DEPARTMENT OF LANDSCAPE ARCHITECTURE AND SPATIAL PLANNING
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INDIVIDUAL COURSE WORK
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INTERACTIVE 3D MODELS IN LANDSCAPE ARCHITECTURE

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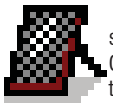
VIRTUAL AND INTERACTIVE 3D MODELS IN LANDSCAPE ARCHITECTURE

Building a 3d virtual and interactive model is extremely beficial in many aspects of Landscape Architecture process. A 3d model can be used right through the designing stage of a project, with the model giving a close simulation of how it feels to be in the spaces. The interactive model can display different options of housing configuraion, park designs, and overall street layouts which can be easily switched between to assess the benifits. Further allong in the design process the model can simulate how well the project functions, how the spaces feel to walk through at human scale, how they feel to fly over or drive through. It can allow one to better resolve the plan, understanding the spaces and between spaces better, and how the project works as and overall design. Then even further down the designign path the model can apply materials to objects, and provides options for different textures which can be compared in realtime. It can help simulate exacly how the project will look over time, through different seasons, different times of day with shadows and light, and varing weather conditions, or even how it looks and feels at night time. It can also help predict how the project wil develop over time, how the tree growth and city change will affect the design. This can help create a better design by allowing the materials, trees and objects to be compared in a virtually real simualtion, and therefore the best combination chosen. Then to the final design stage where temporary arrangements, such as furniture, can be viewed, rearranged, deleted of changed. Interacting with this virtual model the whole way throught the design process will lead to a well resolved project, down to great detail.

After the design stage the virtual and interactive model can be used to present the design to the client. It can give them a realtime visualistion of their project, to see the details, how it should look, and how it feels. It could also help give them options for the design, wether certain aspects of the design can be alterd or exchanged to meet the wishes of the client. It can also show the progress of the design, if changes needed to be made between meeting, switching between the model they saw previosly, and the ammended model it is clear what has been altered. The model can also be used by the Landscape Architect to sell an idea by highlighting its attributes, whether they be materials and detials or special spaces created. The virtual model can be brought to life with movement of cars and people, and sound added to create the mood of the space, whether busy of succluded, noisy of quite. Being able to understand every aspect of the design benifits the client and the Landscape Architect alike through the whole process.

In our semester we explored virtual modeling using Eon Professional, a programming software, used in conjuction with other modeling programs, to experiment with some of viewing and interactive functions. The possiblilities for the virtual model seem endless, but without getting lost in the animation, a real benifit to Landscape Architecture can be found. We designed and modeled a new layout of Stortorvet square in Oslo. We built up the existing surrounding buildings and applied their real facades as materials. We also built in permanent fixtures such as roads and tramlines, and existing trees. Then we enterd our design, and created interactivity to display the possibilites of realtime moveable objects, material comparisons, changing planting arrangements, the seasonal changes of light, sky, and tree foilaige. We also explored programmed moving objects, such as a tram moving through the site, and sound restricted to within close proxcimity of a water feature or running car. These options are just the tip of what is possible in the world of virtual and interactive models. Virtual modelling has so many benifits to the Landscape Architects design process , its boundries should be pushed and possibilites explored.

2DImage : The 2DImage node allows you to display Bitmap images on top of the 3D rendered eon window. It gives outevents when you click on the image. The images can be positioned and the visible area (width and height) can be set. It can also be scaled down.



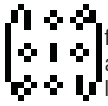
Billboard : The Billboard node specifies a local coordinate system, and rotates it around an axis (or point) as the viewpoint shifts. Objects that are children to a Billboard node are always oriented towards the viewer(and rotates towards the camera when the camera moves). If a child node defines a two-dimensional object such as a tree consisting of a polygon and a texture the object will appear to have three-dimensions. e.g Open a new simulation. Place a Billboard node below the Scene Frame node in the simulation tree.
Place a Mesh node below the Billboard node. Open the Mesh node Properties window and browse for an object file (.x -file) in the Media directory. Place a Walk node below the Camera Frame node.
Run the simulation and walk around the object. The same side of the object is always facing towards you.

ClickSensor : The click sensor is used when you want to click something in the simulation. You can then turn things on off or move them etc. There is many different uses for this command. **e.g** to move an object- place frame in scene and name moveable "object". move object frame into it. Place DragManager prototype below the camera node. Place DragSelecter prototype below moveable object frame. Place ClickSensor node below the moveable object frame. Right click DragManager and copy as link (CAL), open DragManager under DragSelecter and paste. Right-click movable object frame and CAL. Open DragNode folder under DragSelecter and paste. Drag DragSelecter and ClickSensor into route window. Make the connections, ClickSensor OnButtonDownTrue-- DragSelecter Select. Run simulation

Counter : The Counter node is used to count events. The counter value is an integer that may be decremented or incremented. Upper and lower limit values, and a trigger value, can be used to initiate an action by sending an event when the counter reaches a specified value. An example would be, a cube and a sphere, with the cube enclosed in the sphere. The sphere will become transparent at the specified intervals. See examples

Decal : A Decal node applies a texture to a virtual rectangle. This rectangle always faces the Viewport. This is very similar to The Billboard Node, but we found it easier to use. **e.g** Place a Decal node beneath a Frame node. On the Decal node's File tab, specify a texture in the Decal File Name field.

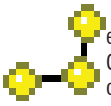
DirectSound : The DirectSound node plays a sound WAVE file using Microsoft DirectSound. Sounds can be played in either in 2D or in 3D. When played in 3D, sound direction is defined by the node's parent frame. Other 3D parameters can be adjusted on the 3D properties tab. Note that 3D sound uses world coordinates for calculating attenuation and Doppler effects. In order to produce realistic sound, the simulation scale must be correct, the perceived distance in a simulation must match the actual distance. Use the Scene node to adjust the simulation scale. **e.g** The file walk.wav will be played at position (10,10,0), with the orientation set to (225,0,0), at full volume, with no panning, and looped. Sound will be audible within a 100-meter radius and at full volume within a 10-meter radius. Place a DirectSound node beneath a Frame node.Position the Frame node at (10,10,0) with a heading of 225. Open the DirectSound Properties window. On the General tab, set Active to Yes , the Sound file to walk.wav, and select the Loop option. On the 3D tab, select Play this sound in 3D. Set Distance min to 10 and Distance max to 100.



Frame : This node is the most common node. It performs translation, rotation, and scaling operations on its children. Frames are used to collect groups of nodes in order to maintain a suitable simulation structure. **e.g** This example will place an object at (0,10,0) ten units from EONs origin. The object's X-dimension will be twice as large as originally modeled. Place a Mesh node beneath a Frame node. Open the Frame node's Properties page. On the Translation/Rotation tab, set the X, Y, and Z values to (0,10,0). Click the Scale tab, deselect Proportional scaling and set the X, Y, and Z values to (2,1,1).

Group : The Group node's purpose is to allow the EON developer to arrange nodes in the simulation tree. There are no properties or fields.

KeyboardSensor : This node detects when a specified key is pressed and generates events that can be routed to other nodes. see examples.



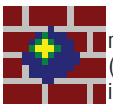
KeyFrame : This node is used to move and/or rotate its parent node. The parent node must support translation and/or rotation.
Objects move through points entered in the properties window. Each entry consists of a time stamp, a position (X, Y, Z), an orientation (H, P, R) and a scale (SX, SY, SZ). From these entries, smooth movement and rotation are calculated so that objects reach each position with the object in the correct orientation, and at the time specified. Two alternative algorithms are available for traversing the path–Interpolate or Spline.
The KeyFrame node has a unique property page, Edit. This is used when the simulation is running and it is possible to set values directly from this page and see updated position/orientation in the simulation window.

KeyMove : This node provides a keyboard motion model and affects its parent node. The parent must support translation and rotation. Movement is controlled by holding down the X, Y, Z, H, P, or R key and pressing the Arrow Up key for higher values or the Arrow Down key for lower values. see example

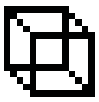
Latch : This is a useful node. The Latch node is triggered by received Boolean values. FALSE becomes TRUE and TRUE becomes FALSE. see example.

