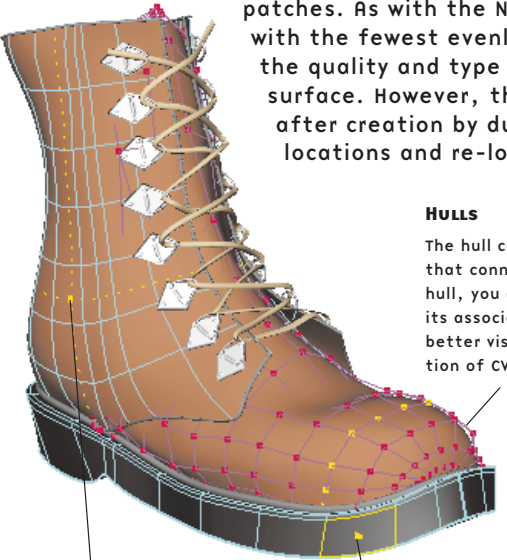
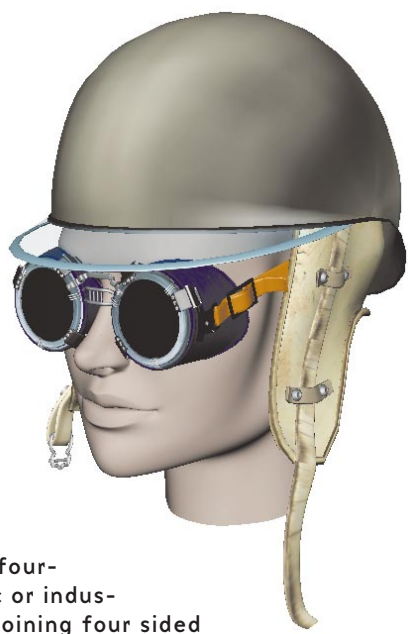


# NURBS Surfaces

The foundation of a NURBS surface is the NURBS curve. To create NURBS surfaces efficiently, you must be proficient in creating good curves. The same principles behind NURBS curves are applied to NURBS surfaces since the two are related. There is an obvious difference: a NURBS curve has only one direction, while the NURBS surface has two directions. The two directions on a NURBS surface have an origin and together they define the Normals of the surface which determine the front and back of the surface. Being aware of these surface properties will help when using certain modeling and rendering operations such as Attaching surfaces or texture placement.

## ANATOMY OF A NURBS SURFACE

The components of the NURBS surface are very similar to those of the NURBS curve, except the edit points are not moveable. NURBS surfaces have CVs, hulls, and spans which define the shape of a four-sided surface. NURBS models, whether they are organic or industrial in nature, generally are made up of several adjoining four sided patches. As with the NURBS curve, it is desirable to define surfaces with the fewest evenly spaced isoparms or CVs. As earlier stated, the quality and type of curve will affect the characteristics of the surface. However, the surface parameterization can be modified after creation by duplicating the surface curves at the desired locations and re-lofting.



### HULLS

The hull comprises straight lines that connect CVs. When you select a hull, you are actually selecting all of its associated CVs. The hull offers a better visual cue for the distribution of CVs in a crowded area.

### CONTROL VERTICES

They do not exist on the actual surface but are used to manipulate the shape of the surface.

### ISOPARMS

Isoparms are lines that represent cross-sections in the U and V directions. Isoparms can be inserted, removed, used to make curves, and snapped to. If you select an isoparm that's not a span or section, it displays as yellow dots. If you select an isoparm that is a span or section, it displays as a solid yellow line. This distinction is important for some modeling actions.

### SPANS

A span or segment is the space between isoparms at edit points. When creating surfaces using Revolve, Primitives, and Loft, or rebuilding them, you can specify the amount of segments or spans.

### SURFACE POINT

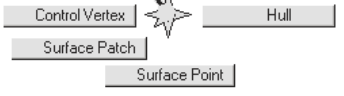
You can select a Surface point that represents a measurement of U and V. The values at this point are dependent on the parameterization of the surface.

### SURFACE PATCH

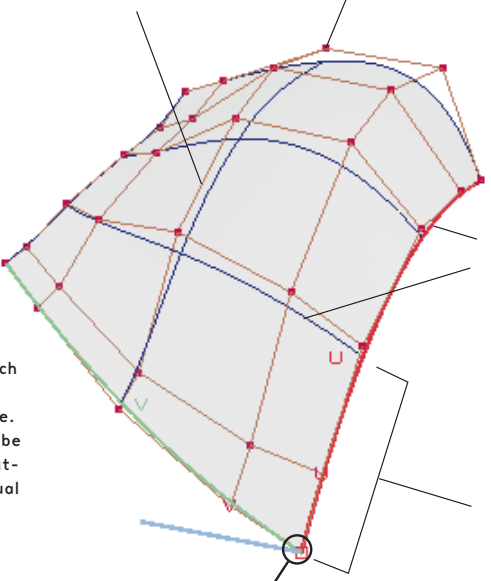
A NURBS surface patch is defined by an enclosed span square. Several patches can be selected and duplicated to create individual NURBS surfaces.

