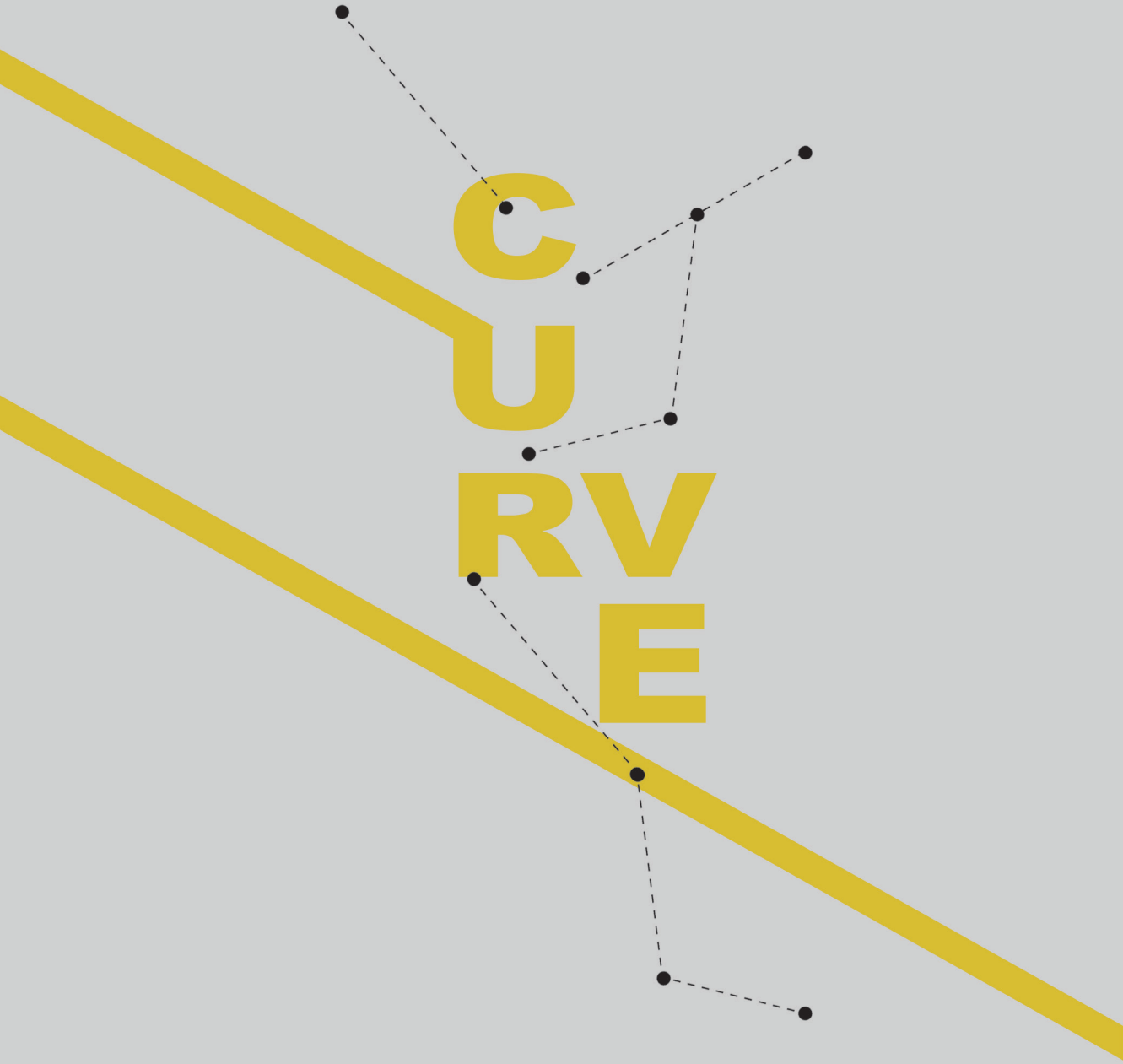

ARE YOU READY FOR A NEW JOURNEY

TABLE OF CONTENT


CURVE

PRACTICE: Curve

What is the “NURBS”?

To put it simply “NURBS” is a software language, and you need to perceive it well. A language structure has many parts that creates coherent sentences...

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To put it simply "NURBS" is a software language, and you need to perceive it well. A language structure has many parts that creates coherent sentences.

Each language has its own rules which need to be followed in order tohave an understandable sentence. Accordingly, you need to start from the scratch, which are letters (Control Points). Then, we have to develop words (Curves and poly curves); in case there are many words, plausible connections should be built between them (Surface and polysurfaces) to have a definition.
However, we are not done yet. Does that sentence have any meaning (Solid)? If yes, you did well. If not, you need to fix it.

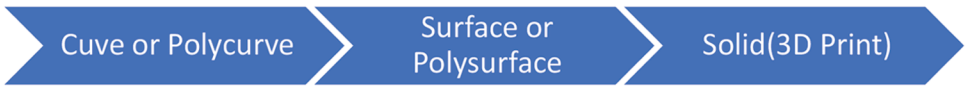
In "NURBS" system modeling, we start by selecting the correct command to make our curve the initial object. Then, we need to make a "surface" between Curves. Here, we have some Surface Creation Commands from which we need to choose the right one. By joining these surfaces, we will have a polysurface and we need a closed one. A closed polysurface or closed surface is like a complete sentence. It is meaningful, and is what we need for the 3D printing process.
Your success will begin by fully understanding your software language and its structure. Here in this book, I will walk you through achieving this level.

Another question is why we prefer "NURBS" for our jewelry modeling system to other software. To answer this question, we need to consider "NURBS" benefits. "NURBS" system, in jewelry designing, is one of the most accurate modeling processes, which helps us model two expensive materials "gold and diamond" on the planet precisely. While writing this book, one gram of gold is $50, and the difference between two diamonds with just one millimeter can cost thousands of dollars. Therefore, we need a software and modeling system for handling this amount of money. "NURBS" is the best choice that we will describe more in details.

NURBS stands for Non-Uniform Rational B-Spline, a mathematical way to create curves and surfaces. It will help if you don't wholly understand NURBS because it is useless. However, it is better to know its structure and parts. In "NURBS" modeling, we usually start with curves, which, after points, are the most initial objects. We have many useful curve-creating and editing commands to enable us to make any shape, from a simple one that can be a line segment to a complex one that can be a 3D curve in the scene.

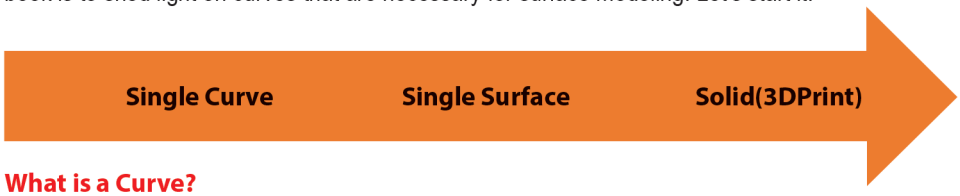
The second step is converting these curves to surface (from curves) or polysurface (from poly curves). There is this question whether they need any editing or modification. We have enormous commands to do such a task in the transform menu. Your final step is to check whether your surface or polysurface is closed or not. If yes (we can call them solid), they are eligible for the 3D printing process, if not, you need to close it.

It is obvious that reaching the last station in NURBS modeling is smooth. Just follow this instruction and enjoy using MatrixGold.



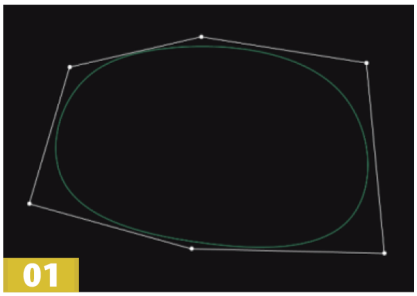
What is Surface Modeling?

Surface Modeling means working with the surface and its control points. In the NURBS system, we cannot turn on the control points of a polysurface due the fact that it needs to be surface to be able to see its control points. Thus, it means you need to make a surface, and for having a surface, we need to have a single curve (in some conditions, we can have a poly curve, and the result turns to a single surface. We will discuss it later more in details. Drawing a single curve requires various knowledge of curve structure like the control points, degree, control polygons, edit points, knots, periodic and non-periodic, uniform, non-uniform, etc. They all help you achieve a single curve and a single surface in the next step. Now you have the chance to manipulate your surface control points and, just with a few techniques, model some complex shapes. In conclusion, the first objective of this book is to shed light on curves that are necessary for surface modeling. Let's start it.

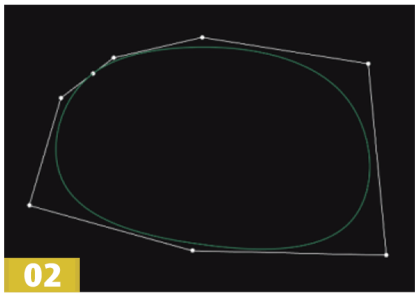


What is a Curve?

This book has been written for experienced MatrixGold/Rhino users, and undoubtedly most of you are entirely aware of the curve; however, I decided to explain the curve and its structure again.
As I mentioned above, we need to have a single curve for using the power of surface modeling.
A single curve can be open or close which can be expanded. It has just one segment that is either periodic or non- periodic.
A periodic curve is a single closed curve that doesn't have any kink or sharp point. All control points are located outside of the curve. You will have a periodic curve if you draw your closed curve using "interpolated curve" or "control point curve" and complete it in one segment. A periodic curve always creates a single surface.



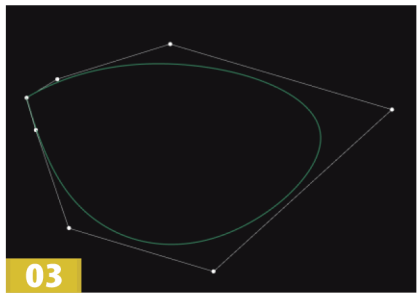
a Periodic Curve

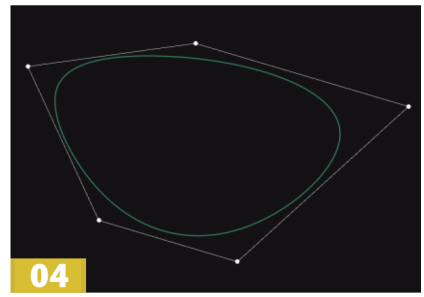


a Non-Periodic Curve

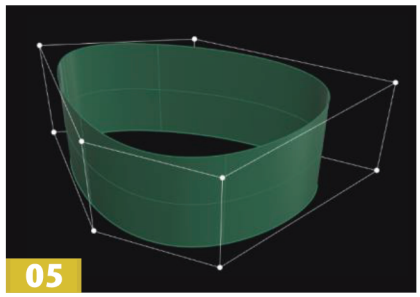
While drawing an interpolated curve, each mouse click places a point that drops on the curve. When using the control point curve or just curve, command the point you place drops out of the drawing curve. It is like a tiny anchor that controls the shape of the curve. The interpolated command sets points on the curve and affects how it is shaped. On the other hand, the control point curve command places control points or the points that lie off the curve and affect how it is shaped.
As it is illustrated from those two pictures above, the left is a periodic curve, and the right is a non-periodic curve. If you want to change a periodic curve to a non-periodic or vice versa, you can use these two commands: "make periodic" and "make non-periodic."

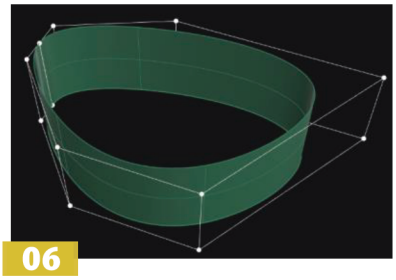
Another way to change a periodic curve to a non-periodic is by using the “insert kink” command. Please notice that moving control points of a periodic curve do not give you a kink or sharp point. On the other hand, moving control points of a non-periodic curve will provide you with sharp corners.



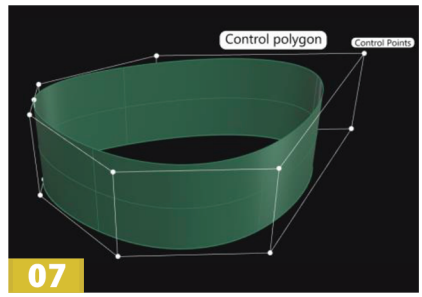


Both periodic and non-periodic curves give you a “single surface.”



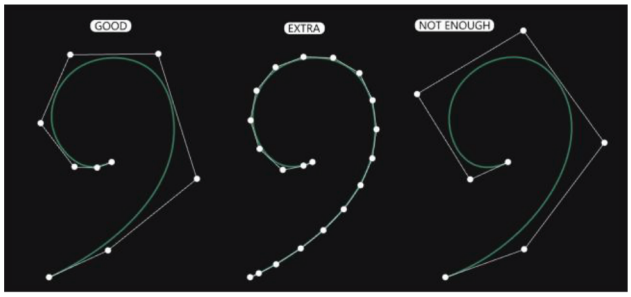


Looking carefully at the curves and surfaces above, you understand that these two different curves will give you a single surface. Despite control points with the small white circles, you see white lines that connect control points. We name them “control polygons.”

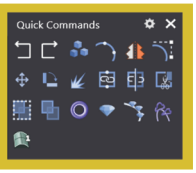


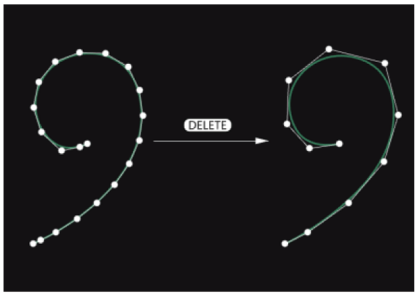
Now I would like to elaborate more on “curves.” Some critical parameters in curves are essential for a surface modeler.

1. Control Points: It s well-known that “control Points” handle the shape of the curve. You can turn them on and off by pressing F10 and F11 key on your keyboard. The number of control points and their coordination play a leading role in the shape of the curve. Having extra and unnecessary control points causes many problems in curve shape control, and a lack of control points causes weird shapes in your curve, thus, a good curve has enough control points. The unusual distance between the control point and curve is a sign of insufficient control points.

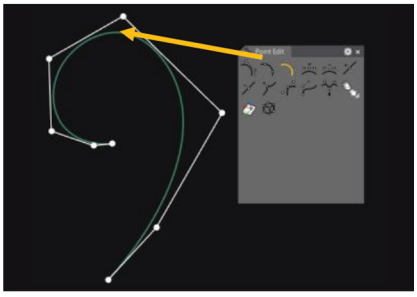


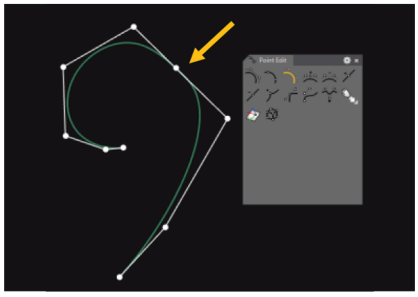
Note: In MatrixGold, you have the "quick commands" tab at the top of the left panel consisting of the most useful commands that we usually need. One of them turns control points on and off; whereas, you can add or remove any icon to this panel.





In "NURBS," you can quickly delete control points of a curve by just selecting an unwanted one and pressing the "delete" key on your keyboard. Notably, this function may change the shape of the curve if you delete many control points.
In "NURBS," we can also add control points to our curve. You can either use the "insert control point" command or type it in the command bar or activate your "point edit" toolbar and click on its icon.





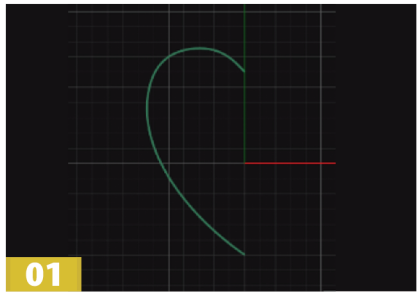
As you noticed, the shape of your curve will change by adding new control points. the reason is control points are parts of control polygons, not curves. Adding or deleting control points will directly change the shape of your curve, which is very significant in surface modeling. So, what is the alternative way of adding control points to a curve without any change in the shape of the curve? To answer this question, we need to know curves better.
The next step is knowing about "edit points."

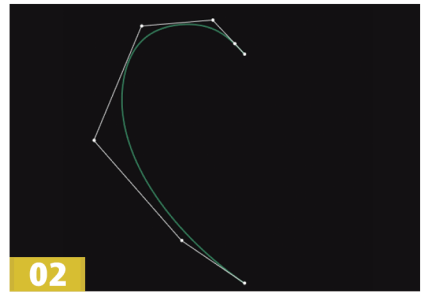
2. Edit Points: "edit points" are points on a curve, similar to "control points", which will control the shape of the curve, although they have some differences. First, "edit points "are always on the curve, not outside the curve. Second, not only does moving an "edit point" never change the location of its neighbor points, but also it will stay in the same place. However, the place of neighboring "control points" will change when you move the "control points" of the curve. Edit points are most useful when you need a point on the interior of a curve to pass precisely through a specific location.
You can delete and add "edit point" to your curve. Deleting the "edit points" will change the shape of the curve, but the good news is, we can add or insert "edit points" without any changes to the shape of the curve. Adding "edit points" to your curve automatically increases the number of control points, which helps you add control points by keeping the shape of the curve.
"Knots" and "edit points" have very close functionality. However, we have the "insert knot" command that helps us to do the same as "insert edit points", on the other hand, "remove knot," functions the same as delete edit points.

Note: Surfaces don't have "edit points," and they belong to curve. Thus, we need to use "insert knot or "remove knot" instead.

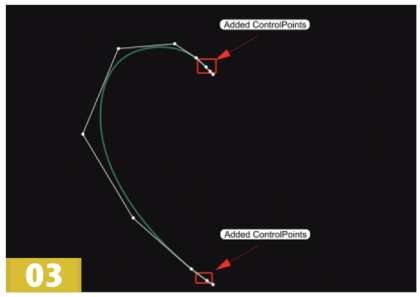
P Practice 1
Making a Single Curve Heart Shape

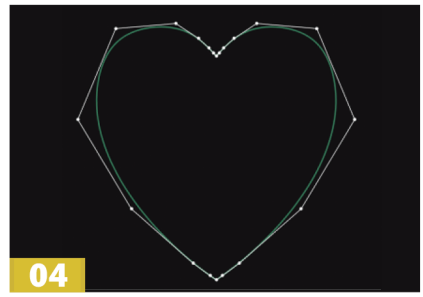
1. Star to draw half of the heart by using the "interpolated curve" command, which helps you indicate the points you want your curve to pass through. Please do not consider them as control points or edit points. They are just points.



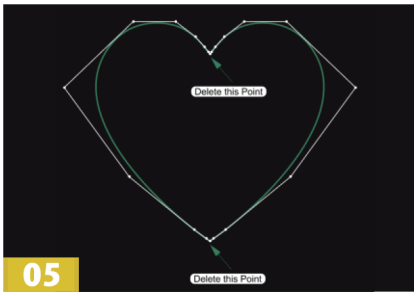


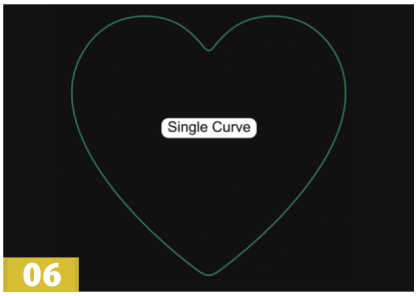
2. Then, turn on its control points, press F10 key, and clean it up. You need to add some control points to both ends of the curve. The curve will be distorted if you use "insert control points" commands in that curvature segment. So, we need to use "insert edit points" commands.





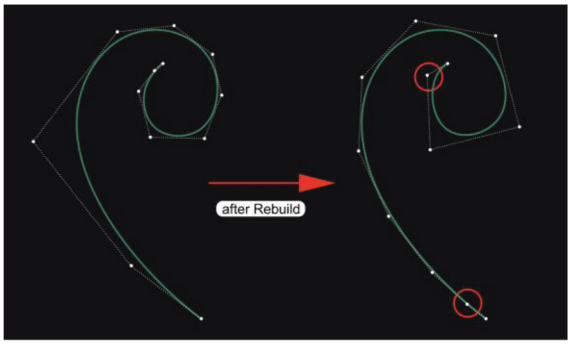
3. Now, you need to mirror the curve and join them. Then turn control points on again and delete the corner points. Now you have a single periodic curve without any kink or sharp point. If you make any surface out of them, your surface is just a single surface.





Rebuild:

Maybe you are wondering why I did not use “rebuild command.” This command is an excellent tool for controlling the number of control points on the curve. If your curve needs more control points, you had better use the rebuild command to change the number of them. On the other hand, if you have a curve with many control points and need fewer versions, you can use the “rebuild” command. You need to be aware that the “rebuild” command uniformly distributes control points along the curve. It means that it tries to place them at an equal distance.

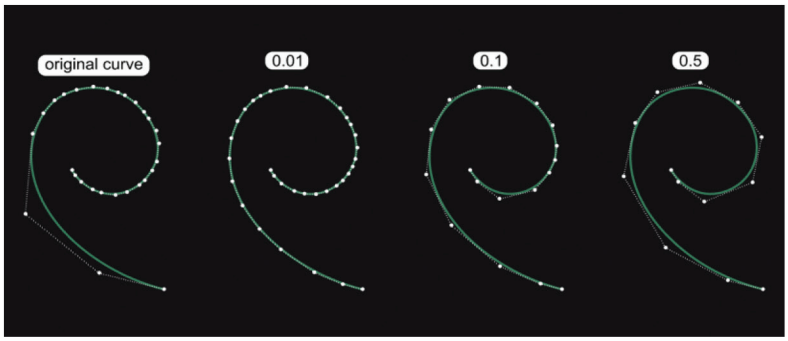


Looking at the photo above carefully, you will see that after rebuild control points, distribution is uniform. If the original curve in the scroll part has more control points, but on the other hand there are fewer of them in the less curvy segment, after implementing “rebuild” command, we will see that the curvy component has fewer control points, i.e. twelve control points along the curve.
There are two points in red circles. They are tangential control points, and they don’t follow this rule. They always stay close to the first and last control point.
In the “rebuild” command, we need to specify our preferred number of control points and their degree.

Fit Curve:

“Fit Curve” is one of the most imperative commands in Surface Modeling. This command helps you manipulate the number of control points by stating the “deviation” tolerance. Generally, we use this command to fit very dense curves to a simpler structure.
By default, the tolerance of MatrixGold is 0.001mm. If you fit a curve with this specified tolerance, the

new curve doesn't have any deviation point over 0.001mm. You do not allow your curve control points to move further than tolerance. The good news is that in the fit curve, control point spacing is based on the curvature of the input curve, so control points are closer together in areas of higher curvature.



Look at the photo above carefully, the curve has been fitted in three different tolerances. Bigger tolerance allows the curve to have a bigger deviation distance, and this causes fewer control points on the curve. Moreover, the span between control points varies. Wherever the curve needs more control points, they are closer together. Unlike the "rebuild" command, the "fit curve" command doesn't distribute control points uniformly.

Degree:

Another subject that is very important in curves is their "degree." The degree has a significant role in the shape of curves. Degree defines how smooth your curve is, and you need to decide which level of smoothness you need before starting to draw. Inded, in jewelry CAD modeling, we do not need curves and surfaces smoothness higher than degree 3. When we start drawing our curves, we use a maximum degree of 3. There is an equation between the minimum number of control points of a curve and its degree.

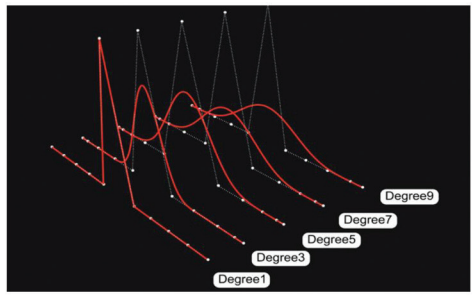
The minimum number of control points of a curve equals a degree plus 1. For instance, if you have a curve in degree 3, the minimum number of its control points is 4. If you delete one of them automatically, it becomes degree 2. So, we can say:

We can use degree 1 and only two control points for straight lines. (Are all straight lines degree 1? No, we can have straight lines with higher degrees)

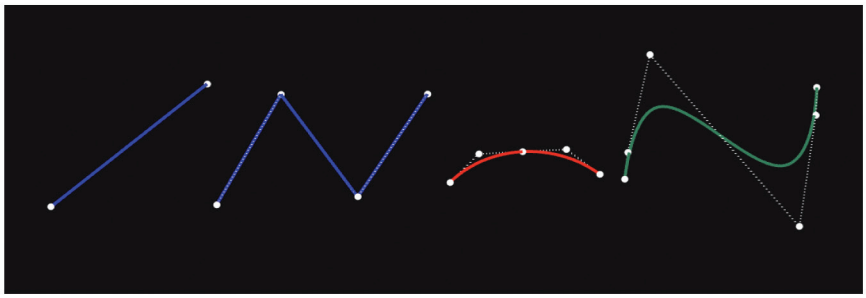
We can use degree 2 with only three control points for Arc shape curves.

We can use degree 3 with only four control points for other free form curves.

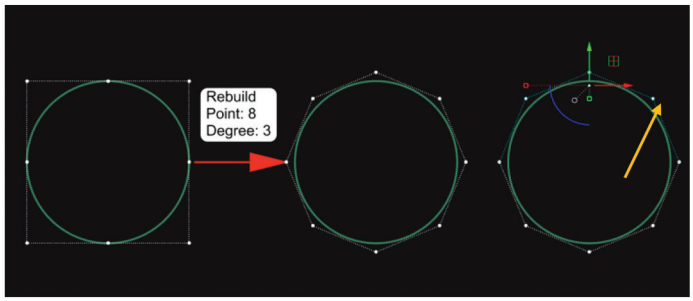
Using curves and surfaces with a degree of more than three is not recommended in jewelry CAD designs. There is no need to go further than that. Stay on degree 3.



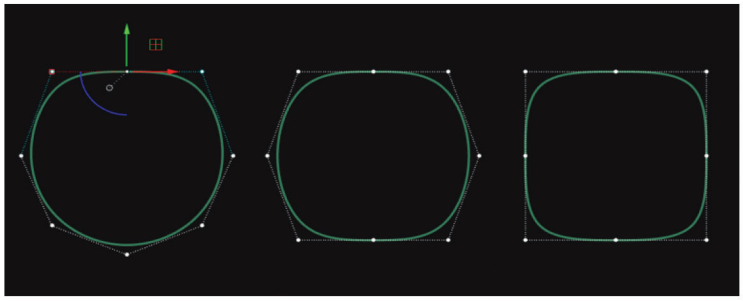
The MatrixGold lines are degree one, Arcs are degree 2, and free form curves are degree 3.



The photo above shows that the higher degree you have, the smoother you will get. Pulling one point of each curve vertically and equally indicates that a curve with a higher degree requires more power for moving. In surface modeling, we use degree 3 curves and surfaces to make it ready to design our desirable profiles for surface modeling. Some profile shapes are absolutely suitable for our surface. Some of them are as below, which you can use the " Add to Library" command to enhance your profile libraries.



Use the "Circle" command to make a circle from the origin. By default, all basic geometries in the curve menu are not deformable, and you ought to "rebuild" them or make them deformable. In this example, the curve has been rebuilt, and it is a periodically closed curve which is ready for manipulation. Turn your "O'snaps" on, check the "end" and "near" box, select the last three top control points, use the scale handle in your gumball and move it up. It snaps and stops suddenly and makes a straight line of those points. Repeat the same for three bottom, left, and right control points, and make a square.



