

# Rendering glass & metal

Mastering 3D Graphics ~ issue #2

## (3D Studio MAX)

~ Alessandro Cangelosi

(c) 1999 Imago Edizioni (<http://www.imagonet.it>)

With version 2.0, 3d Studio MAX includes a rendering engine based around ray-tracing. We have to say that it does not seem to be equal to the ones used by LightWave or Mental Ray, but great improvements are coming soon in version 3! Maybe this is the reason why 3D MAX has not been used a lot in a productive or experimental sphere, and the users who tried to use it to render metal or glass surfaces have faced too many difficulties. Even if I have been a Kinetix customer for several years, and my team uses mainly this software, I hesitate when using it in a professional capacity.



But recently, when I was in Cinecittà (Rome) to create some cinematic special effects, I had to face the challenge of reproducing metal surfaces in 3d MAX. Let me say that the problem forced me to work hard, but I obtained some nice and realistic results.

Let us get on to analyzing how to solve this problem.

## Beginning with the scale

Before beginning to model the objects, let's control the scale settings in the preference panel. We will use a default neutral scale: 1 unit is equivalent to an inch (in this tutorial we are not interested in the exact scale but just the proportions in the final render).

Now a little theory... Metals do not create any particular problems in themselves, but if you want to get a chromium-plated metal, it's necessary to use a clear grayish coloration and an increased reflection index.

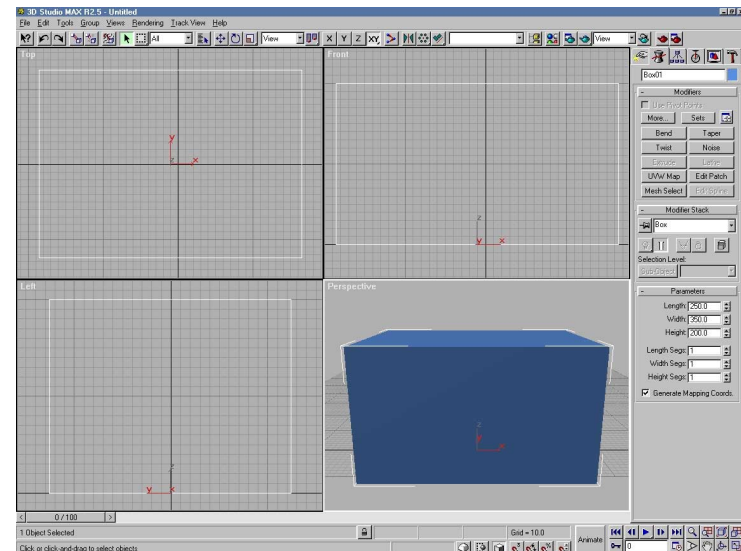
Advice for rendering glass is as follows: the diffuse color has to be black, the brightness has to be high, the transparency approximately to 90% and lastly use a real refractive index (get it from a physics book).

The one remaining thing to do to improve the realism of the image is to place some lights, which will modify the specularity of glass objects only.

Let's look at an example. From the top view create a box with the following settings:

- Length = 250,
- Width = 350,
- Height = 200,
- “Generated Mapping Coords” box active.

You should have a view like the one in [Figure 1](#).



*Figure 1: Using a standard primitive (like a box) you can create the environment for our scene. Using a double-sided texture, we will have empty geometry inside, but the texture will give us 4 walls, a floor and a roof.*

Through the Create/Cameras control, create another point of view similar to [Figure 2](#) – or use the perspective view – anyway the point of view must be inside the box. If you want to see the inner faces of the box, go in the material editor and create it with the help of the ray-tracing engine.

It should be pointed out that 3D MAX is based on a selective ray-tracer that ray-traces only those objects associated to a ray-traced material. This way is possible to remarkably speed up the rendering, using the scanline calculus for the rest of the scene.

We have two possibilities: the first is using a reflection/refraction ray-trace map, to create a ray-trace material.

For the surroundings we will use a scanline material with a ray-trace reflection map.

In [Figure 3](#) you can view the assigned surface settings: shading mode = metal with light reflections, and 2-sided activated to visualize the inner faces.

In the “Reflection” channel, set a ray-trace map to 35% (set this value in the “Amount” field).

Click on that map and leave all the settings unchanged. Go to Global Parameters and set the value Maximum

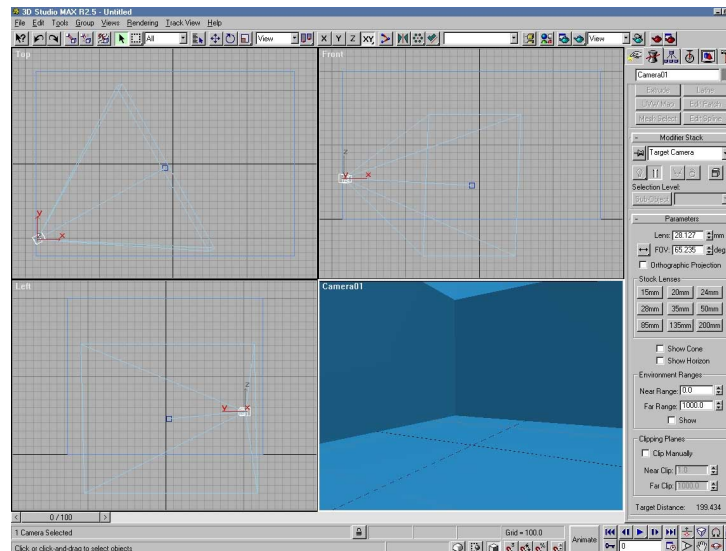


Figure 2: Our point of view is the virtual camera. It will be placed in a corner of the room targeting the opposite side. This configuration is useful to see the modifications on the background like the joining walls or to see the “infinite mirror” effect (infinite reflections on all the walls).

