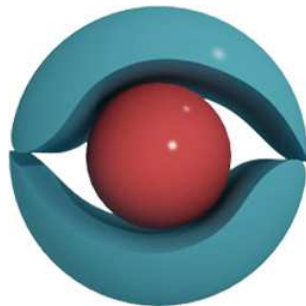


AR-media™

TUTORIALS
“OCCLUDERS”

(May, 2011)



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TUTORIAL - "OCCLUDERS"

INTRODUCTION

Occluders are a special kind of virtual objects that are not displayed during the simulation, but that can hide any other virtual object. Usually you use occluders when you want to use real objects (found in the environment where the augmented reality experience takes place) to hide your 3D models. This process involves the accurate modeling of the real object and then the designation of that object in order to make it an occluder.

EXAMPLE 'VIRTUAL HOLE'

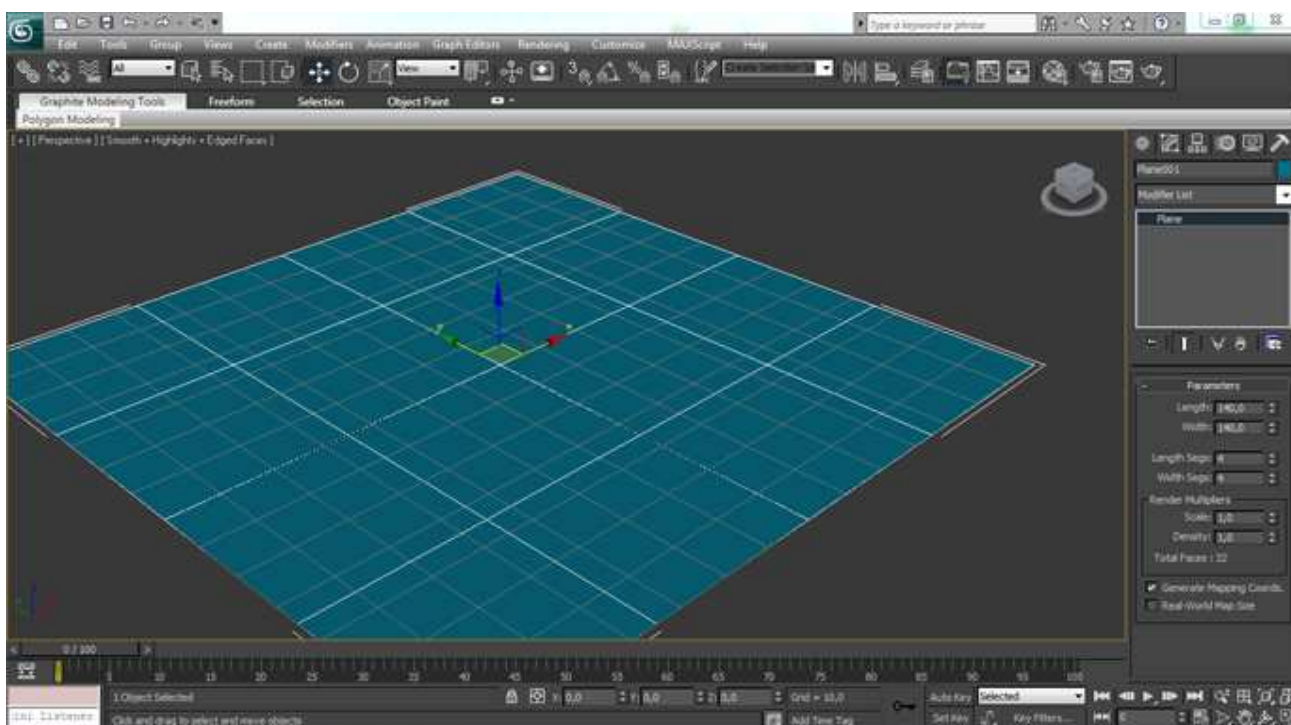
One not trivial but very interesting usage of occluders is the creation of 'virtual holes'. This tutorial will teach you how to create the 'virtual hole' effect, for example you can create the illusion of objects coming out from a hole that could be placed on a table or on a marker. An example of a virtual hole is shown in the following figure.



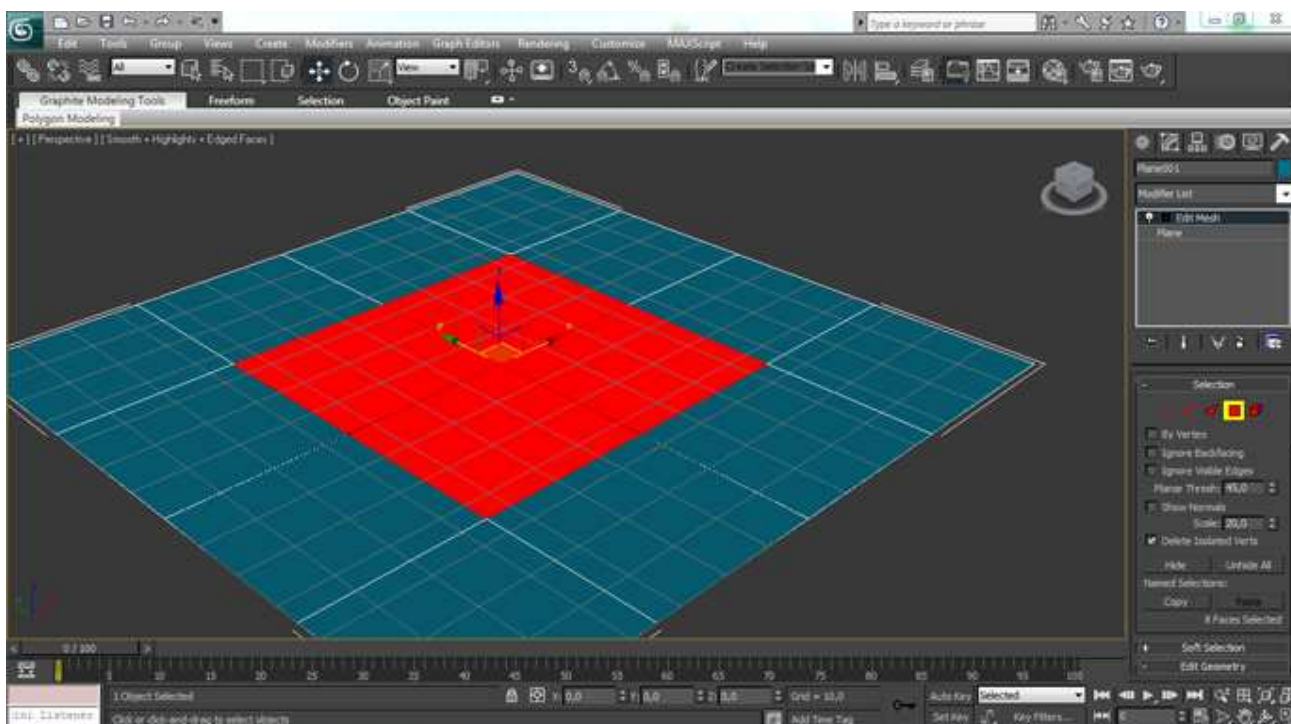
Step 1: modeling

First of all create the hole itself and then the models you'd like to animate as coming out from the hole. For this tutorial we'll create a simple ball that will come out of a square shaped hole. The hole will be hidden by the maker that will open at the beginning of the animation revealing the hole's interiors and the ball will start to move out. Once the ball is out of the hole, it will fall down inside the hole and marker will close.

