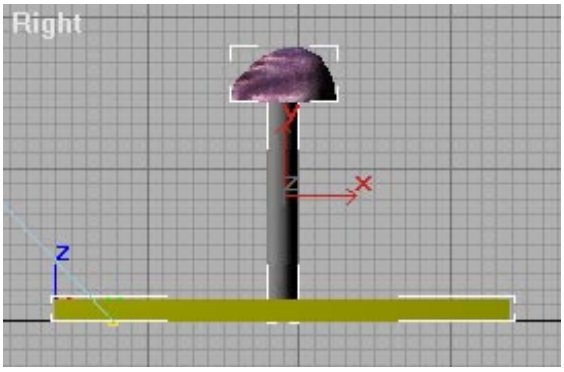
✎ **Move** the **Time Slider** to **Frame 30**.



✓ **Zoom** in on the **Robot** using the Zoom button for "Selected."

✔ **Right-click** in the **Left viewport** to activate it.

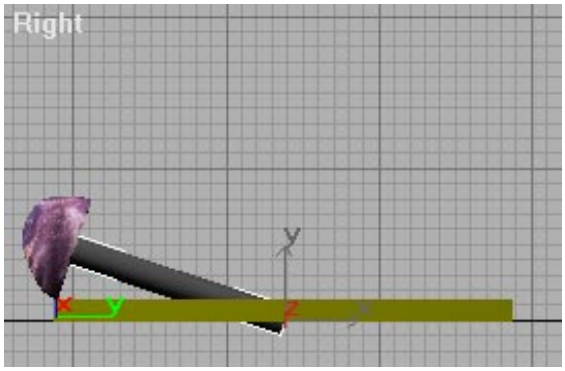
Type the letter "**r**" to change it to the **Right viewport**. The Right view is better lit.



× **Click** the **Select and Rotate** button.

Click the **Neck** to select it, and **hold down** the mouse button. (We're planning to right-click to cancel our movement.)

Move the cursor Up or Down and observe the movement. While holding down the mouse button, **click** the **right mouse** button to **cancel** the movement.



The Neck should be upright again when you finish.

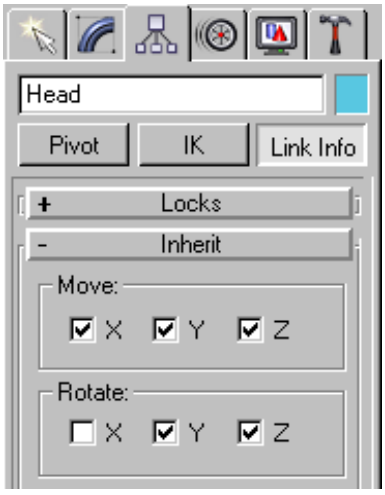
Notice that the Neck's pivot point is somewhere in the Body, at the bottom of the Neck. The fact that the rotation causes the Neck to extend below the Body is something that we would need to fix for the Robot video, but is something we will overlook for this tutorial. This will give needed you practice continuing your animation even when you know something isn't perfect.

It would be a nice touch if the head did not face down in this position. Let's see how we get the head to stay level while we're rotating the neck.

× **Select** the **Head**.

✗

✘ **Select** the **Hierarchy** tab of the Create panel.



Click Link Info.

Expand the **Inherit rollout.** We want to tell the Head not to inherit rotation that might come from rotating the Neck.

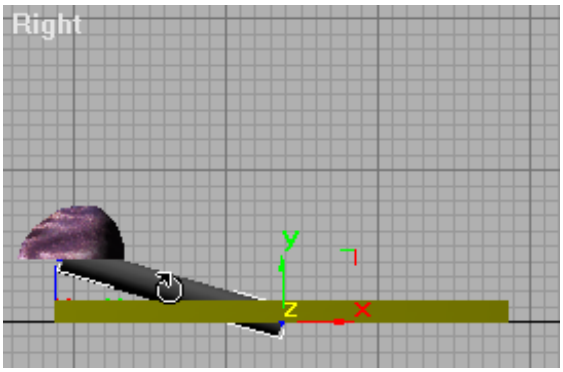
Remove the **check** next to **Rotate X.**

Why X? The answer related to the fact that it was created in the Top view. Here's a closeup of the Head's axis in the Top view, showing that the X Axis is where we want the pivoting to not occur.