Now we need to add control points to create corners much sharper. Type the "Insert Control Points"

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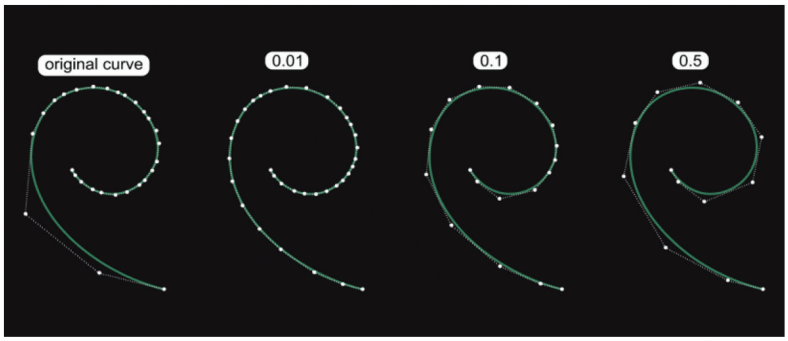

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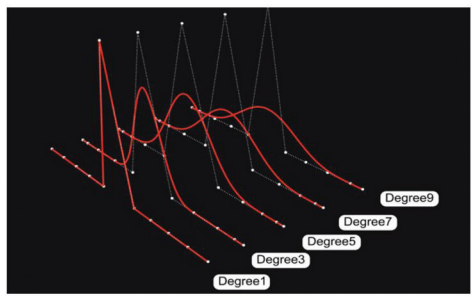

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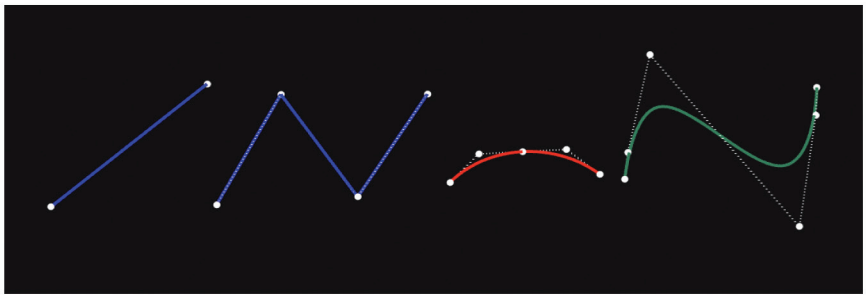

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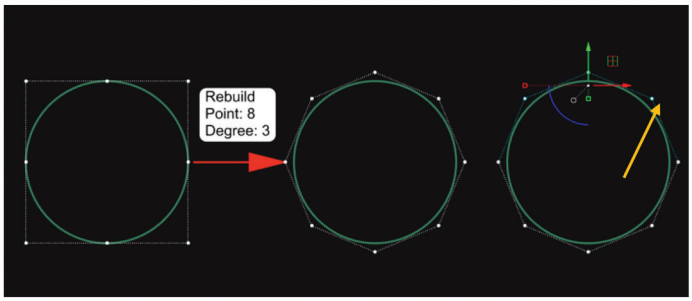
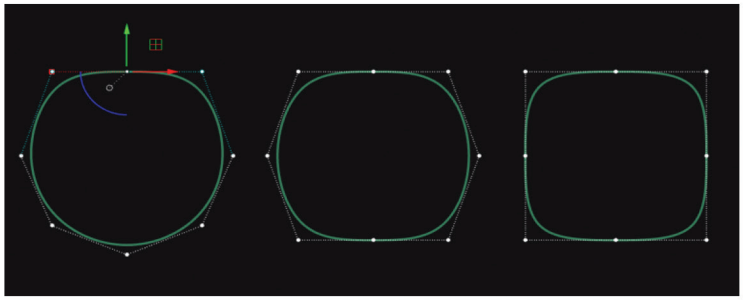
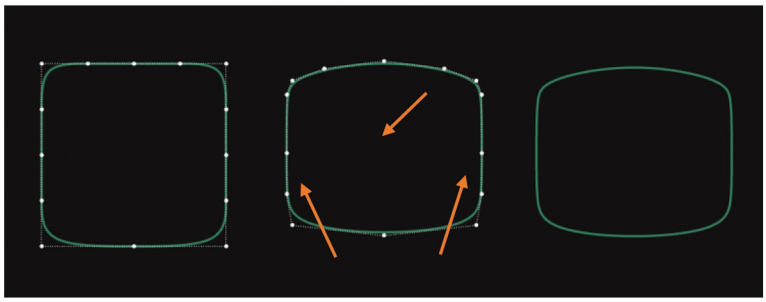


Use the "Circle" command to make a circle from the origin. By default, all basic geometries in the curve menu are not deformable, and you ought to "rebuild" them or make them deformable. In this example, the curve has been rebuilt, and it is a periodically closed curve which is ready for manipulation. Turn your "O'snaps" on, check the "end" and "near" box, select the last three top control points, use the scale handle in your gumball and move it up. It snaps and stops suddenly and makes a straight line of those points. Repeat the same for three bottom, left, and right control points, and make a square.



Now we need to add control points to create corners much sharper. Type the "Insert Control Points"

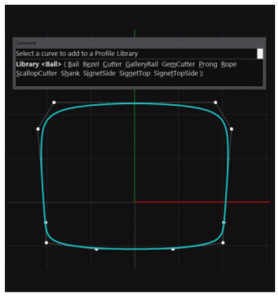
command, and in the command bar, change “Midpoint” to “Yes.” Now, new control points in the middle of each control polygon can be added. The manipulation of control points replaces “seam” to the lowest part which isIt is ready to save.

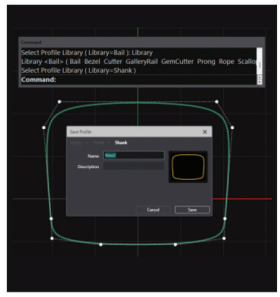


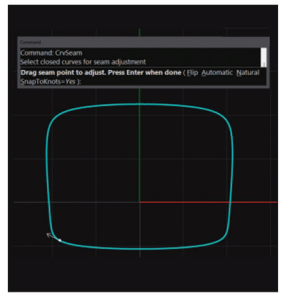
You need to use the “Add to Library” command in the ribbon bar in order to save your profile to your library. Place your profile in origin and click on the command. Choose “shank” library from the command bar and press enter. Choose a name and save it so that you can use the MatrixGold “Profile Placer” command and choose this profile as a cross-section and use it.

Note: Before saving your profile, ensure that your profile curve seam is placed correctly. It must be in the lowest part and at the midpoint of the profile. If it is not, you can use the “adjust" bottom. "Closed curve seam” command and replace it.

There is an option in this command that you need to turn off. “SnaptoKnot” must be in off mode; otherwise, you are not able to move your seam freely.



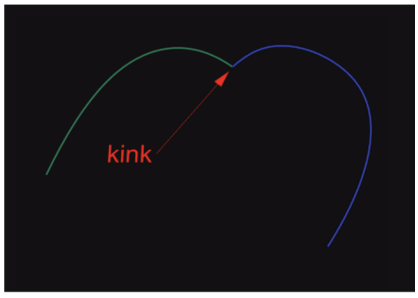


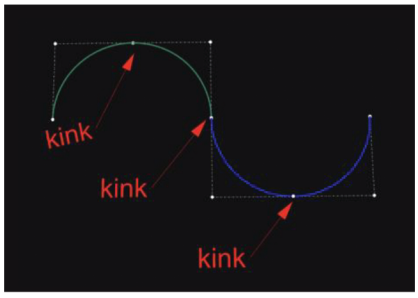


Now you have your profile in “Profile Placer Library.”

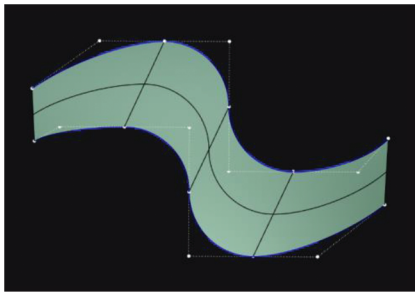
Kink:

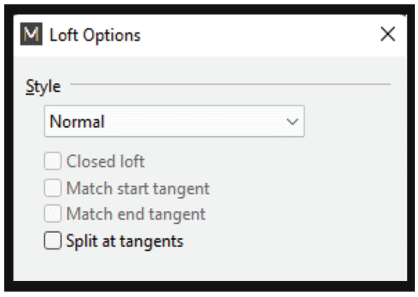
If you link two curves together, we called the joint point a kink provided that on that point the curve dramatically changes direction or the amounts it curves. Surfaces extruded from these kinds of curves will have the kink on those points. In surface modeling we always keep away from having a kink on our curves. Some surface commands like the "Rail Revolve" or "Loft" help you surpass the kink only if the kink point has a tangency continuity. In this case, you can change the “Split at tangent” to “No” to have a single surface from a poly curve.





To have a better understanding of this, I created two curves that have many kinks along and the loft command has been applied in it. Despite of having poly curves, the created surface is a single surface.





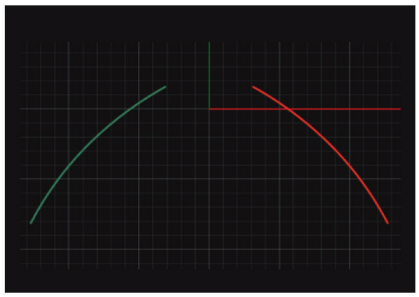
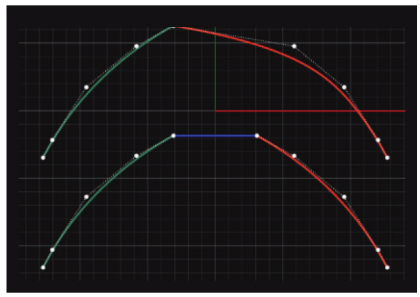
Curve Continuity:

A single curve regardless of its degree has continuity when you start drawing, i.e. there is no gap inside the curve. But if you draw another single curve separated from the first curve, there is no continuity between them. We have already created continuity when we connect them using a line, arc, or free form curve (blending) or even turn on the control points of one of the curves and attach it to the end of the other curve (matching).

Unlike the blending process, while using the matching processes we are not able to add any extra curves. Stretch one of the curves to touch the end of the second curve.

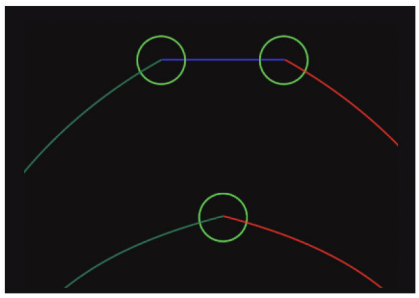
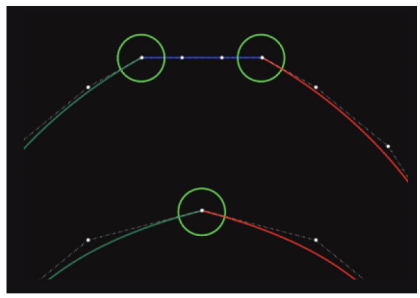
You need to know how to connect curves to have a desired single curve to have a single surface and to be used as an advanced surface modeler.
We need to know two different matching and blending continuity situations in jewelry NURBS modeling: position or G0 and tangency or G1.

command, and in the command bar, change “Midpoint” to “Yes.” Now, new control points in the middle of each control polygon can be added. The manipulation of control points replaces “seam” to the lowest part which islt is ready to save.

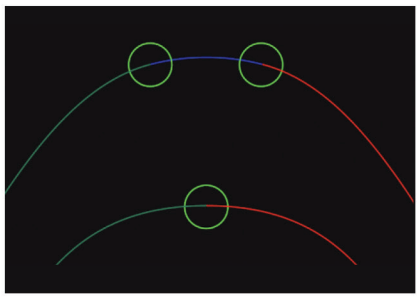
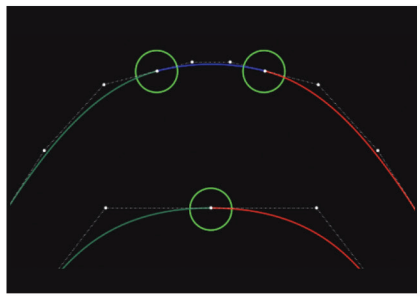
Position or G0:

In this condition, the curves touch at the joining point. G0 continuity measures location only. If the endpoints of each curve are in the exact place in the space, the curves are position continuity. You will never have a single surface if you use any surfacing commands in this state. It means you must avoid creating the curves in this form.

Tangency or G1:

In this condition, not only do the two curves touch but also go in the same direction at the point where they touch. The direction is determined by the first and second points on each curve. If these two points fall on a line, the two curves are tangent at the ends.

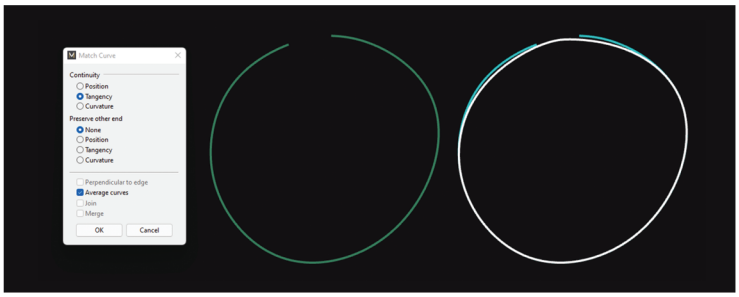



This is the form that we have been looking for, and we use it. We always use tangency continuity to create a single surface. Some might wonder why we do not use the rebuild curve to terminate that sharp point instead of matching or blending. Using the rebuild curve command is an alternative to

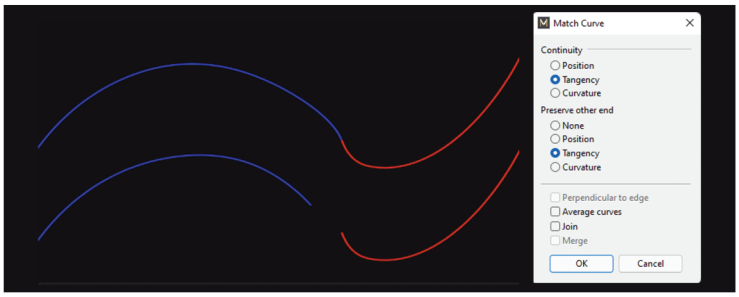
eliminating the sharp corners in simple curve structures. If you use the “rebuild” command in complex curves, you may destroy the curve entirely. Moreover, we use the match and blend to connect two separated curves without continuity.

Match Curve:

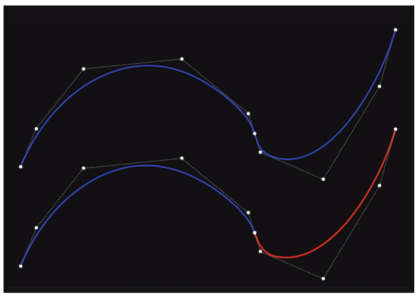
The match command changes a curve endpoint to meet the endpoint of another curve. If the endpoints belong to one curve, you can use it as the close curve command. You can match two endpoints either they touch each other or stay separate.



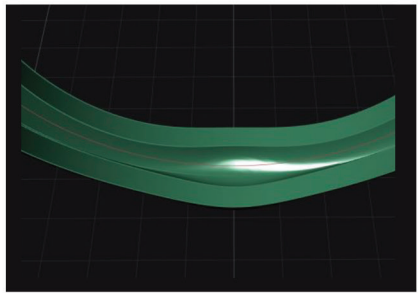
In the dialog box shown after clicking on the endpoints, you can choose which continuity you need to have, position (G0) or tangency (G1). We do not use higher continuity like curvature continuity or G3 and G4 in the jewelry industry. Higher continuity needs curves with higher degrees and more control points. Tangency continuity gives us enough smoothness for the surface.

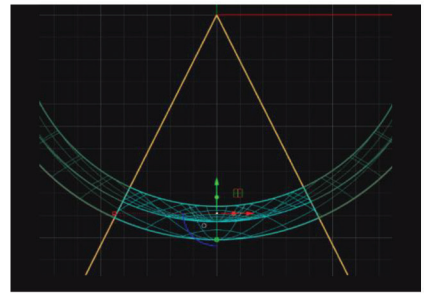


After matching, if you want to eliminate the connection point, you can use the “Merge Curve” command and make a single curve instead of rebuilding the curve.

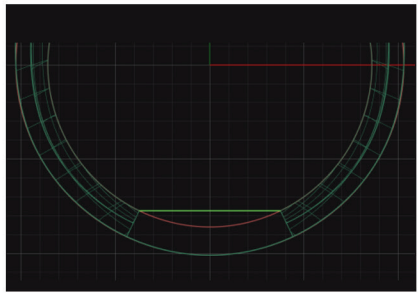


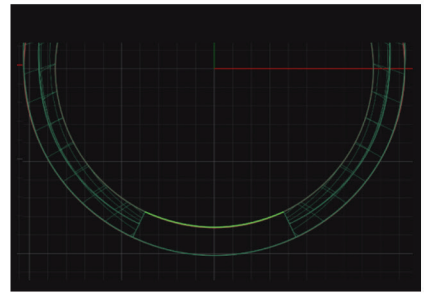
Now it is time to see the match function in practice. For instance, I created a ring, and I want to fix the bottom part., so I have to start the line command and draw two lines like the picture below, and from the front view, split the shank using the lines.





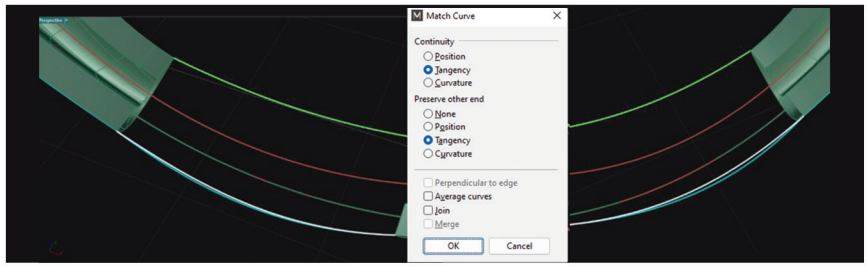
Use the interpolated curve command and connect the corners of the surface.

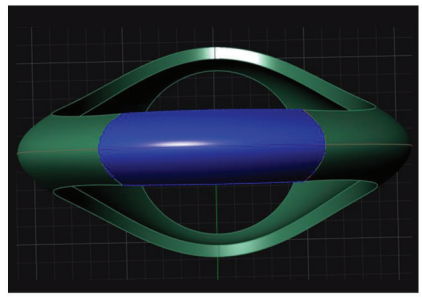




Now we need to fix the continuity between the curve and surface edge. Start the “Match” command and first click near the end of the curve and then near the end of the surface edge. In the” Match” command dialog box, choose the “Tangency” and press "Ok". Ensure that the “Average curved” and the “Join” boxes are unchecked.

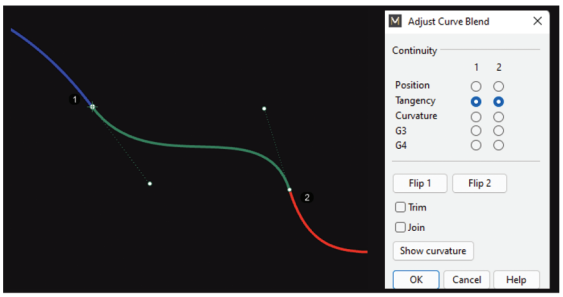
Use the “Sweep2” command to create the surface and enjoy the beautiful continuity.



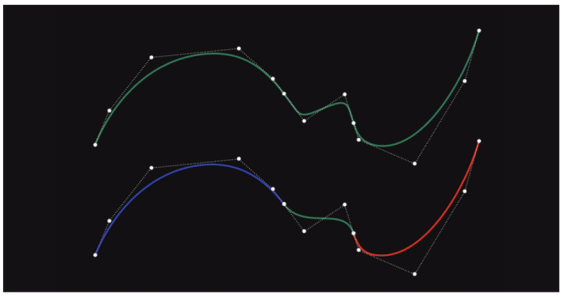


Blend Curve:

This command similarly functions as the “Match” command, except that in the “Blend” you will have a new curve between two endpoints. This new curve creates requested continuity between two endpoints. We use this command to build a new curve shape from existing curves.
We have two different blend commands that work the same, but the “Adjustable Blend” has a dialog box and more controls than the “Blend Curve” command.



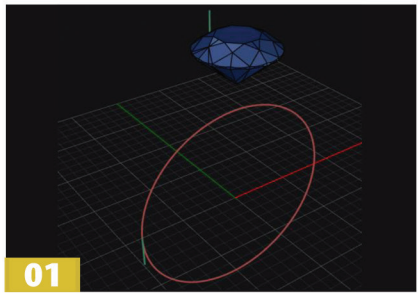
As it is shown in the above picture, a new curve is created with the minimum control points possible for a degree three curve. The minimum number of the control points required to create a degree three curves is four control points.
If you intend to have a single curve instead of a poly curve with three curves, you can use the “Merge Curve” command.

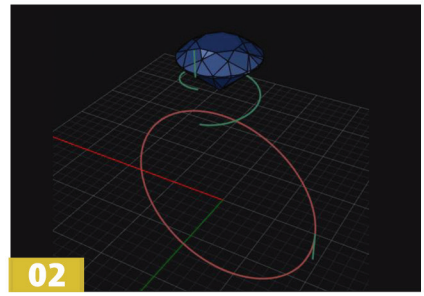


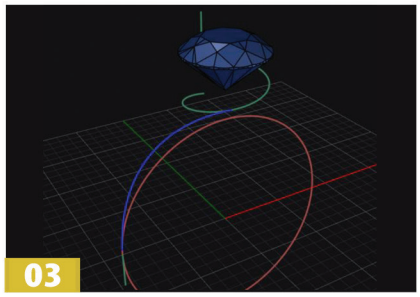
After merging, the curve differed from its original shape because of insufficient control points.
Please be noted that choosing higher continuity like Curvature and G3 will create the blend with a higher degree. If you decide to have a curve in curvature continuity instead of tangency, you will get a curve in degree five.

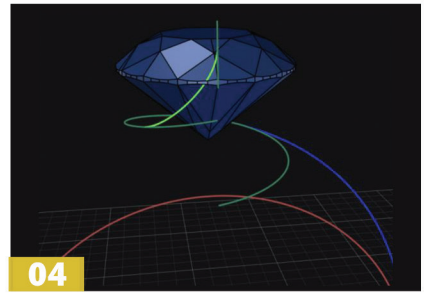
Practice 2
Making a Ring with Blend curve

Let us practice with the blend curve command. Make a ring rail in any size that you desire. Place a gem above and draw two single and straight curves. Make a helix with one turn and smaller than the stone diameter and place it under the gem. Rebuild the helix to the eight control points. Now start to use the “Adjustable Blend Curve” to connect the endpoints. After applying the blend command, if the created curves have the wrong direction, you can use the “Flip” buttons in the “Blend” dialog box and choose the proper direction. If you want to blend the curves, not in their endpoints, you can change the “Blend Start” from the “Endpoint” to the “pick Point” and click on the point along the curve.

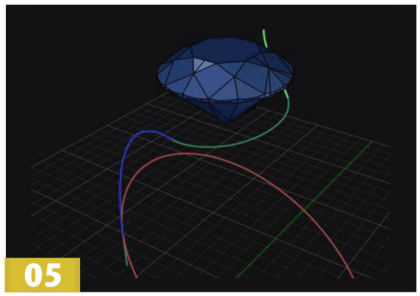


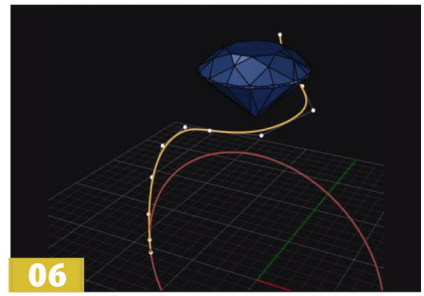


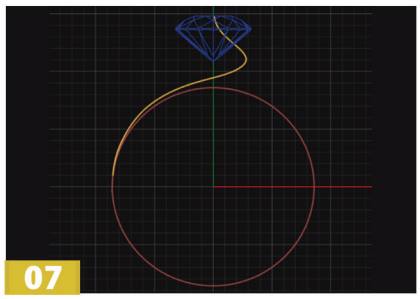


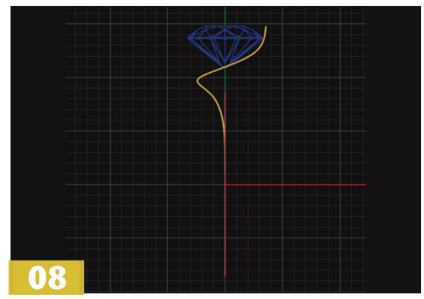


Now apply the “Trim” command to delete the unwanted sections. In MatrixGold, the “Adjustable Blend Curve” is a history-enabled command, and as soon as you start trimming, it updates the curves and gives an undesirable outcome. So, ensure that the “Update Children” feature is unchecked. Then join the curves and make a single curve. Rebuild it to twelve control points. Use the front view and give a smooth shape to the curve.

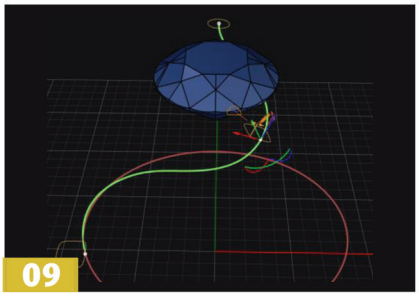


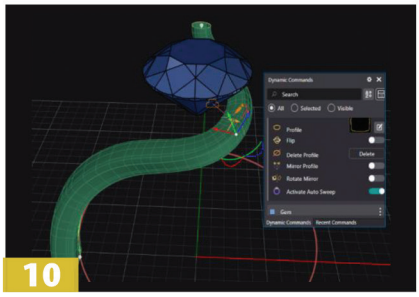




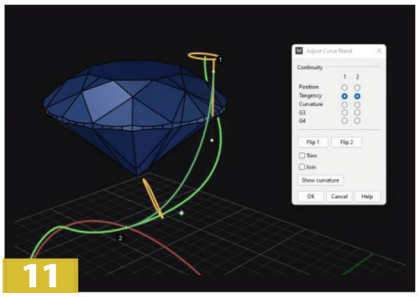


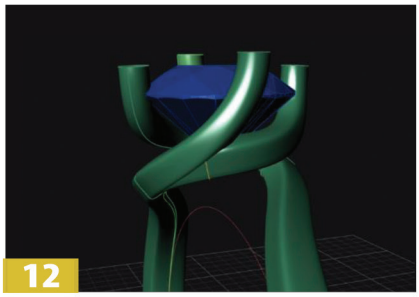
Use the profile placer and orient three profiles on the curve. You can use the “AutoSweep” feature in MatrixGold from the “Dynamic Panel” to see the “sweep1 “outcome.





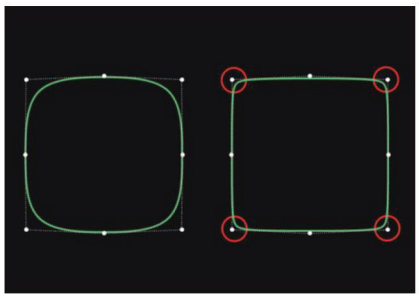
Draw another line on the right side of the gem and use the “Adjustable Blend again” to blend it to the rail. Extract a curve from the surface as a profile, place a circular shape to the other endpoint, and apply the “Sweep1” command.

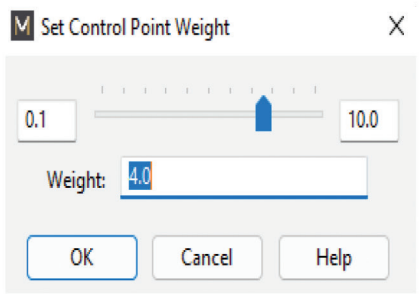




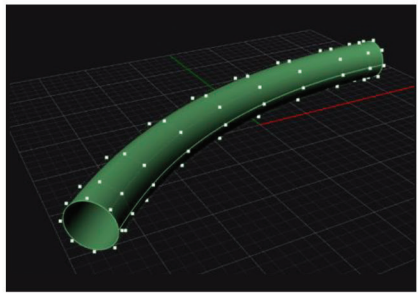
Weight of the control points:

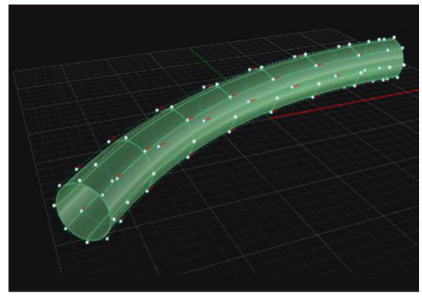
Each control point has a parameter that are called the “Weight.” It determines how much the curve or surface is attracted to the control point. The higher the weight value, the closer the curve or surface is to the control point, and we have a sharper corner.