### SURFACE ORIGIN

Turning on this display option highlights the first U and V isoparms (red and green) and labels them U and V. It also draws a line indicating the surface Normal direction (blue).



NURBS MARKING MENU



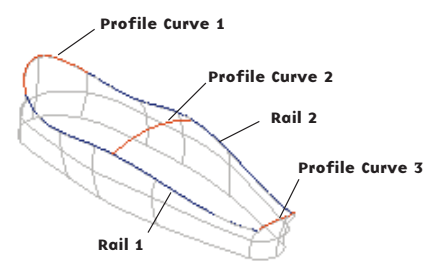
## BUILDING SURFACES

The majority of the surfacing tools begin with creating curves defining the surface. In some cases the curves are used to create simple surface which are then rebuilt and modified by CV manipulation. Other times the curves are used to create much more complex surfaces that would be difficult to attain otherwise. To help you understand the operation of the tools, view the Help Line as you scroll through the menus.

Loft: Select curve(s), isoparm(s) or trim edge(s)

### BIRAIL SURFACE

The Birail Tool creates a surface by using two or more profile curves that sweep along two rails. The profile curves must intersect the rail curves to create a surface. Profile and rail curves can be isoparms, curves-on-surface, trim boundaries, or boundary curves of an existing surface. The advantage of this tool over the Loft is greater control with the addition of rails.



### PRIMITIVES

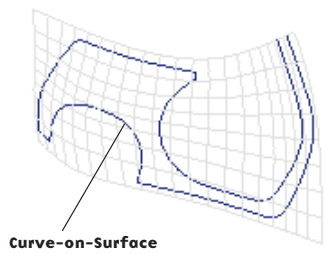
NURBS primitives are common geometric objects such as spheres, cubes, and cylinders. Primitives are often used as the foundation for other shapes.



Deformed Half Sphere

### TRIM SURFACE

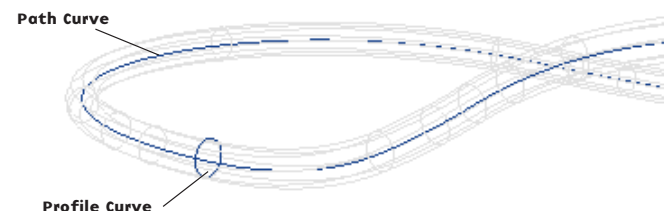
To create a trimmed surface, a closed Curve on Surface is required. There are various ways of creating these curves which will be discussed later in this chapter.



Curve-on-Surface

### EXTRUDE SURFACE

The Extrude tool creates a surface by sweeping a cross-sectional profile curve along a path curve. The profile curve can be an open or closed curve, a surface isoparm, a curve-on-surface, or a trim boundary. The extruded surface on this model create a lip for the scooter surfaces and give the illusion of depth.



Path Curve

Profile Curve

### FILLET BLEND SURFACE

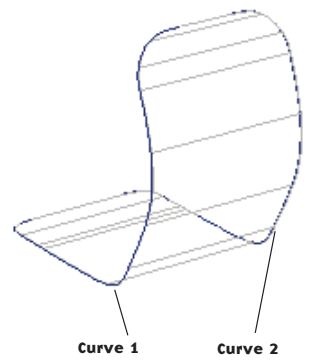
The Fillet Tool creates a seamless blend between two surfaces. The three types are: Circular Fillet, Freeform Fillet, and Fillet Blend. These terms are discussed later in this chapter.



Freeform Fillet

### LOFT SURFACE

a Loft surface is created when a surface is applied to a series of profile curves that define a frame. There must be at least two curves or surface isoparms, and ideally the same parameterization for each curve, to achieve a clean surface. If the curves have the same curve degree and parameterization, the Loft surface will have the same number of spans in the U-direction.

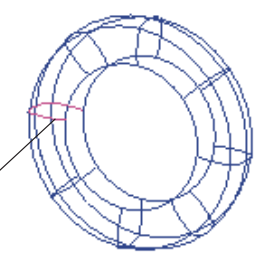


Curve 1

Curve 2

### REVOLVE SURFACE

The Revolve tool creates a surface defined by a profile curve that revolves around a defined axis. The use of construction history is very useful to tweak the shape after the revolve operation. The front fender began as a revolved surface that was then scaled, deformed and finally trimmed. The tire and rims are simple revolves.



Profile Curve

setAttr "spotLightShape1.centerOfIllumination" 17.56598; setAttr "spotLight1.rotate" -type double 3 0 0 0 ; setAttr "spotLight1.translate" -type double 3 0 0 12.56598 ; setAttr "spotLightShape1.centerOfIllumination" 0.33657; setAttr "spotLight1.translate" -type double 3 0 10.213051 19.56598 ; setAttr "spotLightShape1.subAngle" 65.764707; setAttr "spotLightShape1.useDepthMapShadows" on;