Modeling a screw cap in CINEMA 4D

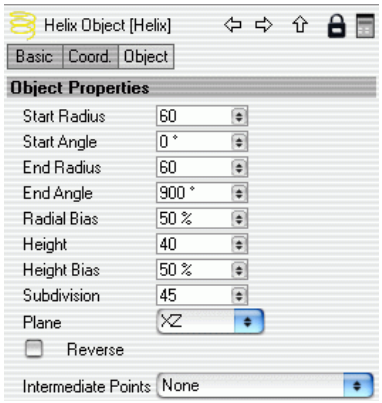
(Release 6+)

Sometimes it's the everyday things that can cause the most problems. This happened to me when I had model a screw cap for a bottle of olive oil in a mini contest.
Never the less there are quite simple methods, if you can find the correct starting point.

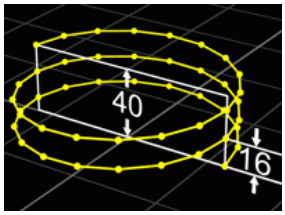
Therefore I've made this short tutorial:

The main problem with this cap is the blending between the cylindrical parts and the intermediate thread.

So, let's start right in the middle and create a Helix.
Here we must realize the number of the turns that are necessary. Two complete revolutions are sufficient in our case, but let's take a little more since we have to delete some points later.
We proceed thus with 2.5 turns, which results in an End Angle of 900° of the Helix (2.5 x 360° = 900°).



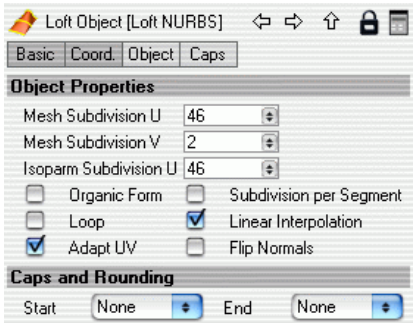
Let's have a first look at this spline. I've chosen a total height of 40 units over 2.5 turns.
So, after one turn we have a distance of 16, after 1.5 its 24, after two complete turns it's 32.
We need to remember this soon!



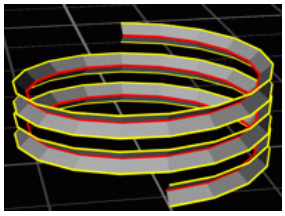
We make two copies of this helix and place all under a Loft NURBS. Then we move the copies so, that the splines are evenly spaced on the Y axis. In this case I've used a distance of 5 units.

It's important to set the subdivision value of the Loft NURBS in such a way that the points from the later polygons will be aligned.

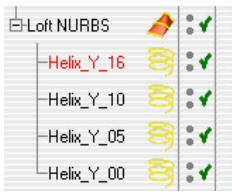
Since the seal at the lower end of the cap usually has nine connecting posts, we double this value to get 18, multiply it by our 2.5 turns and add one for the end. This results in a subdivision value of 46 (18 * 2.5 + 1 = 46).



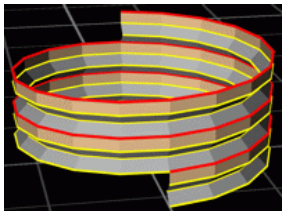
Now we change the radius of the middle helix (red) to 54, so that our spiral receives a V-shaped profile.
(I have deleted the Phong Tag temporary to get an better impression of the object's structure.)



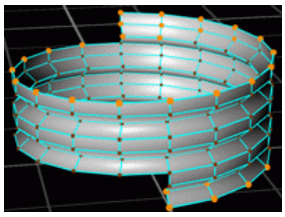
We create another copy of the first helix, move it 16 units along the Y axis and put it into the Loft NURBS.
(You remember: After one turn we've got a 16 units distance.)



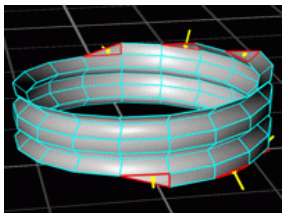
This new spline (red), lying congruent with the first spline along one and a half turns, makes the thread look closed.
But we have to merge the points along this section (because they all are double) to get a really closed edge. We transform this Loft NURBS into a polygon object by hitting "C" and than we call "Optimize" from Structure Menu.



