

# Shading, Materials, Textures

In the real world, two main factors determine the appearance of a surface: what an object is made of, and light.

In Maya, the appearance of a surface is defined by how it's shaded. Surface shading is a combination of the basic material of an object and any textures that are applied to it.

Shading = materials + textures + light



# Shading

because textures are often applied to shaders, the entire process of shading is sometimes informally referred to as texturing.

Applying textures to shaders is also called texture mapping or simply mapping. You map a texture to the color node of a shader that is assigned or applied to a Maya object.



Images courtesy The Art of Maya

# Illumination

Global (ambient)

Local (spot light)

Ray tracing

Ray tracing is a technique for generating an image by tracing the path of light through pixels in an image plane and simulating the effects of its encounters with virtual objects. The technique is capable of producing a very high degree of visual realism, but at a greater computational cost. [-wikipedia](https://en.wikipedia.org/wiki/Ray_tracing)

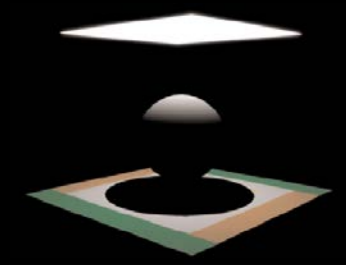


FIGURE Direct local illumination.



FIGURE Global illumination.

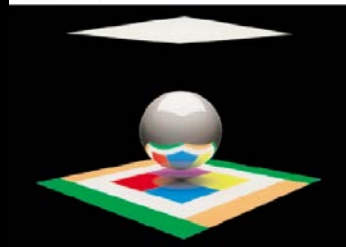


FIGURE Ray tracing and radiosity.

- Local Illumination
- Global Illumination
- Ray tracing

# Materials

materials determine the character of an object's surface

any number of different attributes

- color

- texture

- shine

- transparency

- bump mapping, etc.

