

3d modelling for Virtual Reality

Tutorial #1 – VRML room of primitives!

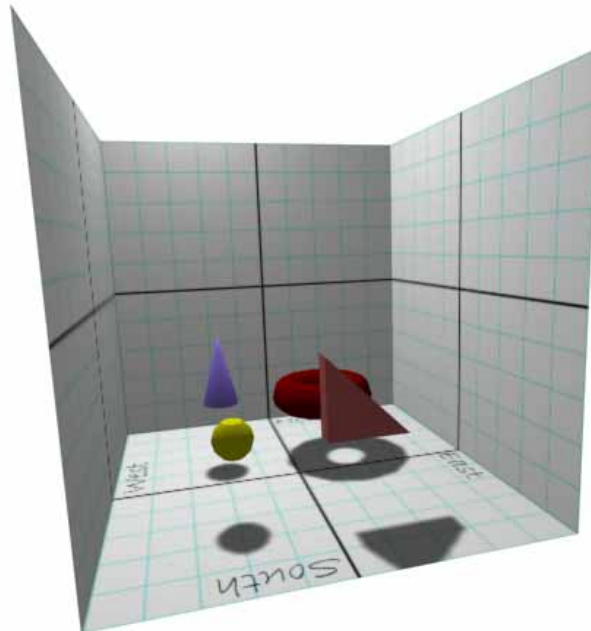


Contents

1	Introduction.	3
2	Prerequisites.	3
3	Creating the 3D model in AutoCAD.	4
3.1	Setting up the AutoCAD drawing file.	4
3.2	Layer set up.	4
3.3	Create the four walls and floor.	4
3.4	Create example objects in the room.	5
4	Importing the geometry to 3ds max.	6
4.1	Importing into 3ds max.	6
5	Developing the virtual reality model.	7
5.1	Counting the polygons.	7
5.1.1	3ds max utility to count polygons.	7
5.1.2	Cortona frame rate display.	7
5.2	Using the VRML97 Exporter.	7
5.3	Testing the VRML world.	8
5.4	Giving the world some viewpoints.	8
5.4.1	Creating an initial viewpoint.	8
5.4.2	Creating other viewpoints.	9
5.5	Giving the world some lights.	9
5.6	Giving the walls and floor a realistic appearance.	9
5.6	3ds max VRML 97 Helpers	10
5.6.1	Background.	11
5.6.2	NavInfo.	12
5.6.3	Anchor.	14
5.7	The other helpers and further work....	15

1 Introduction.

This tutorial will guide you through a method of creating a simple **virtual reality** model of a room, similar to the one shown here.



You will perform all of the initial 3D modelling using **AutoCAD**. You will import the AutoCAD model to **3ds max** and set it up for exporting as a virtual reality model in the form of a **VRML** file, (3ds max has better tools built in for setting up and creating the VRML world file than AutoCAD.)

You will view and interact with the VRML file (world, *.wrl) using a web browser.

When completed you will be able to freely navigate around and view the internal space. You will also be able to click on the objects in the room to access more information.

2 Prerequisites.

You need access to a PC with AutoCAD (could be Architectural Desk Top) by Autodesk, and 3ds max by Discreet. You will also need access to a web browser with a VRML client installed.

You must be able to use AutoCAD in 3D to create surfaces, solid primitives and be able to manage layers. Experience with 3ds max, creating lights and cameras would be an advantage.

3 Creating the 3D model in AutoCAD.



You may find to the right of some of the AutoCAD instructions given here a reminder of the command to enter on the **command line** to perform the instruction.

3.1 Setting up the AutoCAD drawing file.

You are going to model the walls and floor of a room measuring 10m x 10m x10m.

Create a new folder called **vr_room**.

Start AutoCAD and create a **new file** from the **acad.dwt** template.