Let's test this out.

✣ Turn on the Animate button.

Rotate the **Neck** till the head is near the Body, and release the mouse button.



Turn off the **Animate** button.

Right-click the **Perspective** viewport to select it.

Play the Animation.

See how your Robot is not only moving about the Floor, but it's lifting its head as well!

It would be nice to keep track of the Robot so it doesn't go off screen. And it might be nice – even advanced - to take a tangential trip to TrackView to play with one of the animation-type controls we mentioned at the beginning of this section. Of course, after you gain this knowledge it's entirely possible that you will dispute the use of the word "nice." But this knowledge may give your competition animation an edge!

First we'll do what most professional animators do – create a camera and view the action through its eye.

Stop the Animation.

Move the **Time Slider** to **Frame 0** before proceeding.

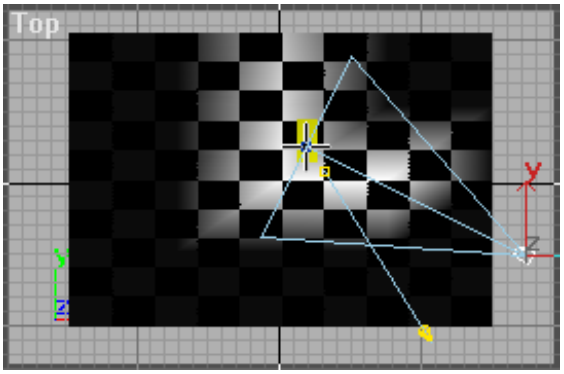
Zoom so that the **Top view** shows the Robot and the Floor.

Click the Create panel and choose the **Camera** tab.

Click on the **Target** button.

We'll place the camera near our light, pointing towards the Robot.

In the **Top view**, **click and drag**, starting from the bottom right corner to position the camera, and dragging to the Robot and letting go of the mouse button, to place the target.



Name this Camera **Robot Camera**, instead of Camera01.

Right-click the **Right viewport** to select it.

Type the letter "**c**" to change this to the **Camera viewport**.

The view in the Robot Camera shows a rather small Robot and we've put too much work into our star for that. If you were to put a lot of effort into a Mars lander, and then lost it because it was too small to see, you'd be disappointed to.

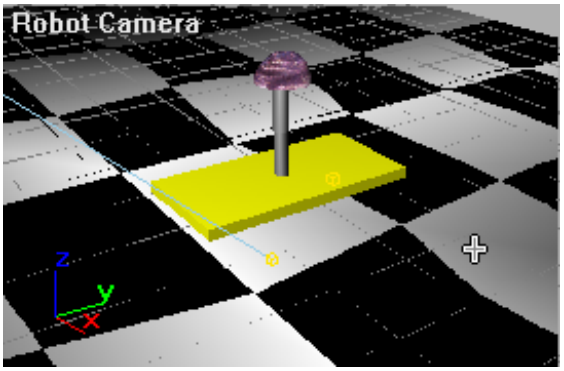
Let's move the camera in closer and raise the height a bit. We'll work in several viewports to do this till we get something that pleases us.

Use the **Zoom** controls so that the **Top** and **Front viewports** are zoomed far enough to see the Floor.

Move the **Robot Camera up** in the **Front viewport**.

Move the **Robot Camera closer** to the Robot in the **Top viewport.**

Your camera view might look like illustration. (Remember how to correct the wavy checker pattern? See **Texture Correction** at the end of Step 5 in Lighting the Robot.)



