

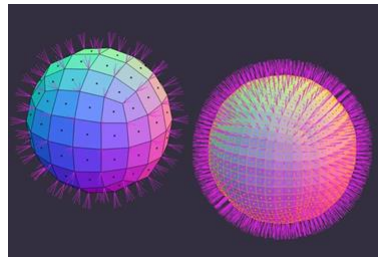
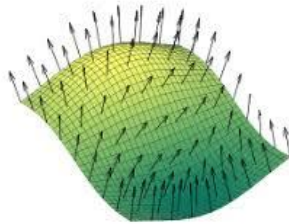
# Unity Game Engine

Introduction to Unity – Normal Maps

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

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## Surface Normal

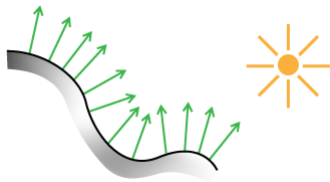


- In the three-dimensional case a **surface normal**, or simply **normal**, to a **surface** at a point P is a vector that is perpendicular to the tangent plane to that **surface** at P.

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## Surface Normal & Shading



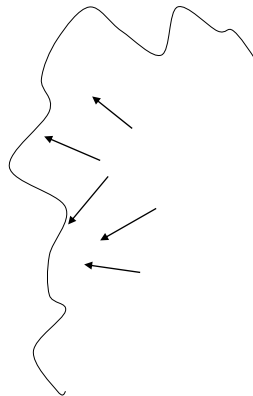
- That the brightness /color of a point on the surface of an object depends on the normal direction which defines the orientation of the object surface at that point with respect to the light.

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## Surface Normal & Bumps

- Consider the lighting for a modeled surface.



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## Bump Mapping

- **Bump mapping** is a technique for simulating bumps and wrinkles on the surface of an object without changing the surface geometry of the underlying object.

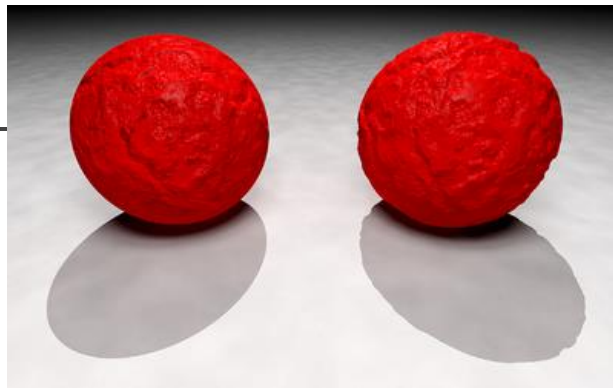
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## Bump Mapping

- Many textures are the result of small perturbations in the surface geometry
- Modeling these changes would result in an explosion in the number of geometric primitives.
- Bump mapping attempts to alter the lighting across a polygon to provide the illusion of texture.

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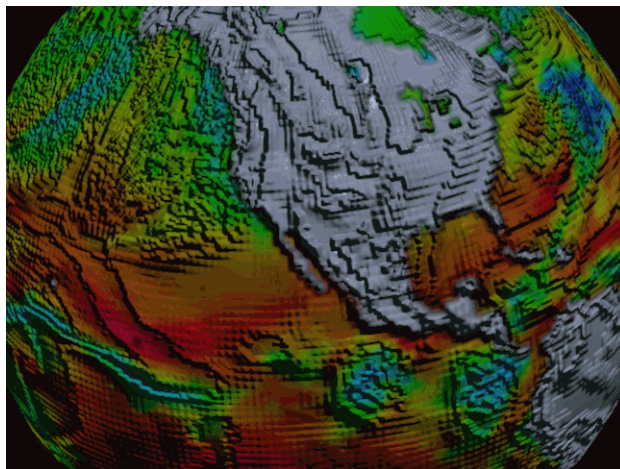


- With bump mapping (left). Simulates a crumbling surface on a sphere, but the object's outline and shadow remain those of a perfect sphere.
- With the surface geometry changes (right). Both its outline and its shadow are rendered realistically.

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## Bump Mapping

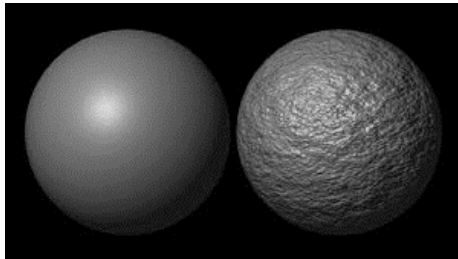


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## Bump Mapping - Normal Maps

- Normal maps are a type of **Bump Map**.
- Normal maps are a special kind of texture that allow you to add surface detail such as bumps, grooves, and scratches to a model which catch the light as if they are represented by real geometry.