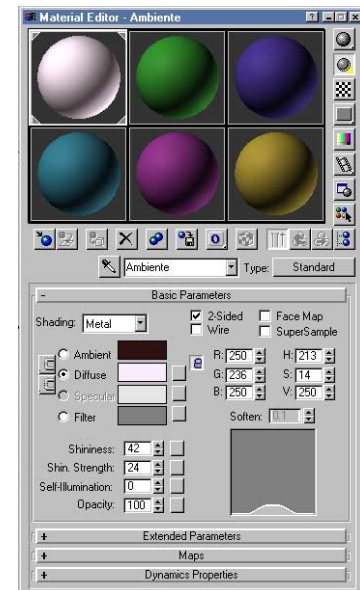


Figure 3: A global view of the material editor with the basic settings for the box material. A low reflecting metal with a double side (2-sided).

Depth = 3 (Figure 4). This operation will speed the rendering because our scene has only a few objects and we do not need a high number of inter-reflections; in other words every ray will break itself after 3 surfaces and then be eliminated.

Before modeling the objects, let's set the lighting. From the Create/Lights panel, create an Omni type light with a whitish color, activate shadows and set them with Multiplier = 0.5 and Shadow. Maps = on, Size = 640, and Attenuation Far on Start = 165, End = 255.

From the Lights panel always create a Spot light like that shown in Figure 5 (don't worry about the schematic visualization at the lower right, it is the Schematic View plug-in used to manage the scenes better. (I was a beta tester for it and now I use the commercial release.)

Let's set the values in the following way: whitish color, Multiplier = 0.7, Attenuation Far = Use, Start = 300, End = 374, Hotspot = 47, Falloff = 54, Cast Shadows = On, Size = 640. Now insert the other objects into the scene.

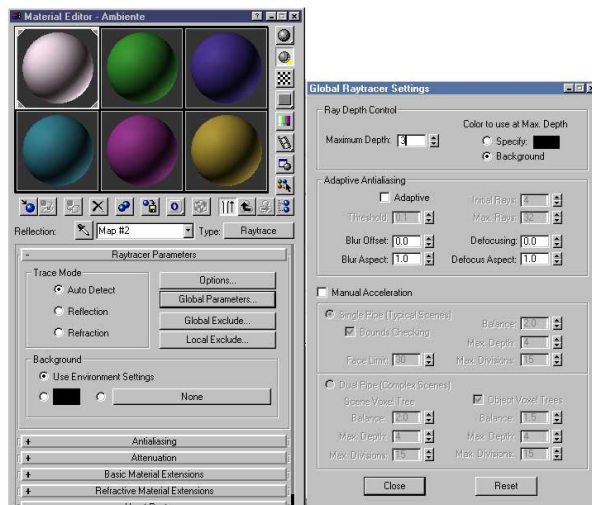


Figure 4: In the global ray-tracer settings panel we settled on a maximum depth of 3, avoiding too high rendering times, because of the low number of objects in the scene.

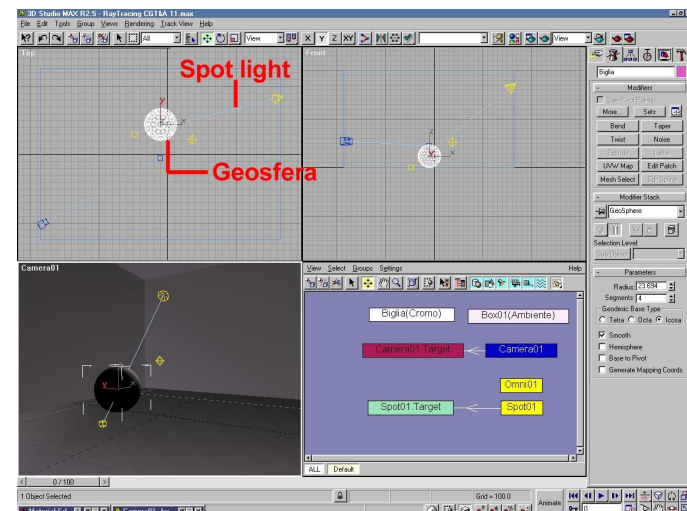


Figure 5: When the first material is ready, we placed a simple sphere as an example showing the power of the 3d Studio MAX R2.5 rendering engine.

From the Create/Geometry panel, generate a GeoSphere with the following parameters as shown in **Figure 5**:

- Radius = 23.694,
- Segments = 4,
- Geodesic Type = Icosa Base,
- Smooth = on,

Click on the “Edit Stack” button and convert the sphere to NURBS.



Figure 6: The sphere is now a realistic chromium-plated pinball, placed in the tenuous atmosphere of the scene. We used ray-tracing shadows to avoid the unrealistic clean edges. As you can see, the sphere is reflected in the walls and these are reflected perfectly on the sphere.

Now in the material editor, create a ray-trace material by clicking on the button “Standard “. As you can see, the panel is totally different, here we will create the chromium-plated metal for the spherical ball we have just modeled. Set:

- Shading = Metal,
- Diffuse = 196,196,196,
- Reflect = 213, 213, 213 (this parameter indicates the

