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How To's

How-to's are step-by-step tutorials that are designed to help you learn more about Maya. While some lessons let you start from scratch, other lessons may provide a start file for you to begin with.

Note - These files may not perform as expected. Always back up your work before using any files downloaded from this website.

These how-to's have been updated to work in Maya 2.5. However, unless otherwise noted, they will also work in Maya 2.0.

Maya how-to's are available in the following categories:

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ABOUT MAYA

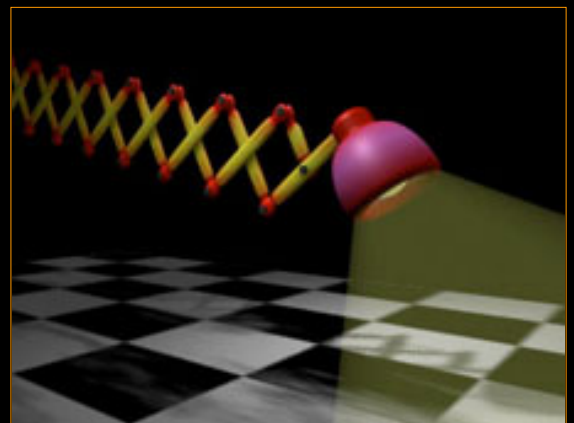
HOW TO MODEL A FLEXO WITH MAYA

namtar@scsinet.es
**CUSTOMER
SUBMISSION**

 by **Lluís Llobera Trias** - Quod/IDEP
Spain

Maya Complete Animation

This is a tutorial to create and make fully operative, with Maya, a flexo-type arm like those used to hold lights. You will work with expressions, driven keys, pivot position, and constraints. You will also learn to add attributes and work with the Graph Editor.

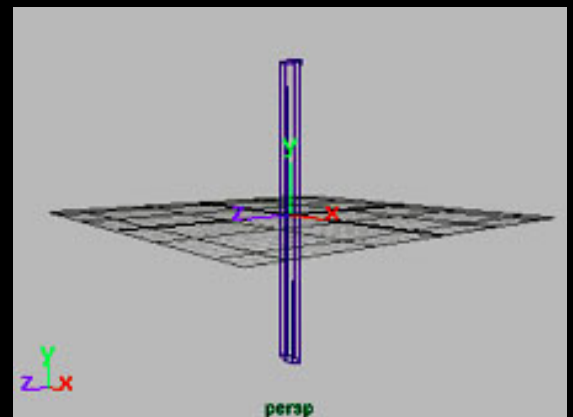

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The point of this exercise is to create a series of arms that rotate properly together when the main arm of the flexo does.

Note: throughout the tutorial, you are told how to create a 5-arm flexo; however, all the pictures contained in this document show a 10-arm flexo. In fact, there's no arm limit as long as you follow the method correctly.

STEP ONE

In "extensible" arms such as these, you get the same element repeated a number of times. Therefore it is very important that the first arm created has some kind of a solid structure. You are going to create a cylinder grouped twice with itself, positioning the pivot for every node in a proper position.



- Create a **NURBS cylinder** and name it "*c_i*", for "inferior constraint". Go to the **Channel Box** and set its Y scale to **10**, and its Z scale to **0.4**.
- Enter "**Insert**" to edit the Pivot Point position, then go to the **Numerical Input Line**, which is a white space just above the Channel Box. Enter the values **0 -10 0**.

You should see that the pivot has moved at the bottom of the cylinder. Enter "**Insert**" again to go back to object editing mode.

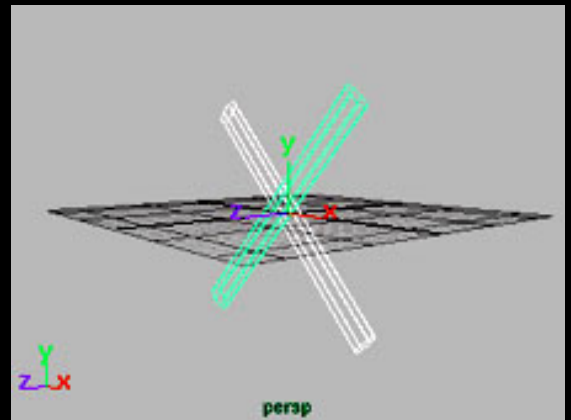
Group the cylinder with itself, and name the new group "*c_s*", for "superior constraint". Now follow the previous steps to position its pivot point at the top of the cylinder (that's **0 10 0**).