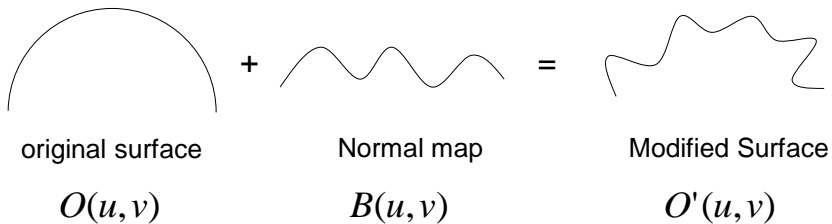


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## Normal Map

Use texture to perturb normal  
creating a bump-like effect

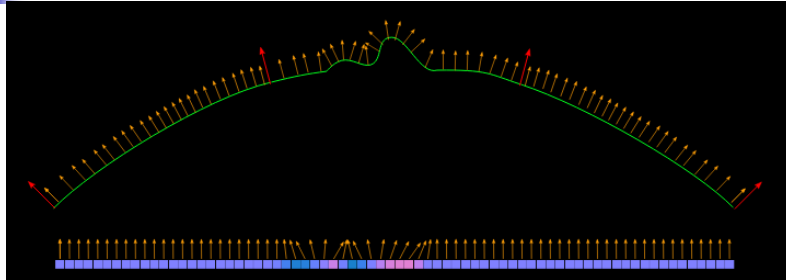


**Does not change silhouette edges**

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## Normal Map



- A normal map is an image texture mapped to the surface of a model, however each pixel in the texture of the normal map represents a deviation in surface normal direction away from the “true” surface normal of the surface.

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## How do I get or make normal maps?

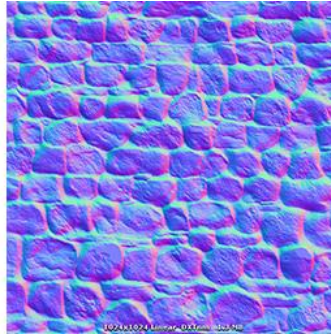
- Commonly, Normal Maps are produced by 3D or Texture artists.
- Sometimes they are produced by hand, and sometimes they are rendered out from a 3D application.

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## Example of Normal Maps

- A stone wall texture and its corresponding normal map texture.



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## Example of Normal Maps

- A character texture atlas, and its corresponding normal map texture atlas



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## Why the bluey-purple colours?

- In a Normal map, the RGB colour values represents the X,Y,Z direction of the vector, with Z being “up” (contrary to Unity’s usual convention of using Y as “up”).
- Normals are always straight up (0,0,1) for a surface point.
- Any pixels which are different to this results in a vectors that point in a different direction - which therefore modify the angle that is used to calculate light bounce at that point.

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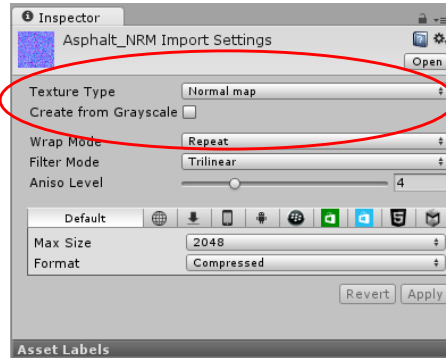
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## Import a Normal Map in Unity

- Get a normal map and import it like what you did to use a regular texture map.
- Changing the “Texture Type” setting to “Normal Map” in the import inspector settings.

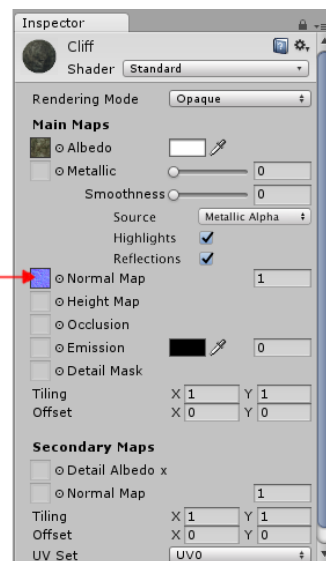
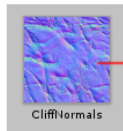


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## Material with Normal Map

- Once you have a normal map, place it into the Normal Map slot of your Material in the inspector.



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## Hands-on Activity

- Download a texture image & its corresponding normal from <https://opengameart.org/content/50-free-textures-4-normalmaps>.
- Create a scene with a plane (floor). Create a material for the floor with the downloaded images by assigning the regular texture image to “Albedo” and the normal map to “Normap Map”.
- Make the camera look down the floor.
- Create a point light, place it above the floor and move it around (e.g. circle around above the floor).