

# Objects, Duplicates and Transforms

# 2

## Introduction

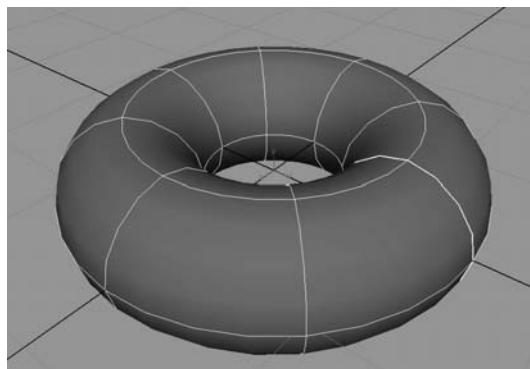
Now that you are familiar with moving around in Maya, we can move onto creating some primitives and see how their position and orientation within 3D space are represented and how these attributes can be edited. We call basic objects “primitives” in that they are the basic Maya 3D shapes from which we can model objects – in the same way that molecules are composed of atoms, complex models and characters are composed of sets of primitives.

## A Simple Object

To examine how Maya represents objects and their positions we’ll show you how to create a NURBS torus (a doughnut-shaped surface) using `Create|NURBS Primitives|Torus`. In addition to 3D object primitives, Maya also collects curves, lights and camera creation under the Create menu heading – because these are essentially primitives of other types.

Let’s pause briefly to examine some of the functionality within the menu items that you’ve just used:

- *Actions and tools.* All menu items can be classified as either an action or a tool. An action works on currently selected things, whereas a tool requires no selection in order to work.



**Figure 2.1** A NURBS Torus.

A tool will also have some usage instructions that appear in the help area (the NURBS Torus menu item is a tool and not an action).

- *Menu hierarchies.* In Maya there is a menu hierarchy that we will constantly follow: Menu Set|Menu Heading|Menu Item|Options Box.
- *Options box icons.* Beside most menu items there is a small box-like icon. When this icon appears it means that we can open up a dialogue box to change various options concerning how the action or tool will function (such as setting the inner and outer radius of the torus).

Any dialogue options that are changed will not reset to the default when you close the window – so *do* remember if you’ve changed various attributes as this can cause a fair amount of irritation due to unexpected results caused by “option fiddling”. As soon as the torus is created and displayed on screen, several parts of the Maya interface will update to reflect this change to your scene. All of the interface changes that you can see right now will constantly update in relation to your currently selected item or items.

## Selection Methods

Using the selection tool you can select single or multiple objects in Maya: selection of a single object can be achieved by LMB clicking on an object or holding down the LMB and dragging a box over it – in any of the views. Use the “f” key to focus the view around the currently selected object and the “a” key to focus the view around all objects in the scene. The selection tool is in the toolbox at the top and can be activated by either clicking on its icon or by using the hotkey “q”.

Multiple objects can be selected by dragging a selection box over all of them, using the lasso tool to draw a selection around them, or selected one by one through `Shift+LMB` clicking on each required object. This method is particularly useful when a tool requires items to be picked in a certain order. Deselecting is a matter of LMB clicking onto an empty area. Note that whenever a new item is created in Maya, either through an action or the use of a tool, it becomes the currently selected item. As more objects are created, it’s now going to be useful to have a list of objects (and items) in the scene.

## The Outliner

The Outliner enables you to organize your scene by listing all the items that have been created – useful for selection in complex scenes and when objects are hidden. `Windows|Outliner` will invoke this editor. It can also be used to select items in a scene, using the LMB to click on the desired item. Using combinations of `Shift+LMB` and `Ctrl+LMB` multiple item selections can be made (note that the cameras for each view are already listed).

