AUTODESK UNIVERSITY 2014

Modeling for Architecture, Engineering and Construction: 3ds Max® Design

Jose Manuel Elizardo – Autodesk

VI7273-L In this hands-on lab we will maximize on several of 3ds Max® Design software's powerful modeling tools to help you take your architecture, engineering, and construction content to the next level. We will explore various different workflows that will enable you to increase the quality and detail of your Revit software models and create all new models directly from within 3ds Max® Design software.

Learning Objectives

At the end of this class, you will be able to:

- Recognize the various modeling tools available in 3ds Max® Design
- Use these tools to create striking models
- Determine which tool is appropriate for which task
- Use these tools to augment the quality of your Revit software models

About the Speaker

Jose Manuel Elizardo has been with Autodesk, Inc., since 2007. He first joined Autodesk as part of the 3ds Max Quality Assurance Team, specializing in rendering-related initiatives, such as the ongoing integration of the mental ray rendering engine and the original implementation of the iray rendering engine. Now a 3ds Max Technical Specialist for the Media and Entertainment division, Jose's focused mainly on promoting the value of Visualization throughout various industries.

Before joining Autodesk, Jose worked in a Montreal-based visual effects studio, where he worked mainly on television advertisements and product-shot visualizations. Jose has a passion for creating striking photorealistic imagery for design and visualization purposes, and he speaks English, Spanish, French, and Portuguese.

AREA | Jose Elizardo's Blog

YouTube | Jose Elizardo

0.0 Contents

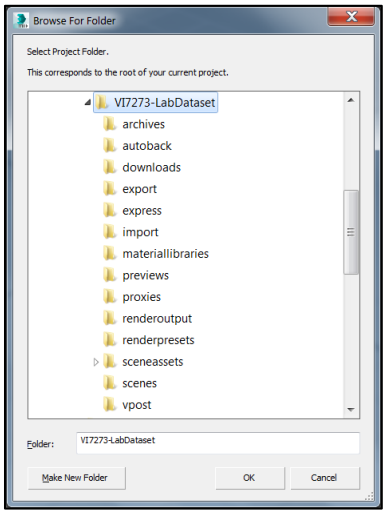
01. Project Setup

Project Folder

When working with 3ds Max it is important to have a project folder defined. This allows you to keep all files pertaining to a specific project organized in one location.

To set the project folder:

1. In the Quick Access Toolbar (upper left of screen), click on the  Project Folder Icon.
2. Browse to the class project on disk (VI7272-LabDataset) as referred to by the Presenter.

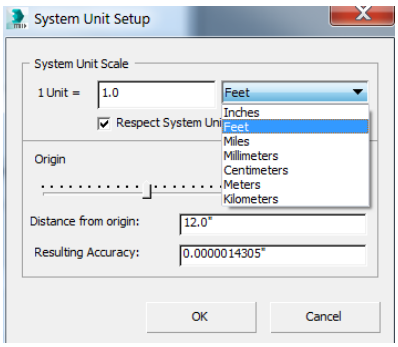


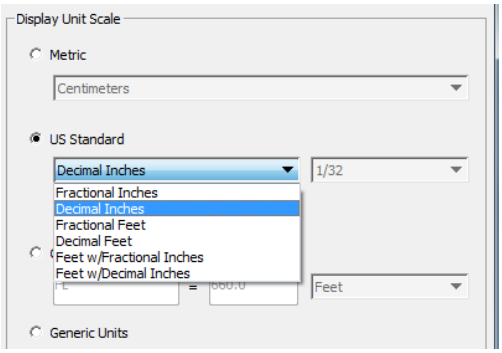
Unit Setup

Revit calculates system units in Imperial units (Feet and Fractional Inches). When Metric units are set as the “Project Units”, Revit dynamically converts the Imperial units into Metric units, in the UI. This means that FBX always exports in the actual system units, Imperial (Feet). In order to make sure that no conversion occurs upon import, it is important that the System Units in 3ds Max Design be set to the same as Revit; Imperial (Feet).

To setup Units for correct Revit Import:

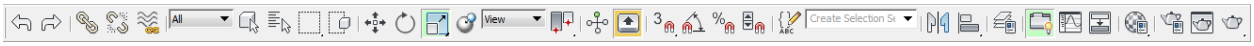
1. In the menu bar go to Customize> Unit Setup
2. Press the System Unit Setup button
3. Make sure that 1 unit = Feet
4. Also, set the Display Units to US Standard> Decimal Inches
   *** ***Display Units*** *will only drive what the UI displays, internally 3ds Max will use Feet as its measurement, or as defined by the* ***System Units****.*



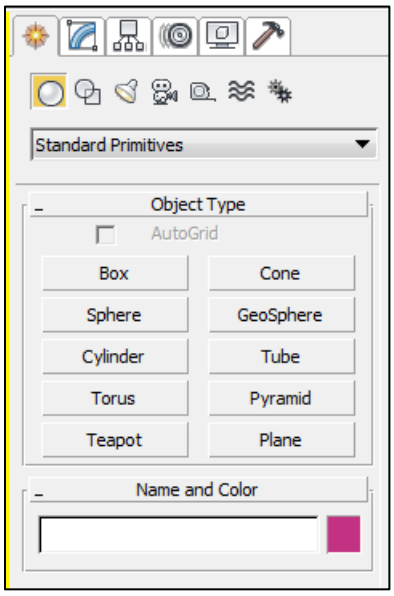


0.2 Introduction to 3ds Max Design UI layout

Let's take a moment to get familiar with the general layout of 3ds Max Design's UI. Below the **Main Menu** we have the **Main Toolbar**. This is where we find the most common functions such as Undo\Redo, the Translation tools (move, scale and rotate), quick access to the Material Editor and Render Setup, as well as many other tools.



On the right side of the screen we have the **Command Panel**. The Command Panel comprises six sub panels that give you access to most of the modeling features of 3ds Max Design, as well as some animation features, display choices, and miscellaneous utilities.



On the lower right hand corner of the screen is where we find all our camera and viewport navigation tools. Viewport actions such as orbiting, panning, zooming are all found here.

To tumble in the viewport:

1. Activate the Orbit tool
2. Try tumbling in the viewport by holding down the left-mouse button.

We will refer to these tools for common viewport interactions in this session.

