The Glamorous World of Modeling

Ah, the glamorous world of modeling. No, not the high-fashion supermodel kind, but rather the more sundry task of efficiently building our base surfaces.

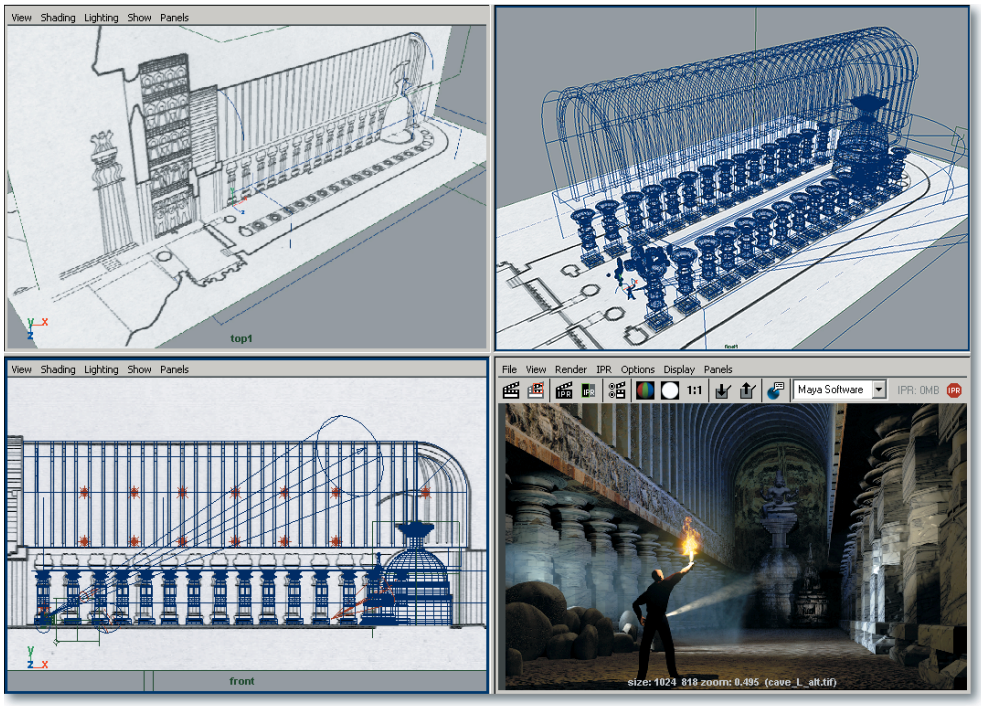
The Glamorous World of Modeling

work smarter, not harder

Luckily for us, Maya is much smarter than your common supermodel. The modeling component in Maya owes its heritage to Alias, which was long considered the industry's pre-eminent NURBS modeler. Because of this, Maya's initial support was stronger for NURBS and lighter on polygonal modeling, but it is now very robust for both methods. Thus, here you will find a mixture of useful tips for both sides of the fence. Just remember that modeling is one area of CG production that, if not approached sensibly and lightly, can lead a team into a world of hurt, making the entire project painful rather than pleasant. So, let's hit the modeling runway—you look FABULOUS!

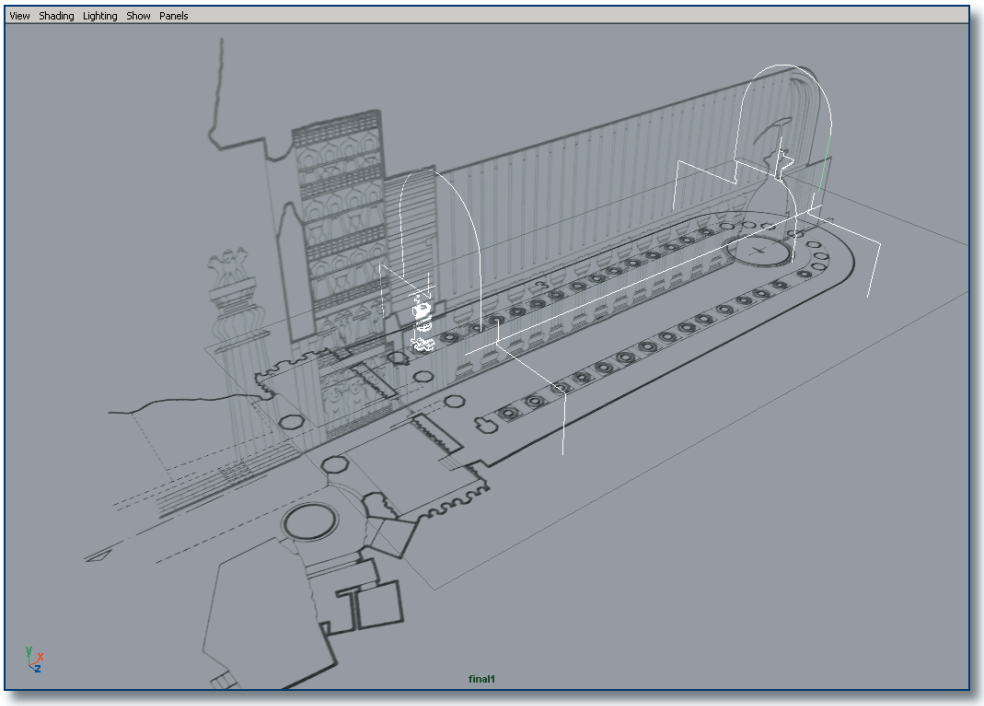
ALIGNED IMAGE PLANES

Because we frequently use three-view source imagery as a starting point for tracing or guiding our work, a useful technique is to use multiple image planes, each reflecting side, top, or front views, respectively. The trick is to align them properly so that we end up with Michelangelo's David instead of your sedentary Uncle Harry. Use View, Image Plane, Image Plane Attributes, Center values to shift the placement of each image plane so that they align with each other. Make sure your original Photoshop images have the same relative scale, or you might end up with your Aunt Edna instead.



