

PathDeformer

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1 Introduction

1.1 What is PathDeformer?

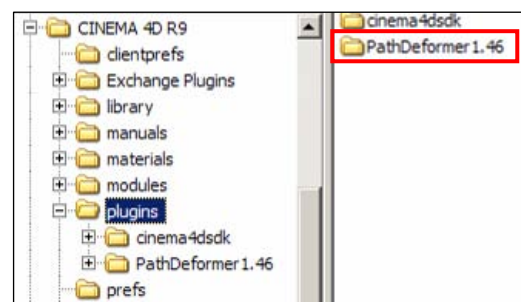
With PathDeformer, you get a unique deformer with great possibilities. Did you ever try to make a complex deformer setup for a snake or fish, a roller coaster track or one of these bendable desk lamps you used to have back in the 80's? That is quite hard work to do with the standard deformers of CINEMA 4D. With PathDeformer you have all necessary functionalities you need to do such things in a minimum of time.

PathDeformer is able to bend, scale and twist every kind of object along a path and even use a rail path to easily control the banking of the object you want to deform. Just give it a try and be surprised by the multitude of effects you can achieve with this plugin.

1.2 Installing PathDeformer

To install PathDeformer, simply put its folder into the plugin folder of CINEMA 4D. When you start CINEMA 4D next time, PathDeformer will be available in the plugins menu.

Of course you can also integrate a button for PathDeformer in your window layout (see CINEMA 4D manual chapter 3.2.4).



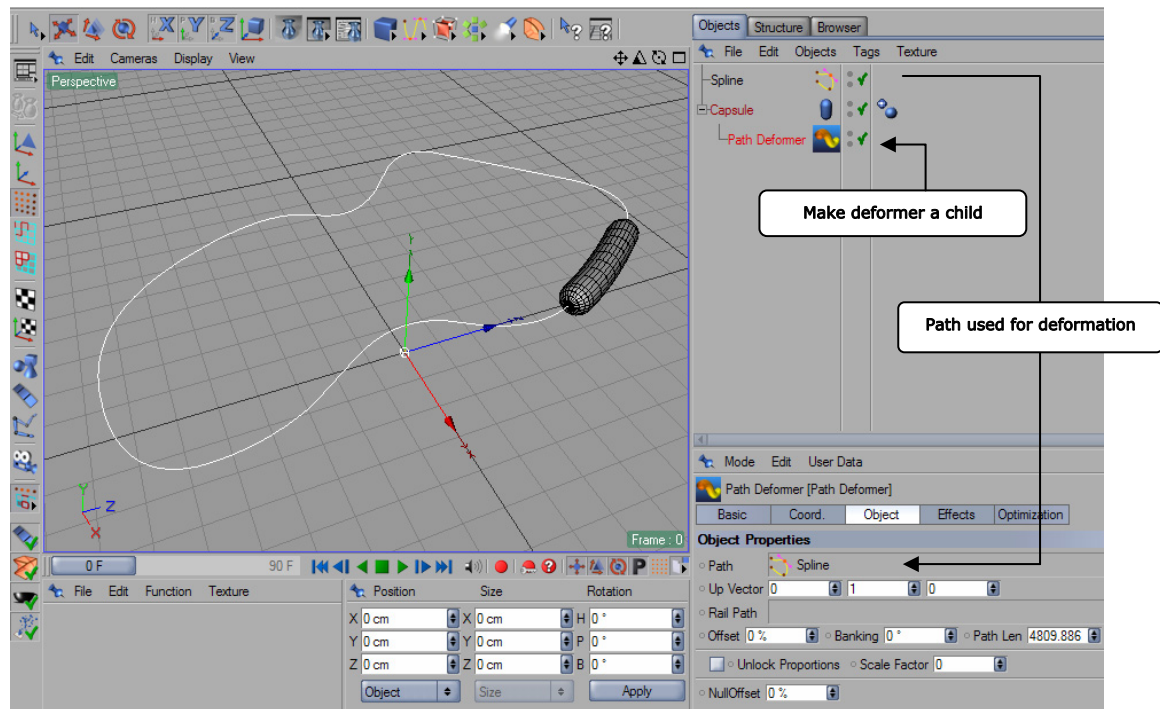
Together with PathDeformer, you also received several example scenes that demonstrate the usage of PathDeformer. They can all be found in the PathDeformer directory.

2 Usage

2.1 Basics

All in all, PathDeformer is used like any standard deformer object in CINEMA 4D. To apply path deformation to an object, select PathDeformer from the plugin menu. In the object manager, drag & drop the PathDeformer object onto any other object you want to deform, making it a child of the object.

To make PathDeformer actually deform the geometry you also have to define a spline which will work as deformation path. You can take any parametric spline object, or create a custom shape with the spline tools of CINEMA 4D. After that, select PathDeformer in the object manager and simply drag & drop the spline object into the link field "Path" in the attribute manager. Now you have already created a deformation.