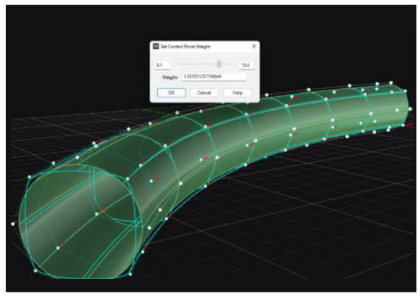


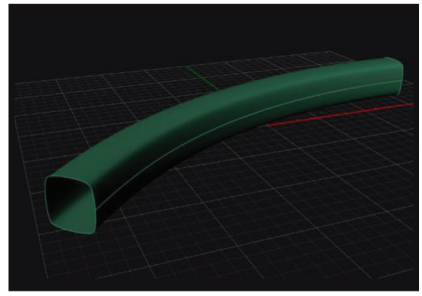


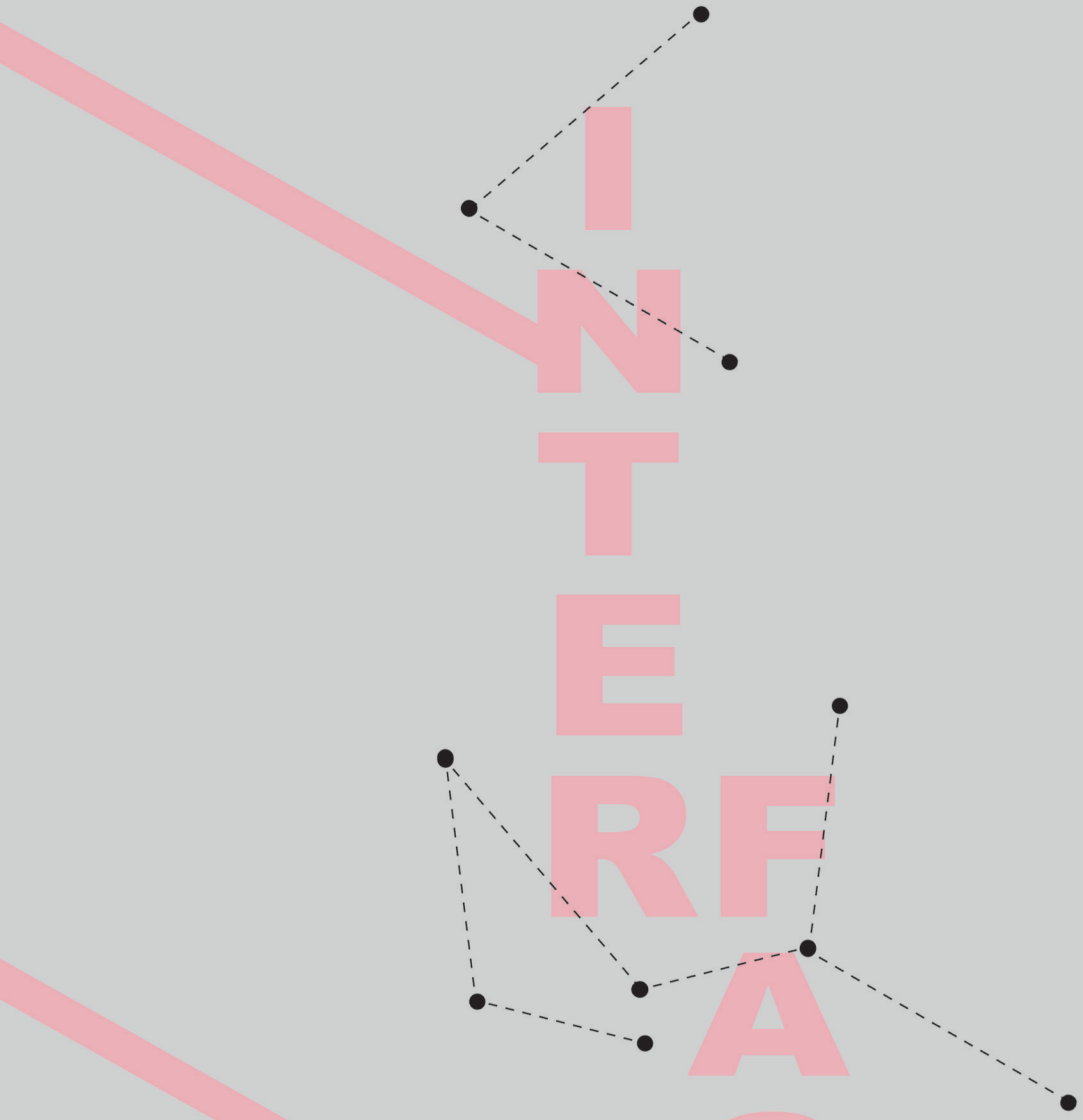
Draw a curve and use the Pipe command to make a tube. Rebuild the surface to eight (8) control points along with the U as well as ten (10) control points along the V direction. Select the four (4) control points and type “SelU” in the command bar. Start the “weight” command and move the handle to the right.







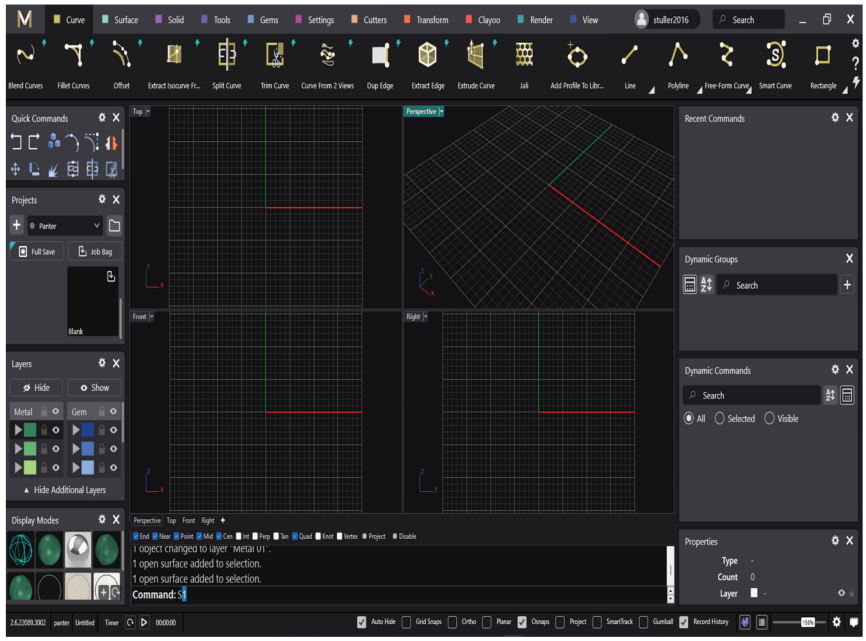



INTERFACE

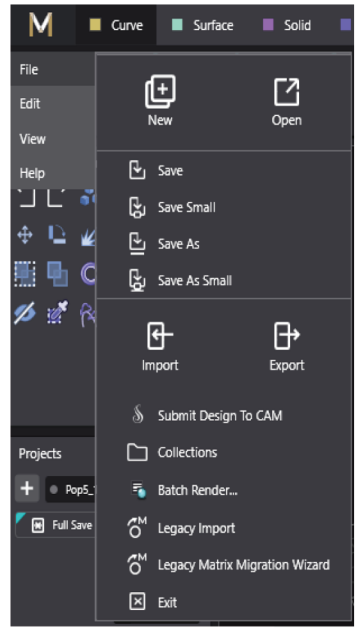
PRACTICE: Interface

What is the “INTERFACE”?

If you want to use the MatrixGold software more powerfully you need to become entirely familiar with its interface. ...

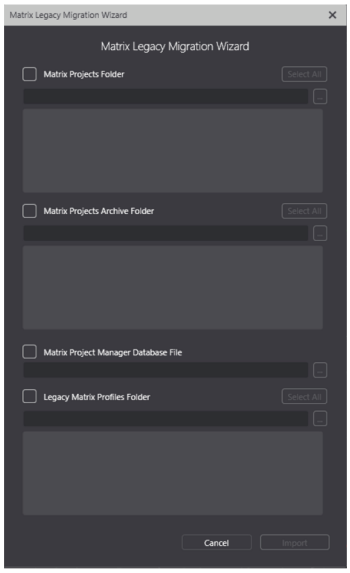


If you want to use the MatrixGold software more powerfully you need to become entirely familiar with its interface. In the first part, we start reviewing the “Main Menu” at the top left.



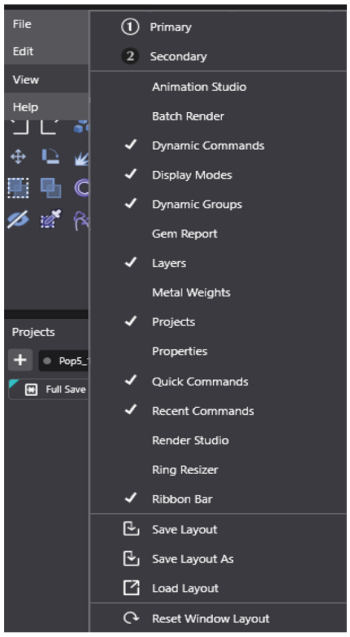
“New” creates a new document and helps you start from the beginning.
“Open” helps you open an existing file that are already saved on your computer.
“Save” allows you to save the file in its location that has been opened.
“Save Small” just saves the objects. This kind of saving, never keeps any parametric history in your document.
“Save as” gives you an access to save your file in any folder and allows you to rename it.
“Save as small” saves your geometry and objects without their parametric history in any location that you require on your computer. A combination of the “Save as” and “Save Small”.
“Import” allows you to bring any supported file into the opened file.
“Export” allows to save your selected geometry in a new file and in any supported format. This is very useful if you desire to save your file in a different format like STL, or OBJ.
“Submit Design to CAM” allows you to connect to the Stuller CAM service and deliver your file for next processes.
“Collections” will open your collection folder through the MatrixGold interface.
“Batch Render” will lunch batch rendering process.

"Legacy Import" helps you convert the Matrix9 geometries to the MatrixGold ones. Open a Matrix9 file in the MatrixGold and click on the "Legacy Import" and select the elements that you desire to convert to MatrixGold objects.
"Legacy Matrix Migration Wizard" helps you bring all Matrix9 elements into the MatrixGold libraries like profiles, projects folder, archives, project manager database files.
You just need to mark the parts that you desire to import in the MatrixGold and click on "Import".



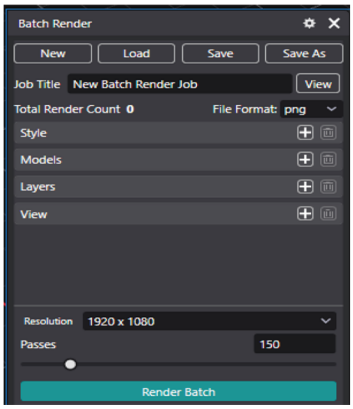
The "Edit" menu allows you to make any changes like undo, redo, copy, and similar operations.

The "View" tab consists of all the available panels and pallets that you can move and dock wherever you want to.



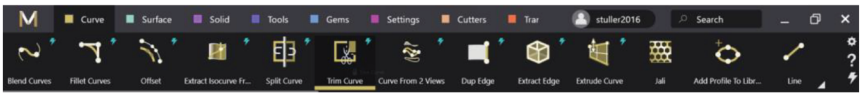
"Primary" and "Secondary" options will allow you to toggle and shift between different layouts that you have created. All changes will be saved automatically, and you do not need to save the layouts anywhere.
"Animation Studio" is a new feature in the last version of the MatrixGold, which provides you with functional tools to create a short animation of your model.
"Batch Render" enables you to render many different versions of your model in a fast and convenient way.
"Dynamic Commands" is a place that holds all the commands that you have used to build a model with parametric history.
"Display Modes" allows you to toggle between existing different display modes of your viewports. Left-clicking on the icon will change the active viewport and right-clicking on the display mode will make that change to all your viewports.
"Dynamic Group" allows you to categorize your objects into a group before doing any more commands so you can organize your document.
"Gem Report" creates a list of the available gems that you used in your model.
"Layers" shows you all the available layers that you can assign to the objects in your documents to keep your model well-organize.
"Metal Weights" offers you the weight of the selected object in Grams or Pennyweights.
"Projects" shows your incremental savings as job bags and full saves. This is a place where you can access to the projects that you have been working on for future use. This window helps you stay organized with your work.
"Properties" provides a quick review of what you have selected.

"Quick Commands" is a customizable list of the most used tools that will assist you in modeling. You can add or remove any commands by dragging the icon inside or outside of this panel.
"Recent Commands" shows you a list of the most recently used commands in your document.
"Render Studio" will provide ready-to-use material to apply to the objects in your document for rendering process.
"Ring Resizer" is a collection of tools that allows you to resize a created ring to any ring size that you wish for. Whole processes happen less than a minute and as less distorted as possible.



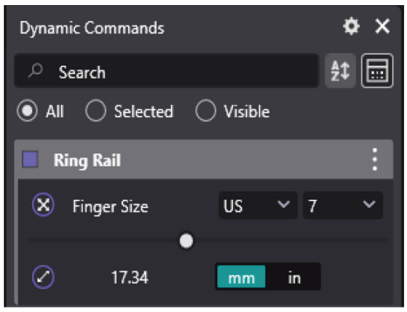
Ribbon Bar:

The "Ribbon Bar" is located near the Main Menu and consists of all the commands that you draw and edit your models. They have been placed into separate categories that are distinguished by the type of the objects.
Some commands have small triangle located at the bottom right-hand corner of the icon and indicate that there are variations of the command that can be used. This is an alternative way for choosing these variations in the command line.
The "Search" box is located at the top right, and you can use to filter out the commands and keep those that contain those keywords.



Dynamic Commands:

Some commands in the "Ribbon Bar" are carrying a lightning bolt at the top right corner of themselves. It illustrates that these commands support the "parametric" feature and will have a list in the "Dynamic Command" panel. Using the parametric feature has many benefits and helps you update your model fast and easily. By changing one of the parameters, all parameters in the list will be updated automatically.



To determine how it works, follow the instructions below.

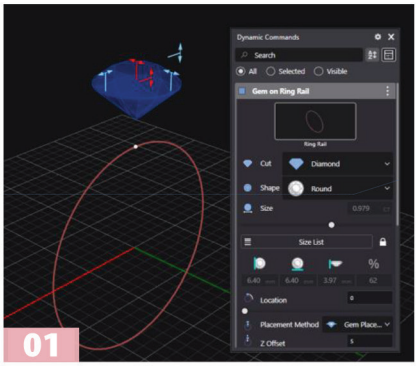
1. Go to the "Ribbon Bar" and "Tools" menu and click on the "Ring Rail" command. Choose your preferred ring size and press Enter.

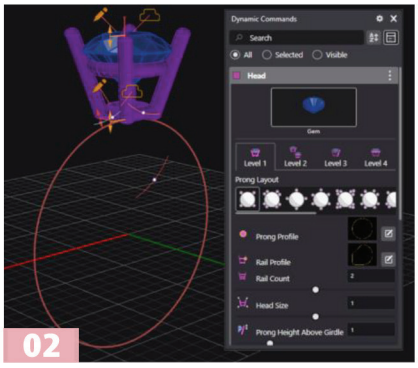
2. Go to the "Gems" menu and select the "Gem on Ring Rail" command and click on it. A diamond cut round shape gem will appear above the ring rail. Moving the handles will change the parameters like size and position. As you find your proper size and position, press Enter to confirm the gem.

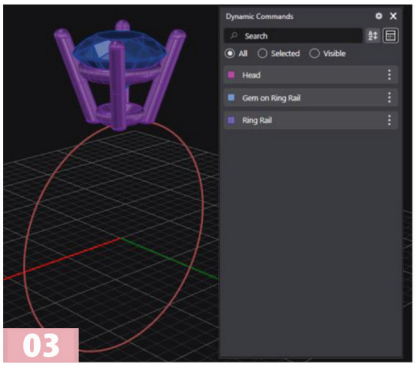
3. Go to the "Setting" menu and select the "Head" command and click on it. A basket will be made around the gem, and you can manipulate the handles to reach to desirable size and shape.

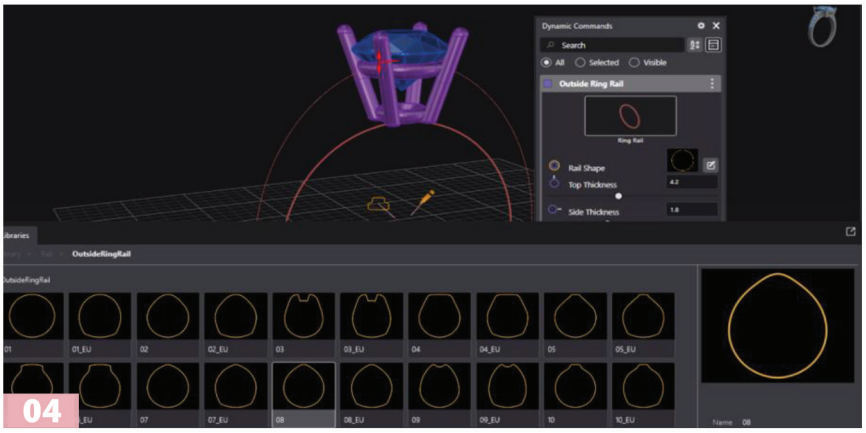
4. Go to the "Tools" menu and select the "Outside Ring Rail" command and click on it. A close curve will surround the ring rail and you can change some of its parameters as well as its shape. Just go

to the “Rail Shape” section and click on the box just at the right side of the panel. Now you can choose your preferred shape. Select number eight profile and click on the “Select” button. Press the enter key if you like the shape.



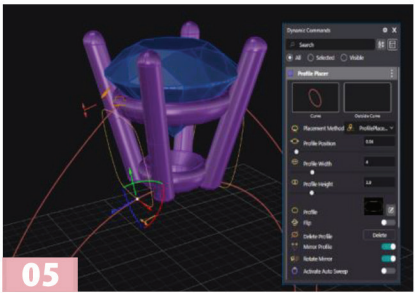


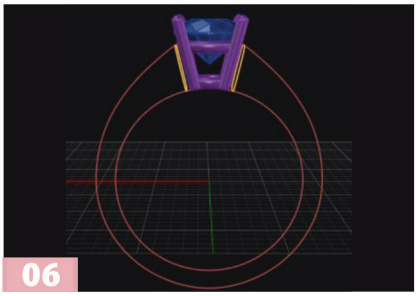




5. Go to the “Tools” menu and select the “Profile Placer”. This command helps you orient a profile on the curve and prepare it for the “Sweep” process. Use the handles to change the width and height of the profile. To move the profile along the profile, you can use the small white sphere on the seam point of the profile. In the “Dynamic Commands” panel opened for the “Profile Placer”, choose the “Mirror Profile”

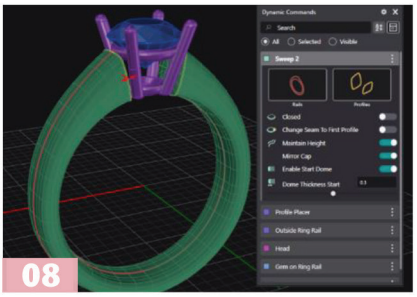
option to have another profile to the right side of the ring rail. If you do not like the shape of the profile, you have to go to the profile library by clicking on the black box in front of the profile section and choos the preferred one. You need to use the “Outside Curve” box , to lock the profile height as the same as the outside ring rail,. Click on the box and select the outside curve. The height of the profile is fitted to the outside ring rail now.

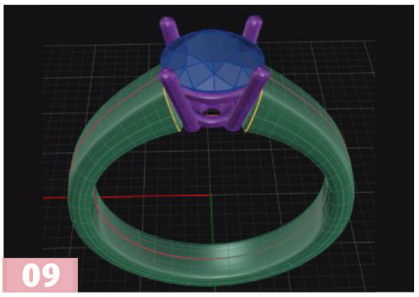




6.Go to the “Surface” menu and select the “Sweep2” command to have the parametric feature, you had better use the “Sweep2” with the lightning bolt sign at the top right side of icon.

7.First select the rails,then select the profiles and press the “Enter” key to allow the command to create the surface. If you like the surface, press the “Enter” key.

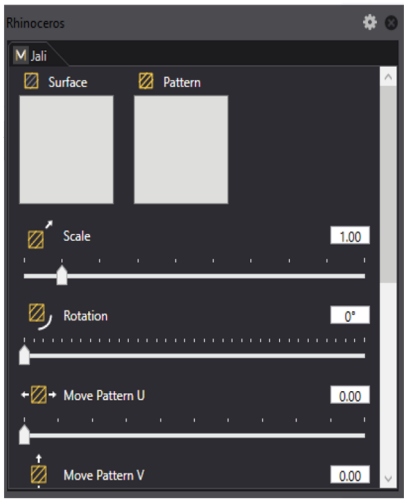




8.Now it is time to use the “Dynamic” feature of the MatrixGold and enjoy using it. For example, you can refer to the “Dynamic Commands” panel and click on the “Edit” button at the top right of the “Ring Rail” window and change the size of the ring rail.
All parameters will be updated subsequently. Try to change the size and shape of stone and see the result.

Some Advanced Commands in MatrixGold

JALI:



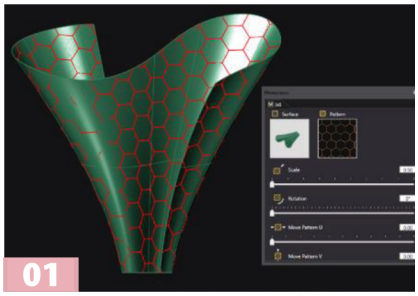
This is a brandnew and awesome builder on surface tool that help you to place the "hatch" patterns on the surface, regardless of its isocurve layout and topography.

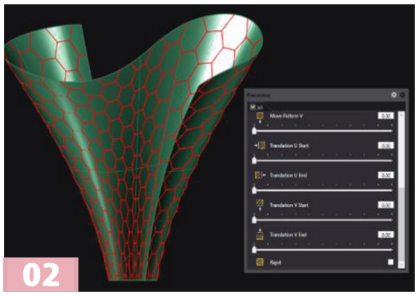
You just need to have a single surface for it. It does not matter it is single curvature or doubly curvature. Click on the "Jali" icon and you will see a dialog box will appear.

Click on the "Surface" box and select your surface,then click on the "Pattern" box and choose your desirable hatch pattern.

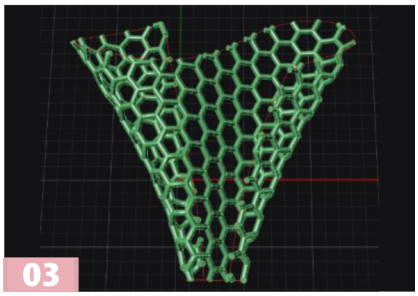
The "Scale" handle changes the hatches size. "Rotation" helps you rotate your pattern on the surface. "Move Pattern U and V" handle move the patterns along the U and V direction of the surface.

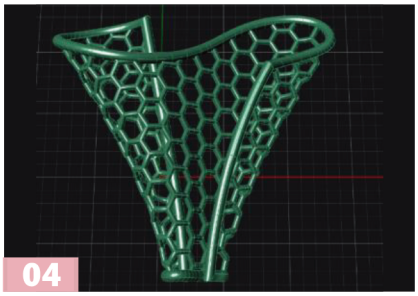
The "Translation" handles change the start and end edge of the pattern along the U and V direction of the surface and the "Rigid" option control the shape of the pattern whether follows the isocurve layout or not.





In the left figure the "Rigid" is "On" and in the right one it is "Off". After applying the Jali, you can "Ungroup" them and use the "Pipe" command from the "Solid" menu.





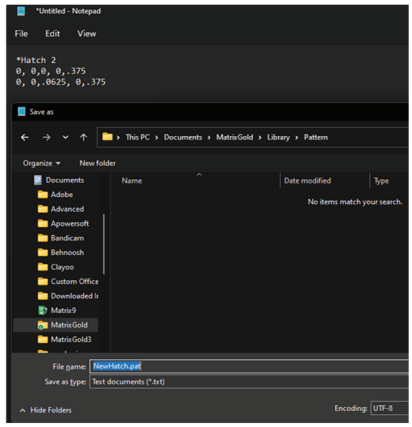
How to add hatch patterns into the "Jali Library":

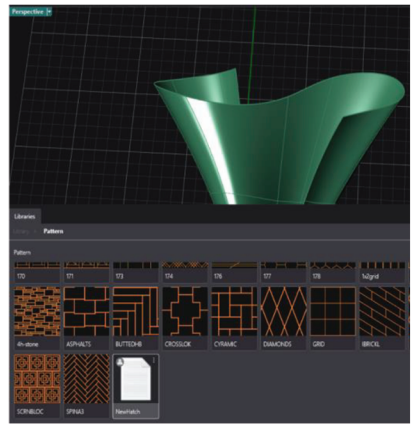
Hatch patterns are a set of numbers that have been placed in a ".PAT" format file. Creating hatch pattern is not easy and you must have tools and plugins. I will introduce a website to help you to

create hatch patterns. However, let us use ready-to-use additional hatch patterns from the Rhino Website and import them in the MatrixGold library.
Please go to the following website and download the ZIP file.
https://wiki.mcneel.com/rhino/draftingpage
Extract it into your computer. It includes a .TXT file that you can open it with your Windows Notepad program.

```
; Rhino default Hatch Pattern file
; Explanation
;first value   = angle
;second value  = starting line point X Coordinate
;third value   = starting line point Y Coordinate
;fourth value  = next line shift along the line direction (relative to X Y coordinates)
;fifth value   = next line shift perp. to line direction (angle +90°)
;sixth value   = mark length
;seventh value = gap length (usually negative)
*Hatch 1x45
45, 0,0, 0,1
*Hatch 1x0
0,0,0,0,1
*Hatch 2
0, 0,0, 0,.375
0, 0,.0625, 0,.375
*Hatch rhombus
45,0,0,0,1
0,0,0,0,1
```

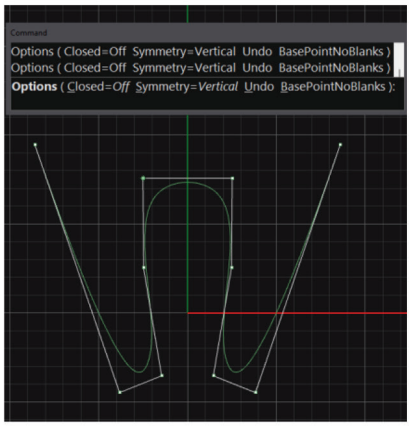
This file has more than 1000 hatches and each hatch starts with a star sign, name, and continues with the a few digits. These numbers and digits create the hatch shape. We need to copy one of the hatches and paste it to a new .TXT file and save it as .PAT format in this address: Documents/MatrixGold/Library/Pattern to have them in the MatrixGold library. Now if you apply the “JALI” again, you can see your pattern in the library. Select and apply it on the surface.

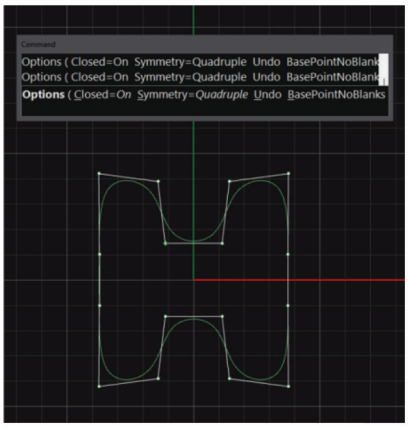




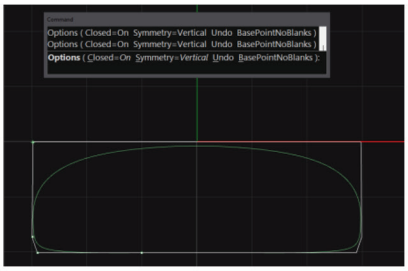
SMART CURVE:

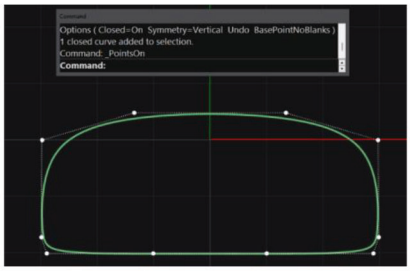
Smart Curve helps you to create a uniform control point curve with additional features. One of these features is the “Symmetry”, whichassists you to draw a very optimized symmetrical curve. You can apply the symmetry to your curve in vertical, horizontal, and quadruple directions along with the optional “Close” command.
Unlike the “Interpolated Curve” that we don’t have any control over the exact location of the control points, we can place each control point whenever we desire.
We use the “Smart Curve” to create our profiles for the surface modeling technique.





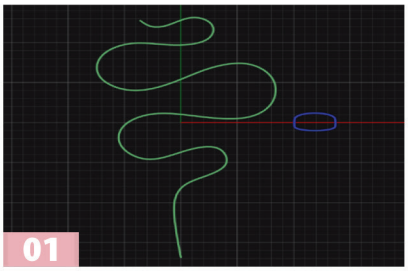
To create your profile for surface modeling, you just need to run the “Smart Curve” and enable the “Vertical Symmetry” and “Close” options. In this case, you can make your profiles with the least control points as possible.

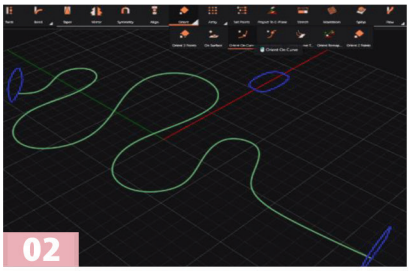




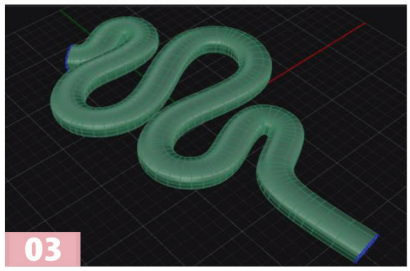
Snake Pendant:

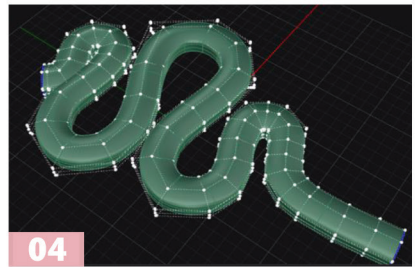
1. Use the “smart Curve” or “Interpolated Curve” to create a rail for the body shape of the snake. Draw a profile by using the “Smart Curve”, go to the “Transform” and select the “Orient on the Curve” command from the “Orient” menu. You need to activate its “Perpendicular” option and select the profile and then select the rail to place the profile perpendicularly on the curve.



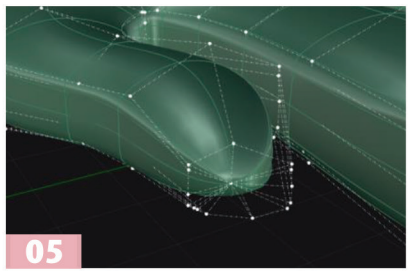


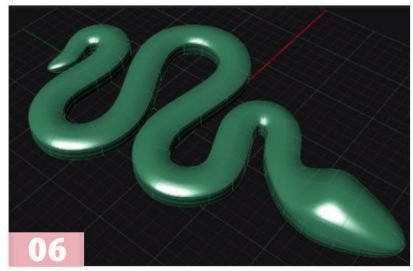
2. Use the “Sweep1” command to create the surface. As you are noticing, you have created a surface that you can turn on its control points. There is no change in the number of the control points along the profile. However, they have increased dramatically along the rail. We need to reduce them. You can use the “FitSrf” with the fitting tolerance of 0.05 or 0.1. Unlike the “Rebuild” command that you need to input the number of the control points, you just need to input the fitting tolerance. This is a number that allows the surface deviate in this range.