Save as room.dwg in the vr_room folder.	saveas
Change units to meters.	units
Set limits to <0,0> <10,10>	limits
Set grid spacing to 1.	grid
Set snap to 1.	snap
Save.	save

3.2 Layer set up.

Create the following layers: la

Name of layer:	Colour:
floor	Your choice
wall1	Your choice
wall2	Your choice
wall3	Your choice
wall4	Your choice

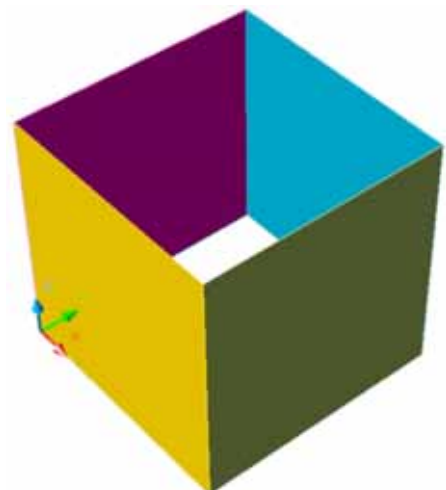
3.3 Create the four walls and floor.

Use any method you like to model the room shown below. Use surfaces rather than solids, such as you can with the **3dface** command.

Each wall should be 10m by 10m.

Assign each wall and the floor to it's own layer. Double clicking on each surface should bring up it's properties window, where you can change the layer it is on. Each surface should acquire the colour of the layer it ends up being on.

Save.



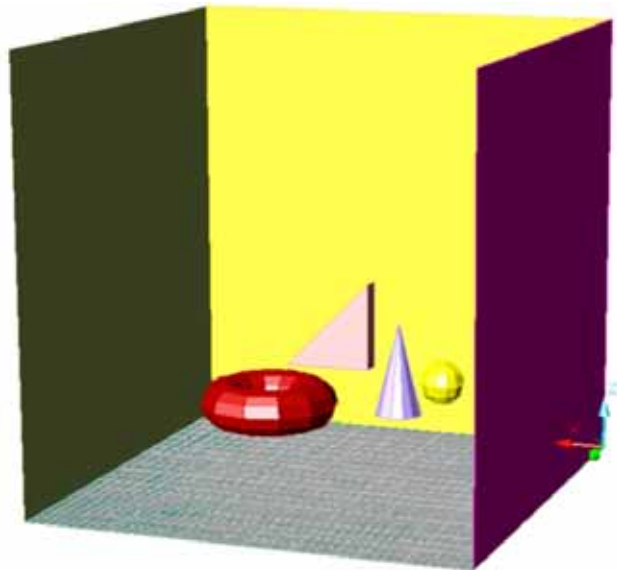
3.4 Create example objects in the room.

Create objects like the ones shown here (torus, cone, sphere and wedge). Place them 2m off the floor, (2m in the Z direction).

Create a new layer for each solid object, each with a different colour. Assign each object to its' respective layer.

Save.

You have now completed the basic modelling of the geometry of the room and contents.



4 Importing the geometry to 3ds max.

Now you will import the AutoCAD **room.dwg** file into **3ds max**. Remember, all of these files are being stored in the **vr_room** folder.

4.1 Importing into 3ds max.

Start 3ds max. (Under D for Discreet).

