

Design, Visualize, and Create with Autodesk® Mudbox®

Craig Barr - Autodesk Media & Entertainment

AV5314-P Autodesk Mudbox is now available in Autodesk Design Suites spanning many different and diverse industries. The use of Mudbox has expanded beyond feature film and games to other industries, including architecture, manufacturing, design, and science. This class will examine how Mudbox is being used in a variety of creative and industrial disciplines. We will cover using Mudbox for concept creation, design, visualization, detailing, texture map extraction, sculpting, and painting. This class will explore the power of Mudbox as a unique, diverse, and tactile digital content creation tool. We will also discuss how you can extract data from Mudbox to use in Autodesk 3ds Max®, Autodesk Maya®, Autodesk Alias® Design, and other applications.

Learning Objectives

At the end of this class, you will be able to:

- ...appreciate how Mudbox, as an effective digital content creation tool, can overcome practical design and workflow challenges
- ...integrate Mudbox into any workflow
- ...utilize Mudbox as an effective concept design and visualization tool
- ...use Mudbox to produce and extract high-resolution detail maps for use in other applications

About the Speaker

Craig Barr is a Technical Marketing Specialist at Autodesk specializing in Mudbox® and Maya®. Before joining Alias/Autodesk in 2005, Craig worked in feature film, commercial, and games production. Craig has most recently been published in 3D World magazine (April 2011 issue) presenting a creature design, sculpting and painting workflow as well as a chapter on vector displacement mapping in Mudbox for the book Game Development Tools (May 2011). He also runs the Mudbox blog on The Area <http://the-area.com/blogs/craig>



@The_Mudroom

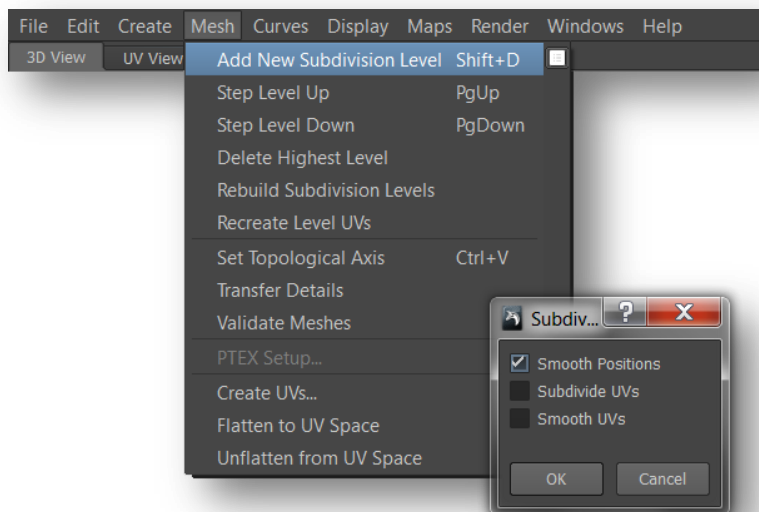
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Focus 1 – Concept Exploration Strategies in Architecture

Mudbox provides an excellent way to explore design concepts in a tactile, iterative, hands-on manner, freeing the designer from a traditional, linear design process. The ability to quickly sculpt up concepts, build up variations in the same file and then produce quick renders makes Mudbox an asset to any design toolset. In this section, we will examine Mudbox as a freeform exploration tool, and, as an effective detailing tool for external applications.

