Introduction

Using Radiosity with Blender

The Radiosity helps to achieve a photographic quality rendering : radiosity takes into account all light interactions between two close objects. The result is spectacular most of the time. Xavier Michelon has written an article on linuxgraphic where he explains more−in−deep the concept of radiosity.

A glimpse to what we will render during this tutorial

Blender use Radiosity in its own special way. In any classical renderer, the calculation of radiosity is made during the final rendering. Blender uses a different approach which could surprise the newcomer. After having created the scene, the calculation of a radiosity solution is made. The result of this calculation is then stored as VertexPaint in a self created material, and the whole scene is replaced by this vertexpainted solution. You can then separate the different items, add textures to them, lighting, and make renderings from any point of view. Because the radiosity solution is linked to a material, you don't have to recalculate it for each point of view you decide, so this speeds up the rendering. Unfortunately, this approach is barely useful during an animation, because when an object is moved, the radiosity solution is not re−calculated.

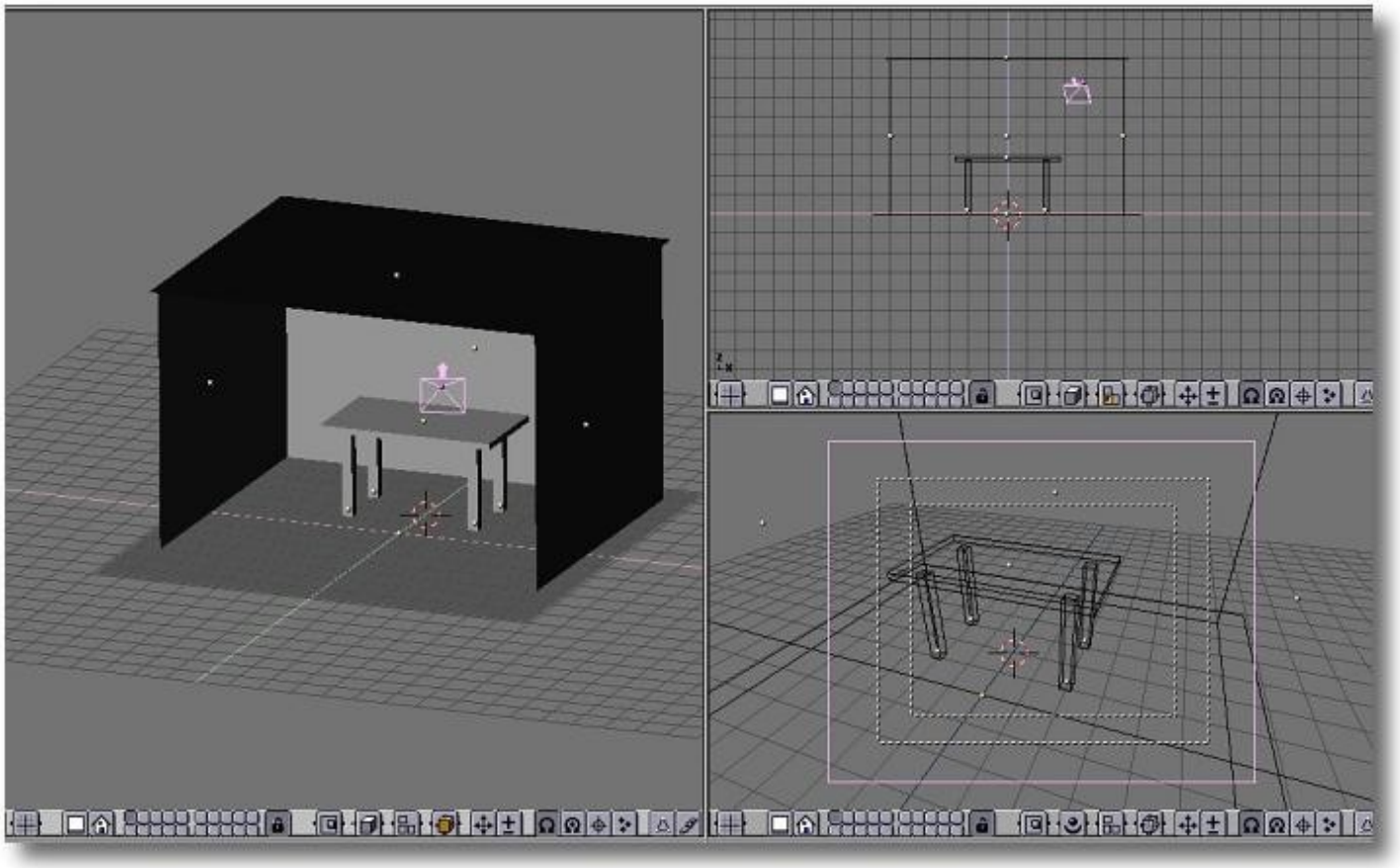
−−>*Pre−requisites in order to understand and go through this tutorial:*