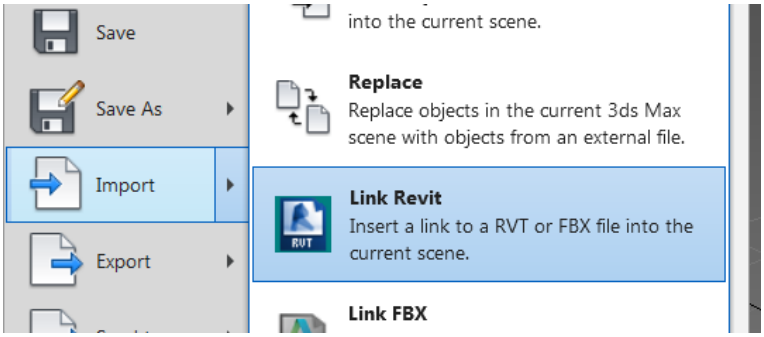
03. Easy Crown Moldings

3ds Max Design has very powerful tools for easily creating moldings of all sorts. The following chapter will demonstrate one technique used to create crown moldings. The same technique can be applied to modeling all sorts of moldings.

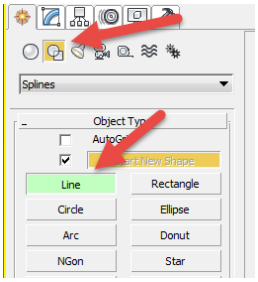
Getting Started

Let's link our Revit project and get the basics of this technique laid out. The first thing we will need to define is a path for the molding itself. We'll create a spline object by snapping it to parts of the scene we want to have a molding on. This spline will serve as a path for the crown molding.

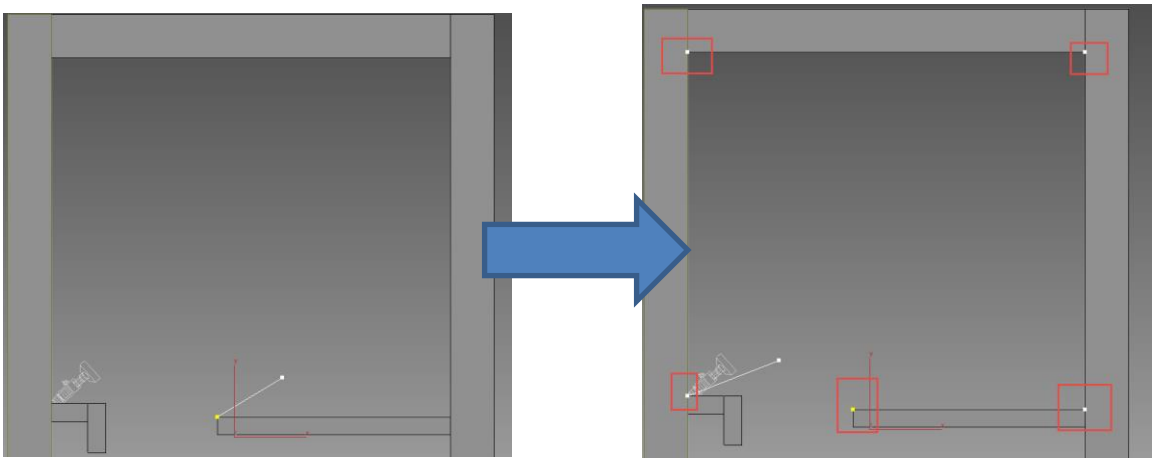
1. In 3ds Max Design, navigate to the Application button> Import> Link Revit



2. Select MyCondo.rvt
3. Select 3dView1 and under **Preset**, **select Autodesk Revit** - **Do Not Combine**
4. **Attach this File** (say **Yes** to the Daylight dialog)
5. Close the Manage Links dialog
6. Enter **Top** view by hitting the **T** key (pan and zoom view until model is fully framed)
7. Open **Layer Explorer** and expand MyCondo layer
8. Locate **Compound Ceiling 2' x 4'** and **Floor Generic**; hide them by turning off the **lightbulb** next to each. Close the **Layer Explorer**
9. Next, enable **Snaps** by pressing the **Snaps** button on main toolbar
10. Right-click on **Snaps** button and make sure only **Vertex** is enabled
11. In **Command Panel**, select **Shapes**, than press the **Line** button



12. In the viewport, draw a line along the interior walls by clicking and snapping at every corner (when the mouse curser gets near a vertex a snap icon (yellow cursor) will appear indicating a snap will occur). It helps to zoom in closer to the parts we want to snap to.



13. Right-click to exit line creation

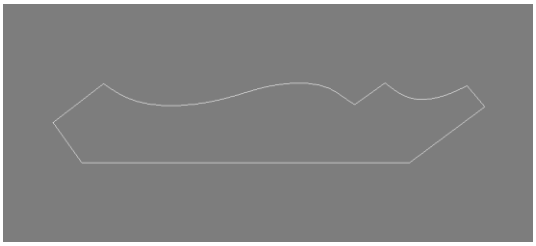
Making a Crown Molding

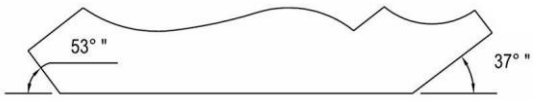
Now that we have setup a path for the molding, we need to define a 2 dimensional profile of the molding itself. The profile will follow the path defined and create the geometry.

Open *01_Crown_Moldings_Cont.max*

1. In Perspective (**P** keyboard shortcut)View, tumble view in order to see the room properly
2. Select **Line001** either in the scene or in the **Scene Explorer**
3. In **Command Panel,** locate the **Modify** tab expand the Modifier List, add the **Sweep** modifier
4. Make sure **Use Custom Section** is enabled

5. Select **Merge From File** and chose **Molding_Profile.max** in the Crown_Moldings sub-folder
6. From the **Merge** dialog, select **Molding_Profile** object, hit **OK**.

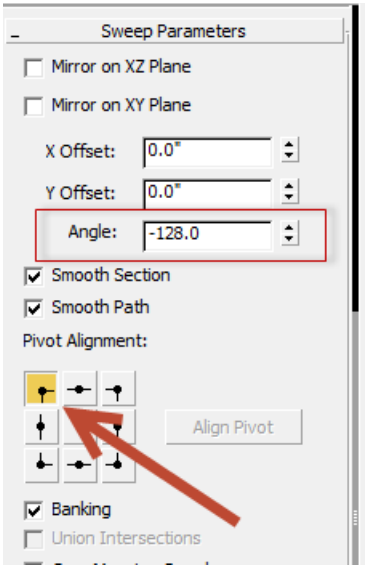




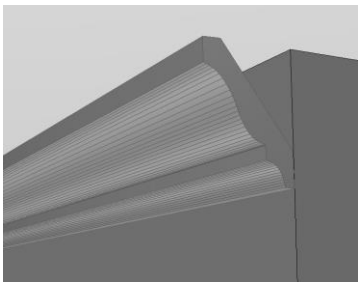
This file contains a spline that I modeled in 3ds Max Design (image above left) in the shape of crown molding profile. The profile image can be found doing a simple Google search (image above right). This can be repeated for any molding profile as necessary. If you'd like, you can open this file and examine how it was created, than create your own!