## Shaded and Unshaded Object Display

You can change between a shaded and unshaded display mode in each view by pressing “4” for unshaded and “5” for shaded. If you have any NURBS objects in your scene, you can vary the

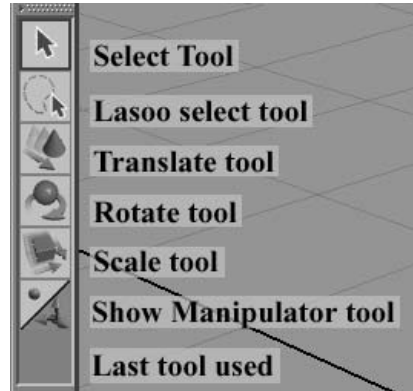


Figure 2.2 The Toolbox.

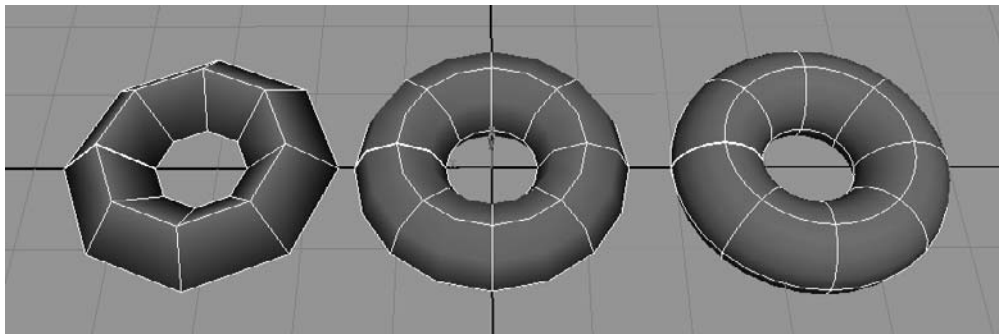


Figure 2.3 The Three Smoothing Modes.

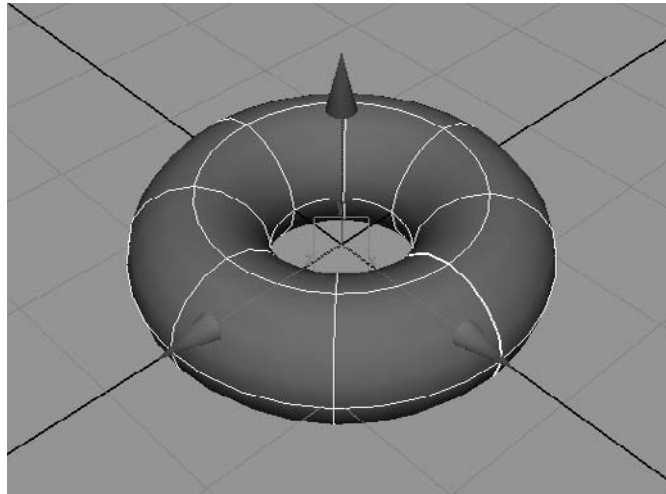
degrees of smoothing by selecting the NURBS object and using keys “1”, “2” or “3” to step through the smoothing levels. This allows you to optimize your display to give the best level of interaction. Note that this does not affect how smooth the objects actually are, just how fast your graphics card’s interaction with Maya will be.