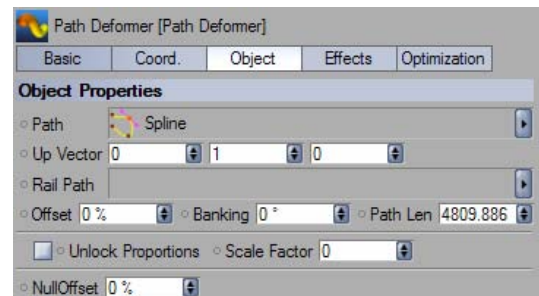
Basic PathDeformer setup

2.2 Deformer attributes

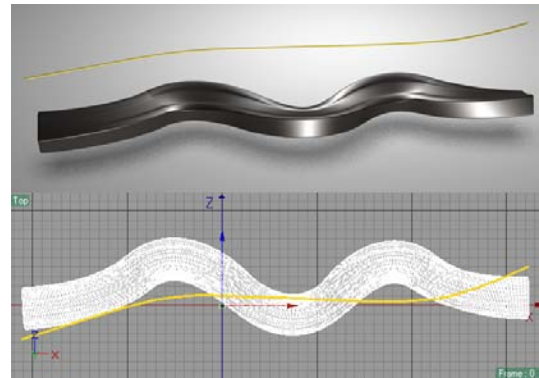
The PathDeformer object contains a number of parameters organized in tabs. In the following, all these parameters will be explained in detail.

2.2.1 Tab "Object"

- *Path*
Drag & drop a spline object here to use it as deformation path.
- *Up Vector*
Since PathDeformer aligns the object along its Z-Axis, the heading (Y-Axis) must also be defined for a proper deformation. This can be done with the Up Vector. If you experience torsion or flipping in the deformed object, you should change this.
- *Rail Path*
Alternatively to setting the Up Vector, you can use a rail path to align the deformation correctly. To do this, simply create an appropriate spline and drag & drop it here. This may not only be used to prevent flipping but also for creating an exact alignment at every position of the deformation path, e.g. for the wagons of a roller coaster or a racing track with banked curves. Read more on page 9 and 10.
- *Offset*
This is the most important parameter for animation. Use it to move the deformed object along the path. A value of 100% represents the whole length of the path. Setting it to 50% will place the object in the exact middle of the path.
- *Banking*
Use this parameter to roll the object around its Z-Axis.
- *Path Len*
Here you can always see the exact length of the deformation path. This is especially useful when you want to use PathDeformer for deforming infinite objects, e.g. crawlers, ribbed belts or conveyor chains. Read more on page 12.



PathDeformer Object attributes



A Rail path example



Banking examples

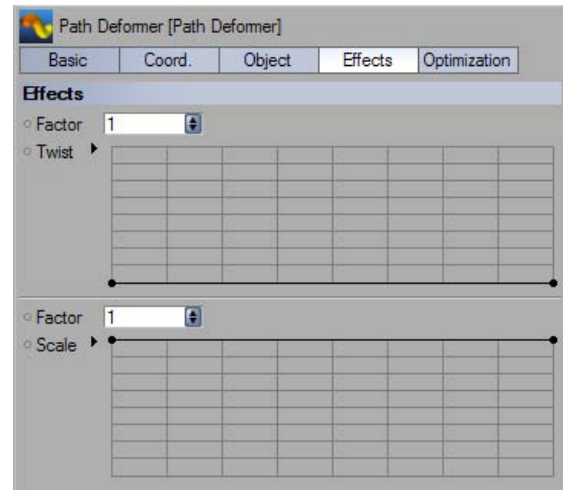
- *Unlock Proportions*
While PathDeformer normally keeps the original length of the deformed object, you can active this to unlock the proportions and set a length yourself.
- *Scale Factor*
Use this to set the length ob the deformed object, if *Unlock Proportions* is activated. Animate this parameter to let an object “grow” along the deformation path.
- *NullOffset*
If you are using PathDeformer also to align a null object to the path, you can set it’s relative offset from the deformed object. Read more about NullOffset on page 11.