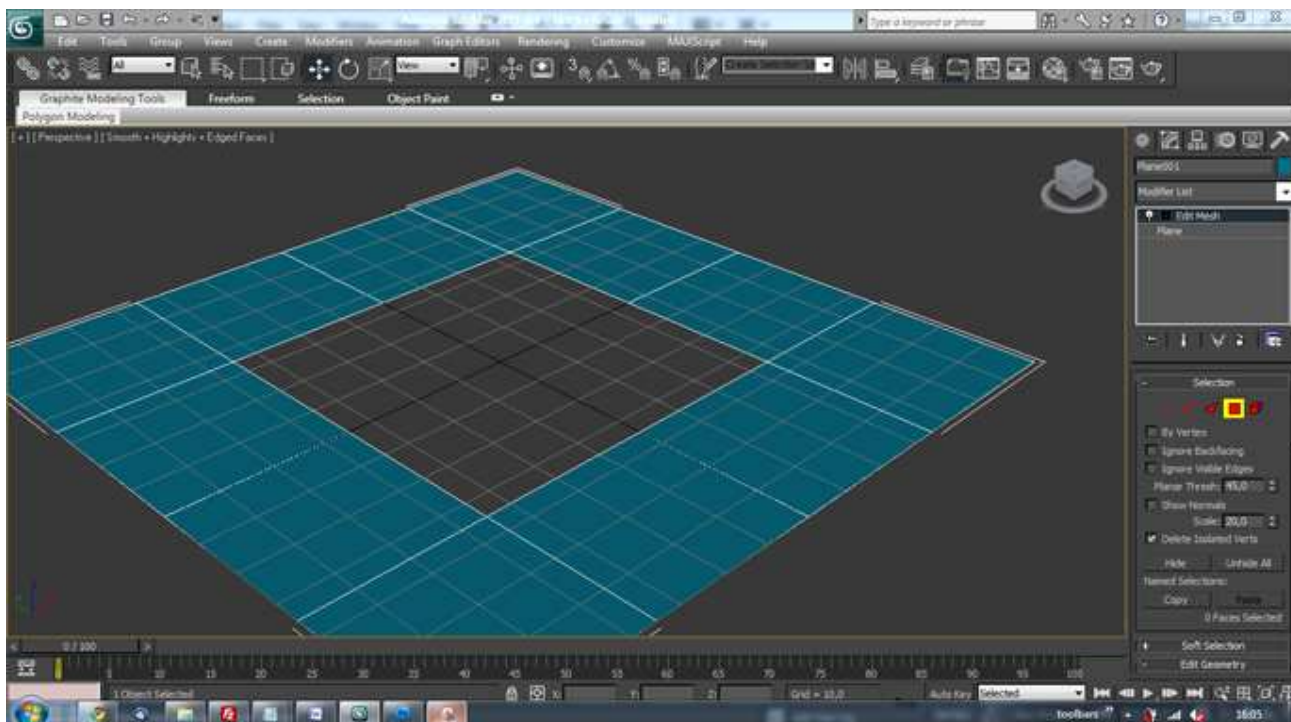
Creating the ground: create a **plane** with each side 140 units long. Center the plane at the origin (0,0,0) and be sure to have at least 4 segments for each side



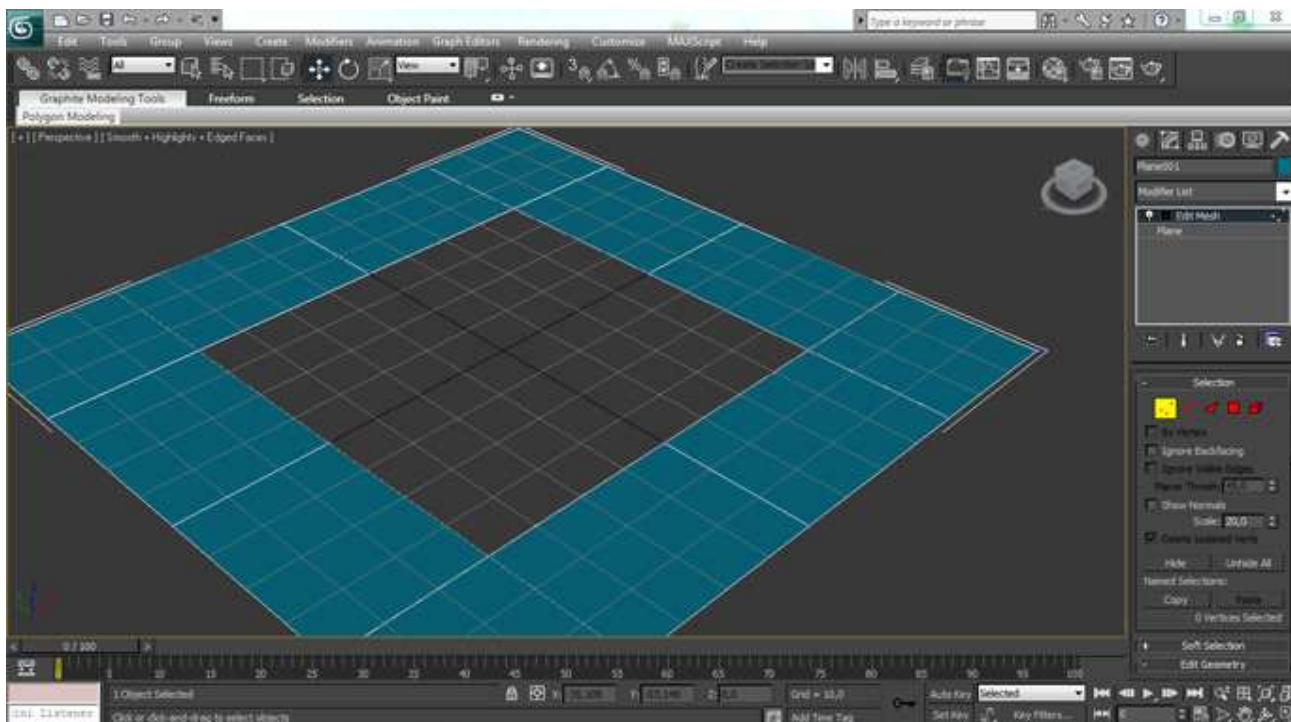
add an **Edit Mesh** modifier, select the four central polygons



