GA2211 – Hard Surfaces Modeling Section A & B – Class Notes – Week 5

UV Layout and Beginning Texture Mapping Techniques

UVW Space-

UVW space is another workspace we work in. While XYZ ("World"/"Local") space puts sense of our 3D environment in terms of the directions X , Y and Z – UVW Space is 2 Dimensional. So as not to confuse the spaces, the letters U, V, and W are used to denote that we are in UVW or "Texture" Space. The U and V are the lateral and vertical axis…and W is assumed to be pointing toward at the viewer (out from the screen), and because of this is sometimes omitted ("UV" or "UV's").

UVs:

You can think of UVs as flattening and laying out the panels and polygons of your mesh onto a flat surface, so that all surfaces are represented. This is the ideal goal of clean UV layout. For a 2 Dimensional texture to wrap properly across your 3 Dimensional mesh, you need this relationship.

PAPER CUT-OUT MODELS AS METAPHOR FOR UV SPACE:

It helps to think in terms of "**Paper Cut-Out Models**". These are paper puzzles that you cut out and glue together to make a model of something in 3D. The creators of paper models have the same problems as 3D artists – that is, they must print a 2 Dimensional image that shows the entire paper model, which must be assembled into a 3D paper model. This is accomplished by dissecting the model into flat pieces:
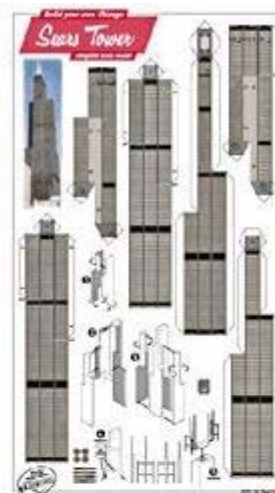
In this example to the left, the printed 2 Dimensional cards on the right contain all the pieces used to create the 3 Dimensional parts on the left.

The manufacturers have sized and arranged the "shells" accordingly so that the printed image is even and in scale with no distortion.

This is our goal too, as we lay out UVs.

You can think of the completed models to the left – the ones analogous to what we see in our viewport – as being in XYZ space.
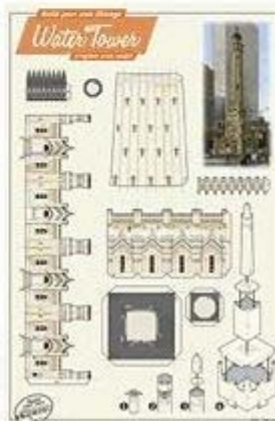
You can think of the 2D printed boards to the right as being in UVW space.

Previewing your UVs:

To see the UVs of any given polygonal mesh, you must use the "Unwrap UVW" modifier:

1) Apply the "Unwrap UVW" modifier to your Editable Poly/Mesh.

2) Lower in the stack, click the "Show End Results" button to preview the effects as you work in sub-object mode.

3) In the Unwrap UVW stack item, scroll down and click the "**EDIT**" button to bring up the UV Editor.

These are the current UVs of this polygonal mesh. They may look like random noise at the moment, but we'll make sense of them soon.

Primitive UVs and Modeling Changes:

All primitive polygon meshes being with reasonably clean UVs. Try creating some primitives and use the Unwrap UVW map modifier to view the UVs:
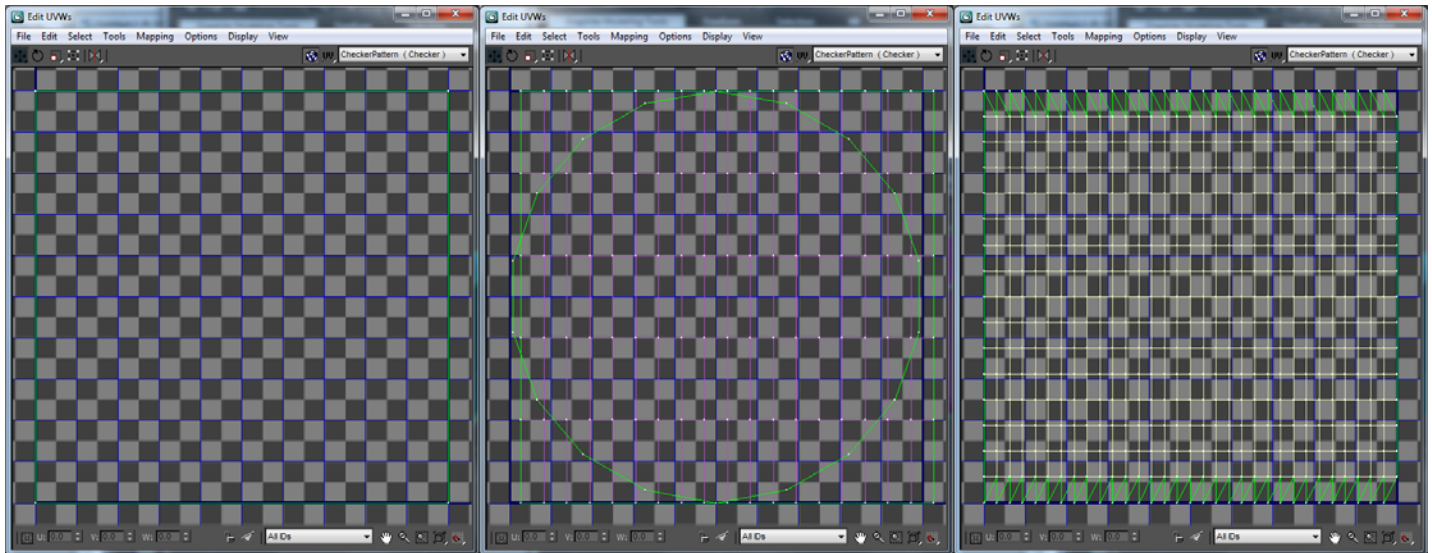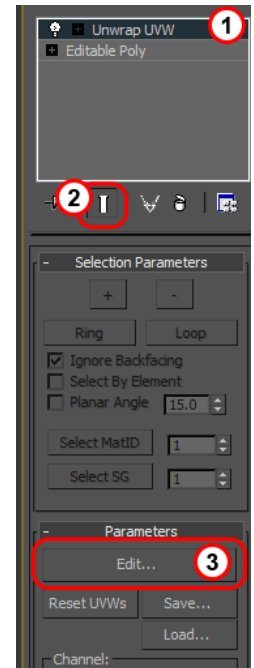
You'll notice that Max has done a reasonable job of laying out their pieces into the UV space. The images above are for a Box, Cylinder and Sphere.
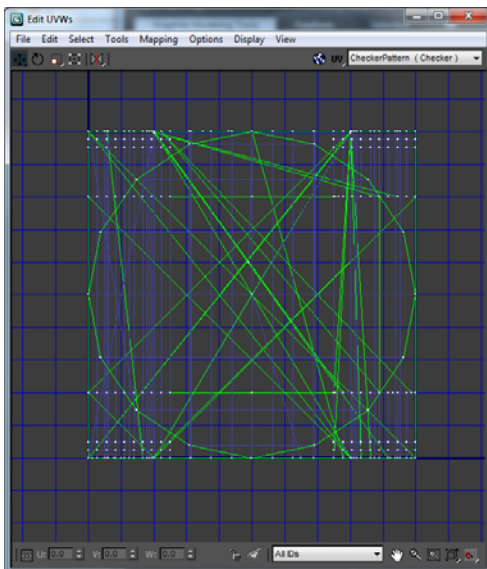
As soon as you begin to model – cutting faces, extruding and moving polygons to add detail – you create new faces that have undefined UVs. The end result is that, when your model is complete, the clean UVs that Max layed out for you are no longer valid:

The image to your left is a mailbox…all the UVs are bunched up on top of each other and undefined.

This is when it is time to begin UV Layout.