Play the animation while the Robot Camera viewport is active (right-click to activate the viewport), and when you're finished playing, Stop, and move the Time Slider to Frame 0.

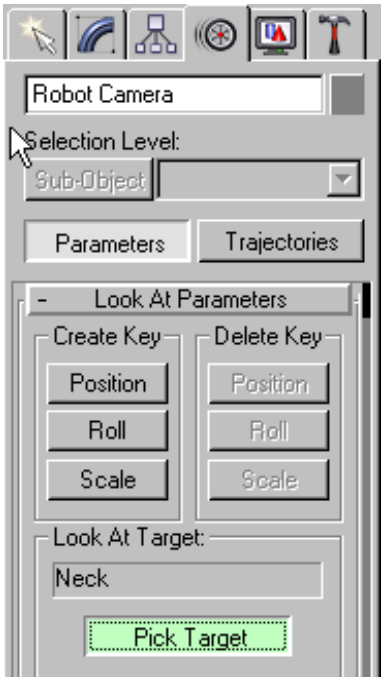
We need to have the Camera Target follow the Robot around. We could link the Target to the Robot. Or – we could change the object that the Camera looks at. Let's have the Robot Camera look at the Neck. This will expose you to a specific type of Animation controller that you might find useful in your competition video, the "Look At" controller.

Make sure the Robot Camera is still selected.

✔✔ **Select** the **Motion panel.**

Expand the **Look At Parameters** rollout.

Click Pick Target, and click on the **Neck** in the Robot Camera viewport.



✔✔ **Play** the animation again. This time the Robot Camera follows the robot through its movement by centering its view on the Neck.

This is what we want. We're nearly through! Congratulations. The last section consists of some refinements to the animation.

✔✕ **File > Save.**

Review

We learned a bit about the Linking mechanism. The Child object inherits its movements, rotation, and scale from it parent object. We disengaged the rotation inheritance from the Neck to the Head.
We've learned that 3DSMAX creates objects with Animation Controllers. The type of controller determines the kind of movement the object makes. The Look At controller forces an object (it doesn't have to be a camera) to always face a specified target.

1. Animation and Controllers

We find out more about animation in this section. We introduce a shortcut that allows us to continue the up and down movement of the Robot Head and Neck. We get re-introduced to the LookAt controller and learn about the Path Controller as a way of getting our Robot to move along a path.

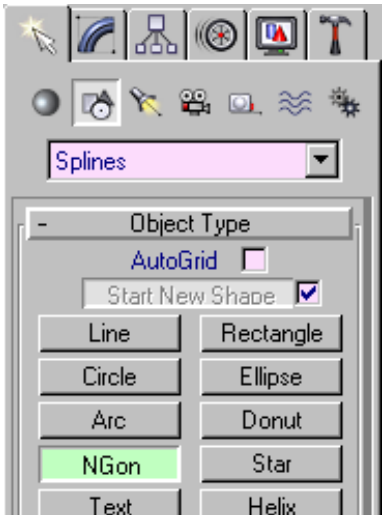
We're getting Advanced training for the price of a beginning tutorial.

1. Make sure you're at **Frame 0**, and **Zoom Extents** your **Top view** to include the **Floor**.

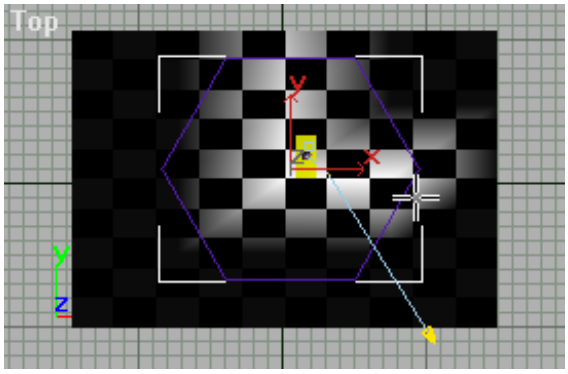
   We're setting up the view in order to draw a path for the Robot to follow.