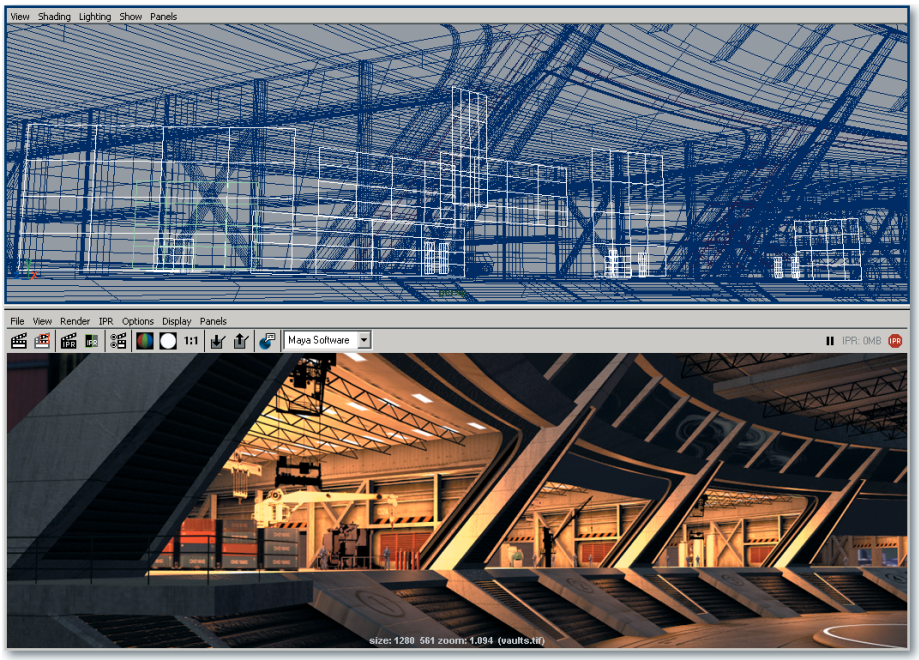
ALPHA ONION SKINS

A variation of the last tip is to map a reference image onto a NURB or poly card instead of using image planes. If the reference image is a drawing or is linework-based, copy the Color channel into the alpha in Photoshop, invert it, save it as a .tif, and then map it with a File Texture to the Color channel in a basic Lambert shader. The alpha will be respected when textured shading is used, turning the card into a transparent onion skin of linework. Next, turn down the Alpha Gain in the File texture node to fade it into the background and align as in the previous tip. Now place them into a layer and use Reference display mode to avoid selecting them during your modeling. They basically become 3D overhead transparencies—a bit more interesting than your garden-variety bar chart, however.



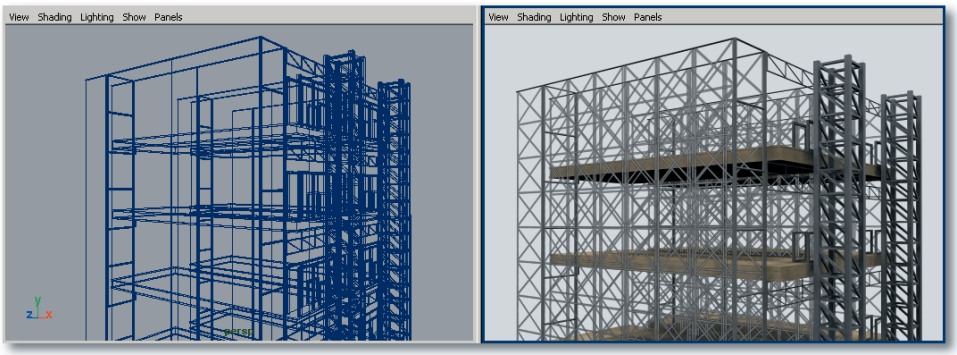
MAYA CARD TRICKS

An excellent strategy for efficient rendering is to augment scenes with scanned images or animated texture maps onto flat surfaces, known commonly as cards or billboards. This is used to optimize an otherwise unmanageable scene or simply to add more detail cheaply. As an electronic version of paper dolls, there are limitations, because the elements must remain roughly perpendicular to the camera and in the background. Cameras cannot roam around them. A good application, though, would be crowd scenes, trees, cityscapes, or otherwise overly heavy background elements. Note that you must match the lighting in your card image to the scene in which they are being placed, possibly resetting some light direction in Photoshop using the Render Lighting filter. You must also mask out the object, making sure that the area outside the object's alpha is black. Now use this map in an Incandescent channel in a Lambert shader and turn the Color channel down to black. Map a file copy of the Alpha channel to the Transparency channel, which acts as a stencil and creates the look of complex geometry with the expense of a single polygon. Animated maps can be used as well, which are useful for tree leaf rustling or pedestrians walking. This very simple trick is used much more than you might think in many well-known film effects scenes. Just goes to show that the best tricks are often the simplest!

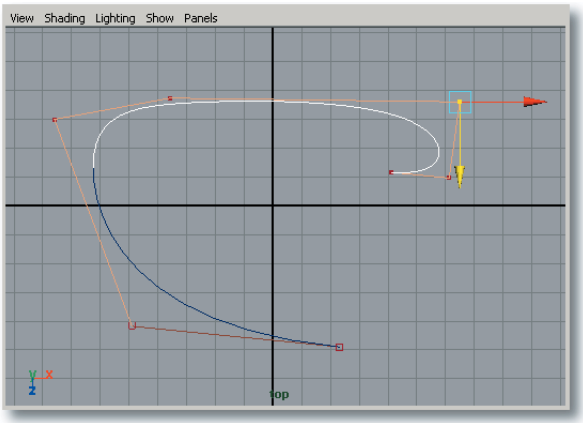


MAPPING VERSUS MODELING

One of the cardinal rules in efficient modeling is never model what you can map. Bump or Displacement mapping can replace surface detail and texture, and Transparency mapping can substitute for excessive repetition of simple elements, such as truss work or piping runs. Distant truss work or piping can be simulated reasonably well using the trick of adding a Bump map of a gradient created by path stroking an airbrush over a truss pattern in Photoshop. This effectively modulates the light normal into a tube-like highlight that otherwise would look flat and mapped.



