Constraint Basics

Like Modifiers discussed back in chapter 13, Constraints are provided to help with animation. Like many other Blender features, constraints have changed considerable from previous versions and are divided into 3 main groups—Transform, Tracking, and Relationship. Some of these we have already used through key commands like Track To (Ctrl-T) and Child Of (Ctrl-P).

In this chapter, we will focus on some of the basic constraints like tracking to various things and working with paths.

Transform Constraints:

Copy Constraints:
You can copy the location, rotation, scale, and transforms from one object to another using these constraints. You select the Target object to copy from, select the axis (or inversions) and choose to use world or local space for the axis reference.

Limit Constraints:
Like the copy constraints (location, rotation, scale, distance), you can set axis limits for motion on an object. Great for giving an object limited motion or motion on a specific axis.

Tracking Constraints:

Tracking Constraints:
There are several different tracking constraints that give slightly different options relating to how an object follows a target and if an axis stays upright at all times. In past chapters, we have accessed these using “Ctrl-T”.

Armature Constraints:
There are several constraints in this category related to Armatures that will be discussed in a later chapter (Inverse Kinematics, Spline IK).
Chapter 16 - Working With Constraints

Relationship Constraints:

Child Of Constraint:
Works exactly like what we did in the previous chapter, but with visual controls.

Locking Relationship Constraints:
Several other constraints in this category lock to another object such as providing a floor level, providing a pivot point and following a path.

Tracking To An Object

There are times you want to “constrain” or “follow” a certain object in your scene. New constraints are being developed in Blender, but for now, we will just be talking about the most common one used to keep the camera focused on an object: the “Track To” constraint. The tracking constraint is useful in animating by saving you a lot of time and frustration trying to place location and rotation keys on the camera in an effort to try to keep your target centered. When used in conjunction with Paths (discussed in this chapter), you can create very smooth animation paths. Objects besides cameras can also be used with tracking.

To set up a simple camera tracking constraint, Select the camera first, then the target while holding down “Shift”. Press “Ctrl-T” and select “Track To Constraint”. Sometimes it’s convenient to target an Empty object (created in the Add menu, like we used in the lighthouse scene). This allows you to move your target around in your scene so the camera can focus on one object for a while, then move to something else by moving the target in that direction. You also have an influence option where the camera will track solidly to the object or allow some flowing of the camera.

The other way to apply the Track To constraint is through the Constraints panel discussed in this chapter. However, by pressing “Ctrl-T”, this constraint will automatically be placed in the stack. You can even choose to follow a vertex group, lock to specific axis and space, and even choose the amount of influence of the tracking.
Open the Robot Arm scene you made in the last exercise and add a camera constraint. You may target any part of the robot arm you like or create an Empty and target the camera to that. In the scene below, the camera was targeted to the gripper head. In the Object properties panel, I renamed the sphere on the gripper head to head. If needed, experiment with the axis settings to get the camera to pint to the object.

After you create your scene, develop a 150 frame animation of your robotic arm moving in all directions with the camera also doing some movement.

**Call the instructor when finished**
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Following Paths and Curves

Sometimes, you need to have an object flow along a smooth path in an animation. For example, it would be easier to have a spaceship flow along a line that angles and banks along that line than it would be for you to insert location and rotation keys throughout the animation. Paths and Curves are found in the same Add menu and can not only be used to create animation paths as discussed above, but can also be used to create extrusions. To create 3D extruded objects, you need to create a 2D sketch of a profile and a path for that shape to follow along. In this chapter, we will be working with both.

Following Paths:

Your first step is to create a path. Any type of Curve in the Add menu can be used as a path, but let’s use the Path option. Hit the “Shift-A”, select Add, Curve, then Path. You will then get a path on the screen. Enter Edit mode and you will see several points and arrows pointing the direction of the path. You will also see some options in the Tool Shelf related to the path, including “Switch Direction” - useful if you shape the path in the wrong direction and find out after you place the camera on it.

Shape the path as desired, add more vertices through Subdivide if necessary and exit Edit mode. You can also select an end point and use “E” to Extrude.

There are several ways to get the camera, object or lamp to follow the path. For now, we’ll stick to the traditional way by creating a Child-Parent relationship. Select the object first, then the path (the parent). With both objects selected, press “Ctrl-P” to make a parent. You’ll see several options- select the “Follow Path” option. You will see a dashed line between the 2 objects. Press “Alt-A” to see the animation along the path. In order to get the object exactly placed on the line, move the object and place it. Rotate the object to point in the correct direction as well.

