

Material ID Unwrapping

By Logan Foster
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Foreward

This tutorial was taught to me by Joe Maruschak who in turn as one of the senior artists at Dynamix taught this same method to much of the Dynamix art team and other people that he has crossed paths with over the years.

Joe had originally intended to write this tutorial himself, but due to the closure of Dynamix and starting at a new job, he found himself a bit short on time. Hopefully I can capture within this document everything that I have learnt about this method of UVW coordinate setup through the conversations that I have had with Joe.

For those of you who have extensive experience with Discreet's 3DS Max, you will notice that a lot of the steps in this tutorial are very similar to methods that you already use in your scenes. Hopefully this will allow you to pick up on the process very quickly. It is not difficult, it is just time consuming.

This tutorial has not been written for newbies or people with little experience or knowledge of 3DS Max. If this is you, I recommend that before you go any further into this document that you perform all of the tutorials that ship with Max and then come back after you understand everything there. Without a solid base understanding of this software there is nothing that this, or any other tutorial, can possibly teach you in regards to making 3D assets for your project.

Wherever possible, I have tried to include as much theory or notes as possible regarding specific tasks so that you, the reader, can understand what is going on and use this knowledge to help replicate the process on your own.

You will need the following items to participate in this tutorial

- Discreet 3DS Max version 3.1 or greater
- The accompanying ZIP file which contains the example files and maxscripts used in this tutorial
- The Texporter Utility plugin which is available for free from www.maxplugins.de
- The two checkered bitmaps which you can use to help setup and test your UVW setup (included with this file)

To help you out further, you should check out www.scriptspot.com and look for two programs, one is called "LiveLink" (which will update your Max material file whenever you save your bitmap texture) the other is a small utility called "Paint by ID". These two programs are not necessary to complete this tutorial, but they are useful towards helping speed up the process.

Please note that all sample files that are included in this document require Max R4 to open. If you do not own, or have not upgraded your version of 3DS Max to version R4 you can follow along through the use of the images and the accompanying file called "UVW_basic.3DS".

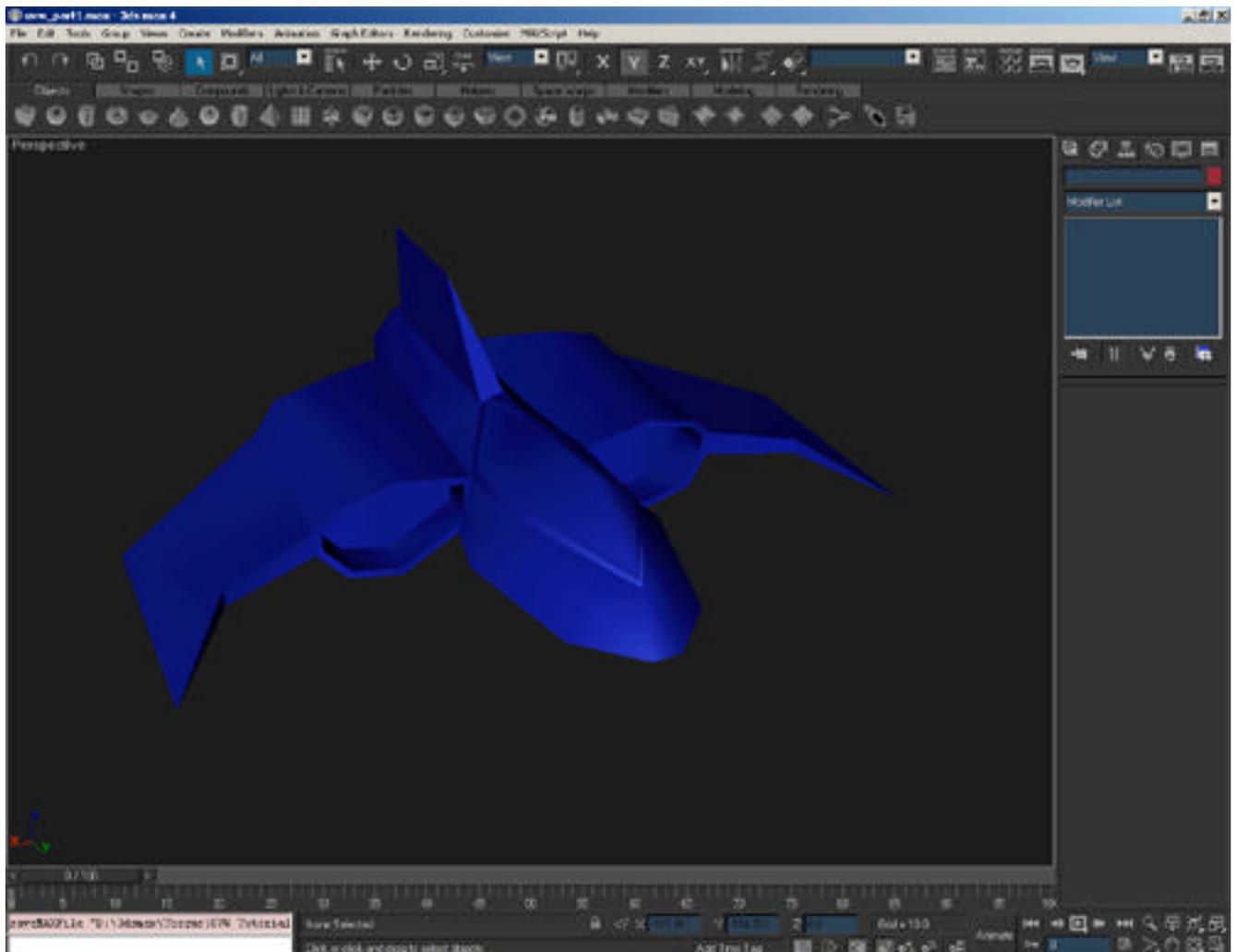
Part 1: Materials Setup

Introduction: In this first part we will be using Max's material editor to apply a Multi/Sub-Object material to our sample file. This material will eventually help us setup UVW coordinates for painting and texture placement.

Note: You should be running Max R3.x, or R4.x. If you are not running one of these versions, you will not be able to participate in this tutorial (sorry but the tutorial requires certain features that are available only in these versions of the software). For all of the reference images in this tutorial I have used 3DS Max R4.26 with a custom UI. Do not be alarmed if screenshots look a bit different than yours they are in your version 3DS Max.

Load up your copy of 3DS Max.

Now that you have Max loaded, open the file "UVW_part1" into Max. This will allow you to follow along and understand what I am describing in this part of the tutorial.



After the file has finished loading (it should be only a second or two at most), you will see a very simple looking low-polygon fighter plane that I have quickly created for this tutorial, this is the reference model that we are going to texture throughout this tutorial. Once you have finished the

tutorial, you should easily be able to apply all of the processes outlined here to any model that you create for your game project.

The first thing that we are going to do is setup a material that will assist us in assigning UVW groupings which we will eventually paint and use to apply a texture to our object.

Note: *this material is only temporary and is used only to help setup our mapping coordinates, we will eventually replace this with another material for the final texture.*

Open your material editor and choose an empty sample slot.

