

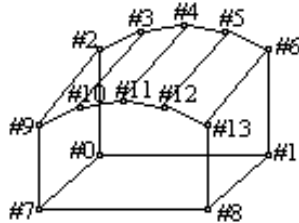
Texture Wrapping Demo

In this demo I explain how I do the texture wrapping on a mesh.

I use this technique to paint the top and bottom of a fuselage.

First how to wrap a texture over the top of the fuselage, then how to get a sharp edged bottom.

For this purpose I made a mesh looking like this:



The UV-positioning was done the same way as you would do it for a fuselage. Then I copied the mesh and pasted it again, moving this copy to the right. The left is the conventional mesh; the right is the one to be changed. To have all points related to the same origin, I've build two 1 line meshes and joined each of them with one of the boxes. After deleting the lines, the two boxes have the same origin 0,0,0. The only difference between them is the z-coordinate of each point.

The mesh on the right now has the following characteristics: (edited in Wordpad)

```
/* 14 points, 7 faces, 14 uvCoords */
materiallist {
    materialname { "demo" }
}
points {
    (-20 0 -70) (20 0 -70) (-20 30 -70) (-10 35 -70) (0 37 -70)
    (10 35 -70) (20 30 -70) (-20 0 -10) (20 0 -10) (-20 25 -10)
    (-10 30 -10) (0 32 -10) (10 30 -10) (20 25 -10)
}
texcoords {
    (1 0.03054) (0 0.03054) (0 0.03054) (1 0.03054) (1 0.59461)
    (0 0.50060) (1 0.68862) (0 0.59461) (1 0.72623) (0 0.63221)
    (1 0.68862) (0 0.59461) (1 0.59461) (0 0.50060)
}
faces {
    4 4 0 -1 ( (0 0) (7 1) (8 2) (1 3) )
    4 4 0 -1 ( (0 0) (2 4) (9 5) (7 1) )
    4 4 0 -1 ( (2 4) (3 6) (10 7) (9 5) )
    4 4 0 -1 ( (3 6) (4 8) (11 9) (10 7) )
    4 4 0 -1 ( (4 8) (5 10) (12 11) (11 9) )
    4 4 0 -1 ( (5 10) (6 12) (13 13) (12 11) )
    4 4 0 -1 ( (1 3) (8 2) (13 13) (6 12) )
}
```

Some explanation: first come the x,y,z coordinates of the 14 points (numbered 0 to 13).

Then come the 14 Texture coordinates (U-value 0-1, V-value 0-1). U and V point to a relative position on the bitmap. (0,0) is the left-hand bottom of a bitmap, (1,1) the right-hand top.

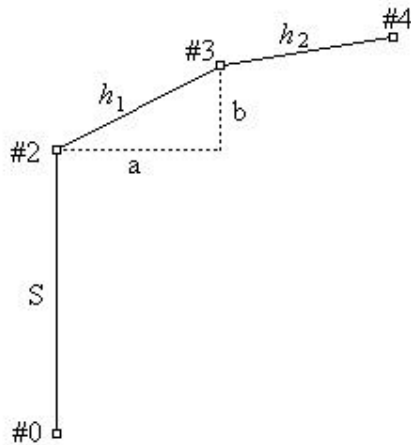
Then the faces: **points** **????** **material** **????** ((#point #texcoord)....)

(The **????** means I don't know what this is)

From this face table, you can trace which texcoord is related to which point.

So point #0 has Texcoord #0;... point #6 Texcoord #12

The wrapping of the texture is done entirely in Wordpad. The goal is to calculate the wanted texture coordinates of the points #3, 4, 5, 10, 11 and 12. (Texcoords 6, 8, 10, 7, 9 and 11).
 First :calculating the sides h_1 and h_2 .