Now that the profile has been assigned, some settings need to be adjusted in order to have the crown molding line up with the wall and ceiling correctly.

1. Using the camera controls, zoom into the scene to have a better view of the molding.
2. In the **Sweep** modifier settings
    a. Set **Angle** is set to 128
    b. And select the upper right **Pivot Alignment**



And there you go, if you unhide the ceiling object you will see that the new crown moldings line up perfectly. You can now do this to all other rooms in the house, with any molding of your choice. This also works for baseboards and window\door moldings.

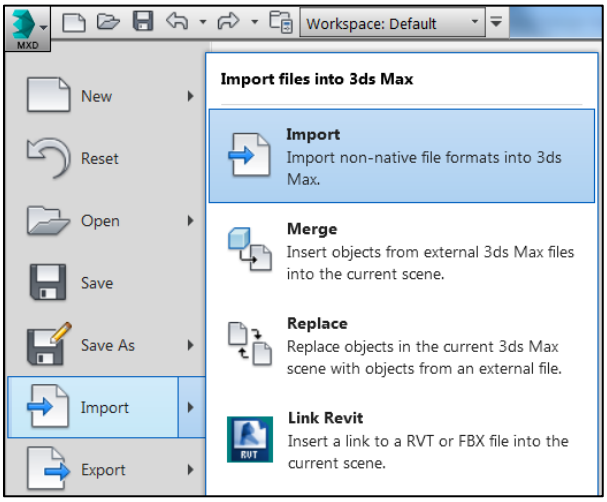


04. Enhancing Revit Families

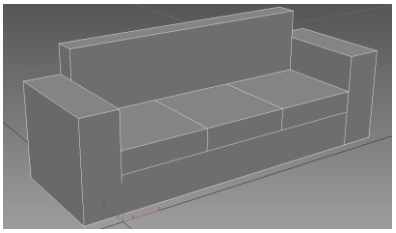
The next example we will look at in this lab is how to take an existing Revit Family object and enhance the overall look of it. We will use common polygon modeling controls found in 3ds Max Design. The Revit Family we will be using is a simple model of an 8' sofa that was created in Revit. It was than exported to FBX. Because we will only be performing modeling operations to this sofa, we want to make sure that all unnecessary components of this scene are removed at import time. Later on we can merge the completed sofa into a full Revit scene.

Importing Revit file

1. Navigate to the Application button and select **Reset** (to reset 3ds Max Design)
2. Application button>**Import**



3. Select **MySofa.fbx**
4. In the FBX importer dialog> Current Preset, select *Autodesk Media & Entertainment* (normally we would select the Autodesk Architecture preset, but because we want to disable some things, we need access to all the settings)
5. Expand the **Cameras** rollout and disable *Cameras*
6. Expand the **Lights** rollout and disable *Lights* and *Global Ambient Color*
7. Press **OK**

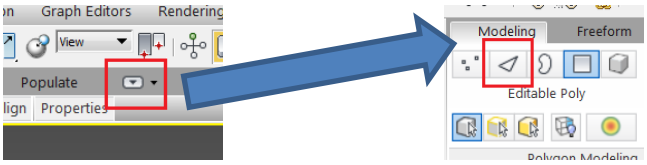


Modeling: Subdiving the model

In this section we will look at how we can further subdivide the mesh in order to accommodate the modeling operations we will need to do.

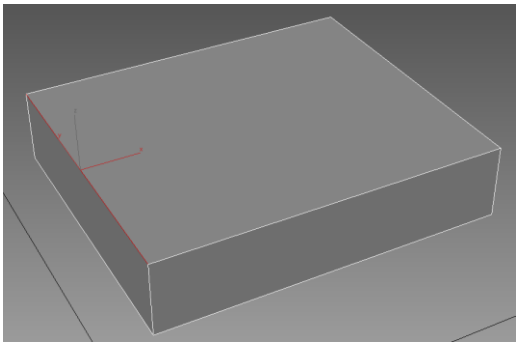
Open *03_Sofa_Modeling_Start.max*

1. Select left-most cushion and isolate (**Alt+Q**)
2. Right-click to access quad menu> **Convert To:> Convert to Editable Poly**
    - By default objects come in as Editable Meshes; Editable poly mode is the most complete in terms of available toolset
3. Expand the Ribbon on main toolbar area and under the Modeling Panel, enter **Edge** sub-object mode:

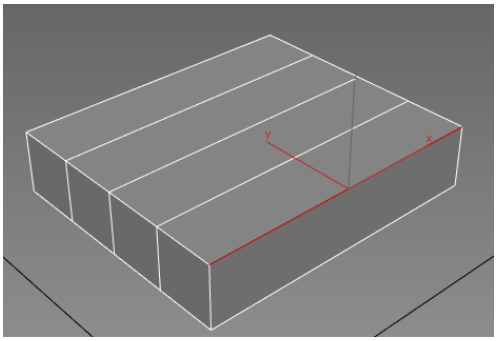


4. Select the following edge:

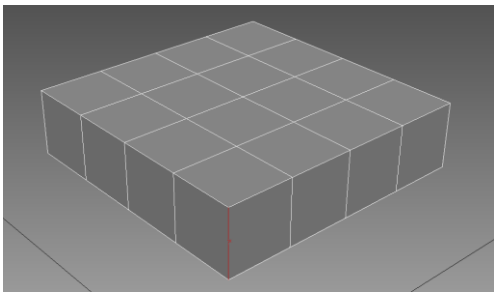
Pro Tip: Enable **Ignore Backfacing  *in order to avoid selecting edges, faces and vertices that are located on opposite sides of the model.*



5. **Ring** selection by pressing  on the **Ribbon** panel
6. Next, in the **Loops** panel of the Ribbon, access the **Connect**  Settings by pressing the downward arrow next to the **Connect** icon.
    a. In the **Segments** field enter 3
    b. Hit the green check to commit these changes
7. Select the following **Edge** and **Ring**  the selection:



8. Repeat step 7
9. Select the following edge and **Ring**:



10. Access the **Connect** Settings again
    a. In the **Segments** field enter **2**
    b. In the **Pinch** field enter **45**
    c. Hit the green check to commit the changes
11. Exit **Edge sub-object** mode by pressing the **Edge** button in the Ribbon

Modeling: Making Dimples

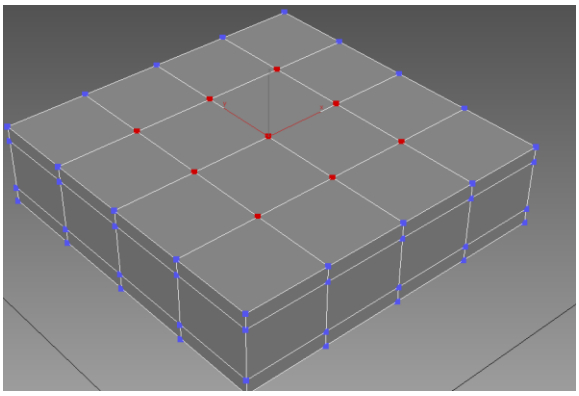
In the next section we will explore an easy technique for creating sofa dimples as typically found on some styles of leather sofas.