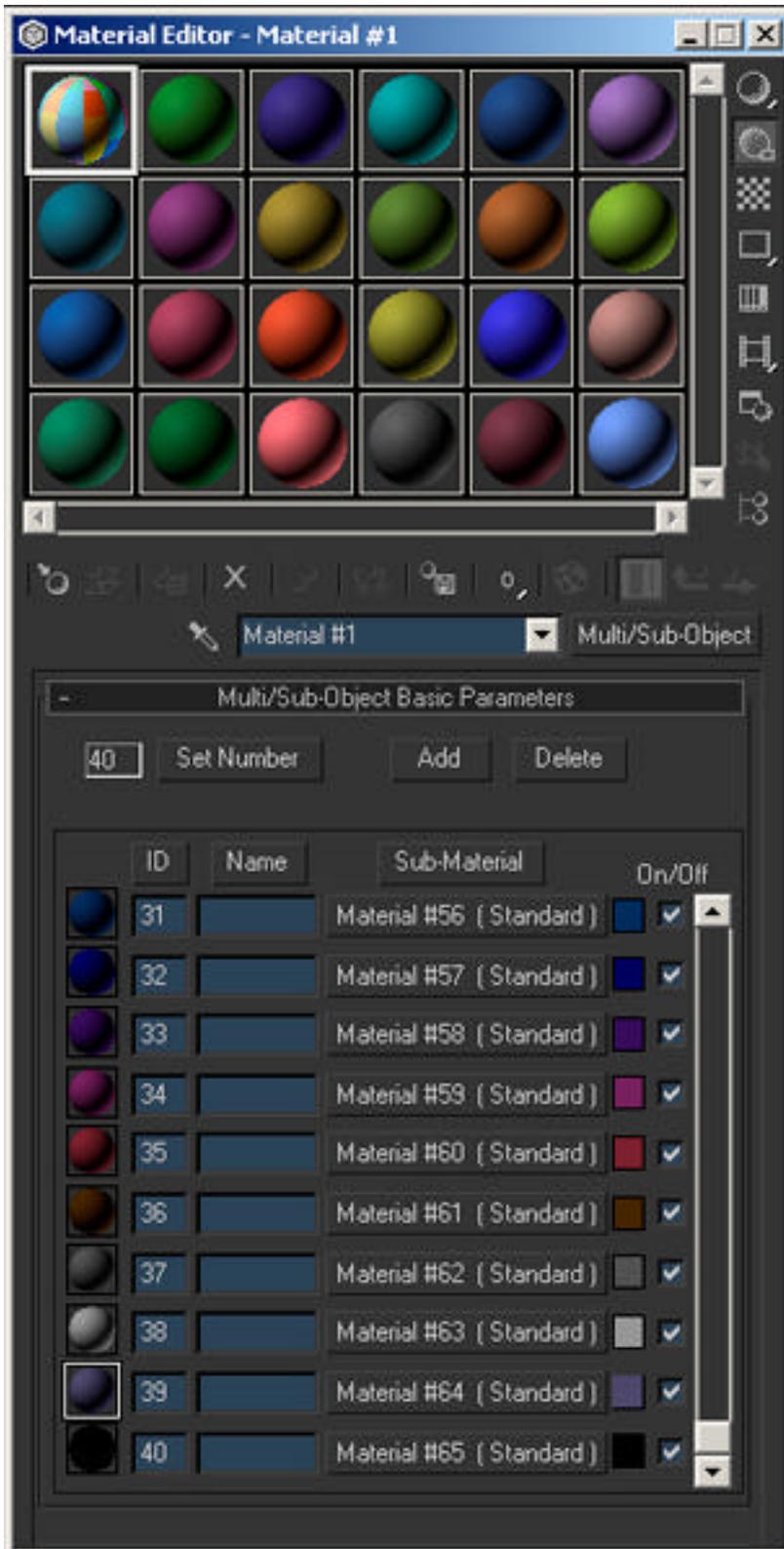
Change the material type from “standard” to “multi/sub-object”. You can discard the old material if you like since you do not need it and it will not affect the final outcome we wish to achieve.



Next, you need to add a large number of Material IDs to this multi/sub-object material by clicking on the “set number” button (I have set 40 ID channels in my example file). These ID channels will be used to create groupings of faces that will be planar UVW mapped. So obviously the greater number of IDs that you allow yourself to use in your multi/sub-object material, the more options that you will have to create ID groupings on your mesh.

Note: *You may need to use 99 ID channels on some meshes, it really depends on how complex your object is.*

Change the sample color for each Material ID to a color that is unique within this multi/sub-object (do not use black or white as a sample color). This will allow you to spot the different groups that you will assign to your mesh in your 3DS Max viewport display. Set the very last ID channel in your Multi/Sub-Object material to pure black (this is the only time where you will want to use black for any of your ID channels).



Apply this material to the fighter plane object by dragging the material slot onto the object, or if you have the fighter plane object selected you can click on the "assign to selected" button that is in the material editor window.

Now that we have setup our material and assigned it to our model save your work.

Part 2: Object Setup

In the previous part of this tutorial you setup a Multi/Sub-object material that will help us with our UVW coordinate setup and then assigned this material to our object.

As we continue on, in this part of the tutorial we are going to setup the model so that we can begin to group faces together for UVW coordinate placement by assigning material ID numbers to faces. This is similar to the typical Material ID mapping method that you likely already know about.

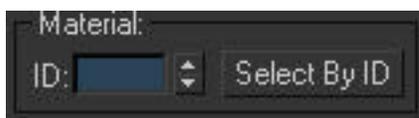
Note: *You can continue to work with the file that you first started with, or you can load up UVW_part2.max.*

With our material created and assigned to our model it is time now for us to get to work on setting up the UVW groupings that we will use. This is a very simple process that involves the same techniques as setting up material IDs for multi/sub-object material placement.

The first thing that we want to do is select the fighter plane, and collapse the modifier stack of the object to an “editable mesh”. We are doing this to prevent modifiers that have been previously applied to this object from affecting the work that we are doing right now.

Note: *It is highly recommended that you always setup your texture coordinates before you link your mesh to your skeletal deformation system. There is a way to get around this tough. You will need to create a clone of your mesh and then setup the UVW coordinates (as outlined in this document) on the cloned mesh. Once that is complete, save your UVWs to a file and then apply the Unwrap UVW modifier to your original mesh, load the UVW coordinates that you just saved, and then move the Unwrap UVW modifier down the modifier stack so that it is below your Skin modifier.*

Now that we have collapsed the mesh, click on the modifier tab located on the control panel on the right hand side of the screen. Enter into the “polygon” sub-object mode of the editable mesh modifier that you see listed.



Now that you are in the polygonal sub-object mode of your mesh, select all of the faces on your model and assign them the very last material ID number of the Multi/Sub-object material that we previously created (which is 40 if you forgot). This will make the object appear pure black in the shaded viewports.

With the object appearing black in our Max viewport it makes things a lot easier for us to visualize the groups that we are going to setup and also ensure that we do not miss any faces as we setup our groups, which could be an annoyance later on.

Note: *I recommend that if you haven't done so already, that you turn on the “wireframe overlay” option (F4 key) and the “shade selected faces” option (F2 key) so that you can see your polygonal faces easier in the viewport.*

The next step that we are going to do is select faces (or polygons) on the object that are on the same or similar planar angles to one another, or that we want to map with a specific section of our texture (ie. the face or the hands).