3.It is time to manipulate the control points by using the gumball and some point selection commands. We need to select a row of the control points at the start and end edge of the surface to close the end of the surface, and scale them down while pressing the shift key and having the object snaps (End and Point) on. Control points will collapse to one point if they stay close enough together. Type “SelV” and “SelU” in the command bar to select all of control points along different directions. We will describe these techniques in the following chapters in details.

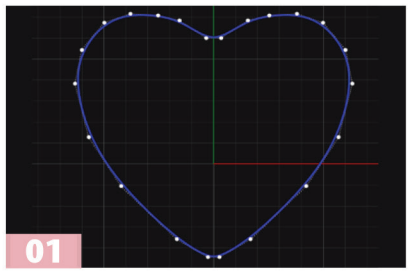


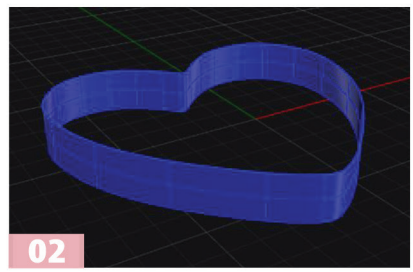


Texture 3D:

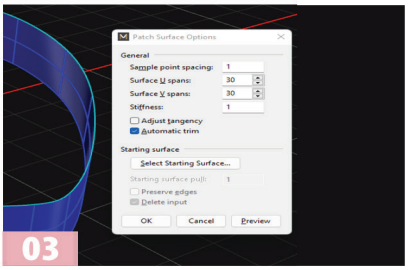
This is a parametric command that helps you construct a displacement display mesh for surfaces, polysurfaces, or mesh. You can use any different kind of photos. However, you need to use depth alpha ones that many of them are in the Matrix gold library for having the best result,. Let us make a hammered heart shape and learn more about this incredible command.

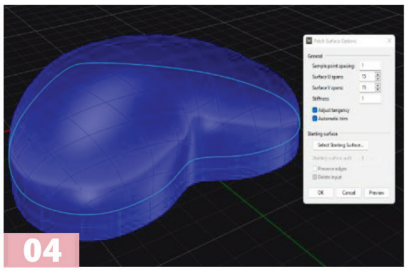
1.Draw a single heart shape curve using the “Smart Curve” command as below. Use the “ExtrudeCrv” command to have a single surface.

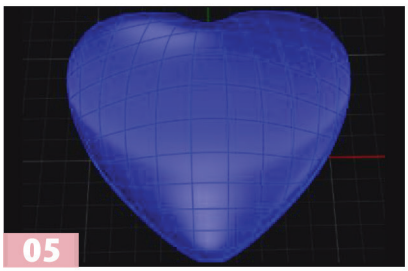




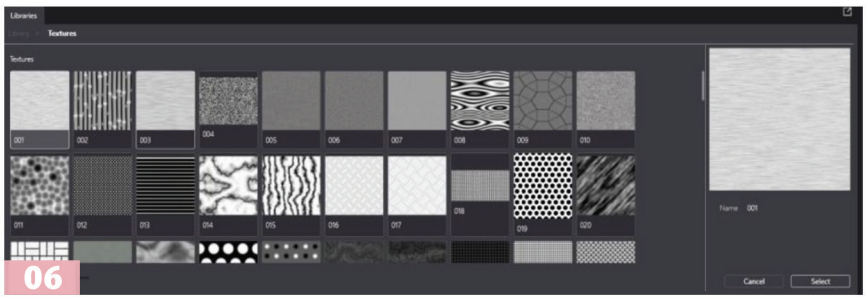
2.Delete the curve. Refer to the “Surface” menu and click on the “Patch” command. It will ask you to select a curve or edge of the surface. Select the edge of the heart shape surface and press the “Enter” key. A dialog box will appear, and you need to change some options. Mark the “Adjust Tangency” box and "Automatic trim". Change the “surface U and V Span” to the 15 or 20. Click on the “Preview” button to see the surface and to apply the command, press Ok button.



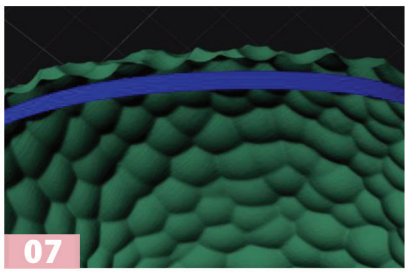


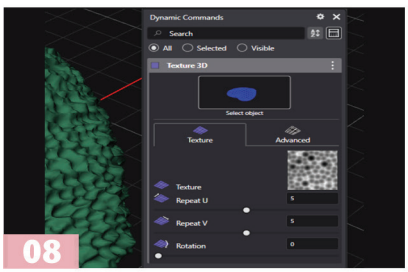


3.Using this technique helps us have a surface without any pole point, where the isocurves of the surface in both directions gather in one place. Now it is time to apply the “Texture3D” to the surface. Select the surface and click on the “Texture 3D” in the “tools” menu. The library panel will open and request to choose a texture.

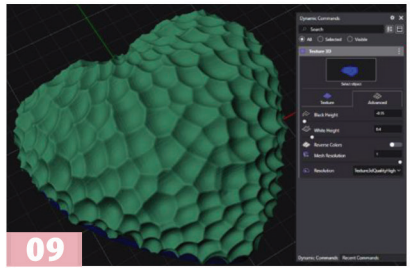


4.Select the texture number eleven (11) and press the select button. Texture will be applied on the surface. However, it is not clear enough to see well. We need to apply some changes. Change the “Repeat U and V” values to two (2). Go to the “Advanced” part and input number one (1) to the “Mesh Resolution”. This section increases the quality of the created mesh from the surface.





5.We need to change black and white values to solve the problem of having gap between displacement mesh and original surface. Black height measures the lowest point from the original surface and white height measures the highest point from the original surface. Divide the desirable distance between the highest point and lowest point between them. So, if we need 0.7 mm, we can input 0.35mm to the white point and -0.35mm (notice to the minus) to the black point. To finalize the job, just press the “Enter” key. This is an open mesh object. To create a close mesh and a printable version, use the “Offset mesh” command.



Smart Pattern:

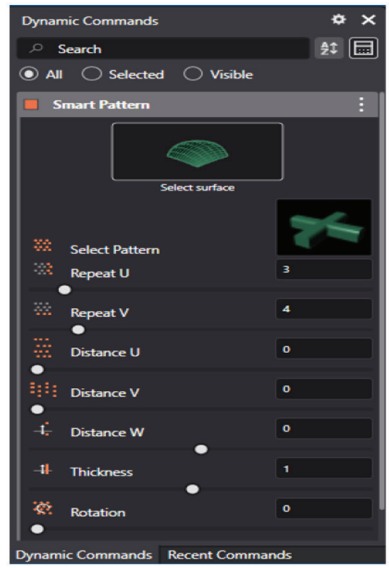
This command helps you array any object along the U and V direction of the surface. You need to change some parameters like repeat U or V and rotations to have a desirable result.

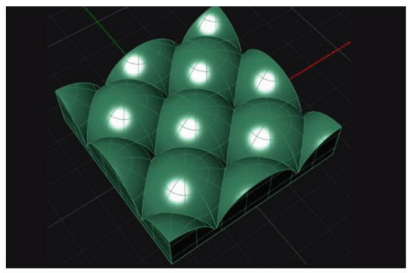
This command is parametric version of “Array along the Surface” in the “Array” menu.

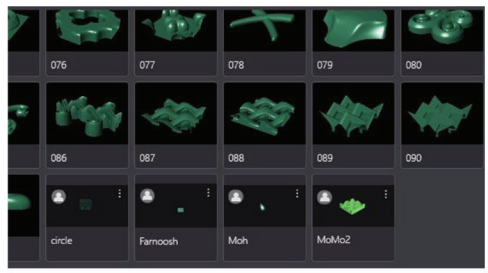
To access the pattern library, you need to click on the box in front of the “Select Pattern” section and choose one of the existing patterns provided by the MatrixGold.

If you desire to add new object to the library, you must make your object inside a 5 by 5 rectangle and at the origin point. Then, you need to save it to Documents/MatrixGold/Library /SmartPattern folder.

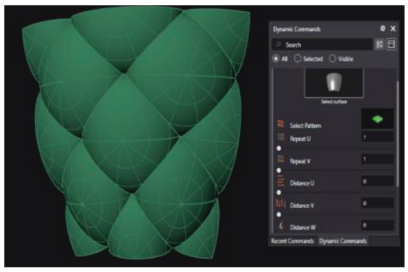
Now if you open the Smart Pattern library through the command, you will see your object.

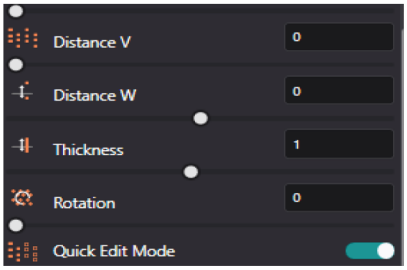






By activating the “Quick mode” feature, you can see the changes faster and more conveniently.



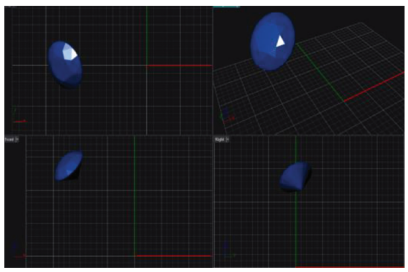


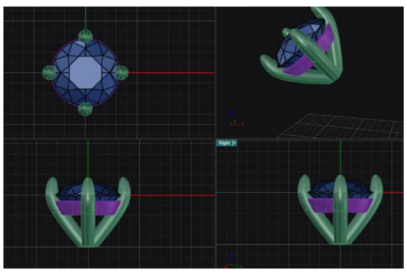
Gem View and Surface View:

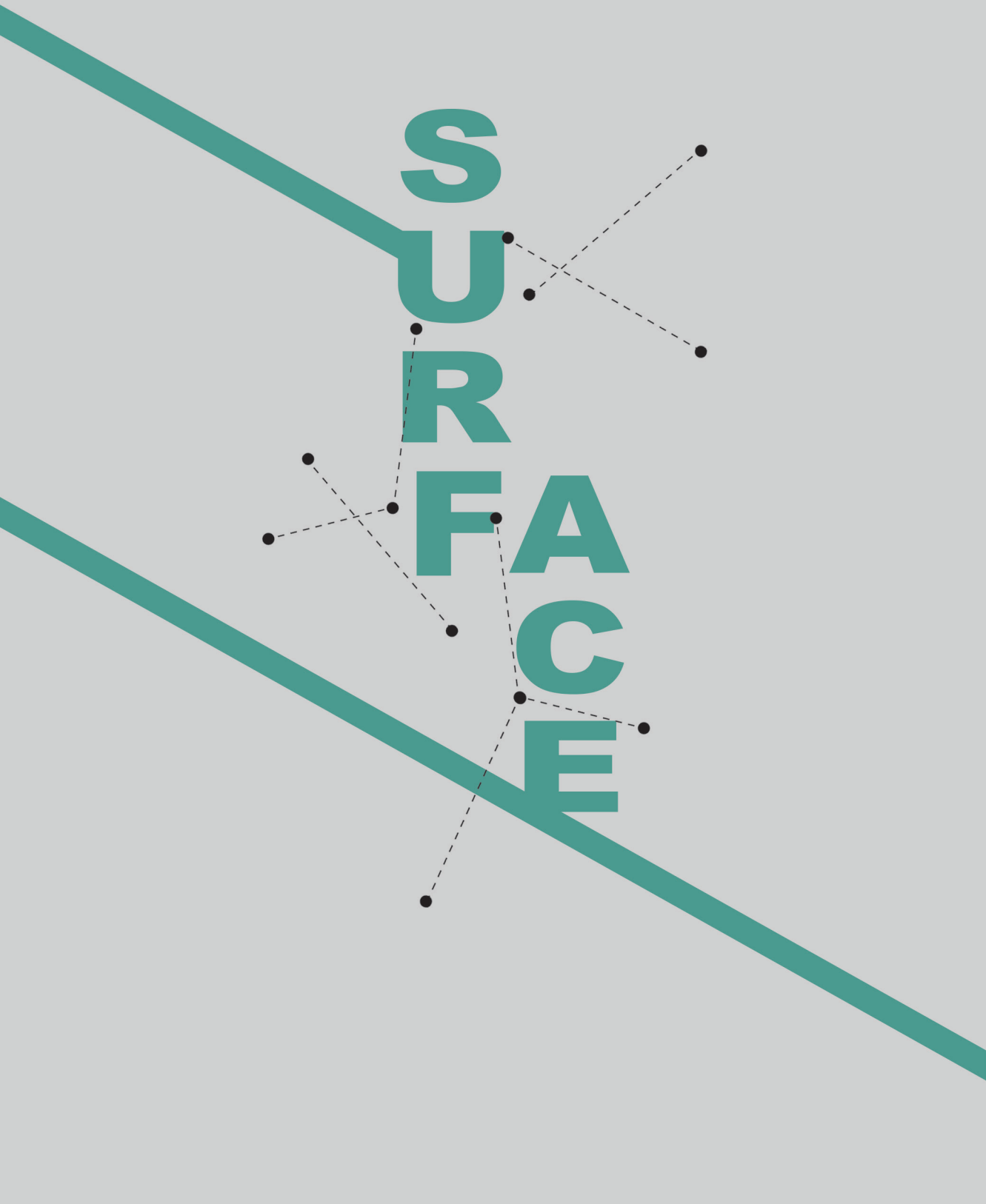
One of the most interesting featutes in the MatrixGold is that you can relocate your construction plane from the world origin and place it anywhere that you want. This feature helps you apply commands to the objects according to the active Cplane.

To apply a new Cplane to a Gem, you need to select a gem and then click on the “Gem View” command. All parallel viewports (top, front and right) adjust the camera to the new Cplane. However, the perspective viewport remains unchanged.

Let’s clarify this option with an example. Imagine you would like to place a customized prong around the gem in 3D space. Drawing a curve in this condition is frustrating. Now the “Gem View” command assists you to move the Cplane to the gem and place the camera perpendicular to it. As you are drawing the prong in parallel viewports, it will apply to the perspective as well. Look at the photo above, if you look at the top, front and right viewports, itseems that the gem is in the center of the world. But if you look at the perspective, you will see that the gem is in a location in 3D space. This is what happened after applying the Gem view command. Now, it isit is easy to draw a claw and array it around the gem. To exit the gem view and reset the view ports, just click on the Gem View again while not selecting any objects.



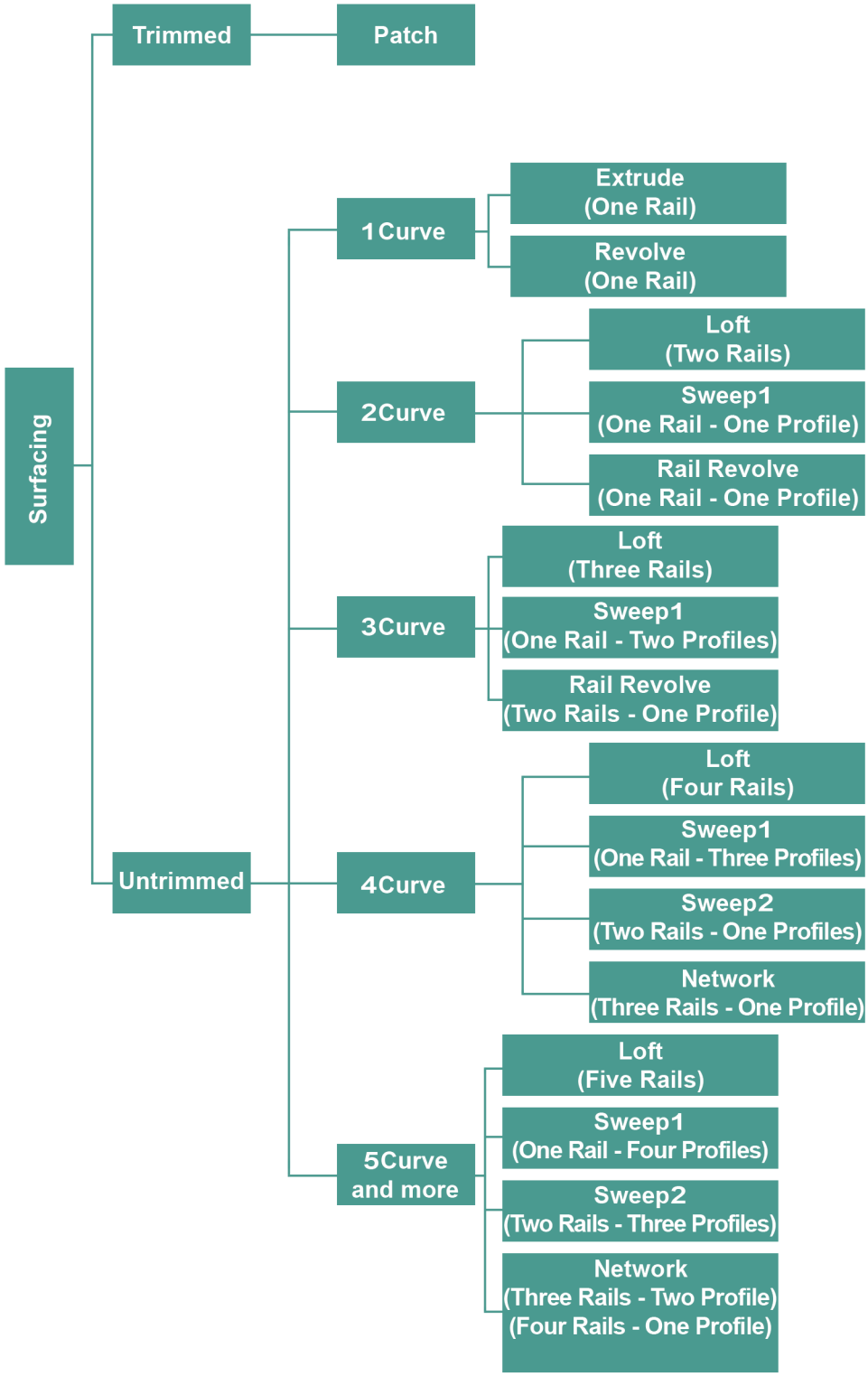



SURFACE

PRACTICE: Surface

What is the “SURFACE”?

As it is discussed earlier, after making a single curve,
we need to convert it to a single surface...

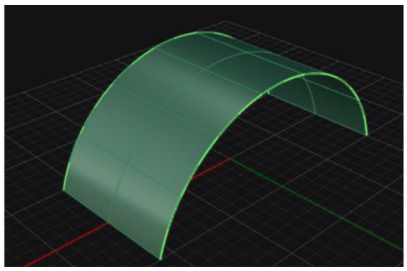

Surfacing
Trimmed
Patch
Untrimmed
1Curve
Extrude
(One Rail)
Revolve
(One Rail)
2Curve
Loft
(Two Rails)
Sweep1
(One Rail - One Profile)
Rail Revolve
(One Rail - One Profile)
3Curve
Loft
(Three Rails)
Sweep1
(One Rail - Two Profiles)
Rail Revolve
(Two Rails - One Profile)
4Curve
Loft
(Four Rails)
Sweep1
(One Rail - Three Profiles)
Sweep2
(Two Rails - One Profiles)
Network
(Three Rails - One Profile)
5Curve
and more
Loft
(Five Rails)
Sweep1
(One Rail - Four Profiles)
Sweep2
(Two Rails - Three Profiles)
Network
(Three Rails - Two Profile)
(Four Rails - One Profile)

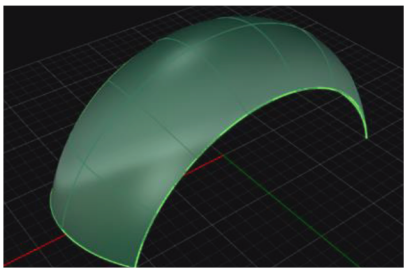
What is Surface?

As it is discussed earlier, after making a single curve, we need to convert it to a single surface.
This section focuses on the most critical “Surfacing” commands, and we will learn them entirely. They are “Loft,” “Sweep1”, “Sweep2,” and “Network.” Choosing appropriate surface commands and using them correctly are considered your winning card.
But before jumping to explain the commands, we need to know some expressions about the surfaces.

Single Curvature vs. Double Curvature Surfaces:

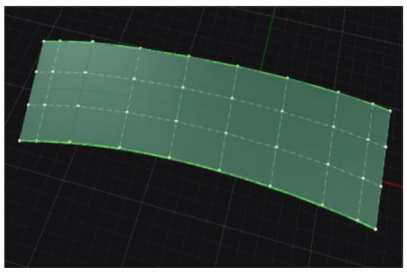
Every surface in the MatrixGold has two directions that we call UV. Suppose one of them is straight without any curvature. In that case, we call that surface a “Single Curvature surface". These surfaces are developable. You can use the “Unroll Surface” command to flatten them within the tolerance. On the other hand, if both directions have curvature, neither of themis straight; we call this kind of surface the “Doubly Curvature.” They are not developable. You cannot flatten them within the tolerance. However, you can use the “Smash” command to create a flattened representative of the surface.

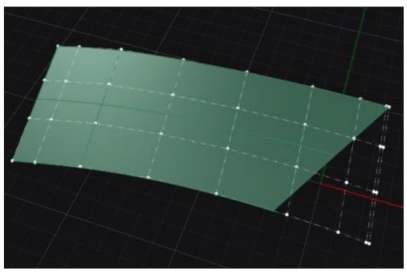




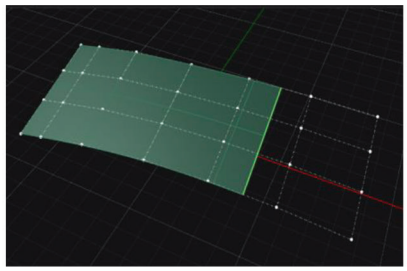
Untrimmed surface vs. Trimmed Surface:

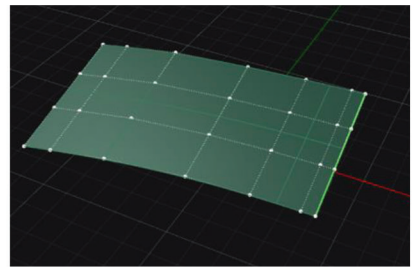
You can make an untrimmed surface if you create your surface using one of the following commands:loft, Sweep1, Sweep2, Revolve, Rail Revolve, and Network command. An untrimmed surface is a surface where its control points all exist on the surface, and it does not have any extra control points outside of the surface edge. We need to have an untrimmed edge surface to apply some commands like the “MatchSrf” or “MergeSrf,”, and hence as a surface modeler, you always need to have an untrimmed surface to control.



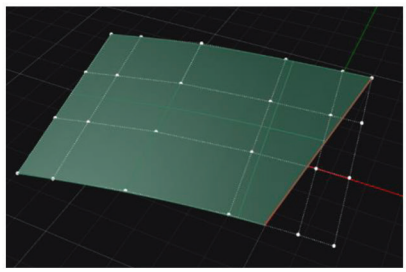


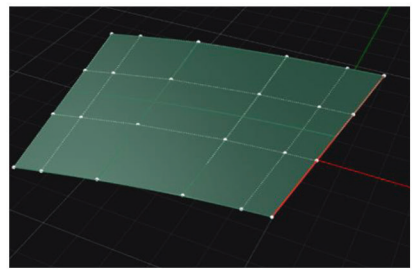
If you trim an untrimmed surface along its isocurve, you can convert this trimmed surface to an untrimmed one by using the “Shrink Trimmed Surface” command.





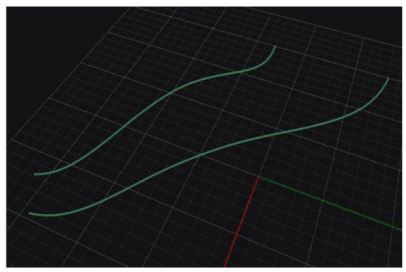
However, if the trimming object is not along the isocurve, you cannot use this command to convert it. You need to use the “Refit Trim” command in this condition. You cannot find this command in the earlier version of the Rhino. This is a new command in the Rhino7.

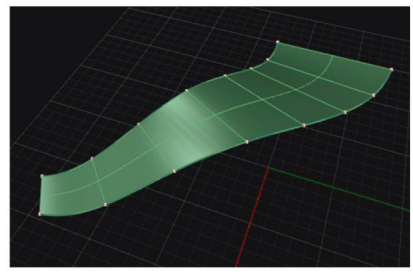




LOFT:

The “Loft” command helps you create a surface between two or more rails without having any profiles or section shapes. The” Loft” command uses the “knot” vectors and the “Control Points” on both curves to create the surface. The designed surface is untrimmed.

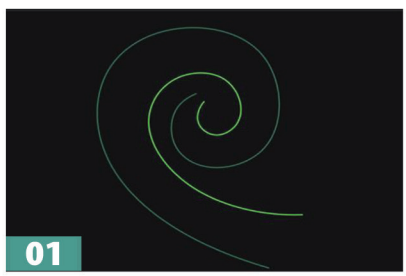


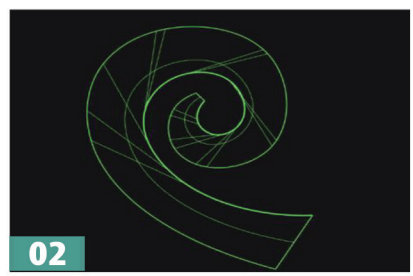


Using the loft command is easy for simple curves. However, the complicated curves have another story. You need to follow some rules.

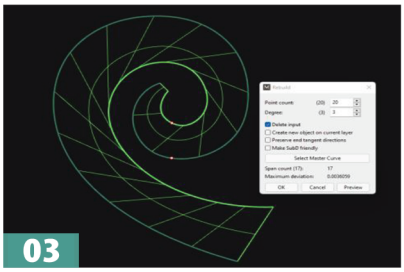
- Let me give you an example to see the result.

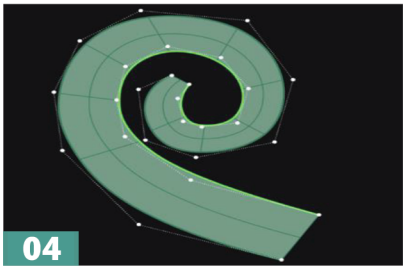
Draw two curves using the “Interpolated curve”, same as the photo below, and apply the “Loft” command.



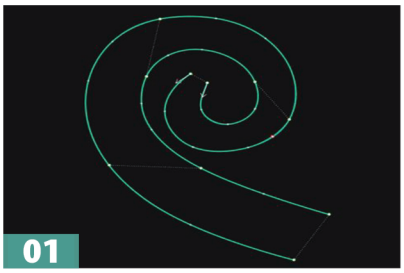


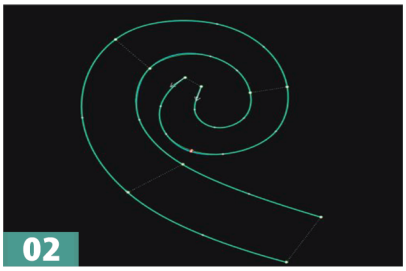
Look at the surface carefully. The isocurves in both directions are not perpendicular or nearly perpendicular. This principle must be considered if you wish to have perfect topology on your surface. Using the “interpolated Curve “command creates non-uniform curves and does not give you any accesss to control the location of the “Knot” and “Control Points.” Even using the “Rebuild” or the “FitCurve” commands is not helpful. It makes the curve uniform, but there is no power to place the knots and control points in front of each other.
To fix this problem you have three ways:
The first solution is to redraw two new curves by using the “Curve” command to define the location of the control points manually. Place the control points in front of each other.

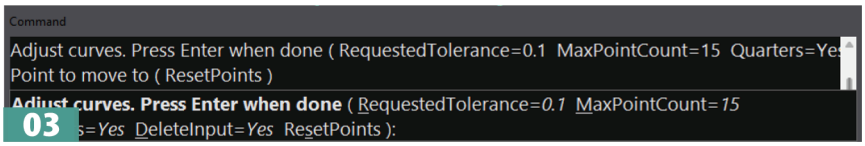




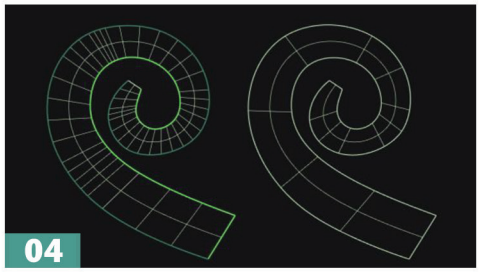
Now the isocurves in both directions are nearly perpendicular to each other, which means we have a good surface for surface modeling.
- The second way is using the “Rebuild Crv Non-Uniform” command. This command will enable the user to move the knots and control points on the curve.
Select two rails, type “Rebuild Crv Non-Unifor,” and press enter. Some lines, which are connecting some points, appear between two rails. Move the endpoints of the lines to stay in front of each other. Put the “DeleteInput” to yes and turn on quarters. Change the “MaxPointCounts” to 15 and then press enter.