materials contain and control all of those different attributes

# Materials

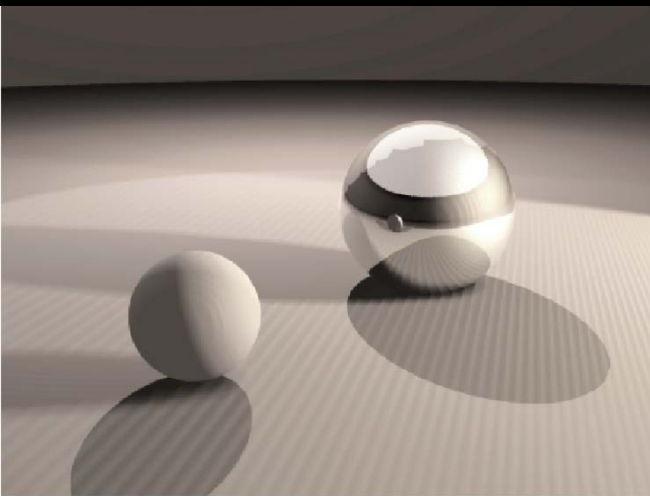


FIGURE *Specular vs. diffuse materials.*

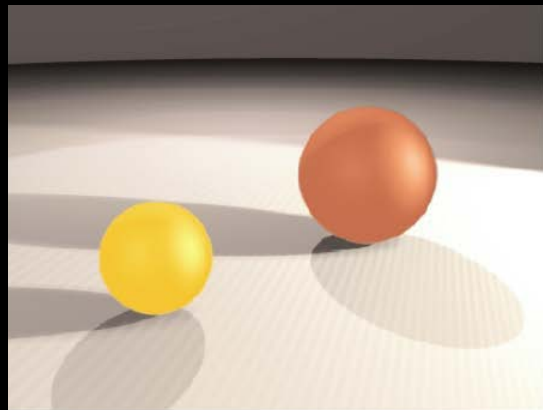


FIGURE *Gouraud Shading.*

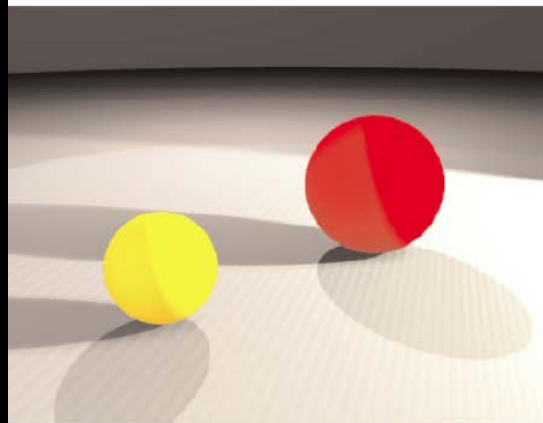


FIGURE *Lambertian Shading.*

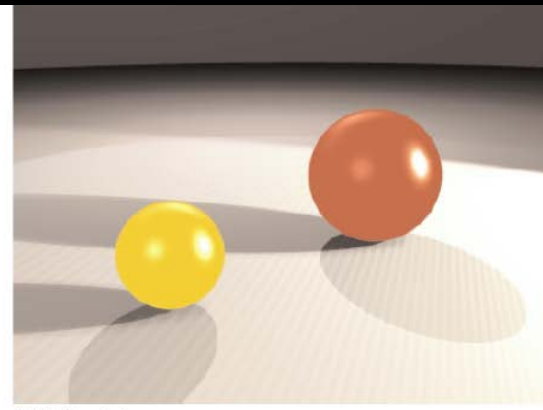


FIGURE *Phong shading.*

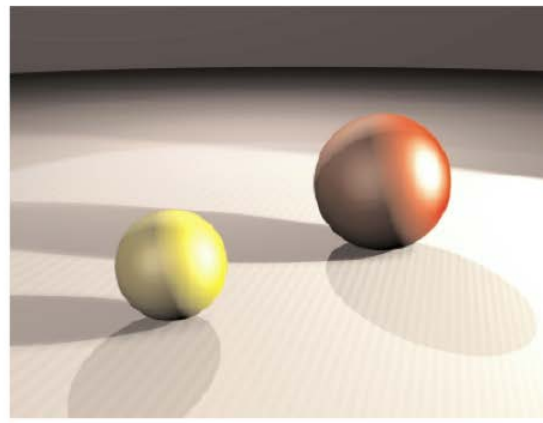
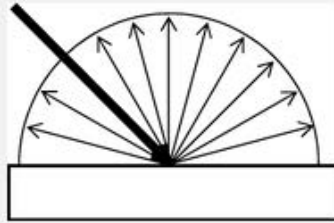


FIGURE *Blinn shading.*

# Reflections

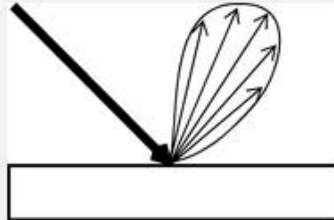
Diffuse  
Specular  
Glossy

how reflective  
the object is



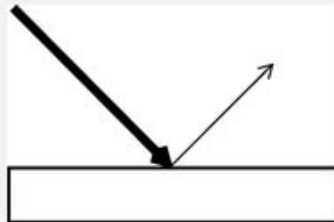
Diffuse reflection.

Diffuse surfaces reflect (scatter) light in many angles. Diffuse reflection accounts for more of the color than any other type of distribution because most objects are opaque and reflect light diffusely.



Glossy reflection.

Glossy surfaces are actually specular surfaces with micro surfaces at angles to surface plane. These micro surfaces reflect light not only specularly but also diffusely (at angles very close to the specular transmission), giving the surface a glossy appearance.

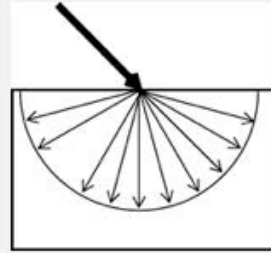


Specular reflection.

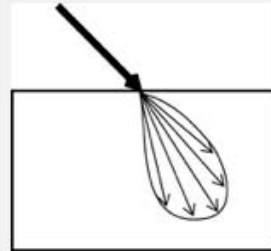
Specular surfaces reflect light at the same as the angle at which the light strikes the surface. Specular reflection gives objects a glossy or mirror-like appearance.

# Refractions

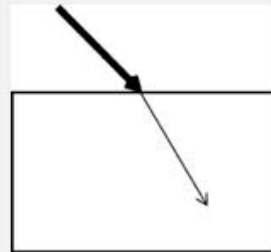
Refraction is the change in light direction caused by a change in speed that occurs as light passes through a solid, transparent object.



Diffuse refraction.  
Diffuse refraction scatters light in many angles.