## Transformations

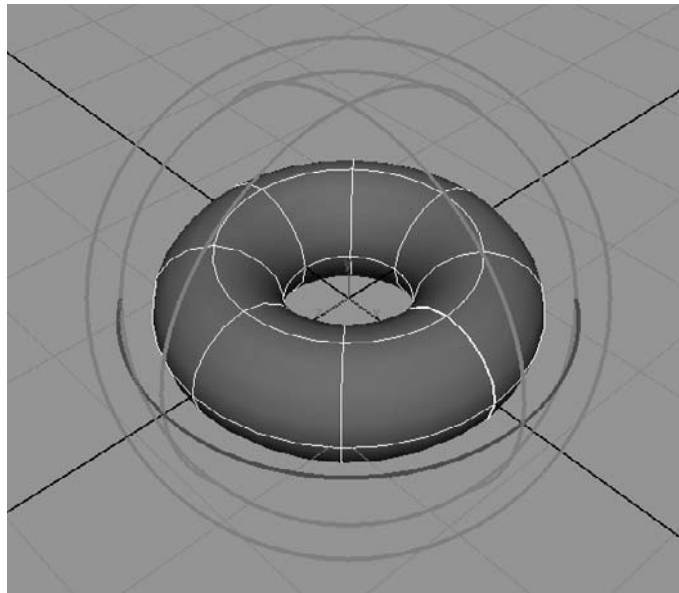
To the right of the Maya screen is the Channels Box. This displays a list of attributes common to the item or items currently selected. For instance, if you were to select the NURBS torus then its name would appear at the top, followed by a list of the keyable attributes that this item possesses; keyable attributes are also known as channels. The first set of channels contains the transformation (or transform) attributes. Transforms come in three flavours – Translate, Rotate and Scale – in the three axes, X, Y and Z. In the same way that complex characters or models are described by collections of primitives, movement is described by concatenations of these transforms. Intriguingly, there is another set of channels below, containing attributes describing the inputs to the shape of the selected item – you may notice that these mirror the choices in the options box for the NURBS torus. We will examine this in greater detail in the following chapters.

## Transform Manipulators

Objects can be quickly transformed using the manipulator tools which are in the toolbox at the left-hand side of the window. Below the lasso tool is the Translate manipulator, the Rotate manipulator and the Scale manipulator (hotkeys “w”, “e” and “r” respectively). Activation of these tools while an object is selected will display the handles for the manipulator – each one having their own specific form.



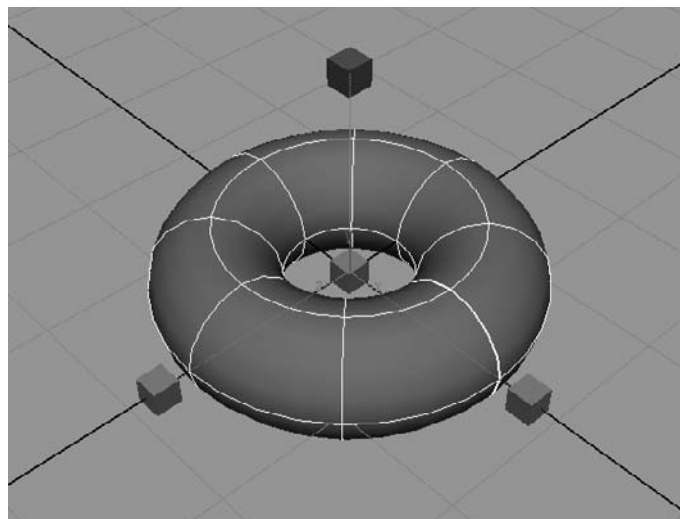
**Figure 2.4** The Translate Manipulator.



**Figure 2.5** The Rotate Manipulator.

Common to all axes and manipulators is a colour coding: red for X, green for Y and blue for Z. This makes it easy to determine which axis is which no matter what you or the handle's orientation is in space when you use the manipulators, so note that the relevant attributes update in the Channels Box. Clicking and dragging on any of the handles with the LMB will activate it – turning it yellow – and will allow you to transform the item. It is also possible to translate, rotate or scale in more than one axis at a time without having to individually click on the handles one after another. For translating, **Ctrl**+LMB clicking on the X axis handle will move the object in the YZ plane, clicking on the Y axis handle will move the object in the ZX plane and clicking on the Z axis handle will move the object in the XY plane (notice how the centre square changes to align itself with the active plane). If you **Ctrl**+LMB click on the centre handle, you will return to translating the object relative to your viewing plane (the default). With the rotate handle there is an outer ring that remains perpendicular to your view and selecting that handle will allow you to rotate an object around the view axis. For scaling, click on the centre handle to scale in all axes at once and hold the **Ctrl**+LMB on a single handle to scale in the plane the other handles form. Additionally, you can transform an object quickly in only one axis by holding down shift and dragging the MMB in the direction of the handle of the currently active handle.