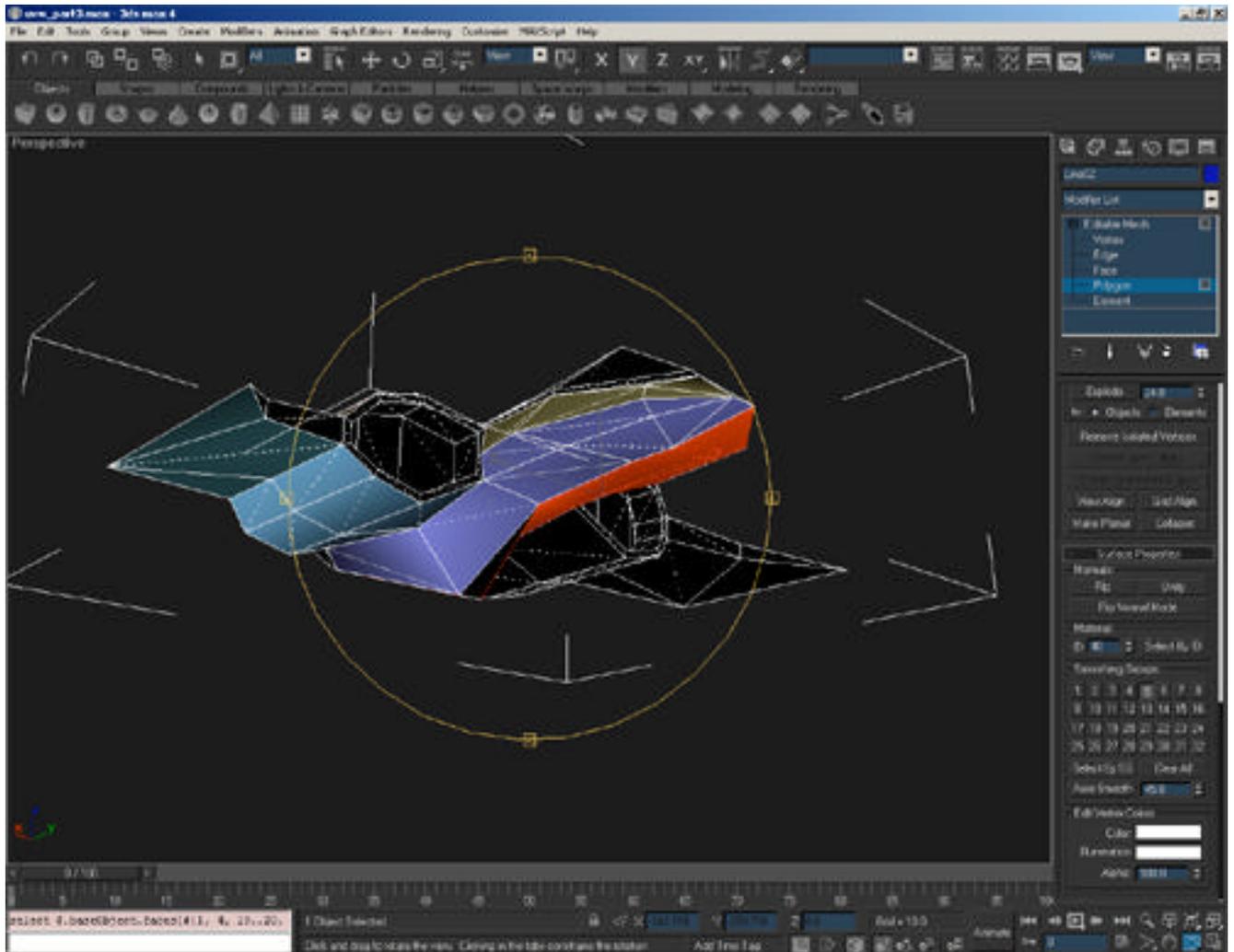
Assign these selected faces a unique ID number, you can do this under the surface properties rollout in a type-in box called "Material ID". Notice that after you assign an ID to the face(s) the color of the faces will change to match the color of their corresponding material ID in the Multi/Sub-Object material that we created earlier and applied to this object. If you like, you could also use the aforementioned UVW Paint script to assign the ID numbers to the faces.

To conserve on texture space, it is recommended that you give symmetrical areas of your object different ID numbers. When you setup your UVW mapping coordinates, you can then place these two groups on top of one another (by flipping one of the ID groups), thus allowing you to have both halves use the same texture information. For example on this mesh I will use the same mapping on the fuselage and the wings. On a character you could do this on the face, the chest, legs, feet, arms, hands, etc.

Proper usage of texture space not only looks professional, but allows you to have more detail on your model while using the least amount of space on your bitmap.

Note: *During this step I usually work solely in the Perspective viewport (maximizing it so that it takes up the entire screen) and have the option "ignore backfaces" turned on so that I don't accidentally select (or deselect) faces.*

Note: *I also recommend that you have a pen (or pencil) and a piece of paper beside you. As you assign ID numbers to groups of faces, write down what part of the object this group number belongs to (ie. on my model ID 1 is the left side of the main body). This will help you later on in the tutorial when you begin to setup your UVW groups for painting.*



Create as many groups as necessary until your mesh no longer has any black faces on it. When you are done, look at the patchwork of colors that is applied all over your model and modify any faces to new material IDs if necessary if you wish to assign them to another group. If you are happy with the selection of IDs then continue onward. If you are not happy then go back and reassign IDs until you are.

The next thing that we are going to do is create a template object that we are going to work with for the UVW coordinate setup. We are doing this because the Smoothing Groups that are setup on the model right now will slightly distort the placement of the UVW coordinates as we try to map them, so we need to work with a copy of the object that has the smoothing removed.

Exit out of the polygon sub-object mode on your mesh (it is very important to ensure that you are out of your sub-object mode) and select your mesh (if it isn't selected already).

Make a clone (copy) of your mesh. You do not have to leave the cloned shape at the same position as the original.

To keep things from getting confusing, you will want to select the original mesh for the fighter plane and hide it from Max. The most common way of doing this is by clicking on the viewport tab, and clicking on the "hide selected" button.

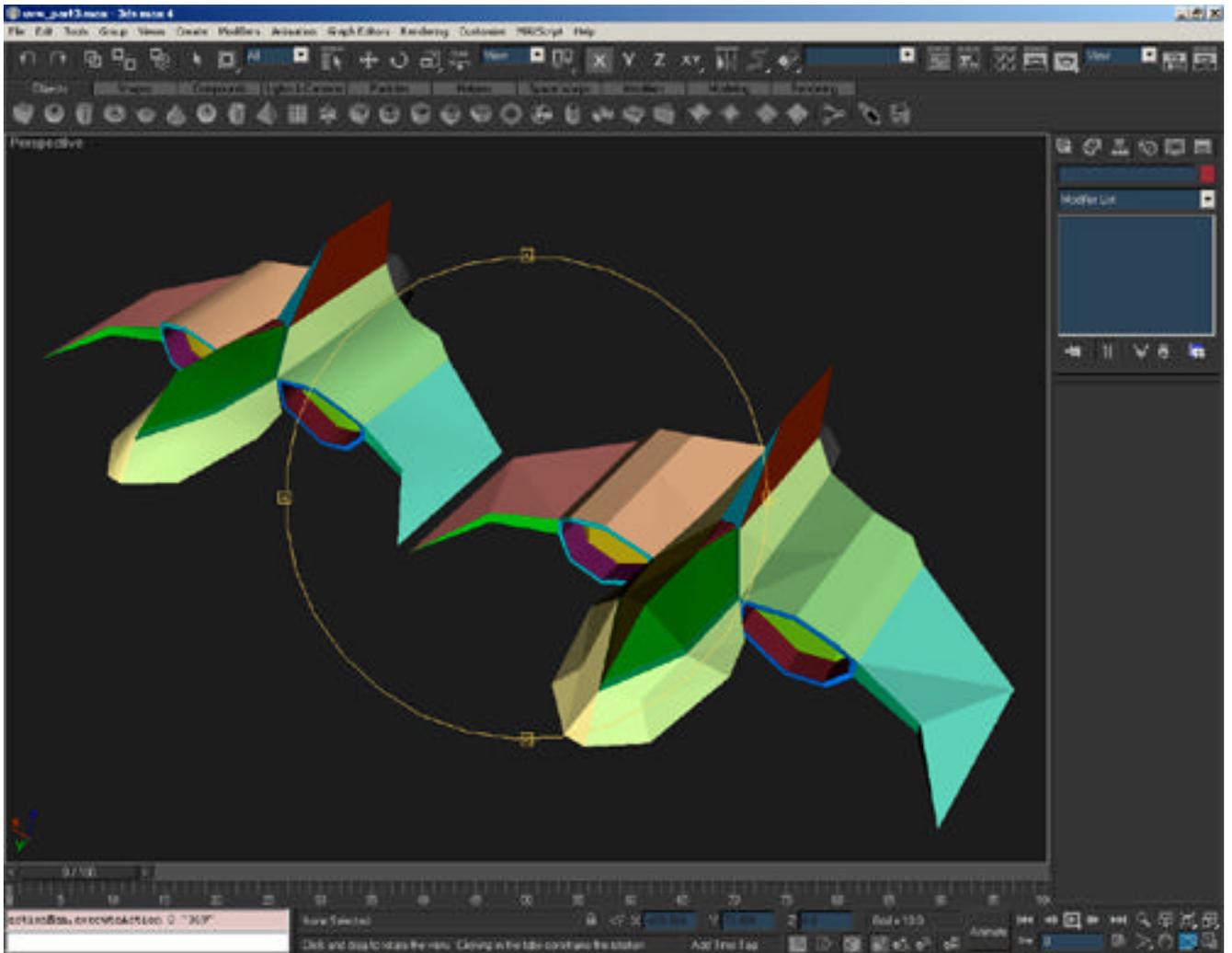
Select the cloned mesh (it should be the only mesh remaining in your viewports) and rename it "Clone_Temp".