Light : If the EnableFrame folder is empty, the Light node will illuminate the entire scene. If the EnableFrame folder contains a Frame node, or a reference to a Frame node, only the objects beneath that Frame node will be illuminated. New simulations have two default Light nodes: Ambient and Headlight. The Ambient light type is set to Ambient and produces lighting effects similar to reflected sunlight. The light produced by this node has a light gray color so as not to overwhelm the Scene. The Headlight node is set to light type Directional. As the headlight is a child of the Camera, it shines from the viewer, straight ahead. **e.g good example.** In this example, the viewer may interactively change the type, position, and orientation of a light source while it illuminates an object. Select New from the File menu. Put a Frame node under the Scene node. Move the Light node (called Headlight) from the Camera node to the new Frame node. (While there is another light source in the simulation, the Ambient, we will not use it in this example.) Place a Mesh node under the Frame node and load the file Camera.x. Place a KeyMove node under the Frame node.
Place a Counter node under the Frame node. Set the upper limit of the Counter Interval to 4, and activate Cycle mode. Place a KeyboardSensor node under the Counter node. Select VK_SPACE in the Virtual keyname field. Make sure that the Enabled box is checked. Drag the above mentioned KeyboardSensor, Counter, and Light nodes to the Routes window. Connect the KeyboardSensor node's OnKeyDown field to the Counter's Increment field, and the Counter's Value field to the Light's Type field. Place a new Frame node under the Scene node(the new node is automatically named Frame1). Set its Y coordinate to 10. Finally, place a Mesh node below Frame1 and select the file Sphere2.x. Start the simulation. You may now move the light source using any of the X, Y, and Z, or H, P, and R keys in combination with either the Arrow-up to increase values or the Arrow-down key to decrease values. Additionally, the light type can be changed by pressing the space bar. Remember that some of the light source types are independent of position and/or orientation. Moving these will produce no changes in simulation lighting.

LightOfDay : To simulate sunlight during different hours of the day, the colors and intensities of the Light nodes in a scene must be constantly adjusted to correspond to the current time. The LightOfDay node simplifies this task by providing a uniform and easy means of monitoring and controlling a large number of Light nodes in an EON simulation. See Help but found this confusing.

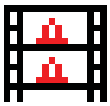


Material2 : Represents a material in the scene. To apply a material to an 3D object, you need to combine it with a geometry node (Mesh2) using the Shape node. They are also linked to textures. This is a simple concept but to get your head around it you need to review a simulation tree, for example, in one of the tutorials.



Mesh2 : The Mesh2 node is a new version of the Mesh node, to be used together with other nodes in the Visual nodes set. It represents a geometry in the scene, storing the mesh data.
A Mesh2 node contains the actual definition of a 3D model, but not the appearance (which is being stored in the material resource node). When an importer creates the resource database from a 3D file, it will create a mesh node for each 3D object found in the file and store the 3D mesh data in a separate file, then make the node reference this file. Compare this to how textures are stored in a similar way. However, unlike textures, the mesh data file (which has the extension .eog) can only be read and used in EON.
Normally, you can treat the node and its associated mesh data file as one entity, since the file is embedded inside the simulation file. However, sometimes it is useful to lift out the mesh data file and store it somewhere else, preferably on a server. In this way, the simulation can start up and run immediately, meanwhile the file (which can be huge) is streamed down from a server in the background. When it's downloaded, it will be initialized and loaded into the simulation window. See the chapter about Distribution for information about this new feature.
To fight the data storage requirement even more, a mesh in EON can be compressed and its polygon count reduced also. Compression is like JPEG image compression, where you would trade off precision and quality for smaller data size, while polygon reduction means you are actually reducing the number of polygons building up a mesh. See the Geometry Compression chapter for more information on how to use this new powerful feature.
To make the mesh visible, you need to combine it with a Material2 node using the Shape node. Could be huge possibilities

MouseSensor : This node detects both the position of the mouse and mouse clicks. **e.g** In this example, object rotation is controlled by the mouse. Place a Frame node beneath the Scene node and a Mesh node beneath the Frame node. Place a MouseSensor node somewhere in the simulation. Drag the Frame node and the MouseSensor node to the Routes window. Connect the MouseSensor node's position field to the Frame node's Orientation field.



MovieTexture : Textures are images that can be used to supply details to a surface in a very cost-effective way (computation-wise). There are two types of texture resource nodes: Texture2 and MovieTexture. The difference between them is that the latter uses a movie file as the image source, while the former uses a simple static image file. Any movie format supported by the DirectShow system (and thus can be played with the Windows MediaPlayer) can be used in a MovieTexture. Note also that in addition to image, the MovieTexture can optionally supply a sound track to the simulation as well. Conversely, you can also disable the video channel, and only use the sound channel, e.g. to play a background tune in MP3 format. The MovieTexture node must be referenced by a Material2 node to be visible in the scene. Also, this Material2 node must be used by a Shape node as well

MultiMaterial : Some 3D modeling software supports multi-materials, which means a single mesh can be assigned many different sub-materials, potentially one sub-material on each face of the mesh. EON supports this by creating a MultiMaterial node whenever such a multi-material is encountered during the import process. Each sub-material in the multi-material will be imported and created as well. Then the MultiMaterial node will contain references to these sub-materials.

Panorama : This is very easy to make a quick enviroment around your model. The Panorama node provides ground, horizon and sky textures for your simulation. The sky and horizon are always placed as if they were at an infinite distance from the viewer (the camera). Objects in a simulation are never obscured by Panorama node textures. This node works best when used with graphics cards that support mipmapping, such as cards based on the Voodoo chipset. NOTE: The Panorama node is intended for displaying environments above ground level. If a user tries to move the viewpoint below groundlevel the movements will be mirrored, i.e moving upwards will appear as moving downwards and contrariwise.

Place : This node places an object at a new position, either relative to the current location or at an absolute position. The Place agent changes its parent node's position in the "grandparent's" coordinate system (i.e., X, Y, Z, H, P and R-values). The parent must support translation and/or rotation.is intended for displaying environments above ground level. If a user tries to move the viewpoint below groundlevel the movements will be mirrored, i.e moving upwards will appear as moving downwards and contrariwise.

Position : The Position node can be used with any node that has both a position and an orientation field. It moves its parent Frame node, and consequently its sibling Mesh nodes, with a user-defined velocity and acceleration to a certain position and orientation. Movement is performed along a straight line, the shortest distance between the start point and the destination point. The destination position and orientation can be changed during simulation runtime, even during the movement of an object. This capability is very useful in some situations, such as when implementing drag-and-drop behavior.

Slider : The Slider node provides a vertical or horizontal slider control that appears on top of 3d rendering window. The moving point part of the slider can be moved by dragging it with the mouse or by sending values to the SliderPos field. The Slider can be used as a way for the user to interact with the application or it could be just used to display a value on a scale. A minimum and maximum value can be set and small markings can appear on the slider at the interval you set. The Position and area covered by the slider can be set. This slider automatically shows different size pointers when the height is altered. When it is horizontal the height should be 10, 15, 20 or 30 and when the slider is vertical the width can be these values.

SoftShadow : Very effective node.The SoftShadow node is well suited for the most common type of scene with shadows, where one or more objects cast shadows on a horizontal ground plane or floor. In particular, the node works well in scenes where one or more omnidirectional light sources light a scene from "outside", i.e. where the light source is placed relatively far away from the objects that it affects. See HELP for details and examples.

Switch : The Switch node is used to switch between children in a subtree. For example, if one of a node's two children is visible and the other is not, changing the value of the Switch node hides the visible child and displays the other. **e.g** In this example, each time an object is clicked in the simulation window, it is replaced with another. Place a Switch node and a ClickSensor node beneath the Scene node. Place three Mesh nodes beneath the Switch node. Place a Counter node in the simulation tree, set the Counter interval to 0.2, and select Cycle mode. Connect the ClickSensor node's OnButtonDownTrue field to the Counter node's Increment field. Connect the Counter node's Value field to the Switch node's Value field.