Be careful when translating or rotating items relative to the viewing plane, because the object can sometimes end up in a completely different orientation to the one required (look at the rotate values changing in the Channels Box using the outer rotate manipulator ring). Double LMB clicking on the icons for translate and rotate will bring up an options box allowing you to change the relevant tool's behaviour – for example, double LMB clicking on the translate tool will allow you to define the co-ordinate space that the translation works in and whether the tool will work in discrete units. When using discrete units, relative mode will increment the current position/rotation/scaling by the amount, otherwise all values will be in absolute transforms. This LMB double-clicking method in the toolbar will also bring up options (if available) for any icon displayed in the toolbox area. While a handle is active (yellow), you can still use the MMB to control it by holding it down in a window and dragging the cursor in the direction of the handle.



**Figure 2.6** The Scale Manipulator.

## Using the Channels Box for Transformations

The Channels Box not only displays the keyable attribute values for the currently selected item, but also enables these values to be changed. Some of the channels have attributes, such as visibility, that are represented by different data types like Booleans (yes/no, on/off). LMB clicking on any of the values makes the text field active and you can type any number into it. LMB drag over a series of fields and the value you type into the remaining active field will ripple down into the other highlighted fields. Typing in numbers for the values could quickly become tedious though, if you consider how many times this would have to be done over the course of animation. A greater degree of speed and interaction with the selected item's attributes can be achieved by using the "virtual slider". LMB click an attribute name, hold the MMB down in an adjacent window and drag left and right to see the attribute change value. This can very quickly allow you to sketch in the broad strokes of your transforms before typing in values to give a greater degree of accuracy. This method is pretty useful and is one of the ways that Maya will allow you to work faster. It keeps you focused on the job in hand by not having to move your mouse away from the important areas of the interface, such as trying to click on a manipulator handle for the attribute. This may sound a little like laziness, but if you're working on a large scene day-in day-out, then it's going to save you time – which in the long run equates to finishing your scene on time.

## A Simple Stick Character from Primitives

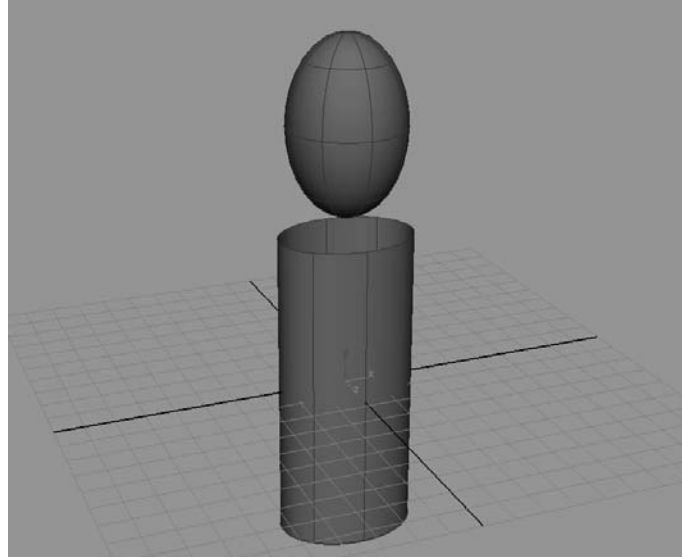
So far, we've covered enough ground that you can make a stickman from a combination of primitives. However, if you are going to use this as a simple character, then there are still a couple of modifications that you will need to make to the primitives that you will use. For this section, the primitives can be either *polygonal* or *NURBS* surfaces.

The head can be made from a sphere, the arms, legs and torso from cylinders. For starters, we will just make the head and torso from a sphere and cylinder.