The final thing that we are going to do is remove the smoothing groups that I had previously mentioned from our cloned object.



Enter into the polygon sub-object mode of the editable mesh modifier on the "Clone_Temp" mesh. Then select all of the faces and press the "clear all" button that is located under the smoothing group parameter rollout on the Editable Mesh modifier. This will make your object look flat shaded or "faceted" when you look at it in the viewport. As previously mentioned, you are doing this to ensure that the planar mapping that you are about to do to setup the UVW mapping coordinates is exact (faces that are assigned to smoothing groups can affect the planar mapping).

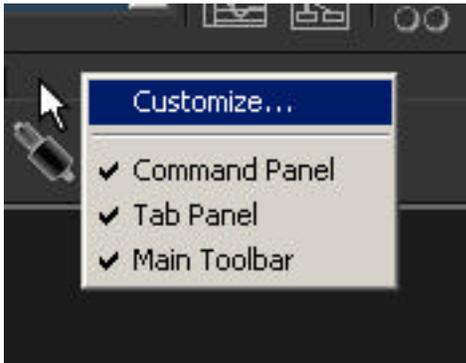
Exit out of the polygon sub-object mode on your mesh and save.



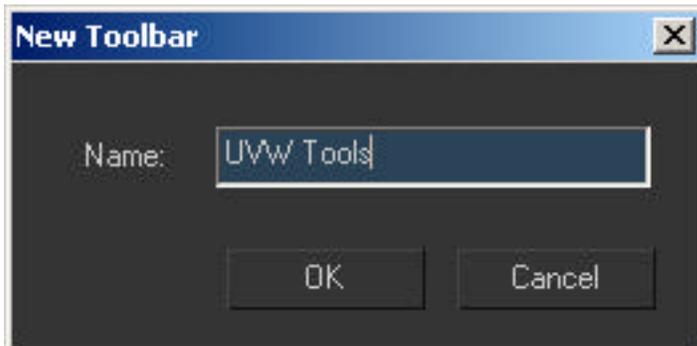
Part 3: Automating with simple scripts

In the previous steps you setup a multi/sub-object material that you then applied to your object and you assigned ID numbers to each of the faces on the object. In this next part of the tutorial, you are going to set each of these ID groups so that they are planar UVW mapped, and so that they are at the same pixel aspect ratio (scale) to one another. To achieve this, you are going to learn how to create quick Maxscripts from the MacroRecorder located in the Maxscript listener window, which will assist you greatly in speeding up the process.

The first thing that we need to do is create a custom tab panel. This tab panel will be used to hold the two Maxscript buttons that you are about to.



To create a new tab panel, right click on the UI tabs that are located at the top of the screen in 3DS Max (if they are not shown on your screen press the Y key to unhide them) and choose "customize". A new window will appear. Next, select the "toolbars" tab and then click on the button called "new".

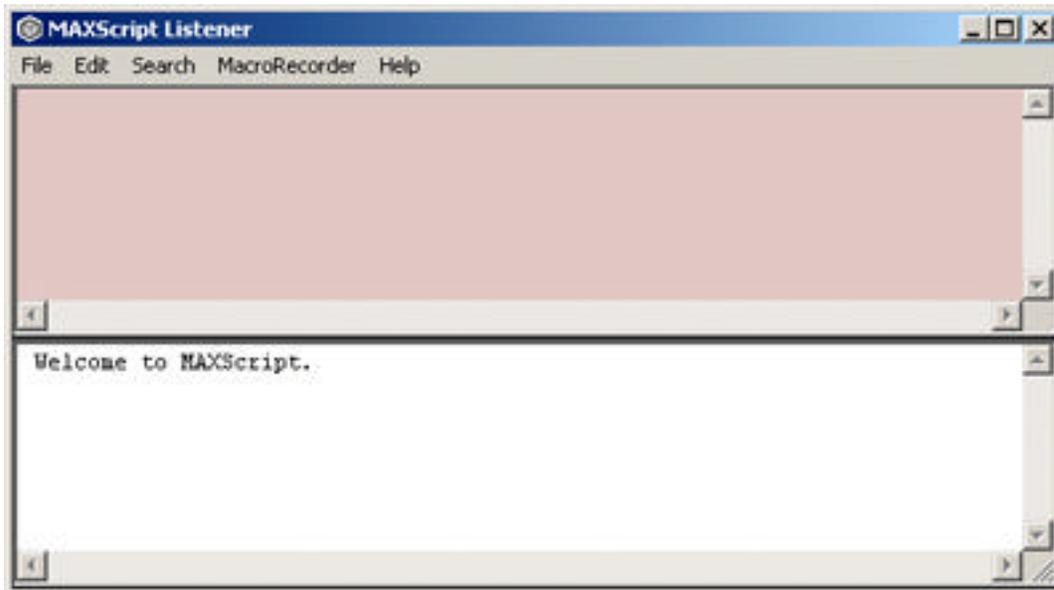


A window will appear asking you to enter a name, enter a unique name such as "UVW Setup" into the appropriate field that is provided. Press OK when you are done and then close the customize window.

A small rectangular shaped floating window will now appear in 3DS Max, this is the new tab panel that you just created.

The next task that we need to perform is to generate some simple scripts that will help us automate the UVW mapping process.

Open your maxscript listener window. Two such ways to do this include right clicking on the "Maxscript Mini Listener" and choosing "Open Listener Window" or by clicking on "Maxscript>Maxscript Listener" from the main toolbar.



