Texture Mapping

Sung Soo Hwang

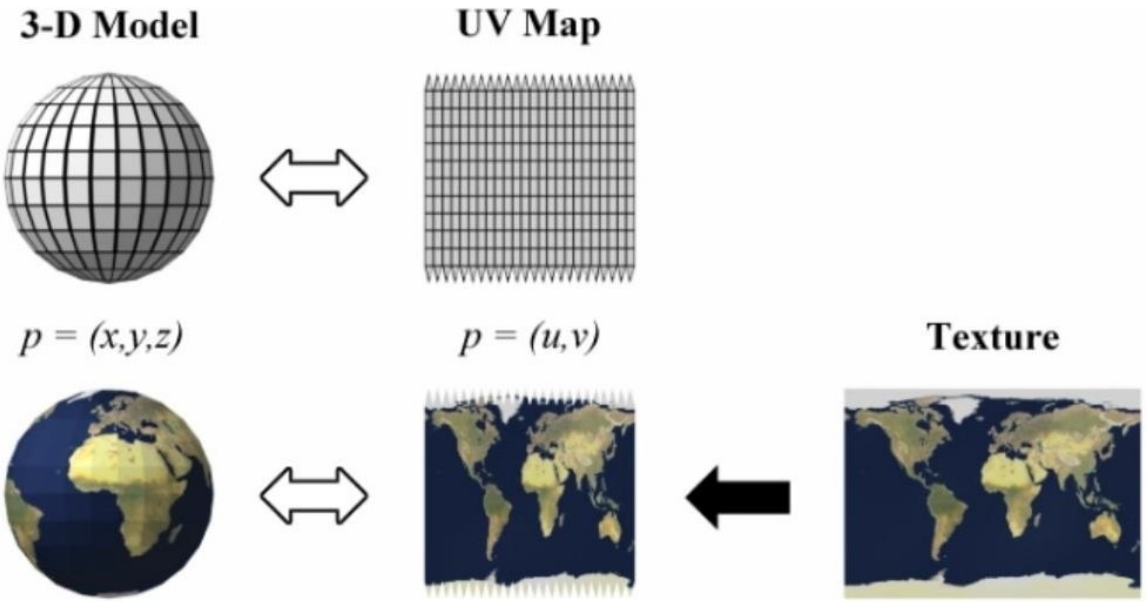
Texture Mapping

- Texture Mapping
  - A way of adding surface details
    - Map a texture to the surface Map
    - Use UV Coordinate system
  - Two steps for Texture Mapping
    - UV Unwrap
    - UV Mapping