Group the node *c_s* with itself, and name the new group "*SUP_01*". Now you can rotate the node *SUP_01* **45** degrees in the **Z** axis. You have successfully created the first arm of the flexo.

STEP TWO

Enter **Edit->Duplicate->Options** and reset the values.

Duplicate the node *SUP_01* and name its copy *INF_01*. In the Channel Box, set its Z translation to 1.



Now you are going to create an expression to make this new node rotate every time that the superior arm does. Check that *INF_01* is still selected, and go to **Window->Expression Editor**. Name the new expression "*inf_rotate*", and enter in the expressions area

INF_01.rz = 180 - SUP_01.rz ;

Click on "**Create**". From now on, every time that the *SUP_01* rotates in the **Z** axis, the *INF_01* will rotate also. Check it if you want. After you have, set the **Z** rotation for the *SUP_01* to **45** again -- the whole exercise will assume this as its value.

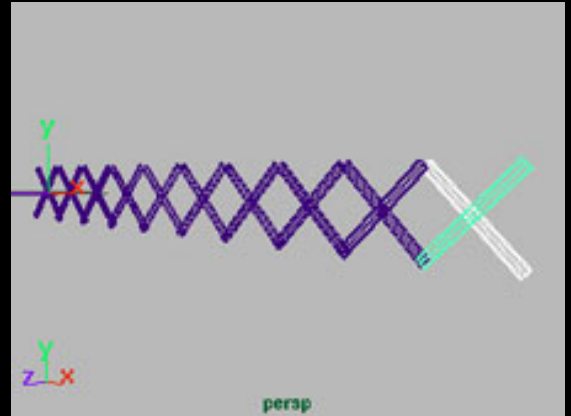
Since the arms of the flexo are alternated, you will now have to move the pivot points of the *c_i* and *c_s* nodes of the *SUP_01* and *INF_01* arms in an absolute **Z** translation of **0.5**. To achieve this, the easiest procedure is to select each of the sub-nodes, click "**Insert**" and, in the **Numeric Input Line**, enter

. . 0.5

You will have to repeat this operation for each of the sub-nodes.

STEP THREE

Select *SUP_01* and *INF_01* and then select **Edit-> Duplicate-> Options**. Set the number of copies to 4 and click on the **"Duplicate Input Connections"** box.



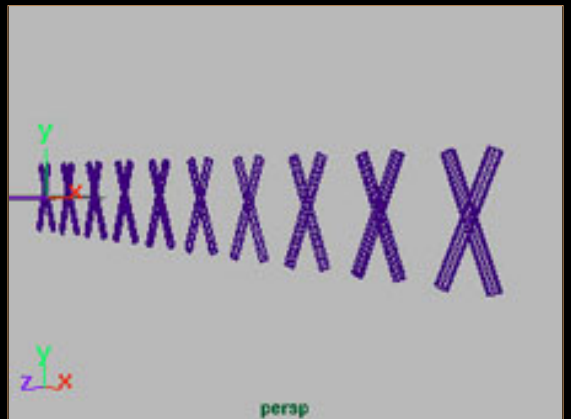
When you click on **"Duplicate"**, Maya will create four new superior cylinders, called *SUP_02* to *SUP_05*, and four inferior cylinders which are named *INF_02* to *INF_05*. Select in the Outliner the nodes *SUP_02* and *INF_02*, and set them to an **X** translate of **14** units. Pick the next two nodes, move them to **28**, and so on.

Now look what happens when you rotate the *SUP_01*: only the inferior arms rotate with it. This is because only *INF_01* had the expression applied, and therefore the superior arms aren't aware of what is going on.

STEP FOUR

Select the nodes *SUP_02* to *SUP_05* and (in the Animation menu) select **Animate-> Set Driven Key-> Set Options**.