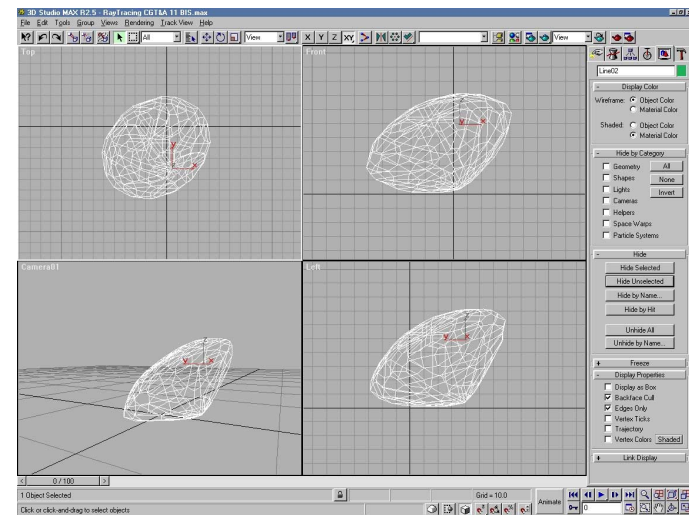


Figure 7: Let’s place a more complex object in the scene to show the rendering of glass, using refractions and reflections. The geometry has a diamond like structure and is very simple. Draw a linear spline to make the outline of the object, and use the “lathe” modifier with 8 sections. The last thing to do is the doweling of the faces using the “Edit Mesh” modifier, and eliminating the automatic smoothing on all the faces.



amount of reflection of the material, but instead of being expressed as a percentage, it uses the three common RGB values; the closer it is to white, the more reflective it becomes)

- Shininess = 77,
- Shininess Strength = 55.

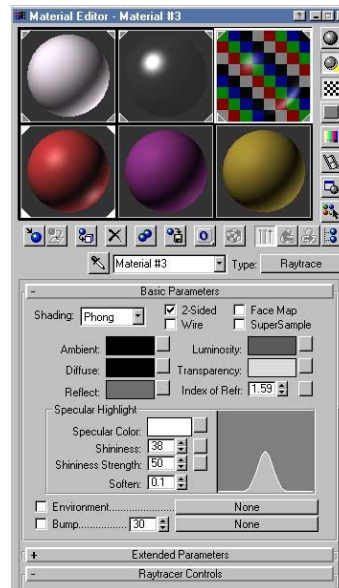
Let's use these material settings for the NURBS sphere and render the scene; you should get something very close to [Figure 6](#). (If you don't have a powerful machine, use a test resolution of 320x240. On our dual Pentium Pro 200 with 256MB of RAM, a 768x576 render took 1 minute 46 seconds.)

Now create a simple diamond, like that shown in [Figure 7](#) using a linear spline for the profile and the lathe command to make it 3D. Using few intermediate sections, remember also to eliminate the smoothing of the faces.

We chose this object to simulate a glass material with a lot of refraction and reflection.

From the material editor create a new shader similar to that shown in [Figure 8](#) and assign it to the above listed object.

Behind this object place a simple red sphere, so you will be able to analyze the effects of refraction.



*Figure 8: Here you can see all the settings used for the glass surface. We preferred using a ray-tracing material instead of a map, because it gives better final results and shows you how to master this kind of technique.*



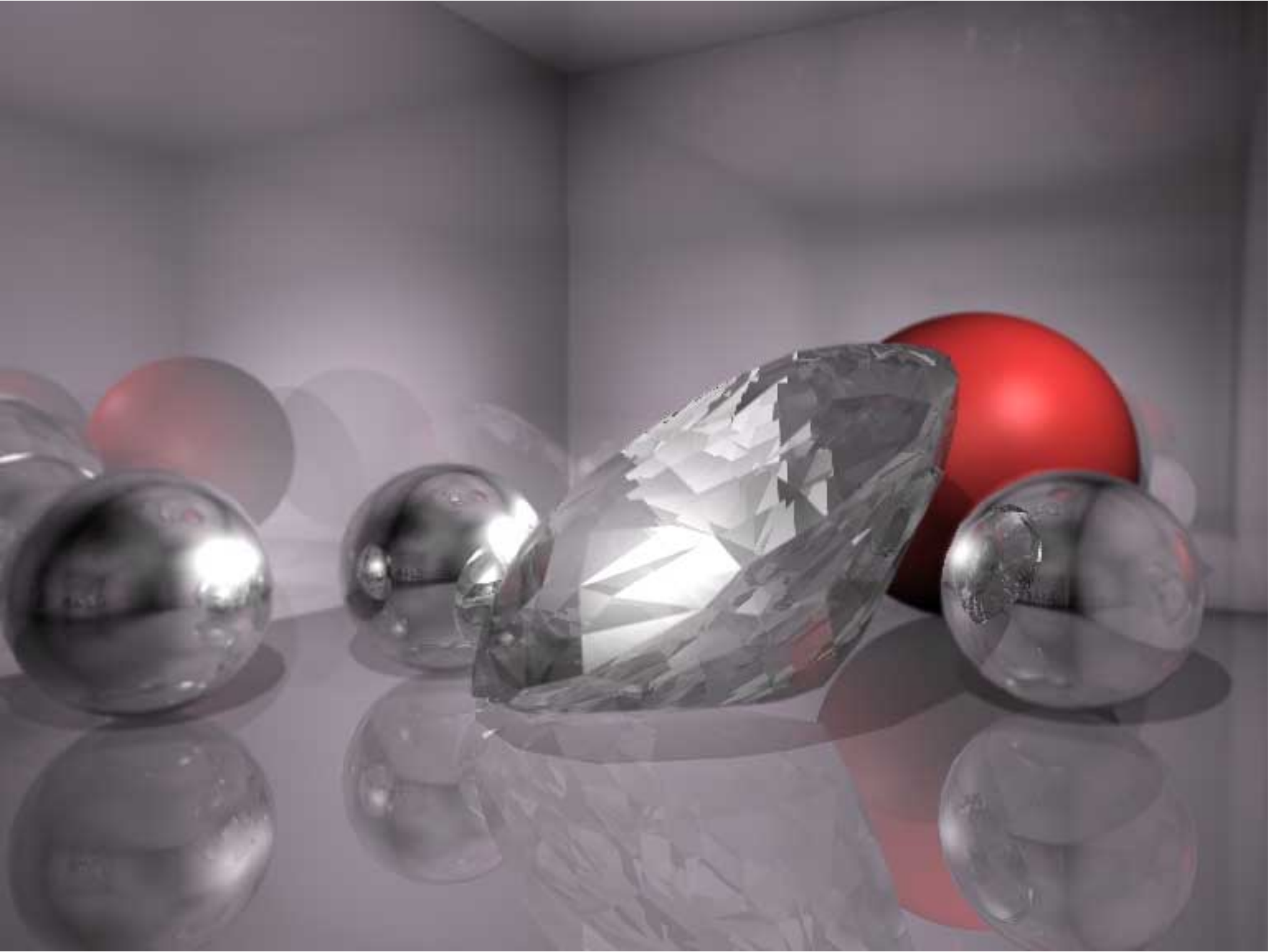
*Figure 9: After finishing the tutorial, the scene became more complex; duplicating the metallic pinball with the "clone" tool and creating a bigger one with brighter colors. In this way we get a lot more reflection and refraction effects.*