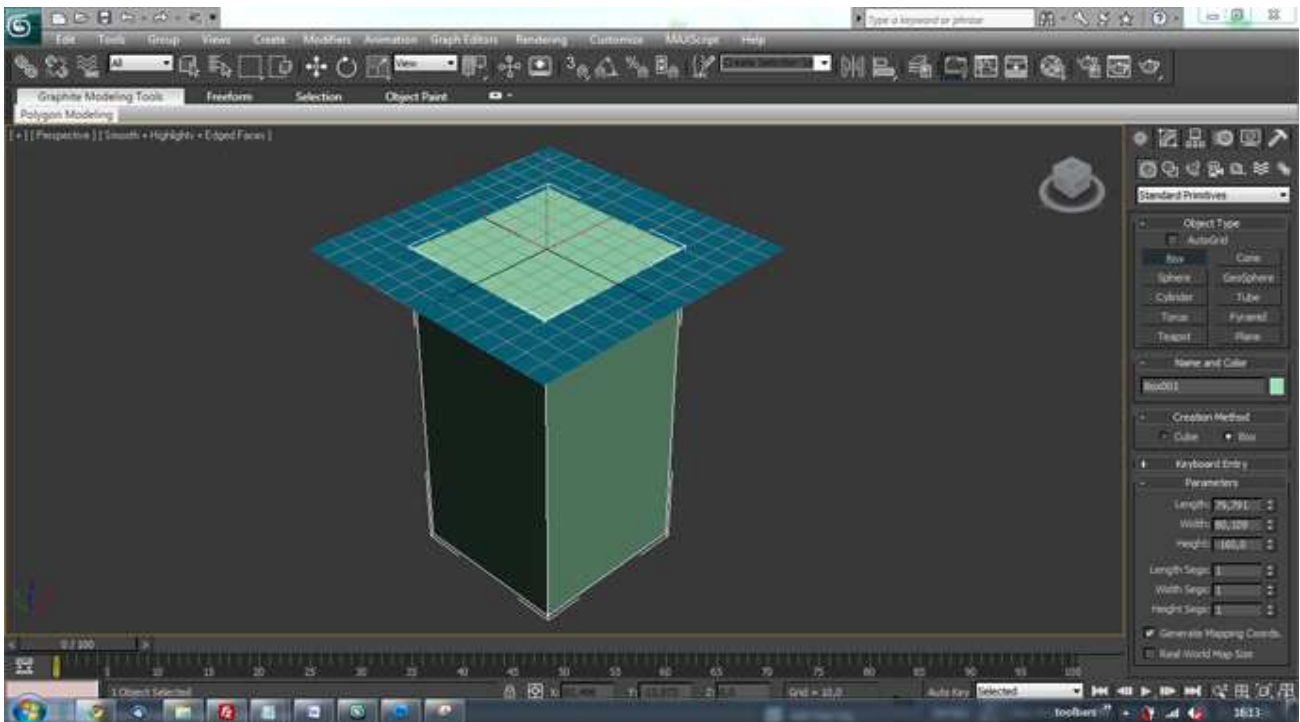
and delete them



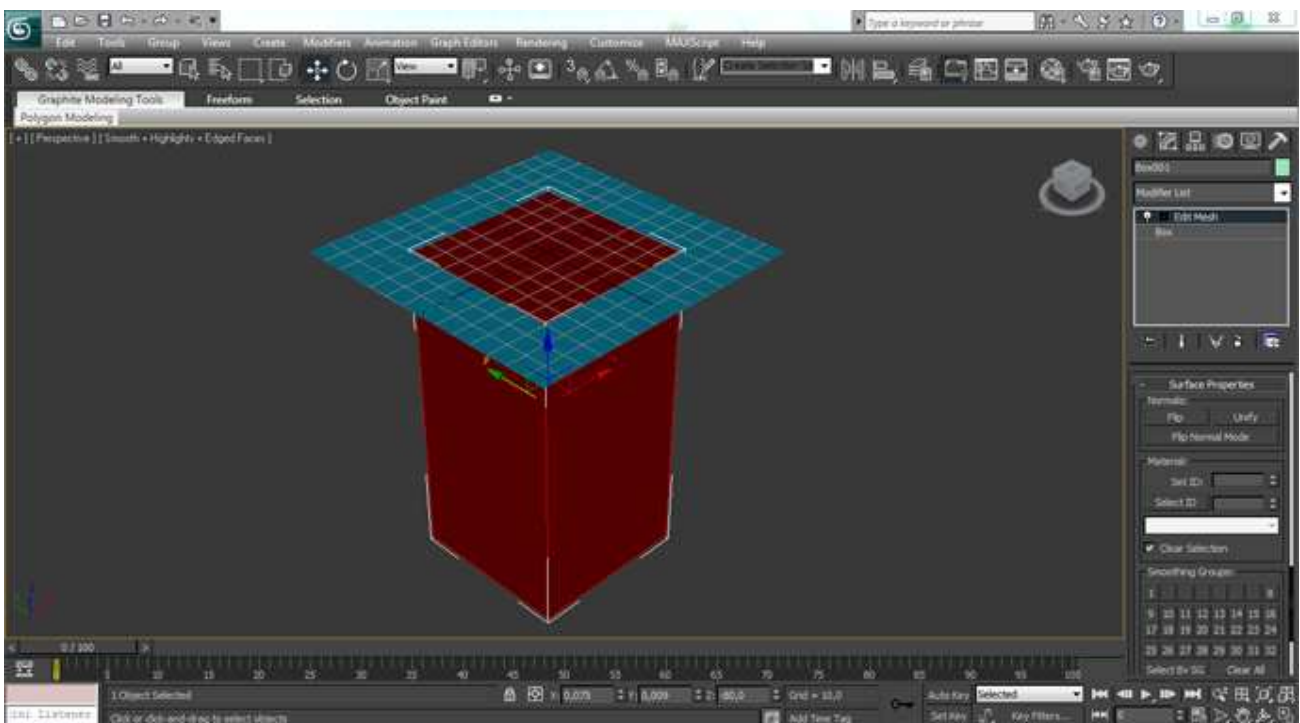
adjust the hole so that each internal side is almost 80 units long



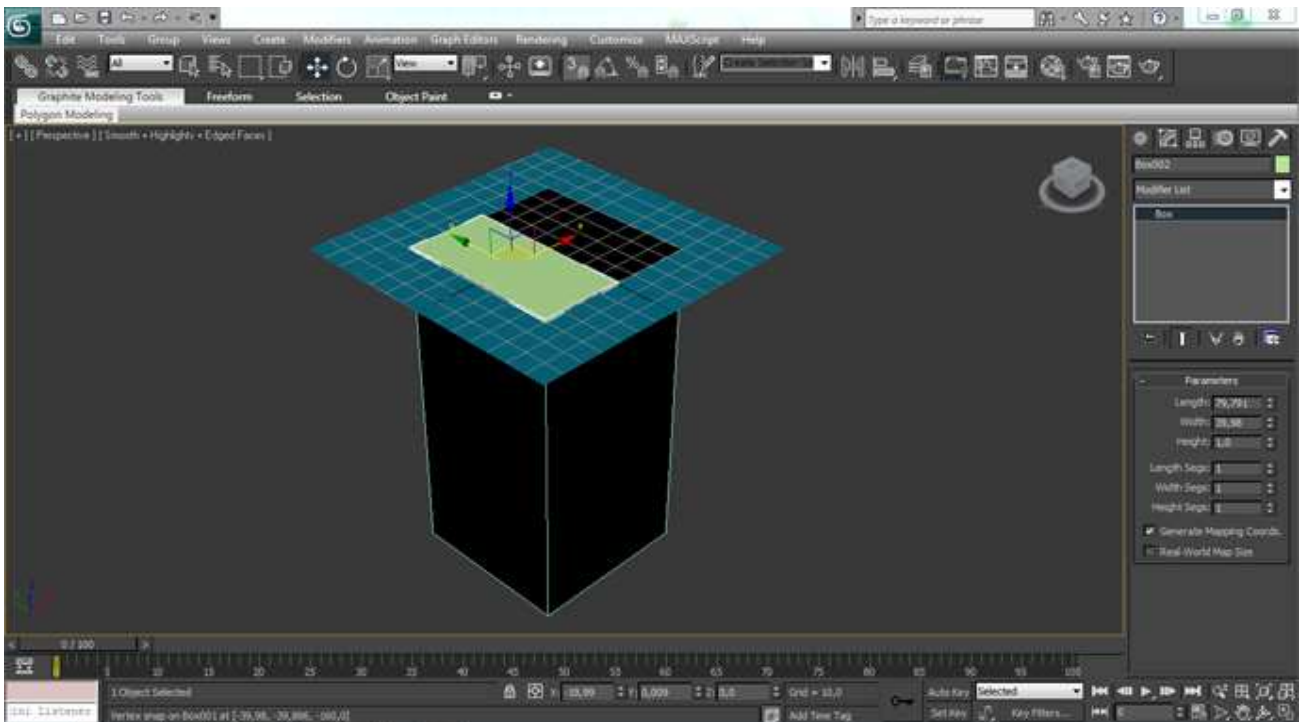
Creating the hole interiors: create a **box** that fit the hole's interior sides and goes below the plane just created