UV LAYOUT and the UV Editor:

The end goal of UV layout is to arrange the UVs into shells that represent perpendicular projections with the least amount of distortion possible – in practice, this means cutting up the model (with the UV Editor Tools) and laying it out cleanly into it's pieces:
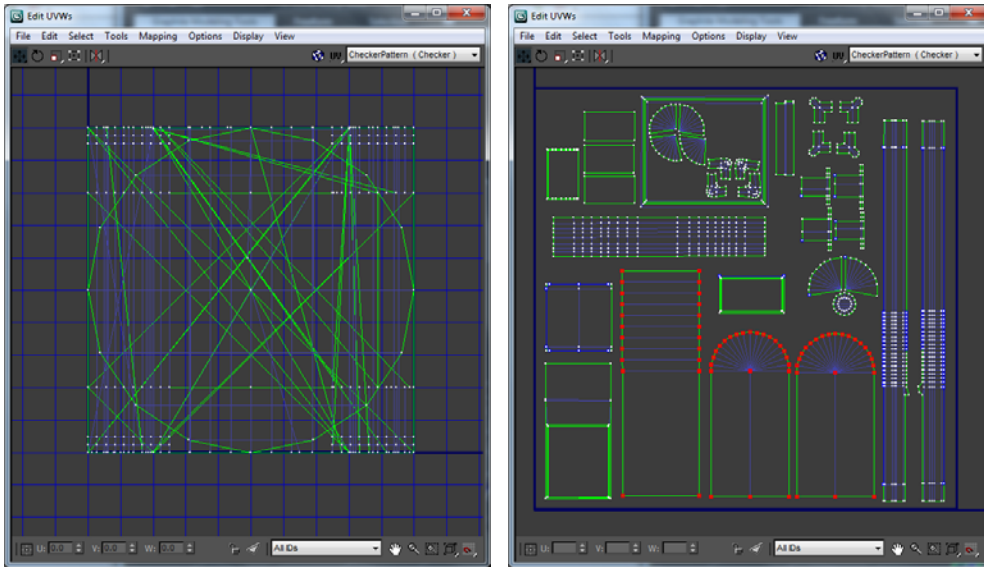
The image on the left is the before, and the image on the right is after about an hour of UV Layout.

Tools within the UV Editor:

Sub-Object selection –

The UV Editor has its own sub-object selection. Use THESE sub-object modes to select vertices, polygons and edges. This is available from the Stack (open the [+]) or right-click menu.

Once you have made a sub-object selection, use the following tools to move it in the UV space…

4) Transform Tools:

Move /**Rotate**/**Scale** – Same as transform tools in the viewport.

[*Note:*] *Snaps, such as grid, point and angle snaps are still available in the UV Editor. Click "S" to toggle them on/off as you would in the viewport.*

Freeform Tool –
The freeform tool lets you quickly make all the other transformations from one handle.

5) You can hide the checkerboard background with this toggle.

6) This is your work area.