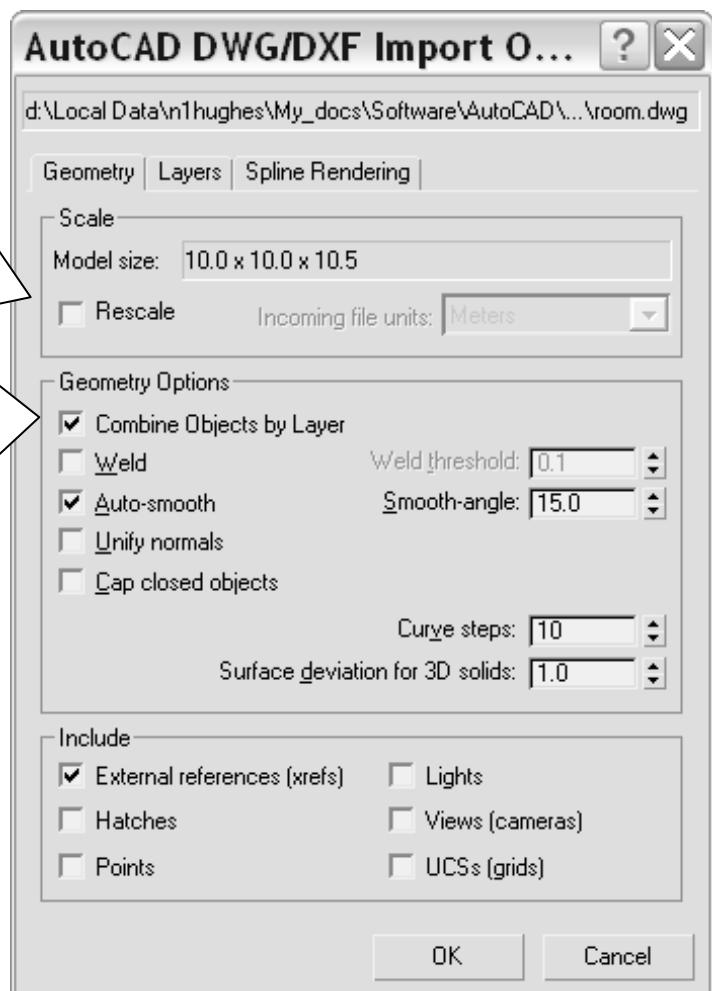
To import the **room.dwg** file:

File Import...

Browse to the **room.dwg** file and **Open** it.

In the **AutoCAD dwg/dxf import options** window ensure that **Rescale** option is **unselected**. This ensures that the room model remains 10 units X 10 units X 10 units.

Also ensure that **Combine Objects by Layer** is selected. This combines each layer in the AutoCAD model with a corresponding selectable object in 3ds max model.



OK the AutoCAD dwg/dxf import options.

Once the room has loaded save the model as a 3ds max file, **room.max**, from the File > Save pulldown menu.

5 Developing the virtual reality model.

Now the fun really starts. 3ds max will be used to create the VRML file, or world, of the room, **room.wrl**. This VRML file will be the primary element of the virtual reality model for this tutorial.

The VRML file will be viewable in a web browser with a VRML client (plug-in). To get started let's have a look at the VRML file exported from the raw imported AutoCAD file.

5.1 Counting the polygons.

One important factor in interactive media creation is how many frames per second (fps) the system can refresh the display when the user is navigating or interacting with it. Remember that a refresh/response rate of 10 fps is considered to be the lowest frame rate acceptable for interactive work. The number of surfaces in the model has a huge influence on this. The other major variable is of course the actual computer system being used which is possibly out of your control, so it is best to keep the model as simple as possible.

5.1.1 3ds max utility to count polygons.

There is a utility in 3ds max which enables you to count the number of polygons in your model. Check out the **More...** button under the **Utilities** tab, and select the **Polygon Counter**.

As a guide, you should aim at no more than 3000 polygons, certainly no more than 5000. This should be the first thing you check when you open up the model in 3ds max. You may need to go back to the CAD model and simplify the geometry, or perhaps delete some of those nice looking downloaded tree and car blocks!

5.1.2 Cortona frame rate display.

A useful feature of the Cortona VRML client is the frame rate counter. Right mouse button click in the display area and select:

Preferences

General tab, and set **Display Frame Rate** to **Frames per second**.

The **fps** value should appear in the bottom left corner of the browser window when viewing the VRML world..

5.2 Using the VRML97 Exporter.

Ensure that the room.max file is open. To create a VRML file or world from the 3ds max model simply export it as a **VRML97** file, from the pulldown menu:

File
Export...

In the **Select File to Export** window:

Save in: **vr_room**
File name: **room**
Files of type: **VRML97 (*.WRL)**

Click on **Save**.