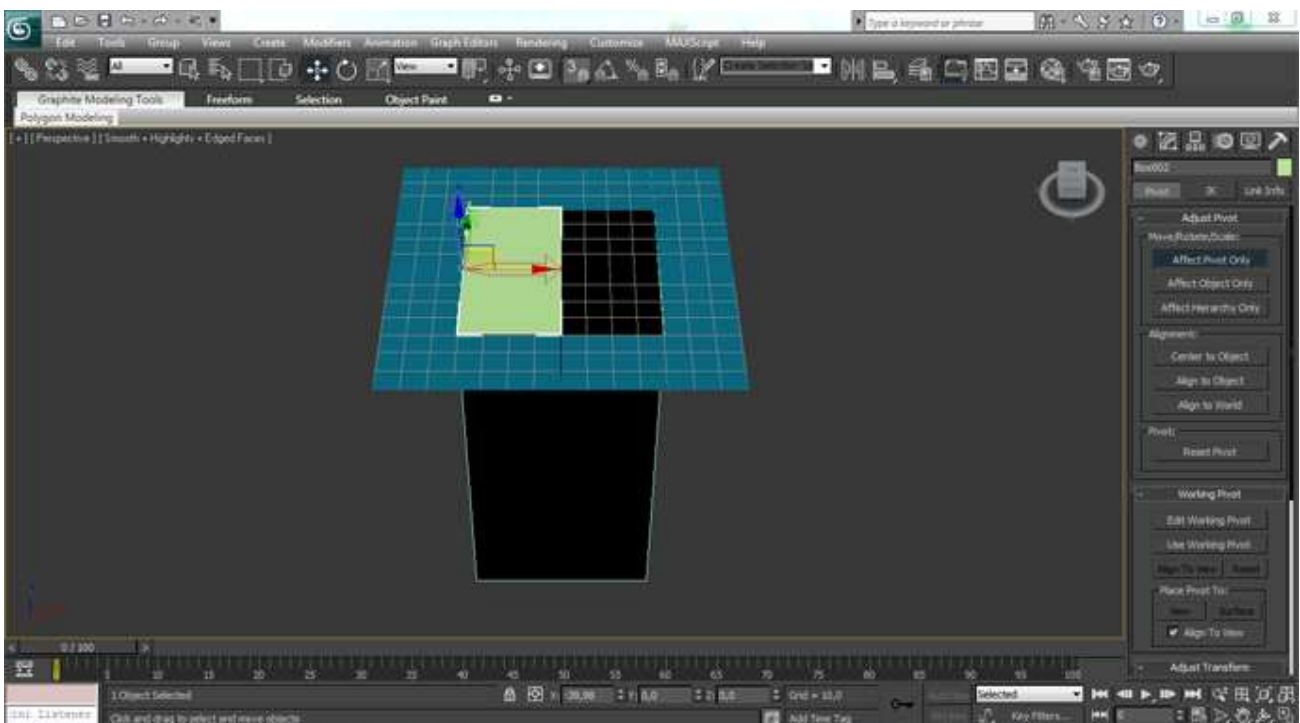
add an **Edit Mesh** modifier to the box, select every polygon and **flip normals** (this will make the hole interiors visible); select the top polygon (the one that occupies the hole's entrance) and delete it



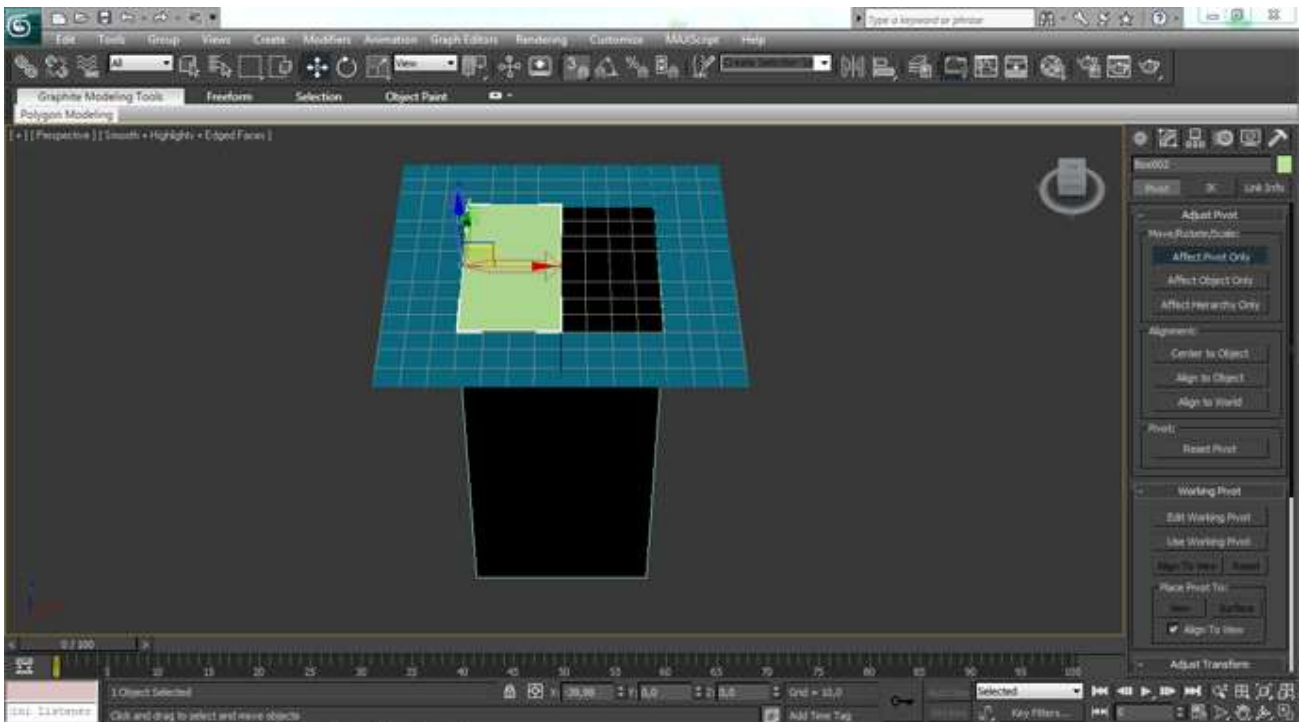
Create the hole's door: create a **box** whose size is almost half the hole interior side (width: 40 length: 80 height: 1) and place it as shown below



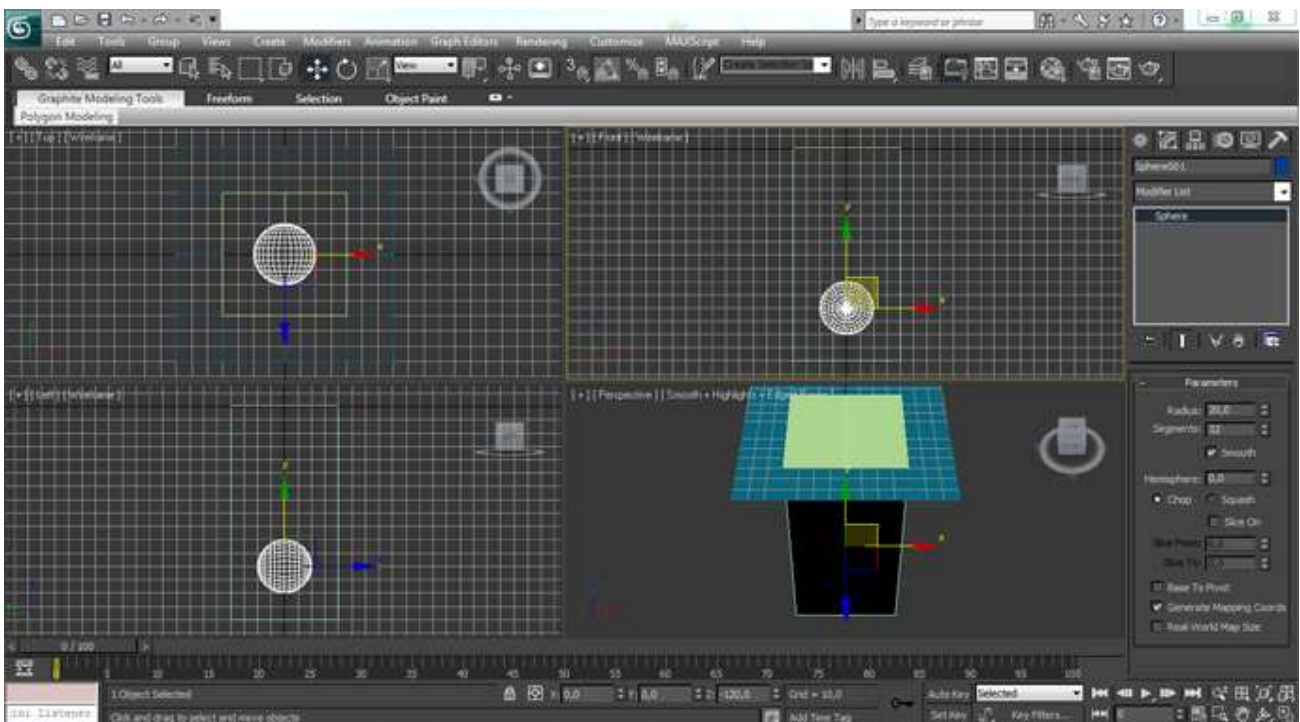
move the **pivot** of the box so that its origin is placed exactly on the hole interior side (*Hierarchy -> Affect Pivot Only* and move tool)