https://www.wikiwand.com/en/Texture_mapping

Texture Mapping

- Example



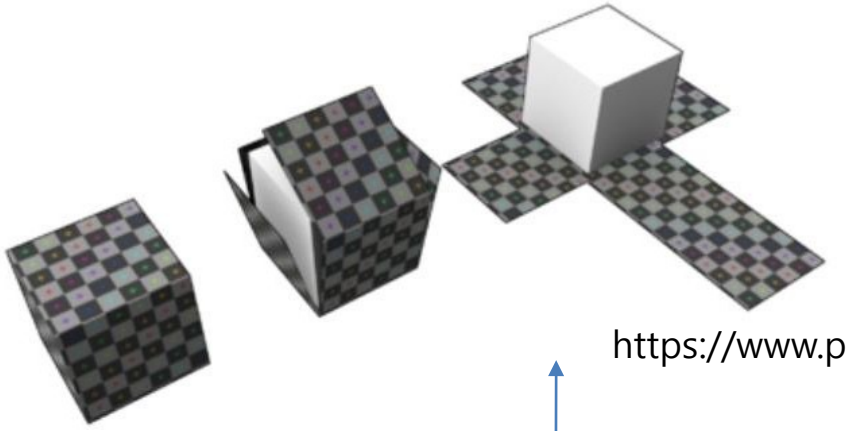
UV Unwrapping

Texture Mapping

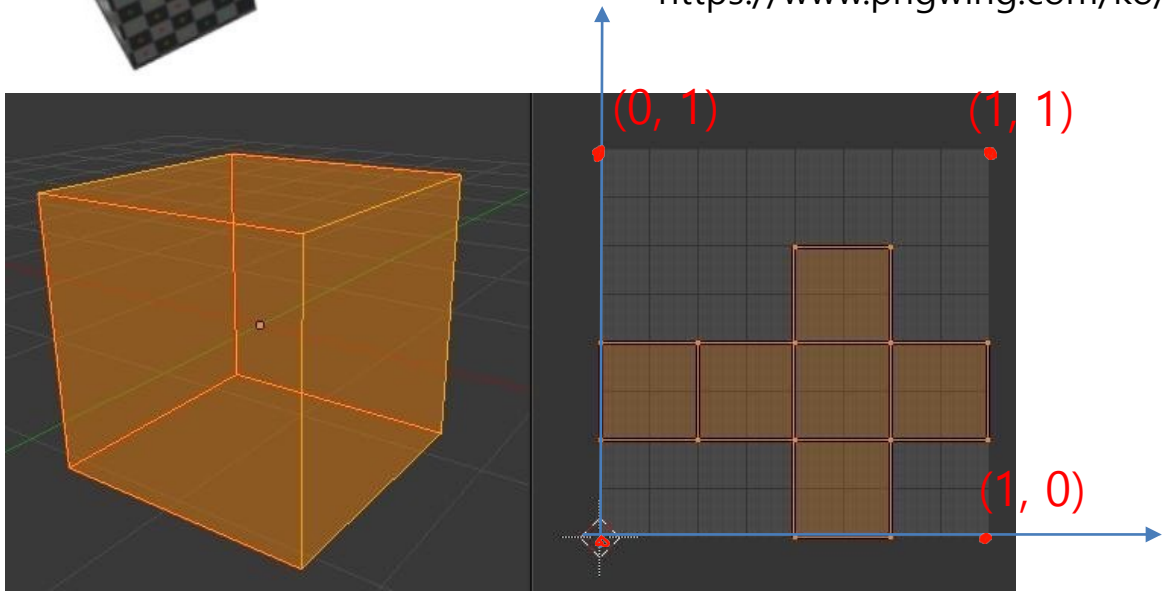
https://ko.wikipedia.org/wiki/UV_%EB%A7%A4%ED%95%91

Texture Mapping

- UV Unwrap
  - The process of Spreading 3D objects on 2D UV coordinates.
  - To make an UV map of the object.

