TUTORIALS

TECHNIQUES / TIPS / TRADE SECRETS

MAYA

built for speed

Part two

In the concluding part of our tutorial on creating a vehicle for a next-gen game, we look at the process of texturing the car and exporting the file ready for use

BY STEVEN KENT

● This month's tutorial takes you from untextured model to finished in-game asset. Note: the *Maya* file on the CD requires the HDRI file building_probe.hdr. You can download this for free from **www.debevec.org/probes** by clicking the link below 'Overcast Breezeway, Soda Hall'

The first part of this two-part tutorial focused on creating a car model suitable for use in a next-generation game, using a mixture of polygonal and subdivision surface techniques. In the file on the CD, additional objects such as windscreen wipers and the antenna have been added and the shut lines cut out and bevelled to complete the model ready for the second part of the tutorial.

This issue's walkthrough explores the process of texturing, testing and exporting the car. First, to set up the scene for UV unwrapping, you will group all panels that will be on the same texture sheet and apply a chequered texture, so that the flow of the UVs can be seen more easily. Then you will UV unwrap all the panels and arrange the UVs onto these separate texture sheets. To add realism to a car paint shader, an Ambient Occlusion map will be created and edited in *Photoshop*. This map will then be used together with a Layered Texture in *Maya* to blend the Ambient Occlusion map with a colour, so that the colour of the vehicle could be changed without needing to create multiple colour textures. Following this you will create texture maps for front and rear lights, adding an alpha channel that will control the reflectivity. After the material set-up is complete, the car vehicle can be tested with an environment map so that you can see how the reflections on its surface might appear in the game.

Finally, the scene will be set up so a game engine would be able to 'read' all data contained in the file. Specific naming conventions will be used, attributes added to group nodes and their pivots will be set so that the doors, bonnet and boot rotate around their hinge positions correctly. As a last step, the scene will be cleaned up to remove its History and any unused nodes which may have built up during its creation.

The processes covered in this article are complex and game-specific, so it is intended as an overview of the workflow, not a complete step-by-step guide. We are also assuming that you have some previous *Maya* experience, although scene files are provided on the CD for you to deconstruct.

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FACTFILE

FOR
Maya

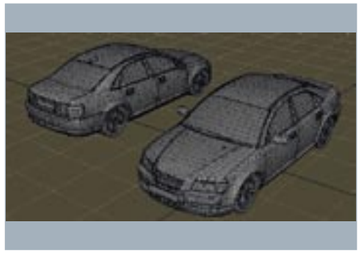
DIFFICULTY
Intermediate

TIME TAKEN
3–4 days (total)

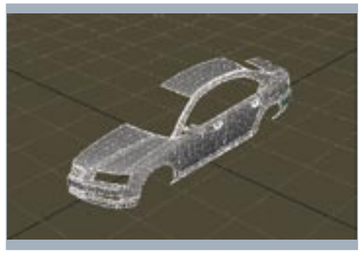
ON THE CD
- Full-size screenshots
- Initial, intermediate and final *Maya* scene files

ALSO REQUIRED
building_probe.hdr file (Free download from **www.debevec.org/probes**)

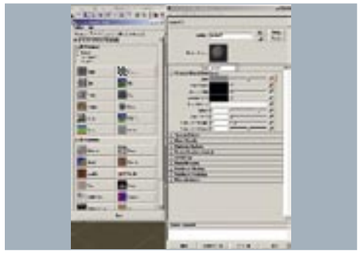
STAGE ONE | Creating UV maps



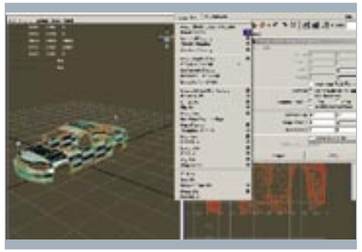
01 The finished car model from Part One can be found on the CD ('1_Initial File.ma'). It clocks in at slightly over 20,000 polygons. To complete it, details like windscreen wipers and the antenna were added and the shut lines were cut out and bevelled so a smooth edge was created on the sides of panels where, for example, the doors and fenders and fascias meet.