The Maxscript Listener window will appear on the screen. The listener window is broken down into two halves. The top half is a window for the macrorecorder, the bottom half is a scripting window. The MacroRecorder will display (in Max's scripting language) most of the functions that are being done by Max when do you perform an action. By default the macrorecorder window will not display anything. If the Macrorecorder is turned off, you will want to activate it by choosing "MacroRecorder>Enable" from the Maxscript Listener toolbar.

Now we will begin to record our first macroscript. Note that as you perform these actions, the MacroRecorder window in the Maxscript Listener will update itself:

- 1) Select your mesh
- 2) Right click on the mesh and from the quad menu choose "convert to editable mesh". This will collapse your model to an "editable mesh"
- 3) Enter into the polygon sub-object mode in the objects editable mesh modifier

The MacroRecorder should have added three lines of text:

```
select $Clone_Temp
macros.run "Modifier Stack" "Convert_to_Mesh"
subobjectLevel = 4
```

Those three lines will become our first macroscript. Select those three lines from your Maxscript Listener and drag and drop these lines of code onto the "UVW Setup" tab panel that you previously created. This will create a small button in the tab. When this button is pressed, it will perform the actions that you dragged onto it (select the object named Clone_Temp, Convert the selected mesh to an Editable Mesh, and then enter into the Polygon sub-object mode of the Editable Mesh modifier).

Note: I tend to rename my macroscript buttons so that they display a text name (such as "collapse") instead of an icon. You can do this by right clicking on the button and changing the appropriate option.

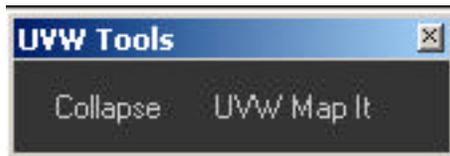
Let's go forth and create our second macroscript button.

- 1) Add an UVW Map modifier to your object
- 2) Leave the mapping type as planar and set the U and V tiling settings on the modifier to any value that matches the aspect ratio of your bitmap image. For example, if you are using a square bitmap the U and V values will be the same, if you had a texture that was 256x64 the U value would be 4x greater than the V value. My personal preference is to set U and V to a value that is just slightly larger than your mesh but still matches your texture's pixel aspect ratio. In this case I have used 700 as the value for both fields. This will force the pixel aspect ratio on the coordinate shapes that are created to be exact and to scale with one another, which is very important.

Look in your maxscript listener window again, you should now have the following lines of text added to the MacroRecorder pane:

```
modPanel.addModToSelection (Uvwmap ()) ui:on  
$.modifiers[#UVW_Mapping].width = 700  
$.modifiers[#UVW_Mapping].length = 700
```

Once again, select these lines of text and drag and drop them onto the "UVW Setup" tab panel to create a new button.



You have now created two macrosript buttons which will help you automate the UVW setup process and save a hell of a lot of time in the process.

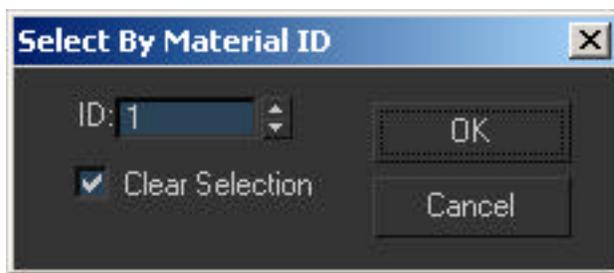
Note: These buttons will only work with this file. You will need to modify these scripts a bit if you would like them to be a bit more dynamic.

Part 4: Setting up the mapping coordinates

Now that we have setup our Macroscripts it's time to move onto actually mapping the faces of the model to explicit UVW coordinates. Although this part of the tutorial does seem to be bit tedious it does not take much time to complete. This is also where all of your hard work in the previous parts of the tutorial finally begins to pay off and show itself.

Click on the first macroscript button that you created. It will select the shape, collapse the object to an Editable Mesh, and then enter into the polygon sub-object mode of the Editable Mesh modifier.

Scroll down the Editable Mesh modifier option and click on the button "select by ID". In the window that appears, enter 1 as the value and press OK. You will see the faces that were assigned ID number 1 hilite in the viewport.



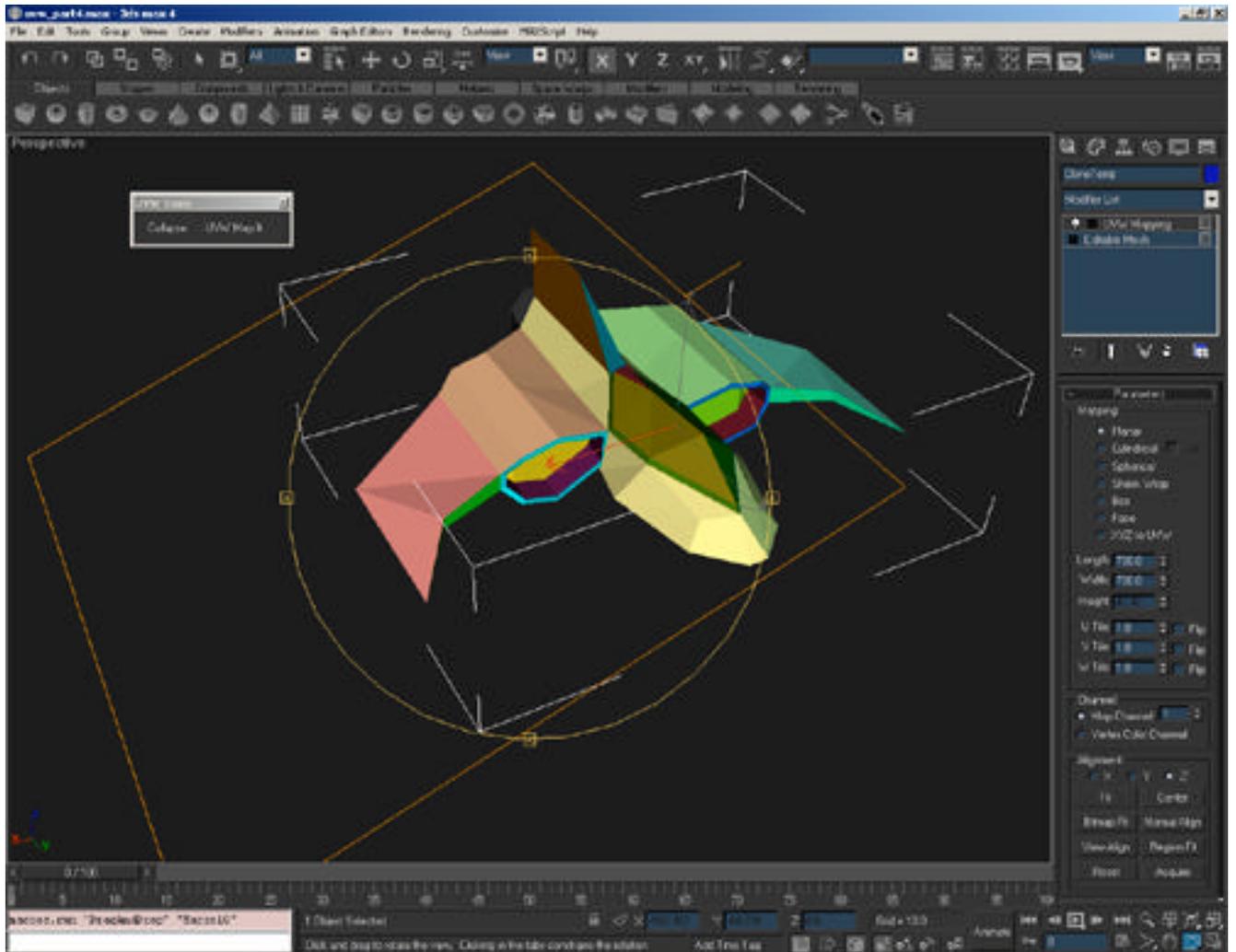
Click on the second macroscript button. This will add your UVW map modifier to your object with the U and V size settings that you had applied in the previous part of the tutorial.