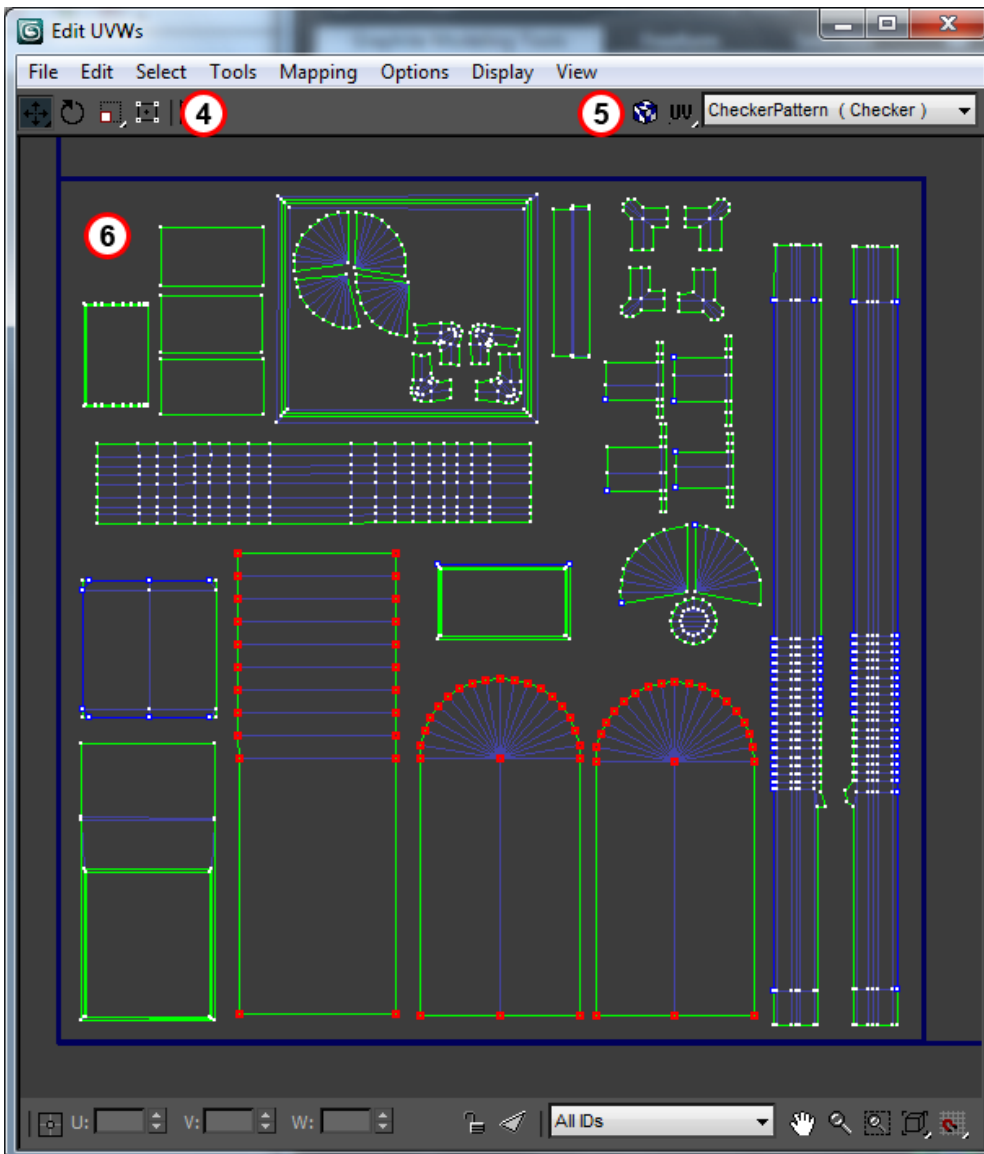**7)** If you drag on the outside corners of your selection, you will get **Scale**.

[Note:] You can hit to constrain the scale or move to one

