Textures

- A texture is defined as a 2D-array of texels, often read from an image file
- A texture (i.e. all the texels) is defined in its own coordinate system.

- We associate (u,v) texture coordinates with each (x,y,z) vertex of a polygon
- Then we interpolate the texture coordinates during scan conversion
- Finally, we blend the pixel colour with the texel colour.

Rather than altering the surface colour, we can alter the surface normals, to create bumpy surfaces, this is called bump-mapping

Pixel resolution > Texel resolution

Solution: We use a Bilinear interpolation filter. We compute a texel colour from adjacent texels, averaging horizontally and vertically.
⇒ The resulting image looks smoother, but blurry

Texel resolution > Pixel resolution

- Adjacent pixels may map to texels far apart in the texture, leading to missing detail
- One solution: mipmapping.
- The idea is this: the further away from the viewpoint, the less detail we need.
- So we use a set of texture maps (each of a different resolution), and select which map to use, according to the distance of a pixel from the viewer. How to create the different texture maps? We simply downsample the original texture (e.g. by $\frac{1}{2}$ each time) and store each texture map in memory. When rendering we select the texture map according to the distance of the pixel from the viewpoint.

We can even store the illumination of a surface in a texture and create a so-called lightmap. Lightmaps can be combined with texture maps.