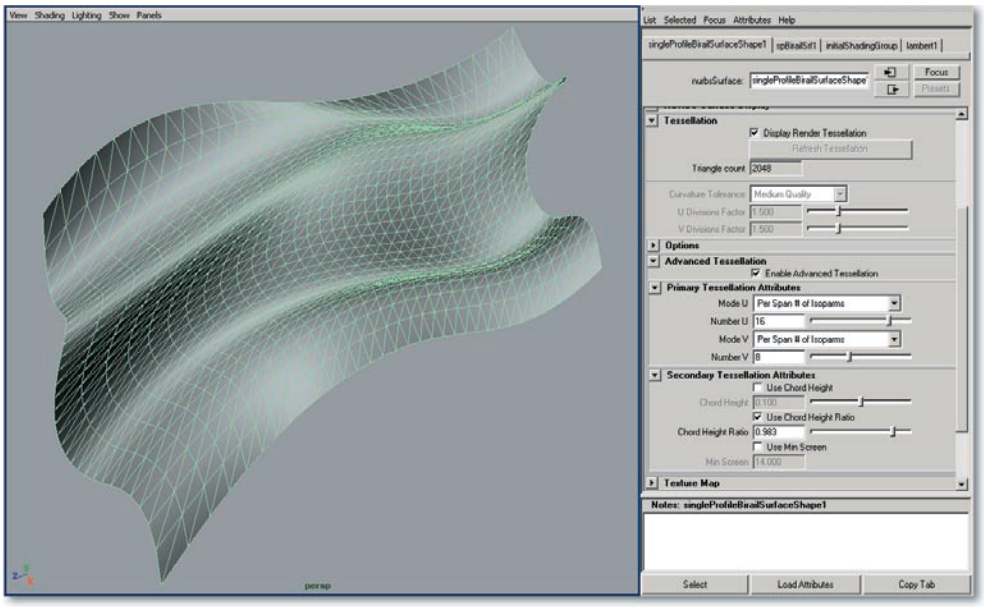
INSERT HERE WHILE DRAWING CURVES



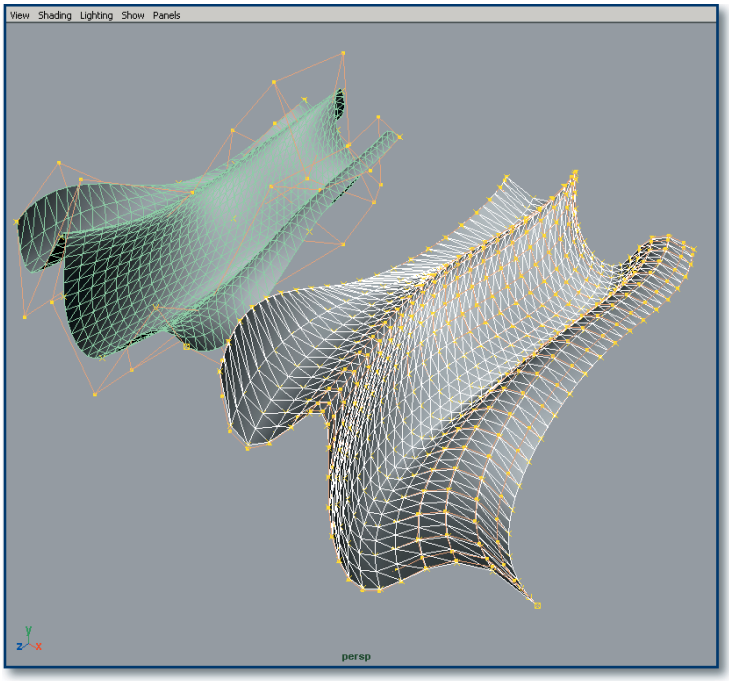
Here is a hot tip for modifying NURBS curves as you draw them. As you place CV points, hit Insert before finishing the command, and you will notice it gives you the transform jack to modify the current CV placement. Now press the up or down arrow, and it will move the jack to other points in succession. Hit Insert again and continue, or finish the curve. Pretty tricky, eh?

EXPLICIT, R-RATED NURB TESSELLATION

Sorry, nothing too racy here, just a steamy hot tip that can dramatically speed your renders and reduce your modeling. Maya breaks a beautifully curvaceous NURBS surface into a polygonal mesh during the act of rendering, and it usually does a reasonable job of setting the amount of tessellation required. But as with all automatic things in Maya, it is best for you to decide what is proper. Pick a NURB surface, go to Attribute Editor, Tessellation, Advanced Tessellation, and enable it. If you check Display Render Tessellation in the Tessellation box above, you can compare what Maya is suggesting to a more optimal setting that you might make. Use Stick to Mode U, V of Per Span # of Isoparms, and raise and lower the Number setting until that chunky monkey becomes as smooth as a baby's behind. And you thought there was no nudity involved in this tip.

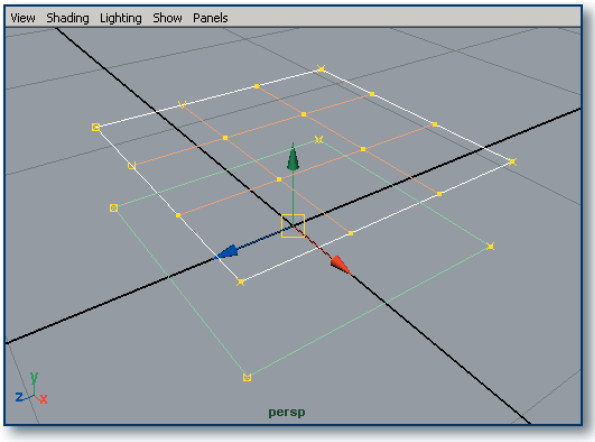


TESSELLATION VERSUS CVS



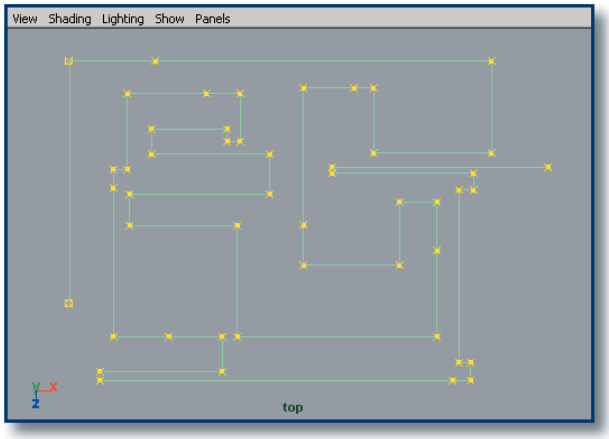
As we just covered in the previous tip, subdivisions are a necessary parameter to define adequate rounding of NURBS curved surfaces. Many fail to consider, though, that within modeling, the biggest factor affecting render times is subdivisions (tessellation settings) and how they are related to CV count. One can easily magnify the render time by multiple factors if subdivisions are not properly understood. For instance, many surfaces have a flat component where a subdivision of 1 is all that is necessary. Remember that subdivision settings are relative to the span between isoparms, not the length of the surface. Therefore, if isoparms and the corresponding CV count are high, fewer subdivisions are needed. The inverse is true as well—if you have fewer CVs to describe an object (a good goal), then more subdivisions are required. You can see this is a push-pull relationship, and there are no magic numbers to define just how many CVs are necessary. Typically, it is best to rely on setting finer tessellation instead of adding CVs, which will build up the file size. The main point is to understand what your settings accomplish and optimize just to the point of noticeable faceting, as dictated by the proximity of the object. Setting manual subdivisions is a tedious affair, but if you integrate it into your workflow after each element is built and drink a pot of coffee at each sitting, it goes unnoticed.

LINEAR VERSUS CUBIC HEROICS



If you envy superhero antics and would like to get similar admiration and respect, try this tip. NURBS models can get notoriously unmanageable in size, often for no good reason at all. In the effort to reduce CV count, a major efficiency step is to use Degree 1 Linear modeling operations over Degree 3 Cubic for flats. The default and often-used setting of Degree 3 creates a minimum of 16 CVs in order to be able to deform a surface freely. Degree 1 restricts the CV count to 4 for a flat planar surface. If the surface never needs deformation and will remain planar (the bulk of architectural scenes or hard models, for example), model with the Degree 1 option. A many-fold savings will result in the weight of your model, creating room for further detail elsewhere. File size will be held down, RAM use will plummet, you will be hoisted up as a true hero, and world peace will ensue (we all hope).