TextBox : The TextBox node adds a text box to the simulation that can be used to provide the user with information. The text box can be moved within the 3D environment, or have a fixed position and size. The text box's orientation is adjusted so that it always faces the viewer. It can be used with a ClickSensor to pop ou information about objects in the model

Texture2 : Textures are images that can be used to supply details to a surface in a very cost-effective way (computation-wise). Texture2 supports only 4 image formats: JPEG, JPEG2000, PNG and PPM, so any foreign image formats should be converted to either JPEG or PNG before the import procedure begins. Note however, that many importers will automatically convert most of the common image formats to either PNG or JPEG2000, but still, to maintain maximum control you should it yourself. The Texture2 node must be referenced by a Material2 node to be visible in the scene. Also, this Material2 node must be used by a Shape node as well. We found that PNG files were best because of there transparency nature.

TextureUVMap : It allows you to map a texture on an object manually using several standard projection types such as planar, cylindrical, spherical, etc. When mapping an image/texture try to use the projection type closest to the object you want to map it on. However, it can be a bit tricky to position the textures exactly the way you want it so we recommend you to do the texturing in a modeling program before importing it into EON.

TimeSensor : A TimeSensor node generates pulses at regular intervals. These pulses can be used to control actions of other nodes.

Viewport : The simulation window can show several viewports at the same time. A Viewport node defines the user´s field of view and how the simulation is displayed in the simulation window. The Viewport node must be connected to a Frame node, defining the user`s position in the simulation. see HELP for lots more details. Lots of opportunity here

Walk : The Walk node implements the walk motion models found in many 3D environments. The Walk node is controlled with a mouse or joystick. This node affects its parent. The parent must support translation and rotation.
Walking movement is controlled by pressing the left mouse button (default settings), and moving the mouse. Speed is proportional to mouse movement after the button is pressed. Maximum speed and assignment of the walk mouse button may be modified.
If you have a Camera node as a parent to a Walk node, you can examine a simulation by holding down the middle mouse button (default settings) while moving the mouse. This will turn camera around, while still standing on the same spot. When the button is released, the orientation will stay in the last position, and you can continue to start walking using the left mouse button. If you want the viewpoint to snap back to the position it had before you initiated the turn around navigation, hold down the ALT key before you release the mouse button.
If enabled, you can go up and down in the Z-axis by holding down the right mouse button (default settings) while moving the mouse forward (up) and backward (down). e.g in HELP

Weather : The Weather node enables you to substantially increase the level of realism in your simulations. It adds rainfall to a simulation and the user can control various parameters, such as the density of the rain and the transparency and color of the raindrops. If wind is used, raindrops will deviate from the vertical plumb line. The direction of the wind is specified using the angle from the positive X-axis, considered positive when rotating counter-clockwise round the Z-axis.
NOTE: The Weather node must be placed under a specific Camera node, otherwise it would not start.
NOTE: The Weather node does not work with DirectX 3, since the node uses features first implemented in DirectX 5.

Need to be explored further, because they seem like they would be beneficial to a Landscape Architectual model

ChangeSimulation
CgMaterial
CollisionManager
DragDrop
FlashObject
HatchMaterial
Instructor
LaunchExternalProgram
LightOfDay
Mesh2 Compression and distribution of files
OceanWaves
PopupMenu
RPCHuman

A main aim if we were to repeat this model would be to focus on reducing the size of the model, and some of these nodes offer a option to do this

PROTOTYPES

Prototypes are a much simpliar concept. You can drag and drop them into a scene and are mostly ready to go. They are also mostly very self explainitory, for example the BMW prototype which is a BMW car. You can drag this into the scene and it appears at 0,0.
The following prototypes we have used or experimented with.

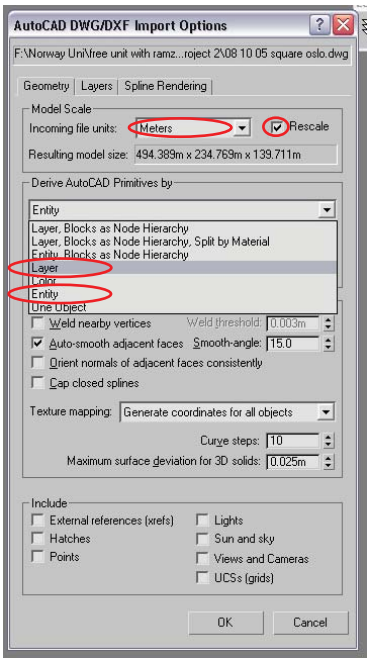
Apartment
BMW
CityHighway
Day-Night
GrandRoom
Helicopter
MountainDome
Mountains
OnOffForFrame
Robert
SkyDome
SkySphere
TextureChanger
TownSquare

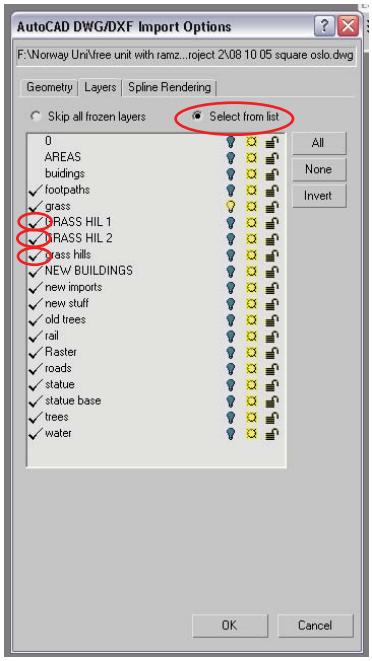
Some protoypes are easy to use but there is usually a node or 2 that do the same thing but with more options, and if set up correctly they can run much more smoothly. For example, the OnOffForFrame prototype can turn an object on and off with a key. We used this technique to swap between winter and summer tree foilage but using a latch node and a click sendor, with a counter node and timer node you could switch between the two seasons with one touch of a button. With this technique you can also add effects like fading in objects etc. which is makes the transition much more smoother.

A prototype can be created in 3ds Max using the raptor plugin. Once a model or object is completed you can export as a prototype.

AUTOCAD TO 3DS MAX

To generate the plan in line work we used AutoCAD, laying down a google aerial photograph as a raster image to trace the building outlines, the road layout and major elements in the square (water feature, trees, statue) From there we designed our square and drew it up in CAD. Firstly just linework to create the spaces, then after creating a copy of the linework it can be turned into 3d. To create the grassed mounds we drew up contour lines at the different heights, and once in 3ds Max it can be turned into a terrain. The rest of the model we created just using various extruding and subtracting commands in CAD, using the linework. Once most of the model had been constructed we imported it into Autodesk 3ds Max.