The Set Driven Key window will pop up (from now on, we will call it **SDK**). In the **"Driven"** frame you'll see the four nodes you have just selected.



In any orthographic window select the *SUP_01* and, returning to the **SDK**, click on **"Load Driver"** to place it in the **"Driver"** frame.

Click on the **"Rotate Z"** next to the Driver frame (it'll get dark), and select the four nodes in the Driver. Click on their **"Rotate Z"**. Now click on **"Key"** to set the first connection.

Select the *SUP_01* node and set its **Z** rotation to 60 degrees. After that, select the *SUP_02* to *SUP_05* nodes and rotate them to 60 in **Z** as well. In the **SDK** window, set the second connection by clicking on **"Key"**. Close the **SDK**.

Look what you have now: the superior arms only seem to work properly when the Z rotation of *SUP_01* is between 45 and 60 degrees. Let us fix this.

Select the nodes *SUP_02* to *SUP_05* and go to **Window-> Animation Editors-> Graph Editor**. Press the "f" key to execute a "frame all"; a blue curve will appear in the right window. Select it (all of it, including its beginning and end) and enter :

Curves -> Pre Infinity -> Cycle with Offset

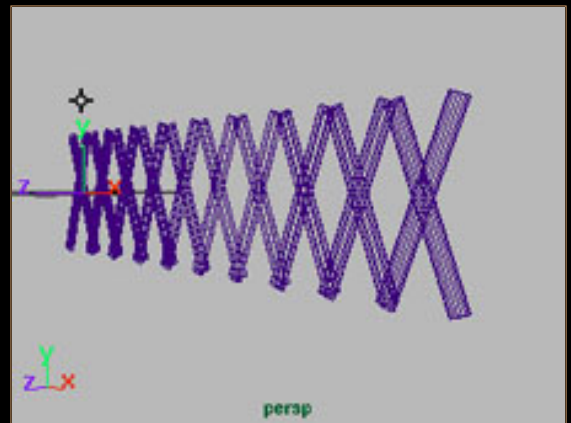
Curves -> Post Infinity -> Cycle with Offset

Close the Graph Editor. Now all the arms rotate correctly.

STEP FIVE

Using the Outliner or the Hypergraph, add constraints from certain nodes to the other ones. This is the formula to do it:

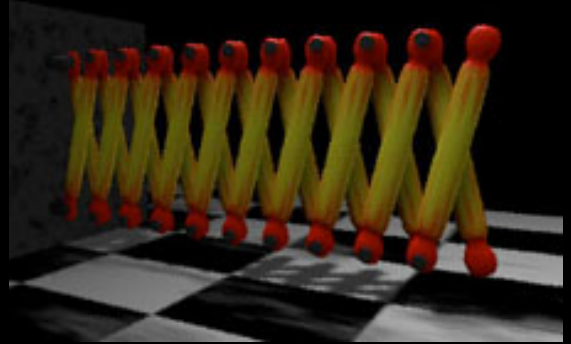
- Select the node *c_i* from *SUP_0x*, then the node *c_s* from *INF_0(x+1)*.
- Select **Constraints-> Point**. You also have to do it the other way around, i.e.: select the node *c_i* from *INF_0x*, then the node *c_s* from *SUP_0(x+1)* and select **Constraints-> Point**.



For example, the first step is to select *c_i* from *SUP_01* and *c_s* from *INF_02* and constraint them. Then, pick the *c_i* from *INF_01* and the *c_s* from *SUP_02* and constraint them too. Continue until you have no arms left.

STEP SIX

You should now have the flexo working correctly. But having to depend on the **Z** rotation for *SUP_01* is time consuming, and inefficient.



Now we will create a new node with an attribute to get it to work.

- **Select** all the nodes (Right Click and "**select all**" is the easiest way) and group them.
- Name the group "**FLEXO**".
- Enter "**Insert**" to edit its pivot point position.
- Go to the Numeric Input Line and enter:

. 15 .

Select **Display-> Objects Components-> Selection Handles**. From now on, you'll be able to select the whole object by clicking on this handle.