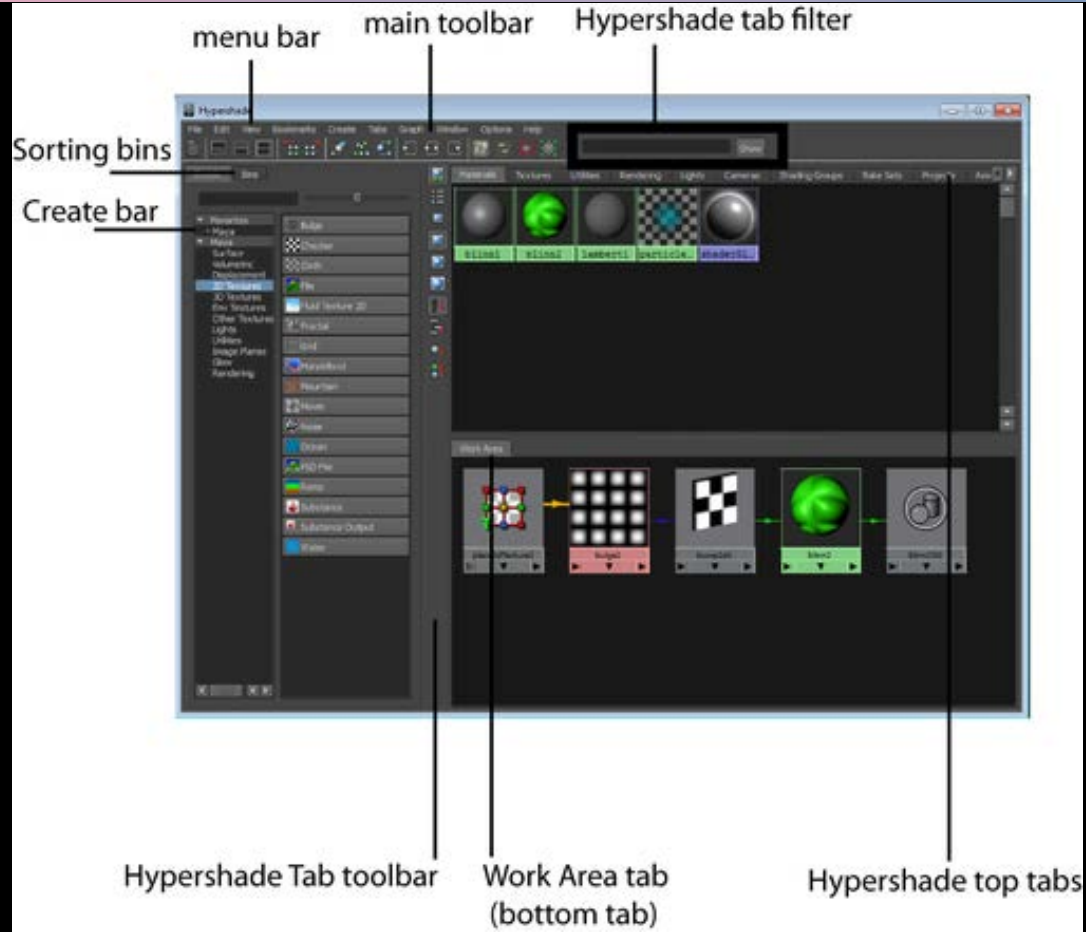


Glossy refraction.  
Glossy surfaces are actually specular surfaces with micro surfaces at angles to surface plane. These micro surfaces refract light not only specularly but also diffusely (at angles very close to the specular transmission), giving the surface a glossy appearance.



Specular refraction.  
Specular surfaces reflect light at the same as the angle at which the light strikes the surface.