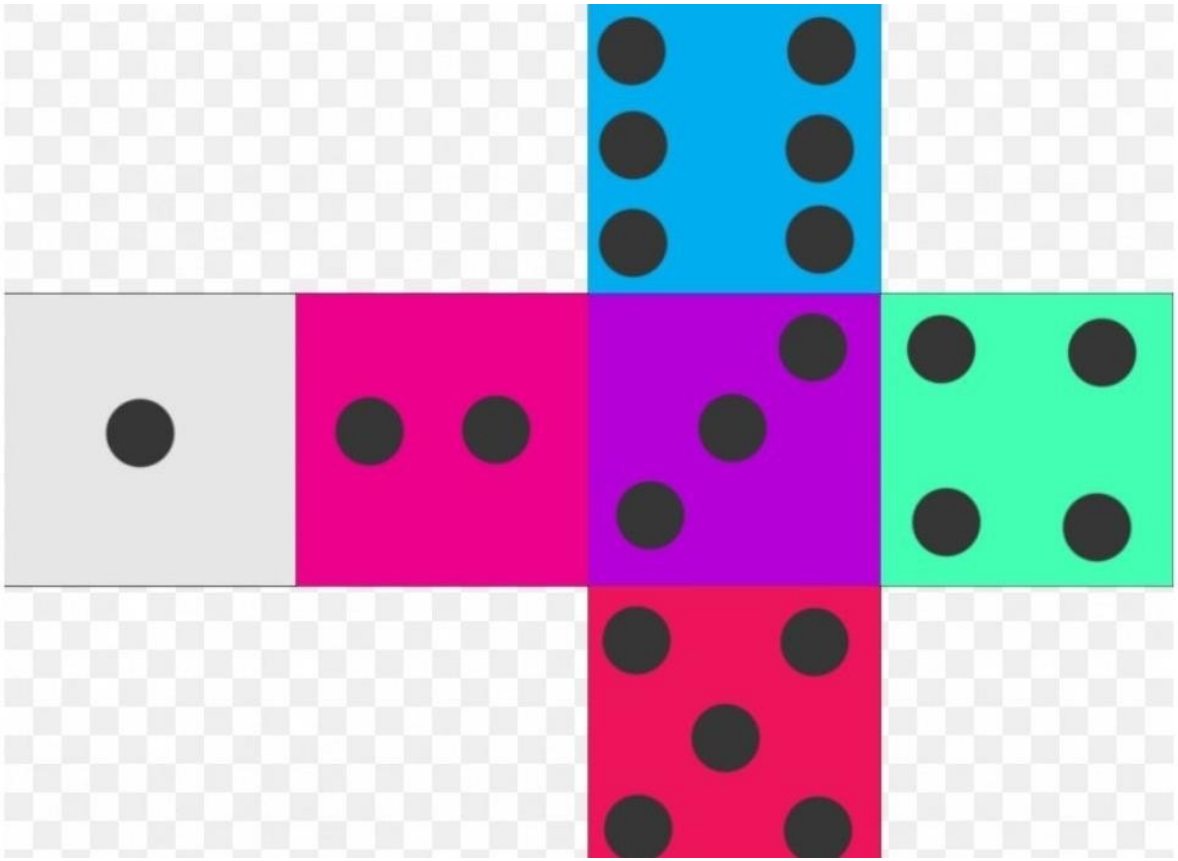


https://www.pngwing.com/ko/free-png-ngxgy



Texture Mapping

- UV Mapping
  - Mapping texture to UV map

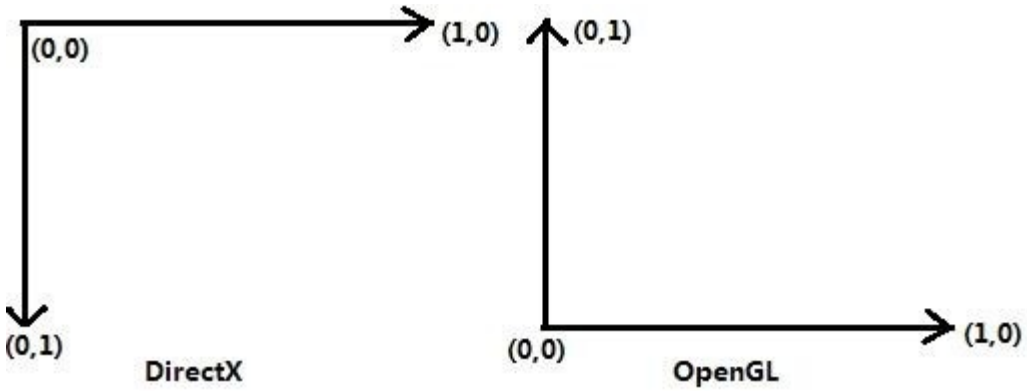


https://www.subpng.com/png-grb3pv/

Texture Mapping

- UV Coordinate System
  - 2D coordinate system used in computer graphics
  - Similar to XY coordinates in mathematics. (x-axis: u, y-axis: v)
  - A two-dimensional float value(float2) from (0,0) to (1,1).
  - Two different ways of UV expression
    - Direct X and OpenGL