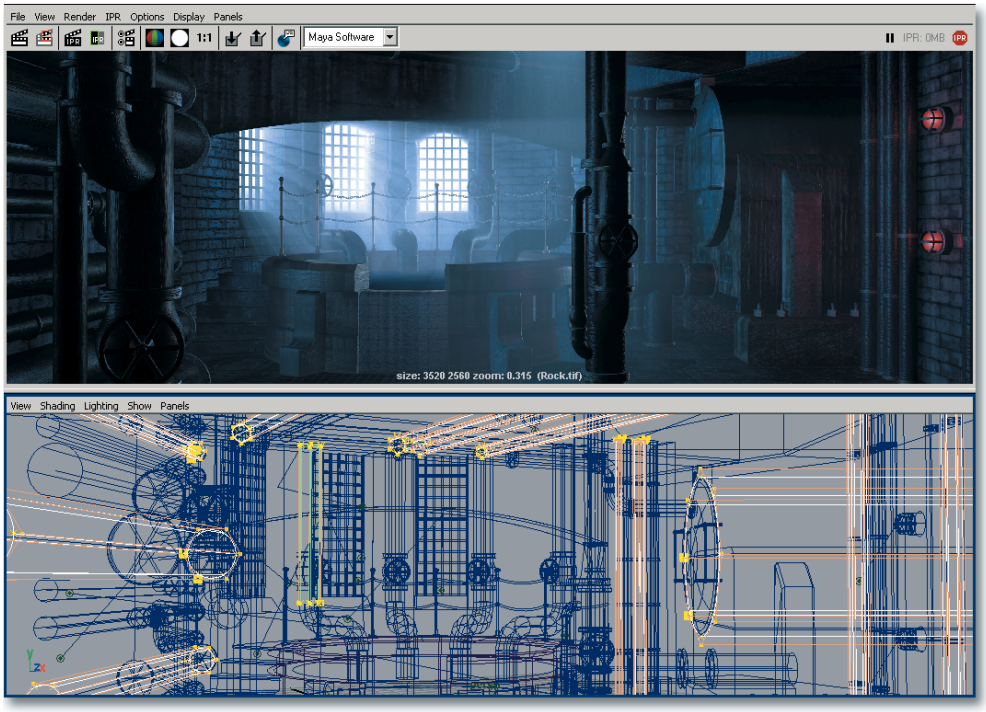
CONSTRAIN THOSE UNRULY CURVES



Here's a handy tip when drawing curves. Maya will constrain the next CV to horizontal or vertical axes with the simple addition of the Shift key. You may have known this since you were in diapers (it's been there since v1.0), but if not, it's a gem.

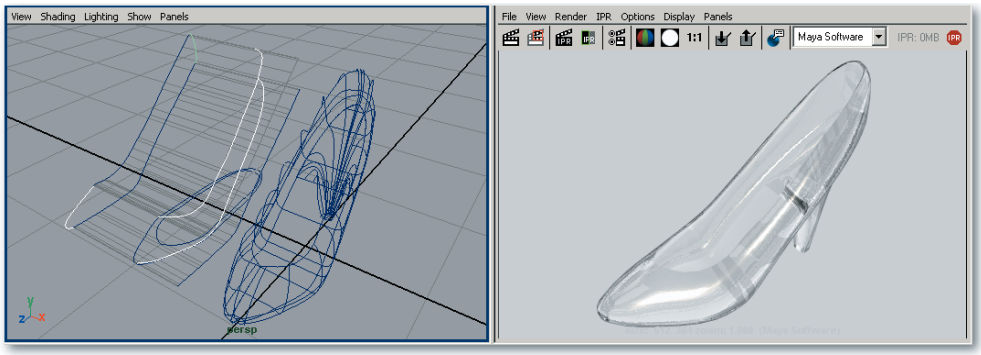
THE REVOLUTIONS WILL NOT BE TELEVISED

In our quest to eliminate unnecessary CVs, another very useful technique is reducing the number of sections in a revolve creation. You will notice that as the revolve sections are reduced, the circular profile becomes more oblong and distorted. For entertainment applications, accuracy is not a great factor, so this can be reduced from the default of 8 down to 4, 5, or 6. Also note that the distortion created will only be noticeable at the end profile, so for piping or tubing, it will appear indistinguishable from a higher section element. Again, this will vastly reduce CV count if the model has a fair number of revolves, such as a grimy boiler room containing huge amounts of pipework. Also, it helps to reduce midsection CVs on straight runs by lofting between two circles using the Degree 1 Linear option with 4, 5, or 6 CV circles (not the default 8).



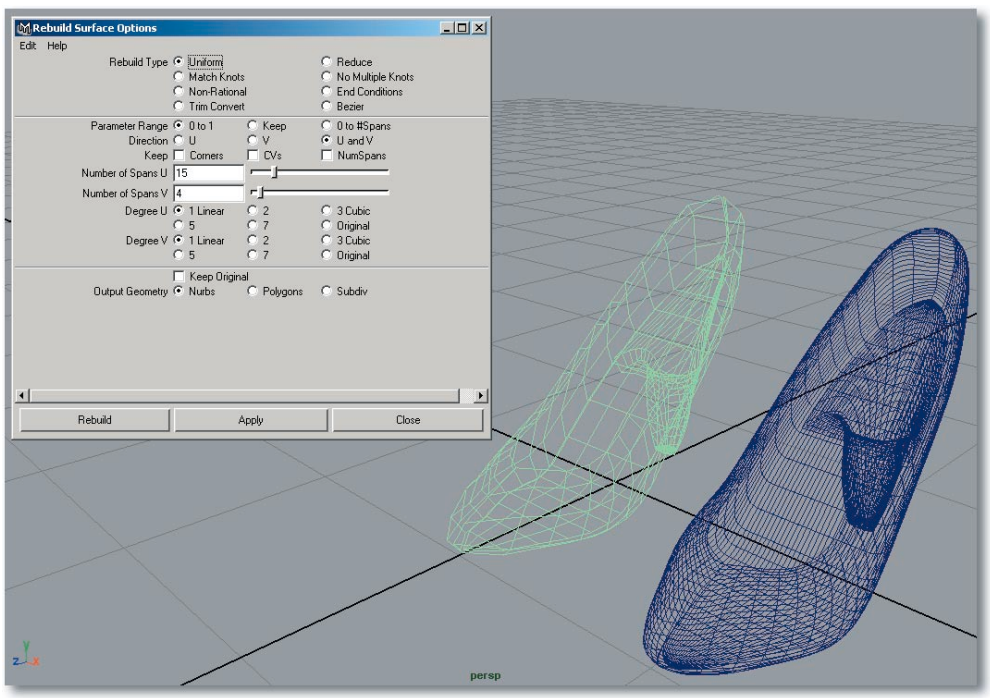
BI-RAILING THE MISSING GLASS SLIPPER

If you ever find yourself needing to model a glass slipper for a CG feature animation involving fairy tales (it HAS happened), there is no better way than using the wondrous Birail command. This example is intended to show how Birail can solve some particularly sticky topologies, such as a shoe, by effectively sweeping a changing profile across two guide rails. If you can conceptually break forms down into this scenario, it can work wonders. In this case, draw shoe profiles in the top and side views. Now extrude or loft the side profile curves so that there is a horizontal extrusion that passes over the top profiles. Project a top profile curve onto the extrusion using Edit NURBS, Project Curve on Surface tool. Now pick that Curve on Surface and copy it using Edit Curves, Duplicate Surface Curves. Do the same for the lower profile and attach the side profile curves to the newly created rails. Use Surfaces, Birail, Birail2 Tool to create one half of the shoe. Now use Edit, Duplicate with a negative 1 in the X Scale filed to mirror the other side, giving you a shoe fit for a princess.