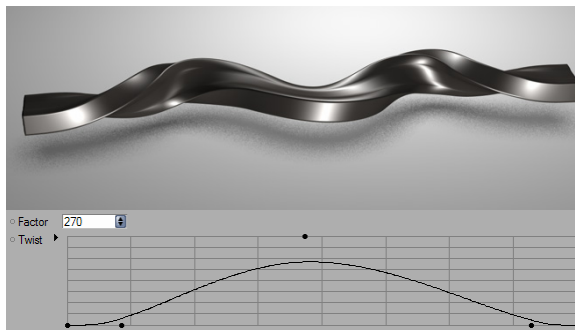
Unlock Proportions & Scale Factor example

2.2.2 Tab "Effects"

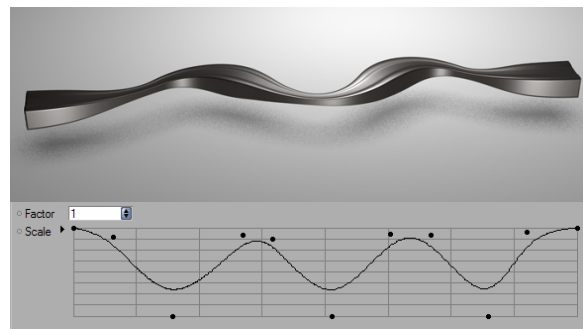
- *Twist / Factor*
The twist effect enables you to change the banking for each position of the deformation path. Edit the curve to create any twists you want and use the factor parameter to determine the twist effects' strength. Setting the factor to 360 will cause a complete twist where the twist curve reaches the maximum.
- *Scale / Factor*
This effect works almost like the twist effect. Here you control the size of the object at each position of the deformation path.



PathDeformer Effects attributes



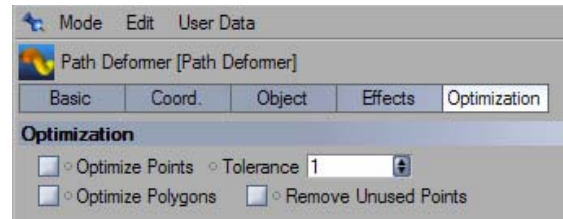
Twist effect



Scale effect

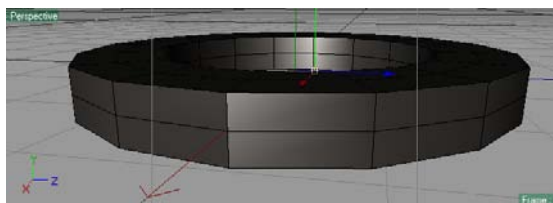
2.2.3 Tab "Optimization"

The functions found in this tab work exactly like the "Optimize" function of CINEMA 4D. The only difference is, that the optimize feature of PathDeformer is done in realtime for each frame. It is extremely useful for creating crawlers, chains and all kind of looped geometry.

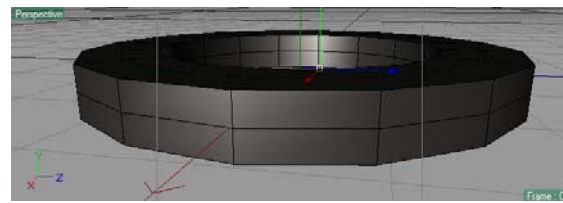


PathDeformer Optimization attributes

- *Optimize Points*
Activate this to melt points within the tolerance range.
- *Tolerance*
This is the tolerance range. If points are located closer to each other than the tolerance allows, they are melted during optimization. When you set the tolerance to a very high value, you can also use it for simple polygon reduction.
- *Optimize Polygons*
Activate this to delete double polygons, that would create dual planes.
- *Remove Unused Points*
This function –surprisingly– removes unused points that aren't connected to any polygons.



Without optimization: Phong shading is broken



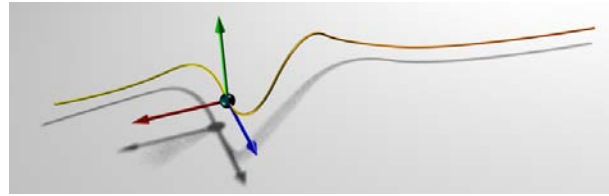
With optimization: Smooth phong shading

3 Practice

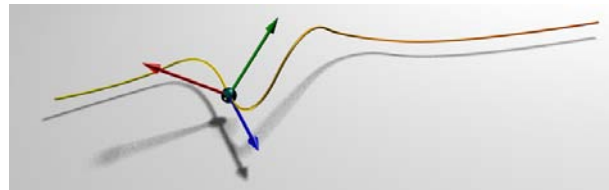
In this chapter you get more tips for typical use cases of PathDeformer.

3.1 Understanding the Up Vector

The Up Vector defines the direction to which the Y-Axis of an object is aligned. In most cases, this is simply +Y. By aligning the Z axis of an object to a spline path, and aligning the Y axis just to +Y, rotation can usually be calculated without problems. But what should be done, if the spline path points exactly in +Y direction? In this case, both Y and Z axes would point to +Y, which produces a singularity: the orientation of the object can not be precisely calculated. In the context of 3D software, this is also called the "Gimbal Lock" and should be prevented whenever possible.



By default, Y axis is aligned to +Y direction



Changing the Up Vector alters the orientation

If you experience sudden turns or flips when working with PathDeformer, you should choose a direction for the Up Vector that is different from all directions the Z axis of your object will ever point to (driven by the deformation path).