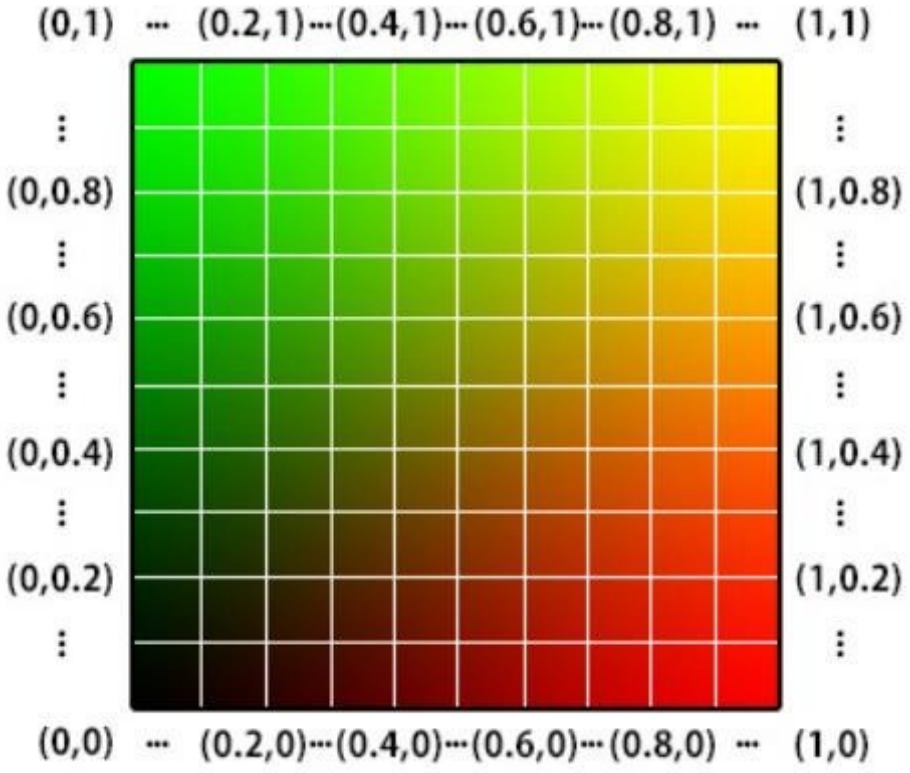
※ Unity follows the OpenGL method.



https://gamedev.net/forums/topic/682989-texture-mapping-coordinates-for-opengl-and-directx/5314517/

Texture Mapping

- The OpenGL UV coordinates are expressed in colors as shown in the picture below.



(u, v, 0) = (r, g, 0)