Now select **Modify-> Add Attribute**. Name the new attribute "**Length**", enter **0** for its minimum value, **100** for the maximum, and **50** as default value.

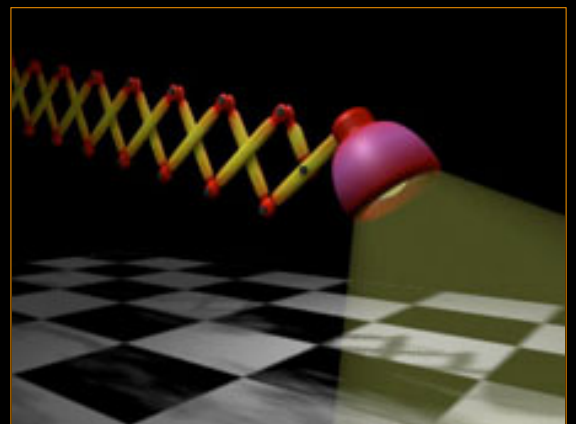
Select the node *SUP_01*, and select **Animate -> Set Driven Key -> Set -> Options**. Load the node *FLEXO* as the driver. Select the attribute "**Length**" next to the Driver frame, and the **Z** rotation from the Driven frame. Press **Enter**.

Set the "**Length**" Value to **0**, and the **Z** rotation for *SUP_01* to **0**. Click on "**Key**". Now set "**Length**" to **100** and the **Z** rotation for the *SUP_01* to **90**. "**Key**" it again.

CONCLUSION

Well then you have just finished building the flexo!

Now it's up to you to add details, such as the joints (which should be constrained to the nodes *c_i* from the arms), etc.



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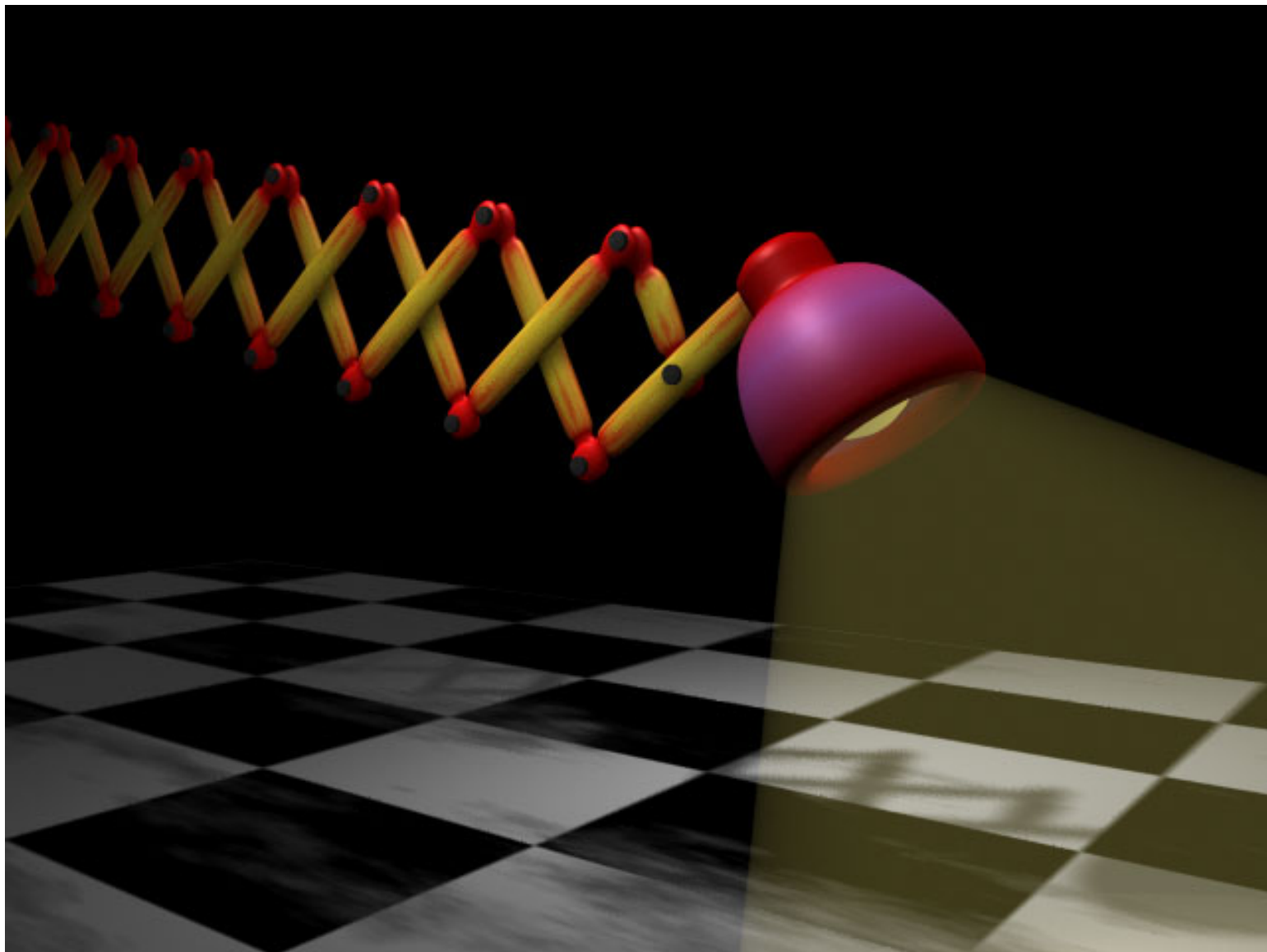
Here's the final file for you to download. You can open it with any version of Maya.