Start from previous scene (or open *04_Sofa_Modeling_Dimples.max)*

Hit OK button to Isolation warning dialog

1. Select cushion and enter **Vertex** sub-object mode from Ribbon
2. Select the following vertices (hold **Control** key while clicking to add to the selection):

Pro Tip: To make this process easier and to avoid accidentally moving vertices around, do this process while in **Select mode by pressing the **Q** key

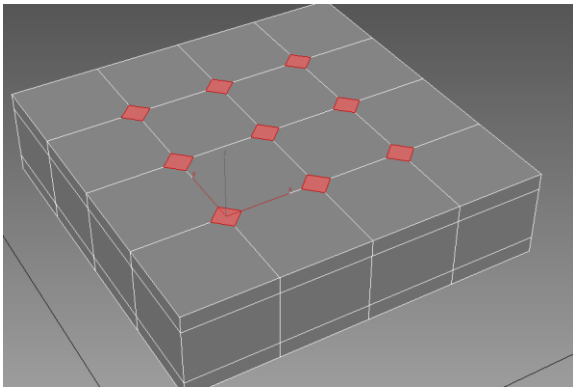


3. Next, in the **Vertices** panel of the Ribbon, access the **Chamfer** 

settings
    a. Enter **1.25”** in chamfer amount
    b. Hit the green check to commit these changes
4. Back in Ribbon, hold the **CONTROL** key on the keyboard and enter **Face** sub-object mode

***Pro Tip: Holding the Control key while changing sub-object modes will convert the selection accordingly.*

5. Next, press the **Shrink**  selection button
6. Deselect (**Alt+Click)**the unnecessary faces until the following faces remain:



7. Locate the **Bevel**  tool in the Ribbon, access its settings
    a. Enter **-3.00”** in the **Height** field
    b. Enter -**0.75”** in the **Outline** field
    c. Hit the green check to commit these changes

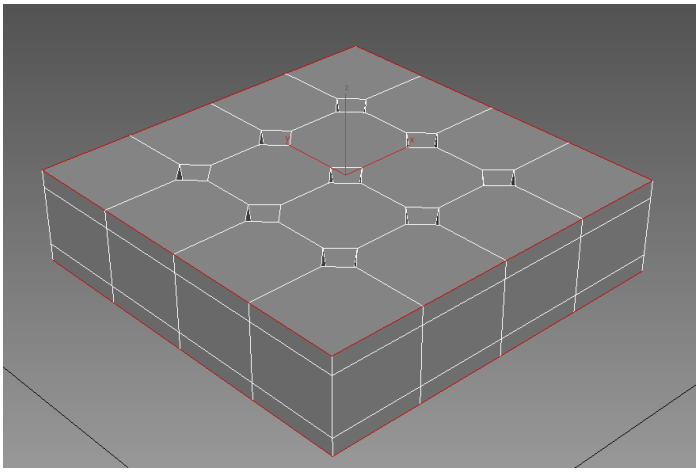
Modeling: Making the Stich Lines Part 1

In the next 2 sections we will create the stitch lines of common sofa fabric. These will include the upper and lower contour stitch as well as the sew lines that connect the dimple sections.

Open *05_Sofa_Modeling_Stitch_Lines_Part_1.max*

Hit OK button to Isolation warning dialog

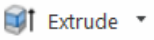
1. Select cushion and enter **Edge** sub-object mode
2. Select the following edge (double-clicking on an edge will select an edge loop, **CTRL+double-click** will add to the current selection). Alternatively, this selection has been saved as a **Selection Set**  found on the main toolbar named Edge_Stitch_Selection_01.



***Pro Tip: Selection Sets are handy ways of saving any kind of selection, whether it is objects or sub-objects as in this case. When these files were prepared for this lab, selection sets were saved in order to speed up the workflow during class.*

3. Locate the **Chamfer** 

tool in the Ribbon and access its settings
    a. Enter 0.2” in **Chamfer Amount**
    b. Press the green check to commit these changes
4. Holding the **CTRL** key, enter **Face** sub-object mode
5. Press the **Shrink** 

button
6. Locate the **Extrude** 

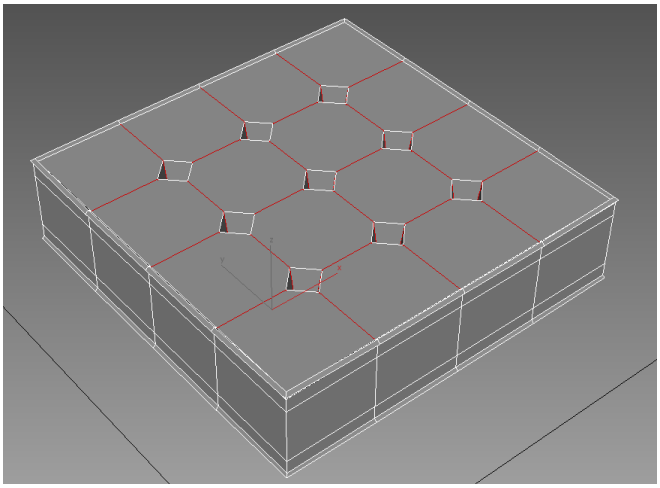
tool in the Ribbon, access its settings
    a. Expand **Type** and select **Local Normal**
    b. Enter 0.25” in **Height**
    c. Hit the green check to commit the changes

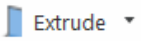
Modeling: Making the Stich Lines Part 2

Start from previous scene (or Open *06_Sofa_Modeling_Stitch_Lines_Part_2.max)*

Hit OK button to Isolation warning dialog

1. Select the cushion and enter **Edge** sub-object mode
2. Select Edge_Stitch_Selection_02 **Selection Set,** to make the following selection:



3. Locate the **Extrude** 

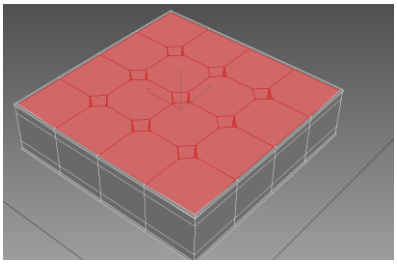
tool in the Ribbon and access its settings
    a. Enter -0.2” in **Height**
    b. Enter 0.00’ in **Width**
    c. Hit the green check to commit the changes