Ex) R=0, G=1 → (u, v) = (0, 1) = Green

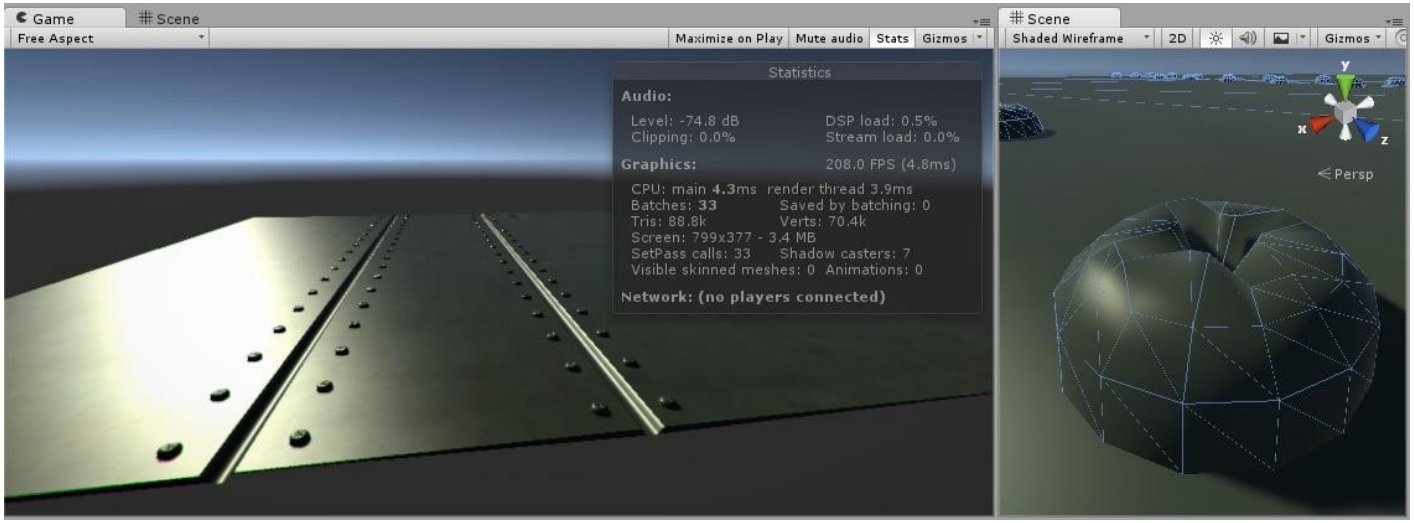
R=1, G=0 → (u, v) = (1, 0) = Red

R=1 G=1 → (u, v) = (1, 1) = Yellow

Normal Map

- A normal map is a special kind of texture that allows you to add surface detail to a model that catches the light as if it is represented by real geometry.

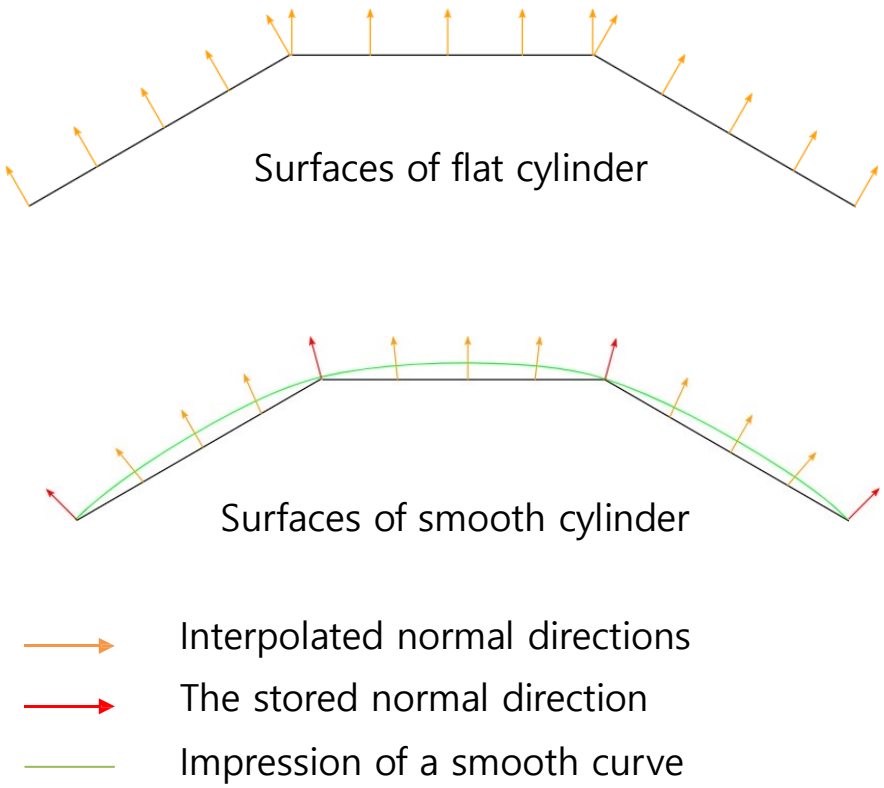
- With a normal map, the surface geometry can become much simpler, and the detail is represented as a texture that modulates how light reflects off the surface.