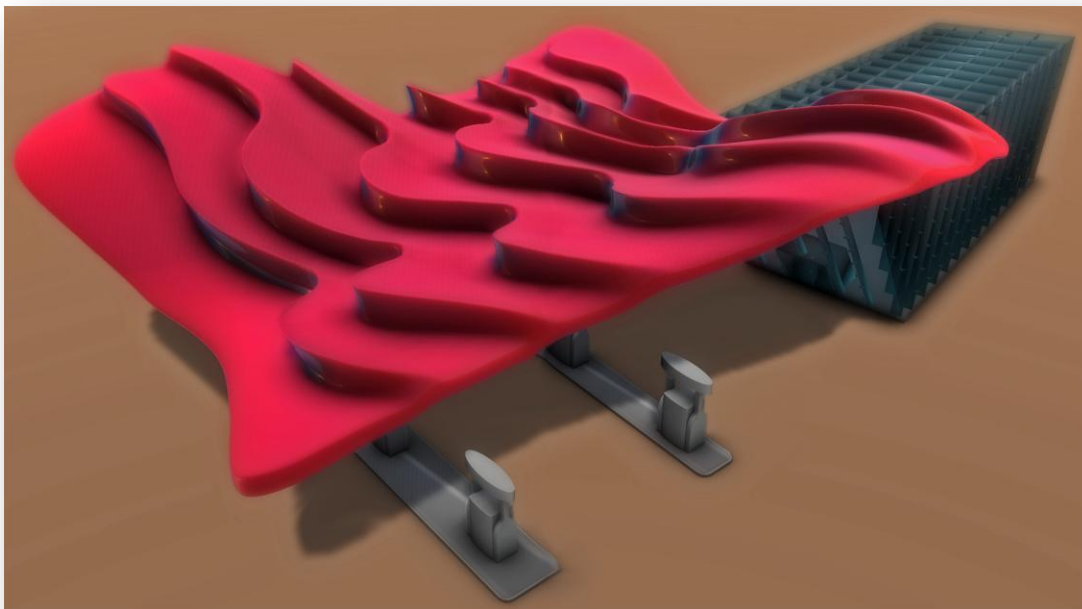
Undulating Waves

- Mudbox allows for infinite layers. Take advantage of this and always work with layers. This is a very powerful way to preserve sculpt and paint history as well as an excellent way to store design iterations.
- Take a look at the Subdivision Menu:



- Meshes can be subdivided to round-out or “smooth” any angles (with *Smooth Positions* enabled), or to lock any sharp or faceted areas (*Smooth Positions* disabled). These two methods can also be blended (ie. to preserve some edge or corner hardness). Start by subdividing with *Smooth Positions* off for a few levels and then enable it for a few more levels.

- Use the Freeze brush on areas of the mesh that you do not want to be altered by sculpting activity (subdivision level dependent). Freeze-paint “hard point” areas that you need to conform to existing engineering or structure
- The default stamps and stencils provide excellent starting points for sculpting. Mudbox 2012 added a few new Vector Displacement Stamps that provide more precise and interesting sculpting effects (for more info, see the Vector Displacement section in this document). Sculpting details on separate layers allows for blending and multiplying the overall strength of details (Mudbox allows you to use negative and positive values beyond 0 and 100)



- Use shadows and Ambient Occlusion (in the Viewport Filters tab) to accentuate and clearly define your sculpting

Tip:

- Mudbox 2012 SAP has the ability to preserve hard edges and creasing from Maya, Max and Softimage

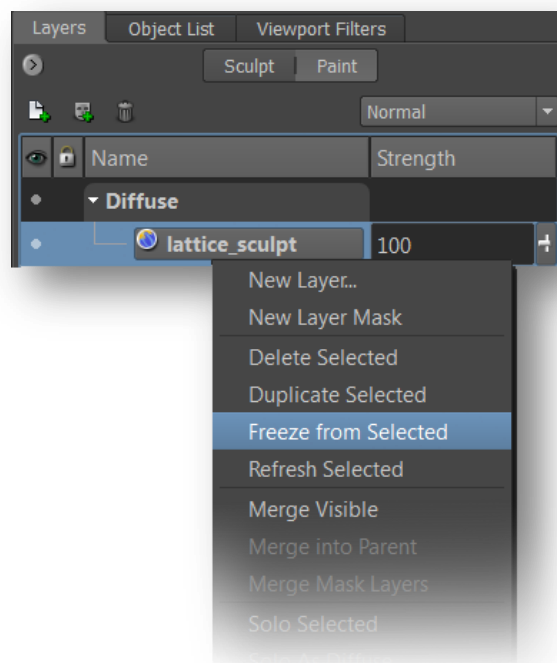
Lattice Structures – Rapid Creation of Complex Shapes with Images

Using existing images to sculpt details within Mudbox is nothing new. Sculpting and painting ultra high-resolution detail from existing photographs, textures or illustrations is something that Mudbox excels at. Here, we examine a technique that is a very powerful way of taking 2d patterns and visualizing them in the form of 3D structures. We can either paint directly on to the surface, import existing images or do a combination of the 2. Either way, the white levels from the image are what we will use to freeze the surface and sculpt interesting details. This technique is very simple and fast to work with, so it is an excellent way to produce rapid concept visualizations.