On the UVW Map modifier options, click on the "Normal Align" button. When you have "Normal Align" activated the mapping gizmo for the UVW Map modifier will align to any face that you click and drag across, giving you a fairly accurate planar map position. The Normal Align feature is also the reason why we created a copy of the mesh with all smoothing removed, if smoothing was left on the model Normal Align would use an interpolated normal based on the smoothing that is applied (which we do not want).

With the planar mapping aligned correctly, you have now setup your first UVW coordinate.

Now we must assign planar mapping to the other ID groups that we assigned on our object. Use the previous steps mentioned in this part of the tutorial, once for each ID number used, until you have planar mapped every ID number that you have assigned on to your object.

Note: Repeating these steps for all of the ID numbers might sound like it is tedious or slow, but it will only takes a few minutes to accomplish. As soon as you start going, you will end up with a rhythm that will this process go by in no time at all.



When are finished, right-click and collapse your mesh to an “editable mesh”. This will collapse the modifier stack and bake the UVW coordinates onto the mesh.

Part 5: UVW Coordinate Setup

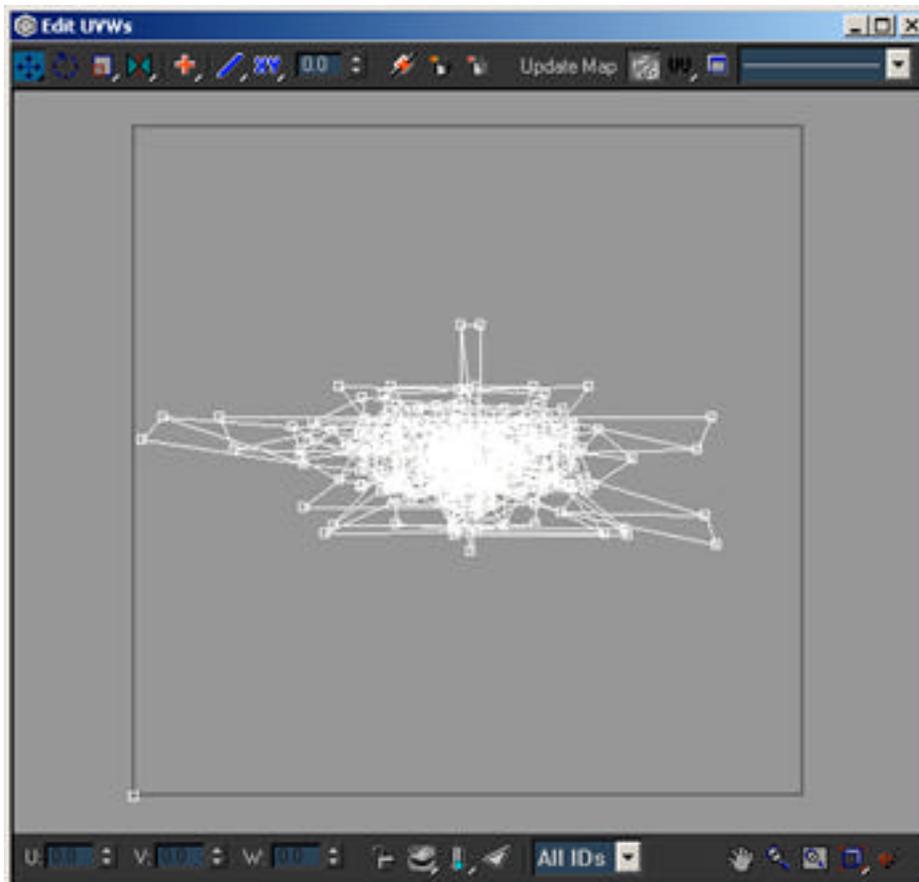
In the previous parts of this tutorial you had setup and applied planar mapping to all of your UVW groups that you wish to map. In this part of the tutorial we will be positioning our UVW groups so that everything maps correctly and so that we will have a template to work from when we begin to paint our texture.

Open your material editor and create a “standard” material in one of the available material slots. In the diffuse channel slot add in the checkered bitmap material that has been included with this tutorial. We are using this “checkered” material so that we can setup better alignments and positions of our UVW groupings so that everything looks the best that we can possible make it.

If you haven’t done so already, turn on the “show in viewport” option in the diffuse channel of your material. Then apply this material to your object. You should now see the checkered pattern material apply to your entire mesh in the shaded viewports.

Add an Unwrap UVW modifier to your object

Under the UVW Unwrap modifier click on the edit button



A new window will appear. In the center of this window there is a big mess of UVW coordinates that match the shapes of the faces that you had assigned the Ids to. What we have to do now is

move these groups around the Edit UVW window and begin to build our mapping coordinates. The easiest way to move these UVW groups around is to use the “select by id” pulldown (located at the bottom of the Edit UVW window) to choose specific ID groups. Once an ID group is chosen, move and rotate these ID groups around in the Edit UVW window so that each of these ID groups are isolated from one another (this will allow you to choose the IDs easier).

Now that we have separated all of the ID groups from one another, we now need to move them around the Edit UVW window. We want to position ID groups that are adjacent on the mesh so that they are adjacent here in the window to form a 2D layout of the fighter plane model. Use the checkered bitmap that we applied to the model to tweak the layout and placement of UVW groupings.

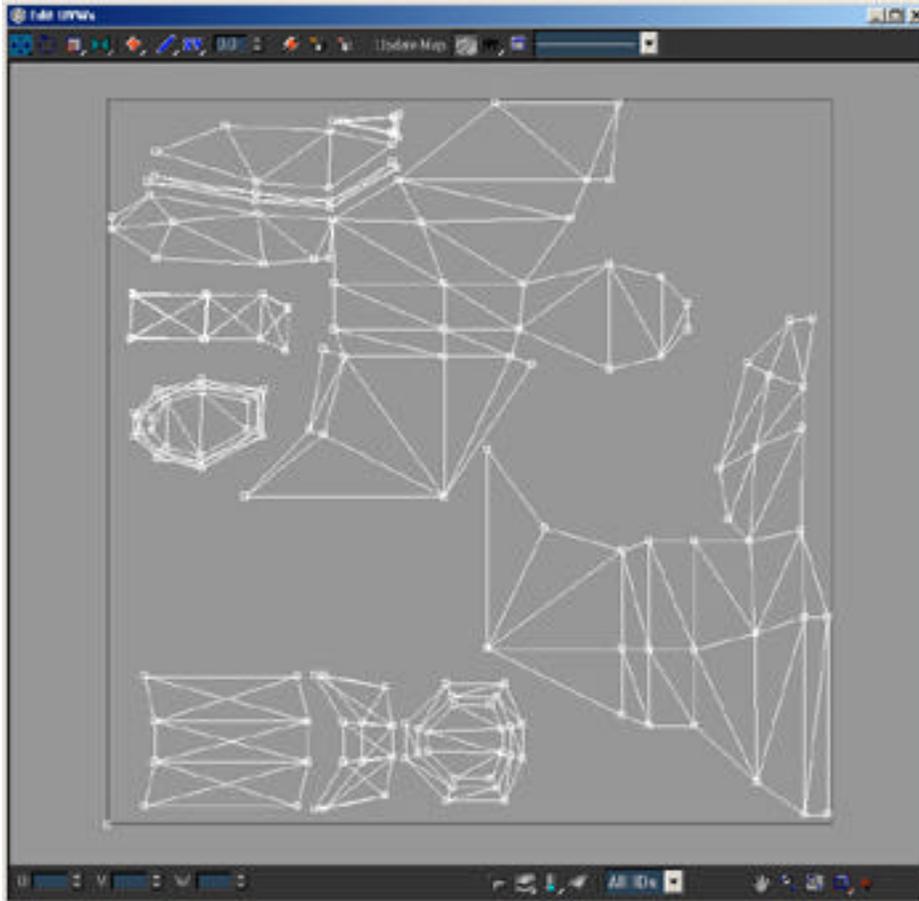
The key thing to remember here as you setup your texture is that you want to get maximum usage of the available texture space. If there are UVW groups that are a mirror of another group, then place them on top of one another in the Edit UVW window. Wherever two vertices overlap, it is recommended that you weld them together through the use of the weld tool that is provided in the Edit UVW window.