axis.   +   will constrain proportions as you scale.

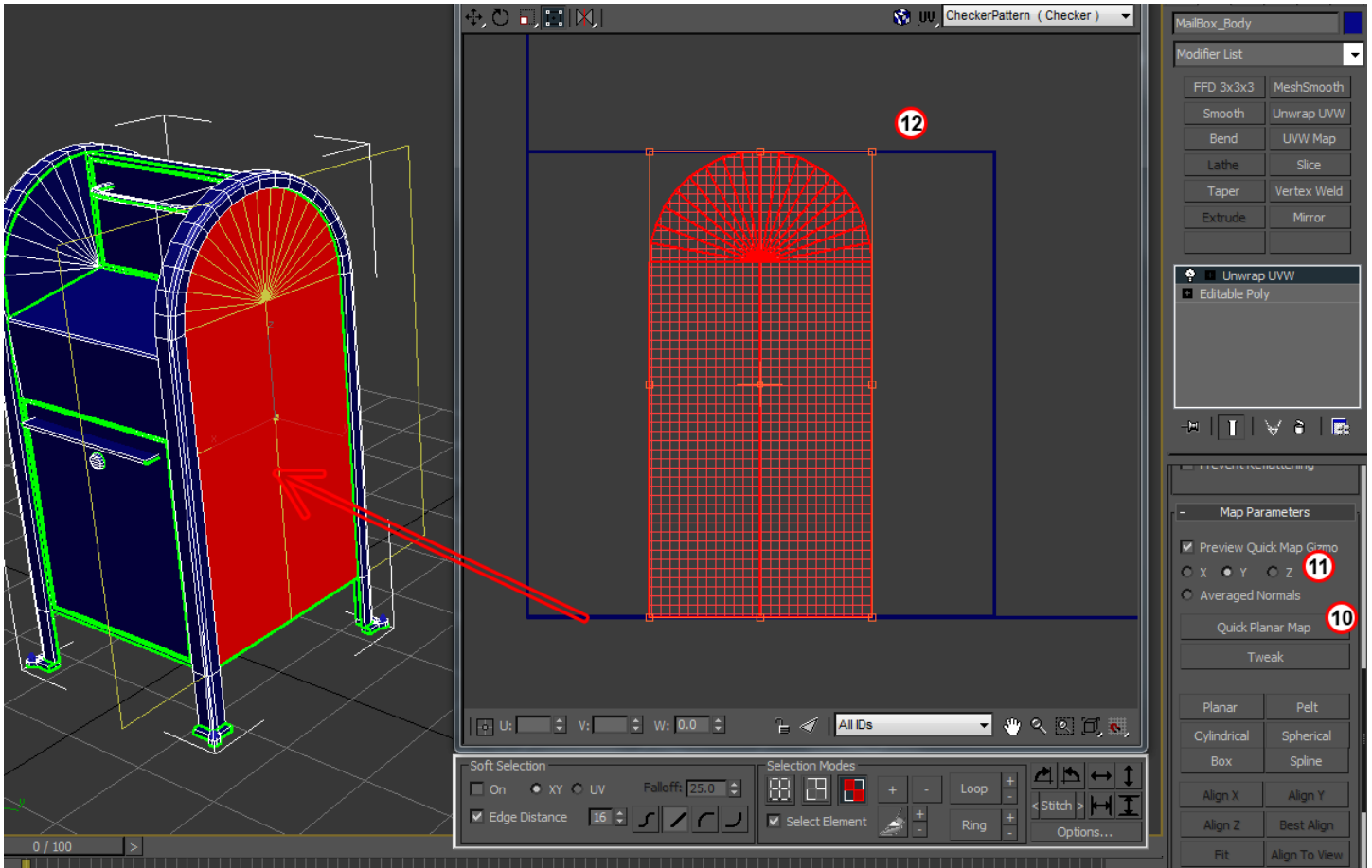**8)** If you drag on the center of the outside edges, you get **Rotate**.