E.g. when your deformation path goes straight up somewhere, you should rather point the Up Vector to a direction, where the deformation path never points to (+X or +Z). With PathDeformer it is possible to set an Up Vector into any direction you want.

3.2 Using the Rail Path

Sometimes, especially when working with more complex deformation paths, the Up Vector can't prevent all unwanted flipping. No matter what vector you set, there's always a part of the deformation path that points into Up Vector direction.



Examples for unpredictable flipping: Sometimes different Up Vector settings don't help

That kind of artefacts can be effectively avoided by using a rail path. The rail path is just another spline object that defines an Up Vector for each position of the deformation path.

Here is a good method for creating a rail path:

Select the deformation path spline object in the object manager, and press CTRL+C and CTRL+V (on Macintosh, use the apple key instead of CTRL) to copy it. Move the new spline object away from the deformation path a few units (e.g. in Y, X or Z direction). Then drag & drop the new spline object into the *Rail Path* link field of PathDeformer.

The deformed object will now probably look a bit odd, but that is not a problem. Now activate the *Point Edit* mode and adjust the rail path to your needs by just selecting and moving the spline points. While moving a point, the banking changes in realtime.



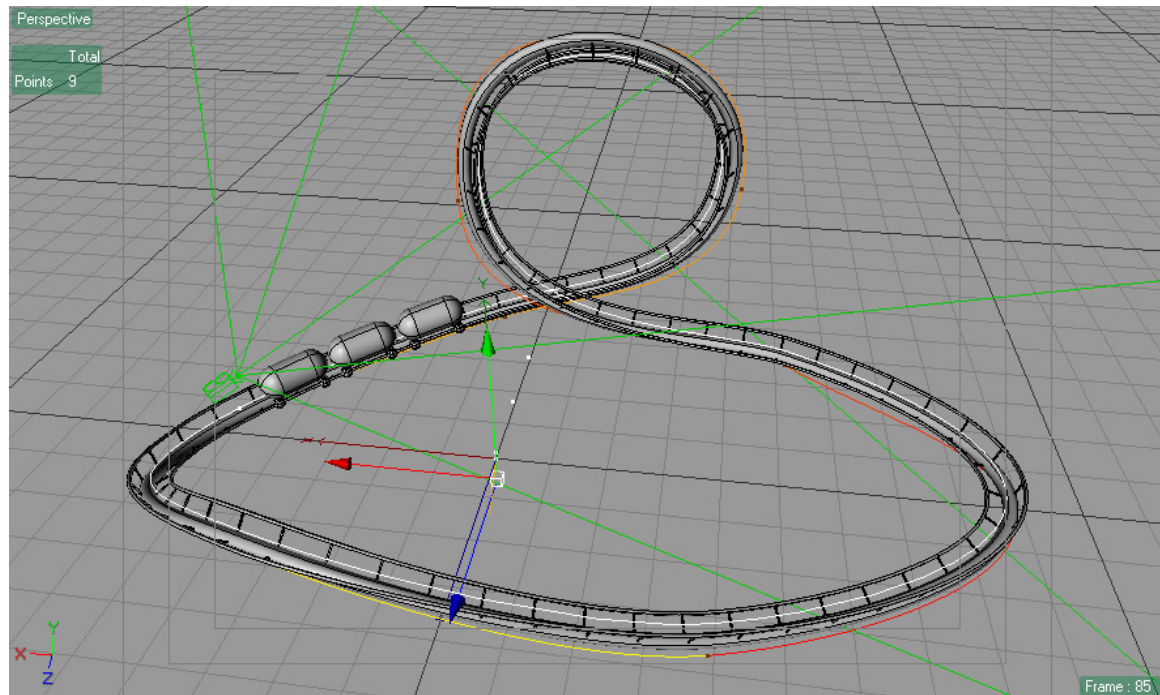
Using a rail path, almost every deformation is possible without unwanted flipping

The rail path may not only be used for avoiding artefacts when deforming an object, it is also capable of creating precise banking e.g. for the curves of a roller coaster, or a racetrack. Just have a look at the examples that come with PathDeformer.

3.3 Using the Null Offset

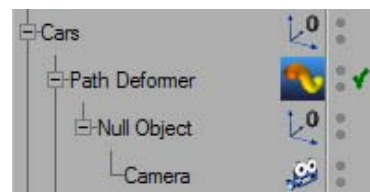
Sometimes you will want to attach another object to the deformed object. This can be of great use for camera animation: you can attach a null object, to target the camera to and make it follow the deformed object. You can even attach the camera itself e.g. to create a roller coaster camera.

The example "Rail_Null_Offset.c4d" demonstrates this feature in perfection. When you open it, you will find a complete roller coaster (deformed with PathDeformer and using a rail path) and a camera.



