Intro to NURBS Patches
Maya 2012

(This tutorial assumes you have already done the Curves tutorial in this set.)

Concepts

- A patch is a surface made from spline curves
  - One spline goes in one direction,
    - (called the “U” direction)
  - A second spline goes in another direction
    - (called the “V” direction)
  - Together they form a grid, or mesh, of curves
  - The CVs of the curves
    - form a mesh of CVs
    - which in turn generates the surface patch

- The type of patch is derived from the type of spline
  - a NURBS patch is made with NURBS splines
  - a B-spline patch is made with B-splines
  - In Maya, all patches are NURBS patches

- Advantages of patches:
  - They are truly, mathematically curved
• unlike polygonal surfaces
  • which are only approximations of the curvature
  • (See the *Polygonal Modeling* tutorial)
• This means you very easily get very smooth deformations

• **Disadvantages** of patches:
  • They are always defined as a grid (U and V directions) of CVs
    • -- that is, a grid of rows and columns of CVs,
  • The structure of a surface is its “topology”
    • Patches have a rectangular topology
      • Their topology is therefore much more restricted than a polygonal surface’s topology
        • which has no restrictions
      • No matter what the shape of a patch,
        • its topology is a rectangular grid
        • For example, a patch sphere still has a rectangular grid of CVs

• The same tools you use to edit a curve can also be applied to a patch
  • (See the *Curves* tutorial in this set)
    • For example:
      • Moving CVs, adding CVs, changing multiplicity of CVs, etc
  • You can use any of the standard modeling techniques to generate a patch
    • For example: extrusion, revolve, loft, ….
      • See the *Common Modeling Techniques* tutorial in this set

**Create A Simple Patch**
• Go to the **Surfaces** module
  • >Create >NURBS Primitive >Plane []
    • Change the U Patches = V Patches = 5
  • >Create
  • In the Persp window,
    • >Shading >Smooth Shade All

• Put your cursor over the patch
• Right mouse down, > Control Vertex
• Click and drag to select some of the CVs of the NURBS patch surface
• Hit w key for Translate mode
  • Translate the selected CVs up or down
  • The patch surface deforms

**Display of a Patch**
• You can use all the same tools you used for the display of curves

• Click or drag to select the NURBS patch surface
• >Display >NURBS >CVs, Edit Points, Hull, etc.

• Alternatively, place your cursor over the patch
  • Right mouse down, > Control Vertex

• Since the patch is mathematically smooth,
  • You can decide the quality of smoothness display you will see
  • Select your patch
  • >Display >NURBS >Rough, Medium, Fine
    • (Shortcut keys = 1,2,3)

**Adding/Deleting Isoparms of a Patch**
• The curves you see displayed on the surface of the patch are called “isoparms”
• You cannot add or delete isolated CVs of a patch,
  • because the CVs of a patch are by definition arranged in a rectangular mesh
• To add or delete CVs, you must add/delete entire isoparms
  • -- that is, entire rows or columns of CVs

• To globally change the number of isoparms:
  • Select the patch
  • >Edit NURBS >Rebuild Surface []
    • Change **Number of Spans U** or **Number of spans in V**
      • (Similar to what you did in *Curves* tutorial)

• To insert a new isoparm at a specific location,
  • (See the *Adding Surface Points to an Object* tutorial for more detail)
• Cursor over patch, right-mouse, >Isoparm
• Left click on an isoparm, drag to where you want a new isoparm
  • Shift-click on another isoparm, drag to add a second isoparm

• Then….
• >Edit Nurbs >Insert Isoparm