9) If you drag anywhere in the middle of the handle, you get **Move**.

Tools in the "Unwrap UVW" Modifier:

There are tools in the modify Panel menu of the Unwrap UVW modifier that you will use in conjunction with the UV Editor. Have both open, and a good view of your viewport too as you work.

QUICK PLANAR MAP:

10) Quick Planar Map – Quick Planar map will do a quick planar projection of the selected polygons. It is not necessary to specify an axis to shoot down, but sometimes this is desired. With some co-planar polygonal faces selected, click the "Quick Planar Map" button.

11) You can specify an axis to shoot down here. The Quick Planar Map will shoot down this axis. Use the World Axis in the bottom left corner of your viewport to determine which axis is best. In this example, it was Y.

12) As soon as you hit the "Quick Planar Mapping" button, a projection is made and the results are visible in the UV Editor. You can use the Transform tools (4) to further edit and place the projection.

Some sections of your model will not lend themselves nicely to a planar projection. The Cylinder Mapping projection will work nicely for cylinder-shaped sections of your mesh. It is also useful for doing multiple planar mappings in one go – so long as the sections of your mesh have contiguous edges – as in the outside faces of a square column.

CYLINDER MAP:
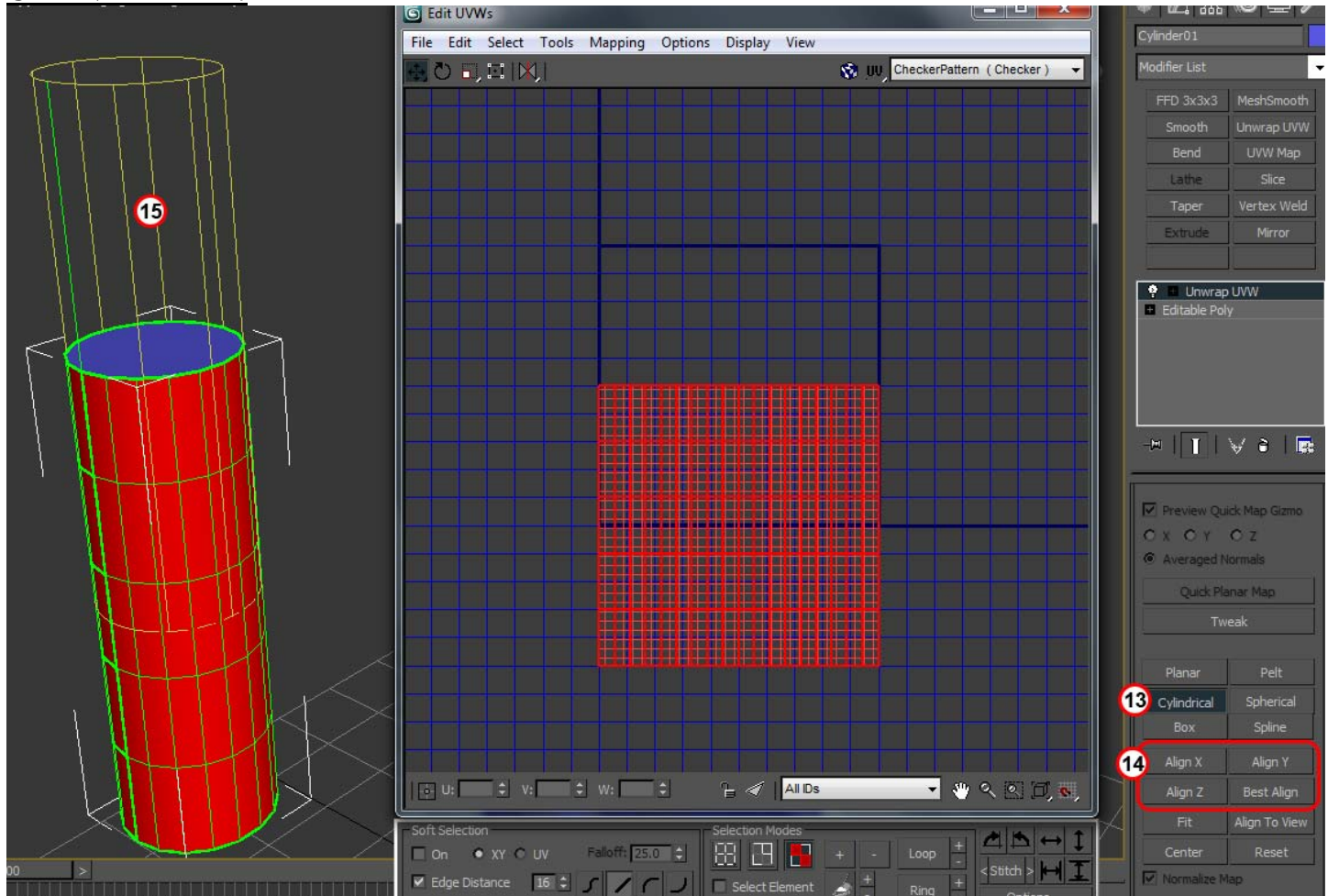
13) Apply the Cylinder mapping by pressing the **CYLINDER** button.

14) The projection may be on the wrong axis. You can use this section to align the long axis of the cylinder projection to one axis.

15) Look at the result in the viewport. A preview Gizmo will show you the direction of the mapping. Click the alignment buttons (14) or use the transform tools in the main viewport to adjust the fit.

[*Note:*] *With Cylinder mapping, there is always a seam – a section that is the beginning and the end wrapping point for the cylinder projection. You can determine where this seam is by rotating the Gizmo (15) about the long axis of the cylinder. Watch the result in the UV Editor as you let go of the rotation. If you are mapping a partial cylinder mesh and have a seam separating two sections…rotate the gizmo until the two sections are jointed in the UV Editor. This will put the seam at the ends of the selection, rather than somewhere in the center.*

RELAX:

You can use the "RELAX" tool to fix distortions caused by bad projections…or to fix distortion on complicated geometry with an organic flow or undercuts in the geometry.

To Relax:

Select the faces you've previously projected/mapped.

In the UV Editor, go to "Tools > Relax…".

Click "Start Relax" to begin the automatic Relax. Click "Stop Relax when n you are satisfied with the results.

Target Weld/Weld Selected:

These two tools are available from the UV Editor menu: "Tools > Weld Selected" & "Tools > Target Weld".

In vertex sub-object mode of the UV Editor, you can use the above tools to weld selected sections that you've previously mapped together. This minimizes texture seams, and is advisable.