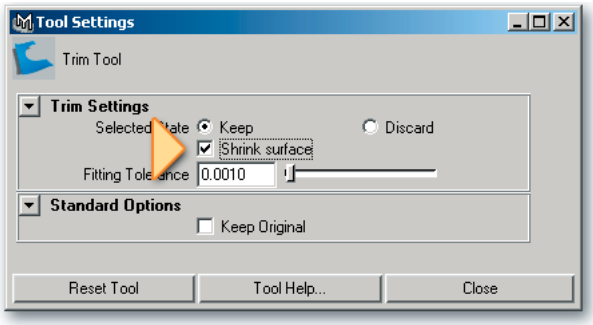


SLIPPER REBUILDING

One of the true great Swiss Army Knife commands in your modeling toolbox is Edit NURBS, Rebuild Surfaces. You can change U and V Degree, direction, and number of parameterization spans while retaining the boundary and shape of the surface. This comes in handy when optimizing surfaces or creating the right spans for animation behavior. Let's look at the shoe modeled in the previous tip. Let's say it is too heavy for a real-time game. Turn Spans to 1 and 1 and output to Polygon Quads. This is a NURBS command that often is more flexible to use than the NURBS To Polygons tool. Now let's say that we need to up-res the shoe for a close-up in an ad campaign. Turn Spans up to 20 and 20, output back to NURBS, and we have a gleaming glass slipper worthy of close inspection.



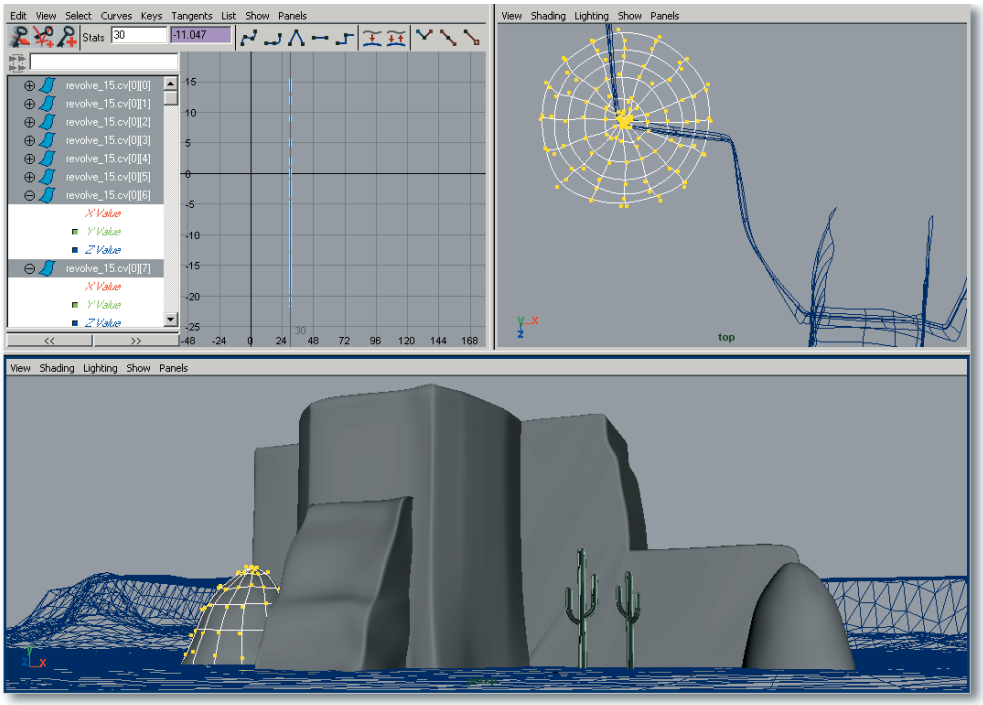
SHADY, UNDESIRABLE ELEMENTS IN MAYA



Maya sometimes provides tools that are initially attractive but end up creating problems in the production pipeline. An example is Trimmed Surfaces, an unavoidable and useful tool for creating odd shapes or holes in NURBS. Trims actually do not reduce ultimate geometry, though. Instead they offer what is in effect a masking of what is underneath. Alternatively, it is useful to create the trimmed surface, use Edit Curves, Duplicate Surface Curves to pull the profile curves, and then Loft or Birail derivative surfaces if possible. Another option is to use the Trim Tool option of Shrink surface. This will reduce the Trim to actual geometry instead of "hiding" it. Holes are a bit more of a problem, but they can be re-created by breaking the surface into discrete patches, or even by trying a transparency map instead. Another problematic command is Surfaces, Planar. A Planar face is a convenient way to create odd perimeters, but it suffers from the same Trim problems. Again, try a collection of patches with a projection map to make up for it, or better yet, use a polygonal surface for such shapes. Lastly, avoid using Edit, Duplicate with the Instance option on. Instances only reduce the working file size of the model, but when going out to render, they don't offer any savings. Therefore, a false sense of security can result as your file grows to unrenderable sizes, even though the file size might be tiny. Worse, Instance copies can create problems when grouping or ungrouping.

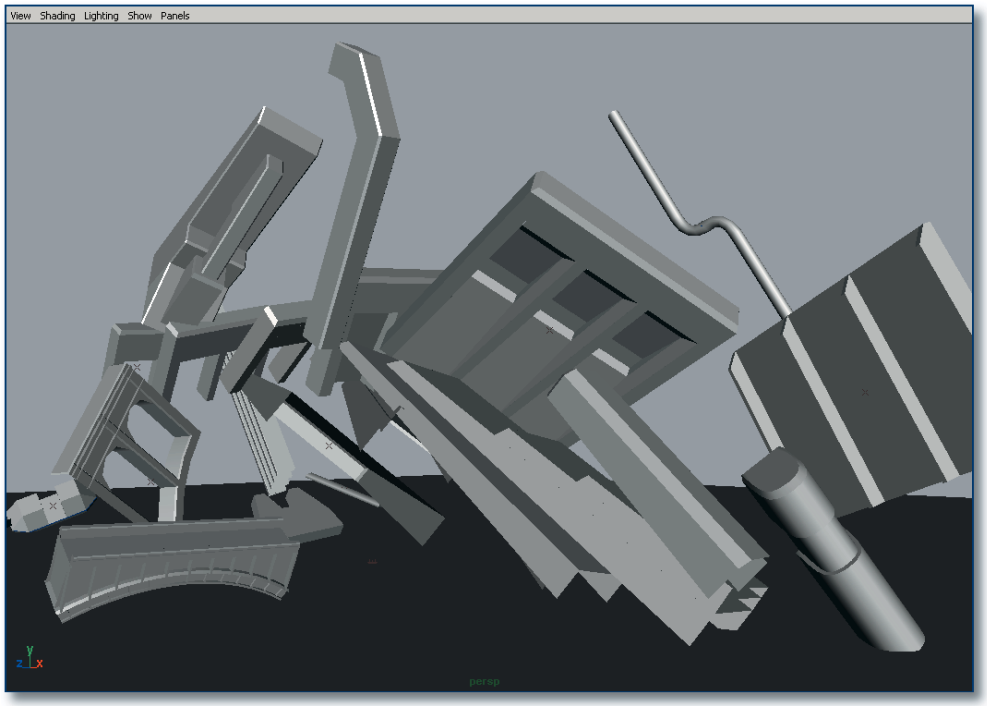
RANDOMIZE THOSE CVS

Here is a great trick for deforming objects without deformers. Say what? Actually, this is a very easy way to slightly perturb surfaces without taking the time to tweak a deforming operation. Simply take a NURBS or poly surface that you want to randomize, select all CVs or vertices, and set a keyframe on them. Now open the Graph Editor and use a MEL randomizing script, such as RandKey.mel, found online at a site such as Highend3d.com. With the script, randomize the value, not time, and update on the Time Slider. The surface will be either too subtle or totally wrecked, so adjust accordingly. After adjusting it to your liking, delete the animation on the surface because you will be carrying a lot of animation baggage you don't need.