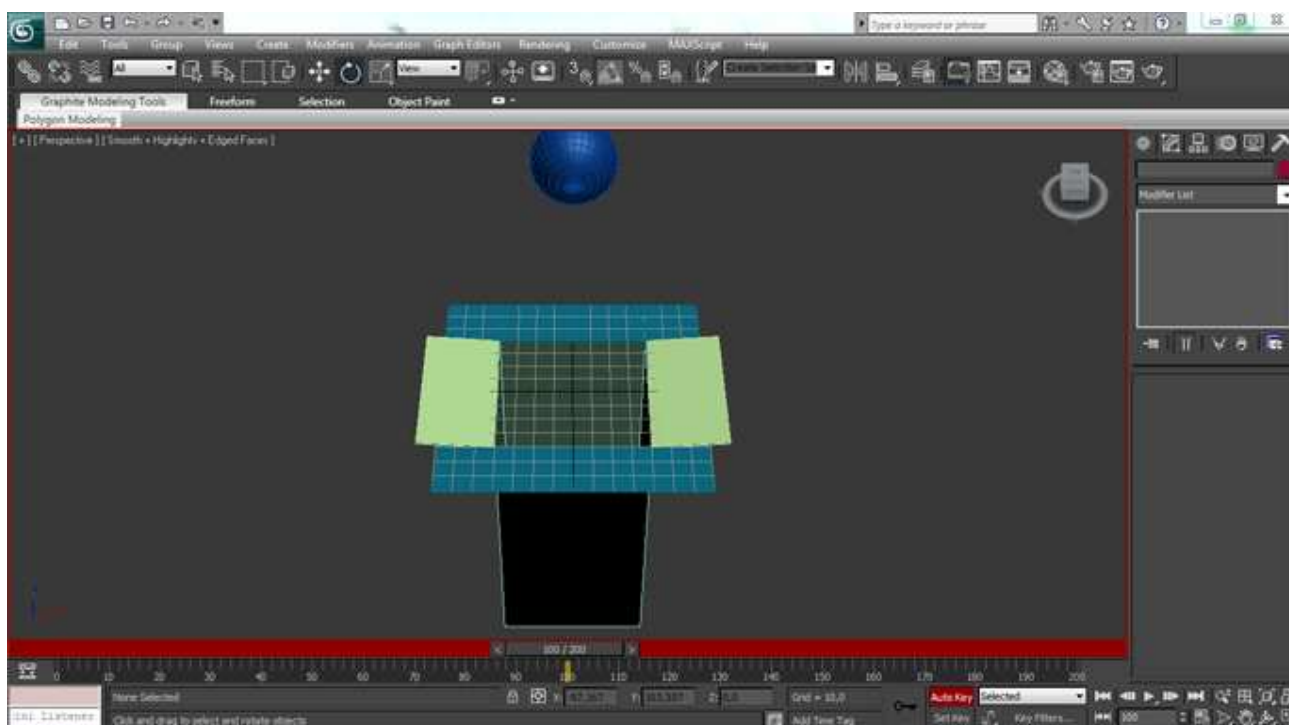
create a new **box** like the previous one, move it to the opposite hole interior side and rotate it by 180 degrees



Create the ball: create a **sphere** (radius: 20) and place it the hole (almost at 0, 0, -120)



Animating the scene: set the **End time** for the animation to 200 and turn **Auto Key** on; to animate the ball go to frame 100 and move the sphere to (0, 0, 150); go to frame 200 and move the sphere to (0, 0, -120), i.e. to the original position; to animate the hole's door go to frame 30, select each of the door's sides in turn and rotate them by 90 degrees outward; go to frame 50 and rotate again each of the door's side by 85 degrees so that the door is almost fully open



now keep setting up the animation so that each object goes back to its original position (you can select and copy symmetrically each keyframe before key 100 for the door's boxes); turn **Auto Key** off and go to frame 0 (you can eventually improve the animation as you wish).

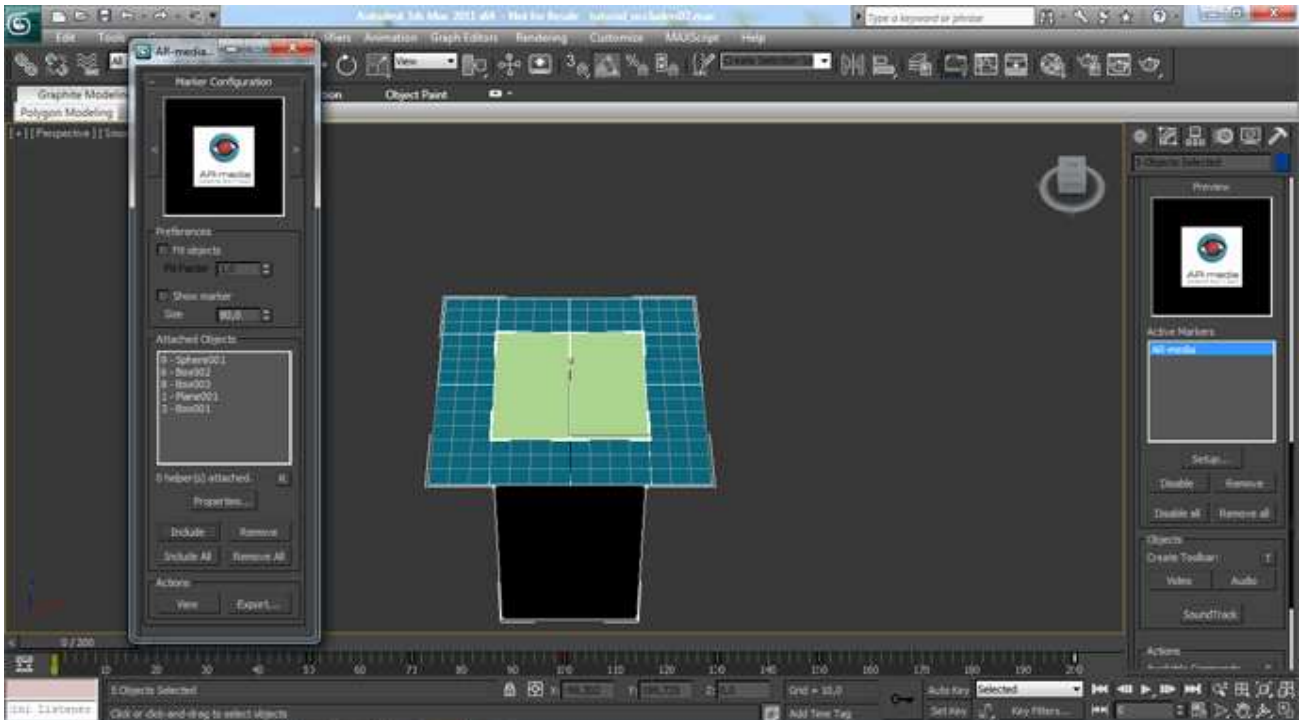
Step 2: marker's setup

Open the Plugin interface (*Utilities tab -> MAXScript rollout -> AR-Media™ Plugin* from the dropdown list); choose the **AR-Media marker** from the library and click the **Add** button; scroll down to the **Active Markers** list and, with the chosen marker selected, click the **Setup...** button; the marker setup window will appear, click the **Show marker** option (if everything is fine with your scene, then the marker should be place exactly where the hole is, you may need to move to a different key to let the hole's door reveal the marker) - the marker object is just a placeholder that won't be displayed during the simulation, anyway, once you have assured that it is exactly where the hole is, you can hide it again by un-checking the **Show marker** option. Select all visible objects created so far; in the marker setup window click the **Include** button (even though you're adding every object the marker you cannot use the **Include All** button because you'll need to treat some of the objects separately from each other); the list of **Attached Objects** will be populated by the objects you've selected; click the **View** button to preview the scene.