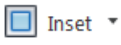
Modeling: Adding Volume

Open *07_Sofa_Modeling_Adding_Volume.max*

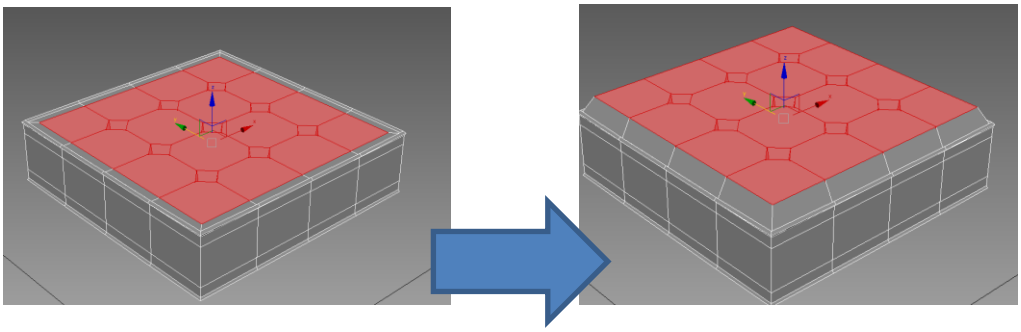
Hit OK button to Isolation warning dialog

1. Select the cushion and in the modifier stack, select **Editable Poly**
2. Enter **Face** sub-object mode
3. Select Face_Selection_01 **Selection Set** in order to have the following **Face** selection:

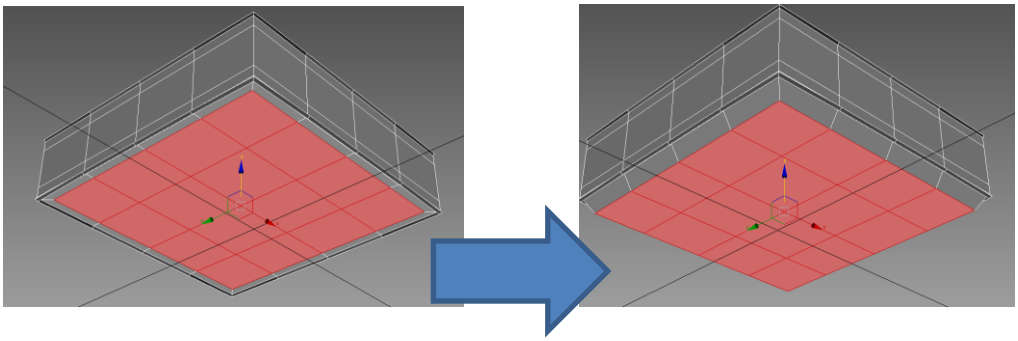


4. Locate the **Inset** 

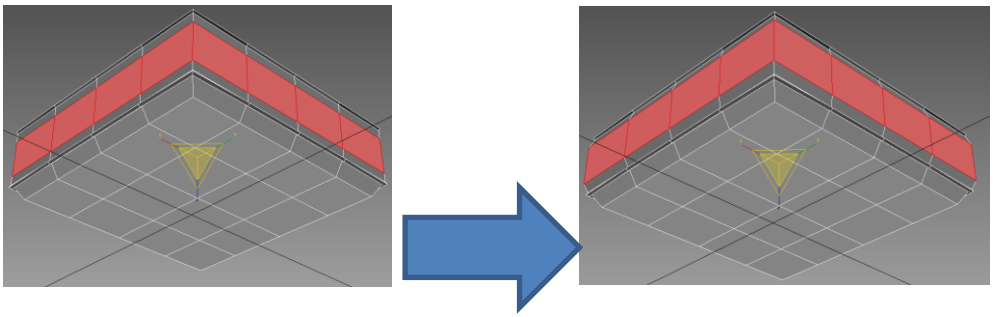
tool in the Ribbon and access its settings:
    a. Enter 0.8” in the **Amount** Field
    b. Hit the green check to commit the changes
5. With the **Move**  tool enabled, slightly move the selected faces upwards
6. With the **Scale**  tool enabled, scale the faces inwards slightly



7. Select Face_Selection_02 **Selection Set** (these are the faces below the pillow, tumble viewport in order for the view to face the underside of the cushion).
8. Locate the **Inset**  tool in the Ribbon and access its settings:
    a. Enter 0.8” in the **Amount** Field
    b. Hit the green check to commit the changes
9. With the **Move**  tool enabled, slightly move the selected faces downwards



10. Select Face_Selection_03 **Selection Set**
11. With the **Scale**  tool enabled, scale the selected faces outwards:



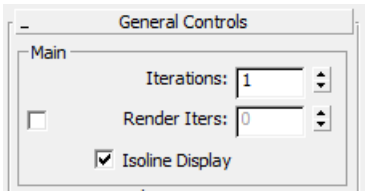
Modeling: Adding Smoothing

Now that the base model is complete, all we need to do now is add smoothing. For this we will use the new **OpenSubdiv** modifier found in 3ds Max Design Extension 1. OSD is essentially a subdivision smoothing algorithm similar to Turbosmooth and Meshsmooth. However it offers many benefits the other 2 modifiers don’t. For a more comprehensive overview of OSD, visit my AREA blog.

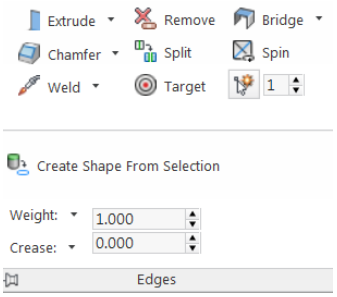
Open *08_Sofa_Modeling_Adding_Smoothing.max*

Hit OK button to Isolation warning dialog

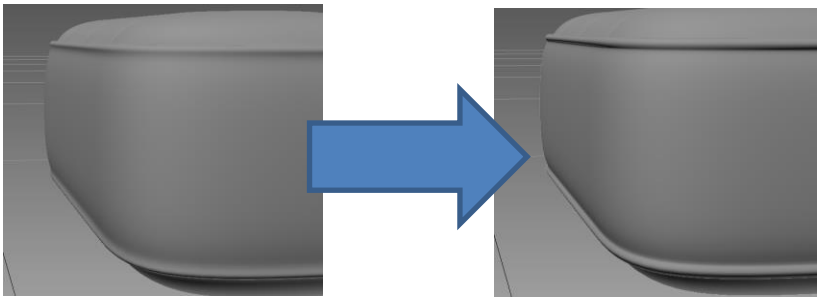
1. Select cushion in Command Panel, expand **Modifier List**
2. Select **OpenSubdiv** from modifier list
3. Set **Iterations** to **3**