We should also insert other omni type lights, without using the “affect diffuse” function. This will not influence the surface color of the objects, but only the specularity, creating multiple luminous glares on the glass.

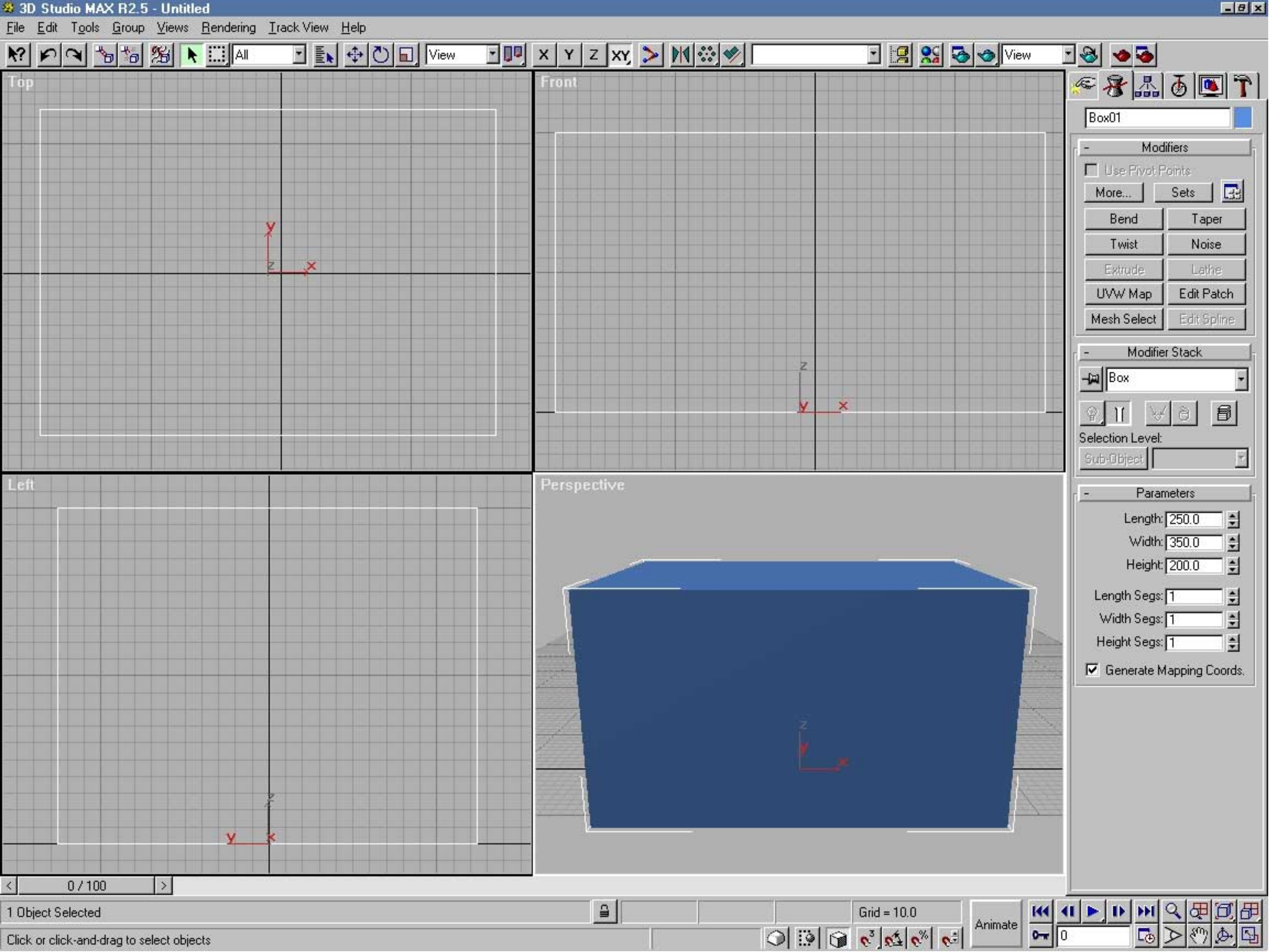
The position of the omni lights is not important but for the best results place them around the object.

In **Figure 9** you can see the final rendering with the adaptive anti-alias used on the reflections and in particular, the depth of field effects in the mainly illuminated zones.