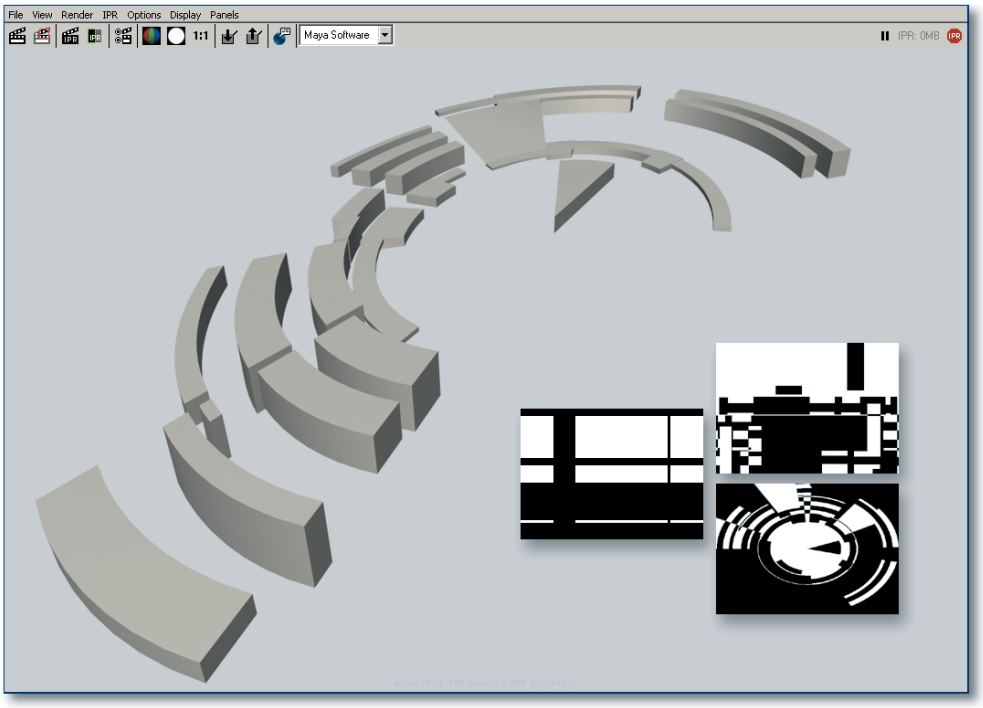
JUNKYARD DUMPING SIMULATION

Need to model a junkyard with piles upon piles of random objects, all resting on top of each other? You could painstakingly orient each one manually, or you could try this Killer Tip. Take the objects to be piled, raise them up in the air above a plane set at ground level, and with them all selected, choose Soft/Rigid Bodies, Create Active Rigid Body in the Dynamics menu set. With all of them still selected, select Choose Fields, Gravity. Now pick the ground plane and choose Soft/Rigid Bodies, Create Passive Rigid Body. Then play back until the pieces fall onto each other in a jumbled heap, saving you hours of tedious monotony. Aren't 3D apps great? Don't forget to lock down the objects and delete the extra dynamics baggage on the objects by choosing Edit, Delete by Type, Rigid Bodies.



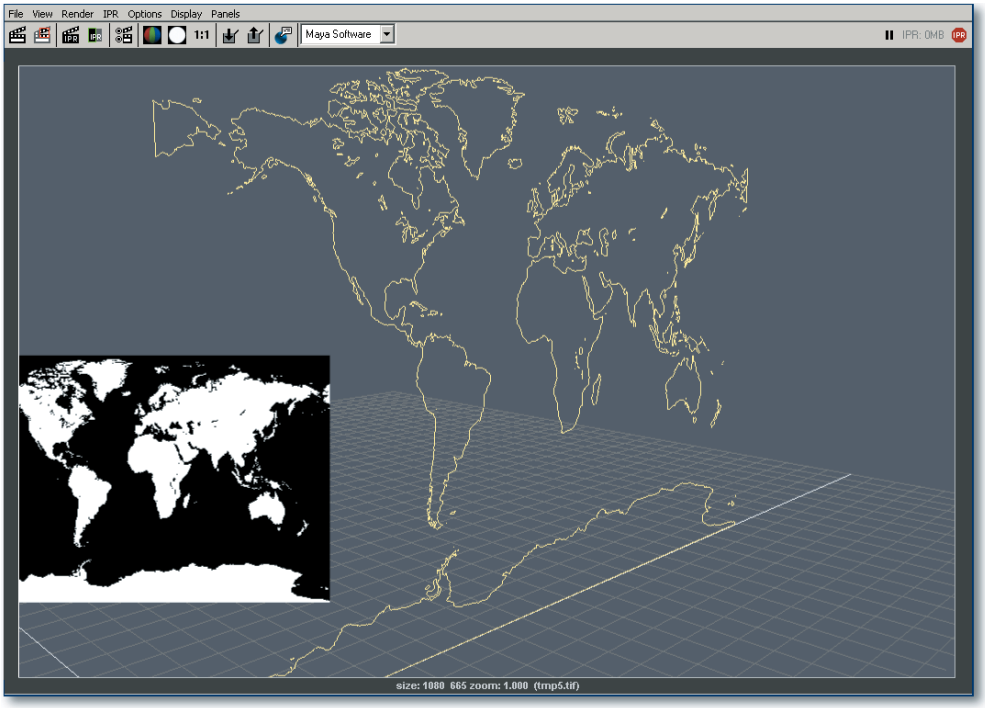
USE OF PHOTOSHOP AS A MODELING TOOL

Photoshop a 3D tool, you say? No, this is not a sneak preview of version 10.0. Instead it's an often-overlooked filter that's been available in Photoshop since version 1.0, found under Filters, Distort, Wave. Sometimes intricate design work needs to be generated for 3D modeling details, and this trick can speed up that process. First, start by drawing basic linework in Photoshop using marquees or lines. Then use the Wave filter with a very small number of Generators, perhaps one to two. Choose Square as the Wave shape, and select Repeat Edge Pixels. You should have a nice garbled and unusable image at this point. To make it shine, turn the Wavelength and Amplitude down very low and tweak as desired. When an aesthetically interesting pattern is formed, this can be autotraced as described in the following Killer Tip and implemented in your model as what the FX industry affectionately calls "Greeblies," or sundry tech details.