4. Select **Editable Poly** from modifier stack
5. Enter **Edge** sub-object mode from Ribbon
6. Enable Show End Result  in Ribbon (this will allow us to work on the low-res model while seeing how our changes effect the final, high-res model)
7. Select Edge_Selection_01 **Selection Set**
8. Locate the **Edges** panel in the Ribbon and expand it



9. Enter **0.2** in the **Crease** field (this sharpen the stitch line around the cushion)



10. Select Edge_Selection_02 **Selection Set**
11. Enter **0.1** in the **Crease** field (this will make the cushion's corners slightly sharper)

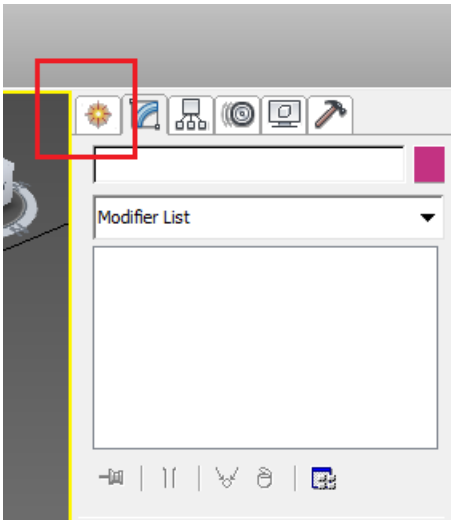
Modeling: Adding Buttons

In the following section, we'll use the **Object Paint** tool to quickly add buttons in the dimple areas of our cushion.

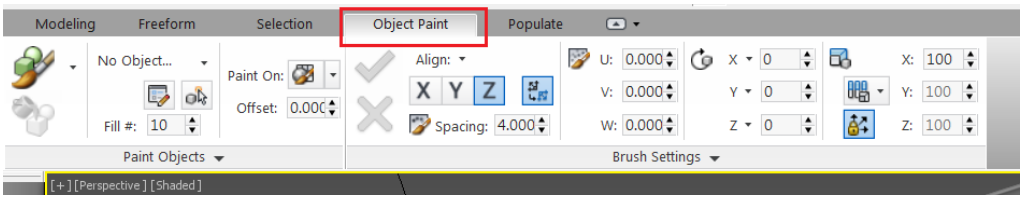
Open *09_Sofa_Modeling_Buttons.max*

Hit OK button to Isolation warning dialog

1. Navigate to the **Command Panel** on the right and select the **Create** tab



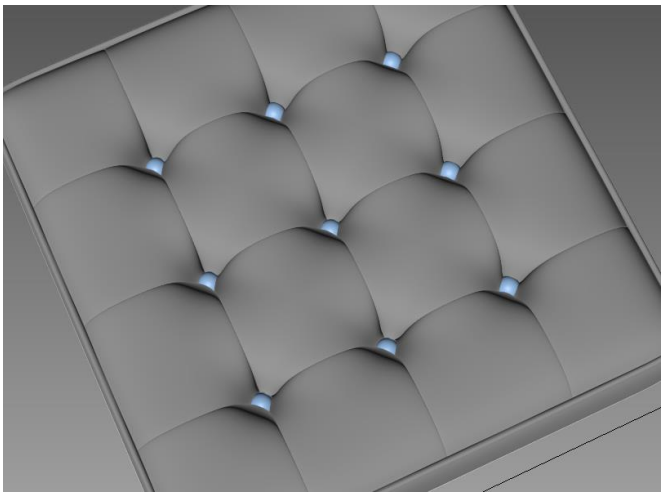
2. Select **Sphere** and create one anywhere in the viewport
3. In the **Radius** field enter **0.75"**
4. With the sphere selected, access **Object Paint** in the ribbon



5. Enable **Paint Mode** by pressing 

*** The default settings for Object Paint will be sufficient for what we want to do here

6. Go into **Top** View (**T**) or tumble perspective view to a top perspective
7. In each of the 9 dimples on the model, **left-click** to add a sphere. Should look like this:



8. Right-click to end **Object Paint** mode

9. Delete original sphere by selecting it and pressing the **Delete** key
10. Open the Scene Explorer (**H**) and select all 9 new spheres
11. Enable the **Scale**  tool and scale the spheres downwards on the Z axis
    *** This will flatten the spheres, creating a more button-like object
12. With the **Move**  tool, move the buttons upwards slightly
13. Select the cushion and in the modifier stack, select **Editable Poly**
14. In the Ribbon, navigate to the **Modeling** tab
15. Locate the **Attach** 

tool, and enable it
16. One by one, click on each sphere. This will make the sphere part of the same object as the cushion.

Modeling: Finalizing the Sofa

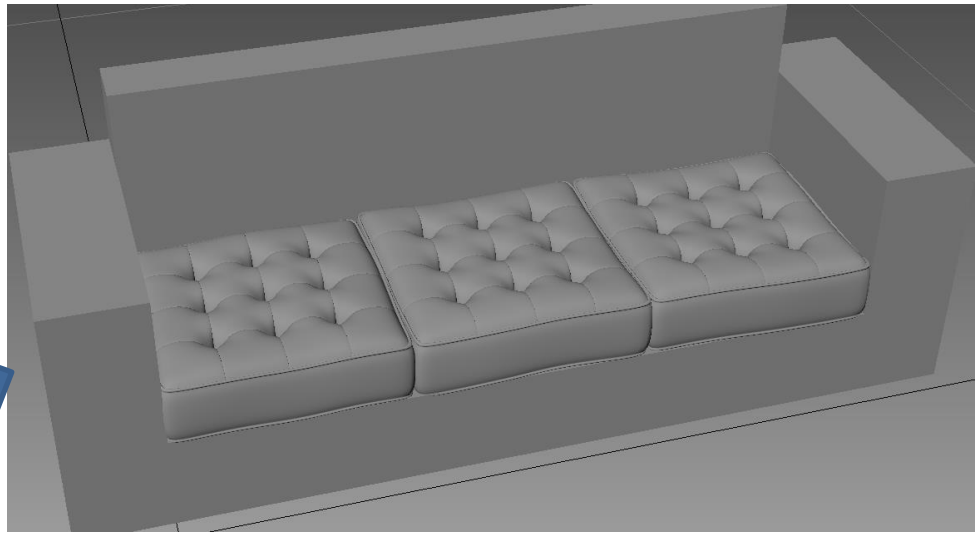
How that our cushion is complete, let's make a few copies of it and add some randomization so each cushion appears to be unique.