[flexo.ma](#) (~270k)

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ABOUT MAYA

HOW TO BUILD AN IRIS

By Alan Harris

Maya Complete Animation

In this lesson, you will learn how to build an iris and use Set Driven Key to animate it opening and closing.

To achieve this, you will create a locator and add an attribute called Shutter. This attribute will range from 0 to 10. 10 equals the iris in closed the position.



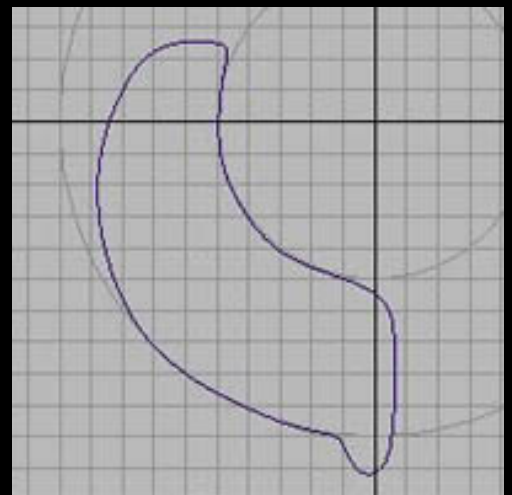
[Play Movie](#) [321 k]

STEP ONE

Set the **Grid Options** to default settings.

Create two Nurbs circles at the origin -- one 10 units and the other 5 units. Template them to use as guides.

- Create a closed **CV Curve** as shown.
- Duplicate the curve and translate in **Y** to **-0.2**
- Select the top curve and select **Surfaces > Planar**.
- Select the top curve and the bottom curve and select **Surfaces > Loft**.
- Delete the curves or delete history on the surfaces.



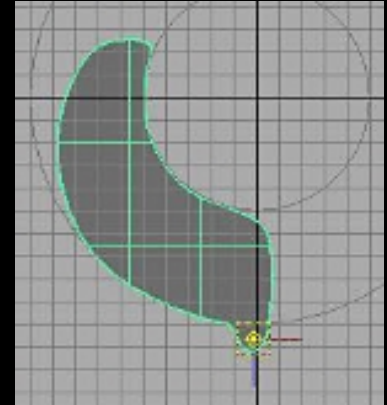
STEP TWO

You will need to group these surfaces twice to get two different pivot points. One for creating the subsequent shutters and the other for the local rotation.

- Select the two surfaces.
- Select **Edit > Group** and rename this node *localPivot*.
- Select the node *localPivot*, then select **Edit > Group** again and rename this node *centerPivot*. This node should be at the origin.