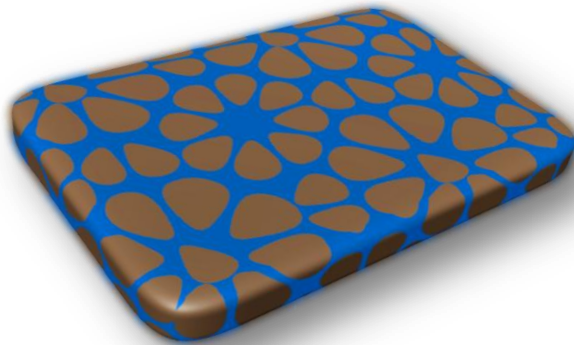
- Paint with white or import white images. Freezing will only affect the non-white areas. You can achieve gradual fall-off sculpt effects with soft, gradient-frozen areas.



- o **Freeze** - Locks affected vertices so they cannot be modified while you sculpt. You can freeze vertices on the base subdivision level as well as on sculpt layers. By default, frozen faces appear blue.
- Use *Adjust Color* to define the black/white difference in your images (presets available in Mudbox 2012 SAP)
 - Be sure to employ “*Freeze from Selected*” on an adequate level of subdivision (usually a higher resolution to produce solid details)



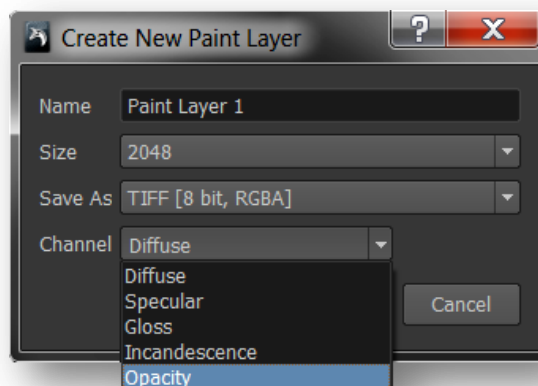
- Turn off the display of your diffuse paint layer to see the frozen versus non-frozen areas of the geometry. Anything in blue will not be affected by sculpting.



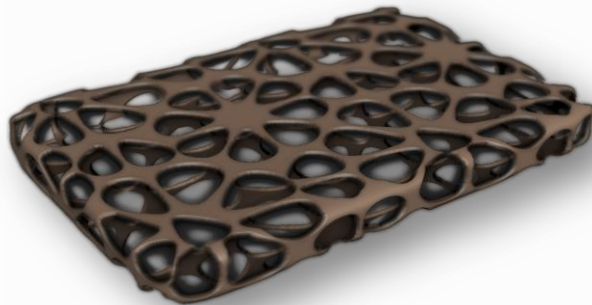
- If you want the opposite of what is frozen, use *SHIFT+I* to invert the freezing (*Shift+U* to unfreeze all)
- Always store your details on NEW sculpt layers
- Using the sculpt tool, set the *Strength* to a value of 5 (the strength is dependent upon the values of your texture map (a lighter texture map will need more sculpt strength...but this isn't all that crucial as you will see ahead) and scroll down and hit "Flood"
- Flooding applies the tool uniformly, across the entire surface, and will only affect areas that are not frozen
- You can now quickly adjust the depth of the sculpt by adjusting the layer strength (use negative values to sculpt in the inverse direction)

Creating quick cut-out effects

- Duplicate the diffuse texture layer that you used to freeze the geometry
- Create a new Opacity layer