### Renaming and Annotation

At this point it will be worthwhile changing the names of the newly created objects, as the default names are not only long but give no real clue as to their use. LMB click on the name of the objects in the Outliner and type in something more meaningful: Head and Torso. It is a good idea to make a habit of this, because as you start working on more complex scenes with larger collections of items, it will be useful to see at a glance in the Outliner what the item's function is. Also, you might not be the only one working on the scene and there's nothing more annoying than trying to figure out what relevance `nurbsSphere136` has from a huge list of names in a scene that you've been given. It may also be useful to pop the current working window (in this case the front) to the foreground, as this will give us the maximum amount of screen space. Remember that you can quickly switch between foreground windows by holding down the Hotbox and LMB dragging in the centre zone to the desired view choice. This avoids having to press the spacebar to return to all of the windows being displayed and then popping the desired window to the foreground.

To make a scene even clearer to another user, object annotation can be used. This creates 3D nametags which are parented to the relevant object. Select the Head and use `Create|Annotation` to bring up the text input field, enter "head" and press OK. The annotation will appear in the viewport and can be translated so that it doesn't get in the way. The text



**Figure 2.7** The Torso and Head.

can also be changed by selecting the `annotation` node in the Outliner and opening the Attribute Editor on this node. The text input field will appear at the bottom.

### Moving Pivot Positions

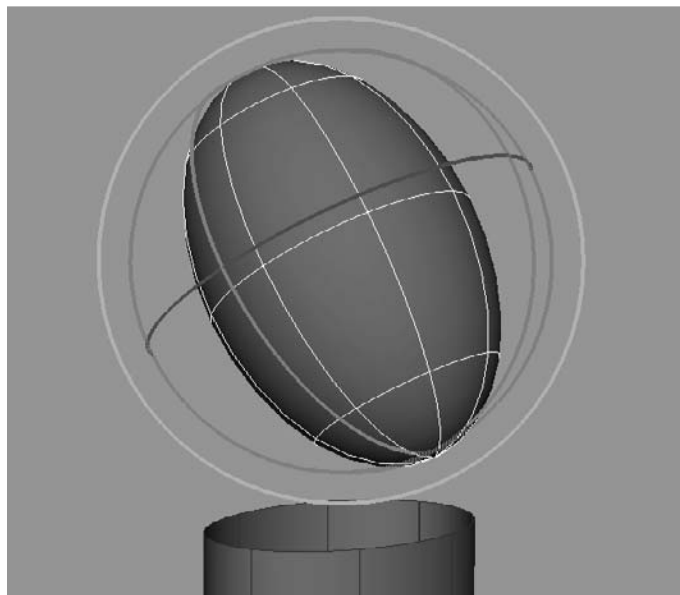
One of the changes that need to be made to the objects is the position of their manipulators. For example, if you were to rotate the head object so that the character could look up and down, the position of the rotate manipulator should be at the bottom of the head.

Each manipulator appears at a specific location in the primitive and it is from this location that the calculations for transformations are made. This position is known as the “pivot point” and by default appears at the object’s local origin (i.e. at the centre of it). So you need to change the pivot point for the head to allow you to rotate it correctly.

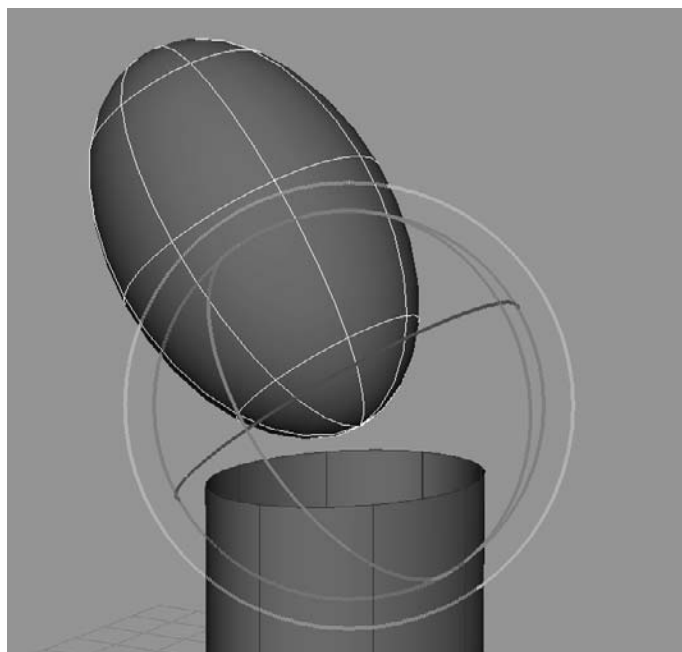
- Select the item in question.
- Click on the transform tool for the pivot you want to change (in this case, the rotate manipulator).
- Press the Insert key – you should notice that the display of the pivot changes. This indicates that its position relative to the object can now be edited.
- Move the pivot to the bottom of the head by dragging with the LMB as you would a standard translate manipulator.
- Press the Insert key again to take the pivot out of edit mode.