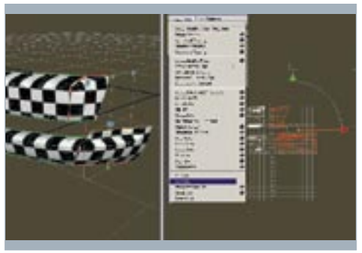
02 It's important to create a clean UV set so overlay textures like dirt and decals can appear on the car's paintwork properly. Select those objects which will be using the car paint material and group them using Edit > Group. Name the group 'car_body' and hide the rest of the geometry, so you can select objects to work on more easily, by selecting the car_body group and pressing [Alt]+[h].



03 A chequered texture can be used to ensure the flow of the UVs is correct and there are no texture-stretching artefacts. Create a new Lambert material by selecting Assign New Material > Lambert in the Lighting/Shading tab of the Rendering menu set. Select the new Lambert material and, in the Attribute Editor, connect a Checker Render Node to the Color attributes.



04 The texture on your model should now appear as a black-and-white image, but will be completely disordered, as the UVs are not yet laid out properly. Select all the objects in the car_body group and apply a planar UV projection by selecting the option box in Polygon UVs > Planar Mapping and applying Fit to Bounding Box with the Mapping Direction set to X Axis as above.



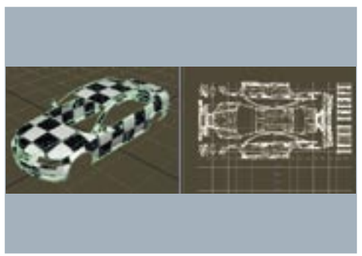
05 The front fascia shown in the screenshot above is mapped in a similar way to the previous step. First, planar map it using the Z Axis setting, then select the polygons facing the X Axis, and map them using the X Axis setting. The two panels are then joined by scaling and aligning them properly, selecting the adjoining edges and using the Polygon UVs > Sew UVs tool.

EXPERT TIP

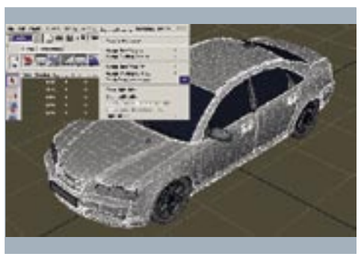
Experimental unwrapping

Experiment with the Cylindrical Mapping option, which is ideal for unwrapping shapes like the wheels or exhaust pipes. New UV unwrapping tools are constantly being developed, either privately by in-house development teams; in official updates for *Maya*; or as freely available plug-ins such as *Pelt* (**www.digidim.info**). New techniques like LSCM (Least Squares Conformal Mapping) would make texturing complex models easier, but for the purposes of this tutorial, a series of Planar Mapping projections is sufficient to lay out the UVs correctly.

STAGE TWO | Creating materials



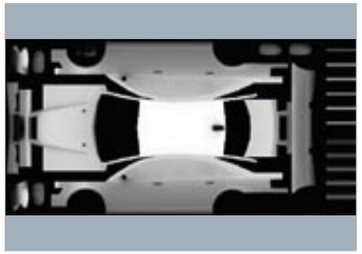
06 Go around your model using a series of planar mappings and manually edit tricky areas by selecting the UVs you want to edit and using the UV Smudge and UV Lattice features. Lay out the UVs so they fit in an area with a 2:1 aspect ratio, so you can later apply a 1024x512 texture. After that, scale the UVs so they fit within the 0,0 to 1,1 area of the UV window.



07 Some games may require an Ambient Occlusion (AO) map: a texture which controls the amount of ambient light each part of a surface receives. Combine all objects in the car_body group, ensuring that no UVs on this model overlap. Create a plane to act as the ground and unhide all other objects. In the Lighting/Shading menu, select the options box for 'Batch Bake (mental ray)'.

08 In 'mental ray Baking Options', use the settings above and select Convert to create the Ambient Occlusion map. The texture will automatically be applied to the surface, which, by default, will be output in the folder called project name\renderData\mentalray\lightMap with the filename prefixed as per the Prefix field (indicated in the screenshot above).