This is a simple application of the most common mathematical formula: $h^2=a^2+b^2$
 Then comes calculating the ratio between those values and the height S. The points #0 an #2 of that side S have a difference in their V-texcoord: ΔV . The calculated ratio multiplied with this difference gives us the reach in V-texcoord h_1 and h_2 should have to be surface proportional with the sides of the mesh. Adding these results to the V-coord of point #2 gives us the V-coord of points #3, 5 and 4. Adding them to the V-coord of point #9 gives the results for points #10, 12 and 11.

$$S = 30$$

$$h_1 = \sqrt{a^2 + b^2} = \sqrt{10^2 + 5^2} = \sqrt{125} \approx 11,18$$

$$h_2 = \sqrt{10^2 + 2^2} = \sqrt{104} \approx 10,20$$

$$\Delta V(\#0 \leftrightarrow \#2) = 0,59461 - 0,03054 = 0,56407$$

$$V_{h_1} = \frac{11,18}{30} \times 0,56407 + 0,59461 = 0,80482$$

$$V_{h_2} = \frac{10,20}{30} \times 0,56407 + 0,80482 = 0,99660$$

Calculation of the other two v-coords is similar.

The new set of texcoords looks like this now:

```
texcoords {
    (1 0.03054) (0 0.03054) (0 0.03054) (1 0.03054) (1 0.59461)
    (0 0.50060) (1 0.80482) (0 0.71081) (1 0.99660) (0 0.90259)
    (1 0.80482) (0 0.71081) (1 0.59461) (0 0.50060)
```

The texture is now wrapped over the top of the box. This did not add anything to the model, so there is absolutely no FPS drawback. But it looks a lot more realistic now, check the included demo model. The lozenge pattern is not stretched anymore as it was before.

Giving the bottom a sharp edge.

This is relatively simple to do. Edge smoothing is only done by MCU if two faces have shared texture coordinates.

So adding 4 extra texcoords for the bottom face: 4 4 0 -1 ((0 0) (7 1) (8 2) (1 3)) will cause a sharp edged bottom.

First copy the texcoords #0, 1, 2 and 3 and paste them at the end of the list. Increase the number of texcoords to 18. Change the texcoord references in the face from 0, 1, 2, 3 to 14, 15, 16, 17.

To simplify the work of the bitmap artists, I also lower the V-coord of these 4 sets, making the position of the fuselage bottom line less critical. I usually set the V-coords to 0. This means the bottom will be painted with the bottom line of the bitmap. Because of the poor rendering of Anim8or, I've set them to 0.0071 (the center of the bottom pixel).

Again, I don't usually do this, it was done only to show the effect in Anim8or too.

The new mesh looks like this now:

```
/* 14 points, 7 faces, 18 uvCoords */
materiallist {
    materialname { "demo" }
}
points {
    (-20 0 -70) (20 0 -70) (-20 30 -70) (-10 35 -70) (0 37 -70)
    (10 35 -70) (20 30 -70) (-20 0 -10) (20 0 -10) (-20 25 -10)
    (-10 30 -10) (0 32 -10) (10 30 -10) (20 25 -10)
}
texcoords {
    (1 0.03054) (0 0.03054) (0 0.03054) (1 0.03054) (1 0.59461)
    (0 0.50060) (1 0.80482) (0 0.71081) (1 0.99660) (0 0.90259)
    (1 0.80482) (0 0.71081) (1 0.59461) (0 0.50060) (1 0.00710)
    (0 0.00710) (0 0.00710) (1 0.00710)
}
faces {
    4 4 0 -1 ( ( 0 14) ( 7 15) ( 8 16) ( 1 17) )
    4 4 0 -1 ( ( 0 0) ( 2 4) ( 9 5) ( 7 1) )
    4 4 0 -1 ( ( 2 4) ( 3 6) ( 10 7) ( 9 5) )
    4 4 0 -1 ( ( 3 6) ( 4 8) ( 11 9) ( 10 7) )
    4 4 0 -1 ( ( 4 8) ( 5 10) ( 12 11) ( 11 9) )
    4 4 0 -1 ( ( 5 10) ( 6 12) ( 13 13) ( 12 11) )
    4 4 0 -1 ( ( 1 3) ( 8 2) ( 13 13) ( 6 12) )
}
```

Now you can see a sharp edged RED bottom in stead of the smoothed and stretched lozenge.

List of files and their destination included in the zip.

(demo).bmp *Simpatch folder, remove the brackets. This is a 256-color bmp.*
03138000.dts and 03139000.dml *Simpatch, replaces the Morane Bullet.*
demo.bmp *Project folder of Anim8or. This is a 24-bit color bmp*
wrap.3ds *The Studio Max version of the demo model*
wrap.an8 *The Anim8or version of the demo model; Anim8or project folder*
wrap.doc *This document*