- Basics about creation and manipulation of objects
- Editing an object, adding new materials
- Making a simple render

S t e p 1 :

Creating a basic scene

In order to learn the best way how to use radiosity, I chose to build a very simple scene. We will make three **walls**, one **floor**, one **ceiling** and a **table**. Start Blender and build your items as shown on the following picture. Use basic planes for the walls, ceiling and floor, it will ease the calculations, thereafter.



Toggle into **edition window (F9)** 

For the **floor**, we will use the default plane of Blender. Resize it in order to give it a size of 14 grid units (hold the CTRL−KEY all along). In order to speed up the calculation of the radiosity solution, we are about to delete the internal face which as no interest in our case. Edit the **floor**  , select all the

vertice (A−KEY) and press the 

button until it appears 'off'. To make sure that the visible face is the top face, we will look at the "**normals**". Press the 

button and you will see small blue lines on your object, the location of the line is showing the visible face. If they are pointing the wrong side, select all the vertice (A−KEY) and press the 

button. Repeat this step for all the **walls** and duplicate the **floor** to create your **ceiling** (of course, don't forget to flip normals!).

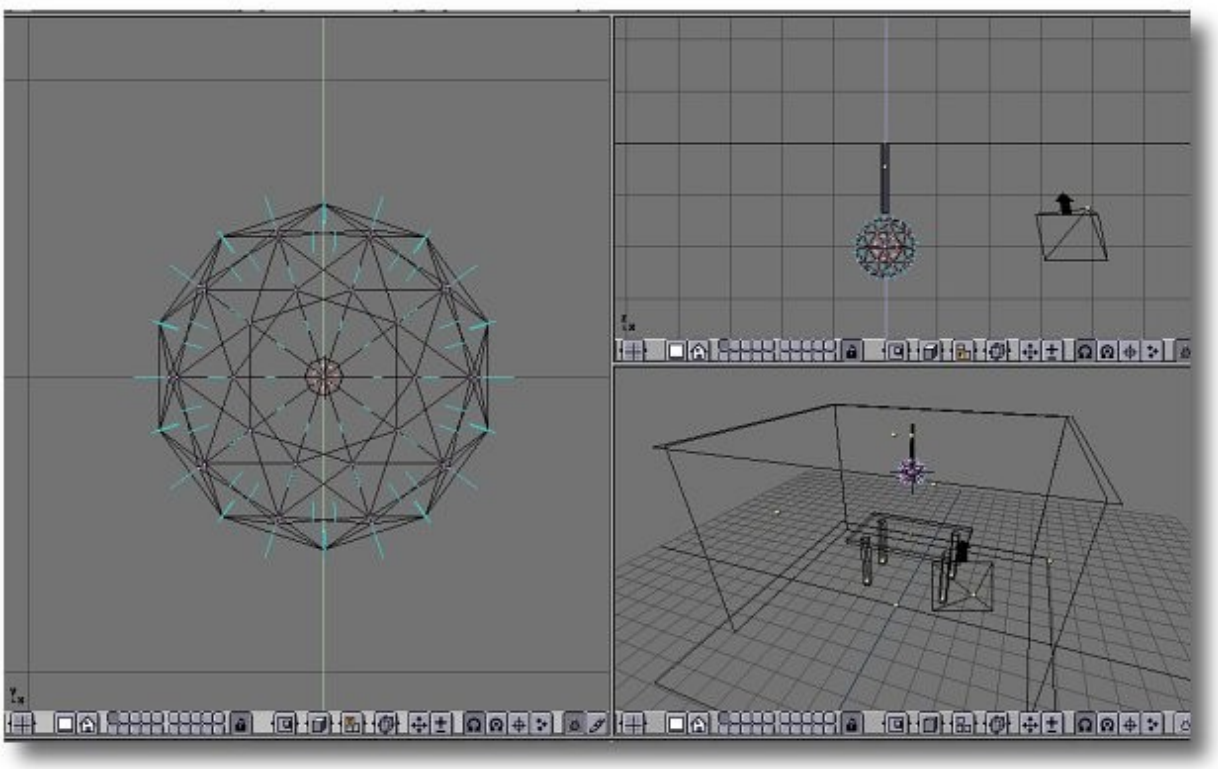
S t e p 2 :

