The Composite order is a combination of the Ionic and Corinthian orders. It combines the volutes of the Ionic with the foliage of the Corinthian. Both orders have a base and a fluted shaft. We chose the Composite order because it is the most challenging and contains elements that can nicely be modeled as nurbs. It actually offers an opportunity to apply a variety of nurbs operations.

Building the pedestal and base as revolved objects.
- With the 2D drawing tools, draw an open shape on the ZX plane, whose end points are on the Z axis.
- In the Revolve Options dialog, select Facetted, enter 4 for # Of Steps, and select Join Adjacent Coplanar Faces.
- With the Revolve tool active, click on the profile you drew and then on the Z axis. This generates a 4-sided pedestal, as shown. After the initial generation the 3D form can still be edited and reshaped.

Modeling the shaft of the column.
Note that a classical column, which is an anthropomorphic shape, has a diameter to height ratio of 1:6. We use a shorter body here to allow for better visualization of the construction process. Also, even though the classical column has 20 flutes, we use 12.
- Generate a thicker primitive cylinder for the column body and a thinner one for the flute, roughly as shown.
- Using the same diameter with the thinner cylinder generate two primitive spheres on its top and bottom. Use Center Face and Endpoint snaps to generate the spheres.
- With the Boolean Union tool active click on the flute cylinder then the top sphere. Repeat the operation with the bottom sphere.

Creating the capital details.
Variations of the Sweep tool will be used to create acanthus leaves, ornamental foliage, ionic scrolls, and the abacus.
We shall first create one of the ornamental foliages as an axial sweep.
- Draw the shown source and path profiles.
- In the Sweep Options dialog select Axial Sweep and set Scale X and Y to 0.1 and Rotate to -90°.
- With the Sweep tool active click on the source then the path, then at the center of the shaft, and then on the center of the flute twice.

A total of 12 copies of the flute are now evenly distributed along the perimeter of the shaft cylinder.
- With the Boolean Difference tool active, click on the shaft, then on the joined flutes. The shapes of the small cylinders are subtracted from the larger cylinder and become its flutes, which can still be edited using the Edit Controls tool.

The shaft also has a characteristic called entasis, which is a taper in the column to make it look straight, even at a distance, when viewed from eye level. This will be added to the shaft using the Deform tool.
- With the Deform tool set to Taper, click on the shaft. This causes a deformation box to appear, as shown.
- Click on the top corner of the box and move it towards the center of the shaft. Then click again to complete the deformation.

A taper is applied as shown.

You will next generate a different type of a revolved object for the base of the column.
- With the 2D drawing tools, draw an open shape on the ZX plane and with its ends on the Z axis, as shown.
- In the Revolve Options dialog, select Smooth and Construct As Smooth Revolve.
- With the Revolve tool click on the base profile, then the Z axis. A round form is generated, which can again be edited and reshaped after its initial generation with the Edit Controls tool.

Modeling the pedestal and base as revolved objects.
- With the 2D drawing tools, draw an open shape on the ZX plane, whose end points are on the Z axis.
- In the Revolve Options dialog, select Facetted, enter 4 for # Of Steps, and select Join Adjacent Coplanar Faces.
- With the Revolve tool active, click on the profile you drew and then on the Z axis. This generates a 4-sided pedestal, as shown. After the initial generation the 3D form can still be edited and reshaped using the Edit Controls tool.

Creating the capital details.
Variations of the Sweep tool will be used to create acanthus leaves, ornamental foliage, ionic scrolls, and the abacus.
We shall first create one of the ornamental foliages as an axial sweep.
- Draw the shown source and path profiles.
- In the Sweep Options dialog select Axial Sweep and set Scale X and Y to 0.1 and Rotate to -90°.
- With the Sweep tool active click on the source then the path, then at the center of the shaft, and then on the center of the flute twice.