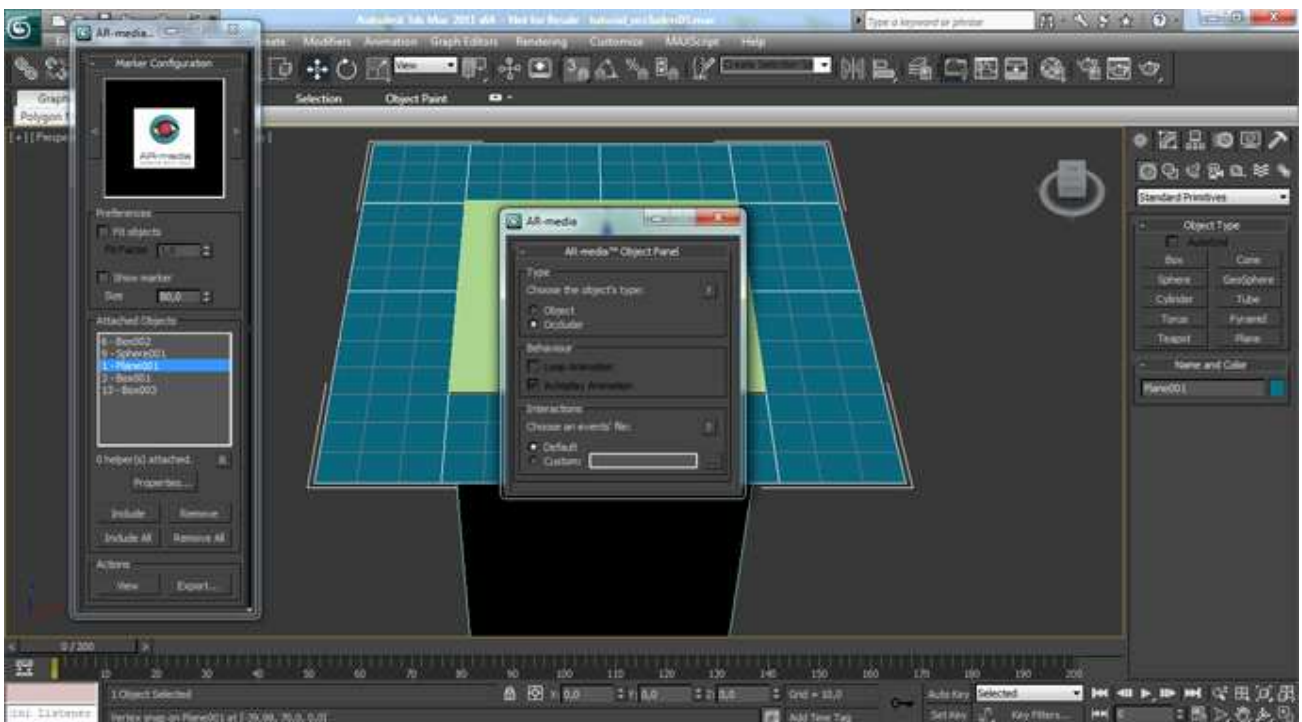
As you'll notice the result is not what you may want: the ground plane is still visible and if you look at the scene from an angle you'll see the hole interior even if the door is closed. Next step will fix the problem.

Step 3: choosing the occluder

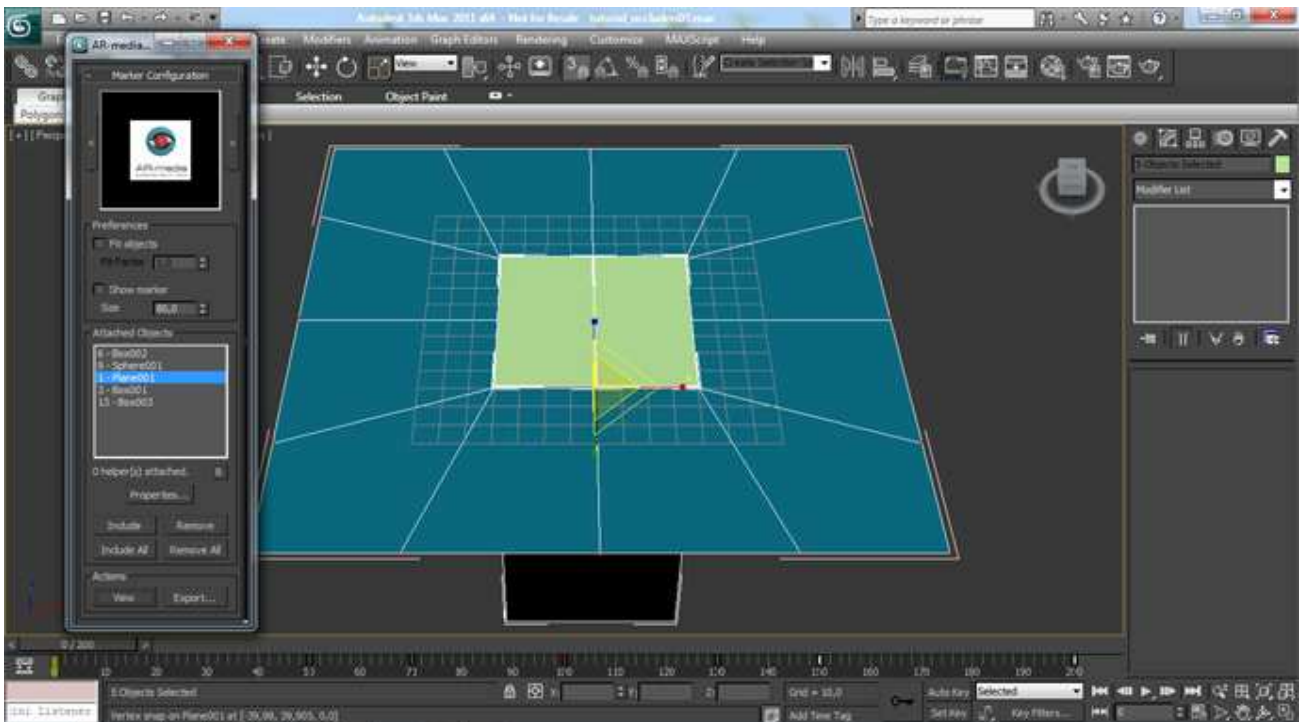
In the marker setup window go to the **Attached Objects** list, select the ground **plane** and click the **Properties...** button



in the window that will open, click the **Occluder** option and close the window



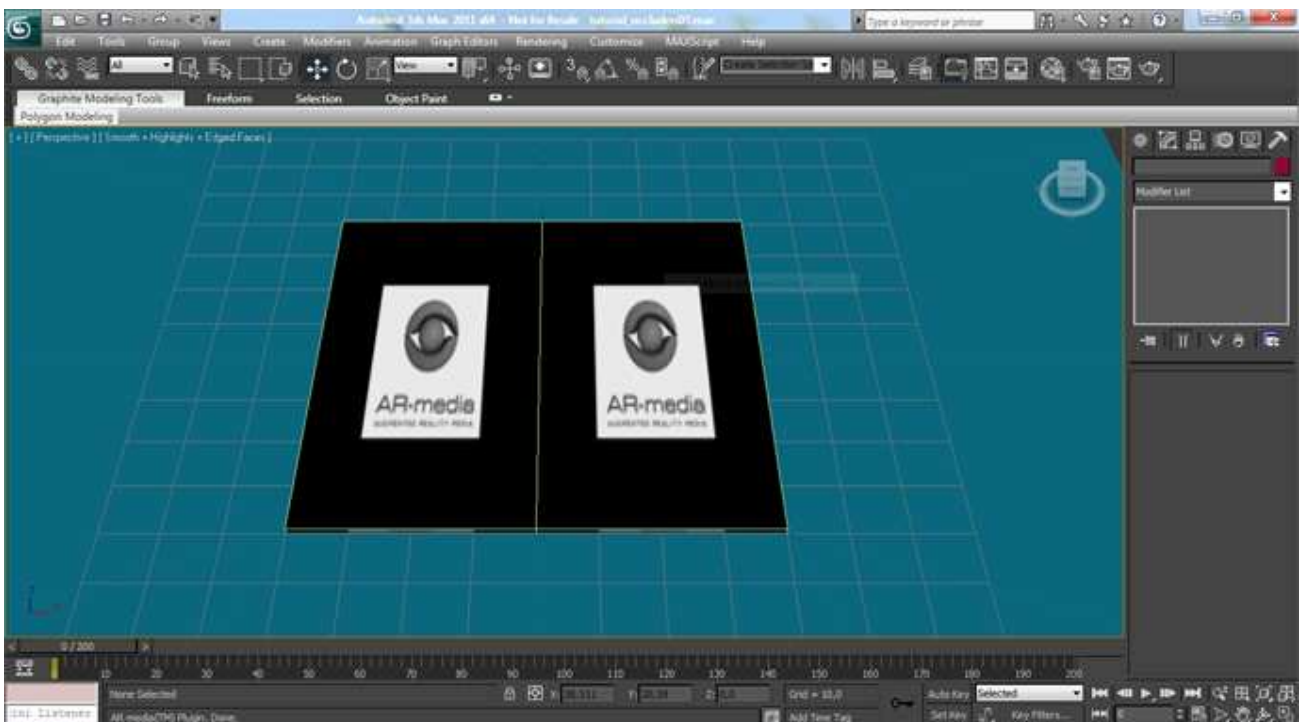
with the ground **plane** selected, go to the modify panel and scale up (175%) the outer vertices