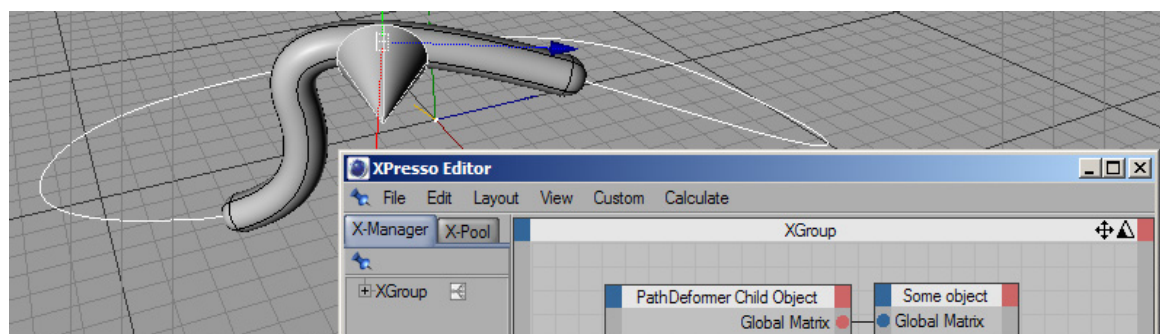
Roller coaster setup in example "Rail_Null_Offset.c4d"

In the object manager you can see that the camera is contained in a null object, which is a child object of PathDeformer.



PathDeformer automatically aligns child objects along the deformation path, which gives you great possibilities. In this example, it is used to create a dramatic looking camera animation. Just hit the play button to watch it. Try changing the *Null Offset* parameter of PathDeformer to move the camera along the coaster wagons (relative to their position).

Dropping objects with geometry into the PathDeformer object will also deform them along the deformation path. If you want the object to stay undeformed, put a null object into PathDeformer and use XPresso to transfer the null object's global matrix to the object (also shown in example file "Null_Offset1.4.c4d"):

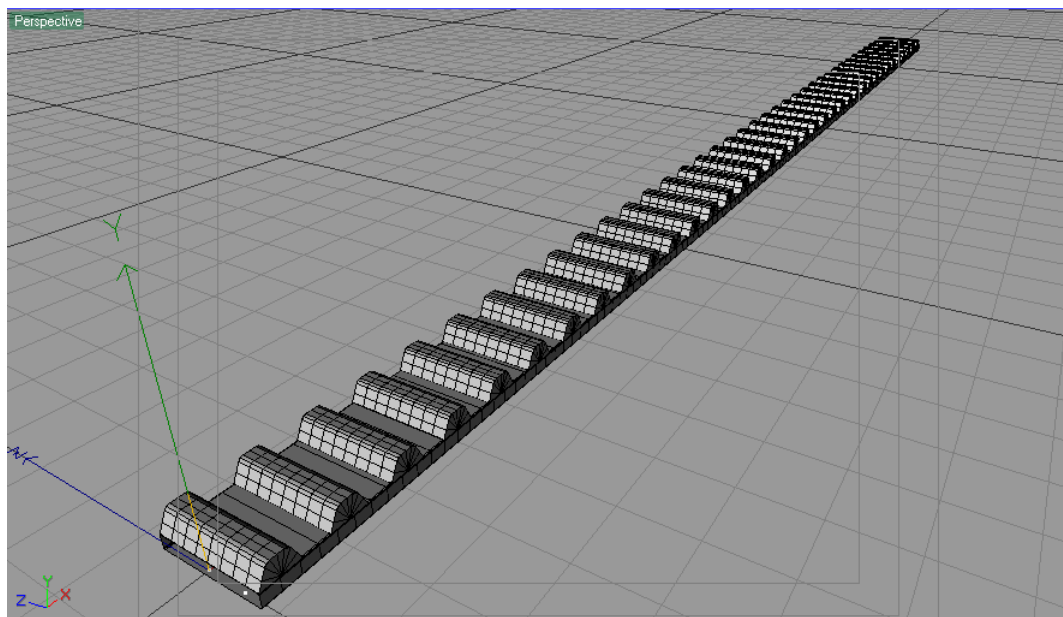
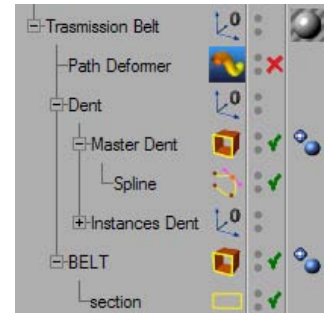