STAGE TWO (Continued) | Creating materials



09 The Ambient Occlusion map might need to be edited, especially for artefacts around aliased diagonal lines and around texture edges. Open the image in *Photoshop* and edit the image so the texture edges disappear and apply a Gaussian Blur filter in Filter > Blur, using a Radius of 1, so the image appears less grainy.

10 The alpha channel will be used to control reflectivity. In *Photoshop*, copy the image to the alpha channel and darken it slightly, then save the image under a different name. As an initial test in *Maya*, create a simple Lambert material and use the newly created AO map to assign it to the Color attribute. Once completed, the map applied to the car should look like the image above.

EXPERT TIP

Paint characteristics

We are creating a very simple car paint shader for the purposes of this tutorial. Developing a 'real' car paint shader which works realistically in a game environment or simulation is considerably more complex, as it would take into account the different paint layers for a base colour, metallic look and gloss finish; and the correct properties for specularity, reflectivity and overlays. Experiment with *Maya's* samplerInfo node and connect the Facing Ratio to a Ramp node to control the amount of reflectivity relative to the camera's viewing angle. This is known as the Fresnel Effect.

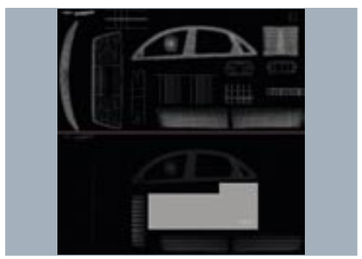
11 To create a basic car paint shader, we will be using a Layered Texture so that the Color can be a combination of the AO map with an adjustable paint colour and controlled reflectivity. Create a Phong material, name it 'mat_Paint' then connect a Layered Texture to the Color attribute. In the Attribute Editor, assign the AO map to the Color node. Change the Blend Mode to Over.

12 Next, click inside the rectangular area marked in red in the image above to add a node to the Layered Texture and change the Blend Mode to Multiply. Adjust the colour and use the Texture Sample window to see the effect of your edits. In this way, the colour properties could be changed procedurally without having to create multiple image files to simply adjust the car's colour.

13 Select the mat_Paint material and connect the AO map to the Reflectivity channel. This will pick up the alpha channel of the AO map. You can tweak the image in *Photoshop* to adjust reflectivity or add another Layered Texture to control reflectivity using a Ramp node combined with a Facing Ratio. Cosine Power can also be changed to a higher value, such as 1000.

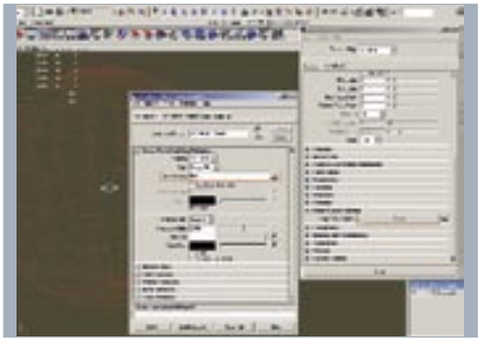
14 Create a front light texture from reference photos (examples are provided on the CD) and add an alpha channel, which will control reflectivity. Create a Phong material, name it 'mat_Lights_Front' and connect the front light texture to the Color channel. Duplicate the texture and use the Dodge Tool in *Photoshop* to create a version that could be used as a glow texture, as shown in the lower image.

15 Create a rear light texture in a similar way, bearing in mind that the alpha channel could control the reflectivity. Create a Phong material, name it 'mat_Lights_Rear' and connect the rear light texture to the Color channel. For the rear lights it may be necessary to create seven separate emissive textures for the various permutations of brake, indicator and reverse lights.