- Right-click on the duplicated layer and select *Adjust Color*
- Adjust the value to -100 to invert to black (2012 SAP also has an *Invert* preset built-in)
- Drag the duplicated layer to the Opacity channel
- Goto *Display>Show Both Sides* (or Shift+B)
- We now have some transport “windows” where our original texture was
- Right-click on the object and stroke upwards to *Edit Material*
- Change *Opacity Affects* to *All Channels (Cut Out)*



Quick Deformers:

Grab Brush:

- Use the Grab brush to pull, push, stretch or squash your geometry
- Adjust the falloff for varied effects (ie. a soft, flowing effect or hardened, blunt effect)

Tips/Tricks:

- Click the Grab brush in screen space, away from the geometry and drag inwards. You will produce an effect much like that of an external force deforming the silhouette of the geometry.
- Enable *Grab Silhouette* to provide even deformation of the middle axis of your geometry. When enabled, the tool grabs the front and back sides of the mesh silhouette together to modify it evenly. For better control, use an orthographic view (top, side) when applying this tool.



- **Grab** - Selects and moves vertices based on the distance and the direction you drag. Useful for making subtle adjustments to the form of the model.
 - **Follow Path** - Specific to the Grab brush. Makes the mesh follow the path of your stroke as you pull extensions out with a sweeping gesture. Stroke more slowly to extend the mesh further. When off, the Grab brush pulls extensions out along a straight line.

Tip:

Modify the Direction property to constrain the movement of the Grab tool. For example, XY constrains vertex movement in the XY plane.

Pose Tools:

Pose tools are not just an effective way to generate character poses. They are also handy modeling tools. Effects such as uniform and arbitrary scaling, twisting and bending, and, squash and stretch are all possible.



- **Create Joint** - Lets you create joints on a model for use with the Pose tool. You interactively create a joint, specify its boundary axis for falloff, and the initial size of the area affected by the joint in one operation.



- **Pose** - Lets you interactively rotate, translate, or scale the highlighted weighted region associated with an active joint. The region of influence for a joint is determined by the joint's falloff and weight values.



- **Weights** - Lets you modify the weighted region associated with a joint by applying or removing color in areas you want affected using a paint-like workflow.



- **Move Pivot** - Lets you move the pivot point for an active joint to affect its behavior in relation to the model components.

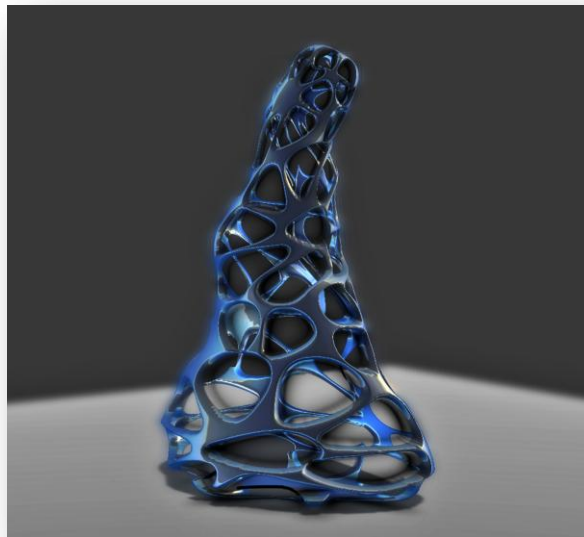
Tip:

- Hold down CTRL while posing to affect the non-weighted areas (opposite effect)

The *Heads-Up Display* window will tell you how to achieve translation, rotation or scaling of your model.

