TUTORIALS
“LINKED MARKERS”
(November, 2011)
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INTRODUCTION

ARPlugin offers the possibility to link two or more markers together in order to “share” a single 3D object over them. This feature permits you to create 3D scenes which spans over different markers, allowing you to create more immersive AR environments and models.

IMPORTANT: linked markers must be treated and used as a big, single marker. In fact, once two or more markers are linked together, you must carefully place them in the 3D space and then using them as a single unit during the AR visualization. Moving a linked marker separately from others will surely cause visualization problems.

EXAMPLE ‘AR World’

This tutorial will show you how to create an earth model and visualize it entirely (from any direction, even from below) by using the Linked Markers feature. The final result of the tutorial is showed below.

Step 1: modeling the earth

For this tutorial, we simply create a sphere object and then applied an earth’s texture to it. Once modeled, we obtained something like the following:
Step 2: Setting up the marker, first try

Now that we have the 3D scene correctly setup, we can go on by configuring the scene for Augmented Reality by choosing the marker we want to use and by setting its properties as well. Click the button in the main AR-media™ Toolbar to access the plugin interface. Select the first marker from the library and click the Use button.

The selected marker will be added to the Active Markers list; once the marker is added to the Active Markers list you can configure it by clicking the Setup... button, the marker’s setup window will popup
In the **Marker Configuration** rollout, click on the **Include All** button and adjust the size of the marker in order to obtain the desired proportions (you can see a preview in the viewports). When you completed the marker configuration, just click on the **View** button to see the scene in Augmented Reality.

In this configuration, you'll notice that you are not able to completely see the entire earth model: for example, if you try to look at the South Pole, you should have to “lever” the marker, thus making it unrecognizable to the camera.

The following steps will show you how to create linked markers, so you will be able to look at the earth model from every perspective you want.

**Step 3: Linking other markers**

Since we already have one marker added to the scene, we just have to choose other 5 markers from the library. Once you added the markers, you will notice that each one of it is positioned at the center of the scene.
The first thing to do is move each one of the marker away from the center of the scene, so they will not overlap when we will link them together.

Once we moved all the markers, we must link all of them together: open one of the Marker configuration panel, click on the Linked markers... button and the Linked Markers Panel will appear:

You can see from the title of the panel that we clicked on the Linked Markers... button of the “AR-media” marker configuration panel. The “Not linked” list will show all the markers which are not linked to this. By selecting a marker in this list and then pressing the << button, we can link two markers together. Since we want to link all the markers together, we will need to select each marker in the “Not linked” list and add it to the “Linked” list. At the end of this process we will obtain a configuration similar to the one in the figure below.
Note the “Currently linked” list that is now filled with all the markers and the now highlighted **Linked markers**... button which denotes that the “AR-media” marker is linked to other markers.

Moreover, you can see from the 3ds Max® viewport that all the markers are visible: in this way, we can freely rotate and move the markers to arrange them in the desired way.

**Step 4: Creating the “Markers’ Cube”**

Our main goal for this step is to create a “markers’ cube”; in other words, a 3D cube with each face containing a marker. This step only involves using the standard **Move** and **Rotate** 3ds Max® tools on all the markers.

**IMPORTANT:** do NOT use the **Scale** tool to adapt the markers’ size, use the **Size** textbox in the **Marker Configuration** panel instead.

Before starting to arrange the markers, we must first decide the size of them: in fact, once the cube has been created it will be difficult to change its size.

Let’s say that for our demonstration scope, a value of ¼ of the earth’s diameter is good.

So, first of all, create a cube in 3ds Max® of the chosen size. We are going to use this cube as a “support” object to help us creating the markers’ cube. In fact, we cannot create a cube from the markers’ planes because they simply will not be recognized during the AR visualization. Remember that there must always be some space between each marker.

In the following figures you can see an INCORRECTLY built markers’ cube on the left and then a working markers’ cube.
Once you created the “support” cube, you must set each marker’s size to a value that must be smaller than the cube’s one. For example, if you choose a cube’ size of 300 units, a good marker’ size will be 200. In mathematical form, a good choice for this value is

\[ Size \ of \ the \ marker = W \times \frac{2}{3}, \ W = width \ of \ the \ cube \]

Now, move each marker to a different face of the “support” cube and place it at the exact center. Once you placed all markers, you can safely delete the “support” cube.

With a bit of effort we have been able to create this cube, so we will obtain a scene similar to the one depicted in the following figure.
Step 5: Attaching the objects to the linked markers

Now that we have completely set up the scene, the only thing we must do is attaching the 3D objects to the linked markers.

Open the Marker configuration panel of one of the markers, select the objects and click on the Include button. The objects will be attached to this marker and also to any other linked marker as well. In fact, if you open the other Marker configuration panels, you will see the same objects’ list.

Step 6: Preparing the “real” markers’ cube

Before we can see our model in Augmented Reality, we must first build our own markers’ cube. We can simply print each marker on a separate page, then cut the marker images and stick them together, or we can create a simple cube net with our favorite drawing tool and then build it.

The resulting cube net, reflecting the markers’ cube configuration used in this tutorial is shown below.

Now if we view our model in Augmented Reality, by rotating the cube, we can see the earth model from every perspective (see figures below for an example).
Note: since it is possible that the “real” markers’ cube has some irregularities (with respect to the modeled cube which is, of course, ideal), the camera tracking may appear unstable. To improve the tracking performances during the AR visualization, follow these steps:

1. Enter the Tracking Management Mode by pressing the F7 key
2. Press the Down arrow key several times to reduce the jittering

**Going further**

**Creating an AR walk:** another interesting application of linked markers is the creation of Augmented Reality walks, in which you can disseminate a real path with markers to create very immersive AR experiences.

**Creating an AR room:** this application of the linked markers’ technique permits to create a virtual room and then visualize it in the real space just by hanging the necessary markers on the walls, ceilings and floors. This technique can be really effective to display furniture or walls’ arrangements in newly created buildings.

**Conclusion**

This tutorial has shown you one of the simplest examples of a 3D scene involving linked markers as well as some other interesting and advanced employments of this kind of technique. We hope you will take advantage of this technique to realize more immersive solutions.