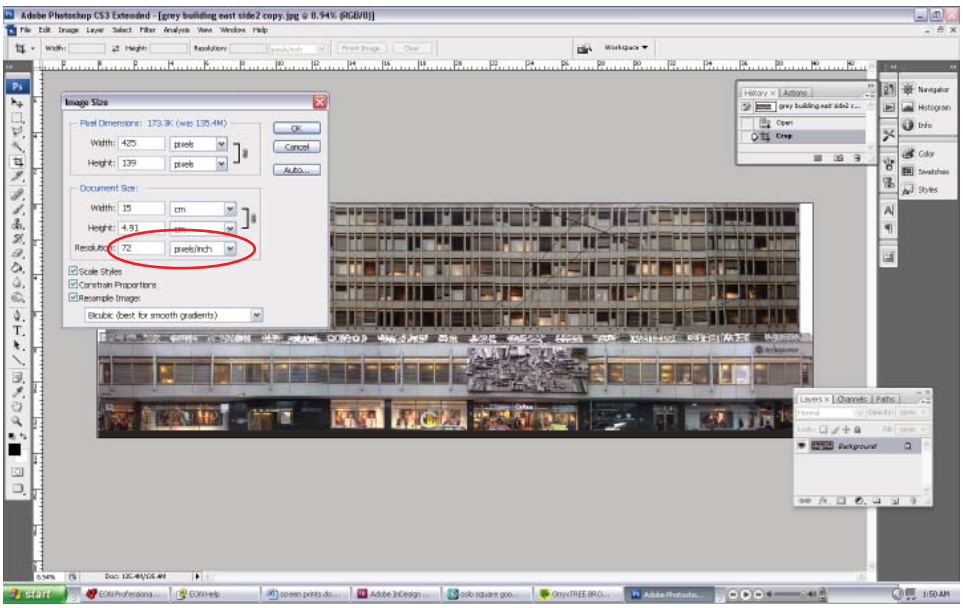




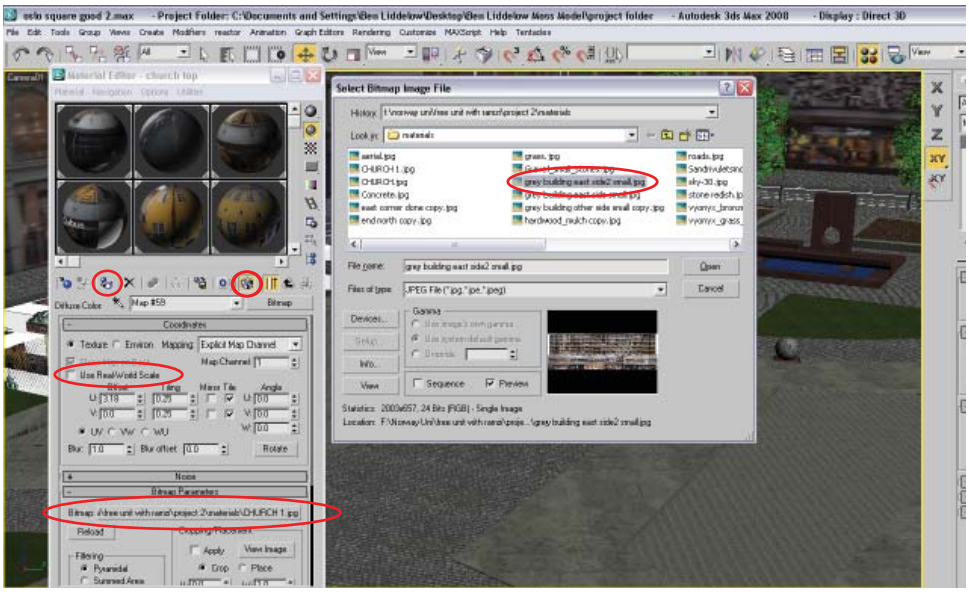
The setting for importing into 3ds max change depending on what layers are being brought in. To start with we brought in all the layers in the autoCAD file. We made sure the model was scaled correctly in meters, selected all the layers and brought the individual objects in as entities (Derive AutoCAD primitives by...Entity). The grass mound contour lines can then be re imported, selecting only the grass contour layers in the layer menu, and choosing the Layer option in the Derive AutoCAD primitives by dropdown. Make sure the scaling is the same as previously, the new objects are geo-referenced, so will import in the correct position. The grass contours are now compound objects and can be turned into terrains.

3DS MAX MATERIALS

Most of our materials for the model are applied in 3ds. Some materials are found in the 3ds material library, however most are not suitable and need to be created. We found using photoshop to create a recuring texture with no seams was the esiest. The patterns could then be saved to the the project folder material library, and applied as bitmaps. To create the building facade materials we merged photos of the buildings , taking out the perspective using



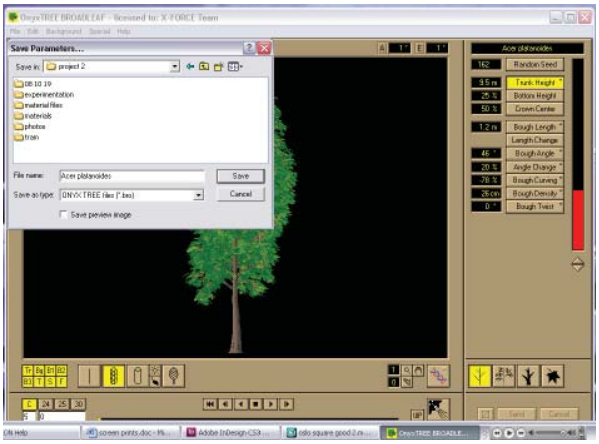
the distort transforming tool. We then saved them as jpegs with small immage sizes, (only 72 px/square inch). Make sure the pages are cropped to the edge of the buildings as this makes it easy when applying sizes in 3ds. Save it in the 3ds project files material library.

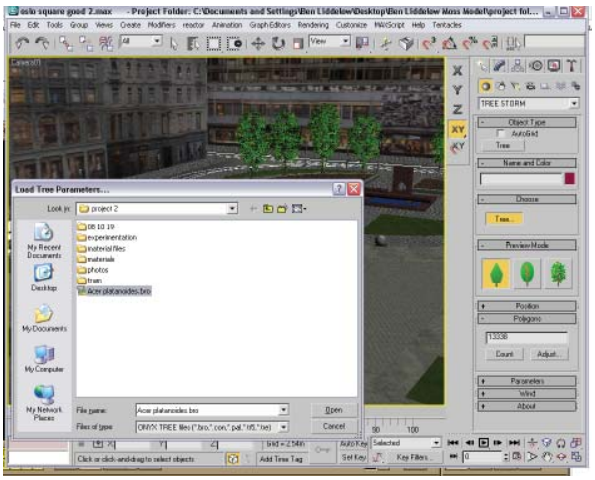


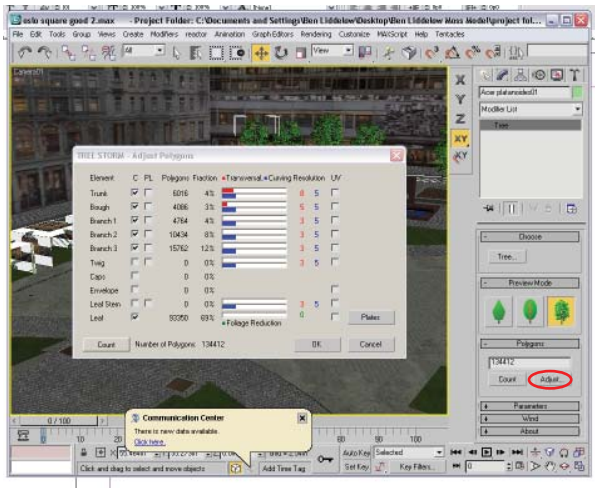
To apply the material we added it to a default slot in the material editor as a map diffusing colour, importing it as a bitmap. We then selected the desired object and applied the material. We then clicked use real world scale. If the checked box is clicked in the material is visible on the object in the viewing window. From there the object needs to be selected and a uvw map applied via the modifiers menu. Click fit on in this menu and if the building and material sizes are in proportion it should fit well, otherwise it ma need to be manipulated to fit. If several materials need to be added to the same building another step is needed. The face required needs to be selected using the edit mesh modifier. Once selected the uvw map modifier can be applied to that face only, and the same process and previously is applied.

It is important to name materials as the names are brougnt into the Eon model and it prevent confusion later. The Eon textures may become quite complex with multi-materials on the one object.