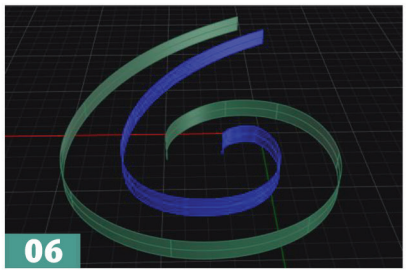


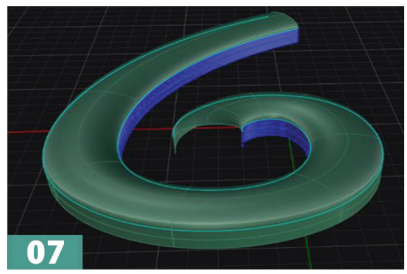


With this command, you can fix the loft issue even between more than two rails.
The third way is using the “Sweep2” command and the “Add Slash” feature. After adding Slash and creating the surface, we need to use the “FitSrf” command with a tolerance of 0.05 to reduce the number of control points. Duplicate the edge and delete the surface. Use the extracted edge for the loft. Now you can have an issue-free loft.

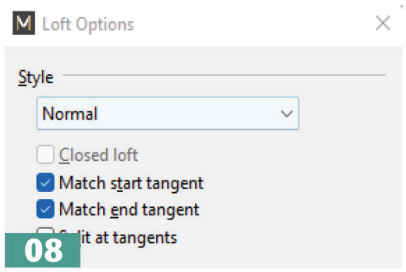


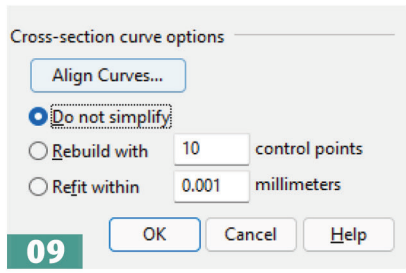
There is an option in the “Loft” command that is very efficient in the surface modeling technique. If you select the edges instead of curves, you can activate a feature in the loft that gives you a dome shape surface instead of a flat one.



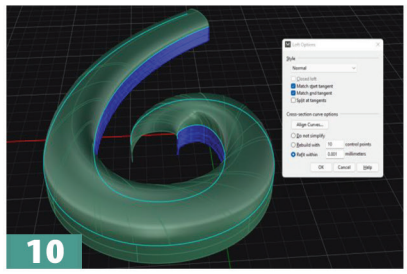


The name of these features is “Match Start Tangent” and “Match End Tangent”. These two options will be active in the loft dialog box after selecting the edges. You cannot choose them in curve mode.





Among the different styles of loft, we always work on the “Normal” mode. We never change it during the lessons. It is the same for the cross-section curve part, hence, we do not rebuild or refit our rails. All rails are drawn manually and with the specific number of the control points. Any changes will destroy your surface.

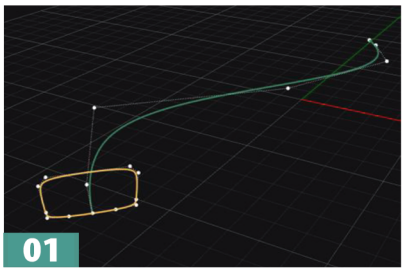


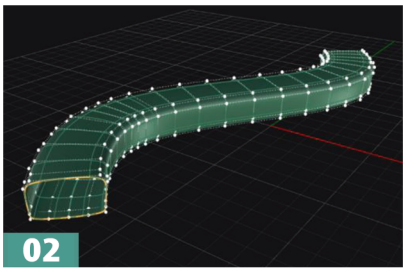
Sweep1 and Sweep2:

These two commands help us create the basic shape of the model in the surface modeling technique. By having many curve drawings and editing tools and features in MatrixGold, you can make any complicated forms and edit them easily. To create a single surface, you need to follow some rules using the sweep 1 and sweep2 commands.

In both commands, the number of the control points along with the profile does not change and remains constant. The rail direction, however, it is completely different and the number of the control points doesn't remain equal to the rail. It happens to keep the surface within the MatrixGold distance tolerance.

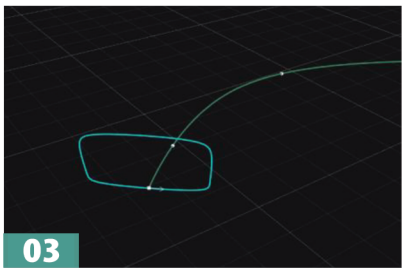
Let us illustrate how it works. Look at the following picture carefully. The profile has eleven control points and the rail has seven control points. Now, we start using the sweep1 command and create a surface.

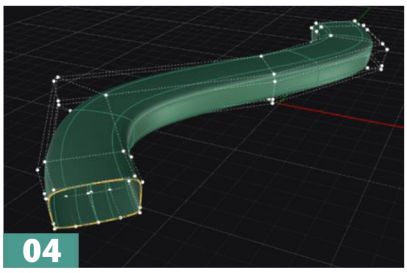

01


02

After applying sweep1, use the F10 key to turn on the control points of the surface and check it. The number of the control points in the U direction remains the same as the profile while in the V direction they have been raised.

There is a particular state that we call the "Simple Sweep". If this occurs, the number of the control points in the V direction will remain the same as the rail. I do not recommend using this feature since we can control them in another way. If you wish to activate the simple sweep, you need to place the seam point of your profile on the "Edit Point" of the rail and deactivate the "Refit Rail" option in the sweep1 dialog box.

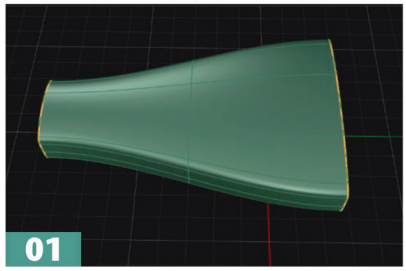

03

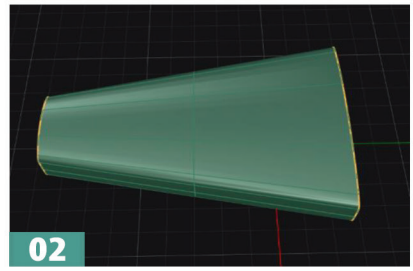

04

Instead of using the simple sweep, I recommend using the "Rebuild UV" or the "FitSrf" command. We will explain this more in following pages.

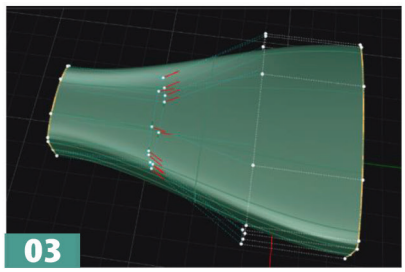
We have an option in the "Sweep1" command that helps us change the way of sweeping between two or more rails. Its name is "Global Shape Blending". This feature is available in many commands with different names, so I highly recommend understanding it well.

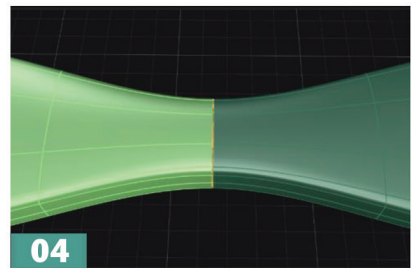
Look at the following figures carefully:



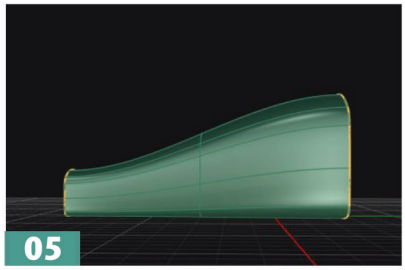


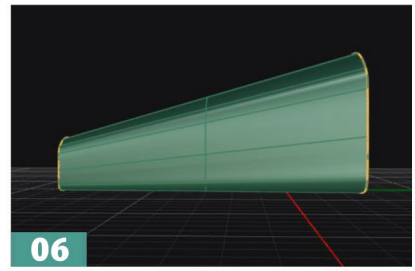
The left figure was created without the “Global Shape Blending” and the right one with the “Global shape Blending”. Basically, the sweep1 command extracts the surface from the profile with the belief that you need a tangency (G1) continuity in the profile location. So, it places the second row of the control points to align with the first row to keep the tangency.



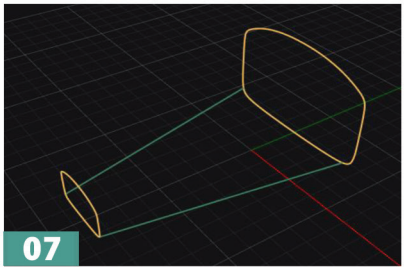


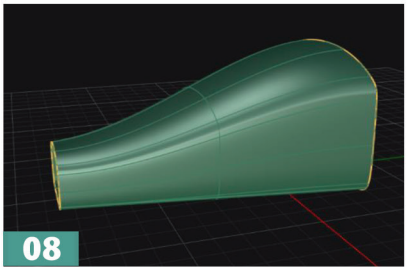
So now if you have a mirrored object, you have a G1 (Tangency) continuity there. This is the default behavior of the “Sweep1” command. If you do not like it or need a linear connection with G0 continuity, turn on the “Global shape Blending”.

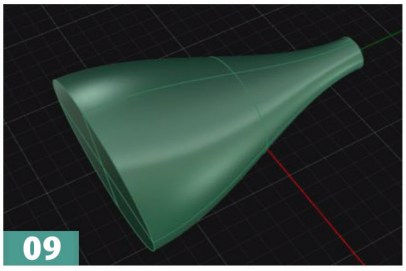


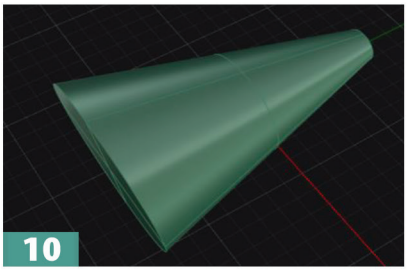


The “Global Shape Blending” affects all aspects of the surface in any direction.
This phenomenon occurs in the “Sweep2” commands too. In the “Sweep2” you can control two sections of the surface. Other sections connect in a way that follows the tangency continuity if you turn on the “Maintain Height” option in the dialog box. In the following figure, upper part of the surface connects two profiles in G1.
If you do not activate the “Maintain Height” option, the rail-free part of the surface is associated with the width scaling, closer rails, lower height, and further rails, higher height.
This phenomenon occurs in the pipe command as well. If the “Shape Blending” option in the command bar is set to the “Local”, we have tangency continuity in the pipe. In the “Global” state, we have linear or G0 continuity.



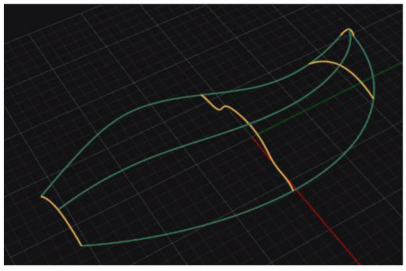


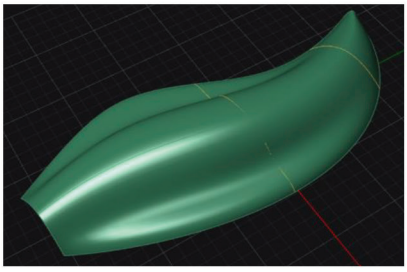




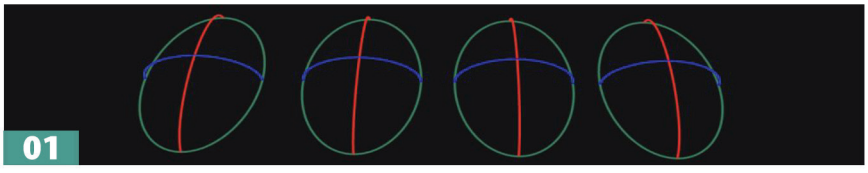
Network:

Last but not least, the command on the surface creation is the “Network” command. This command gives us an opportunity to create the complex surfaces with the infinity number of the rail and profile. If you refer to the chart at the beginning of the chapter, the “Network” command doesn’t have any rail limitation. You can use more than two rails to control your surface.
All curves in one direction must cross all curves in the other direction and cannot cross each other. To run this command, simply select all curves in the network. If the command cannot figure out the curve orders, it will prompt you to select curves in one direction and enter; then select in the other in a perpendicular direction.

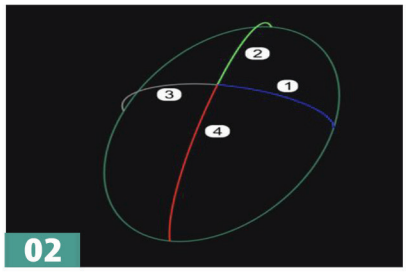


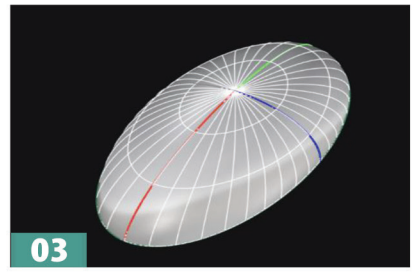


The advanced part of the network command refers to the different surface topologies. Different topologies in different states is needed to be able to entirely understand the “Network” command, follow the steps and see the result.
Draw an ellipse with two arc-shaped curves and duplicate in four as below.

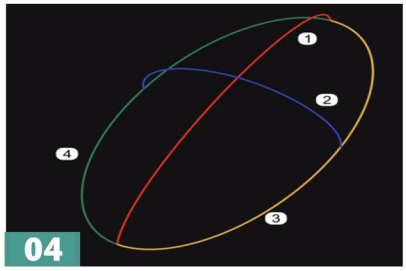


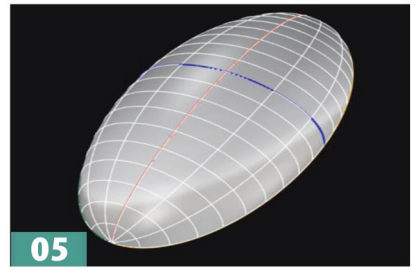
Select one of them and split the red and blue curves by each other. Now, you have four rails and one green profile. They match the network rules. Select all curves and run the “Network” command. As you can see the pole of the surface is on the top, which is gathering point of the rails.



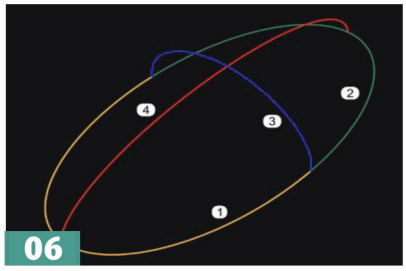


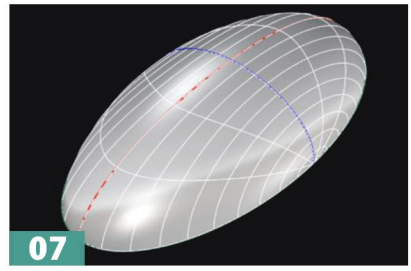
Select the second group of curves and now split the green curve by the red line. Select all curves and apply the “Network” command. Now we have two poles in the surface. The place that rails meet each other.



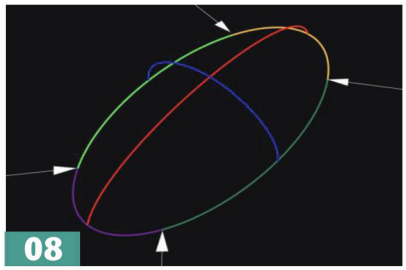


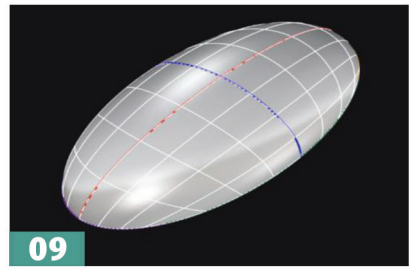
We reached to the third group of curves. Split the green curve by the blue curve. Select all curves and apply the “Network” command. Still, we have two poles.



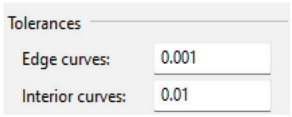


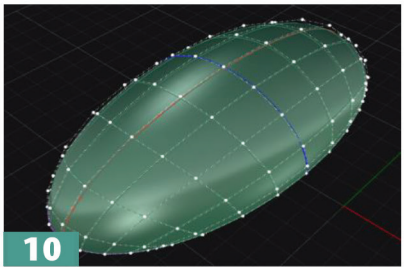
Select the fourth group of the curves and split the green curve like the following photo. Select all curves and apply the “Network” command. There is no pole in these kinds of surfaces.

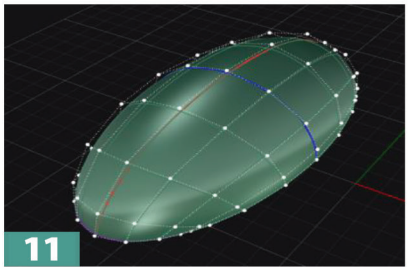


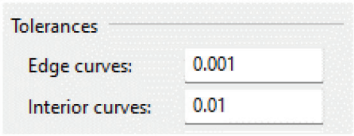


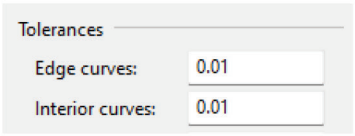
As you noticed, you can create different surface UV layouts by selecting different curve arrangements.
There are a few options in the “Network” dialog box and tolerance part that help you manipulate the number of control points to use in the surface modeling.
The “Edge Curves” tolerance option refers to the curves that touch the edge of the surface. It defines how accurately the edge of the surface touches these curves. By default, it has been set to the absolute tolerance of the MatrixGold, which is 0.001unit. Therefore, if you measure each point of the surface edge to the corresponding one on the curve, it is not over 0.001unit.
The “Interior Curves” tolerance option refers to the curves that pass through the surface. It defines how accurately the surface touches those curves. Changing these two tolerances helps you decrease and increase the number of control points.





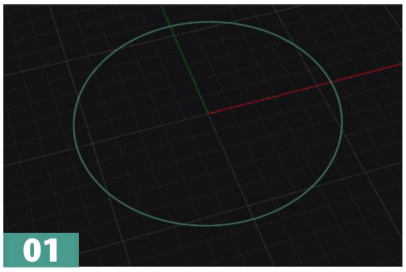


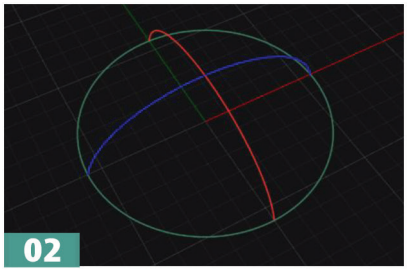




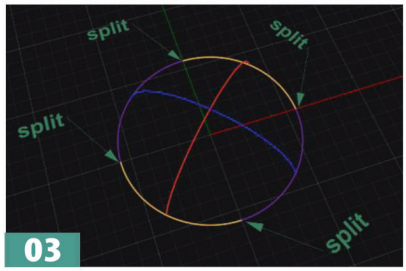
Faceted Stone:

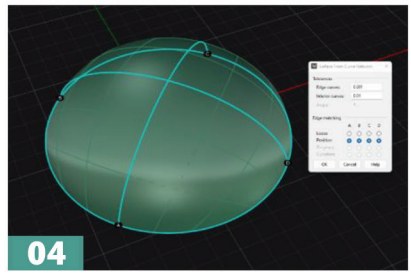
In this exercise, I want to use the Network command to create a faceted stone known as a checkerboard. After drawing the curves as below, make a circle and then draw two arc shape free from curve from the quad snap points.

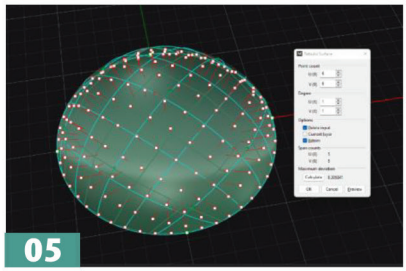


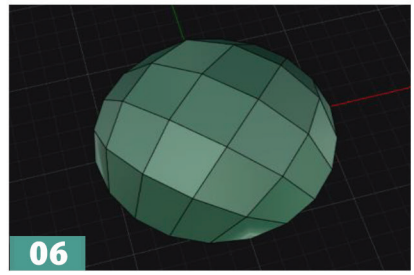


Rotate all curves 45 degrees and split as the following figure. Then, select all curves and apply the “Network” command.
Rebuild the surface as the following dialog box figure. Please note that we change the degree of the surface to one.



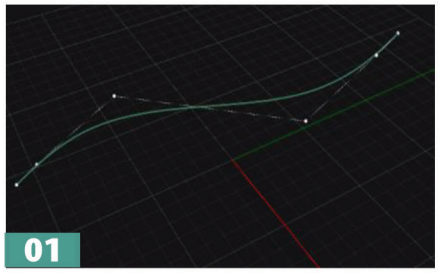


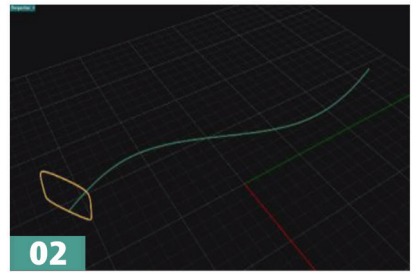


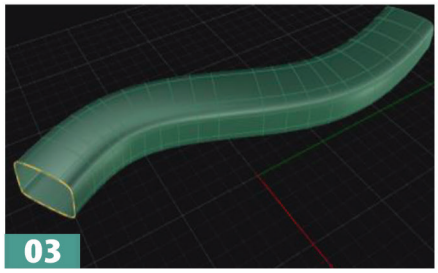


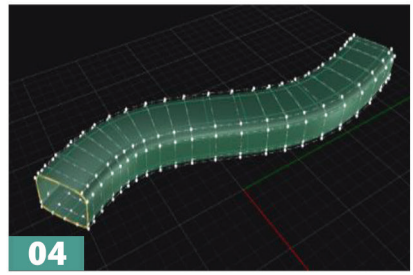
Surface Analyzing:

Draw a curve by using an “Interpolated Curve” command as a rail. A good surface modeler tries to draw the curves with more minor control points but enough.
Use the “profile placer” command to orient created profile on Rail.
Use the “Sweep1” command to create a single surface.
Remember that in creating sweep one surface, we have the same number of control points in the profile direction and extra control points in the rail direction.



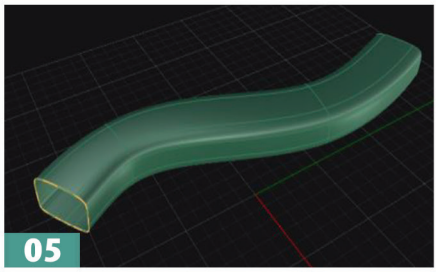


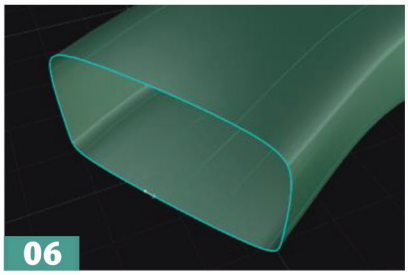




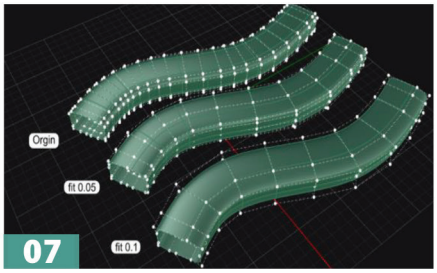
Important: If the sweep1 command encounters a surface below, you need to slightly move your profile or change the profile to seam out at the midpoint. This is a situation in which the surface’s control points equal a “Rail” control point: “simple Sweep.” In MatrixGold, it happens automatically if the seam point and edit point of the profile are precisely placed on the edit

pint of the rail. We do not follow “Simple Sweep.”

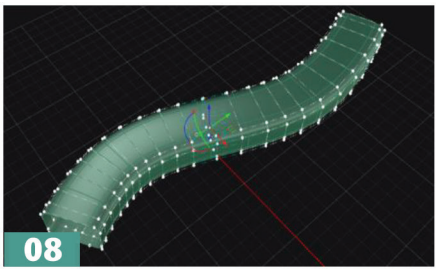


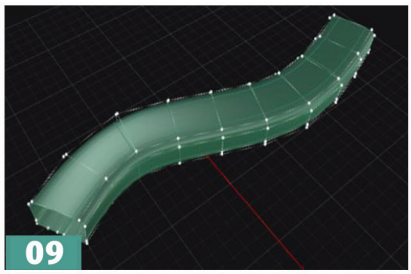


We need to control the number of control points of the surface by using the proper command.
Similar to a curve, first, we try the “fitSrf” command. This command helps to reduce the number of control points in a non-uniform way in both surface directions (U and V). Where we need more curvature, where it keeps control points there and uses other control points to delete them. Selecting a proper “tolerance fit” is very critical. This number varies when you have different surfaces.
Look at the photo above. In this example, we used two different “Fitting Tolerances.” Our selected one is 0.05 despite 0.1 having fewer control points. In 0.1, we have a messy control point arrangement.



Instead of using the “fitSrf” command, we can manually delete control point rows in two directions (U or V). It is a perfect choice when “fitSrf” cannot provide you with a suitable surface, or it fails.
Note: you cannot delete control points individually. You need to delete them in the complete U or V direction row.

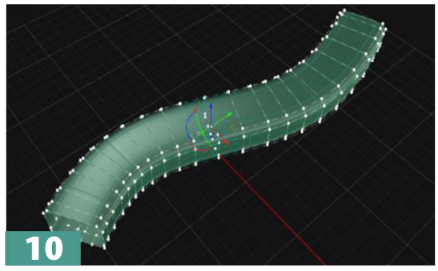


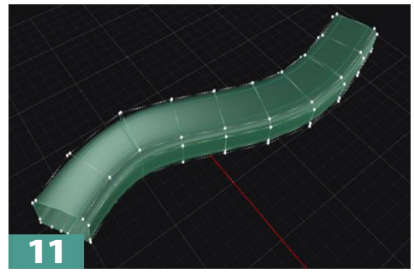


Did you find it frustrating? Did you notice that deleting control points causes surface distortion? Therefore, here we have another technique to reduce the number of control points manually. You can use the “Remove Knot” command. This command helps to delete extra control points without any distortion. Be careful of critical knots in curvature spots. If you delete them, you make a change in your surface.

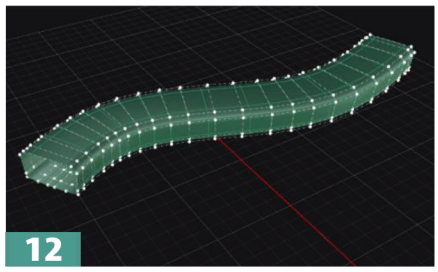
Important: Remember that "knots" are entirely different from control points. Deleting knots causes reduction in the control points, but after removing knots, control points will have new position.

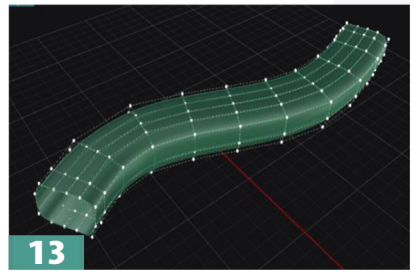
You need to execute the "Remove knot" command to use this command. Then, select your surface, and you will see white lines on the surface. They are surface knots. You can toggle between two directions by using the "Toggle" option in the command bar. Start clicking on the unwanted knot, and they will be deleted from the surface.


10


11

Remember that you do not need to change the number of control points along the profile direction. We made our profile manually and carefully in the previous step.
I am sure that you wonder why we did not use the "Rebuild" command instead. The answer is simple. The reason is the same as in the curve section we explained. When we apply the "Rebuild" command, it will rearrange control points uniformly and does not care about your surface curvature demand. The worst part is that the "Rebuild command" does this action simultaneously with profile and rail direction. We do not need any rebuild along the profile direction, as we already mentioned.

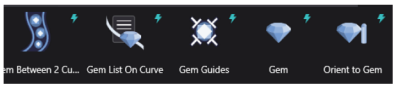

12


13

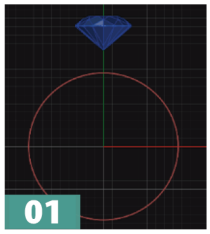
After using the "Rebuild" command on the surface, we have an entirely new control point assembly far from our demand. We drew our profiles carefully in the previous step, but the "Rebuild" command destroyed everything.

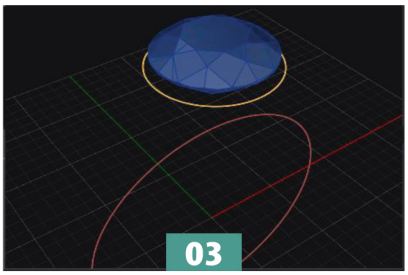
Practice 3
Halo Ring

Select the “Ring Rail” command from the “Tools” menu and choose your desired size for your ring. Go to the “Gems” menu and select a round diamond.

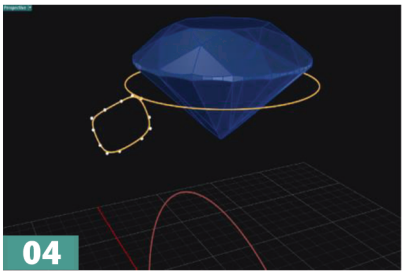


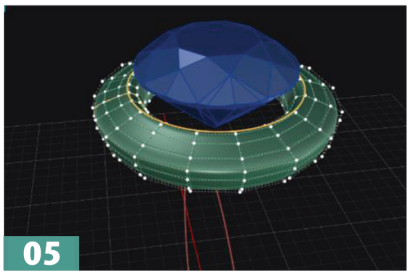
Now we need a circle around my diamond. I can make it with the “Circle” command or with the “Gem offset curve” command in the “Gems” menu. Then place a profile you created before and save it in the “Profile Placer” library. Then do “sweep1.”