2. In the **Create panel**, click on the **Shapes** button.

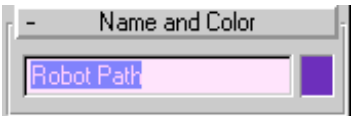
   We could choose almost all of the Shape options as a path, but let's try out the NGon.



Click NGon, and **click and drag** from the **center** of the Floor to create a Hexagon nearly the size of the Floor, and release the mouse button.



Rename NGon01 to **Robot Path.**



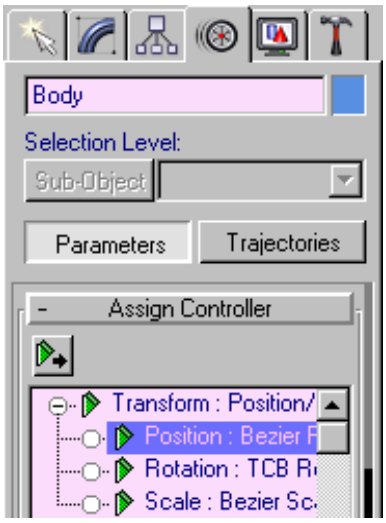
3. **Click** the **Select object** button on the Main Toolbar.

Select the **Body** in whatever view is easiest**.**

4. **Select** the **Motion panel.**

Open the **Assign Controller** rollout and click to **highlight Position**.

The Position of the Body is determined by the "Bezier Position" Controller. This allows you to move the Body around with the Select and Move cursor. Since we want the Robot to follow the path we've created with the NGon we need to change the controller to a Path Controller.

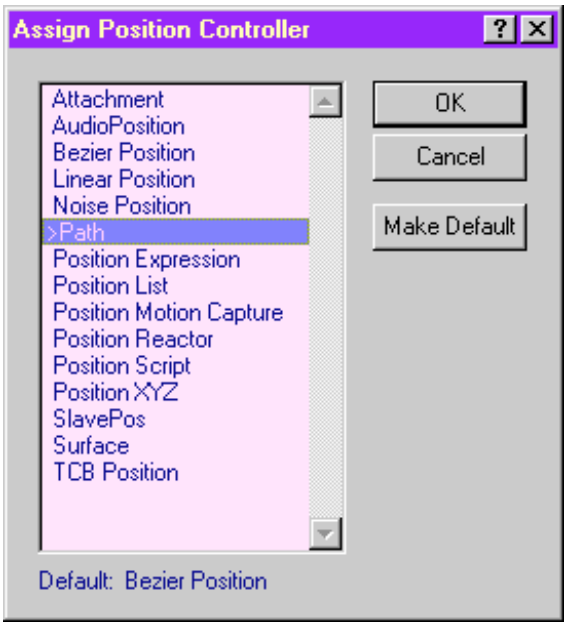


5.

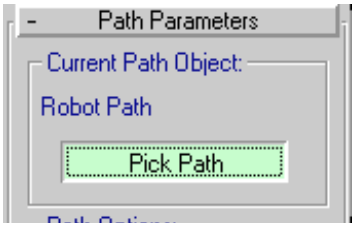
6. **Click** the **Assign Controller** icon to bring up the Assign Position Controller.

Here you see a list of all the possible ways 3DSMAX can control the Body's position. We'll select Path.

Choose **Path**, and **OK** to close the dialog.



Scroll down the Motion panel to the **Path Parameters** section.



Click **Pick Path**, and select the **Robot Path** in the Top view.

The Robot should move to the "3 o'clock" position of the NGon in the Top view. It might be out of the light, however. But let's play the animation to see what we did.

7.

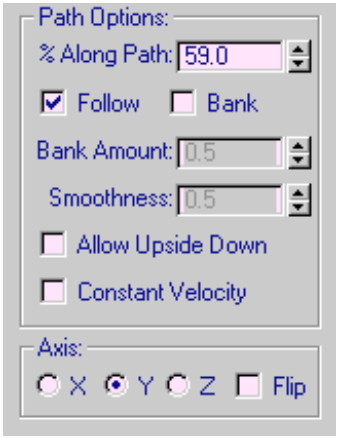
8. Click Play Animation.