To produce a twist effect with Pose Tools:

- be sure to place your joint in an area with large fall-off (the further you drag the green arrow away from the center-weight line, the larger the falloff over an affected area).
- Orbit your view to be directly above the joint and, with the pose tool, click-drag in screen space to rotate and twist around the selected joint

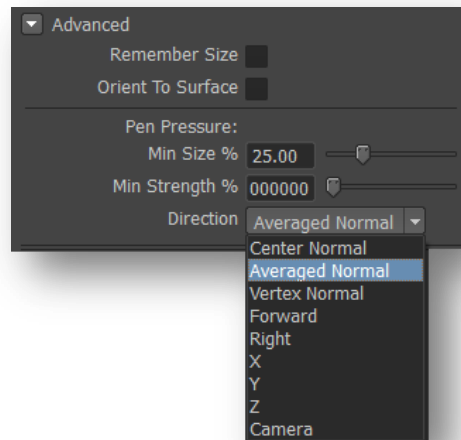


Ornate Detailing with Vector Displacement:

Vector displacement mapping provides an effective and efficient means for the storage and transfer of complex, multidirectional geometric details. Unlike traditional displacement maps, intricate forms with appendages, undercuts, folds, and bulges, such as a human ear can be stored and reused throughout the sculpting and detailing process. Tools and brushes within Mudbox can be customized with vector displacement to provide specific effects on a mesh. Furthermore, vector displacement libraries also allow intricate and complex details to be quickly accessed and reused in a sculpting workflow. The use of vector displacement mapping to help preserve, or maintain, a specific look, design, or style can aid in any sculpting-based pipeline.

Tips/Tricks:

- Always have your Sculpt *Strength* set to 100 in order to receive the full, accurate results from the vector displacement map
- Build-up can be adjusted to a higher value to provide quicker brushing of details onto a surface
- There are advanced settings that provide alternate directions to apply brush strokes. These can be found under the *Advanced* tab in the Sculpt tool properties.



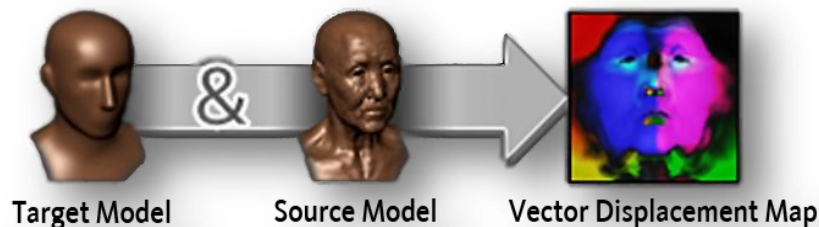
Extracting Vector Displacement Maps:

Use *Relative Tangent* if you plan to use the output vector displacement map primarily for sculpting in Mudbox as a stamp or stencil. In this lesson I am using this approach for sculpting ornate detail.

If you are extracting a vector displacement map for use outside of Mudbox, do not use *Relative Tangent*. If you plan to use the map in another Autodesk application (such as 3ds Max, Maya, or Softimage), use the following guidelines when setting the Vector Space:

For use on an object that will *deform or be animated*, use **Absolute Tangent**.

For use on an object that will *not be deformed or animated*, use **Object Space**.



[Reference links for more information about Vector Displacement at the end of this document]

Focus 2: Traditional Clay Design Approaches and Visualization in Transportation

“Digital Clay”

This section will focus on the use of more traditional approaches to concept exploration within Mudbox. This “digital clay” approach provides designers with the ability to store variations and produce rapid visualizations as well as physical prototypes. Sculpting with clay is a tactile process. Mudbox is the most tactile, hands-on application that Autodesk produces. Many of the same techniques employed in the traditional clay sculpting world can be applied within Mudbox. These include the use of a variety of tool tips for producing varied effects on the surface, using scraping and curve tools, to rubbing texture and painting color. Let’s take a look at some hard-edging and clay sculpting techniques on a car body concept.

- The base mesh can come from anywhere and it doesn’t need to be a car-shaped piece of geometry (starting with a sphere or a cube can produce some very nice concepts for shape exploration).
- The key tools for producing hardened edged surfaces are as follows:



- **Flatten** - Levels affected vertices by moving them toward a common plane. Useful for designing and detailing.



- **Pinch** - Pulls vertices in towards the center of the tool cursor. Useful for more sharply defining an existing crease.



- **Scrape** - Useful for minimizing or removing protruding features. Quickly calculates a plane (based on the vertex positions wherever the cursor is first placed) then flattening any vertices above the plane.