# Hypershade

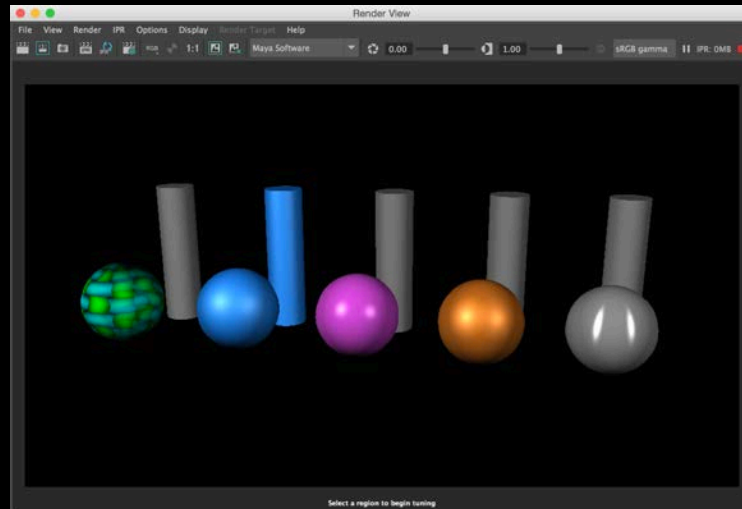




# Interactive Photorealistic Render (IPR)

As you work with shading, you'll find many attributes that have no effect in the scene view, because the scene view is only a rough approximation of how the scene will render.

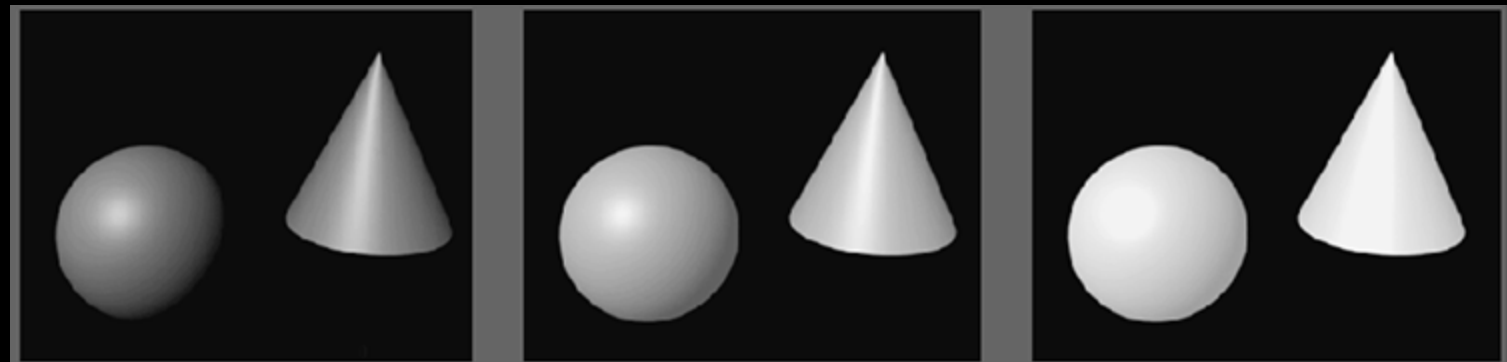
The IPR renderer is ideal for testing shading. It shows the results of all changes you make to shading and shows them immediately. However, some attribute changes such as reflectivity and reflections are not displayed.



# Shader Attributes

Color is the color of the object, such as red or blue. This can be a flat color or a texture map.

Ambience is the amount of ambient color that will affect an object's surface. Ambience in the surface property is a simulation of even flat lighting coming from every direction onto the surface (this is not from an actual light source).