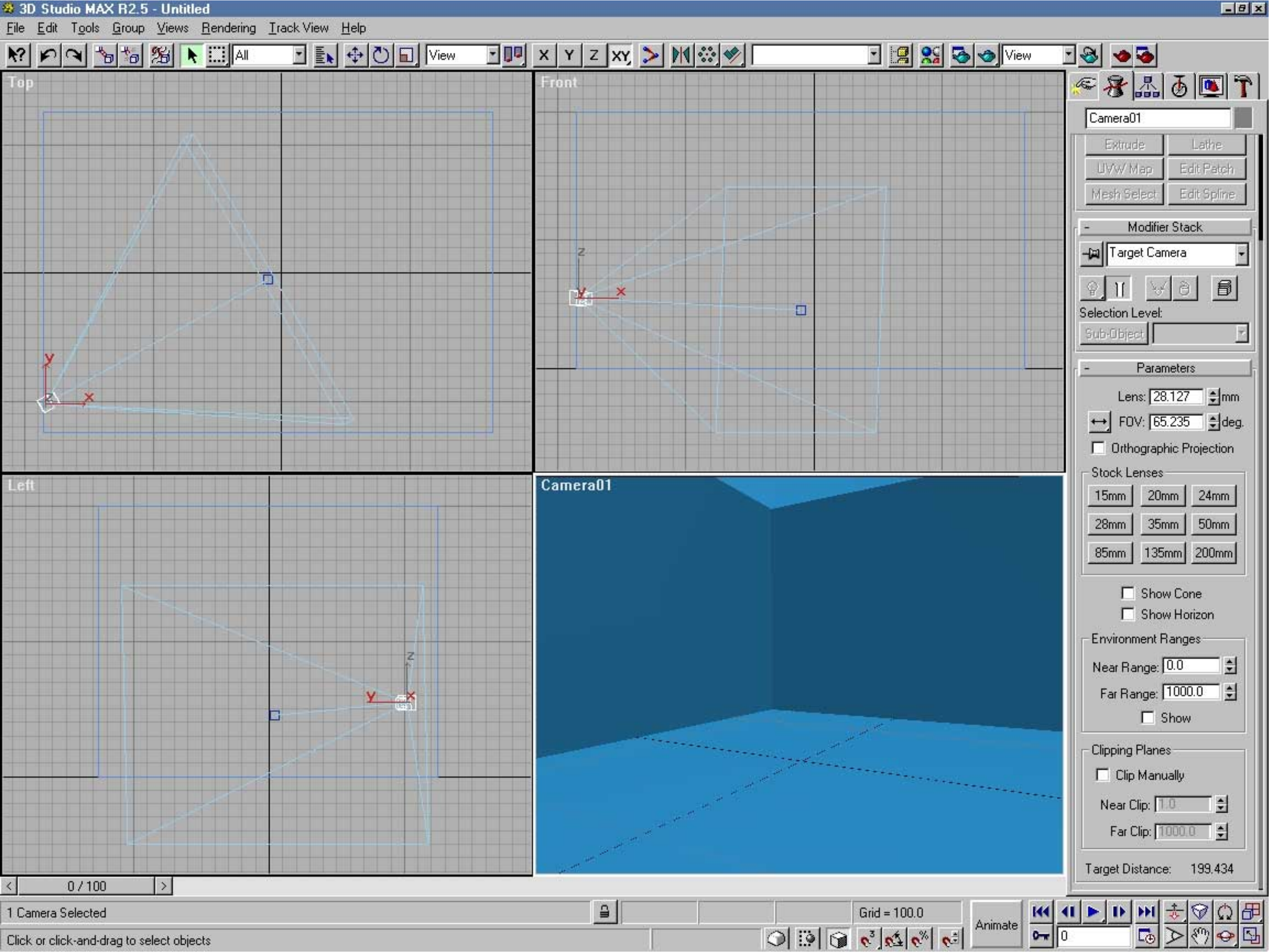
Then in the Video Post panel, insert the Lens Effect Glow to highlight the main lighting areas and the Lens Effect Focus to add a light depth of field effect.