A total of 12 copies of the flute are now evenly distributed along the perimeter of the shaft cylinder.
- With the Self/Copy modifier set to Multi-Copy, the Rotate tool active, and working in Top view, click on the flute, then at the center of the shaft, and then on the center of the flute twice.

A taper is applied as shown.
We shall next model a third ornamental foliage, which we will refer to as an acanthus leaf. While similar to the previous one, we shall generate this differently, using the Nurbz Lofting tool.

- With the Vector Line tool, draw 8 or more “approximate” cross sections for the leaf, as shown below. These are drawn on the same plane and they are then moved perpendicularly to different elevations.
- With the Pick tool select the profiles from top to bottom.
- In the Nurbz Options dialog select By Loose Lofting and set Cap Start = 100% and Cap End = 100%.
- With the Nurbz tool click anywhere on the screen.
- With the Nurbz Curve tool (and all the default settings) click on both profiles to convert them to nurbz curves, as shown.
- After the nurbz surface is generated, you can still edit it to make further adjustments, as shown.
- In the Deform Options dialog choose Radial Bend, Through Center and set Base Reference Plane = YZ.
- With the Deform tool active click on the leaf. After a bounding box appears, click and drag one of its vertical lines approximately 60°.
- With the Deform tool click anywhere on the screen. Observe that loose lofting adds smoothing to your profiles and capping the ends generates a solid.
- After the nurbz surface is generated, you can still edit it to make further adjustments, as shown.
- In the Deform Options dialog choose Radial Bend, Through Center; and set Base Reference Plane = XY.
- With the Deform tool click on the leaf. When a bounding box appears, hold down the option key (Mac) or the ctrl-shift keys (Win) and resize the bounding box to cover only the top half of the leaf. Then click on the top front edge of the bounding box, drag forward to bend by approximately 180°, and click again. The result should be a deformed leaf, as shown.

We shall next generate an ionic scroll as a 2-path sweep. Before we do this we need to draw two path profiles and a source shape, which is done as follows:

- Select the ZX Reference Plane.
- In the Helix Options dialog, select Wire Helix About Axis and set Radius = 20", # Of Cycles = 2, Length = 1/16", # Of Steps = 12 Per Cycle, and Scale Path Width = 0.1. This projects it on the Z plane, which essentially flattens it and transforms it into a 2D shape.
- With the Helix tool active, click on the Y axis. The helix is generated as shown below.
- In the Projection Options dialog select Orthographic Projection, and with the Projection tool active click on the helix. This projects it on the ZX plane, which essentially flattens it and transforms it into a 2D shape.
- With the Vector line tool, draw a continuation of the path. Be sure to leave a gap between the two profiles.
- With the Nurbz Curve tool, click on both profiles to convert them to nurbz curves, as shown.
- In the Attach Curve Options dialog select Merge, and with the Attach tool click on the two ends of the profiles.

They are attached and merged into one curve, which is one of the paths we shall need for our sweep. You may still use the Edit Controls tool to make additional adjustments to the path shape and use the Reconstruct Nurbz Curve tool to increase or decrease the number of visible controls.

The second path is generated using the same method of drawing, projecting, attaching, and merging curves to obtain the desired shape.

We are now ready to derive the 2-path sweep.

- With the Vector Line tool draw a line, which corresponds to an axis of rotation located at the center of the capital. Then, by combining the Vector Line and Arc tools, draw one 2D profile for the bottom and another one for the top cap of the capital shaft, as shown.
- In the Revolve Options dialog, select Smooth and Construct As Smooth Revolve.
- With the Revolve tool click the top profile and on the axis line. Then repeat the operation with the lower profile. The result is two “discs” that correspond to the top and bottom ends of the capital shaft, as shown.

Creating the capital shaft and the abacus on top of it.

The capital shaft will be modeled through a combination of revolved objects and the Blend tool. It will then be engraved with the use of the displacement tool.