During this step I like to refer back to my piece of paper that I have written which parts of the mesh are assigned to which ID groups. I find this very helpful because you can sometimes forget where a group goes or where it belongs. Also, please note that setting up your UVW coordinates and how they will lay out in the Edit UVW window will take a lot of time (hours in fact). There simply is no way that you can rush this step without jeopardizing the quality of your texture and your UVW placement.

Note: *You should use the two test maps that are supplied with this tutorial to ensure that all of your ID groups are lining up properly and so that you do not have any pixel distortion occurring along some of the faces. It is also recommended that you constantly check your perspective window and rotate around your object so that you can check up on what you are doing.*

Note: *It is also recommended that you save your UVW work that you have done (and possibly even your file) very often just in case your software crashes. To save your UVW coordinates to a separate file, click on the “save” button that is located on the Unwrap UVW modifier properties.*

If you should screw up any of your ID groupings while you are aligning them in the Edit UVW window (or perhaps you did not like how they were planar mapped), you can rebuild the specific ID group through the process outlined in Part 4 of this tutorial.



When you have setup your UVW coordinates and are happy with your placement, you can close the edit UVW window.

On the Unwrap UVW modifier rollout, click on the button called “save”. This will allow you to save all this difficult work UVW work that you have done to a file and then later apply it to another model (ie. the original model that we hid).

Note: At this point it is recommended that you burn your texture coordinates onto the mesh by collapsing the modifier stack and forcing the mesh to become an “editable mesh”. You can then reapply a Unwrap UVW modifier if you wish to tweak or modify the coordinates again.

Part 6: Final Setup and Notes

Now that you have done all of this intensive work to get your UVW groups setup correctly, there are only a few small steps left to perform so that we can export our UVW coordinates to a bitmap template that we can use to help paint our texture.

If you do not have the Texporter plugin loaded yet, please save your work, exit out of Max, install the plugin, and then reload your work.

On the main Max UI, click on the Display tab to enter it. Scroll down the list until you see a button that is named "unhide all", click on this button. This will unhide the original mesh of the fighter plane model that we were originally working on.

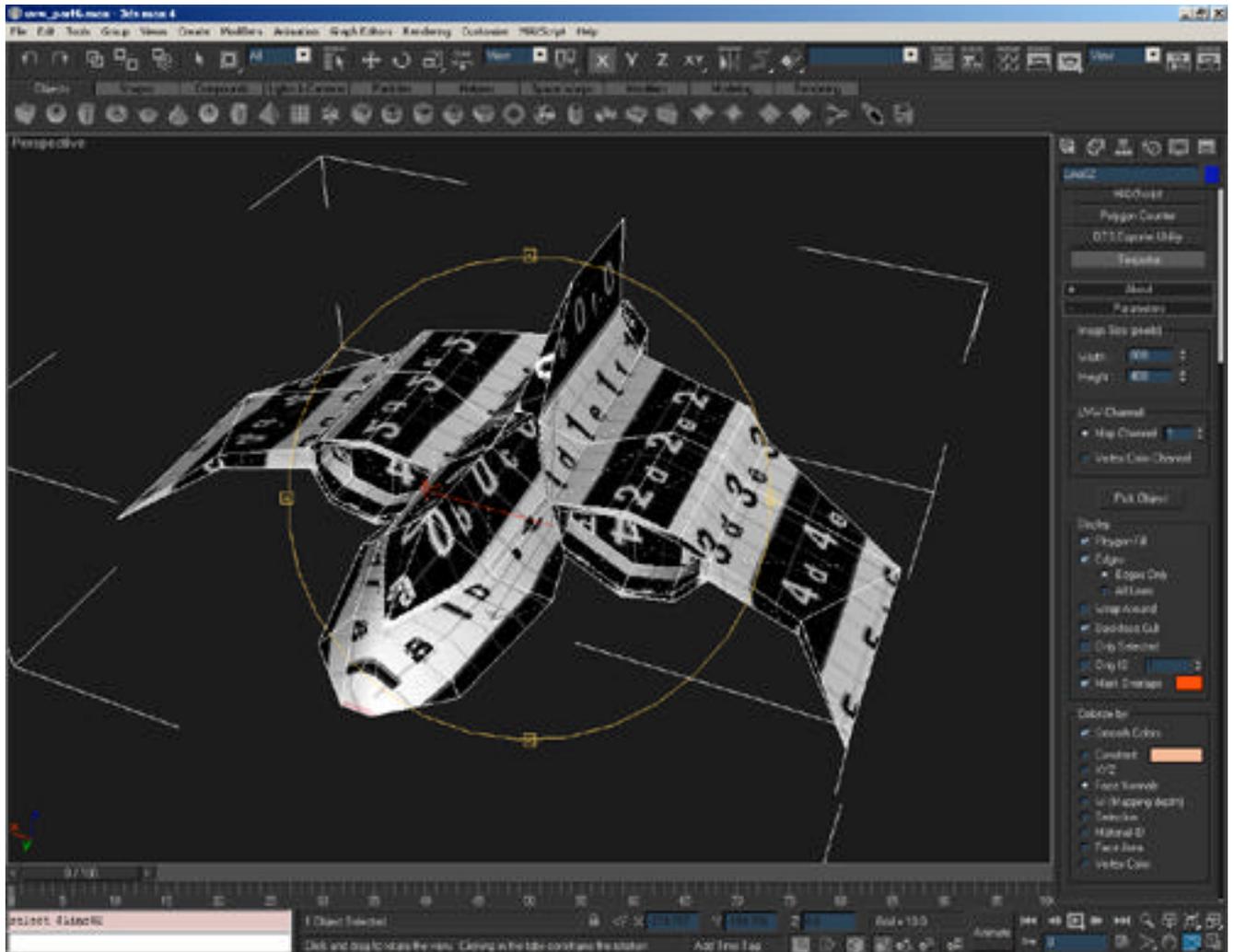
With the original model unhidden, select the cloned object and delete it.

With the cloned object deleted we need to now apply the UVW mapping coordinates that we had setup onto this mesh. Select the fighter plane mesh and apply an Unwrap UVW modifier to it. Go into the modifier tab and Click on the "load" button. Find the UVW file that you had saved in step 5 and load this file. Once this file is loaded all of the UVW setup that you had done to the cloned object is now applied to this mesh. If you like, you can apply the "checkered" pattern again to be certain.

Next you need to burn the texture coordinates onto the object (if you have not done so already). This is done by collapsing the modifier stack on the object.