TREES

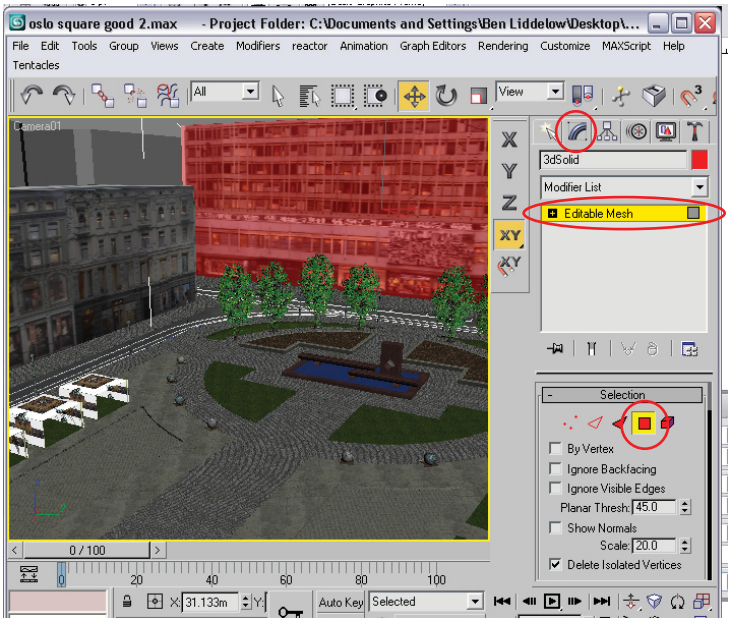






The next step was to the 3d trees. We used Onyx tree broadleaf with the 3ds TREESTORM Plugin. Onyx tree can easily create a wide variety of trees quickly, with size, shape, texture, and colour adjusments for the leaves, twigs, branches, bough and trunk. Firsly we created the desired tree in broadleaf, then saved the parameters as a onyx tree file. Then the same tree could then be selected in 3ds and placed in the model. Once placed the trees can be adjusted to restrict the amount of polygons. Unimportant information can be turned off such as leaf stems, twigs, and in some cases branches. The smallest number of polygons without affecting the visual of the tree needs to be found. We also used this system to make the seasonal adjustment for the trees in eon, creating a copy of the trees in the same postion and having one group with no leaves and the other group with no leaves. Later in eon we could create a switch to move between the two groups. Other options are also available for the same concept, such as different ages of trees and different varieties.

If onyx tree, or the TREESTORM plugin is not available any 3d tree can be imported into 3ds and scaled and moved into postion.


oslo square good 2.max - Project Folder: C:\Documents and Settings\Ben Liddelow\Desktop\...
File Edit Tools Group Views Create Modifiers reactor Animation Graph Editors Rendering Customize MAXScript Help
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Modifier List
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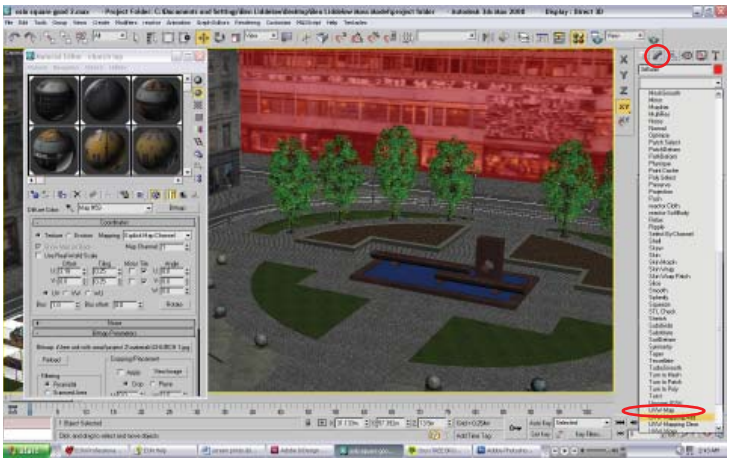
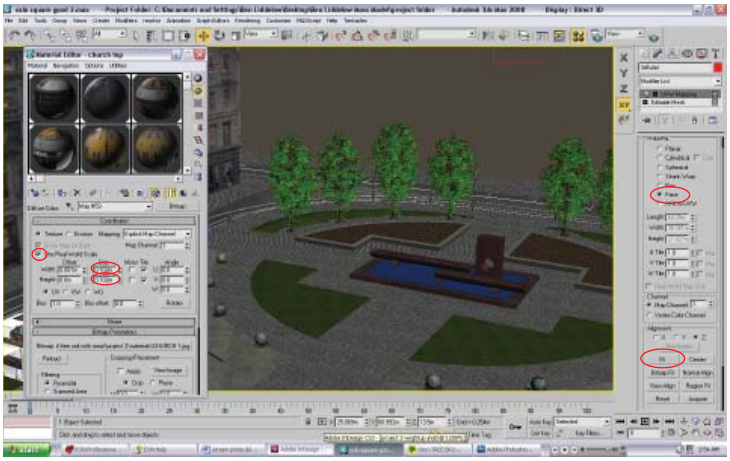
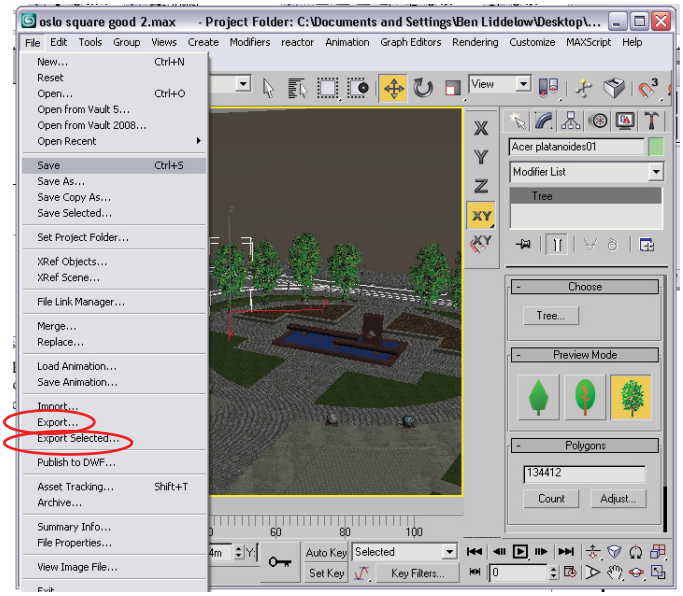
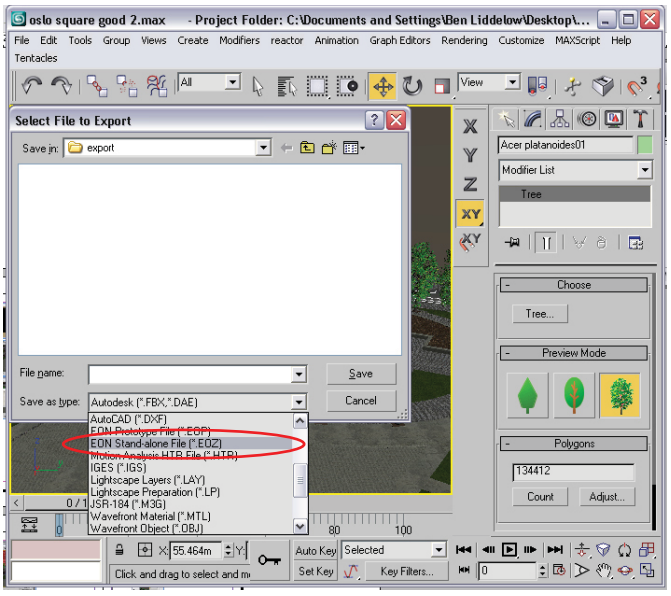