Setting up the lights

The *light source* in the radiosity solution doesn't show as a common lamp. The *light source* is always an object with a material that emits (**Emit** parameter) light.

To simulate a light source the closer to a natural outdoor lighting, the prefered way is to use a half−sphere of light. But in fact, you can use any object in order to emit light, but its size and location will be taken into account in the calculations. In our example, I wanted to simulate the natural lighting of a bulb lamp. Set the creation cursor above the table. Add a **icosphere** (SPACE>ADD>MESHES>ICOSPHERE), resize it in order for it to be roughly the same size as a big bulb lamp and toggle into edit mode  : we also have to delete the inside faces of this object. Exactly the same way we did it in the previous step, select all the vertice (A−KEY) and un−press the 

button in order to have only one sided faces (the external faces, in fact), display the **normals** to make sure they are pointing the good way, which should be the case, normally. In the other case, flip the normals. In order to create eventually a bulb lamp at the location of the icosphere, if needed, I added a small cylinder between the ceiling and the light source. Please note that the creation of the bulb lamp is not the purpose of this tutorial.



Materials

Toggle into the **material window (F5)**  **.**

In this step, materials don't need a lot of care because only reflects tied to the color of the objects will be taken into account in the calculation of Blender's radiosity solution. We will work the details of the materials AFTER the calculation, but if we want the color of the reflects taken into account, we will turn the **table** in blue and the **floor** in brown (because this will be a brown wood floor once textured). You will have to create new materials for each of these objects. The icosphere need a material that emits light. Set a new material and turn the color into a light yellow, and set the "**Emit**" parameter to a value close to **0.130.** With a higher value, you would get a too much powerful lighting, even if we will learn soon how to modify the lighting value.

S t e p 3 :

Starting to compute the solution of radiosity

Let's see now the most important step : the calculation of the radiosity solution. Before going through this step, when you deal with big scenes, I suggest you to save your blend file with a different name, so that you could come back to the initial scene if you make some big mistake. The different radiosity features are available through the Radiosity window. Set the main viewport of Blender in order to see the **table**, it will let you watch the calculation all along its many iterations.

Basculez vers la fenêtre de Radiosité 

What is done here could be explained like this : we first collect the meshes to be taken into account, and then Blender turn these meshes in a set of patches on which it will eventually store a shadow value. Of course, the greater the number of patches, the longer and the more accurate the rendering is, but we can set some limits to the subdivision of the patches in order to keep an acceptable quality/rendering time ratio. Once the solution is computed, we can adjust the gamma value and the quantity of light, and then choose to replace the existing objects by the radiosity solution, or to keep the existing objects in addition to the solution. At last, at the very end, we will exit from the radiosity environment..

Step 1 : collect the meshes

Select all the objects (A−KEY) you want to be taken into account in the solution. In my example, this means all the objects beside the camera (*Shift+ right click two times on the camera to get it out of the selection*). Press the 

button. Thereafter, we are in the **Radiosity** mode.

The 

buttons set the quality of the display. Please select **Gour** which offers the best display quality.

Step 2 : set the quality

Because Blender will subdivide our objects into smaller elements for the radiosity calculation, we can set the minimum and maximum sizes of these subdivisions with the **PAmx and PAmin** buttons, and also with **Elmax** and **Elmin**. Low values will give better quality, but a far longer calculation time.

To enhance the rendering, you can press the **"Subdiv shoot element"** button, along with the **"Subdiv shoot patch"** button, but doing so increases the calculation time. The **MaxEl** button sets the maximum number of elements to calculate. Think about increasing this value if you want a greater solution quality, but beware : a very high number of polys will be produced. The "**Hemires"** button lets you enhance the

quality also by acting on the calculation of the light itself : if you increase the **Hemires** and **MaxEl** values, you can expect many hours of calculation.