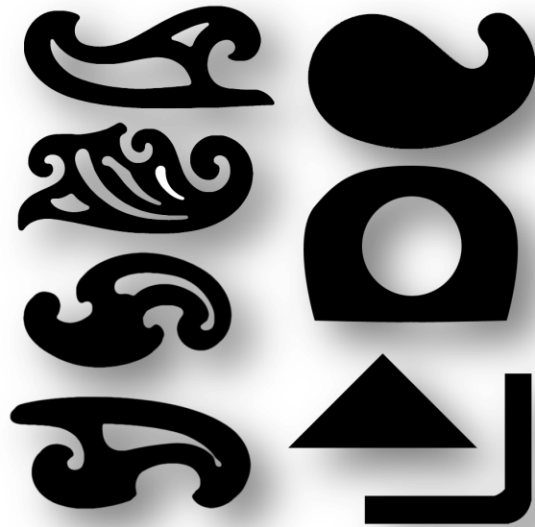


- **Fill** - Fills in cavities on the model surface by calculating a plane (based on the average of the vertices within the tool cursor), then pulling vertices under the plane towards that plane.



- **Sculpt** - Builds up initial forms and moves vertices in a direction determined by the average of all normals within the boundary of the tool cursor. Use the Direction property to modify the default setting (for example, Camera, X, Y, Z and so on). This tool is most-effective for hard-edging when used with stamps (vector displacement produces the best results).

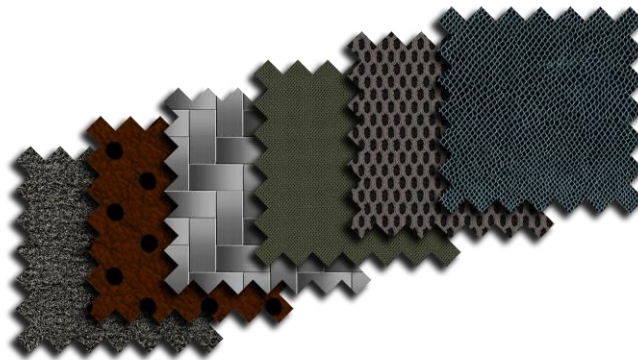
- Using Stencils such as traditional design curves (ie. French Curve) can also help produce some very nice lines and body curves.



- Shadows and Ambient Occlusion help provide some additional depth when checking forms and shapes
- Combing different materials with lighting, HDR imagery, and viewport filters can produce very quick real-time rendering, images and turntables.
- Store iterations of shape changes, details, colors and textures on the sculpt and paint layers
- Create custom material and lighting presets for quick access (stored in the Material and Lighting trays)

Interior Visualizations – Experiencing the details before it is built:

- Build custom camera angle presets to quickly jump to different positions within a vehicle interior (driver’s seat, passenger seat, rear seats, console, etc.)
- Other components are easily imported into Mudbox. In this case we are looking at the car frame
- We can freeze any hard-points to conform to existing structure, always allowing us to “back-up with engineering”
- Paint layers in Mudbox can store infinite material swatches for visualization (colors, bumped and normal mapped textures, opacity, incandescence, specular, gloss, reflections)



- The layers are an excellent way to blend between materials and test different color and texture variations
- Use the projection brush to paint real-world fabric swatches directly on to interior components, seats, carpeting, consoles, etc.

Quick iterations and logo/badge placements: Motorcycle gas tank and seat

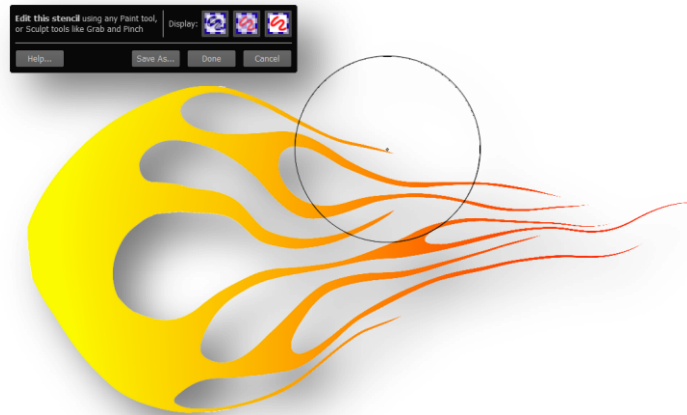
- We are starting here with nothing more than a simple sphere (from the *Create>Mesh* menu)
- Once again, the Freeze brush allows us to quickly lock the bottom of the gas tank geometry to the bike-frame engineering
- Let's take a look at the Grab brush again and begin to shape some gas tank concepts
- Use mirroring to begin to explore profiles
- Enable *Grab Silhouette* – this is where the smooth mid-profile comes in handy
- As per usual, infinite layers are key here to storing many concepts
- Apply some basic materials and begin to adjust the lighting
- The Projection Brush is a great way to place some logos