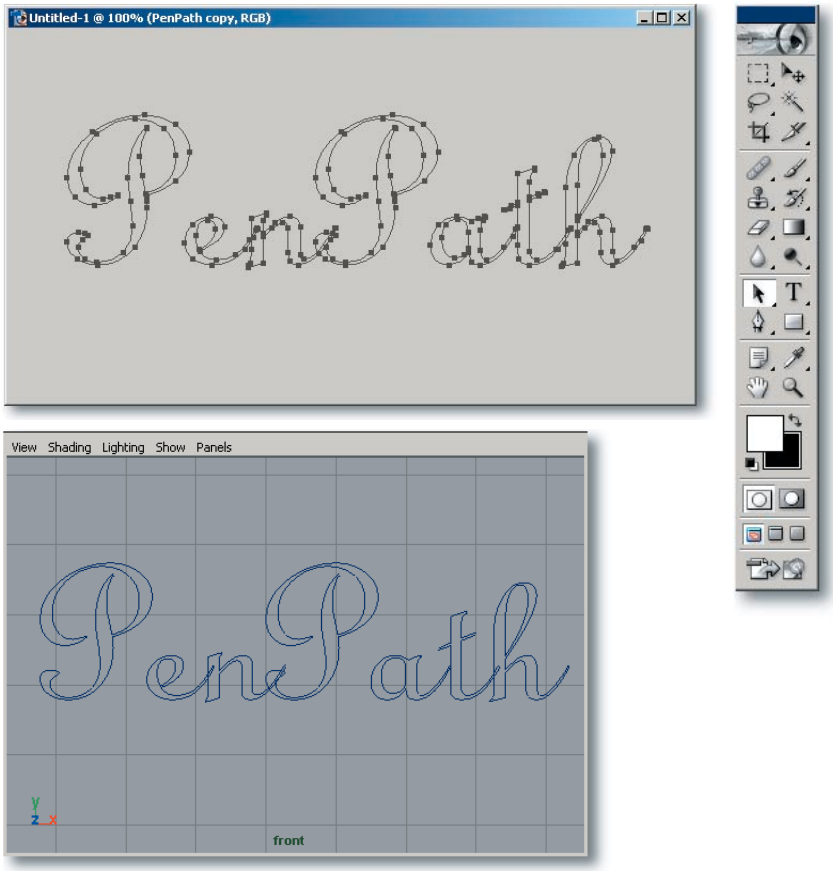
AUTOTRACING FOR FUN AND PROFIT

Frequently, we are asked to do things we would rather not do, such as trace the entire shoreline of every continent on Earth. If you are paid by the hour, this might seem like a good deal, but another approach is to automate such menial tasks, which, if I remember correctly, is why computers were invented. Unfortunately, we do have to trace intricate artwork primitively on occasion with NURBS curves, so a rather nice alternative exists using a package designed primarily for graphic artists—Adobe Streamline. After scanned raster artwork is vectorized in this package, most graphics users will fail to see why DXF is provided as an output file type. 3D geeks will certainly see this as a GOOD thing in Martha's words, so at the push of a button, the work of a million monkeys is performed, and all the coastlines are yours in very fine detail (CV count) if desired. Remember that Maya DXF import in version 5.0 requires you to load the Dwg Translator plug-in from Window, Settings/Preferences, Plug-in Manager.

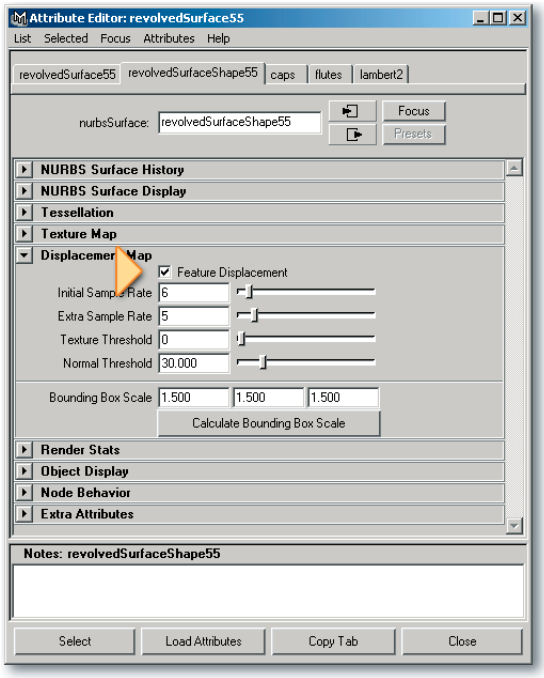


PHOTOSHOP PATHS TO MAYA CURVES

Here's a real magic trick for you Photoshop enthusiasts. Make a path in Photoshop, and then export it in Illustrator format. Now move over to Maya and recall that there was an Illustrator import option. Open the .ai file, and low and behold, it becomes a beautiful NURBS curve, with CVs placed wherever you put a path point in Photoshop. Now here's where it gets really good. Text in Photoshop has a Convert to Work Path command under the Layers menu, so any of the multitudes of fonts you have loaded in Photoshop become yours in Maya. Lastly, the autotracing that the previous Killer Tip pointed out with Adobe Streamline can effectively be done in Photoshop by using the Magic Wand or Color Range tool, converting into a Work Path, and sending the curves over to Maya for more fun and games.