3.4 A practical example: How to create a belt

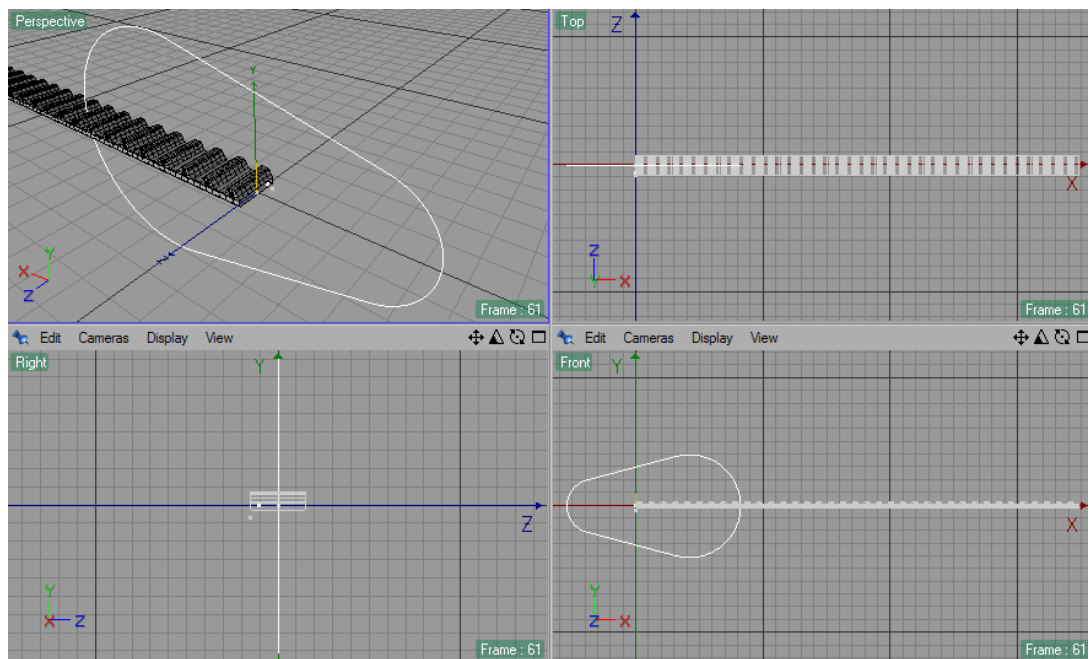
The result of this chapter can be seen in the example file "Belt_1.c4d". You will learn how to use PathDeformer to create an animated ribbed belt using et al. the rail path and optimize features.

- Create a simple straight rubber belt. Use a high subdivision to ensure smooth a deformation look. To create the belt, use simple splines and the duplicate function of CINEMA 4D for the dents.

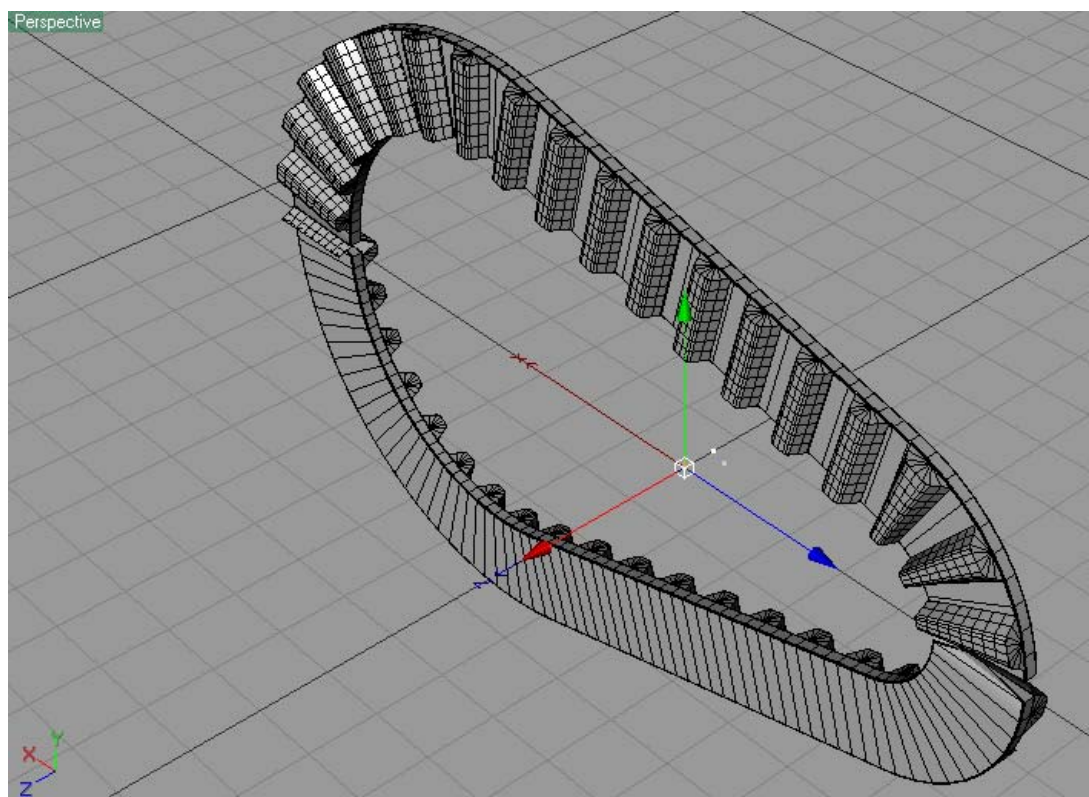
Put all objects in a null object, together with a PathDeformer object. The result may look somehow like this:



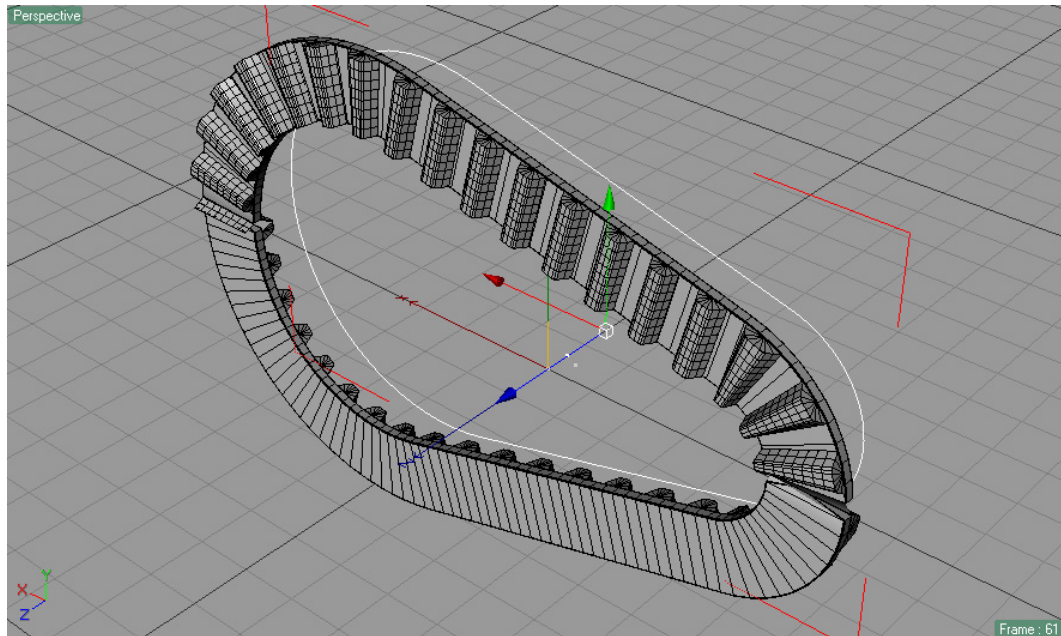
- Create a spline that should be used as deformation path:



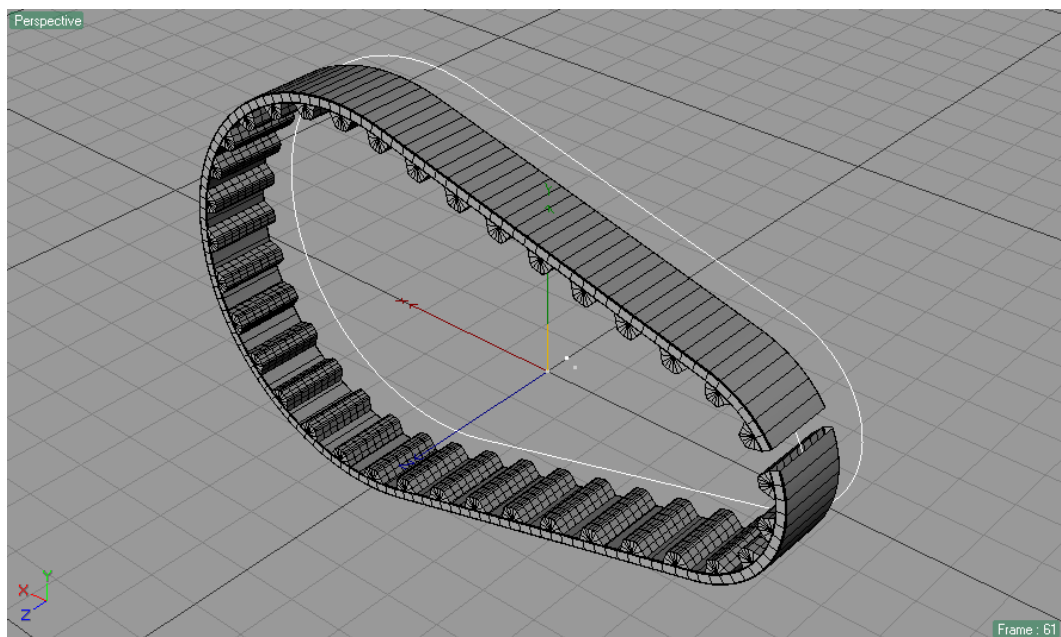
- Drag & drop the spline object into PathDeformer's *Path* attribute. You will now get the following result. It soon becomes obvious that we'll need a rail path.