[*Note:*] *You can determine which edges are matching edges by visually inspecting them in the viewport...or selecting the edge and looking in the UV Editor. It's matching edge on the other shells will highlight in BLUE. You will then know which shell and verts to weld to create a seamless new shell out of the previous two.*

As you work, your UV Editor space can get very messy. I recommend the following work-flow:

A) Drag all the beginning, undefined shells away from the 0-to-1 UV Space...this is the blue square where all projections try to end up. Drag them all into a "junk" pile to the left.

B) As you make projections and mappings, take them away from the 0-to-1 space, so they won't be confused with working projections. Take them over to the right somewhere.

C) You'll notice that all projections try to place the UVs in the 0-to-1 square (blue square). Use this as a workspace.

D) Continue this left-to-right assembly-line until all the UVs in the "junk" pile are gone. Then you will know all UVs have been properly projected.

E) Once all UVs are properly projected, it's time to pack them. Packing means getting them all back into the 0-to-1 UV space. Try to minimize spaces between the pieces and move/rotate them to get them into the space.

UV TEMPLATE AND TEXTURING:

Once you have properly layed out your UVs and packed them into the 0-to-1 Square, it's time to make a template for texture painting.

Packed nicely into 0-to-1 Square
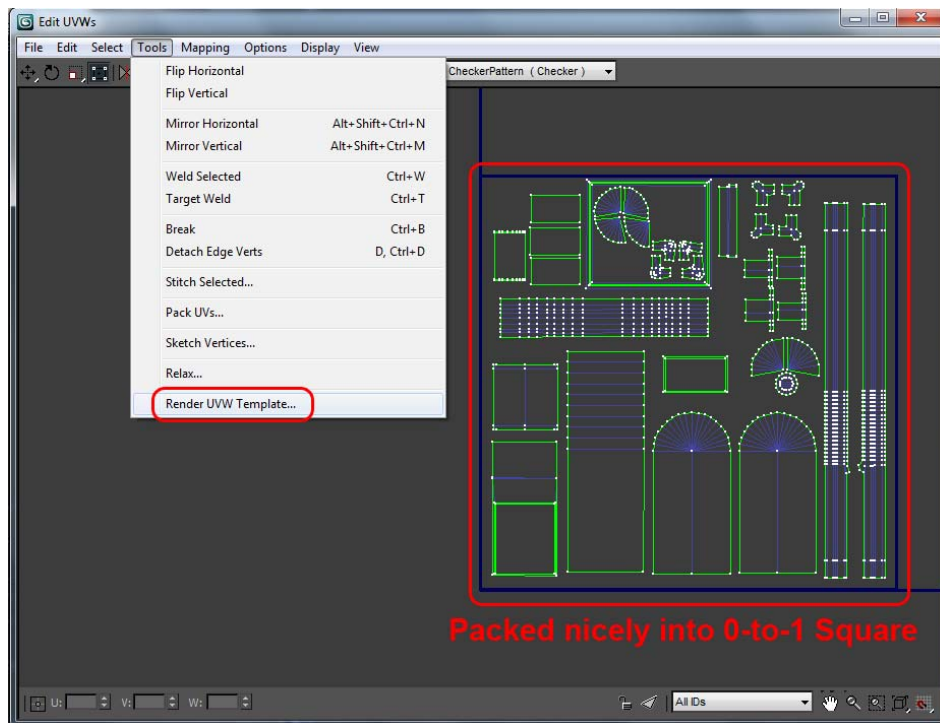
"Tools > Render UVW Template".

You'll get some options for the file size, format and destination.

[**Note:**] *Always render out a UV Template at twice the resolution you think you'll need. You can always scale down the image in Photoshop, but scaling up will not provide any new information...so go higher than you think you'll need.*

Once you've rendered a UV Template, save it by clicking the Save button in the Render Viewer.

Bring this into Photoshop as a new layer, and set the blend mode to "SCREEN".

This last step will make the black portions of the template see-through.

Begin to paint the texture map. Use the Template to guide you as to where you are painting on your 3D model.

To preview your results:
Hide the Template layer and save the texture map. Apply the texture map to the diffuse channel of a material, Assign the material to your mesh.