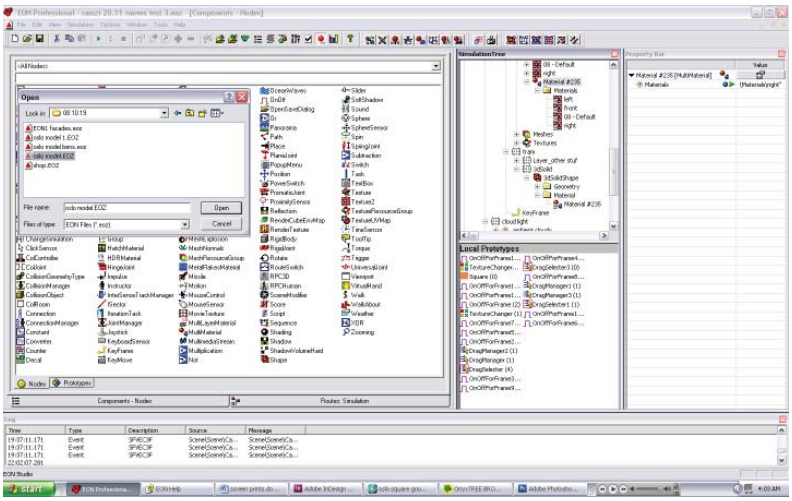
EXPORTING TO EON

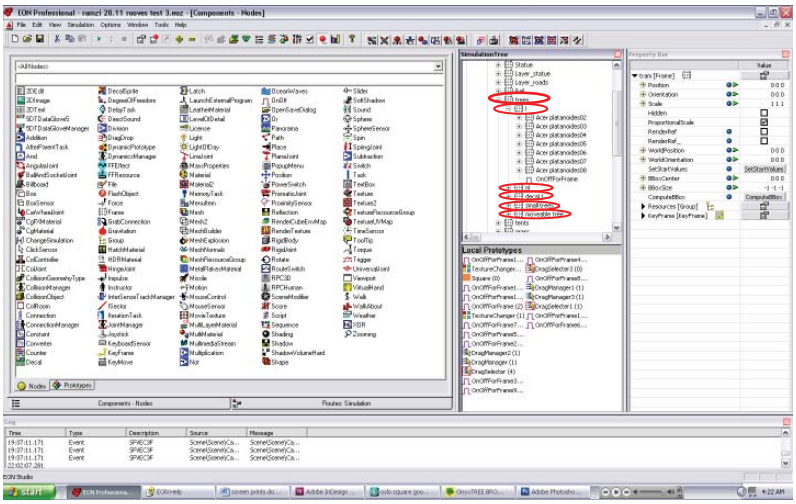
To transfer our model for 3ds Max into Eon Professional we used downloaded Eon Raptor, which is a plugin for 3ds max which allows exporting as eon files. Firsly we did with the whole model, exporting it as a eon stand alone file. The model could then be opened in Eon professional without needing to be imported. More infromation and objects could be brought in individually later by exporting individual objects from max also as an eon stand alone file. When new files are added into Eon they are geo-referenced so they appear in the correct position. We found it is somtimes esier to bring in objects, or specific groups of objects (for example trees with leaves, or trees with no leaves) individually into Eon so we have a more complete understanding and better control of how the files are arranged.





OPENING IN EON PROFESSIONAL



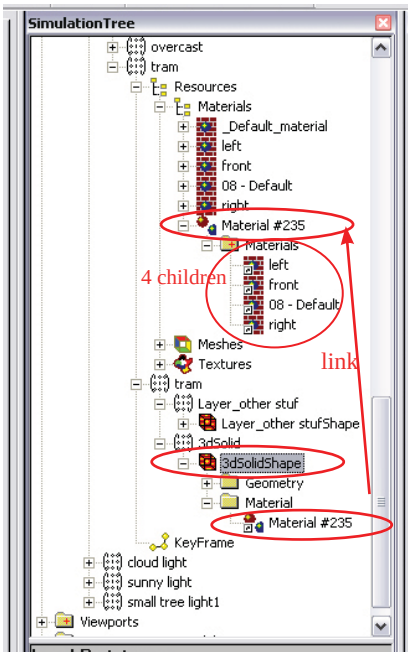


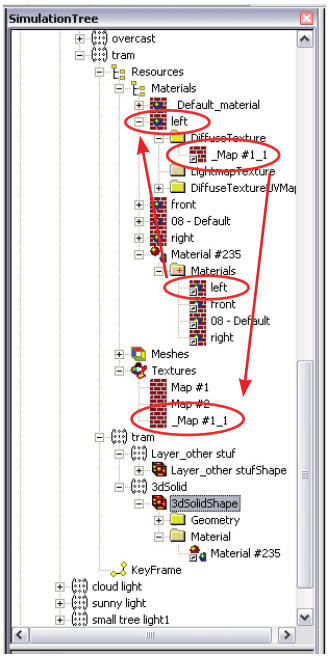
The stand alone file created by Autodesk 3ds Max can just be opened in Eon professional. We found it easiest to create a new Eon file and copy in the scenes from the opened files, then delete the camera and lights out of them. This means there is only one camera and one light in the overall simulation tree.

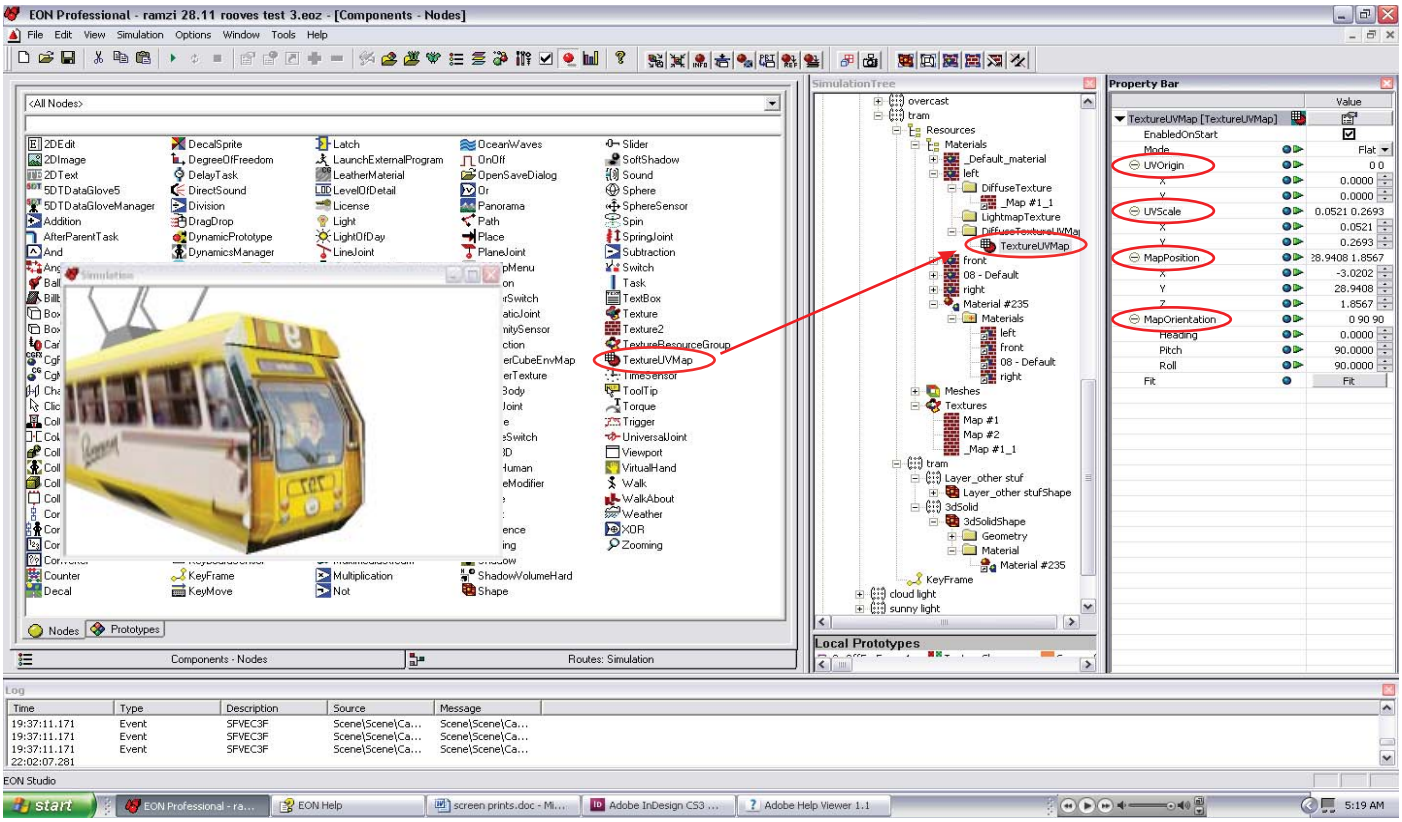
From there the objects can be into groups under their own frames. For example a frame node can be dragged into the simulation tree and the trees with leaves can be grouped benieth it. The frame can then be renamed as trees with leaves. This frame can hold the resources file, which houses the materials, meshes and textures.