- With the Vector Line tool draw a line, which corresponds to an axis of rotation located at the center of the capital. Then, by combining the Vector Line and Arc tools, draw one 2D profile for the bottom and another one for the top cap of the capital shaft, as shown.
- In the Helix Options dialog, set to Two Path Sweep and the Sweep tool active, click on the source, then on each path as shown. The source shapes sweep along both paths simultaneously, as shown.
- Place a sphere in the center of the scroll to complete the form we need.

The source shape is generated by drawing a 4-sided pattern and generating a nurbz curve from it, as follows:

- In the Polygon Options dialog, under Edges select By # Of Segments and the 4-sided icon. Under Pattern, select Pattern and the upper-left icon.
- Make sure the Grid Snap is on and with the Polygon tool ( ), click on p1, p2, and p3, as shown.
- With the Nurbz Curve tool (and all the default settings) click on the 4-sided pattern. The result should be as shown, which is the source shape we need for our sweep.

We shall next blend the two discs.

- Set the Topological Level to Face.
- With the Blend tool selected, click on two edges of each inside face of the cap discs, as shown. For each cap, be sure to select the inside segment (p1) first because this determines the blending direction.
- When the Blend preview dialog appears, select Make Solid and Custom for both the Start and End Parameters. Then move the Start Bulge slider to the right and the End Bulge slider to the left, or wherever you prefer for controlling the blending.
- When the preview displays a satisfactory form for the shaft, click OK to exit the preview dialog. The blended surface is generated as shown.
We shall next engrave the capital shaft using the Displacement tool.

- Generate or scan a bitmap image of a desired pattern to be engraved on the shaft. The one we used is shown to the left.
- With the Displacement tool active click on the capital shaft created above.

- In the Displacement Map Edit dialog set Mapping Type: Cylindrical, Lock Size To: None, Horizontal Tiling Size = 30° and Infinite, Vertical Tiling Size = 5°, Min. = 0, Max, = -1/2°, Smoothness = 15%, Adaptive Meshing = on, Max Segment Length = 1/8", Snap = off, Draw Tiles = on.

- For the preview window select the Right view, Displaced, and move the cylindrical mapping towards the top of the shaft.
- Click Update to preview the displacement in the preview window.
- When satisfied, click OK and the displacement is added to the capital shaft, as shown.

The result is the abacus form shown. After the sweep is generated, you can still edit it to make adjustments, using the Edit Controls tool ( ). Or you can use the Reconstruct tool ( ) to change the density of the control points, as we did. This makes it easier to edit its shape, if desired.

### Building the back of the chair from its boundary shape

- Draw 4 curves that outline the boundary shape of the upper part of the chair, roughly as shown.
- From the Nurbz Options dialog select Nurbz By Boundary Curves.
- With the Nurbz tool ( ) select the four curves in any order. A nurbz surface is generated, which you can still edit to make adjustments, using the Edit Controls tool ( ).

### Building the seat of the chair from its U/V curves

- Draw 3 or more curves that define sections of the intended shape in the U (horizontal) direction, roughly as shown below.
- Also draw 3 or more curves that define sections of the intended shape in the V (vertical) direction, as shown.
- In the Nurbz Options dialog select Nurbz By U/V Curves and set Number In Length (U) = 3 and Number In Depth (U) = 3.
- With the Nurbz tool ( ) active select the U curves in order, then the V curves. The order of selection is significant.

After the nurbz surface is generated, you can still Reconstruct ( ) and Edit ( ) it to make adjustments.

### Attaching the seat and back

- In the Attach Nurbz Options dialog select Merge.
- With the Attach Nurbz tool ( ) click on the lower edge of the back and the upper edge of the seat, as shown.

The two surfaces are attached and the result is a single continuous nurbz surface.

Now that all the parts have been modeled, the final assembly is created by moving each part into position, then copy-rotating it around the capital. At the very end, we used the hammered gold from form-Z’s predefined materials to render the column.