You will now change the location of the *localPivot*.

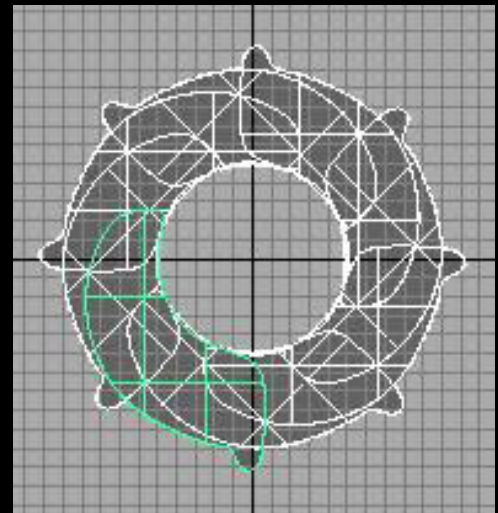
- Select the *localPivot* node.
- Press **Insert** on the keyboard to modify the pivot point.
- In the top view, **Move** the pivot to the corner of the shutter piece as shown.
- Press **Insert** again when finished.



STEP THREE

You will now be duplicating surfaces to create the other pieces.

- Select the *centerPivot* node.
- Select **Edit > Duplicate - Options** and set the following:
Rotate Y to 30;
Translate Y to 0.1;
Number of Copies to 11
- Press **Duplicate**.



STEP FOUR

You will be creating a Locator with an attribute called **shutter** to control the opening and closing of the iris.

- Select **Create > Locator**.
- Select **Modify > Add Attribute...** and set the following:
Attribute name to shutter;
Minimum to 0;
Maximum to 10
- Press **OK**.

STEP FIVE

The Locator now needs a connection to the rotation attribute of the local pivot. To achieve this connection, you will use **Set Driven Key**.

- **Select** all twelve of the *localPivot* nodes.
- Select **Animate > Set Driven Key > Set - Options**.
- With the *localPivots* selected, press **Load Driven**.
- Highlight all the **localPivots** in the left column.
- In the right column of the Driven section, highlight **rotate Y**.

You will now load the Locator as the Driver.

- **Select** the Locator.
- Press **Load Driver**.
- Highlight the locator in the left column.
- In the right column of the Driver section, highlight **shutter**

In this next step you will be setting the keys.

- Press **Key**.
This will set a key for the **shutter** value of **0** when the iris is fully open.
- In the Channel Box, set the **shutter** value to **10**.
- **Select** all the *localPivot* nodes.
- Highlight the **Rotate Y** attribute name in the Channel Box.
- Use the virtual slider with the **MMB** in the workspace by **click- dragging** to the left until the iris is closed.
- Press **Key**.

Test the Set Driven Key by selecting the Locator and entering different values or by using the virtual slider.

CONCLUSION

You should now have the **shutter** attribute controlling the animation of the iris. Experiment with different curve shapes and amount of shutters. You can also experiment with different translate offsets when duplicating the shutters.



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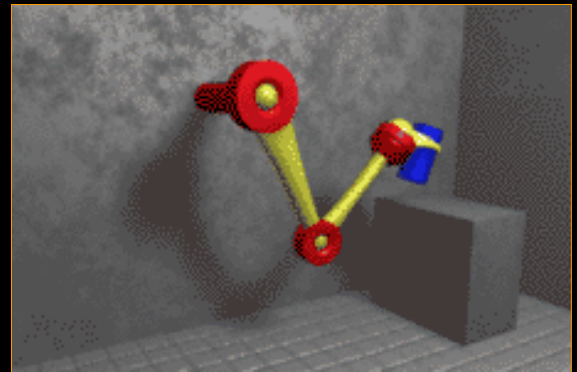
ABOUT MAYA

HOW TO PICK UP AN OBJECT

by Robert Magee

Maya Complete
Animation

In this lesson, you will learn how to make an Inverse Kinematic arm pick up an object and place it on a table. This will involve constraining the IK handle to two Locators then animating the constraint weights to switch the hand between locators.