With our UVW setup correctly applied to our original mesh. We now need to use Texporter to exporter our UVW setup to a bitmap image file that we can use as a template in a program such as Photoshop or Paint Shop Pro to build our texture.

Click on the utility tab, and then click on the "more" button. A new window will appear, in this window there is a list of utilities that you can load. Scroll down this list until you see an option called "Texporter". Select it and press "OK".

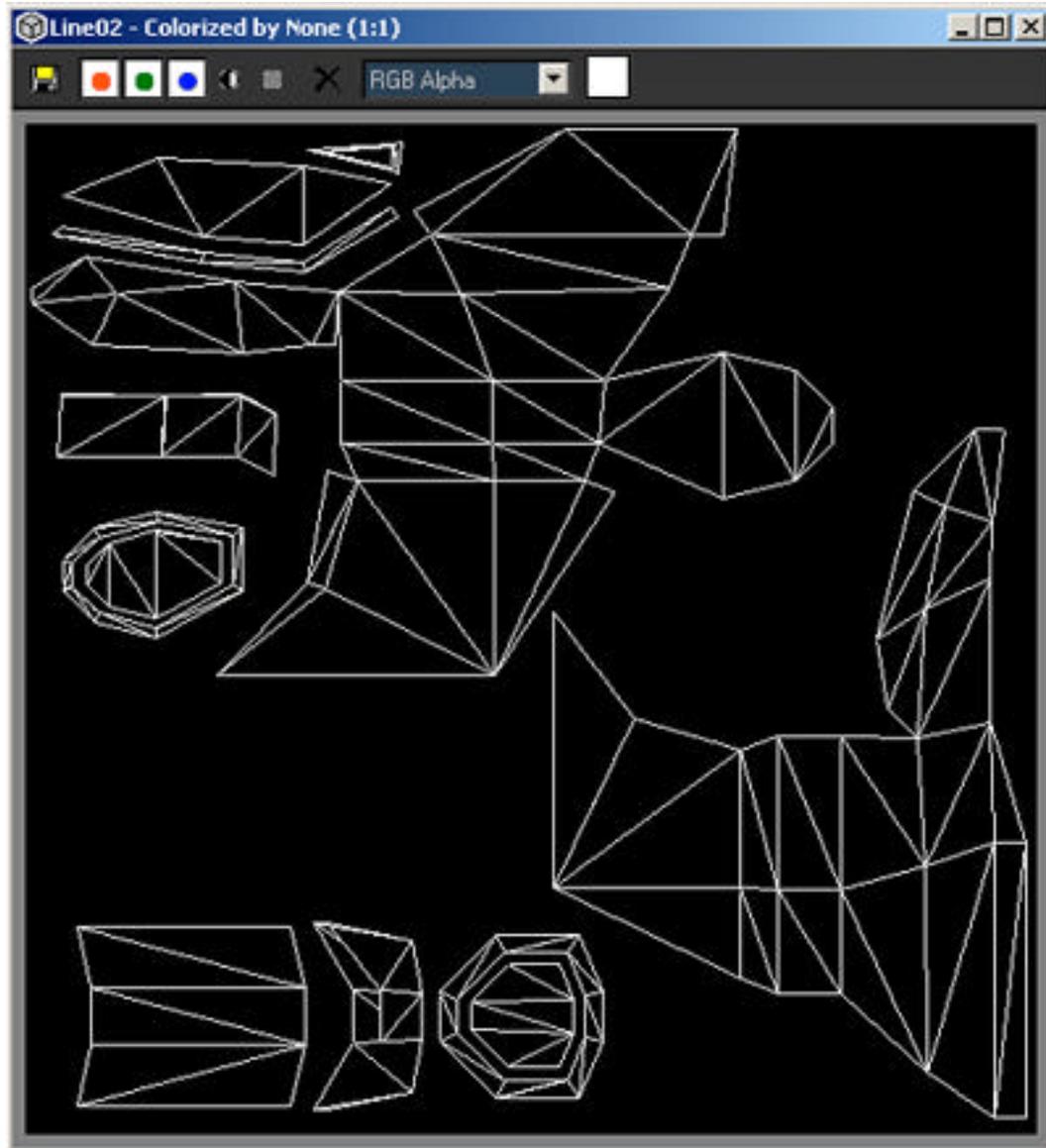


The texporter utility options will now appear in the utility panel rollout.

Set the following options within texporter:

- Width: (use a power of 2 pixel size) I chose 512
- Length: (use a power of 2 pixel size) I choose 512
- Map Channel: set this to 1
- Check "Polygon Fill"
- Under Edges, check "All Lines"
- Check "Wrap Around"
- Set the color value to pure white
- Choose "constant" and set the color value of constant to pure black

To export the UVW map setup to a bitmap file, choose the mesh in your Max scene and press the "export" button. This will bring up a window that is similar to the Virtual Frame Buffer window, in this window Texporter will have converted your UVW coordinates into a raster (bitmap) format. Save this resulting image to a file.



Now that the coordinates have been exported out, we can take this file and use it as a template to paint our texture on.

Note: *If you have a dedicated texture artist on your team, this is where you would hand him the resulting Texporter output so that he/she can work their magic on the texture. This then allows you to spend your time setting up the rigging for the model, or building a new model. Remember to keep the Unwrap UVW modifier under the Skin modifier though incase you need to tweak the setup or apply new UVW coordinates to your mesh.*

Load this image into Photoshop (or your alternative image manipulation program). You will want to use the texporter image as a “screen” layer that will sit ovetop of your texture image and act as a template. Underneath this layer you will paint your texture.

Once you are done building your texture, save this image to two files, one in Photoshop format (with uncollapased layers in case you need to edit it later on) and another in the format you wish to use within 3DS Max and your game engine.

To apply your texture to your model, load up the Material Editor and in a new material slot create a standard material. Place your texture that you just created into the diffuse material slot and then apply this new material to fighter plane model. You should now see your hard work show up on your model in the shaded viewport display.

Use your image manipulation program to tweak the texture until you are happy with how it displays in the Max viewport.

Also, please take note that there is a great little maxscript written by former Dynamix, and current Blizzard Film Division artist Jared Keller that is called "LiveLink". Essentially what LiveLink does, is whenever you change one of your texture files it automatically updates the texture within Max! Definitely a great timesaving utility to help you get your texture setup just right. LiveLink can be downloaded from www.scriptspot.com

Addendum

A more robust and dynamic form of the maxscripts that you used in the above tutorial will soon be available at Logan Foster's website <http://members.shaw.ca/loganfoster/> please check there for the latest version of Torque related maxscripts.

About the Authors:

Joe Maruschak

Joe was once an employee of Dynamix, working as one of their senior artists. After Sierra closed Dynamix, Joe moved onto Bravetree productions (www.bravetree.com) to be their creative director.

Logan Foster

Logan is currently lead artist for BEQ Technologies Inc, developing real-time 3D graphics for various Java based 3D software applications. You can check out Logan's personal website at <http://members.shaw.ca/loganfoster/>.

Shameless Plugs

Torque Game Engine

Torque is the game engine that powered various Dynamix games such as Tribes 2. It is now offered as a very affordable licensed game engine that is geared towards providing small independent game developers with the opportunity to allow them to produce their gaming masterpiece. More information about Torque can be found at the GarageGames website (www.garagegames.com).

LiveLink

As mentioned previously, this script by Jarek Keller forces max to update (reload) the texture that you are using on a material in your scene whenever the texture file itself is updated. You can find a copy of this script at www.scriptspot.com.