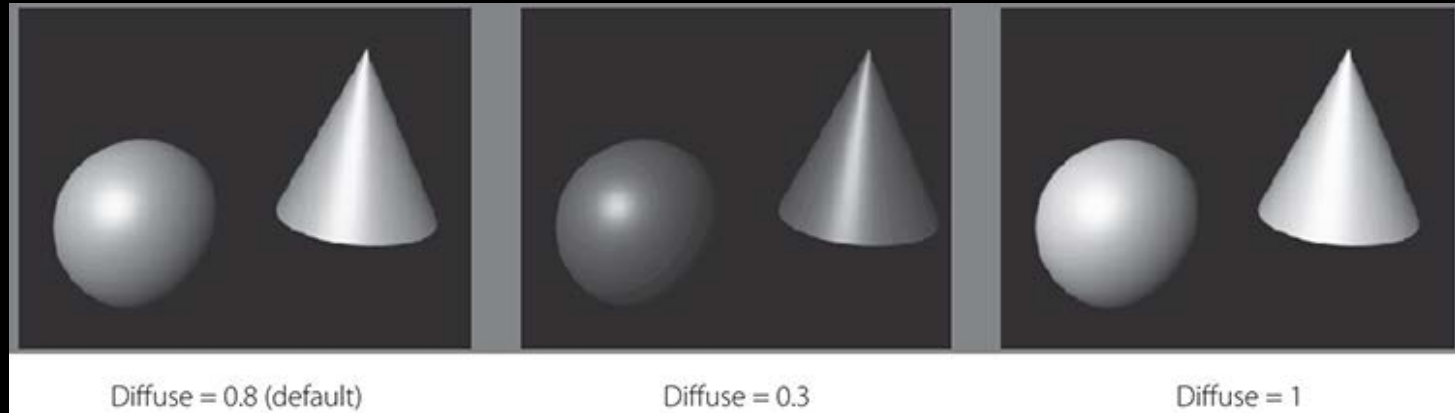
Ambient Color = Black

Ambient Color = Medium Gray

Ambient Color = White

# Shader Attributes

Diffuse value governs how much light is reflected from the surface in all directions. When light strikes a surface, light disperses across the surface and helps illuminate it. The higher this value, the brighter its object is when lit. The lower the Diffuse value, the more light is “absorbed” into the surface, yielding a darker result.



# Shader Attributes

**Transparency** -how transparent or see-through the object will be (glass)

**Reflectivity** -how reflective the object will be.

**Refraction** is the change in light direction caused by a change in speed that occurs as light passes through a solid, transparent object.

**Translucency** - the amount of light that can pass through an opaque object such as paper or canvas.

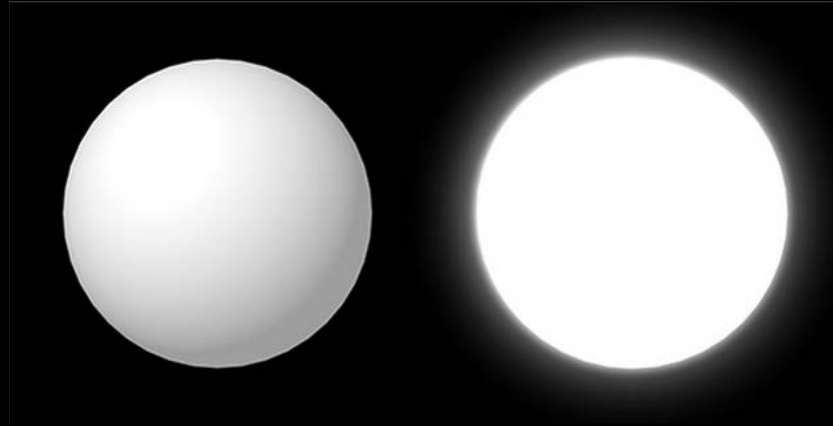
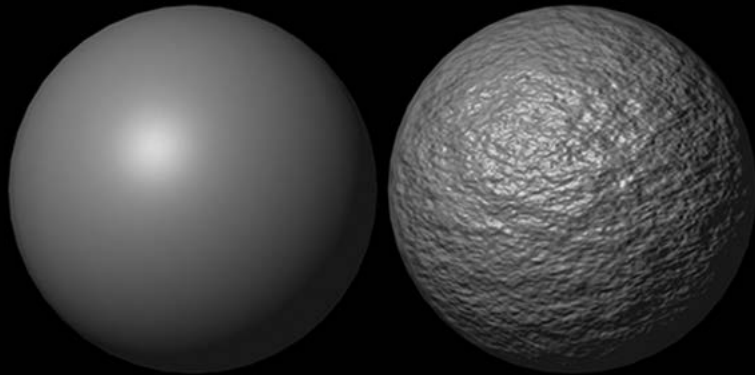
**Incandescence**- the quality of self-illumination—for example, a computer monitor that is emitting light or a lamp shade with the light on.

**Specular** highlights are bright spots that appear on an object's surface when light shines on that object.

**Glow**-a standard attribute that most 3D applications can simulate to aid in the effect of self-illumination.

# Shader Attributes

**Bump maps** simulate a texture along the surface of an object by adding shadow and highlight effects along the surface. Bump maps are grayscale images in which a mid-gray color represents no change in the surface, black represents inward changes to the surface, and white represents a push outward in the surface. The bump map manipulates the surface normals to change the shading properties and make the surface looked textured.



