The Realization of Baking Technology in Virtual Simulation

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Abstract. In the application of virtual simulation, the fluency of real-time rendering directly affects the quality of works. As developers and designers, we always try our best to reduce the computation of real-time rendering. Baking is one of the commonly used techniques for system optimization.

Keywords: Virtual simulation; Baking; 3D modeling.

1. Introduction
In the virtual simulation application, in order to achieve a realistic effect, shadow effect is indispensable, any object lit will form a shadow. If you use real light and shadow, it will consume system resources. To optimize the system, instead of directly creating lights and shadows, baking techniques are used to create light and shadow effects.

2. Baking Principle
The principle of baking technique is to make a map of the real light and shadow effect, and then paste it back on the object to replace the real light and shadow. Then cancel the use of lights and shadows to reduce memory loss. Through the process shown in Figure 1 below, we can have a clear understanding of the baking process. The advantages of baking are obvious. The key to a virtual simulation application is to run the program smoothly. The disadvantage is an extra map.

3. Baking process
In 3D MAX, the lighting and shadows are set according to the selected renderer, with the model scene completed, the renderer selected, and the material map specified. Usually, Scanline, VRay, Mental Ray, etc., can be used to render the corresponding Target Direct, V-Ray Light as the main light source,
and set the relevant parameters of light and shadow. With all the work of the scene in place, you can set up the render and start baking.

3.1. A subsection Preliminary Settings of Render to Texture Window
Click "0" on the keyboard or select the menu command Rendering/Render To Texture To open the Render To Texture window as shown in Figure 2. In the General Settings suite we can set the location of the Light Map file, manually specifying the path, and we can also add a folder to place the Light Map.

![Figure 2. Render To Texture](image)

In the Objects to Bake roll display, as shown in Figure 3, you can set the Bake channel. In the Output volume bar, as shown in Figure 4, each type of bake is added to the object, and in most cases one of the Complete Map and Lighting Map is selected. We select the object, and if we're using a Scan line render, we can add the Light map type, or if we're using a V-Ray render, we can select V-Ray Lighting Map. The map location is usually set to: light channel. Set the bake size. If the map size is small, the accuracy will be affected. If the map size is too large, the bake size should not exceed 1024. In general, V-Ray effect is relatively ideal, but the speed is slow, there are many parameters affecting the speed, need more debugging to achieve the best effect.

![Figure 3. Baking channel Settings](image)
3.2. **Show the UV**

The UV can be developed either manually or automatically. For high precision baking, the UV can be developed manually. Expand the second/third channel UV, which is the UV we used to bake the map. The principle of the engine is to overlay the shadow of the second/third channel map onto the original map, so that the model map has the shadow effect to appear real and solid. This eliminates the need for special lighting, which reduces real-time computer analysis and improves interaction response times. Process the modifier command Unwrap UVW using the spread UV. Click the Open UV Editor button in the parameter volume display to Open the Edit UVWs window, as shown in Figure 5, and arrange the used maps. It should be noted that the size of the map used should always be 2^n Pixels.

Once you have all the above, set the Bake Material palette selection: output to source. The baking diagram will be automatically posted on the self-lighting channel. Check to see if other Settings are normal, such as ambient light Settings, lights hidden, etc. Check the parameters of the whole baking panel one more time, and click the render button to wait for the drawing. The rendered image is the desired Light Map. The Light Map file can be found in the path set above.

**Figure 4.** Output volume display panel

3.3. **Load the Baking Diagram**

The exported model is in FBX format, no need to export the light. In the game engine, import the model, take U3D (Unity3D) as an example, click apply, and the software will automatically display the materials and maps used by the model. Click on it and you can see that the texture ball and texture are exactly the same as in 3DS MAX. The standard naming helps to make a quick and easy choice in U3D. Drag and drop the model file to the scene, and you can see that there is no baking image effect, only the scene default real-time lighting effect. First, turn off the light shadow, select the baking diagram of the corresponding object, drag onto the material ball, and set the UV channel to select and set the baking diagram of other objects. So far, we have completed all the work from 3DS MAX to U3D.
4. Summary
Bake mapping is done in 3DS MAX and is mainly used in simulation engines. In the baking process, the hardest part should be the exhibition UV, the effect of automatic exhibition UV is not good, usually need to be manual exhibition UV, the exhibition UV should follow the principle of maximizing each map in the designated area, at the same time, in this area, the main map should be as large as possible, the secondary map can be appropriately reduced. Secondary maps usually refer to those that take up a small amount of space in the composition of the picture, or those that are not easy to show on the back or bottom. The boundaries of each map should not overlap and should not occupy two checkerboard squares.
The shape and Angle of the light and shadow should change over time, but the baked light and shadow are posted and will not change. However, compared with 24 hours, the time for users to operate the software is very short, so the changes of light and shadow in the time for users to operate the software can be ignored.

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