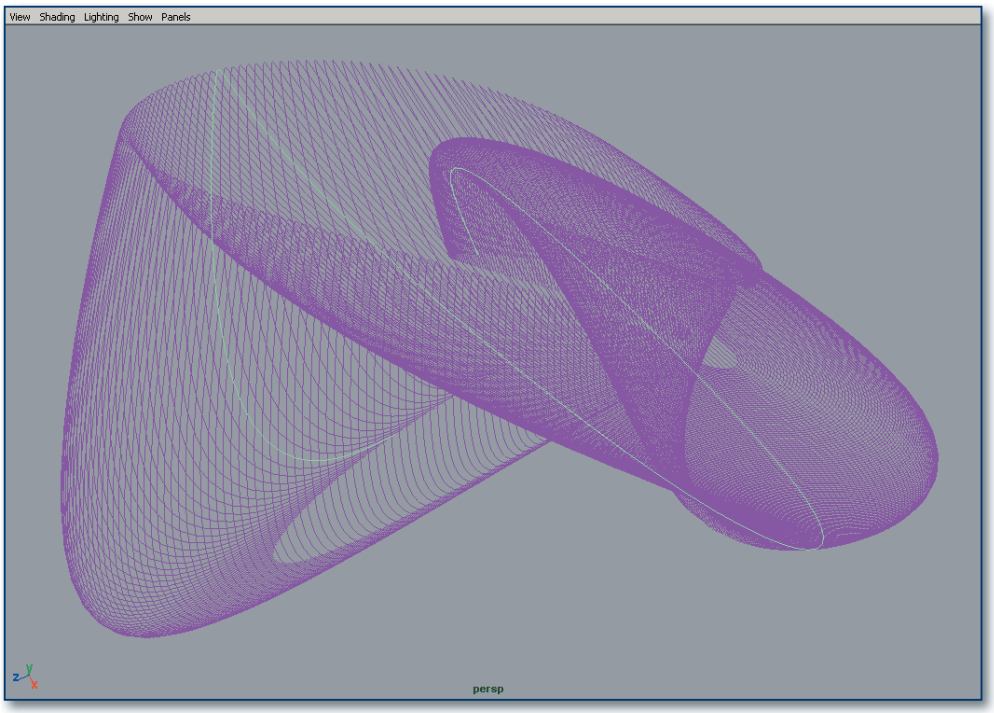
WRESTLING WITH DISPLACEMENT



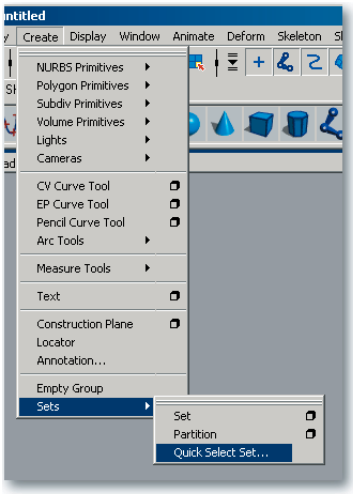
Displacements are one of the truly great, as well as truly painful, features in 3D. They are a magic bullet for creating detailed modeling that otherwise would be prohibitive or wildly heavy. But there is no free ride in life or CG, and displacements are a good example. Challenges arise when you try to get the exact resolution without artifacts, minimize RAM, and preview to facilitate camera animation. Maya has added Feature Displacement as the default method for tessellating the surface intelligently so that triangles are created only where they need to be. The problem arises from artifacts unique to this method, so you should first adjust Initial Sample Rate to capture the detail required, then start Extra Sample Rate at 0 and inch upwards to eliminate noise but retain detail. This differs from the older method of setting explicit NURBS tessellation to achieve detail. Feature Displacement should also help to alleviate the high RAM loads from earlier methods. Finally, to preview results, you need to convert to polygons via Modify, Convert, Displacement to Polygons. The mesh that is created can be only used for previewing, and then it must be discarded or hidden for final renders. If the mesh comes in too large, turn off Feature Displacement in the object's Attribute Editor but check back on render time.

ANIMATE YOUR MODELING

Two animation commands can have great utility when modeling—Animated Snapshot and Animated Sweep. If these are new to you, you are in for a treat. Both are found in Animate in the animation menu set. Animated Snapshot creates a copy of an animated object at selected frames along its performance. This can be used for abstraction or modeling utility if the animation is set up for that purpose. Animation derived from Expressions or IK will not be respected, though, so use Edit, Keys, Bake Simulation first. Animated Sweep differs in that is uses curves only, but it has the strength of being able to construct a monolithic surface from the animation. It is conceptually an extrude based on an animated path. Both of these are processing-intensive, but performance can be improved by turning off Construction History.

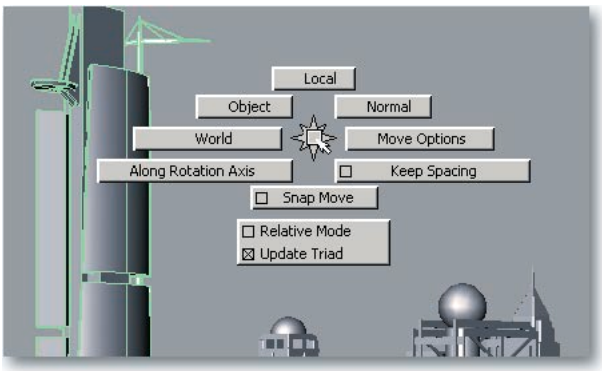


SET SUBTLETIES



Grouping elements is typically useful for animation of those elements or for character work. For simple selection and hiding purposes, layers offer a nice GUI. But what if you need to preserve your carefully assembled selection of various objects, lights, and lattices without disturbing their existing grouping? Enter sets, a wonderful way of saving selections without the data overhead of groups or layers. Definition-wise, sets are useful for purposes beyond simple selection, partitions are for exclusive membership, and Quick Select Sets are the preferred type for general selecting. Make your selection and go to Create, Sets, Set/Partition/Quick Select Set. Enter a name, and then deselect the object. Do other work, and then go to Edit, Quick Select Sets, *your set name* to reselect that group without the tedium of carefully selecting a grouping again. Problem is, only you will know how clever you are.

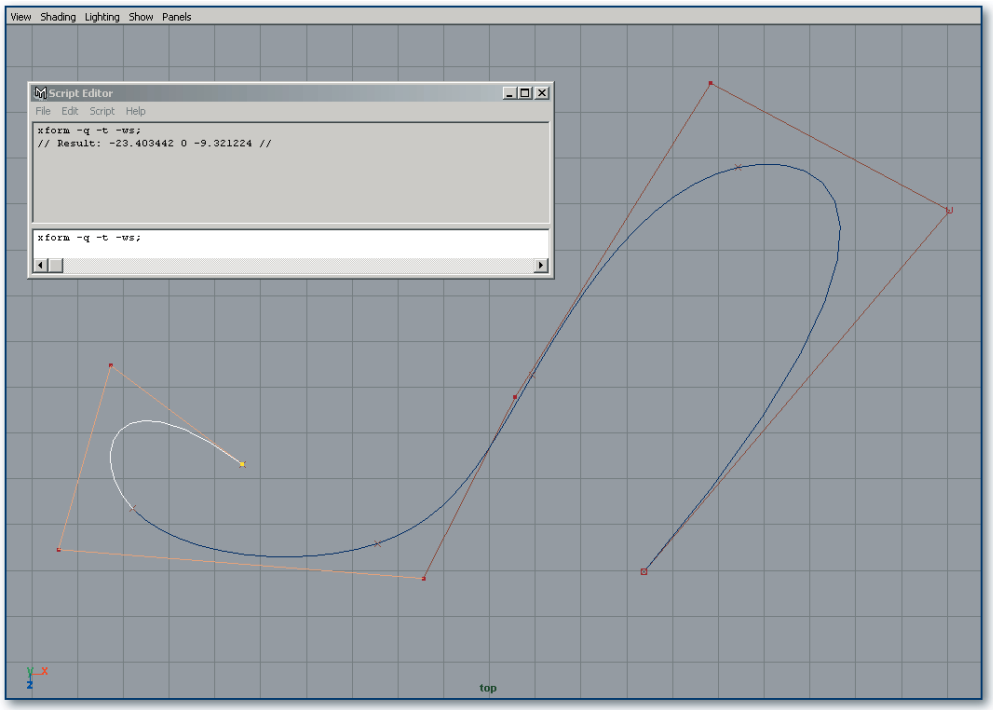
TRANSFORM TOOLS SHORTCUT



Here's a handy little gem when needing to push and pull points or objects around in different orientations. Select an object and hit the usual w, e, or r transform shortcuts, but in this case, keep it pressed, and press the left mouse button anywhere on screen. You are presented with the same options as when you double-click a transform command such as World, Object, or Local Space selection. Quite a timesaver when manipulating points.

INTERROGATING POINTS AS TO WHERE THEY LIVE

Finding the exact location of a pivot point or object center is trivial, but on occasion you might need to find the exact coordinate location of a CV or poly vertex. Make a point selection, open the Script Editor, and type this to call back the X,Y,Z coordinates: **`xform -q -t -ws;`**.



FACE PROPOGATION VIA SHELL IN POLY SELECTION CONSTRAINTS

I had to use one tip title that sounded pretty technical, so here you are. This is actually a straightforward but powerful trick that can save a lot of hair roots. Pick a poly object, go into Face Component mode, and pick a face. If you now need to pick all connected faces, this can be a chore because of model complexity and/or overlapping UVs. The hot ticket here is to propagate face, vertex, or UV selection using Edit Polygons, Selection, Selection Constraints. When open, choose Shell Propagation and then select Close and Remember. Now pick a face, vertex, or UV, and every one related to that one will be picked automatically. This also comes in handy when trying to separate and manipulate groups of related UVs in the UV Texture Editor.