Repeat these steps for the torso. Notice that the Insert key is purely a toggle for the editable mode of the selected pivot. Now for the arms:

- Create a cylinder and in the top view scale it in the X and Z axes so that it has the correct proportions.
- Position the arm in the front view so that it is at shoulder height.

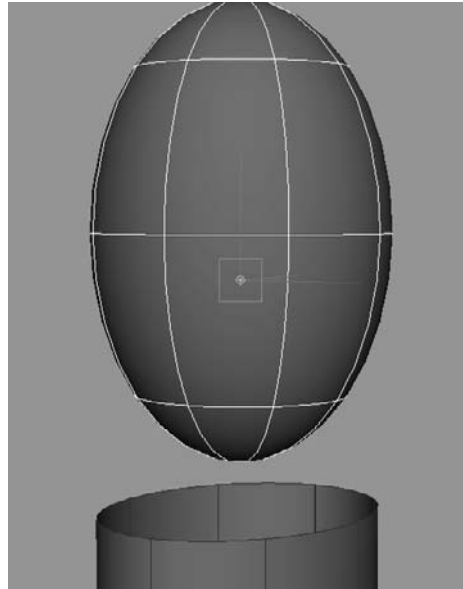


**Figure 2.8** Incorrect Pivot Position.



**Figure 2.9** Correct Pivot Position.





**Figure 2.10** The Pivot in Edit Mode.

- Move the pivot to the top of the arm object.
- Scale the arm down to elbow length.
- Rename the cylinder `rightUpperArm`.

### Duplicating Objects

Now that the cylinder is positioned, you can take a couple of shortcuts by making duplicates of this `rightUpperArm` object as a starting point for all your other body parts. This is because they all have the same basic shape as the `rightUpperArm`, but more importantly because they will also need to have their pivots in the same place. Select the `rightUpperArm` and duplicate it by using `Edit|Duplicate`. The new object will appear in the same place as the original and as it has just been freshly created, it is the currently selected object. Translate this new object down to the correct position and rename it `rightLowerArm`. To aid in the positioning of the new object we can use the Snap Together tool (`Modify|Snap Align Objects|Snap Together Tool`) and the Align Tool (`Modify|Snap Align Objects|Align Tool`). The Snap Together tool lets us pick the surface of the object we wish to align (marked with an arrow), then pick the surface that we wish to align to (we can drag the arrow marker or just repick the required surface until correct). Pressing enter will then align the two surfaces. This can be used to easily align the lower arm to the upper arm, but won't be as precise as needed. Instead, the Align tool can align one object to another using their bounding box edges:

- Select the Align tool.
- Select `rightUpperArm` and then shift-select `rightLowerArm` (or drag across both objects with the tool).
- Press the icon at the bottom edge of the combined bounding boxes to move and align the two objects.

The Align tool will only turn off if another tool is selected, such as the select tool (hotkey “q”), so the aligning process can be carried out until correct. If more than two objects are selected, the tool will align all selected objects with the last one.

Now that you have one limb for the character, you can use some further functionality of the duplicate command to provide all of the other limb objects.

- Select both upper and lower arms and duplicate again – this time use the hotkey `Ctrl+d`.
- Translate the new limbs down to leg height and change their scales if required.
- Rename them `rightThigh` and `rightShin`.