Open *10_Sofa_Modeling_Final_Touches.max*

Hit OK button to Isolation warning dialog

1. Select cushion and navigate to the Modifier stack and expand the **Modifier List**
2. Select **Noise**

3. Drag it below the **OpenSubDiv** modifier
    a. Set **Scale** to 1.5
    b. Enable **Fractal**
    c. Set **Iterations** to 2.0
    d. Set **X** and **Y Strength** to 0.5”
    e. Set **Z strength** to 1.0”
4. Un-isolate the other models by pressing  in the lower-center of screen
5. Delete the 2 older cushion models
6. Select the cushion model, right-click and select **Clone**
7. In the **Clone** window, select **Copy**
8. Move this new copy over to the side of the original cushion; repeat one more time for the third cushion.
9. Select the second cushion, and in the **Noise** modifier parameters, Set **Seed** to 1
10. Do the same with the third cushion and give it a **Seed** value of 2. This will make each pillow have a different ondulation pattern. This value can be changed to anything until we are satisfied with the ondulation.



***In the image above, folds and wrinkles were added to the sofa using Autodesk Mudbox, a 3d sculpting package. Videos of this process will be made available post AU.

05. Creating Covers and Sheets

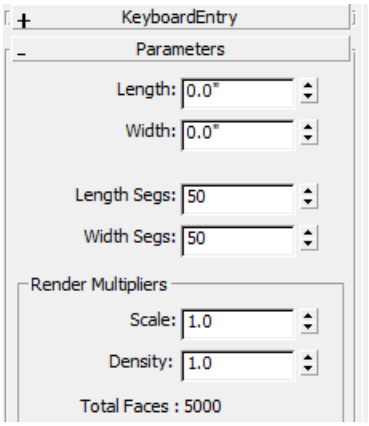
In this next chapter we will explore some easy techniques for creating realistic models of any kind of fabrics. Specifically, we will create a bed cover, however the techniques described below can be used for any other type of fabric object such as towels and throws.

What makes modeling fabric type objects difficult is their non-uniform appearance. They contain many folds, creases and wrinkles. Modeling this by hand would be a nightmare. Instead we will use simulation tools to simulate the real behavior of a fabric type object.

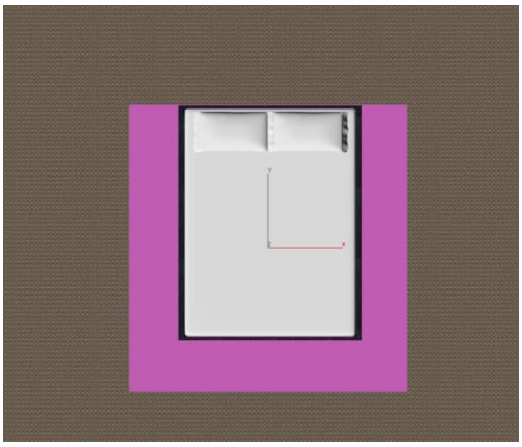
Cloth: Setup

Reset 3ds Max Design and Open *13_Cover_Setup.max*

1. Press **T** to enter **Top** view
    a. If the scene appears to be far away in the viewport press the **Z** key to frame the scene to the current view.
2. In the Command Panel, enable **Plane**
3. Enter **50** for Length and **Width** segments

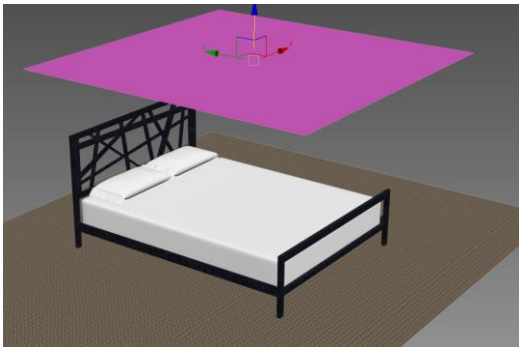


a. Drag a **plane** over the bed model. Make sure it surpasses the bed on all the 3 sides, much like a real cover would



b. **Right-click** to exit creation mode

4. With the new plane selected, press the **P** key to enter **Perspective** view
5. Enable the **Move** tool (if not already enabled) and move the plane above the bed

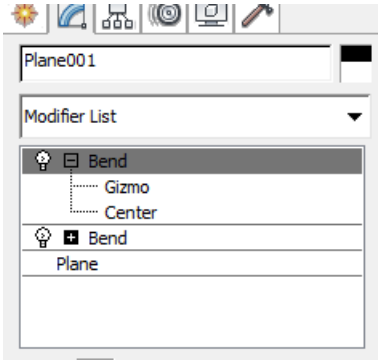


6. Open the **Material Editor**
7. Select the Cover material (upper left slot)
8. Apply the material to the by drag and droping the material on the plane

** It's important to do all texturing and UV assignments at the stage of process, while the Plane object is still flat and easily textured. Attempting to this once the plane has been turned into a fabric will be much more difficult.

9. With the plane selected, expand the **Modifier List** and select a **Bend** modifier
    a. Select **X** as the **Bend Axis**
    b. Set the **Angle** to **-150**

10. In modifier stack, right-click on **Bend** and select **Copy**
11. Right-click again and select **Paste**
12. Expand the second Bend modifier in the modifier stack, select **Gizmo**

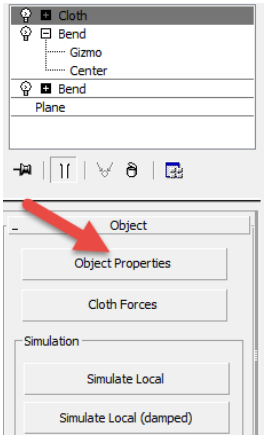


13. Enable the **Rotate** Tool  and rotate the Gizmo along **the Z-axis** (blue line)

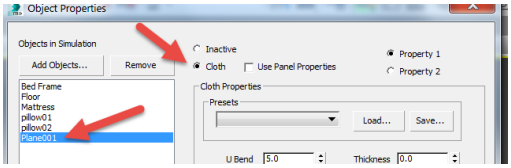
Cloth: Simulation

Open *14_Cover_Sim.max*

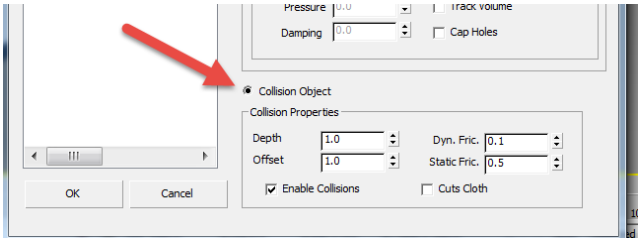
1. Select all models in the scene (**Ctrl+A**)
2. In **Modifier List** add a **Cloth** modifier
3. In Cloth modifier parameters, access **Object Properties**