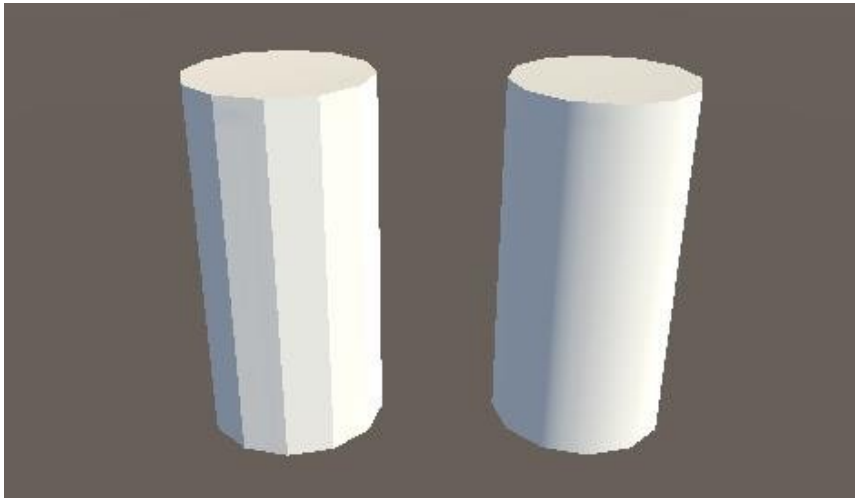


https://docs.unity3d.com/Manual/StandardShaderMaterialParameterNormalMap.html

Normal Map

- A normal(surface normal) is a direction relative to the surface.