In the resulting **VRML Exporter** window simply accept the default settings by clicking on **OK** and the file will be created and saved.

5.3 **Testing the VRML world.**

Open the **room.wrl** file just saved, using your web browser.

If you have not used it before, now is a good time to explore how to use the VRML client you have installed on your system. When the room.wrl world has loaded, experiment with the controls. Try to spin or slide the view. Can you move forwards and sideways? (VRML viewing plug-ins usually have a link on their control panel to some help documentation.)

Explore the contents of the world you have just created and ask yourself these questions:

What are your first impressions when the world first loads?

How easy is it to navigate around?

Does it give you the impression that you are 'immersed' in the world?

5.4 **Giving the world some viewpoints.**

When room.wrl loaded in the web browser, your initial view (viewpoint) was automatically set for you. You can define as many viewpoints (cameras) as you like in 3ds max and you can specify any one of them as an initial viewpoint on the VRML world when it loads. Cameras/viewpoints should be used as much as possible. If in doubt, create another camera. They provide very useful navigation aids in the VRML world.

5.4.1 **Creating an initial viewpoint.**

In 3ds max, create a target camera, 2m (units) from the floor, looking square on at a wall. Give the camera a name that relates to the name of the wall it faces, i.e.

Facing_wall1. Make sure that the camera is positioned inside the room.



For more guidance on creating cameras **check out the 3ds max help system**, particularly the tutorials.

Save the 3ds max file and export it as room.wrl. This time observe the **Initial View** field in the **VRML97 Exporter** window. Set it, using the pulldown, to the camera you have just created in the 3ds max file. Then click OK to save the VRML file.

Check how the world looks now using your web browser.



If you keep the web browser open on the same room.wrl file, each time you export, using the same file name (room.wrl), all you need to do is refresh the browser to view your changes (the **f5** key may do this).

Notice how the world is now presented using the viewpoint you created.

5.4.2 Creating other viewpoints.

In 3ds max, create three more target cameras, 2m (units) from the floor, looking square on at the other three walls. Give the cameras similar names, again relating to the names of the walls they face, i.e. **facing wall2**, **facing wall3**, etc. Again, make sure that these cameras are positioned inside the room.

Save again, then export to VRML97 and refresh the browser. Notice that you now have four viewpoints you can move between, as well as the freedom to move using the usual navigation controls.



Somewhere in the setup of your VRML client, you can configure the display to animate when moving to a viewpoint. This is a good option to have enabled as it keeps you in touch with your relative position in the world.

5.5 Giving the world some lights.

In the VRML world you could see the objects because a headlight was provided for you, by default. This headlight shines a light in the direction you view the world. You can add as many of your own lights to the scene as you like, and you can do this in 3ds max...

Open up the room.max file and create an **omni** light (shines in all directions):

Create
Lights > Standard lights > Omni



For more guidance on creating lights **check out the 3ds max help system**, particularly the tutorials.

You could position the light in a top corner of the room.

Save, export to VML97 as usual, and view the world. Notice the light effect. Incidentally, the VRML client additionally still allows you to switch the headlight on or off.

5.6 Giving the walls and floor a realistic appearance.

The objects in the room.wrl world have colours which are derived from the original AutoCAD model. This is OK, but you may decide that a more realistic appearance is

required for the purposes of your model. It is possible to assign a digital image (or map a bitmap, as they say) to any surface you wish in the VRML world. This can be done in 3ds max.

To make things easy, two digital images have been prepared for this tutorial. One for the walls and one for the floor. They both have the same aspect ratio as the walls and floor (i.e. they are all square).

Walls: room_wall.jpg
Floor: room_floor.jpg

Copy these files from the module web page to your **vr_room** folder.



It is recommended that you keep any bitmaps used in the model in the same folder as the other files you create, so that the path to them is always the same, and the whole collection of required files are then easily moved around.