The file can then be further organised by placing all the other similar frames benieth a major frame. For example once the trees with leaves, the trees with no leaves and the small trees are in individual frames they can be place below a frame called trees. This organisation makes it easier when trying to manipulate the model

Most of the materials imported correctly from 3ds Max, however sometimes when the object had a multi-material, and it was uvw mapped it require some altering. For this we will use the tram as an example. The tram has a multi material node on it which is brought in automatically because the single object had more than one material applied to it. This multi material is positioned below the shape node which is the body of the tram. This multi material has a link in the resources group which shows what this multi material i made up of. This multi material has 4 material-sas children to it, in the form of material 2 nodes. Each of these materials has 3 folders; diffuse texture, lightmap texture and diffuse texture uvw map. The diffuse texture has a link to the texture file which holds the actual jpeg image. The diffuse texture uvw map is where the problem may be occuring. To correct the problem we dragged in a texture uvw map into the diffuse texture uvw map. Then in the property bar the material could be manipulated by scale, orientation, origin and position.This could be done while the simulation window is open so the affect of the adjustment can be seen, however, when the simulation window is closed the changes are not saved we needed to do a print screen of the adjustments or note them down. Once the simulation was closed the same adjusment should be remade and saved.

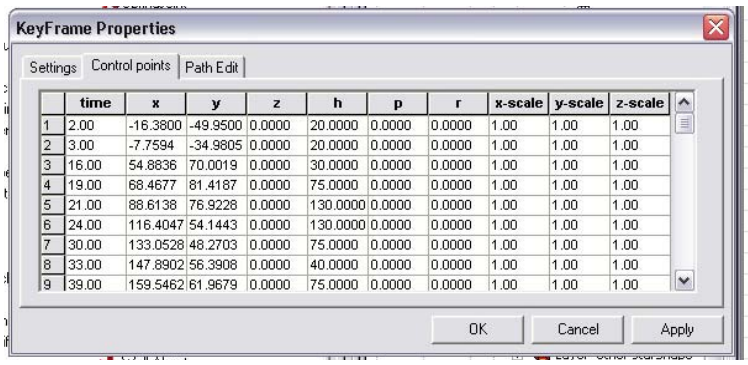






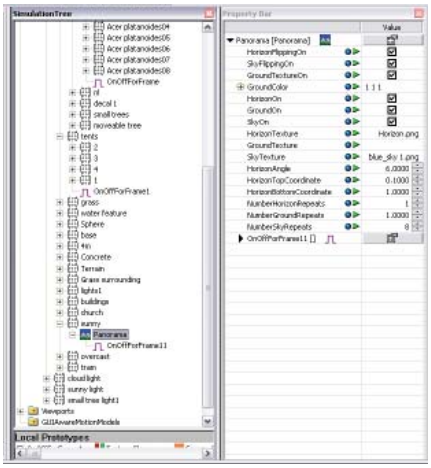
MOVEMENT

To get the tram to move around the track we used the Keyframe node. This node acts on its parent frame so we place it within the tram frame. The properties of the movement can be adjusted and saved while the simulation is running so the path can be defined by trial and error. There are options for importing a defined path, however i did not have the program to create this path file. To generate the coordinates of where the tram should travell we placed blocks at small intivalls allong the track in 3ds Max. We then importe these blocks and noted down the position for each as shown in the properties bar. Then we could just enter these values into the key frame properties option, in the control points field. The time and rotation at each point was just trail and error. The tram route can be run in the simulation after ever change, so manipulation doesnt tak a long time.



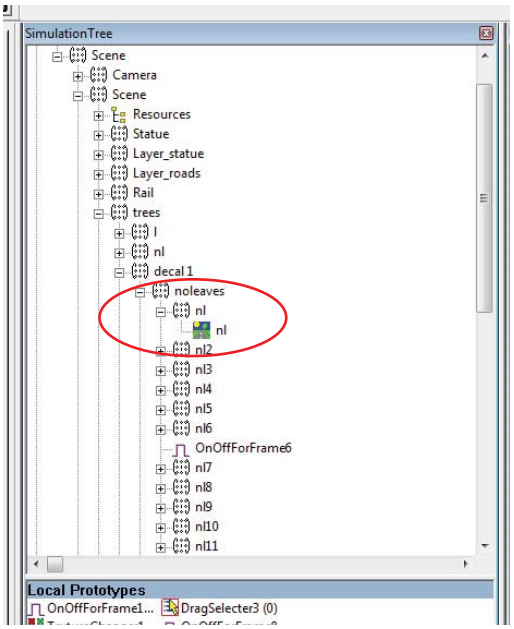
	time	x	y	z	h	p	r	x-scale	y-scale	z-scale
1	2.00	-16.3800	-49.9500	0.0000	20.0000	0.0000	0.0000	1.00	1.00	1.00
2	3.00	-7.7594	-34.9805	0.0000	20.0000	0.0000	0.0000	1.00	1.00	1.00
3	16.00	54.8836	70.0019	0.0000	30.0000	0.0000	0.0000	1.00	1.00	1.00
4	19.00	68.4677	81.4187	0.0000	75.0000	0.0000	0.0000	1.00	1.00	1.00
5	21.00	88.6138	76.9228	0.0000	130.0000	0.0000	0.0000	1.00	1.00	1.00
6	24.00	116.4047	54.1443	0.0000	130.0000	0.0000	0.0000	1.00	1.00	1.00
7	30.00	133.0528	48.2703	0.0000	75.0000	0.0000	0.0000	1.00	1.00	1.00
8	33.00	147.8902	56.3908	0.0000	40.0000	0.0000	0.0000	1.00	1.00	1.00
9	39.00	159.5462	61.9679	0.0000	75.0000	0.0000	0.0000	1.00	1.00	1.00

PANORAMA



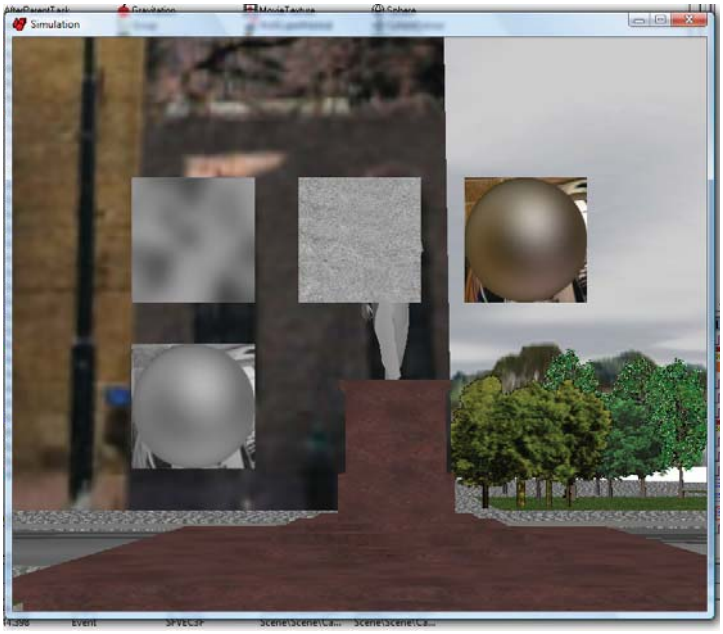
We found the panorama node to be a very simple and effective way to ad in a background with the ability to change it during the simulation. Panorama nodes have a sky, a horizon, and a ground. We made the sky with a photo, the horizon with a pieced together image of hills from google earth, which we then made into a png, and the ground was a generic pattern from eon. We made 2 panorama nodes in the scene, each under a different frame for the different seasons, one was with a clear sky for summer and the other cloudy for winter. These seasons linked in with the trees and ambient light changing. Under the panorama nodes we placed on/off prototypes so we could switch between the two.