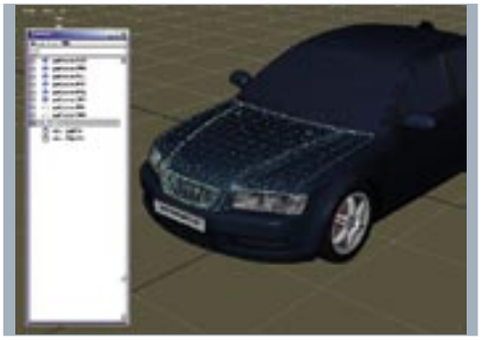


16 A separate material is created for the other parts of the car, such as the grille, windscreen wipers, and antenna. Arrange the UVs of all those parts which will share the texture and create an AO map for them. Use this AO map as an Overlay in *Photoshop* to darken correct areas on the texture map. Open up 4_Complete _Scene.ma from the CD for a list of all materials used for this vehicle.

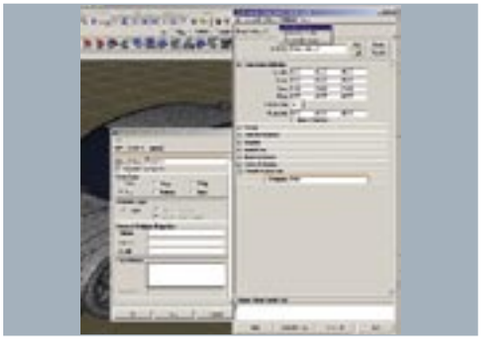
STAGE THREE | Testing and organising the scene for export



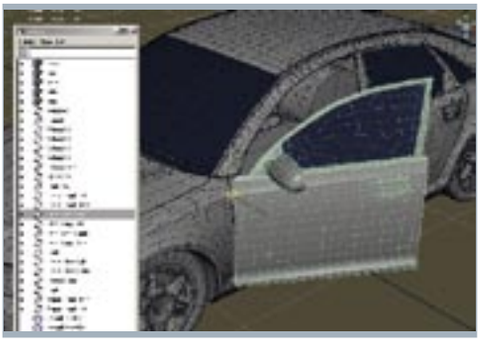
17 To test reflections in the vehicle's surface, you need to apply an environment map. In *mental ray*'s Render Settings, find Image Based Lighting and connect a High Dynamic Range (HDR) image to it. This will create a sphere onto which the HDR image is mapped and projected onto the reflective surface. Note: the scene file on the CD requires building_probe.hdr from **www.debevec.org/probes**.



18 Select all objects and use Modify > Freeze Transforms and Modify > Reset Transforms to reset the pivots of all objects and to ensure that there are no arbitrary transforms on them, as this could make the behaviour of game objects inconsistent. Group all objects and name them accordingly, as illustrated in the scene file. All objects should be neatly moved or combined into separate groups.



19 It's important to name all the groups correctly, as the game engine might take this information to add dynamic attributes to the individual groups. Alternatively, you may need to add custom attributes by selecting the group and opening the Attribute Editor, then selecting Add Attribute in the Attributes > Add Attributes tab. For all materials, the prefix 'mat_' was used.



20 Rotation points need to be set so that the doors, bonnet and boot rotate correctly. Start by selecting the Door_Front_Left group and press [Insert] to enter pivot editing mode. Then move the pivot to the hinge position of the door. Repeat this step for all doors, the bonnet and the boot. For the wheels, use Modify > Center Pivot to centre the pivot to wheel position.

21 Position indicators for effects like smoke, fire, and spark particles may be needed. To create a simple exhaust smoke locator, for example, create a Locator (Create > Locator) and place it at the end of the left exhaust pipe. Name it Effect_Exhaust_Left and repeat for the right side, naming the locator Effect_Exhaust_Left.

22 As a final step, you need to clean up the project and remove all unused and unnecessary nodes. To do this, first use File > Optimise Scene Size and then remove all the History that might have built up over the creation process, by using Edit > Delete All by Type > History.

The specifications for a vehicle in a game environment will always be different and are usually defined by the technical artists or the programmers on each individual project. In this tutorial, we have created a usable vehicle, which, although relatively high in poly-count, is solid and quite basic in its set-up.

From these starting points, the car could easily be adapted for use in virtually any current game engine capable of handling the poly and texture budget. ●