The Robot moves around the path all right, but doesn't point in the right direction. There are 2 steps needed to correct this.

Stop the Animation.

9. In the **Path Parameters** section of the Motion panel, check:

- **Follow**
- **Axis = Y**



Play the **animation** again – YES!!! This time the Robot moves around the path the way we like. While the animation is playing, right-click in each viewport to activate it. The motion of the Robot can be viewed in each active viewport.

Stop the **animation.**

Two more adjustments, and we're through with this tutorial. We will get the light to follow the Robot as it moves around, and get the Robot neck to move up and down while it's going around the path.

1. Select Spot01.

By now you've figured out that you can select Spot01 easily by clicking on it in one of the viewports, or by clicking the letter "h" to bring up the Select by Name dialog. Use whichever technique you wish. Isn't it funny to have a light named after a dog?

2.

3. **Click** the Motion panel again, and in the **Look At Target** section, click the **Pick Target** button and choose the **Body**.

When you play the animation again, the light will follow the Robot. This will make our final step easier to see!

4. Press the **"h" key** to bring up the **Select by Name** dialog and choose **Neck.**

Click the **Spacebar** to lock your selection.

This is a neat trick that will help you keep your Neck selected with your next click. You can confirm that your selection is locked by the highlighted lock icon at the bottom of 3DSMAX in the status bar.

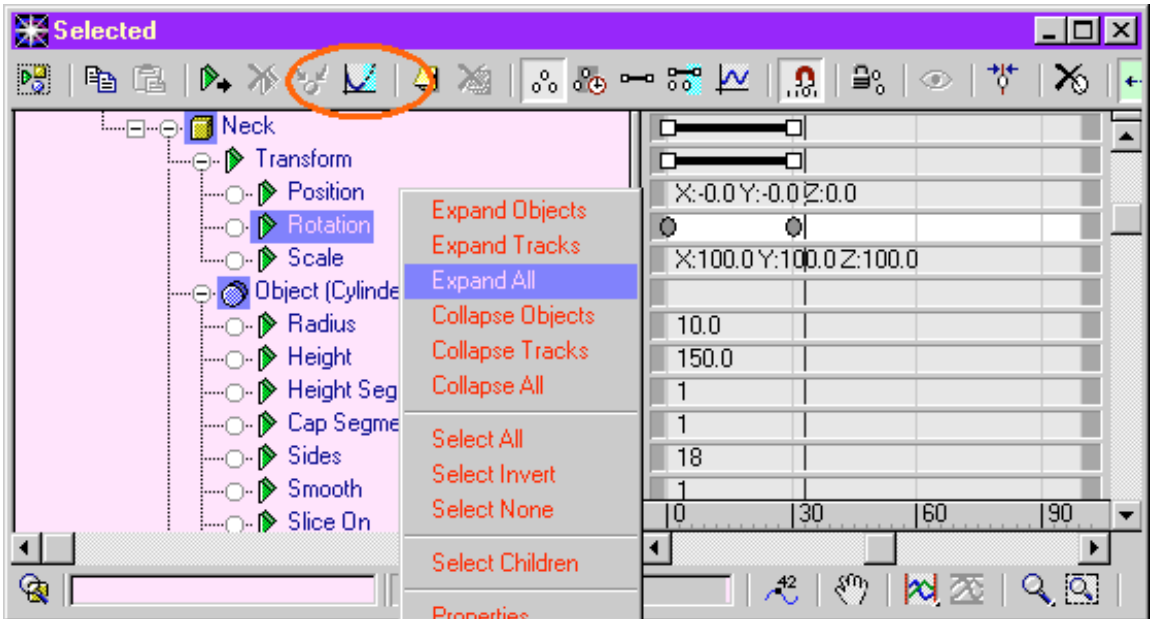
5. **Right-click** on the **Neck** itself to bring up the menu and choose **TrackView Selected**.