In our example, we will let all these parameters at their default values, because this way, we will get more quickly a radiosity solution. Once this tutorial is finished, you could play with the different settings on a personal basis.

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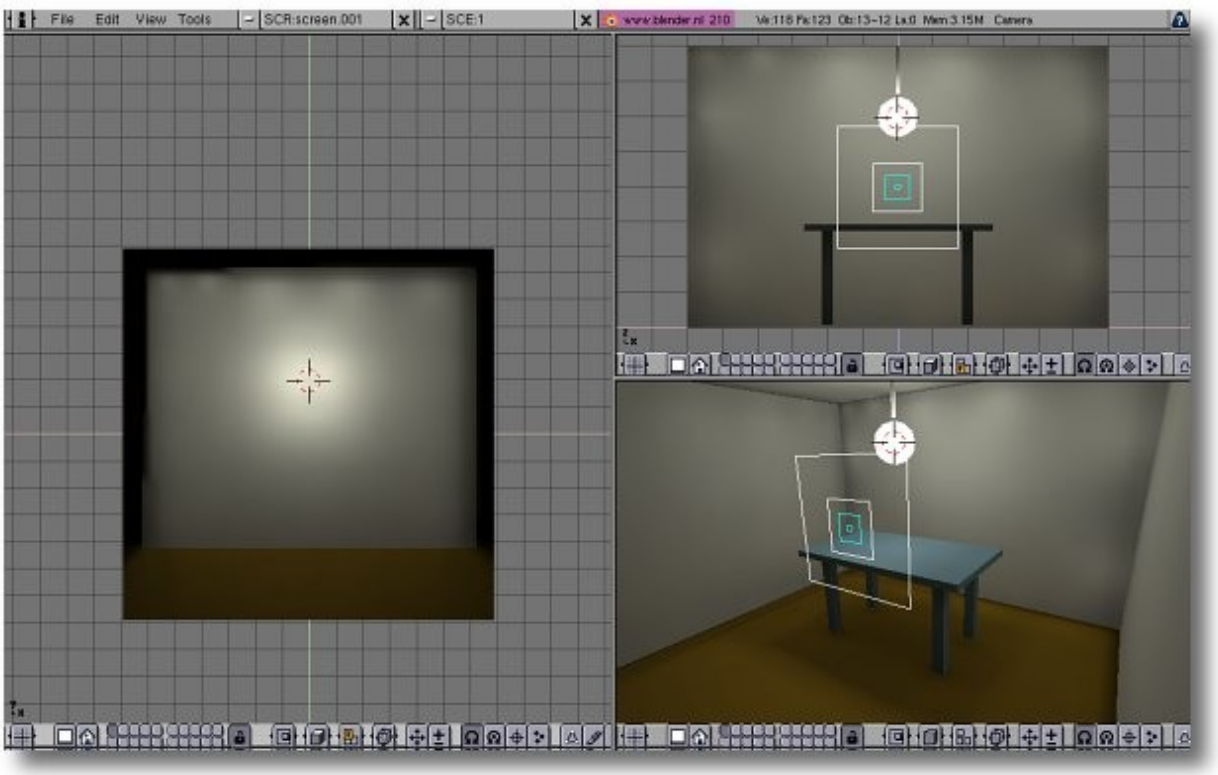
S t e p 4:

Starting the calculation

To start the calculation of the radiosity solution, the only thing left to do is to press the **"Go"** button, and then you will see in real time how the calculation of the solution evolves. The cursor turns into something different during this operation, and the header over the 

buttons indicates that Blender is calculating the solution : **"Solving"**. Once the solution has been found, you can freely move in the display viewport to make sure the solution is good enough for your needs. The calculation time rely heavily on the power of your processor. Moreover, unfortunately, the SMP solutions are not yet taken into account by Blender.
The 

buttons let you adjust the intensity and the contrast of the solution. You can set them at will, but remember that we still HAVE to add a **light source** in the final rendering, so this one will add itself to the radiosity solution. Because once we would have left the radiosity mode we couldn't use anymore these functions, you should better have something a little **darker** than needed at start..