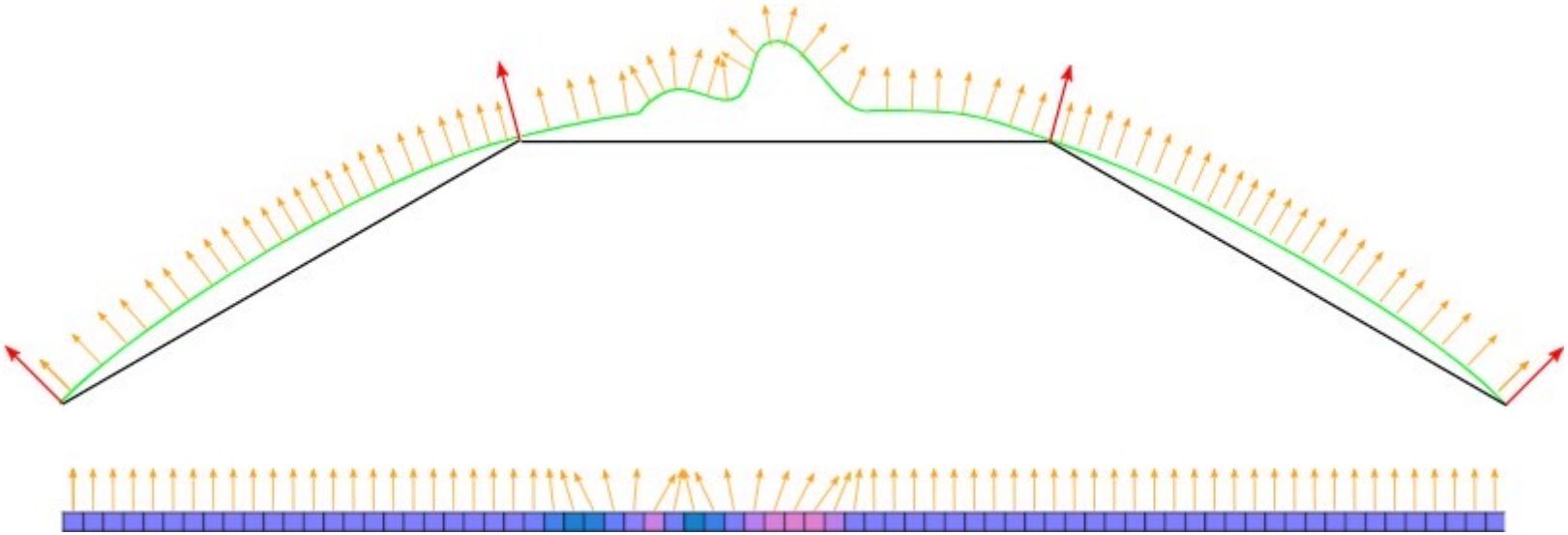


Two 12-sided cylinders (flat, smooth shading)

https://docs.unity3d.com/Manual/StandardShaderMaterialParameterNormalMap.html

Normal Map

- Each pixel in the texture of the normal map(called a texel) represents a deviation in a surface normal direction away from the “true” surface normal of the flat (or smooth interpolated) polygon.

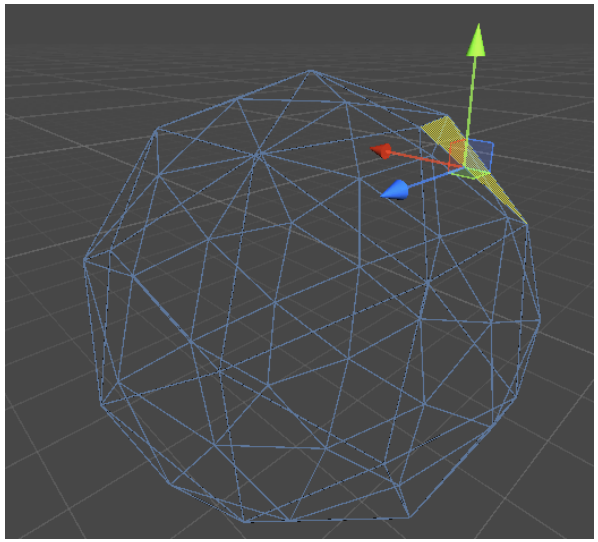


Normal mapping across three polygons viewed as a 2D diagram

https://docs.unity3d.com/Manual/StandardShaderMaterialParameterNormalMap.html

Normal Map

- In tangent space which is a coordinate of mesh based on a polygon, the Z value represents the normal.

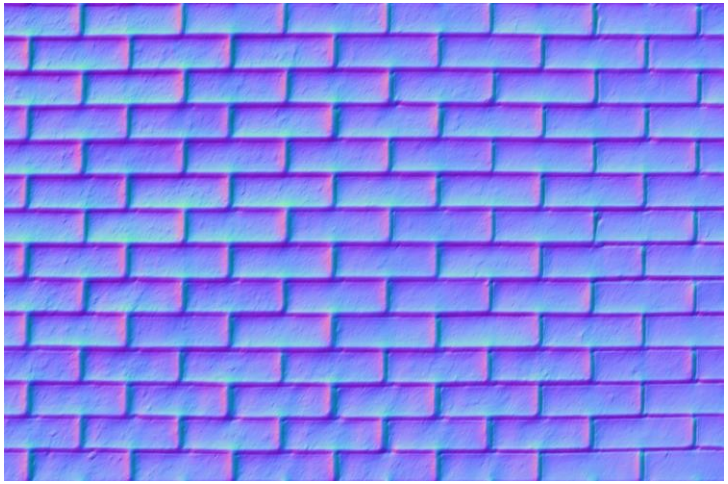


Tangent space

The direction in Tangent space

Normal Map

- The RGB value of each texel(pixel of texture) represents the X, Y & Z values of a direction vector in tangent space.
- The normal value in tangent space always indicates upper(Z), so it always has a high B value in RGB.



An example of a normal map

RGB value of blue