The TrackView dialog opens up. We'll use TrackView to get access to the 2nd controller that is assigned to 3DSMAX objects. The TrackView is used by a large number of animators who like to manipulate objects with graphs and formulae. Go ahead – if you want to be intimidated by this dialog it's your choice!

Right-click Neck to bring up the menu, and choose **Expand All.**

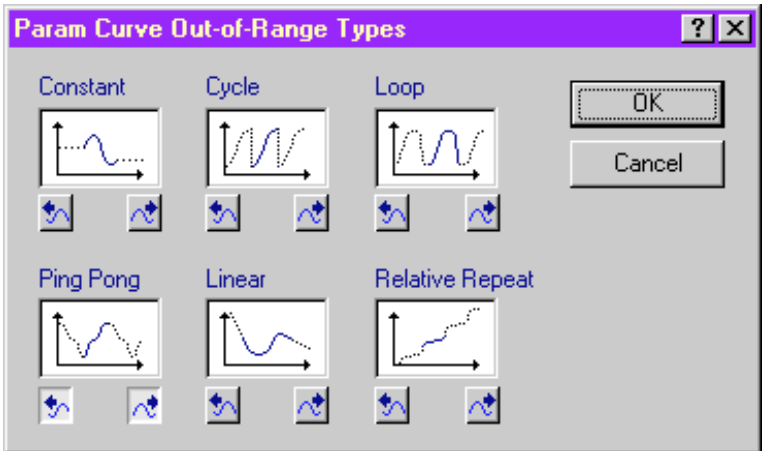
Highlight the Transform called **Rotation.**

You'll notice that the right half of TrackView shows 2 round "keys" for Rotation. The one at Frame 0 specifies the vertical angle of the Neck at Frame 0, and the one at Frame 30 corresponds to the sloped angle we specified at Frame 30. You can even right-click on the keys to bring up a dialog which allows you to control the exact angle. This is powerful!



Click on the **Parameter Curve Out-of-Range Types** button (conveniently circled in red in the TrackView display picture above). 

This brings up the Parm Curve Out-of-Range Types.



Here's the secret. Objects created in 3DSMAX are assigned "Constant." This means that when the object is animated, say from Frame 0 to Frame 30, the animation stops after Frame 30.

Click on the **Ping Pong** diagram to select it (the 2 arrows get selected at the same time) and **OK** to close the dialog.

Close TrackView by clicking on the **X** at the top-right corner of the TrackView window. 

Press the **Spacebar** again to **Unlock** the selection.

6. **Play** the animation.

The Robot Camera view shows the Robot moving around the Hexagonal path, Neck moving back and forth, spinning sharply to match each edge of the Hexagonal path. You've done it! Congratulations! You've come a long way in this tutorial.

The animation is still far from finished however. ("*What*??!")

7. **Render** the animation so you can play it back later.