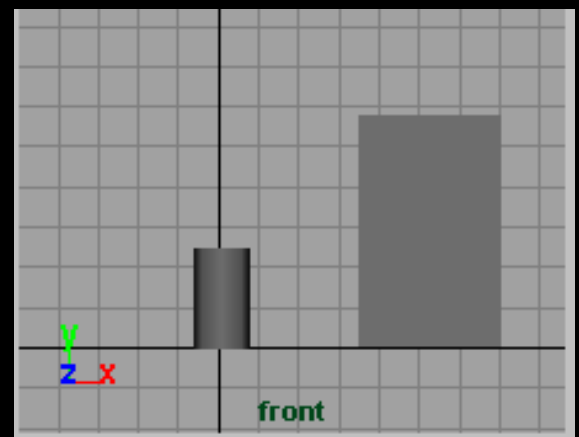
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The key to this lesson is that you will animate the object first then constrain the arm to match that movement. This ensures that the object's movement is exactly what you want before you even have to consider the character picking it up.

STEP ONE

Create a polygonal cube. **Scale** it to create a tabletop. In the front view, place it on the ground along the X axis. Rename the cube's transform node to *table*.

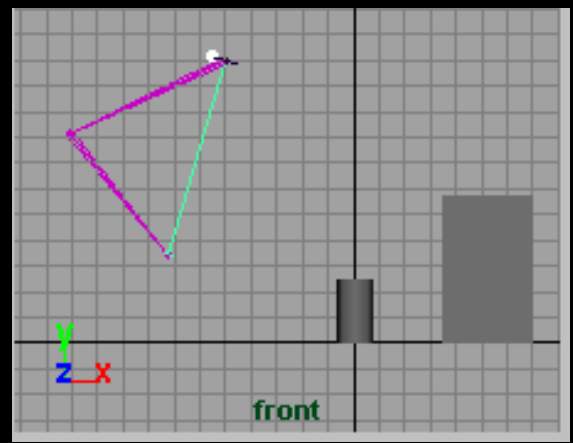
Create a NURBS cylinder. **Scale** it so that it is a little taller. Place it on the ground near the origin. This will be the object that will get lifted up onto the table. Rename the cylinder's transform node to *glass*.



STEP TWO

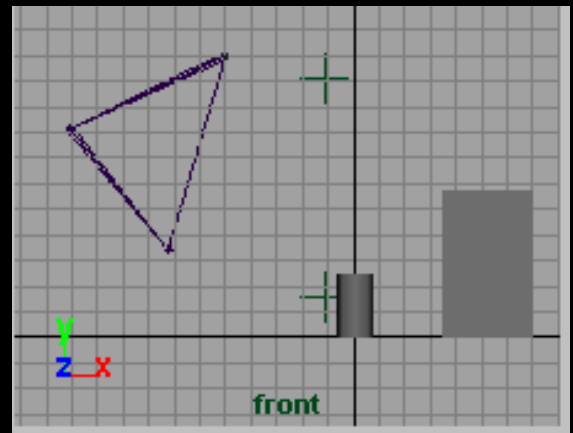
In the front view, place three **Joints** to create a simple arm that will pick up the glass and place it on the table.

Add an **IK handle** that runs from the root joint to the end joint of the skeleton.

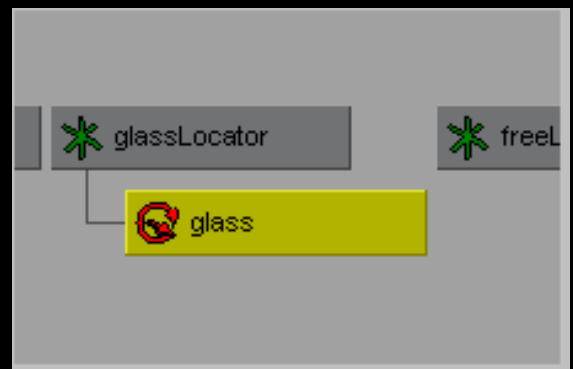
**STEP THREE**

Create two Locators. Place one to the left of the glass and name it *glassLocator*. This locator will drive the arm when it is picking up the glass.