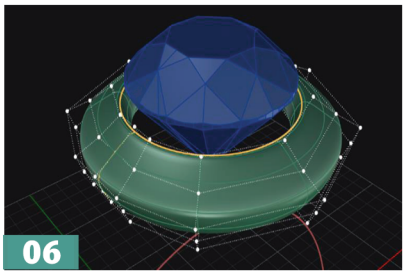


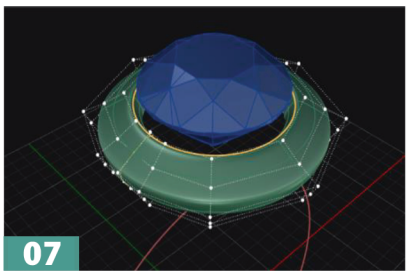


After the sweep1 command, you see that created surface has the same control points along with the profile, but we need to reduce them along the rail. In this case, we can use the “fitSrf” command and use the 0.05 fitting tolerance. Notice that this number is not predefined. You must try some numbers from 0.01 to 0.09 or, in some cases, 0.1 to 0.5. The new surface must have appropriate control point positioning. If the “fitSrf” command does not give your desired surface, you need to try another command. Even in some conditions, the “fitSrf” command cannot precisely provide you with what you want. This is an auto-generated command.

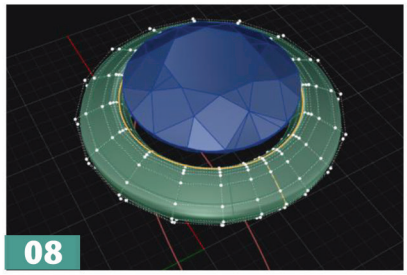


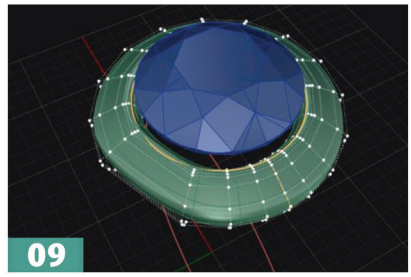


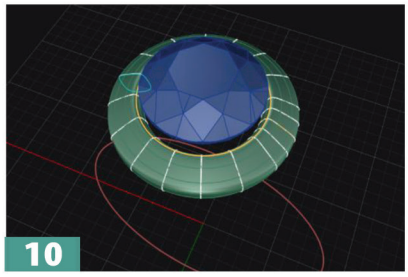


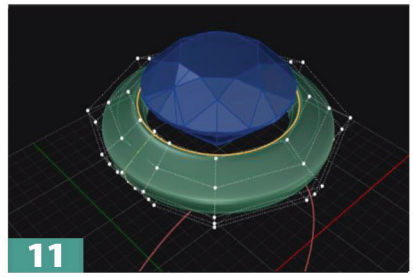


In this case, doing the “fitSrf” command in 0.01 and 0.05 has the same result. But as you can see, the “fitSrf” command applies these changes in both U and V directions. What if you want it just in one direction? Just along the rails. What about using the “Remove Control points” or “Remove Knot.”? Let us try to remove control points first.

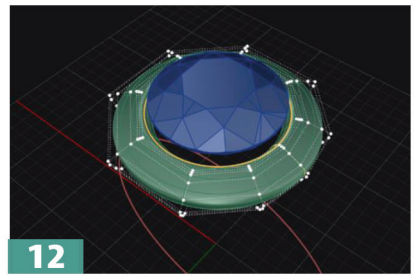








Now turn on the control points of your surface. As you can see, we deleted extra control points along the rail, and now we have the controllable number of points. So, you need to remember that if you want to change in one direction, the “fitSrf” and “Rebuild” commands are not good choices. Both commands work in both directions at the same time. Is there any command that can give us separate control in either direction?



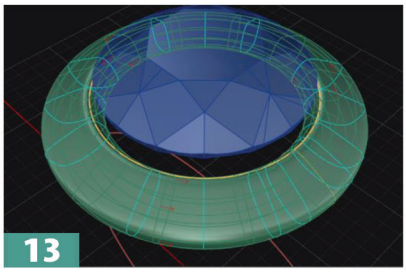
The answer is “Yes”. Let us introduce the “Rebuild UV” command.

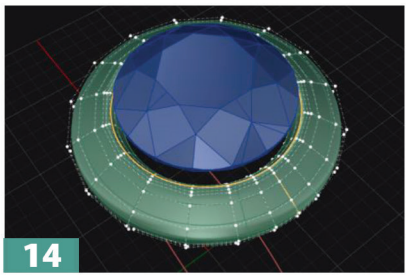
REBUILD UV:

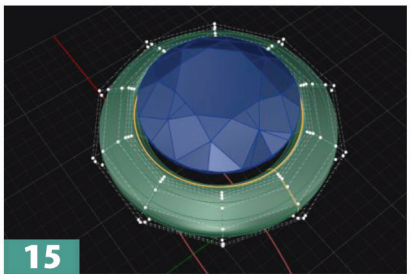
Use this command and you can quickly rebuild your surface in a separate direction . For instance, if you require to rebuild the U direction along the rail, you need to find the “Rebuild UV” command in the “Edit Surface” menu and click on that. Then, look at your surface and follow the instructions.

Look at the picture carefully. After clicking on the command, you will notice two arrows on your surface. They are showing U and V directions.
Each surface has three directions, UVN.
U direction is shown by the “Red” arrow and V direction by the “Green” arrow. In this command, you cannot see the “N” direction that we call the “Normal” surface. If you want to see the normal direction, use the “dir” command.

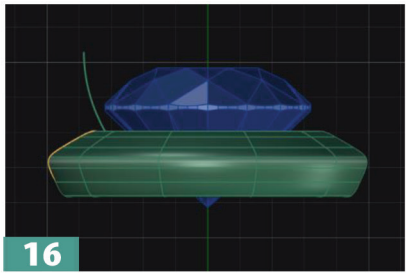
So now we want to rebuild our surface in the “U” direction along the rail. Refer to the command bar, and in the command option, choose the U direction. Click on point count and determine your desired number of control points.


13


14


15

So, now you are familiar with all the essential commands. Now, let us complete the ring.
To make the prong for your mail stone, you can draw a curve and use the pipe command with the cap option in non and one-millimeter diameter.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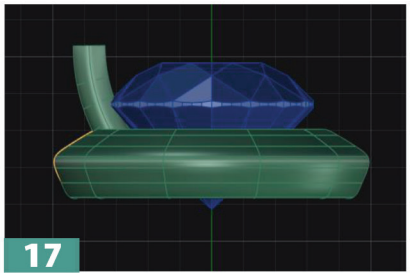
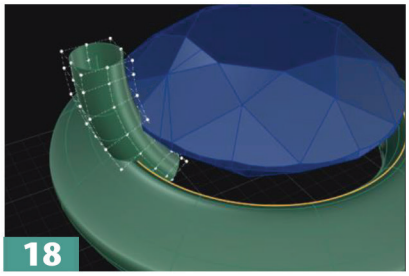

17

So, we need to change the control points layout on the prong. We can use the “Rebuild” command because we need to simultaneously rebuild our surface in two directions.
In the example, as you can see, the U direction is vertical. Therefore, we need five control points along U (red) and eight control points V (green) direction.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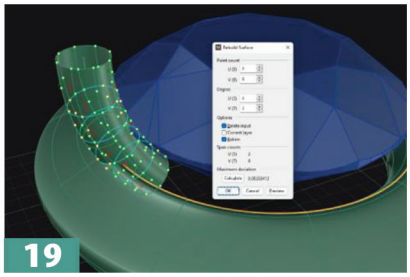
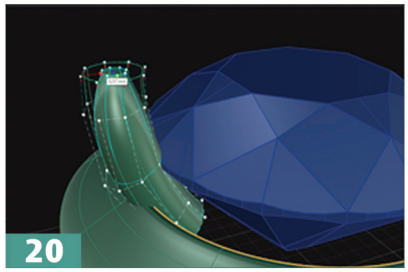

19

Select the last loop of the control point and use the scale handle and shift to scale3D in your Gumball so you can collapse control points and gather them in one point. Ensure your “O’snaps” and End options are on.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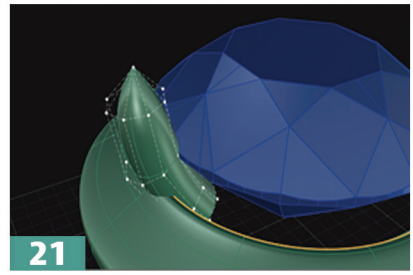
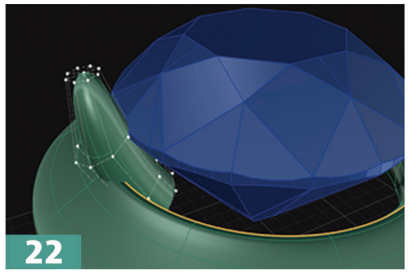

21

Move that collapsed point down and place it in the middle of the below control point loop. Select them and scale them down. Now you can play with your control points and change your surface shape.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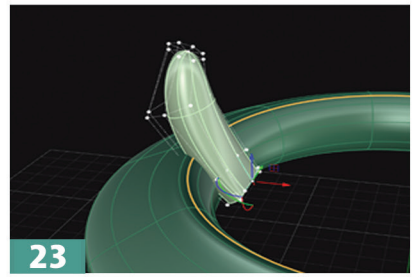
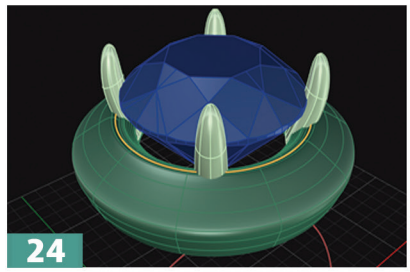
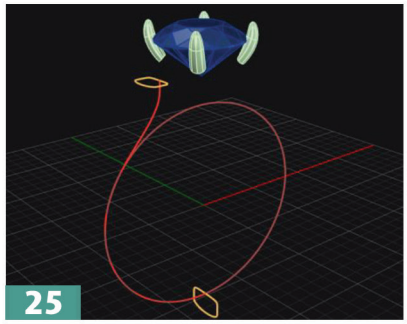

23


24

Now we need to make a shank for our ring. Draw a curve using the “interpolated curve” command and place the profile using the “Profile Place” command. Use your already made profiles, and the “sweep1” command to create your surface.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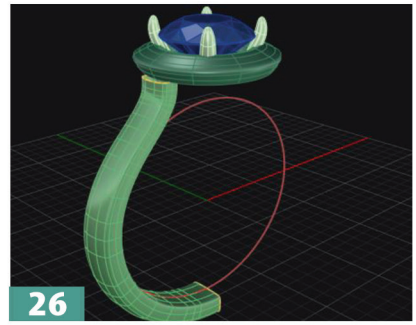
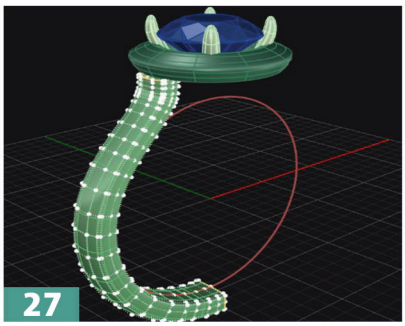
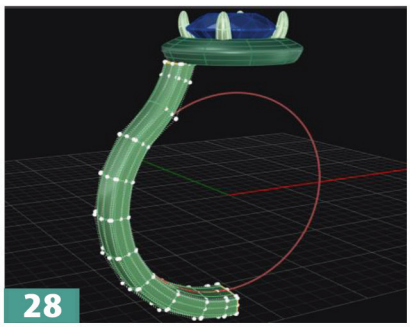
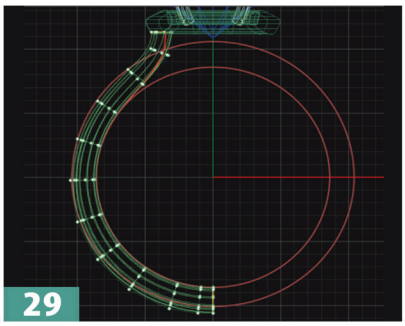

26

So, now we need to use the same technique that we used for halo. Do you need a change in U and V at the same time? No, we need to change just along the rail. Thus, the options in front of your eyes are “Remove Knot” and “Rebuild UV”. I choose to use “Rebuild UV” with twelve control points along the rail. We need to manipulate our surface after rebuilding to have an acceptable one.


27


28

Use the “Outside Ring Rail” command to fix the shank shape thickness according to our demand.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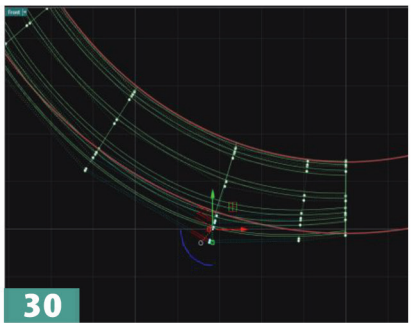
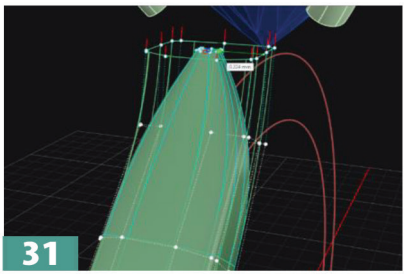
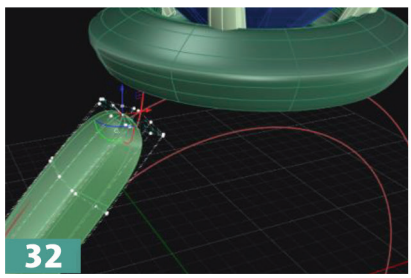

30

Select the last loop of control points, collapse them into one end, and shape your shank.


31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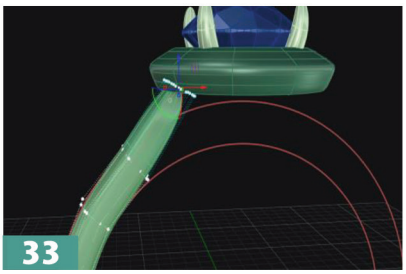
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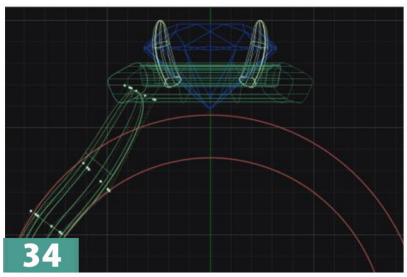
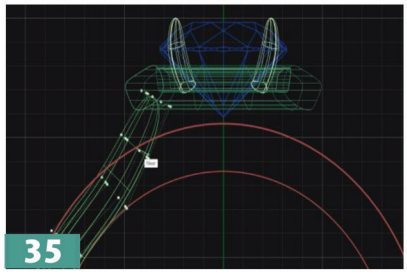

34

But now, we need to use the “Insert Control Point” command to add one new loop to the top end of the shank.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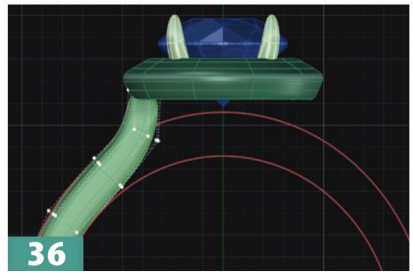
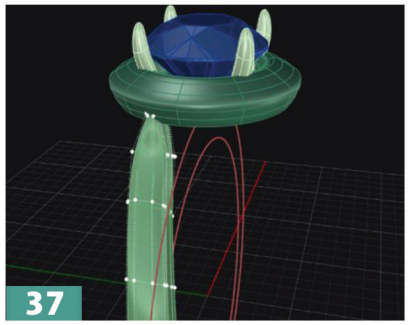
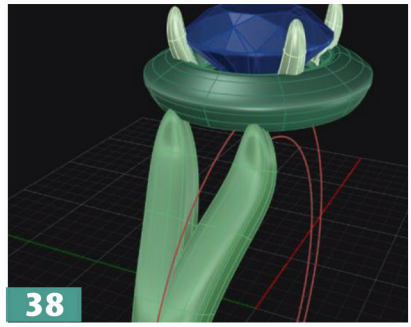
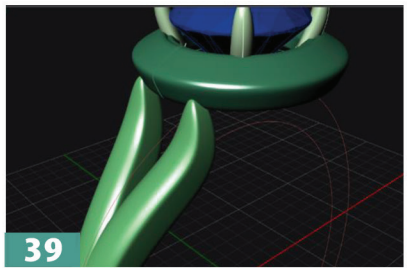

36

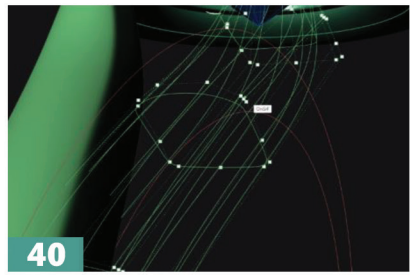
Now by moving the control points around, design your shank. For instance, let us make a split shank. You just need to select control points loops and move them to the left, then mirror it.


37


38

If you require a sharper edge for your shank, you can easily use the “Insert Control Point” command along the rail.


39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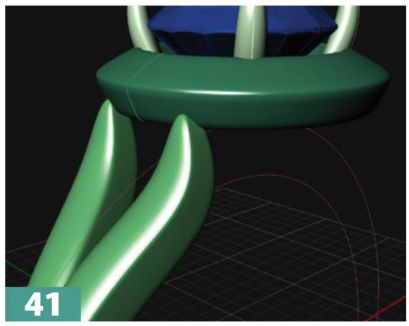
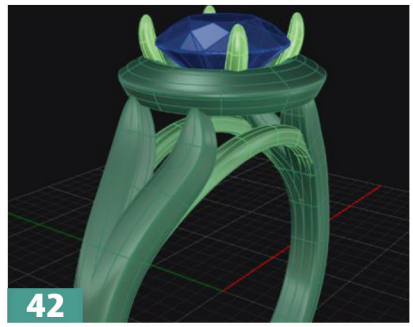
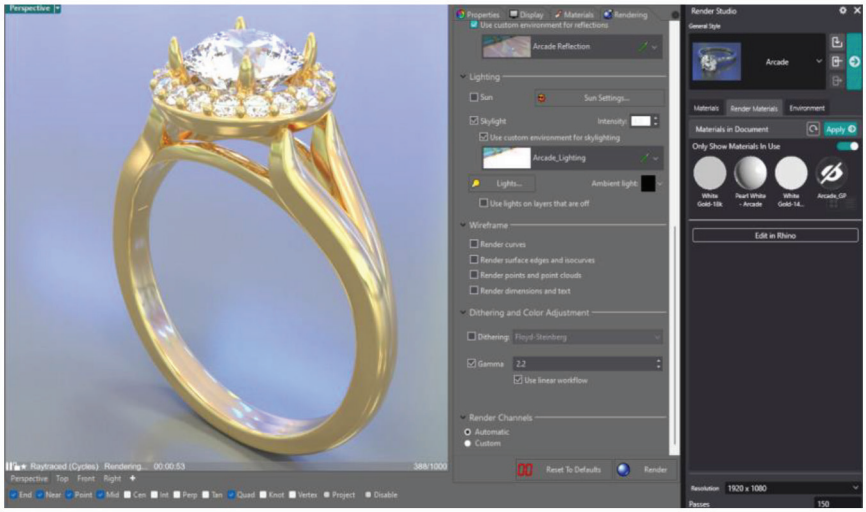

41

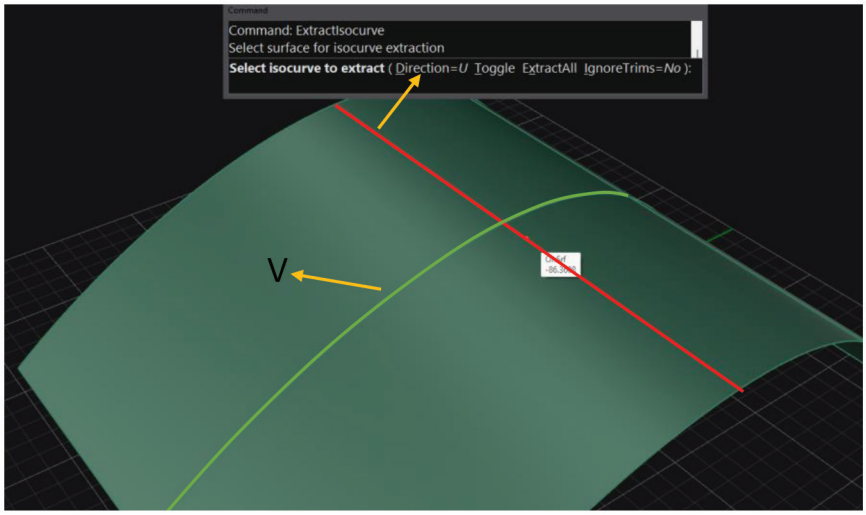

42

We inserted control points for the halo and shank to have their edges sharper.

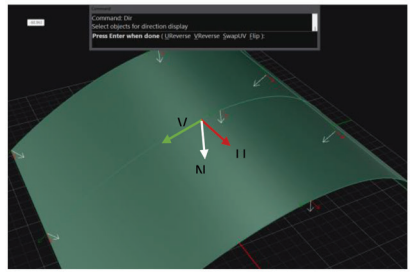


Now I would like to teach more commands to help you control your surface much more accessible. These commands allow you to quickly move your control points along the “Control Polygon, UVN, View, C-plane, and World”. These features enable you to make and edit more complicated surfaces. However, before we start explaining these commands in one example, I need to introduce a few essential expressions.

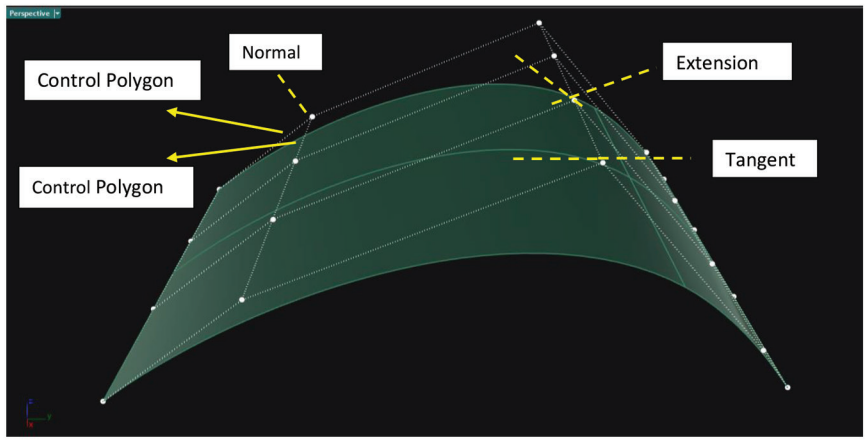
Every surface in the NURBS system has three directions. Two of them are represented by isocurves on the surface. The “Extract Isocurve” command and built-in toggle option show these two directions, which we call them “U” and “V”. Basically, we cannot recognize which direction is either U or V, this is a computer-based process. However, the “Extract Isocurve” can show which direction is U or V.



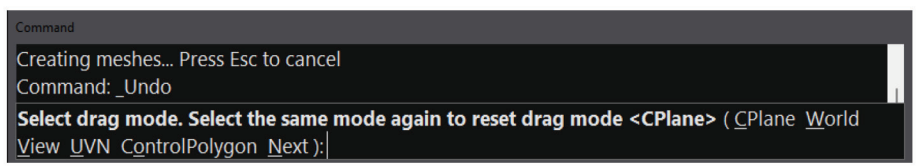
The “Dir” command helps you change and swap the directions of the surface. The green arrow shows the V direction in this picture, and the red shows the U. By clicking on the “U Reverse” and “V Reverse”, you can change the direction of V or U, and even you can swap them.

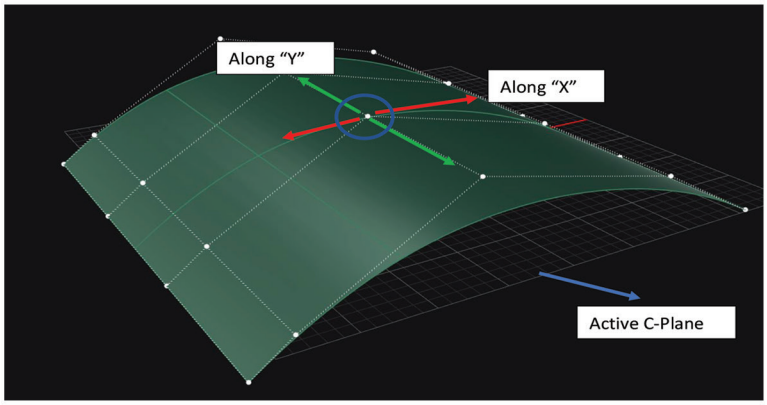


The white arrow shows the “normal” direction of the surface. This direction always is perpendicular to the surface and creates a 90-degree angle with the surface—many commands like the “OffsetSrf” work with the surface normal. We will talk about this topic more.
Despite UVN directions, we have more expressions to talk about. Look at the picture below.

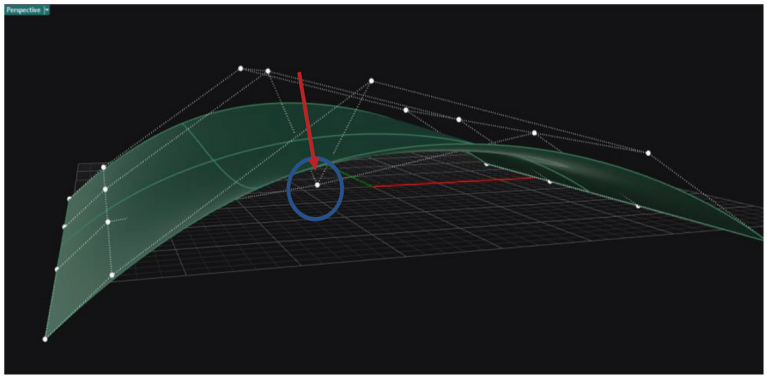


Control points can move along their “Normal”, “UV”, “Control Polygon”, “Tangent”, and “Extension”.
If a control point moves along its Normal, it always follows a perpendicular way to the surface.
Moving control points along the normal surface is very valuable. It assists you in having some complex shapes in a minute.
The main question is that what is moving our control points along the Normal. The answer is by using the “Drag mode” and “Move UVN” commands.
Let us start with the “Drag Node” command. You do not need to turn on your Gumball to use this command, just drag your mouse. This command offers you five different dragging options.
By default, your dragging is adjusted to “C-plane”. If you select an object or a control point and start dragging, it goes parallel to the construction plane. Look at the picture below carefully and follow the steps to understand it entirely.
First, draw a surface the same as the photo and turn its control points on. Please select one of the control points and drag it to go to the left and right. You definitely cannot move it up and down. Why?! Because dragging happens on C-plane, and it just moves along the Top C-plane as the active one.

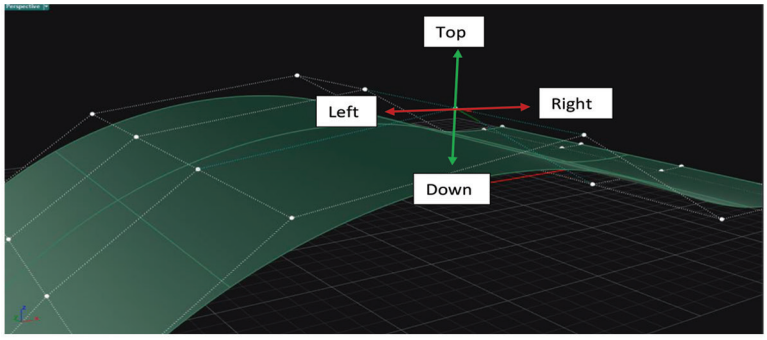




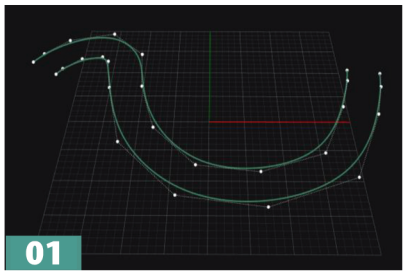
The second dragging option is the "World". If you select this option, a small "w" indication will appear near your cursor, which means the "World" dragging is active.
Dragging in this option will push the controls to point to the XY plane of the world. We rarely use this option, and I recommend not to activate it at all.

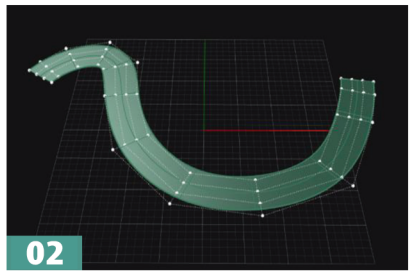


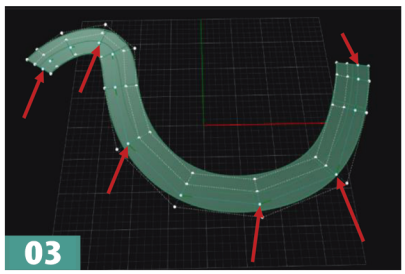
The third one is the "View" mode, which is incredibly important and helpful for our surface modeling techniques. This dragging feature helps you move your control point parallel to the "View Plane". You may wonder about the difference between the "View" and "C-plane".
Unlike the "C-plane" mode, which is the default dragging method, in the "View" mode, you can also move your control points up and down, assuming it is controllable.
To activate the "View" mode, type "Drag Mode" and then click on the "View". After that, the "View" mode indication will be shown beside the cursor.