In 3ds max open the room.max file. Define and apply one new material for the four walls, and one for the floor, applying the respective bitmaps above as maps for the diffuse colours.



For more guidance on working with materials **check out the 3ds max help system**, particularly the tutorials.

Save and export as a VRML97 file. In the **VRML97 Exporter** window look at the **Bitmap URL prefix** settings and ensure that the tick box is unticked. The Bitmap URL prefix is the path to the images used in the world. As the files for this example are in the same folder as the world file, no prefix or path needs to be used.



Note that, for future modelling, there is a utility in 3ds max which enables you to collect together all of the resources, such as bitmaps, used in your model and to save them in a location you specify. Check out the **More...** button under the **Utilities** tab, and select the **Resource Collector**. You can then browse to the location you wish to save the files.

View the room.wrl world. How does it seem now as you navigate around? Do you get a better sense of how you are moving around in the room? The bitmap gives you a good visual reference when moving, particularly if you are close to a wall.

5.6 3ds max VRML 97 Helpers

The development of your VRML world so far has been achieved by working in 3ds max, setting up basic scene objects such as cameras, lights and materials. These are important and fundamental configurations and they need to be well thought out and implemented.

To achieve more control over how you interact with the world, how you navigate around, and how you link to or access external resources (such as other VRML worlds, web

pages, images etc.) you need to use the **Helpers** in 3ds max. Helpers in general are tools which assist your modelling. The Helpers you will use for VRML world creation are, surprisingly, the **VRML 97** ones, and they help you model the behaviour of your VRML world.

This section will give you a quick introduction to some of these helpers. For more advanced information on using the 3ds max helpers, refer to this document:

[3ds max to VRML.](#)

This tutorial will guide you through working with three Helpers:

- Background
- NavInfo
- Anchor

5.6.1 Background.

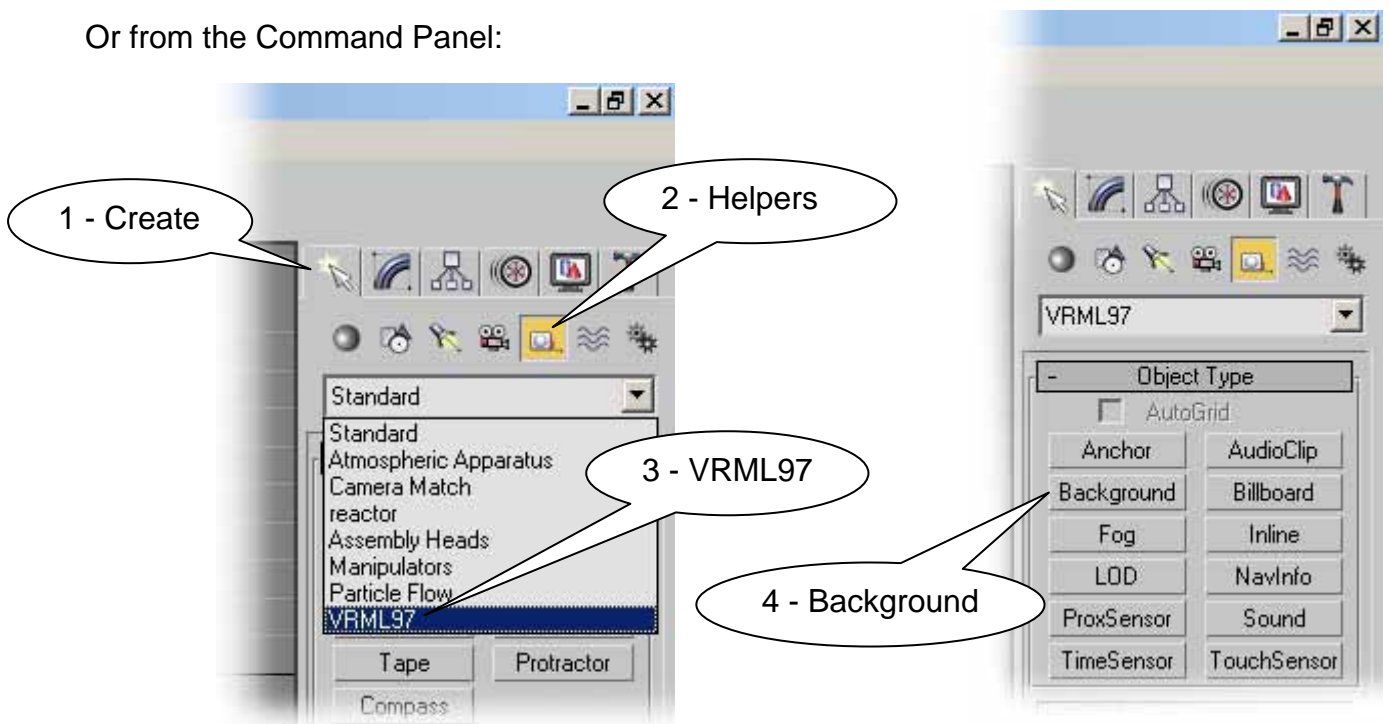
You can create a **Background VRML 97 Helper** in 3ds max. This helper will create a background node for you when exporting to VRML 97. This node sets background appearances.