Right now the object’s animation is exactly 100 frames long. To change this, make sure the path is selected and go to the Object Data buttons. Here’s what you see:

- **Frames**: Adjust the time it takes to traverse the path.
- **Follow**: If selected, the object will rotate as it follows the path. If not selected, the object will follow, but not curve.
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Sometimes you don’t want the camera to follow along the path, but look at an object as it flows along the path. This is where you would want to use the Path, but not the Follow option. Instead, you would put a Track To constraint on the camera so it looks toward an object (empty) as it moves along the path.

Other Curve objects can be used as paths also. For example, if you want a circular path, select the Bezier Circle option from the Curve menu. If the circle appears filled when rendered (F12), change it from 2D to 3D in the Object Data panel.

Using Curves for Extrusions:

You can create a shape and extrude it along a path in Blender. For our example, we will shape a Bezier Circle and extrude it along a Bezier Curve. First, create a Bezier Circle from the Add-Curves menu and shape it into an interesting object. Feel free to add more points with the Subdivide command. Second, create a Bezier Curve and shape it into some shape. Bezier shapes form differently and use spline points. Experiment with them to get the feel of working with them. Go to the Object panel and name both objects in the data block.

Finally, select the Bezier Curve and go to the Object Data buttons. You will see a Bevel Object box in the Geometry panel. Select the circle object. You will see the shape extruded along the curve! You can still shape the circle and the curve (in edit mode) and scale the objects. Play with the Resolution setting in the Shape panel on both curve objects and hit “Alt-C” if you wish to convert it into a mesh.
Chapter 1 - The Blender Interface

For this exercise, you will be using paths and curves to create a roller coaster track. Start with a new Blender file and create a Path from the Add-Curve menu. Shape it in both the front and top views so you have curves and hills. Close the path by selecting the end points and pressing “F” to fill.

Now add a Bezier Circle. Scale it down about ½ size, enter Edit Mode and move the entire shape to the left of it’s center point. Press “Shift-D” to duplicate the circle (still in Edit Mode) and move it to the opposite side of the center point. These will be extruded as the track rails. Return to Object Mode.

At this point, select your track and hit “Shift-D” to duplicate it once.

With one track selected, go to the Object Data panel and select the circle object under the “Bevel Object” option. You may need to select the circle object and scale it down considerably for it to look right. You may also need to enter Edit Mode for the track and use “Ctrl-T” on some points of the curve to twist them to a better curve.

If the rails are not centered over the path, the Circle’s center point may not be directly between the 2 circles. If so, correct the issue.

Challenge Task - A Simple Rollercoaster
Now, select the other path that you duplicated earlier and move it up slightly so it is easier to select. Select the Camera, then this Path. Hit “Ctrl-P” to make a “Follow Path” constraint. A dashed line will display between the two objects. It may take some time to get this correct, but move the camera to the dashed line’s contact point. Adjust the camera angle and test the animation with “Alt-A”. Experiment with this until you are satisfied with the animation. If it is too fast, adjust the curve settings in the Object Data panel.

Add a world to your scene and animate a 100 frame movie.

Extreme Challenge Exercise:

Duplicate the curve one more time and extrude walls around your coaster to make it into a mine tunnel. Add textures and animate. To duplicate a mesh along a path, create a mesh object and child-parent it to the path. With the mesh selected, set Duplication to “Frames”, “Speed” off. Select the curve path and adjust the frames to get the correct number of duplicates in Object Data.

** Call the instructor when finished**
Chapter 16 Reflection and Wrap-up:

Constraints and Paths

In this chapter, you experience some of the constraints that are available to simplify your modeling and animation process. Take a few moments to reflect on these questions.

1. Take a look at the “Copy” and “Limit” Transform Constraints. These constraints are great to have objects copy the motion of other objects or limit an object’s motion. Explain at least two examples of where these features could be useful.

2. In the extreme challenge portion of the roller coaster track activity, you have the option to try to add mesh objects along a path. How could you use this feature, and the path extrusion feature, to create a mine tunnel ride? If necessary, find an example on the internet. Explain.

3. Research the internet, or draw from personal experience, where one of these constraint features may have been used in a professional movie. What did you find? Explain your example.