# Materials

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# Textures

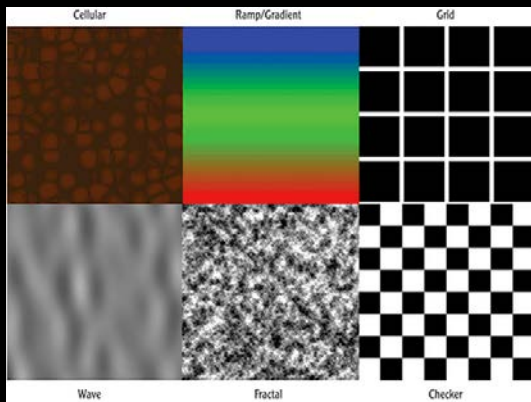
## Procedural

Procedural maps are mathematical algorithms that create various patterns

Brick, Ramp/ gradient, grid, wave, fractal, checker, etc.

Resolution-independent

Seamless



## Bitmap

Bitmap file textures are the standard picture format that you would use in an image-manipulation program such as Adobe Photoshop. These are widely used because you have a lot of control of these textures and can even use real photographs as the starting place to achieve realism.

Resolution-dependent

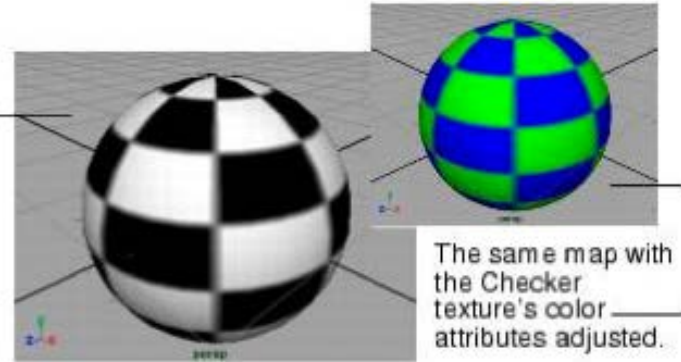
Computer



# Textures

## Checker texture with transparency attribute

A Checker texture connected to the Color attribute of a sphere's material. This is a color map.



The same map with the Checker texture's color attributes adjusted.

A Checker texture connected to the Transparency attribute of a sphere's material. This is a





## Categories




All



### Latest Textures

- 3D Brushes
- 3D Scans
- Substance
- Animals
- Brick
- Buildings
- Concrete
- Decals
- Doors
- Fabric
- Floors
- FX
- Ground
- Grunge
- HDR Skies
- HDR Spheres
- Landscapes
- Manmade
- Marble
- Metal
- Nature
- Ornaments
- Paper
- Plaster
- Plastic
- Roads