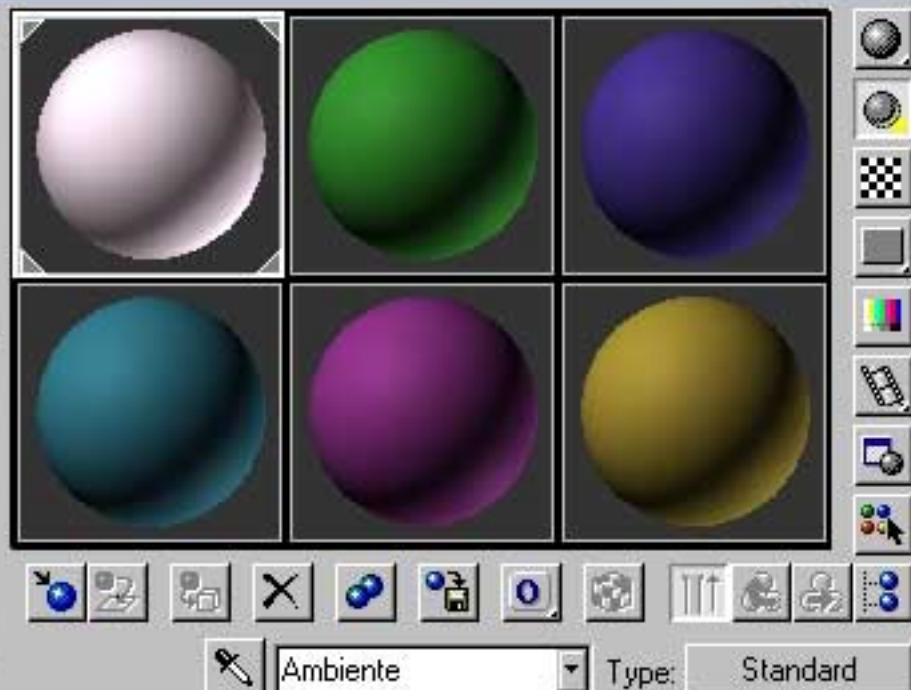












## Basic Parameters

Shading: Metal

☒ 2-Sided☐ Face Map☐ Wire☐ SuperSample☐ Ambient☒ Diffuse☐ Specular☐ Filter

R: 250

H: 213

G: 236

S: 14

B: 250

V: 250

Soften: 0.1

Shininess: 42

Shin. Strength: 24

Self-Illumination: 0

Opacity: 100

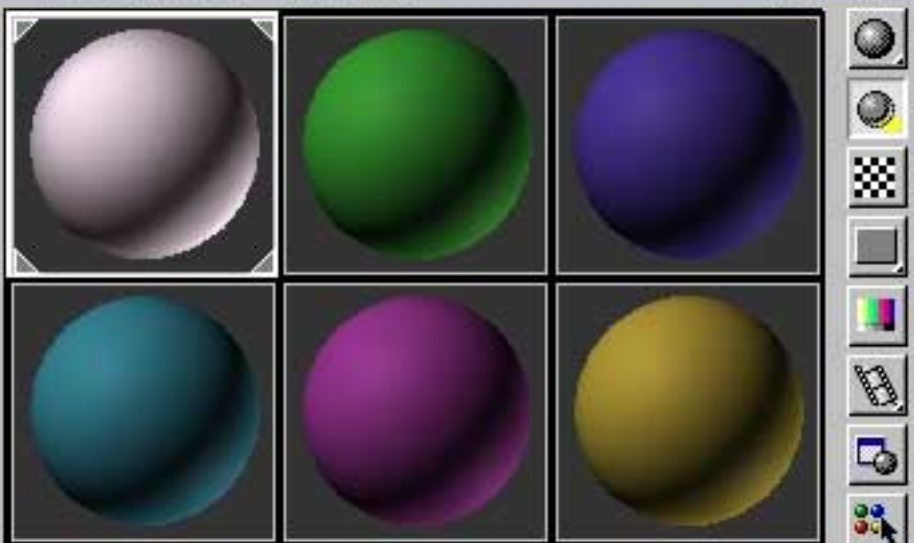


+ Extended Parameters

+ Maps

+ Dynamics Properties





Reflection:  Map #2 Type: Raytrace

Raytracer Parameters

Trace Mode

☒ Auto Detect  
☐ Reflection  
☐ Refraction

Options...  
Global Parameters...  
Global Exclude...  
Local Exclude...

Background

☒ Use Environment Settings  
☐  ☐ None

- + Antialiasing
- + Attenuation
- + Basic Material Extensions
- + Refractive Material Extensions