If you look at the dialogue options for `Edit|Duplicate`, you can see that it’s also possible to reposition the duplicates, without needing to use the manipulators after. But remember that these changes will remain every time you use the action (even if using `Ctrl+d`) until you reset them.

### Freezing Transformations

Looking at the values for translate and scale on any of your selected objects, you can see that these have changed over the course of the manipulations. The next operation will be to “freeze” these transformations. This means that you will be setting these attributes to 0 for Translate and Rotate and 1 for Scaling, without moving them. This is useful in that it allows you to start the transform values from their current position, so that if you were to translate the `rightUpperArm` to 0,0,0, this will position it at the correct torso position. In effect, you have created a new origin for the object. Select the object you wish to freeze and open the dialogue box under `Modify|Freeze Transformations`. Turn on Translate, Rotate and Scale, click Apply and close the dialogue box. Freeze the transformations for all of the objects created so far.

### Mirroring Objects

We can use the above techniques to quickly mirror the limbs across to the other side of the torso. Mirroring will allow you to copy an item and reflect it across a chosen axis.

- Select the `rightUpperArm`.
- Select the `Translate` tool and press `Insert`.
- In the front view, move the pivot to the middle of the torso (onto the thicker line describing the Y axis).
- Open the options box for `Edit|Duplicate`.
- Enter a value of -1 in scale X and 1 in scale Y and scale Z; keep all other attributes to 0.
- Click `Apply`.
- Freeze the transformations of the new arm object and rename it `leftUpperArm`.

The duplicated object was effectively mirrored by scaling it negatively around its own axis and the transformations were frozen, because having objects with a negative scaling value is not useful – it is better to have all objects with a positive scaling value so that transformations can be applied equally. However, the pivots need to be returned to their correct position. Select all of the new arm objects and use `Modify|Centre Pivot` to automatically move the pivot points to the centre of each object. Then it is just a case of selecting both objects, pressing `Insert` and

moving both pivots upward to the correct positions so that the arms rotate correctly. Repeat these steps with all of the remaining limbs until you have a full set of arms and legs for your character and because we'll be using this scene in the next chapter, save it as `StickMan.mb` using `File|Save Scene As`.

## Hiding, Displaying and Templating

Objects can exist in several display states: shown, hidden, referenced or templated. These different states will be extremely useful during the course of your work. Hidden objects, while they will take up disk space in terms of scene size, won't be considered when viewing or rendering and so won't take up memory. Hiding objects will also make it easier to concentrate on the important parts of your scene by reducing visual mess. For example, if you view your character from the side and wish to work on one of the limbs, you can see that it would be easier to hide all the other objects. Select them in the Outliner and use `Display|Hide`. To unhide them, select and use `Display|Show`. If you wanted to work on one of the arms while having the other objects available for visual reference, it may be useful to template them. A templated object is an object that you can see but cannot select – so you won't accidentally move or change it while working on another aspect of your scene. To template, select the object and use `Display|Object Display|Template`. To untemplate, select the object (you'll have to do this in the Outliner) and use `Display|Object Display|Untemplate`.

## Summary

We've now seen how Maya allows you to change transform attributes of primitives in several ways. You can type, use the virtual slider and use the manipulators, giving a variable degree of use and of accuracy. You should also be starting to use Maya with one hand on the keyboard and one hand on the mouse at all times – look at how the transforms and select tools can be selected by “q”, “w”, “e”, “r” and “t”. Couple this with constant use of the space bar and combinations of the Alt and Ctrl keys and it gets harder to eat and work at the same time. Get used to the concepts that we've covered such as editing pivot positions, freezing transformations and templating because we are going to be using these ideas heavily in modeling and animation. Try creating a spiral staircase from one polygon cube with some transform options in the duplicate dialogue box. In the next chapter we're going to have to put the stick character together in a more coherent manner so that it's easier to move it around the scene.

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