Open the room.max file and make the **Top** viewport active.

You create helpers as you do other entities in 3ds max, either by using the **Create** pulldown menu or the **Create** tab in the **Command Panel**. You then click and drag in a viewport to place the helper icon. Helpers are not actual objects that appear in renderings as geometry but they are represented in the model using icons. Mostly their size does not affect their function and is only for your convenience.

Create the helper: **Create**
 Helpers > VRML 97 > Background

Or from the Command Panel:

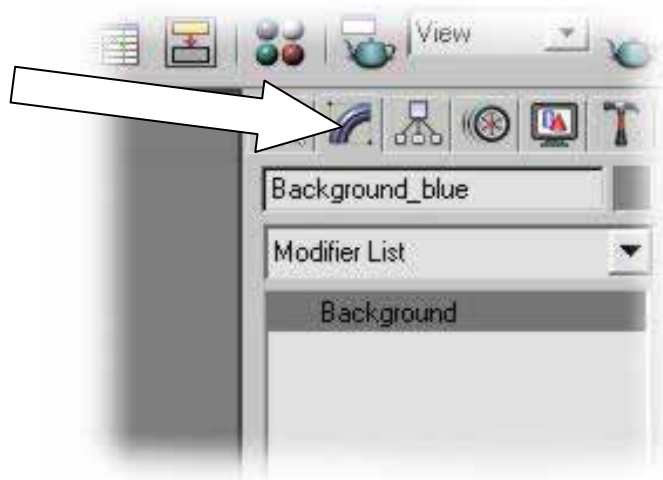


In the Top viewport, outside of the room, click and drag out the helper icon. In the top view it should look like this on the right here.



To change the parameters of the background helper make sure that it is still selected and in the Command Panel click on the Modify tab.

First, rename the background to something more meaningful, such as **Background_blue**, as shown above.



Use one colour by selecting the **One Colour** radio button.

Click on the **One Colour** sample patch and in the **Colour Selector:** window move sliders around to set the desired colour, say a pale blue.

Close.

Save the room.max file. Export the file as room.wrl, as usual. This time, in the VRML 97 Exporter Window have a look at the **Initial Background** setting, select the Background_blue you have just created and click **OK**.

Overwrite the existing version and view in your web browser.

Using the VRML viewer navigation tools, look out of the room at the sky or background.

Back in the room.max file, experiment with different background settings, numbers of colours, etc, and re-export and check the results in the web browser.

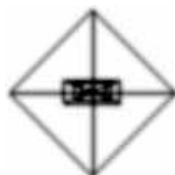
See the [3ds max to VRML](#) for more on background.