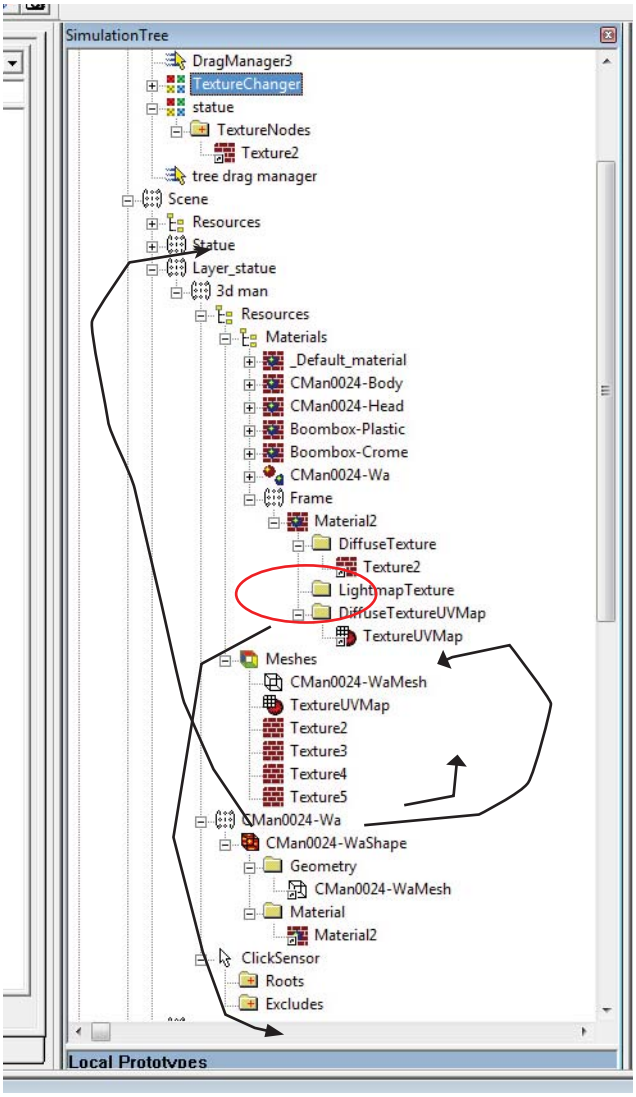
DECAL NODES



DECAL NODES: To keep structure in the simulation tree the decals are placed under Scene/Trees/Decal1. Then They are divided into two categories, leaves and no leaves. This is so you can place a OnOff-ForFrame prototype within each frame so you can switch between each winter and summer foilage. The OnOffForFrame prototype key is syncronised with ambient light, panorama's, decal trees and 3d trees. Each decal frame has to be situated beneath a frame node, so that you can position it within the model.

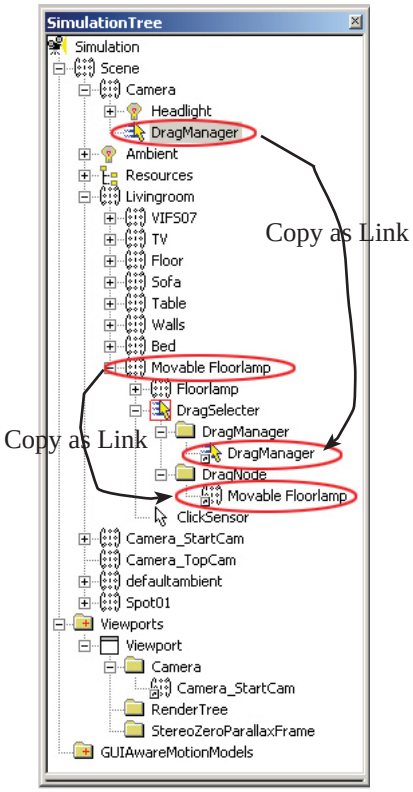
TEXTURE CHANGER: The TextureChanger prototype can give the ability to change the textures on an object. To start with add a Texture Changer prototype to the camera frame. Add as many texture nodes (max 6) into resourses/textures. Then load the desired materials (JPG) to filename in property bar for each texture. Choose which texture you want to appear on the commencement of the simulation, then right click and copy as link. Paste this in Camera/TextureChanger/ Texture node. Next add a TextureUVMap node to resources/ textures. Next add a frame node to materials and place a material node beneath it. right click the TextureUVMap and copy as link, paste it in the newly created frame under materials/diffusetextureUVMap. Then copy as link the primary texture and paste in materials/diffuse texture. All the names of the materials added have to be copied into the TextureChanger property bar, where it says textures. Run the simulation and click on the object the different textures will pop up on the screen. You then click one to change the texture of the object.





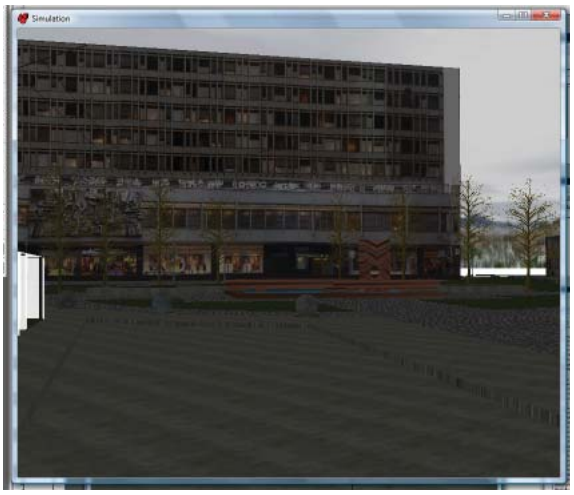
DRAGGING AN OBJECT

DRAGGING AN OBJECT: The click sensor is used when you want to click something in the simulation. You can then turn things on off or move them etc. There is many different uses for this command. **e.g** to move an object- place frame in scene and name moveable "object". move object frame into it. Place DragManager prototype below the camera node. Place DragSelecter prototype below moveable object frame. Place ClickSensor node below the moveable object frame. Right click DragManager and copy as link (CAL), open DragManager under DragSelecter and paste. Right-click movable object frame and CAL. Open DragNode folder under DragSelecter and paste. Drag DragSelecter and ClickSensor into route window. Make the connections, ClickSensor OnButtonDownTrue-- DragSelecter Select. Run simulation We used this technique to move tents around the model and to move trees to different planting locations. While you are moving the objects you can also manipulate them by holding down different keys. For example when you hold down SHIFT the object moves on the Z axis aswell and when you hold down R you can rotate the object in all directions.



ON OFF PROTOTYPE

Another Technique used frequently was the OnOffForFrame prototype which can turn a frame on and off with a touch of a key. We placed OnOffForFrame prototypes all through the simulation tree, to sycronise the change between winter and summer. The light, the background, and the foilage all changed at the same time. You have to place the prototype beneath a frame and within that frame an object can be placed. The default key is Tab but you can change this in the property bar.



CONVERTING TO THE VR LAB TEMPLATE

This step caused many compatability problems, memory issues and function problems. Some of the main faults was the difference between the Eon Professional 6.1 used on our computers, and the Eon professional 5.1 used in the virtual reality lab. This raised problems with nodes and prototypes new to eon, and licencing issues for 5.1. We learned the projected simulation in the vr lab need a small file for it to cope with the real time movement. This is something which needs to be investigated further, with options of different parts of the model loading as needed at different times during the simulation. We found the easiest way to bring the file into the VR lab template was individually by frames with their own resources file in each. The route simulations can then be reconnected for the moving objects and changing textures. We did not fully resolve the conversion issues.