Global Raytracer Settings

Ray Depth Control

Maximum Depth: 3

Color to use at Max. Depth  
☐ Specify:   
☒ Background

Adaptive Antialiasing

☐ Adaptive

Initial Rays: 4  
Threshold: 0.1  
Blur Offset: 0.0  
Blur Aspect: 1.0

Max. Rays: 32  
Defocusing: 0.0  
Defocus Aspect: 1.0

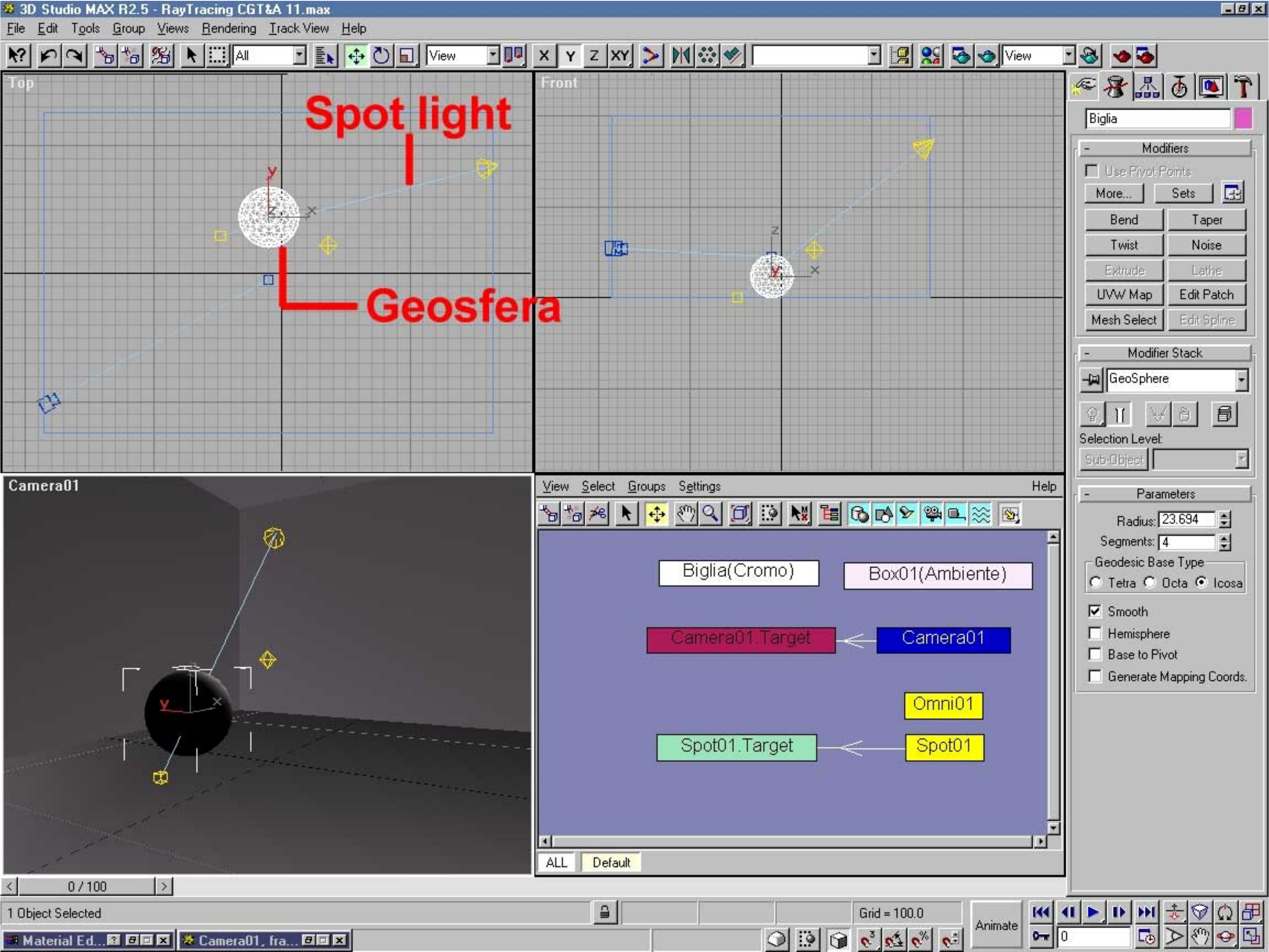
☐ Manual Acceleration

☒ Single Pipe (Typical Scenes)  
☒ Bounds Checking  
Balance: 2.0  
Max. Depth: 4  
Face Limit: 30  
Max. Divisions: 15

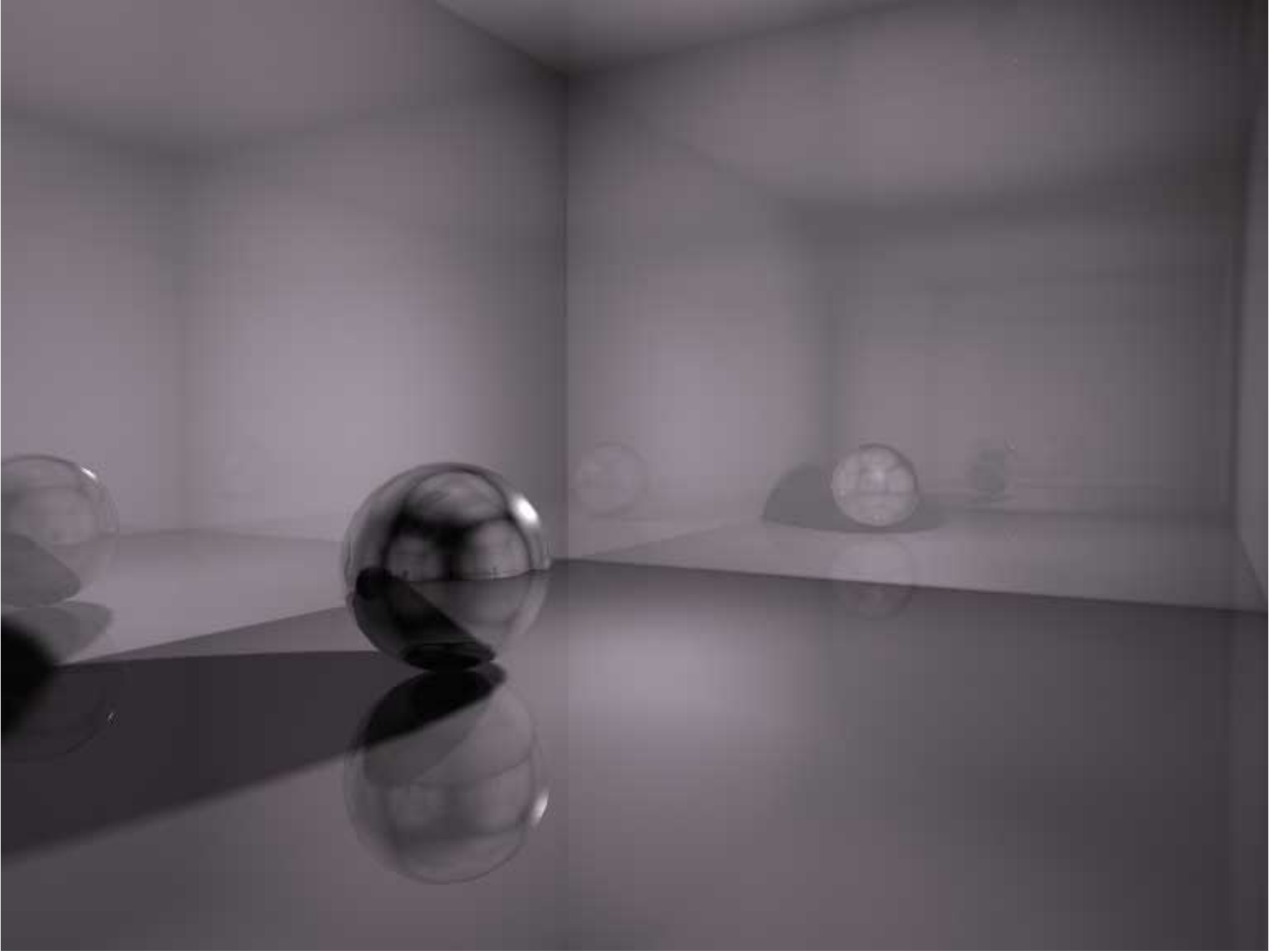
☐ Dual Pipe (Complex Scenes)  
Scene Voxel Tree  
Balance: 2.0  
Max. Depth: 4  
Max. Divisions: 15