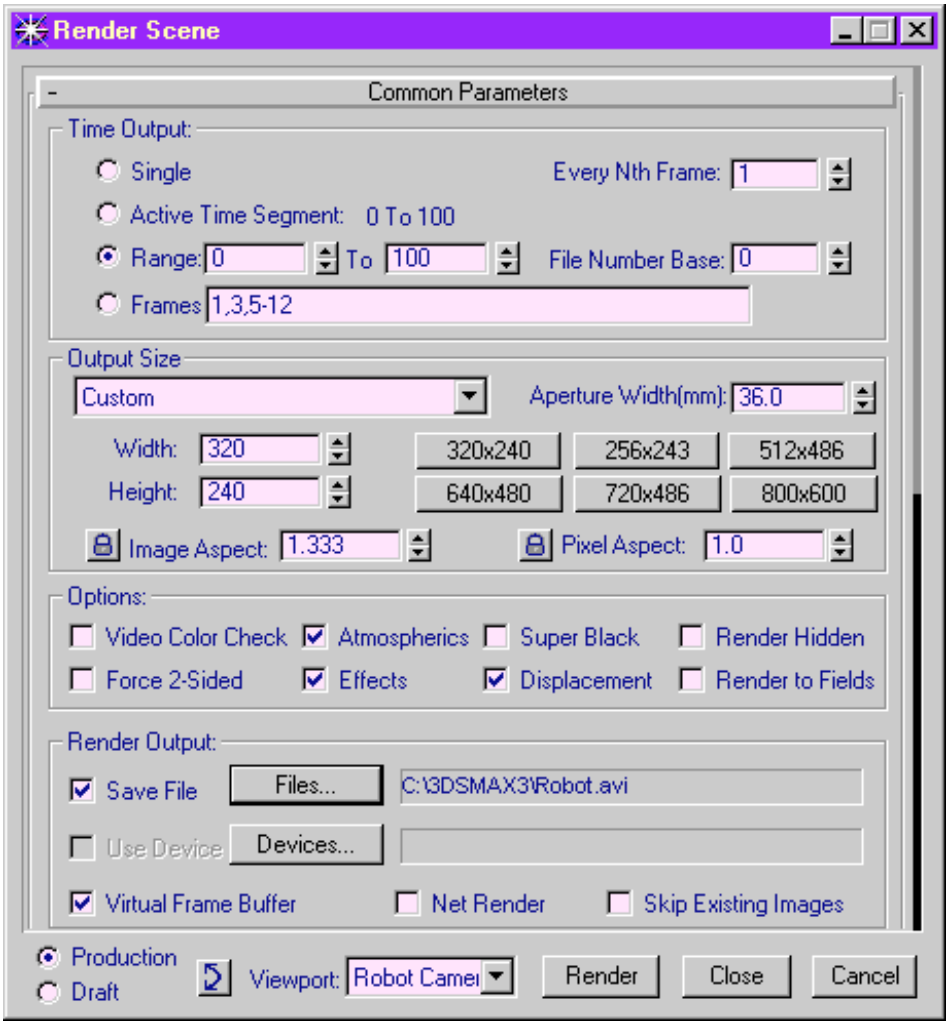
   Rendering > Render brings up the Render Scene dialog.

For Time Output, choose **Range**.

For Output Size, choose **320x240.**

Click on the **Files** button, and save your file as Robot.avi.

Render.



Keep an eye on the Rendering dialog so you have some idea of how long each frame takes to render.

File > View File to play the Animation you just rendered. Choose Robot.avi and watch the results!

Extra Credit

You notice how the Robot moves abruptly around the path? Select the Robot Path, and go to the Modify panel. Try increasing the Corner Radius to get the Robot to spin graciously from one straight segment to the next.

More credit to you if you noticed that the Neck movement restarts abruptly when the animation cycles back to Frame 0. You know how to correct that? First, select the Neck. Then look down at the bottom of the screen below the Time Slider and notice the keyframe dot at Frame 30. Right-click on the dot and choose "Neck: Rotation." Change the value of 30 to something that is evenly divisible into 100 (for example "25").

Okay – just one more thing. You may notice that the rendered animation does not show the reflection of the Neck as well as you thought. This could be affected by the Spot01 lighting characteristics, like the Muliplier being so strong that the reflection is washed out. You can bring up the Material Editor again, and adjust the "Index of Refr" value and see what happens.

Where are we with the Robot Lander?

This tutorial should give you the incentive to go ahead and create your own design. The concepts didn't actually get the robot flying to Mars, but if there were a second tutorial, you probably would at least get as far as the moon.

Congratulations – we've really covered a lot of ground. The 3DSMAX tutorials and Reference Manuals are much more detailed and are highly regarded, so please don't think this tutorial is your only reference. It just happens to jamb a lot of helpful things into one session.

Good luck with your animation!