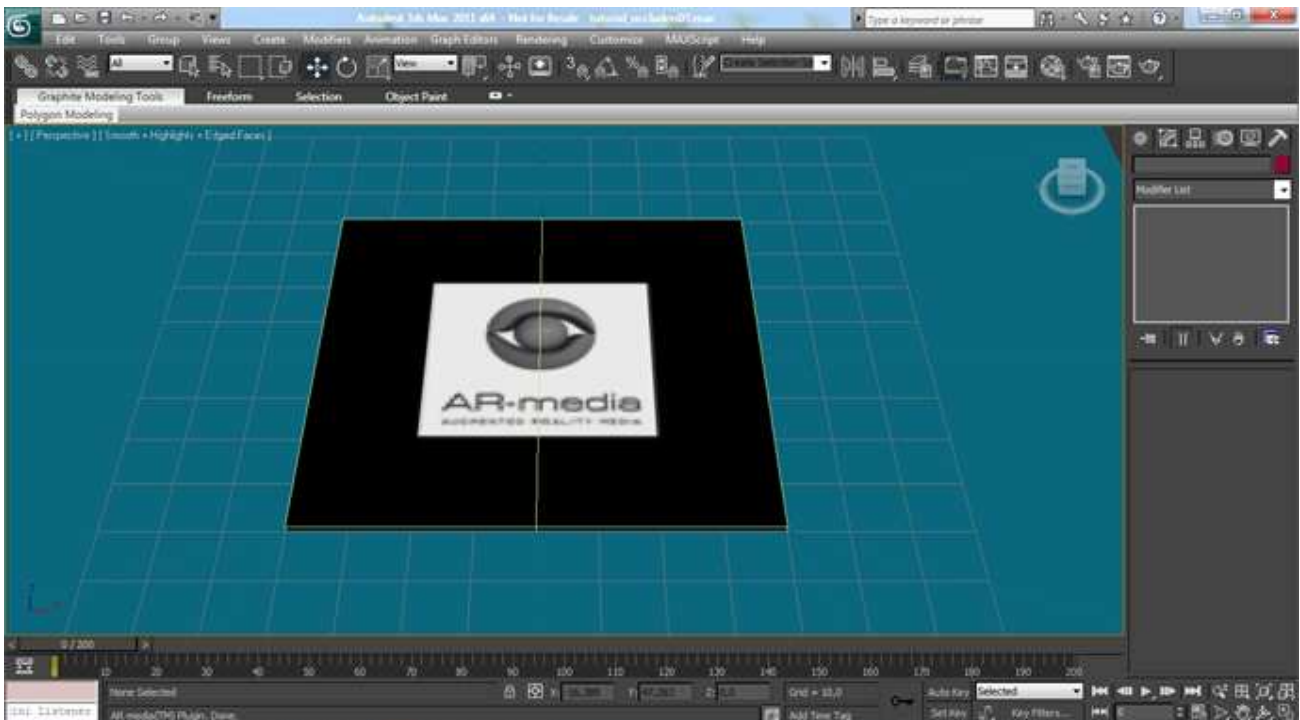
click the **View** button again. Now the ground plane should behave as expected and you should see the hole interiors only through the entrance when the door is open.

Step 4: going further:

To improve the final result you could add the marker's image as texture for the hole door, in order to do so create a new material and set the armedia_marker.jpg file as diffuse map; click the **Show Standard Map in Viewport** so that you'll be able to see the map in the 3D editor; select each of the door's boxes and assign the material to both: you should see the marker's image mapped on both boxes:

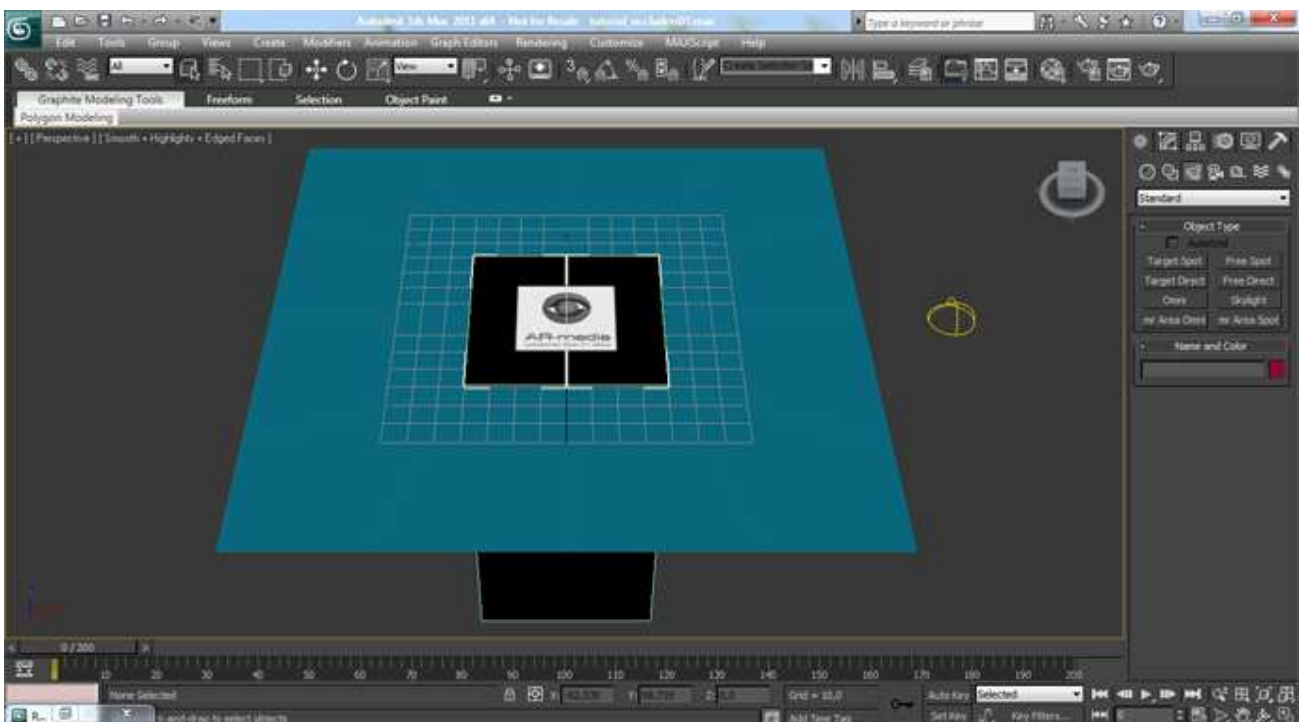


but you need to fix the mapping in order to have half image on one box and the other half on the other box: for each box add a UVW Mapping modifier, in the modifier parameters rollout change the Width parameter to 80 and finally move the mapping gizmo so that the marker's texture is correctly aligned to the door