Place the second locator up above the glass and name it *freeLocator*. This locator will drive the arm when it is not picking up anything.

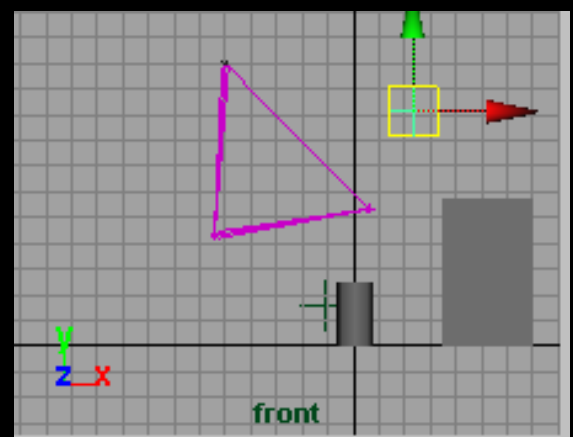
**STEP FOUR**

In the Hypergraph window, parent the *glass* node to the *glassLocator* node. Now any animation you apply to the locator will also affect the cylinder.

**STEP FIVE**

Select the two locators and then the IK handle. Make sure that the IK handle is selected last.

Select **Constrain -> Point** to constrain the handle to both locators at once. It will constrain to a point half way between the two locators.

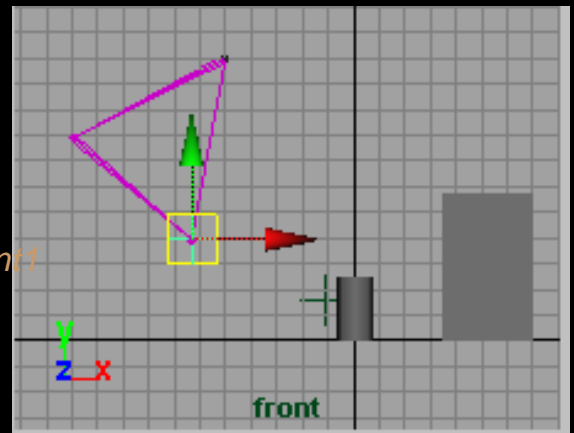


If you **Select** and **Move** the *freeLocator*, you will see that the IK handle updates so that it always places itself halfway between the two locators. Both locators have been constrained using the same weighting, so the IK handle is trying to point at both constraints equally. The result is that the IK Handle is positioned at an equal distance between the two locators.

STEP SIX

Select the IK handle. In the shapes section of the Channel box, you will find the *ikHandle1_pointConstraint1* shape node. It contains two key attributes:

- **glassLocatorW0** which is the weighting of the glass locator; and
- **freeLocatorW1** which is the weighting of the other locator.



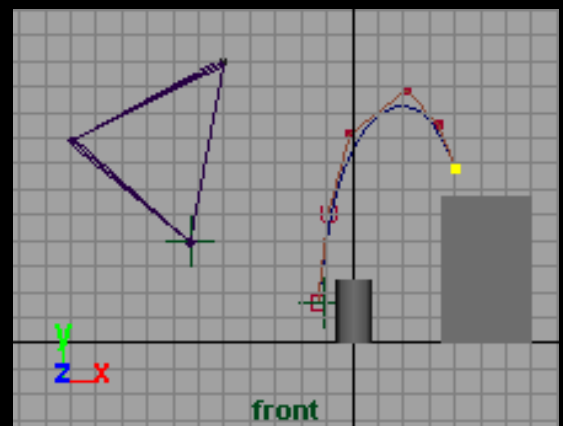
Set the **glassLocatorW0** attribute to **0**. Now the IK handle will move to the *freeLocator* since it has the strongest weighting. If you **Select** and **Move** the *freeLocator*, you will see that the IK handle now follows this locator entirely, because you have told it not to point at the *glassLocator* at all.

STEP SEVEN

You will now animate the glass so that it is positioned exactly where you need it.

Create a CV curve from the *glassLocator* upward to the top of the table.

This will be used as a motion path for animating the movement of the glass. You could also simply set keys on the glass, but using a motion path offers another way to animate it.



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