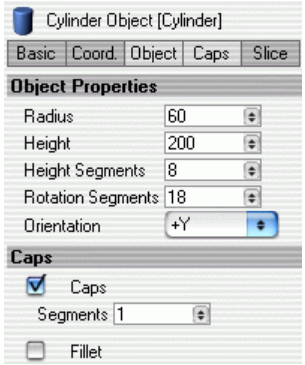
As previously mentioned, we now delete the marked points at the beginning and the end of the thread in order to create a softly, harmonious blending.



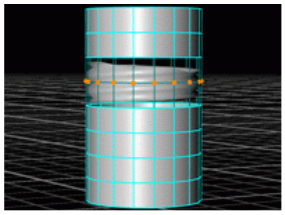
The remaining stairs we fill with triangles, which does not represent a problem, despite the later use in a Hyper NURBS.



Now we create a Cylinder with the same outside diameter and the same subdivision value as our thread.

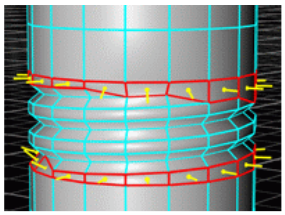


After transformation into a polygon object we delete one of the middle point rows (so that our thread lies freely in this gap), "Optimize" it and "Connect" the two objects.

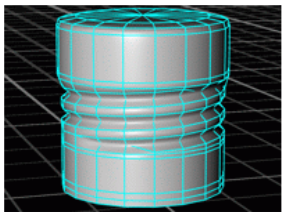


Now we add the missing polygons by hand with the Bridge tool ("B"). Also the Plug-In “Stitch & Sew“ does a good service here.

In this view we can see why it was necessary to have an even number of subdivisions in our Cylinder and Loft NURBS Object. All the points are aligned on the Y axis giving us a clean mesh.

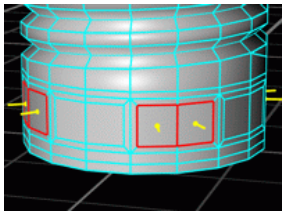


We throw the object into a Hyper NURBS and we can begin making adjustments by selecting rows of points and moving them on the Y axis. If necessary make some horizontal Knife cuts. We also need to remove the surfaces at the bottom by deleting the common point in the middle.

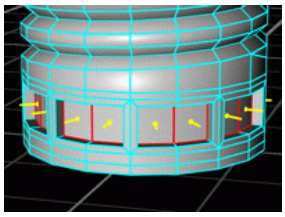


Now, selecting the polygon pairs as shown, we use the Inner Extrude tool ("I") and an Offset value of 3 (with the “Preserve Groups” box checked) to begin creating our connecting posts. This has to be done in several steps, since no adjacent groups can be worked on at the same time.

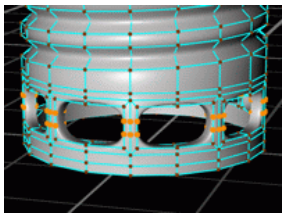
The more we extrude these polygons, the thicker our connecting posts will be where the two sections of the cap break apart.



All the new polygons can now be selected together and extruded ("D") against their Normals, so that they will be pulled inside the object ("Preserve Groups" still active). Afterwards these internal surfaces can be deleted. (The Hyper NURBS was deactivated here.)

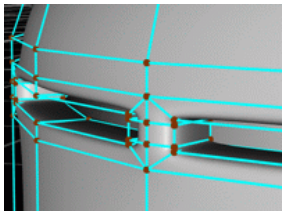


With two further horizontal partitionings in this range...



...and pushing the rows of points closer together, we get the typical connecting posts.

Now it becomes clear why we had to double the number of posts to get the necessary rotation segments of our object. Without these intermediate points, there would be unpleasant distortions on the cut outs, since the corner points would be connected linear with one another.



Finally we make last modifications on the lower end, until the shape is correct.

The corrugation on the upper end must not necessarily be modelled.
You can use a simple bump map to feign that look.

And here you see the result in a direct comparison.
Original photography on the left, 3D on the right.

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With special thanks to Brett Whitburn (3Dub).