☒ Object Voxel Trees  
Balance: 1.5  
Max. Depth: 4  
Max. Divisions: 15

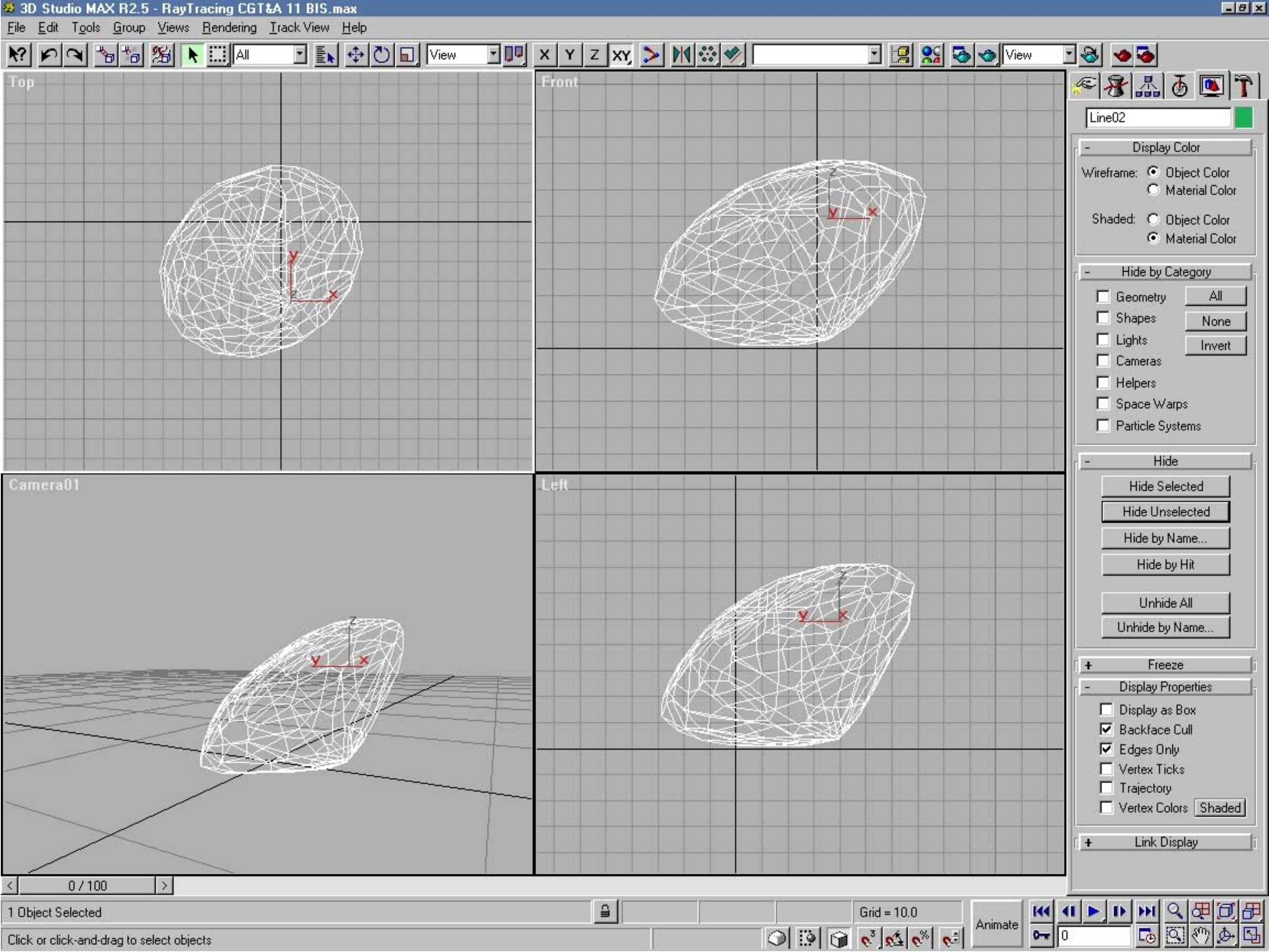
Close Reset

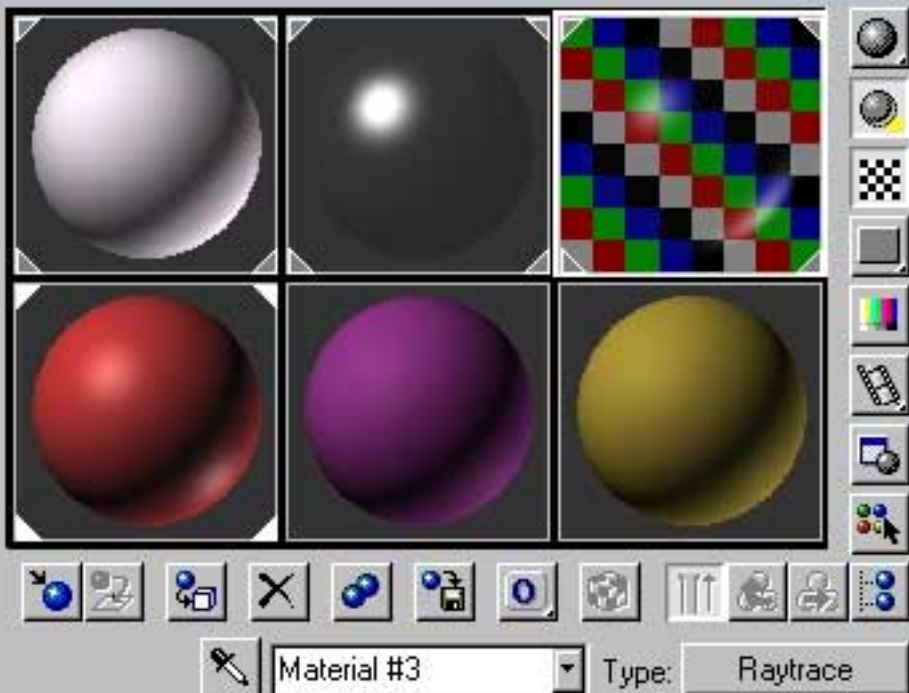












Basic Parameters

Shading: Phong

☒ 2-Sided
 ☐ Face Map

☐ Wire
 ☐ SuperSample

Ambient:

Luminosity:

Diffuse:

Transparency:

Reflect:

Index of Refr: 1.59

Specular Highlight

Specular Color:

Shininess: 38

Shininess Strength: 50

Soften: 0.1

☐ Environment..... None
 ☐ Bump..... 30 None

Extended Parameters

Raytracer Controls

