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CAP 3027

Bump Mapping Script

Basic Structure of Presentation:

-*Introduction to Bump Mapping*

-*Different Bump Mapping Techniques*
- -*Bump Mapping*
- -*Normal Mapping*
- -*Displacement Mapping*
- -*Relief Mapping*

-*Applications, Advances, and In-Depth Properties*

For Reference:

-Nicola == Ni
-Richard == R
-Natalie == Na
-Xiaoxi == X

Start of Presentation

Slide 1

Ni: Hello, everyone. My name is Nicola…
Na: I'm Natalie.
X: I'm Xiaoxi.
R: And I'm Richard.
Ni: We are the Texture Meowpers, and we are your final group of presenters.
Na: Today, We'll be taking a look at Bump Mapping.
R: No need to worry if you have no clue what that is, as we'll introduce the basics for each subject.
X: Also, we'll be presenting a number of visuals and live demos to show everyone how it works.

Introduction to Bump Mapping

Slide 2

Ni: So what is bump mapping anyway? Bump mapping refers to a number of different techniques used in 3D computer modeling to give flat 2D surfaces the illusion of depth. But why is it that we need to create this illusion of depth? 3D models are already, as their name suggests, three dimensional, so why do we need to bother trying to make flat things look like they have depth? Also, how exactly can a simple texture give the illusion of depth, and how good can it really make something look? We will be answering these questions and more in our introduction to the principles of bump mapping.

Slide 3

Na: The reason bump mapping was created has to do with the processing power of computers, and wanting to add even more little details to 3D models. 3D models are primarily created using polygons that are stitched together to form a three dimensional object. It can take a lot of processing power for a computer to show what exactly a complex 3D model polygons looks like, a process known as rendering. This mean that, if a model is made up of a lot of polygons, it can take huge amounts of time for a computer to render an image of it. Thus, we use techniques such as bump mapping to put less of a strain on our machines, and get the images we want more quickly.

Slide 4

X: Even though they simply alter two dimensional images, bump mappings can do an amazing job of looking like they have depth. This is all thanks to the visual properties of lights and shadows. The human eye can often tell that an object has depth by how light falls on the. If part of something is sticking out, then it will likely have more light shining on it than a part that is receding and thus has more shadows cast on it. This basic property means that properly created bump maps can make things look like they have depth simply by making things lighter or darker.

Demo

Bump Mapping

Slide 4

Ni: Typically, bump maps are grayscale images that are limited to 8-bits of color information. Thus, only 256 variations of black, gray or white can be calculated. For example, when values in a bump map are close to 50% gray, there's little to no detail that comes through on the surface. When values get brighter (closer to pure white), details appear more and the surface seems to

pop out. Applying the same logic, when values get darker and closer to black they appear to be pushing into the surface. These techniques mean that bump mapping works best for creating tiny details on a model such as pores or wrinkles on skin. However, with few exceptions, the silhouette of the geometry that the bump map is applied to will be unaffected by it.

Normal Mapping

Slide 5

R: Normal Mapping is another technique of altering a 3D model's surface to appear to have more detail. When artists are creating normal maps, they will have two versions of a 3D model, one with a lot of polygons (high poly) and one with much less (low poly). The high poly model has the detail that we want to add to the low poly model by using a normal map. Normal maps are commonly stored as regular RGB images where each color represents the direction the surface normals were pointing on the high poly 3D model.

Slide 6

Ni: In this slide you can see some examples of how an 3D model would look with an applied normal map. The tire's normal map is seen in the bottom right of the image, which is applied to the model in the top left. Once the normal map and other texture maps are applied to the tire, it appears to have the detail that the high poly 3D model had.Each face that was deleted from the high poly model cuts down on the rendering time and efficiency. Similarly, the loy poly rocks in the center are given detail by applying the normal map to create the render on the right. This one (point to right) is not a high poly model, it simply has a normal map applied.

Displacement Mapping

Slide 7-8

Na: Displacement mapping is an interesting alternative to some of the other mapping techniques and can be used in combination with the others. Where the other techniques only altered thr surface normals, this one actually moves the 3D model when it is time to render. Displacement mapping is used when the details of a 3d model protrude from the surface. As seen in this slide, without the displacement map, the plane does not look like it has any depth. Simply adding this map will give the plane the indents and protrusions necessary to give the illusion of depth.

Slide 9

X: By combining the previous techniques, you can add small details to the displaced 3D model. When it comes time to render, the model will move its position according to the displacement map and the applied bump mapping and/or normal mapping can add even more detail to add to the realism without adding polygons to the model.

Relief Mapping

Slide 10
Ni:

Slide 11
Ni:

Code Examples

Applications, Advances, and In-Depth Properties