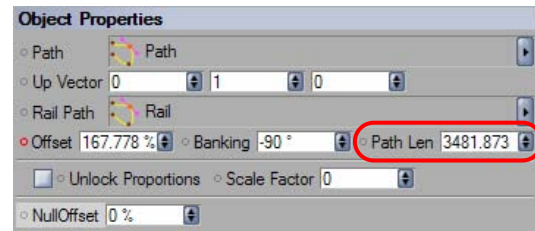
- The rail path for this belt is rather simple: Just copy & paste the deformation path, and move it a bit to $-Z$ direction:



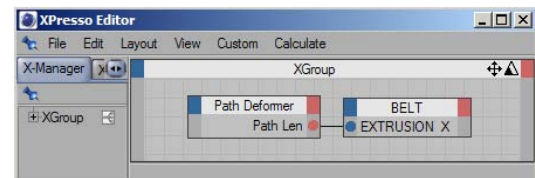
- After that, drag & drop the new spline object into the *Rail Path* link field in the PathDeformer attributes. Now it may look like this:



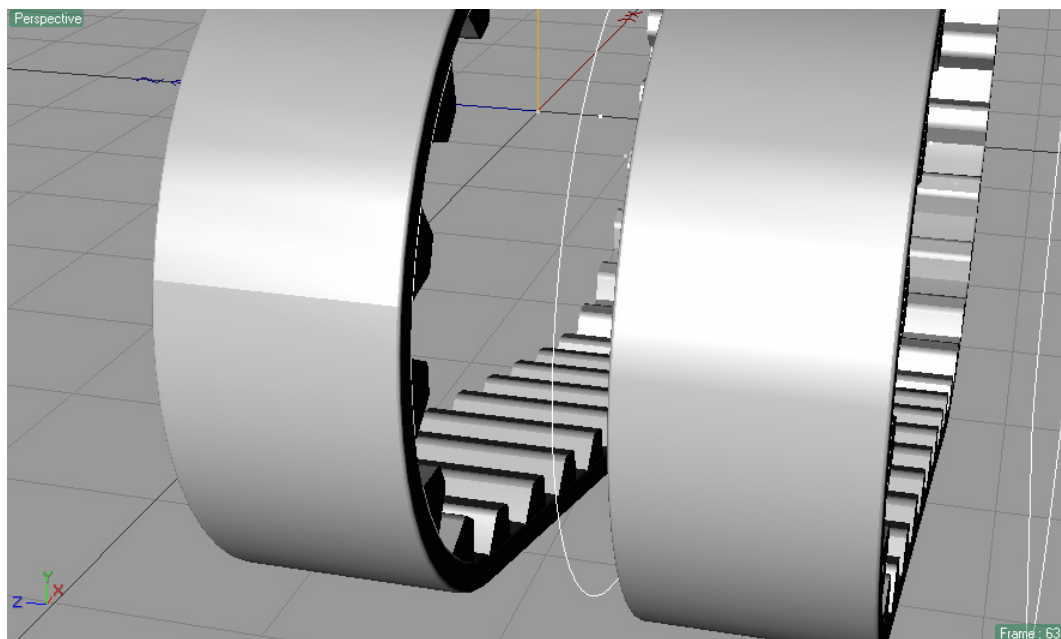
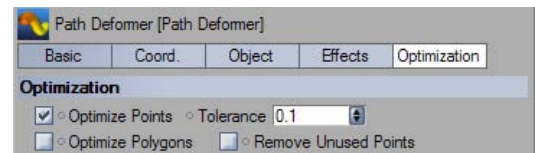
- The next thing to do is to adjust the length of the belt to the length of the deformation path. Remember, the length of the path can always be retrieved from the *Path Len* parameter in the PathDeformer attributes.



- Using XPresso, we can automatically adjust the belt's length to the deformation path length. The node setup for this is rather simple: It uses the Path Len value as extrusion length for the ExtrudeNURBS object. The belt is now almost perfectly closed.



- At the point where the two ends of the belt meet, the shading is broken. To correct this use the functions in PathDeformer's *Optimization* tab.



The belt without – and with optimization

- The last thing to do is to animate the Offset parameter of PathDeformer to make the belt actually move. To do this, simply create a keyframe for the Offset parameter at the beginning of the animation, and another keyframe at the end.
- Now click the play button to preview the animation, and you have successfully completed the belt tutorial!