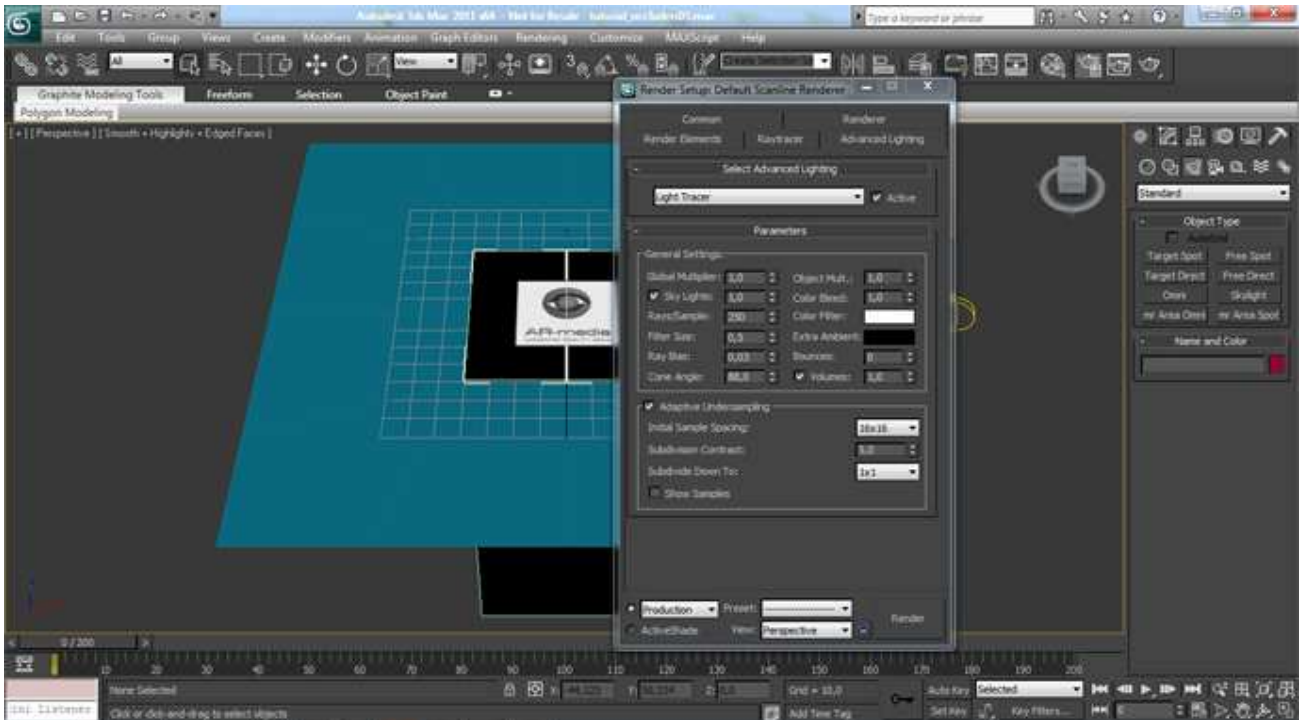


try to view the scene again: now you should see the marker that opens and reveals the hole while the ball comes out of it.

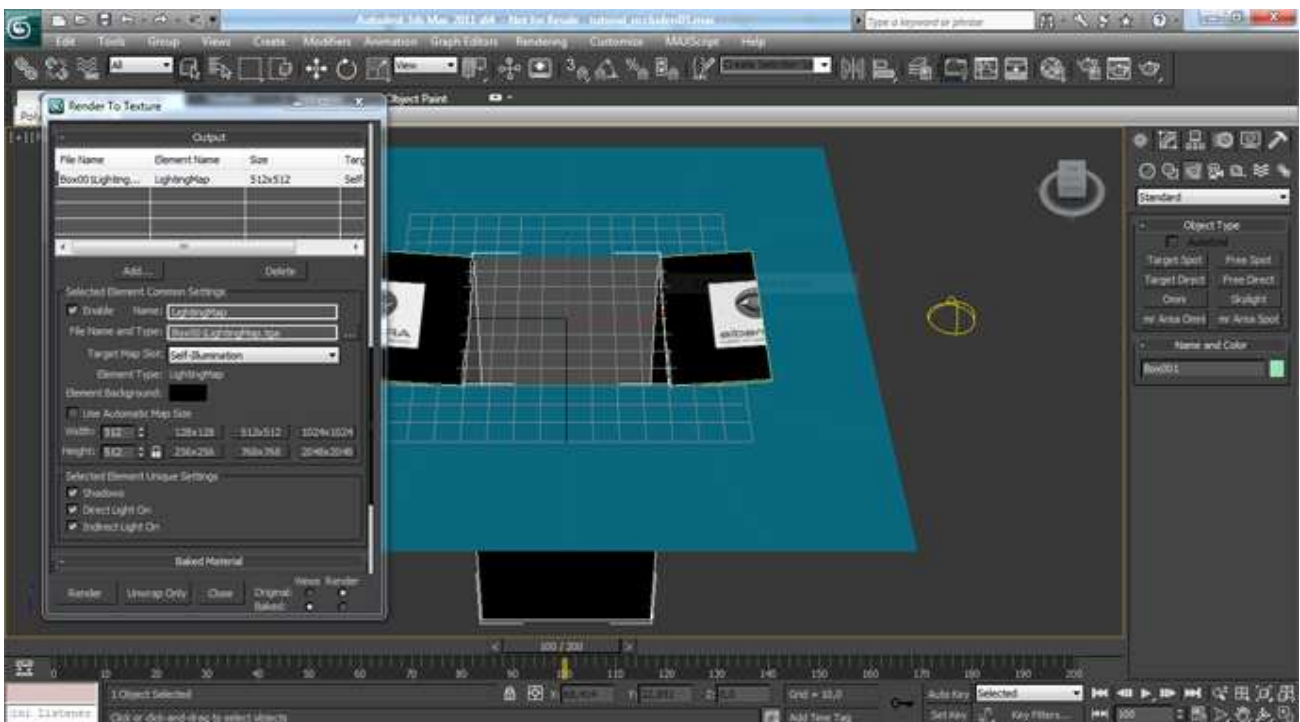
Improving lighting: add a **Skylight** to the scene (*Create panel -> Lights tab, select Standard from the dropdown list and click Skylight*), place the light anywhere near the ground plane



open the Render Setup window, click the Advanced Lighting tab and in Select Advanced Lighting rollout, select Light Tracer from the dropdown list (be sure that the option 'Active' on the right is on)



now you're going to *fake lighting* for the hole interior and in order to do so, you'll use the **Render to Texture** command (RTT); RTT operates on the current frame, so in order to have a nice looking effect you need to do RTT when the door is totally open otherwise you'll get a black hole (that is not what you want), so go to frame 100 (where the hole door is spread and light can enter the most); click the **Render To Texture** item in the **Rendering** menu; once the **Render To Texture** window opens, click the hole interior box (it will be added to the list of objects to use)



scroll down to the **Output** rollout, click the **Add...** button and select **LightingMap** from the window that will appear; be sure that the **Target Map Slot** contains **Self-Illumination**; choose a size for the lighting map (try 512x512) and leave any other parameter as it is (if you have already used RTT previously you may have different settings that should be changed to the defaults value in order to have everything work fine); click the **Render** button to start the operation (lighting information will be stored into a texture and a **Shell Material** will be created and assigned to the selected object); you can now close the **Render To Texture** window, and preview the simulation again: the hole interior should look much better now.

Conclusion

This technique is quite general: you can change the shape of the hole opening as well as the inside volume of the hole. You can also make the ground plane (i.e. the occluder) not a plane at all, what is important is that you have an accurate model of a real object (planar or not) that is occluding the virtual hole. Other improvements can be related to lighting and shading and of course you can also try different kind of animations as well.