Our scene with the radiosity solution displayed

S t e p 5 :

Solution retrieval

Blender offers us up to three choices :

- delete the solution : **"Free radio data"** button
- replace the existing scene by this solution : **"Replace Meshes"** button
- add this solution to the existing scene : **"Add new Meshes"** button

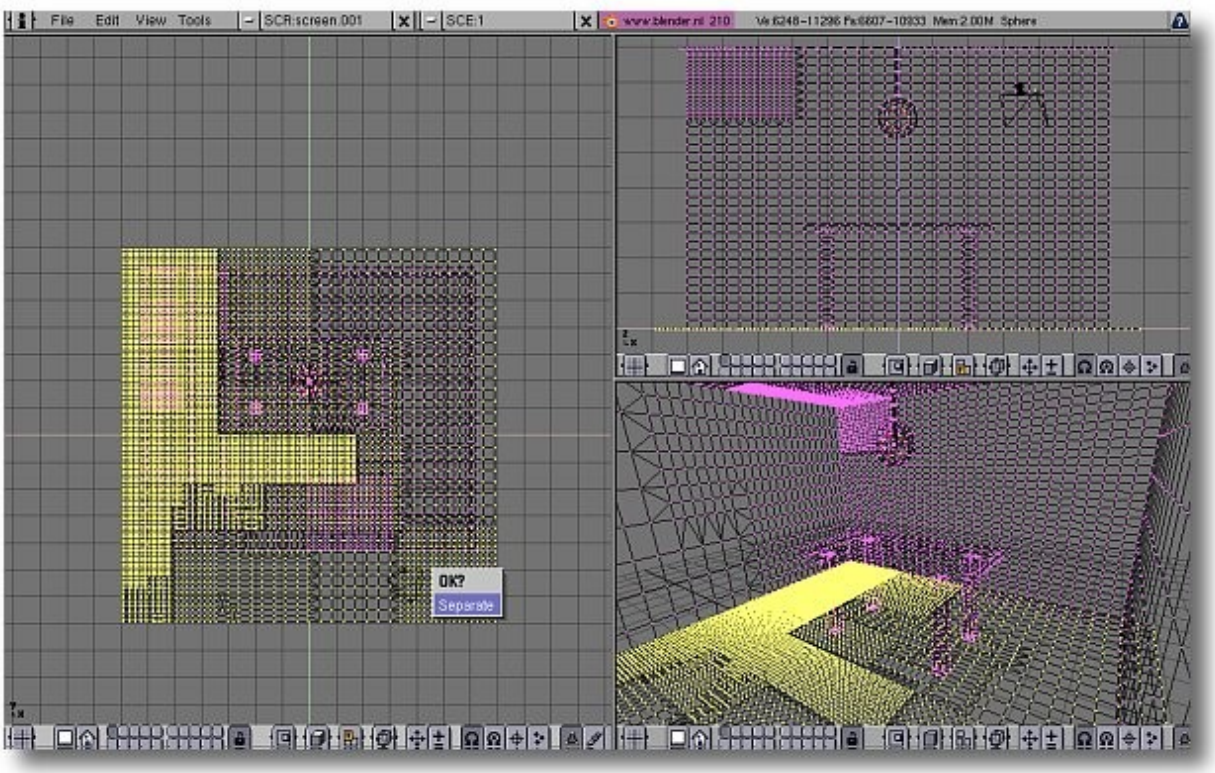
In the following part of our example, we will replace the existing scene. Press the **"Replace Meshes"** button in order to leave the radiosity mode and get back into the classic mode. Now press the "**free Radio Data"** button. You will be amazed to find out that the scene has been replaced by a all brand−new mesh ! You can also find out that this mesh has a new material. In fact, this is this material that contains the radiosity solution, hidden under the guise of VertexPaint. The trouble, could you point out, is that you can't access anymore your old objects in order to give them new textures. Of course, this is still possible, and this is what we will see in the next step.

A new mesh !

S t e p 6 :

Separating all the original objects

This is the less pleasant part involved in the use of radiosity with Blender : select the new mesh and enter the **edit mode**  . Even if the objects have somehow joined, they keep all their original creation links so it is fairly easy to separate them anew. Select (right click) a vertex from the floor and press the L−KEY : the whole original floor is then selected. Now press the P−KEY to separate the object from the global mesh, and answer yes to the question **"Separate ?"**. Repeat this for each of the objects you took into account for the radiosity solution.