5.6.2 NavInfo.

This is a very useful helper. It creates a VRML node which influences how the world responds to the observer moving around in it.

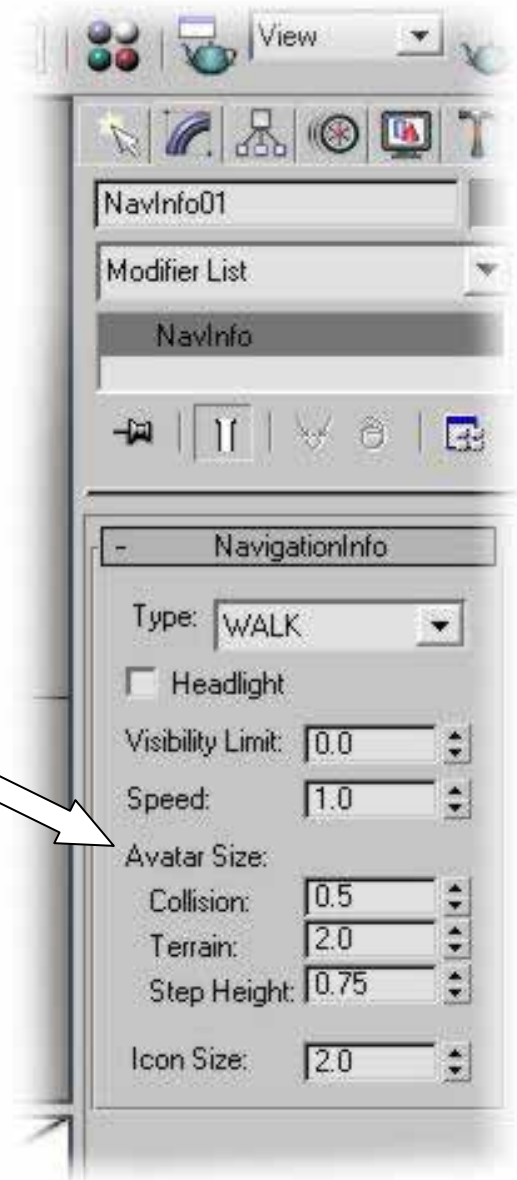
Create the helper: **Create
Helpers > VRML 97 > NavInfo**

In the Top viewport, outside of the room, click and drag out the helper icon. In the top view it should look like this:



To change the parameters of the **NavInfo** helper make sure that it is still selected and click on its' **Modify** tab.

Remember: To select an object either click on it in a viewport or use the **h** key to bring up the **Select Objects** window.



The **Avatar** is the representation of the user in the virtual environment.

VRML senses collision with geometry. You can set the distance away from geometry that collision occurs. This distance is the closest that you can get to objects within the world.

Terrain sets the height above the ground that you view the world (eye level).

Initially use these values.

Note that the **Terrain** value has purposely been set to the same height as the four cameras, to give the sense of consistency between walk through and moving to pre-set views (cameras) in the VRML model.

Save the room.max file. Export the file as room.wrl, as usual. This time, in the VRML 97 Exporter Window have a look at the **Initial Navigation Info** setting, select the **Navinfo01** you have just created and click **OK**.

Overwrite the existing version and view in your web browser.

How does the world look now? Walk around. Walk up to objects, walls etc. Note the collision distance. Use the different views to change your position or view on the world.

5.6.3 Anchor.

This is another very useful helper. It creates a VRML node which creates links to things such as other files (web pages, other VRML worlds, spreadsheets, graphics, etc, etc.) or viewpoints (cameras) within the same world. The links are embedded in **trigger objects**.

(For this section you will need a web page called **sphere.htm** stored in the **vr_room** folder. This file can be downloaded from the module resource web page, or simply created by yourself. It's content is not important.)

Create the helper: **Create
Helpers > VRML 97 >
Anchor**

In the Top viewport, outside of the room, click and drag out the helper icon.

To change the parameters of the **Anchor** helper make sure that it is still selected and click on its **Modify** tab.