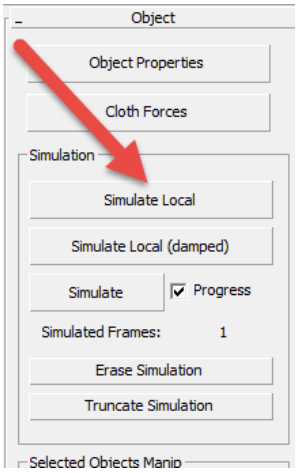
4. In the left pane, select Plane001
5. Make it a **Cloth** object



6. Expand the **Presets** dropdown and select **Cotton**
7. Select the remaining objects (**Ctrl+left** click to select multiple items)
8. Enable **Collision Objects** in the lower portion of the panel



9. Press **OK** to exit the dialog
10. Back in the **Command Panel**, scroll down to access the **Simulation Parameters**
    a. Enable **Self Collision** and enter a value of **3**
    b. Next to **Subsamples** enter a value of **3**
11. Scroll back to the top and **Simulate Local**



**** This is an interactive process. We can therefor tumble in the viewport while the simulation is occurring to get a better idea of the result.*

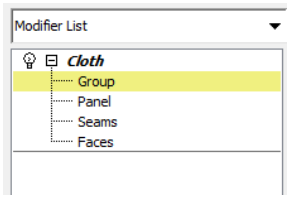
12. Once satisfied with the simulation, disable **Simulate Local**
13. Select Cover object
14. Expand **Modifier List** and select **Shell** from the list
    a. Enter a value **of 0.1**"in **Outer Amount**
15. Expand the **Modifier List** once again and select **OpenSubDiv**
    a. Enter a value of **2** for **Iterations**
16. Done!

05. Bonus

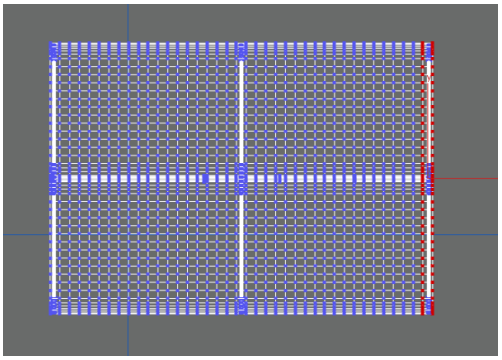
Cloth: Simulating a Tent

Open *16_Tent_Start.max*

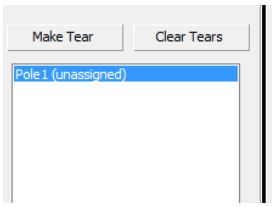
1. Open **Scene Explorer** (**H**) and select all 4 **Pole** objects as well as the **Tent_Fabric** object
2. In the Command Panel, expand the **Modifier List** and add a **Cloth** modifier
3. Access the **Object Properties** panel from the **Cloth** Settings
4. Set Tent_Fabric to **Cloth** and all the Poles to **Collision Object**
5. Press **Ok**
6. Select the Tent Fabric object
7. In the Modifier Stack, expand **Cloth** and select **Group**



8. Go into Top (**T**) View and press F3 to enter Wireframe mode
9. Select the following vertices:

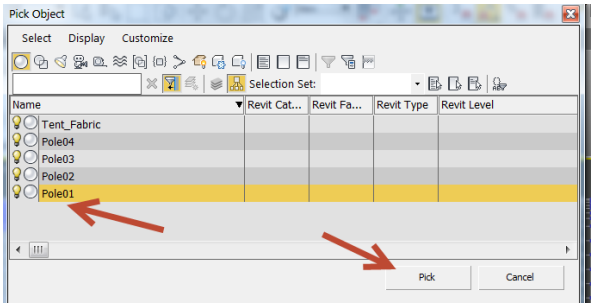


10. In the Command Panel, press the **Make Group** button; name it Pole1
    *** Notice a new group has appeared in the Group section highlighted in blue



11. Press the **Sim Node** button and open the **Scene Explorer** (**H**)

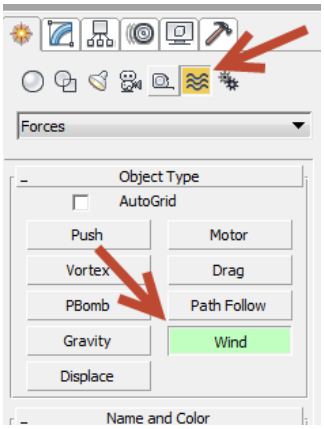
12. Select **Pole01** and press **Pick** button



13. Repeat steps 8 through 11 for the remaining 3 poles (don't forget the center pole!)

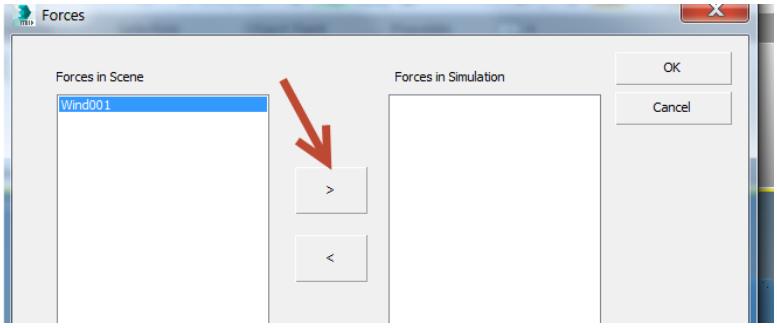
Open *17_Tent_Cont.max*

1. In the **Command Panel**, access **Space Warps**, enable **Wind**



2. Drag in **Perspective** view to create a **Wind Force**
3. With the **Wind Force** still selected access the **Modify** Panel
4. Set the **Strength** to **20**
5. Enable **Angle Snaps**  in main toolbar
   *** The angle snaps default is 5°, this can be changed by right-clicking on the angle snaps icon***
6. Enable the **Rotate**  tool and rotate the **Wind Force** 90° on the **Y axis** so it points towards the camera
7. Select the Tent Fabric and access the **Modify Panel** in the **Command Panel**

8. Click on **Cloth Forces,** and move the **Wind001** object from the left to the right, press **OK**



9. Press **Simulate Local**
   *** The **Wind Force** object can be moved or rotated dynamically in the viewport while the simulation is running. We can see the effect of the wind from different directions as well as with different strengths without having to stop simulation. Also, try playing with the Wind parameters such as **Turbulence** and **Frequency** to generate an even more compelling simulation. Give it a try!****

Below are some rendered examples of different types of fabric which were created using the same technique.

Additional videos have been supplied to attendees of this class. They are located in the following dropbox location:

https://www.dropbox.com/sh/q5hlhvhw041foxa/AADnqjZaXmhnaBRdoUIaGvfia?dl=0