Separating the various items

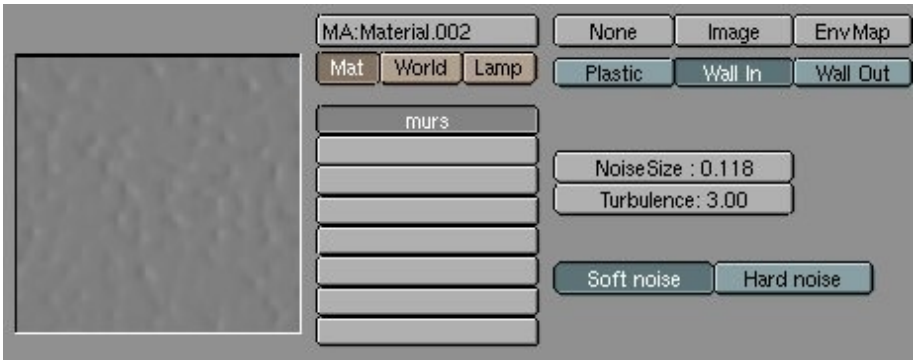
Once this is done, we have many independant objects with their own radiosity solution. We can now work on the different textures and make use of more realistic material properties.

S t e p 7 :

Adding textures

Select the **walls** and shift back into the material buttons (F5)  . You will see that the *radiosity solution* appears like a new material ; the fact it is blue indicates it is shared by other objects (which perfectly makes sense because we separated them). Press the button showed by the red arrow 

to make the material single (say yes to **"Single User"**) or the modification we will make will appear on all the other object taken into account in the radiosity solution. Delete all *specularity* **(Spec)** and increase the *reflection* **(Ref)** to **0.930,** then set all the *RGB* color component to **0.890** in order to get a wall slighty more white than the original default grey. We will add some sort of noise to the **walls** : shift to the texture buttons (F6)  and add a new texture (let's call it walls, or 'murs' in french). Select the **stucci** texture type and give it all the following parameters :



Get back into the material buttons (F5)  , turn off the **Col** button and turn on the **Nor** button. You can play with the bump map intensity using the Nor slider located under these buttons.

For this material, I kept the following parameters :

For the **floor**, do exactly the same, starting by making the material **single**, as already seen. Keep the **Spec** and **Ref** value as are. Shift to the texture buttons (F6) and add a new texture that you can name "woodfloor" (parquet in french) for example. Select the picture shown below (you can download it by right clicking on it).

S t e p 8 :

Use the settings shown below. You could note that I decreased the **"Filter"** value : this gives a more realist look to our texture.

Shift back to the material buttons (F5) and activate the **Col** button in order for the texture to be used. I also added some bump mapping by pressing the **Nor** button two times. Here are the parameters I used :

You now can add a **lamp** in the middle of the room (at the very location of the **icosphere** −remember it ?), decrease its intensity to 0.4, and render a picture (F12). The lamp is strictly necessary if you want to use the *reflection* and the *bump mapping* set for your material, for example.

For a better effect, I turned the **lamp** into a **spot**, with the following values :

To avoid getting a too great contrast, I also added a very basic **lamp** with very low intensity (0.1) located before the table, out of the room.

You can now render your picture (F12) and stare at the result. You can also move the camera and set the lighting sources at will.

S t e p 9 :

Conclusion

It is true that this kind of radiosity solution does not look very professional but it gives anyway great effects when used along with static pictures, and the look it gives to objects is very pleasant, indeed. When used with large scenes, however, things can get messy because you don't have the right to adjust poorly the parameters during the radiosity setting step, and you will have to be very patient during the calculation, which can last many hours. But when combined with Environment Maps on carefully chosen objects, the final result is very beautiful. This radiosity approach is to be tested and worked on, until we get a better way to do all of this.

Hereafter is a boat hull I made for a CD−ROM project depicting the french town Agde during Antiquity. The render used Radiosity, of course, and took 8 hours of calculation because of the 40 amphoras that are stored in the hold. I hope it won't sink ! :)

When working on large scenes, think about dispatching your objects through many layers because the number of polys could exhaust even your brand new graphic card. Think about isolating the light−independant areas of your scene in different layers and make the radiosity calculations on the fewer layers possible at a time. The render will get enhanced quality and rendering time.

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