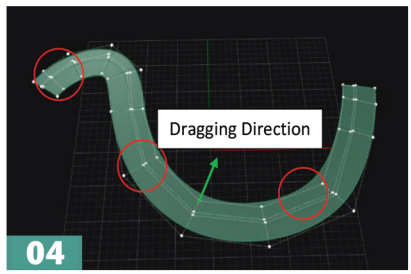


It is highly recommended that you activate it if you want to move your control points freely and controllably.
The fourth mode is the “UVN”. This mode, along with the “View” and the “Control Polygon,” is an essential method. When you activate it by clicking on it, a “UVN” sign will be shown beside the cursor. This mode is tricky and to understand it, you need to fully pay attention them. As discussed before, each surface has three directions called “UVN”. U and V are along the surface Isocurves, and N is perpendicular to each point. We want to move a control point, U or V and N.
Please follow these steps to make the desired surface.
First, draw this curve using the “Interpolated Curve” command.
Second, apply an “Offset Curve” on the curve with the “Loose” option and then “loft” them.
Now, turn its control points on and select a row of control points along the surface using the “SelV” or “SelU” command. Ensure that your “UVN” mode is on by checking the cursor sign.
Now, start moving the control points in one direction and look at the points carefully.

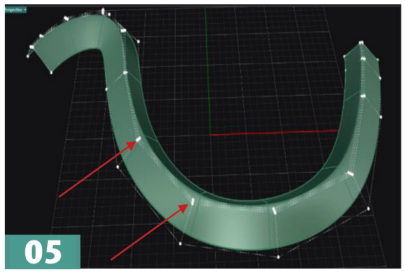


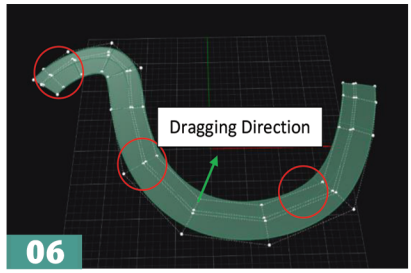




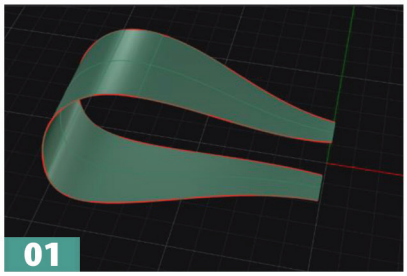


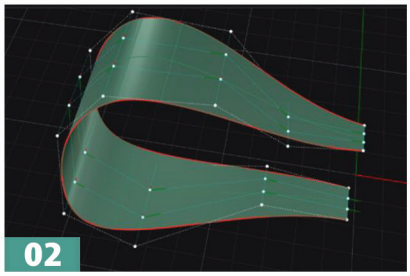
As noticed, control points do not follow the mouse dragging direction; they move in their own U or V direction. We use this technique to create a surface crease and come to the control points together. To add a new control point row to sharpen, use the “Insert Control Point” command.



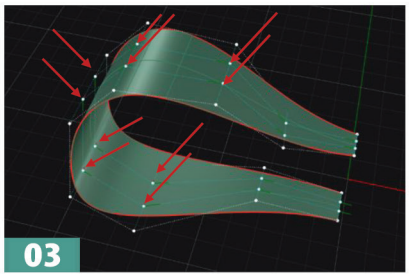


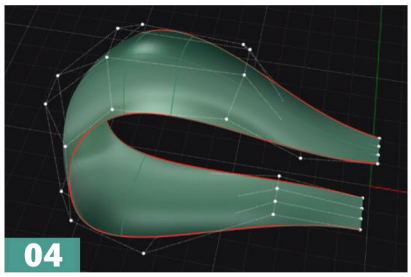
Another feature of using the “UNV” mode is moving the control points along the surface Normal. To activate it, hold the “Ctrl” key on your keyboard while dragging them.
It helps you give shape to your surface. Follow these steps to fully understand it.

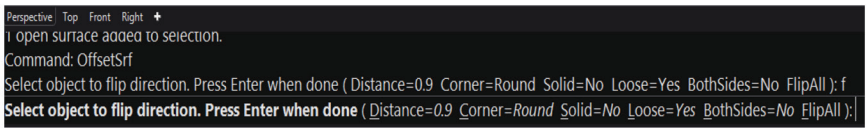




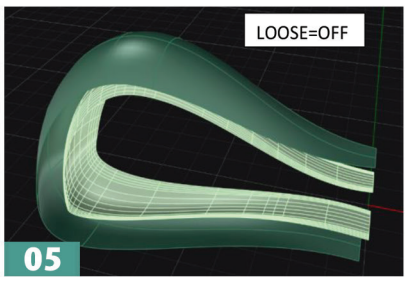
Draw two curves using the “Interpolated Curve “command and then use the “Loft” command to make the surface between them. Be sure that loft-style is the “Normal”. Turn the surface control points on and select the middle two control point rows. Deselect the first and last one, and then place the drag mode in “UVN”; then drag the control points, while holding the “CTRL” key.

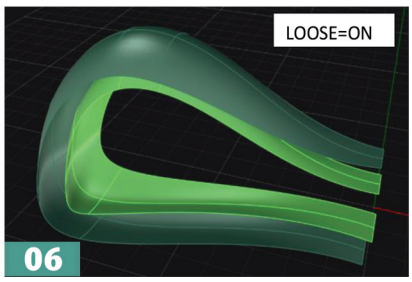




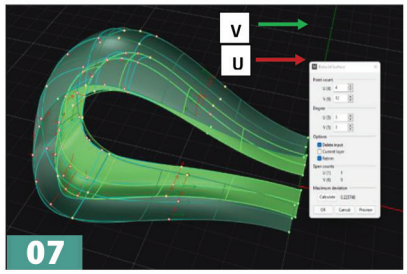


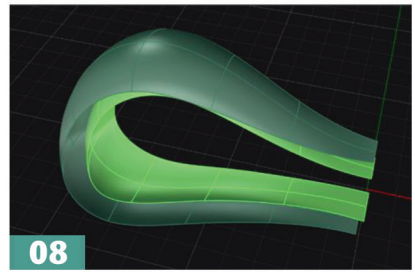
By turning on the “Loose” option, the created surface has the same control points as the original surface.



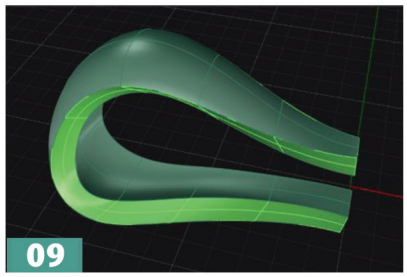


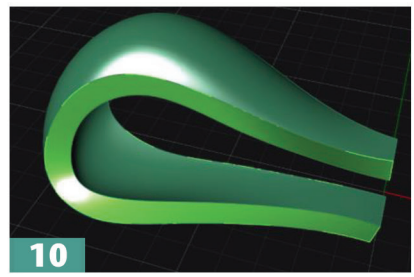
Now rebuild the created surface and the original one along the rail to create a better surface. There is no need to change the number of the control points and the profile. The “V” direction is shown in this picture by a green arrow on the surface. Increase the number of the “V“ control points from nine to twelve, and then press “Enter.”



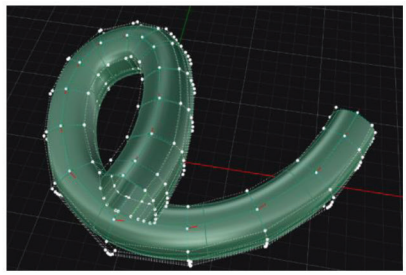


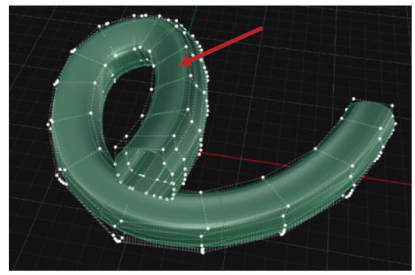
Now use the “Loft” command to close the side of the ribbon. In this stage, the history feature helps you play with the surface’s control points and keeps the surface close. You can change the drag mode to “View” and move the control points.

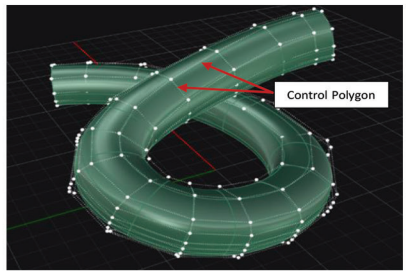


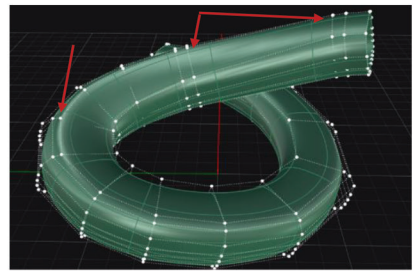


The following dragging method is the “Control Polygon” mode. Generally, its function is very similar to the “UVN” mode, but they have different results. In the “Control polygon” mode, control points travel along the control polygons lines and will be locked in their path, whereas in the “UVN” mode, they can move to the left and right as they are in U or V direction.







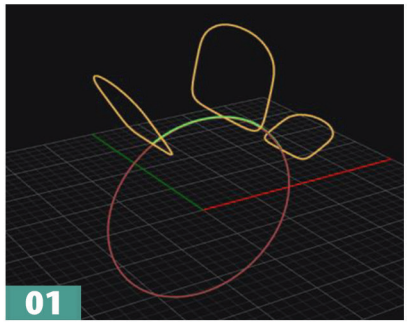


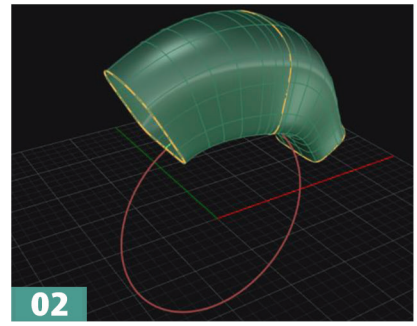
Control points traveled along the control polygons and UV and created the flat surface on the object in the above pictures.
Now it is time for practicing but before we start, let us customize our shortcuts in aliases.
Use Letter “V” for the “SelV” command to select the control points along the “V” direction.
Use Letter “U” for the “SelU” command to select the control points along the “U” direction.
You can quickly shift between the “Drag modes” by assigning some aliases.
Use the letter “C” for jumping to “C-Plane”, “UV” jumping to “UVN”, “VV” jumping to “View”, and “CC” jumping to “Control Polygon” mode.

Alias:	Command macro:
A	Zoom 1to1
C	Dragmode Cplane
CC	Dragmode Controlpolygon
E	extrudecrv
O	Offset
S1	SWEEP1
S2	Sweep2
U	selu
V	selV
VV	Dragmode View

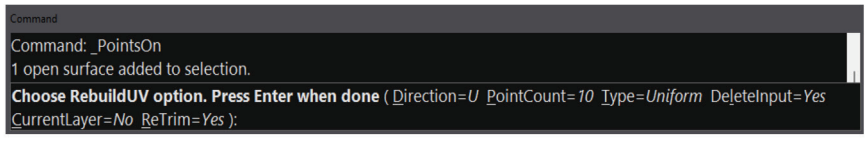
Practice 4
Making a Panther

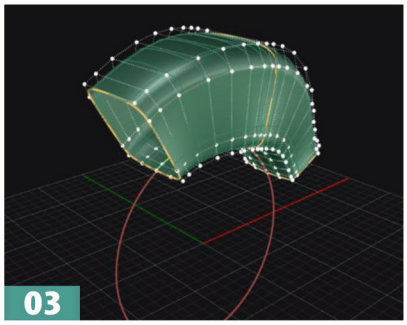
First, we need to close to the model using basic commands like the sweep. Therefore, I need to make a free-form curve on the ring rail, select good profiles, and use sweep one or two.

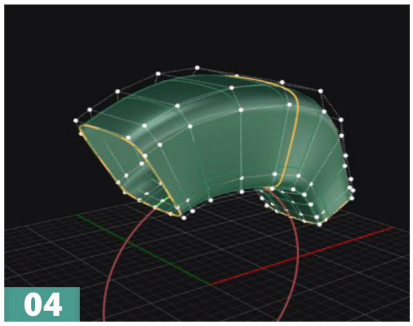




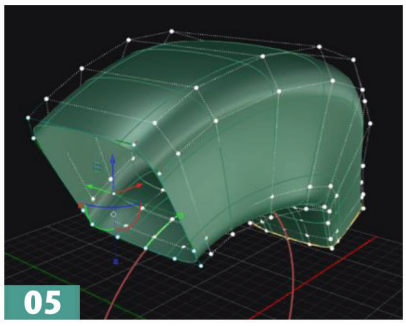
Now turn on the surface's control points and look at them carefully. As you can see and we discussed earlier, the number of the control points along the profile is the same as the curve, but along the rail has been increased. So, we need to delete some of them. The best way to do that here is using the "RebuildUV" command.

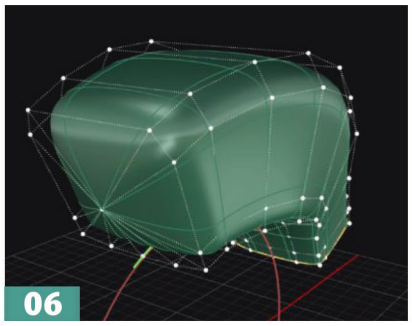




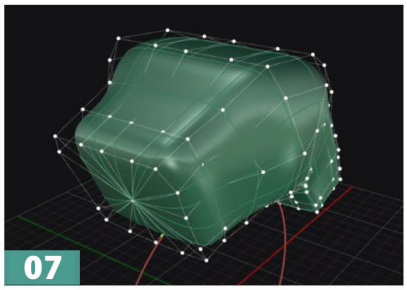


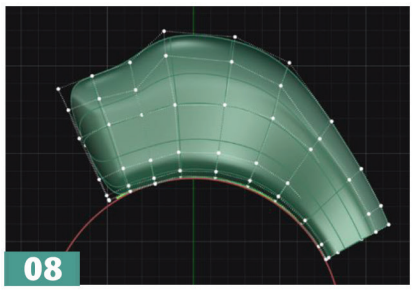
Now let us close the front of the head using the “Gumball” Scale 3D options and the new collapse feature in MatrixGold. Select the last row of the control points using the “V” or “U” short keys. Turn the “O-Snaps (End)” on and use the scale and the “Shift” key to do scale3D and collapse the control points into one point.

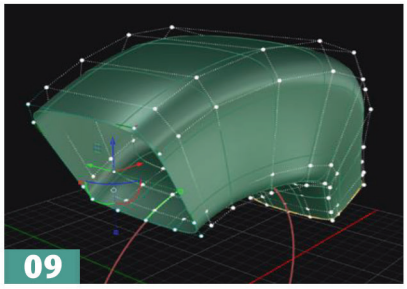


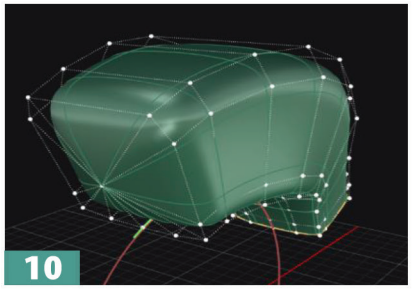


We need to make a few adjustments close to the overall head shape. You can use the “Insert Control Points” command to add more control points.

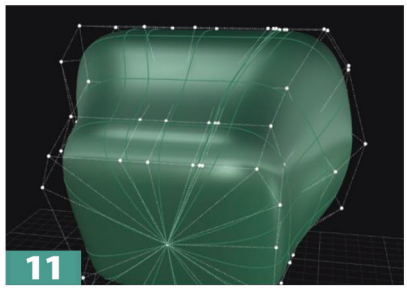


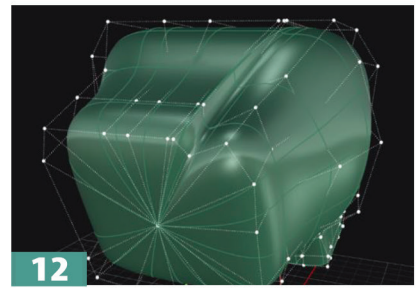




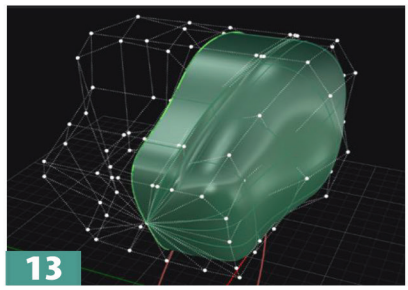


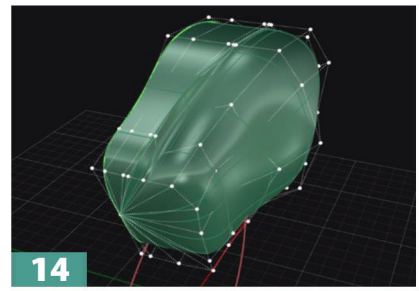
Now it is time to prepare for details. First, we need to make the eye and nose of the panther.
Add two rows of the control point for a sharp edge, then select one of them and move down. Do not worry about the other side, just work on one side.


11

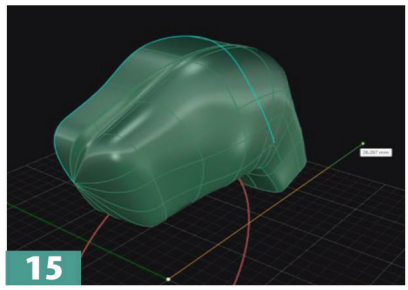

12

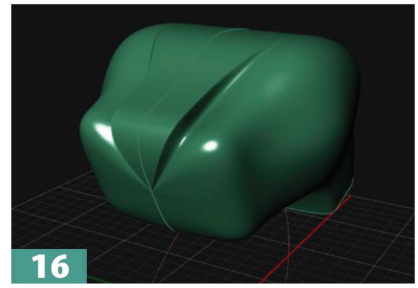
Let us split the head along the “IsoCurve” and then use the “Shrink the trimmed surface” command to delete unnecessary control points.

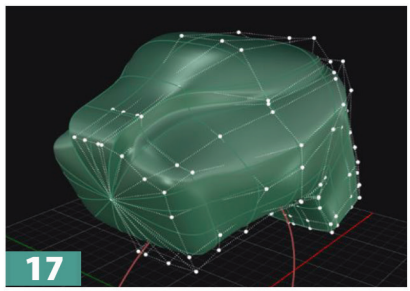

13

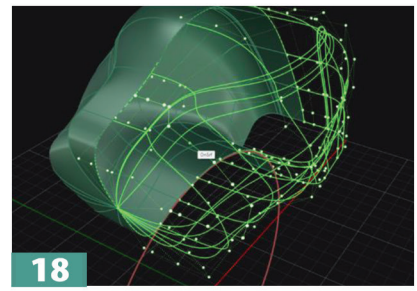

14

Now instead of using the “Mirror” command, use the “Symmetry” command and select the “Naked Edge” and then as the command requires, draw a line along the “X” axis and then press the enter to confirm.

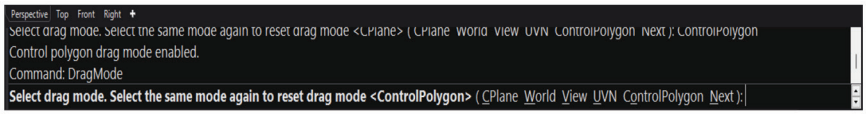

15

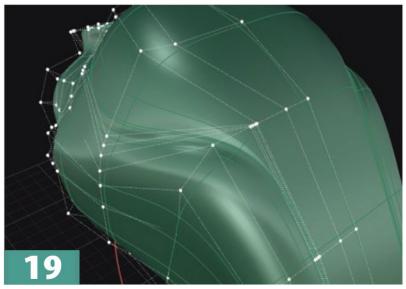

16

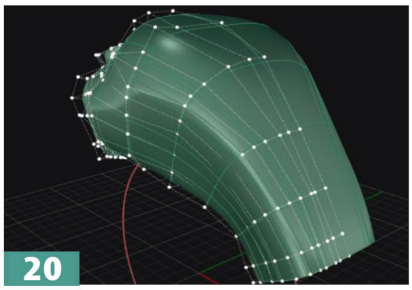

17


18

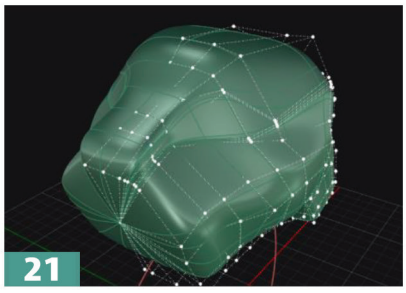
The “Symmetry” command helped you keep the tangency between the original parts and mirrored one. We need to change and move the control points more.
Now change the “Drag Mode” to the “Control Polygon,” start moving the control points along their control polygons and fix the head’s back control points. In this way, you can easily control their movements.



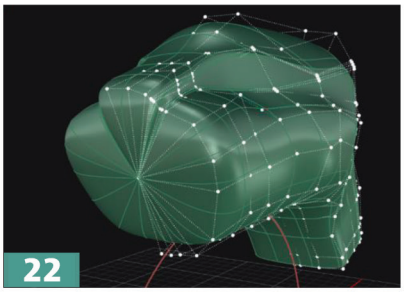


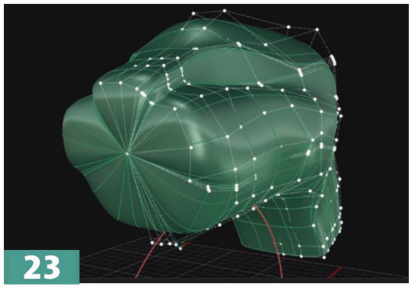


Add another row of the control points near the eye to make the bottom part of the eye. You can shift between “View” and “Control Polygon” modes to move the control points.

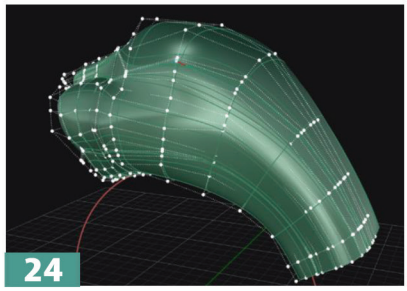


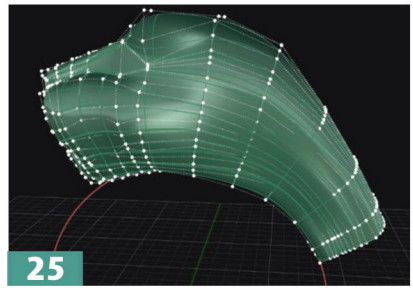
Insert more control points to create the forehead of the panther.



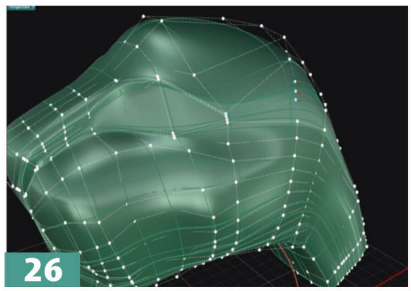


Again, you need to clean the back of the head.


24


25

Now we need to make the ear of the panther. Select those three control points and pull them out.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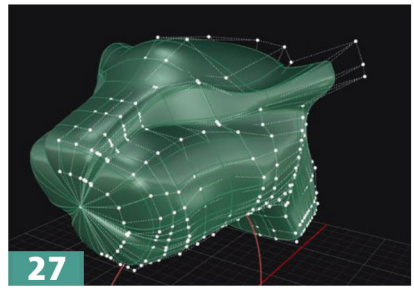
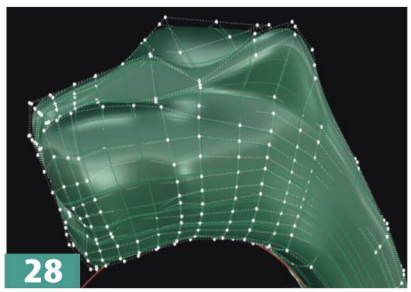

27

Add more control points to the ear area to add more details there.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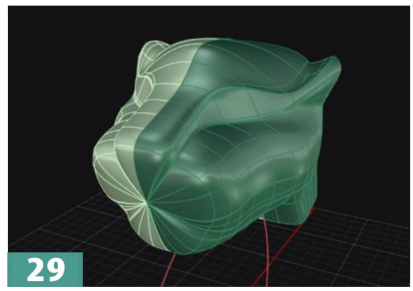
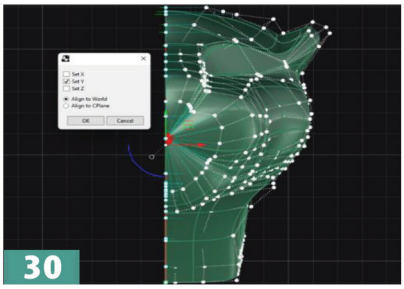
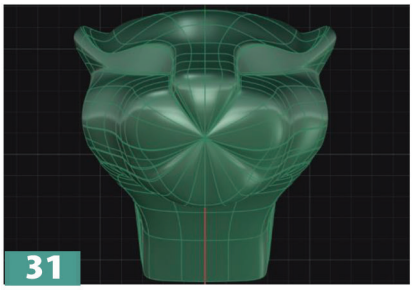
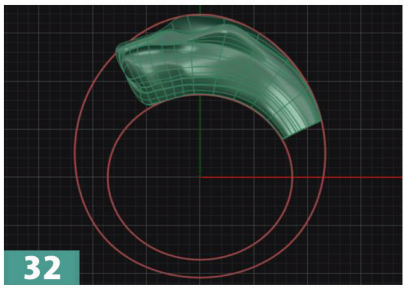

29

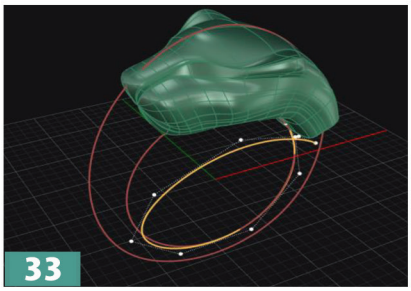
Delete the mirrored part, and to ensure that the control points are located precisely in the middle, use the “SetPt” command and select the last control points and check the “Y” axis to align the control points along the “Y” axis and press enter. Now, control points are lined up,
If you need to collapse or align them.
Mirror it to the other side, and then you can use the” MergeSrf” command to make a single surface. Using the “Join” command, you will create a polysurface, and you cannot turn on the control points anymore. In the “NURBS,” polysurfaces are not eligible to turn their control points on.
The “MergeSrf” command cannot be used in all conditions. First, you need to have an untrimmed surface edge for merging. If your edge is trimmed, you cannot connect.
The hardest part was finished. Now let us make its shank. Outline the ring by using a circle and playing with its control points. Use the “Interpolated Curve” command and trace the ring rail to draw a shank shape. If you look at the control points of the surface edges carefully, you will notice that control point distribution is not uniform. Duplicate the edge of the surface, and to have a good curve, we need to use the rebuild or fit curve command.

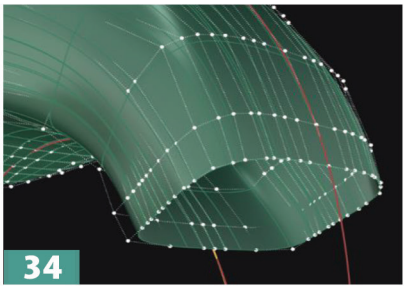
Keep it as the profile for a sweep and rotate it to the other side of the shank. Do the “Sweep” one rail. Ensure that the same points are in the exact location and use the “Roadlike” option instead of the “Freeform”. I highly recommend using the Roadlike option for the helix-like curves. It helps you control the profile rotation while sweeping along the curve. By default, a profile can roll, yawn, and tilts freely along the rail. In this practice, we need to draw an axis parallel to the “Y” axis to not allow the profile rolls inside the ring rail.