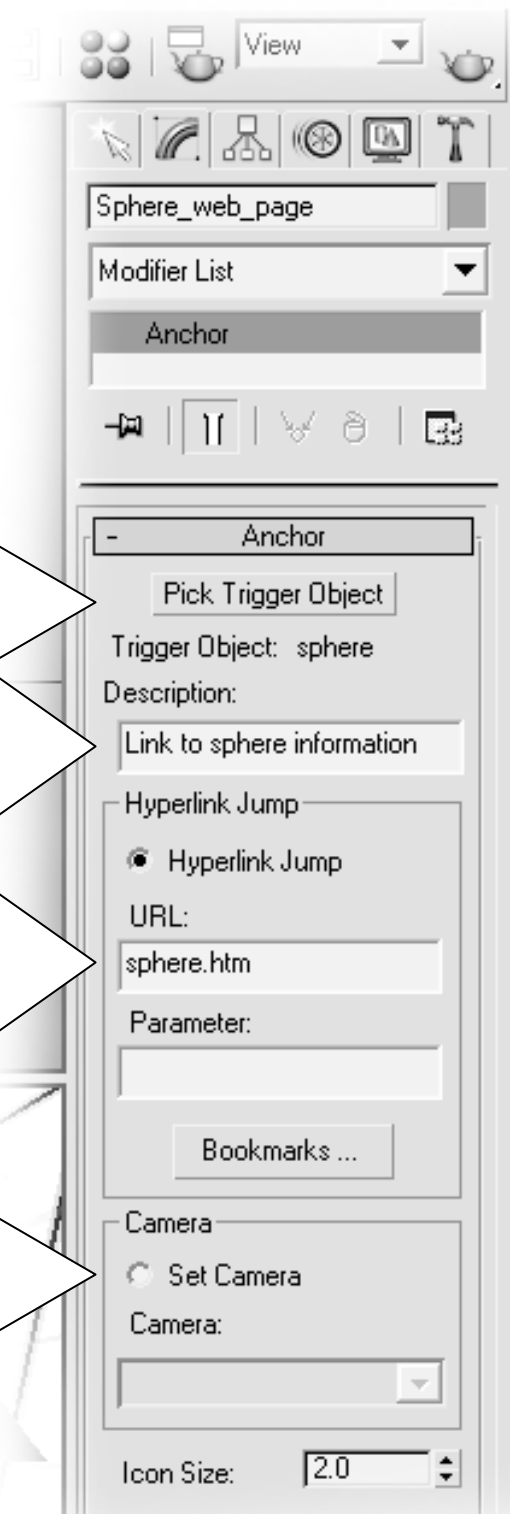
Enter the settings as shown here:

Click button and select the sphere from the model.

Type in your own description here. This may appear in the message bar at the bottom of the web browser window.

Type in the path to the file to be linked to. Here, the sphere.htm web page is saved in the same folder as your vrml worl file.

Alternatively you can link to an existing viewpoint (camera) in the model.



Save, export and test.

Note how the cursor in the VRML viewer changes when moved over the sphere object. Click on it. The sphere web page should open.

Experiment with other settings, perhaps create other worlds and link to them, or link to viewpoints in the model.

5.7 The other helpers and further work....

There are other helpers which you should be aware of:

NavigationInfo

TimeSensor

TouchSensor

Background

ProximitySensor

Anchor

Inline

Sound

LOD

Billboard

They all do really useful things, particularly if your worlds have a high polygon count.

It is recommended that before you start any project using VRML you read through all of the [3ds max to VRML](#) document already referenced in this tutorial. It gives additional advise on modelling procedures as well as more detail on the helpers. Also, as you may expect, there are many web sites bursting with examples, tutorials, hints & tips relating to VRML.

Also there is another tutorial available which goes hthrough animating a sliding door:

[Tutorial #2 – VRML sliding door!](#)

Good luck..... and enjoy!