## New Scans



## Featured Textures



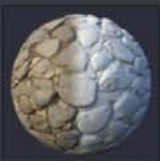
## Freebie of the Day



### 3D Brushes



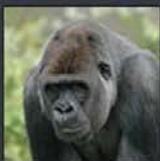
### 3D Scans



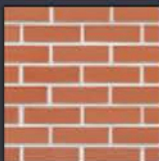
### Substance



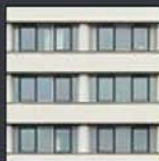
### Animals



### Brick



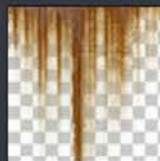
### Buildings



### Concrete



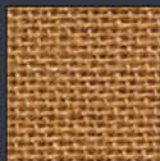
### Decals



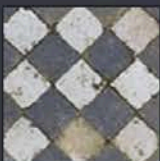
### Doors



### Fabric



### Floors



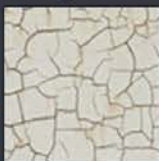
### FX



### Ground



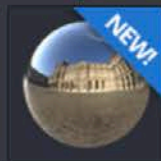
### Grunge



### HDR Skies



### HDR Spheres



### Landscapes



### Manmade



### Marble

### Metal

### Nature

### Ornaments

### Paper

### Plaster

### Plastic

### Roads

### Rock

# Textures

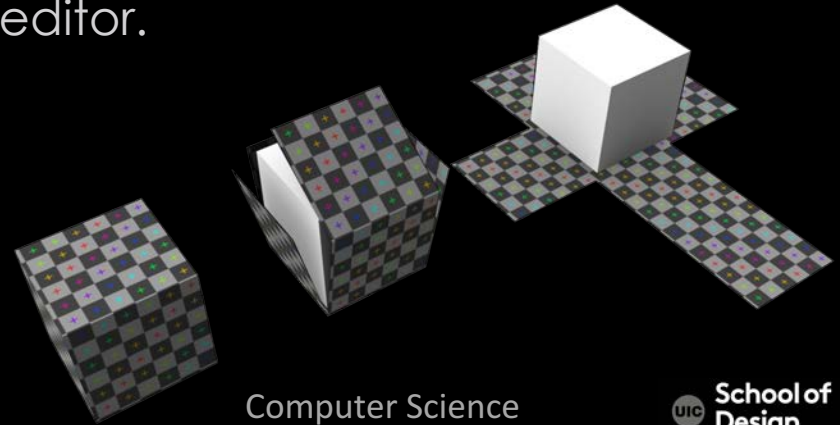
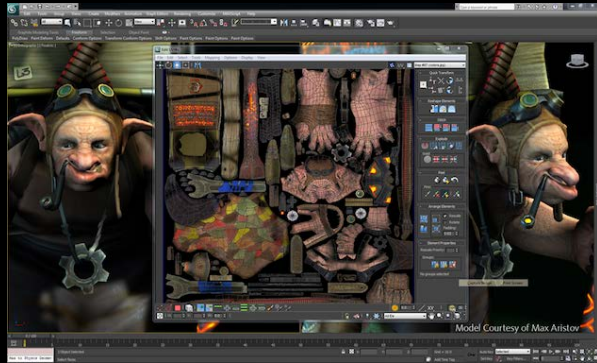
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# UV mapping

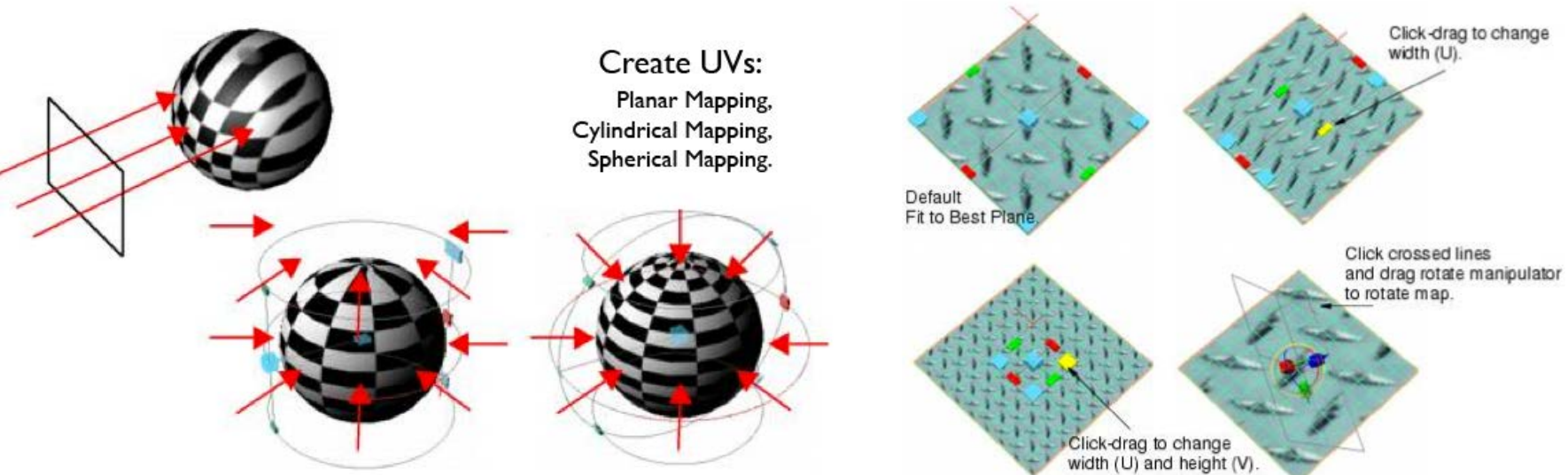
horizontal (U) and vertical (V) coordinates of the 2D coordinate map space that is applied to a 3D object

UVs are 2D representations of a 3D object. There can be a problem with wrapping a 2D image (a texture) around a 3D object. UV mapping helps with this problem: UVs are directly related to vertices on a polygon and NURBS, but the UVs cannot be manipulated in 3D space; they are tied to a 2D coordinate plane and edited in a UV editor.



# Textures

The below image shows how to do UV mapping and the use of place2DTexture node for the 2D texture placement.



# examples

[The Digital Emily Project](#)

[Paul Debevec Light Stage X Smithsonian 3-D portraits of President Obama](#)

[Skin Stretch: Simulating Dynamic Skin Microgeometry SIGGRAPH 2015](#)

[UV mapping tips](#)