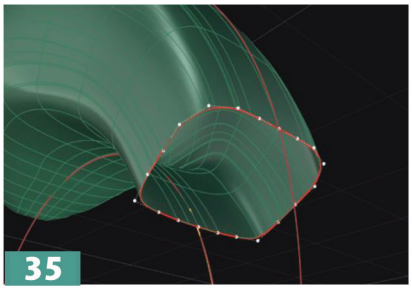


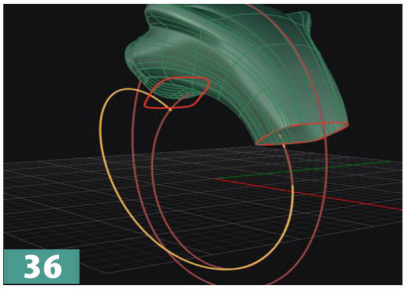


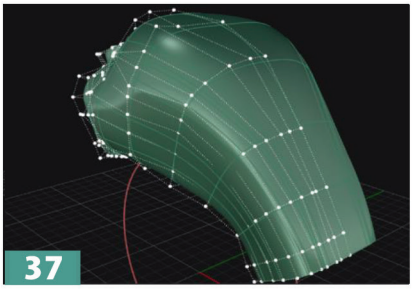


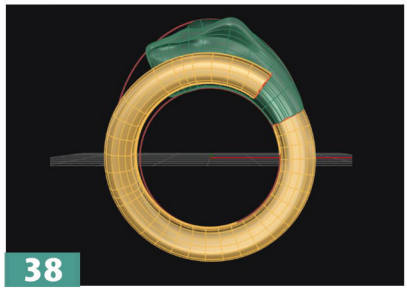








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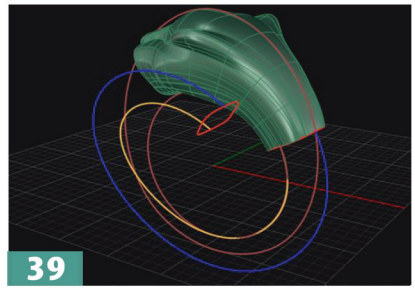
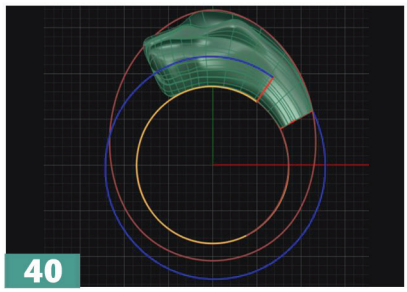

39

Use the “extract Isocurve” command to have another rail on top of the shank, and from the front view, align with the outside ring rail shape and prepare it for the sweep2 process. Apply the “Rebuild” command if needed be.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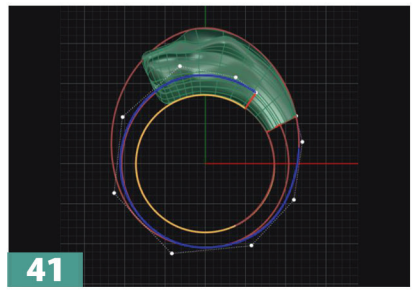
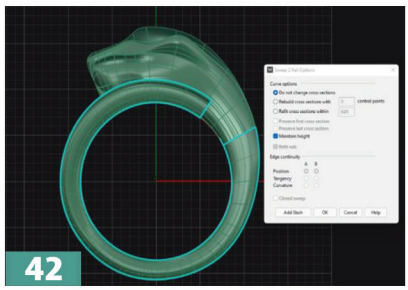

41

Use the “Sweep2” command to create the shank. For controlling the shank’s control points along the rail, we need to use the “Rebuild UV” command and choose the proper direction and give it enough control points to have an excellent shape. Use the “Add Slash” feature in the “Sweep2” command if you have a non-perpendicular U and V isocurve layout. This step is necessary for having a good surface and control points manipulation.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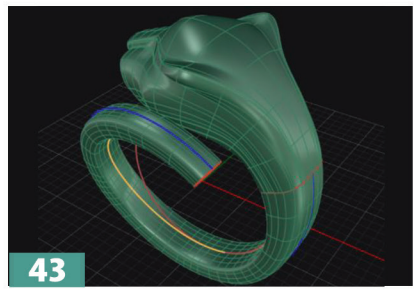
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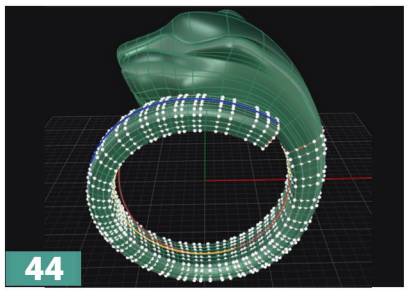
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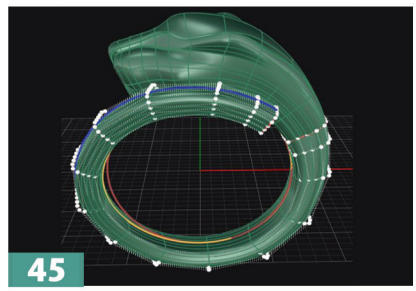
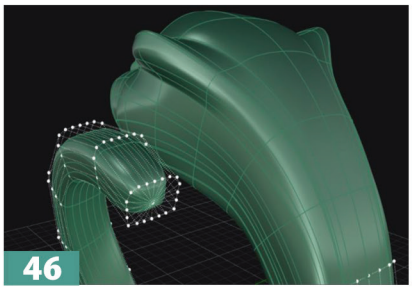
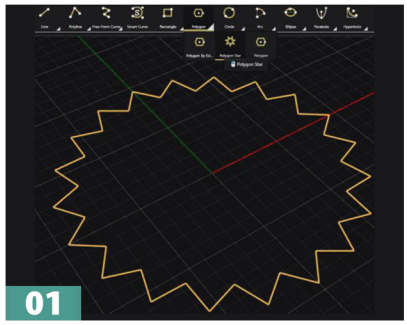
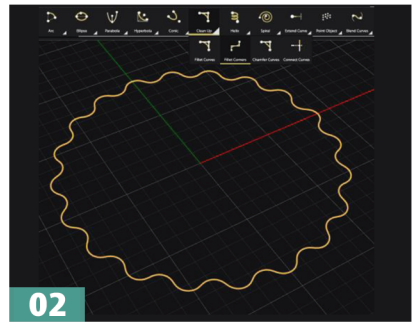

45

Select the last row of the control points and scale them down in 3D mode (holding the Shift key) to collapse in one point and change the drag mode to view and play with control points if needed be.

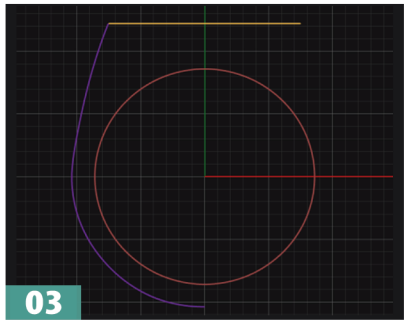


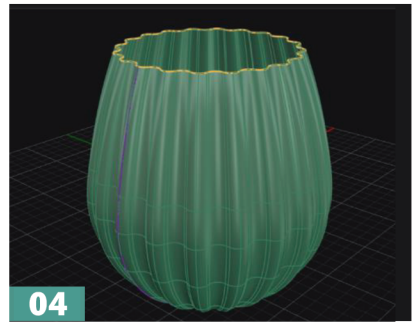
There is another point manipulation tool in MatrixGold in the transform menu. Its name is the “MoveUVN” command. You can assume that you are working with the “Handled Drag Mode.”
Instead of dragging, you use some available handles to control the control points. You can move them along the “U”, “V”, and the surface's Normal. Moreover, it provides you with extra features like “Smoothing”, which is helpful to level the control points in the U or V direction.
To understand the smoothing feature, let us make this ring and follow these steps.
Use the “Polygon” command with the star feature to draw a twenty-sided star polygon. Shape and use the “Fillet Corners” command to make the corners round.



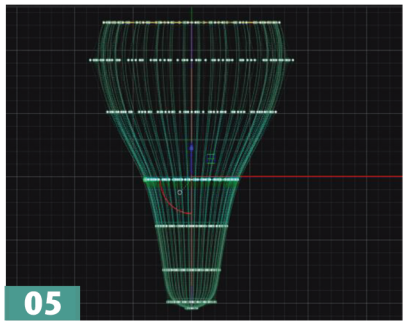


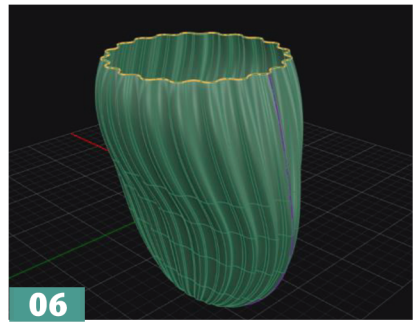
Use the “Ring Rail” command to make a fifty-five-size ring rail and move the filleted star curve above the ring rail. Use the “Interpolated Curve” to draw a rail in the “Rail Revolve” command to make the ring. We need our rail to have eight or ten control points on it so as to use the “Rebuild” command if required.



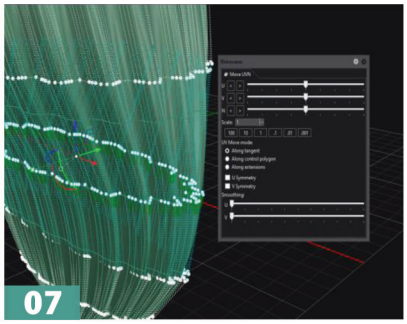


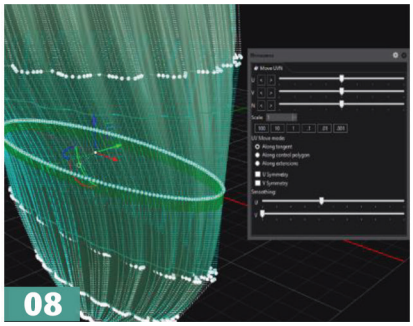
From the side view, scale the control points down in 1D mode to have the shank shape.



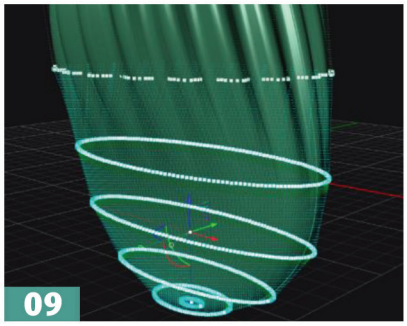


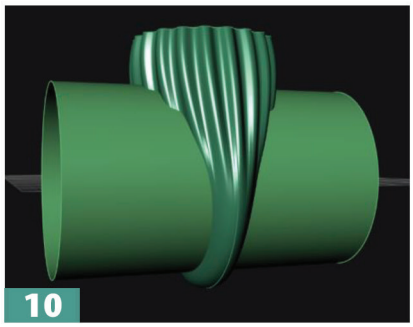
Type “MoveUVN” in the command bar or go to the transform menu and click on the command to pop the “MoveUVN” up. Find the “Smoothing” handle and start moving it.





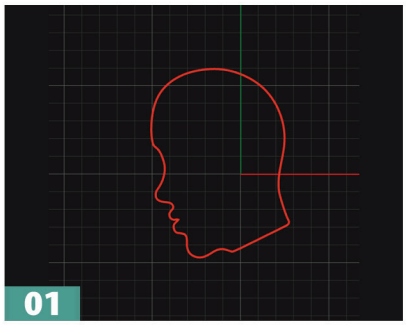
Smoothing tends to even out the control point grid, and the other controls can be used for making minor changes to the shape.

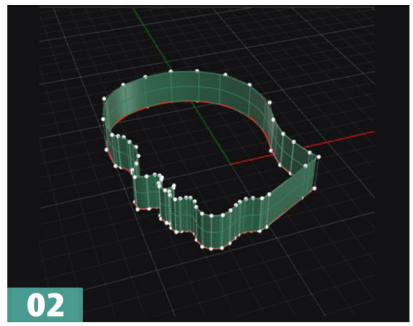




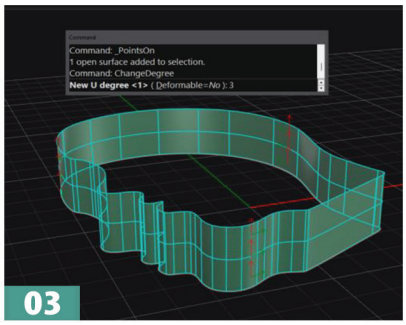
Practice 4
Making a Woman Face

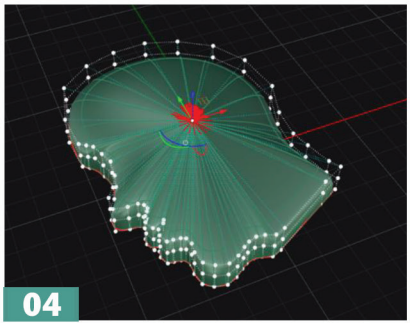
To show the power of the “MoveUVN” command, I would like to show you how to make a portrait of a lady by using this powerful feature.
To start modeling, you need to outline the face. Then you can use the “Extrude” command to create a surface. This surface has degree one in the “Z” axis, and we need to change it to degree 3 to have at least four control points along the extrusion. The proper command for doing that is not “Rebuild”. You can use the “Change Degree” command without any change in the shape.
Then select all the control points in the last row and collapse them into one point using the gumball scale option and object snap.

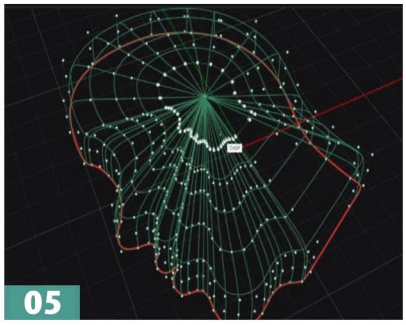


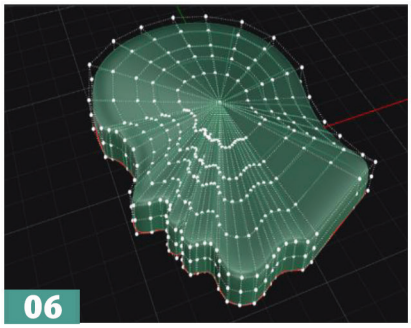


We need to add more control points on the face to have control over details. Thus, we can use the “Insert Control Points” or “Insert Knot” commands.



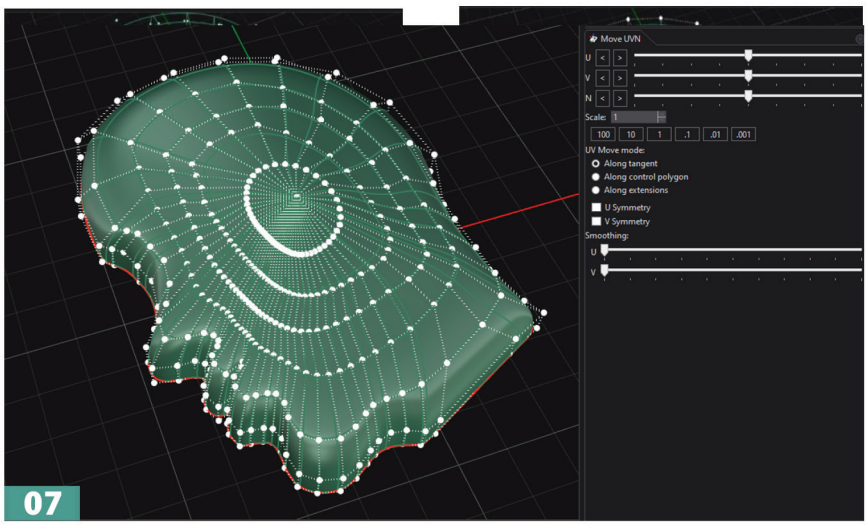


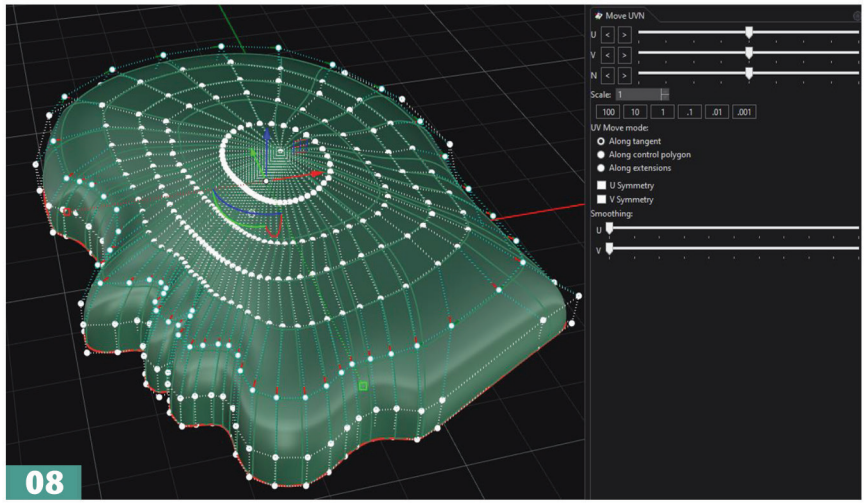




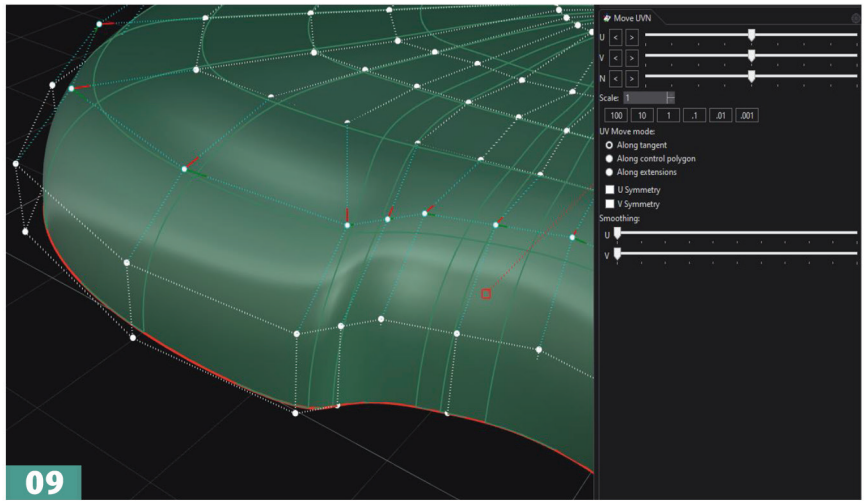
To eliminate the uneven surface and pinches toward the center and to give smoothness, we can use the “MoveUVN” command and its smoothing feature. Type “MoveUVN” and press enter or find it in the transform menu. Select the rows you need to smooth, choose the corresponding direction, and move the handle to the right side as often as required. We need to use the “V” handle in this model, but you must check and find it for yourself.

To have a better organic face shape, select the third row of the control points and scale them to eliminate the sharp edge of the surface.



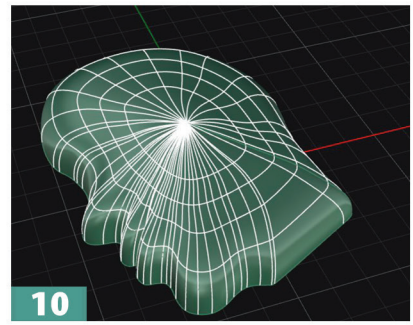


Clean up some areas by moving control points along their control polygons. Instead of using drag mode, we can use the “MoveUVN” movement part. If you select a control point or a bunch of them, you can move them in three directions (UVN) in 3 different ways.

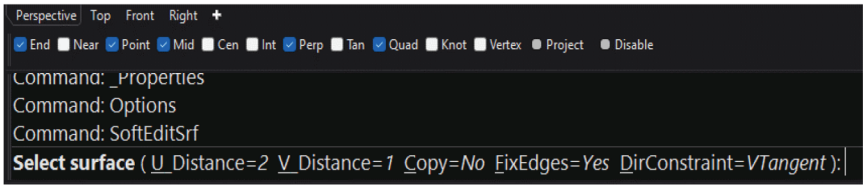


It was moving in U direction but along the tangent of the control points, along the control polygon or its tangency. Now, start moving the control points in two directions (UV) and along the control polygon to clean up the surface.

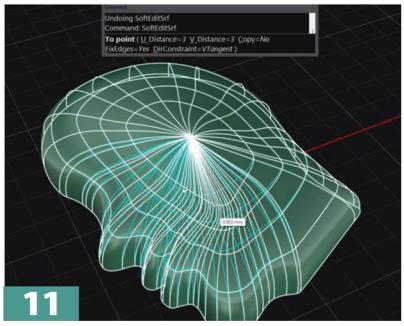
Now, look carefully at the surface topology. As you can see, it does not look the same as the natural face. We need to move and replace the control points. It is challenging to do with the “Drag Mode” or “MoveUVN” command.



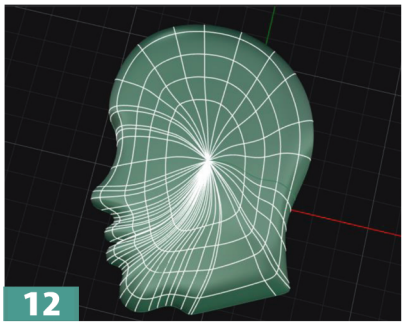
Why? Well, let us explain more. These two commands shift the control points with the same power. In other words, they don't use the "Falloff" feature. If a command provides this feature, you can move the control points with different pull power. Closer to the grab point, applying more power and further less power. The command that gives you this feature is "SoftEditsrf". Using this command, you can relocate the control points along the surface Normal or UV tangency with a predefined distance and U and V.
You can find this command in the "Edit Surface" menu.
So now, we need to move the control points along with their U or V tangency to have a natural face layout.



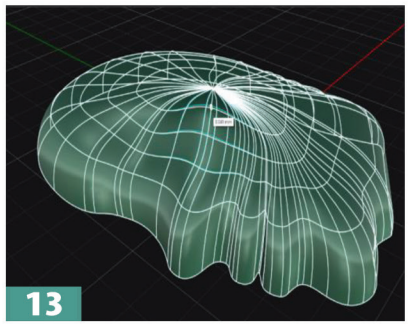
Choosing a bigger distance number grabs more control points in that specific direction. Leave the "Fixed Edges" option in "Yes" to keep the surface border unchanged.
In the "DirConstraint," we have three options including "VTangent", UTangent" and "Surface Normal". If you desire to move the control points on the surface, stay on V or U tangent. However, if you want to move them toward the normal of the surface, change to the "Surface Normal" option.



Well, let us start face modifying using the "SoftEditsrf" command. Type it in the command bar and change the U and V distance to three. It starts to grab three control points in both U and V directions. In this model, the V direction is our desired direction, but maybe for your creation, it is not. So, change it to the "UTangent", while the command is running, select the surface and start editing. A good face has a layout like the surface below.



We need to move the control points along the surface Normal to create the cheek. End the last running command and rerun it. Before clicking on the surface and selecting it, you need to change the “direction constrain” to the surface Normal and start moving them. Sometimes, we can manually use the “Gumball” and relocate the control points. For example, to make the nose hole in the nose part, we can grab its corresponding control point and move it inside.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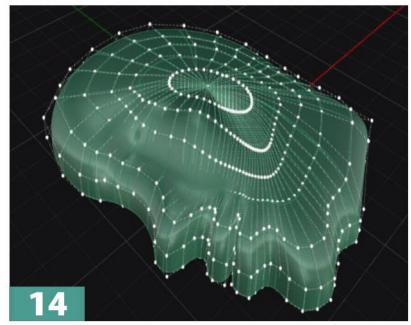
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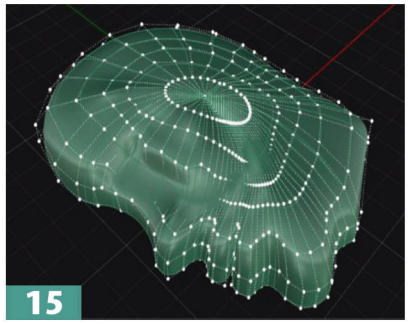
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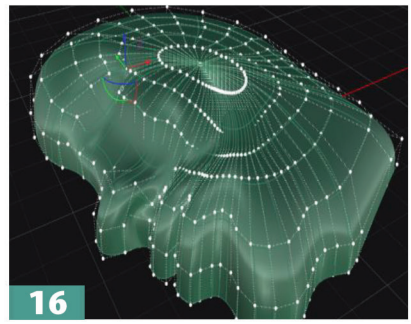
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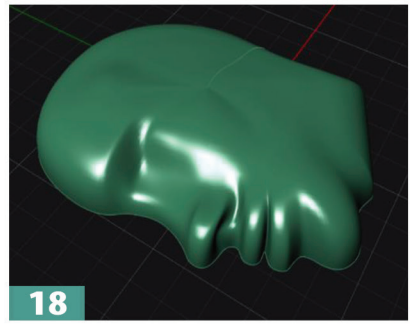
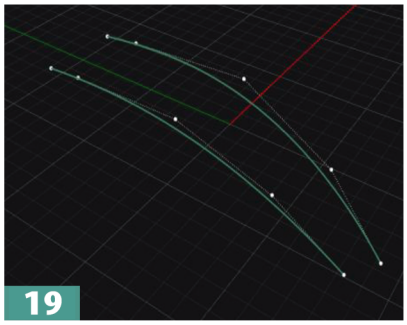

18

What about the hair? Let me teach you a tip to create them in a fast way. Draw two curves and use the “Loft” command to create a surface between them. There is a rule for having a good, lofted surface and that is using the “ControlPointCurv” instead of the “Interpolated Curve” and place the control points of each surface roughly in front of each other. This helps you have a not-jammed surface, a widespread mistake in doing the loft. Before doing loft, you need to extrude them downward and delete the curves. Now it is time to loft and select the edge of extruded surfaces and use them.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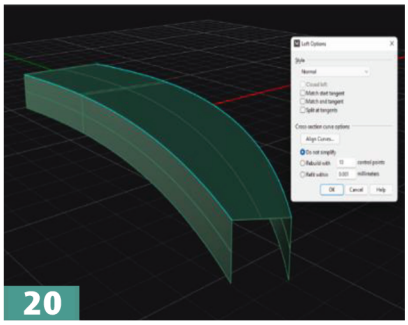
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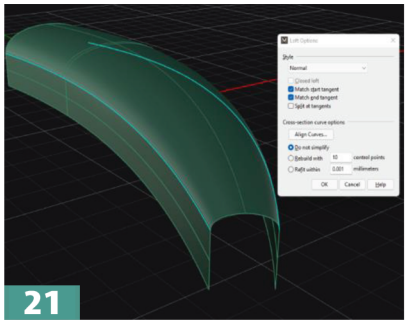
For having a dome shape instead of a flat one, check the “match start tangent” and “match end tangent”. Now, it is time to “merge” surfaces and create one single surface for manipulating. Type the “MergeSrf” or refer to the “Edit Surface” menu and choose the “MergeSrf” command.
Select one of the extruded surfaces and the loft one. Changing the “Roundness” value from 1 to a lower 0.5 leads to creation of a sharper edge between merged surfaces.
Leave it as you need the more rounded edge.
Use the “Insert Control Point” command and add a row of control points near the end edge of the surface and collapse in one point by using the gumball scale handle or using the “SetPt” command. This command helps you gather the control points and weld them if you choose the “X,” Y,” and the “Z” boxes at the same time.
The SetPt command moves objects to a specified location in the x, y, and z directions.
This command is often used to change the position of points and control points accurately.
The SetPt command is a fast way to ensure that a set of planar curves are all in the same plane.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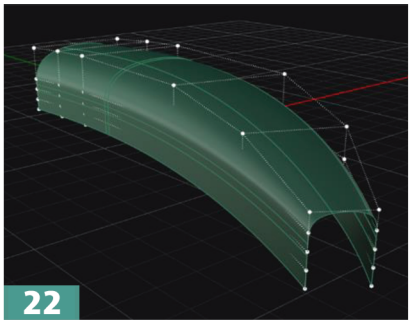
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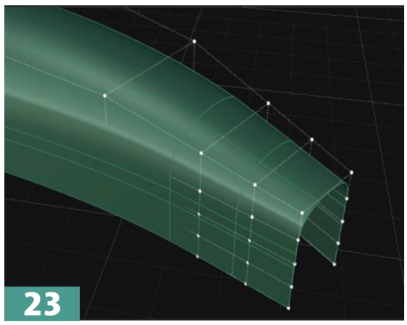
The “SetPt” command exists in the “Transform” Menu.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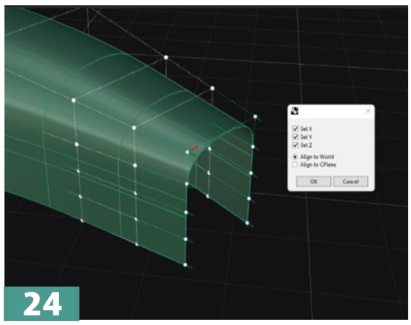
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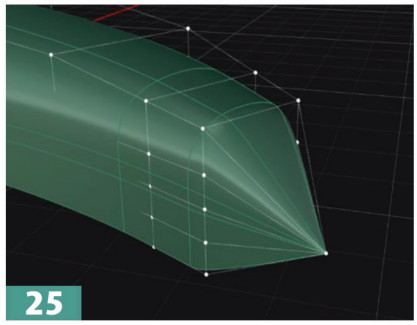
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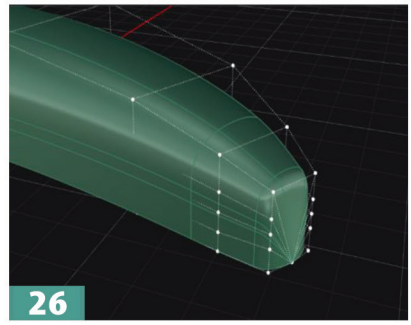
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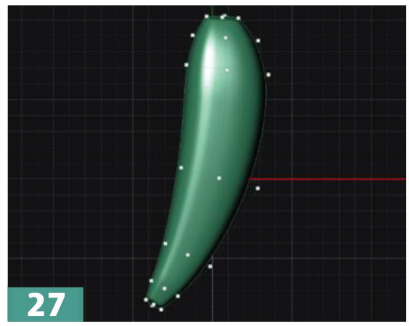
27

Please do the same for the other open sides of the surface and close them. Now, you can start deforming it into any hair shapes that you want.