- o Stencil hotkeys
 - **Rotate** *S + drag*
 - **Translate** *S + middle-drag*
 - **Scale** *S + right-drag*
 - **Activate/Deactivate** *Q*

Editable Stencils:

Goto: *Edit>Edit Stencil*

This is a powerful way of creating your own textures within Mudbox. If you select the tiling option, you can create a tileable texture as well. Mudbox 2012 SAP has an updated version of this that allows you to preview your tiling setup before you begin. The 2012 SAP version also has the ability to create tileable sculpt maps. Combined with falloff, the Grab and Pinch tools are most effective for altering the shape of your stencil. Use any of the Paint tools to alter and create a new texture/stencil.



Tip: Subdivide the stencil you are editing to give you smoother results for shape alteration.

Focus 3: Product Design and Direct Media Creation

When working with other packages, such as Max, Maya or Softimage, Mudbox allows you to bring in cameras and associated image planes, via FBX, to aid in your design process. This is very handy for sculpting and shaping objects to concept art. In this section, we're focusing on how to quickly realize design variations and produce renders that can be used for other media purposes. Mudbox provides a real-time rendering workflow that, in conjunction with a 2D image editing package, can produce some very nice results for print or web use. In this example, a golf club design is explored, textured and rendering using some render pass techniques from Mudbox and composited in Photoshop. Using a combination of material settings, lighting and viewport filters, it is very easy to generate render passes such as: specular, flat diffuse, alpha, ambient occlusion, cavity (detailed ambient occlusion), shadow passes, reflection and z-depth. Splitting everything into passes provides plenty of control over

your final image. The rendering of images and turntables in Mudbox can be found under the *Render* menu set.

For more information on Render Passes in Mudbox, take a look at my video here:

<http://www.youtube.com/watch?v=DGuUpnc-X1U>

Viewport Filter tips and tricks:

Tonemapper: The *Adaption* parameter provides accurate feedback to lighting changes when orbiting around in the viewport. In essence, *Adaption* is taking into consideration the changes from specularly, reflection, etc. cast from the object to the camera and updating the view accordingly. Tuning *Adaption Time* and *Epsilon* down to zero is an excellent way to “lock” the overall lighting for screen renders.

Ambient Occlusion: This filter can be quite GPU intensive in the viewport, although it does produce some very nice results for rendering. Turning the number of casts and directions up to a much higher number will produce smoother results. Enable “Only AO” to preview the results on your object against white.

Cavity Map: Cavity maps are an excellent way to emphasize finite details on a surface. Cavity maps are very useful for giving your image that final “pop” for details. For more information on how to work with Cavity Maps in Mudbox, check out my article and video in **3D World Magazine** here:

http://the-area.com/blogs/craig/tips_and_tricks_generating_cavity_maps_in_mudbox

For more information regarding Vector Displacement:

Craig Barr (2011). ***Vector Displacement in the Sculpting Workflow***. In: M. Ansari, ed. 2011. ***Game Development Tools***. Boca Raton, FL: A K Peters/CRC Press. Chapter 16

Videos:

<http://www.youtube.com/watch?v=QuGDdhSqlhg&feature=related>

<http://www.youtube.com/watch?v=6GFoH1ET6JE&feature=relmfu>

Docs:

http://download.autodesk.com/global/docs/mudbox2012/en_us/index.html