Lab 3

IAT 343

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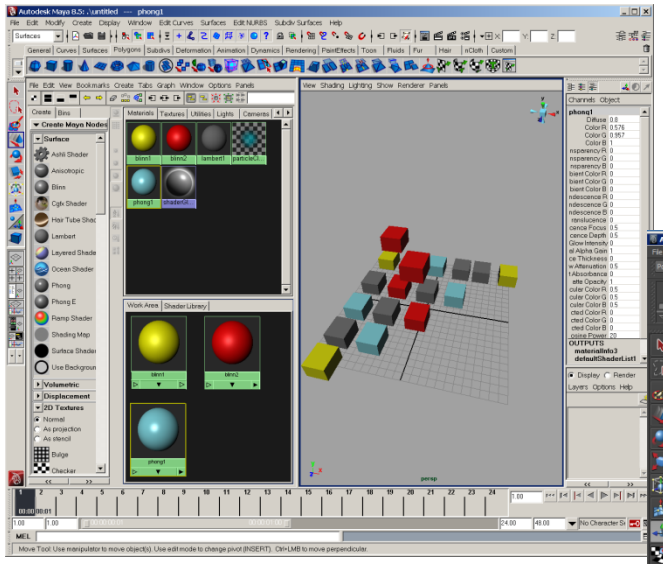
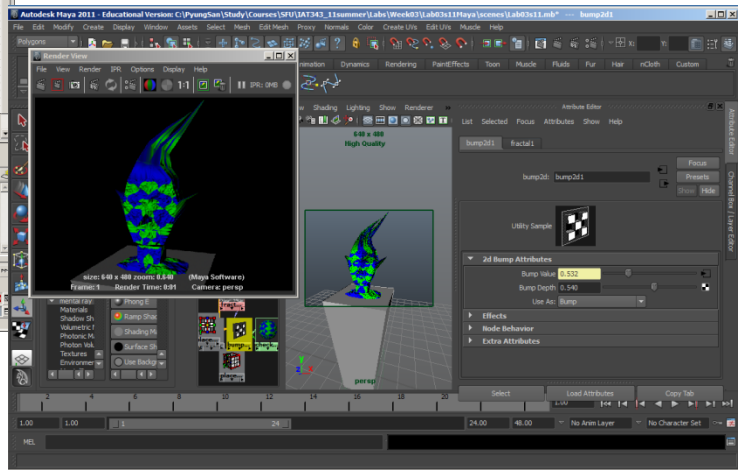
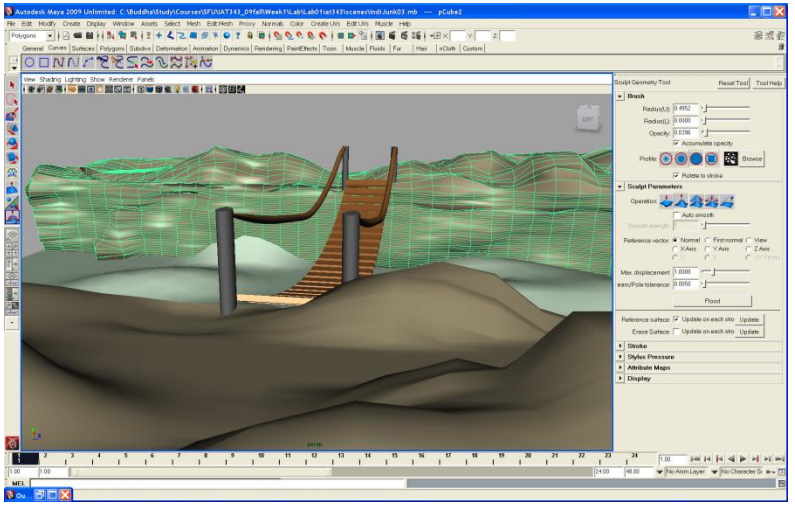
Today's Lab







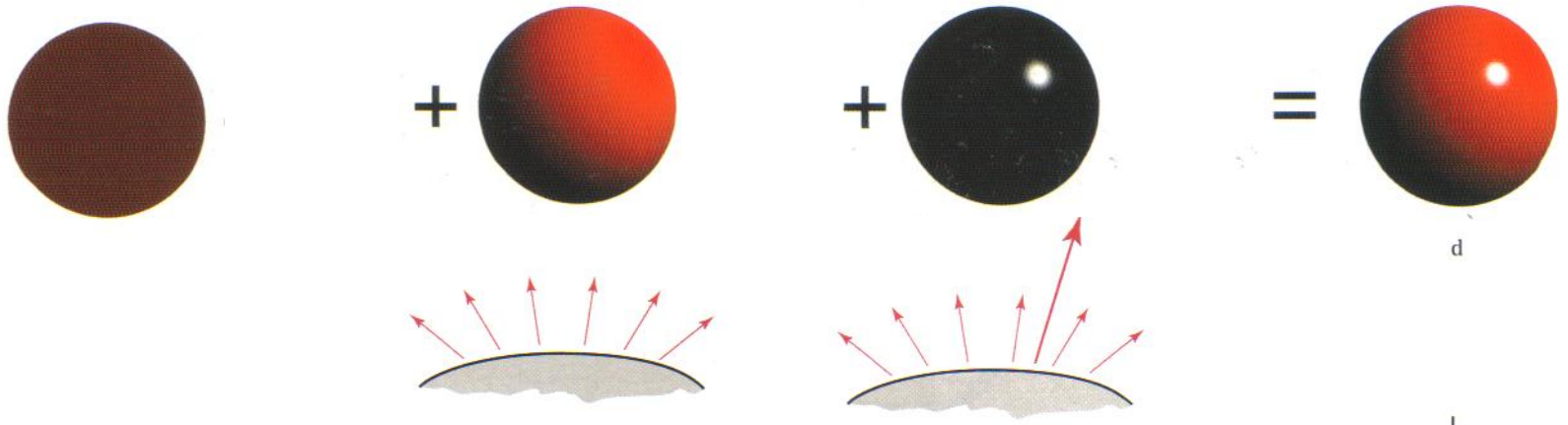
Team project idea? Review animations at National Film Board of Canada

http://www3.nfb.ca/animation/objanim/en/films/film.php?sort=director&director=Barker%2C+Cordell&id=17537

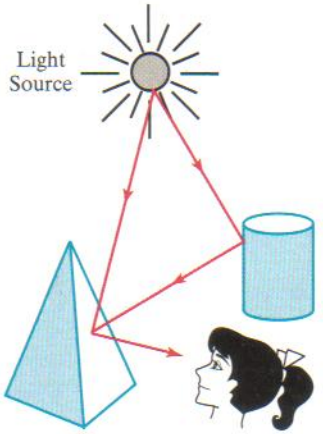
About the Lab submission

- Post your invidual web address on the webct.

Surface Shaders



- Ambient
  - Even illumination (environment color)
  - Background light
- Diffuse
  - Main color
  - Scattering
  - Absorption
  - Mirror (~0)
  - Rough surface (>0)
- Specular
  - Highlight
  - Reflection



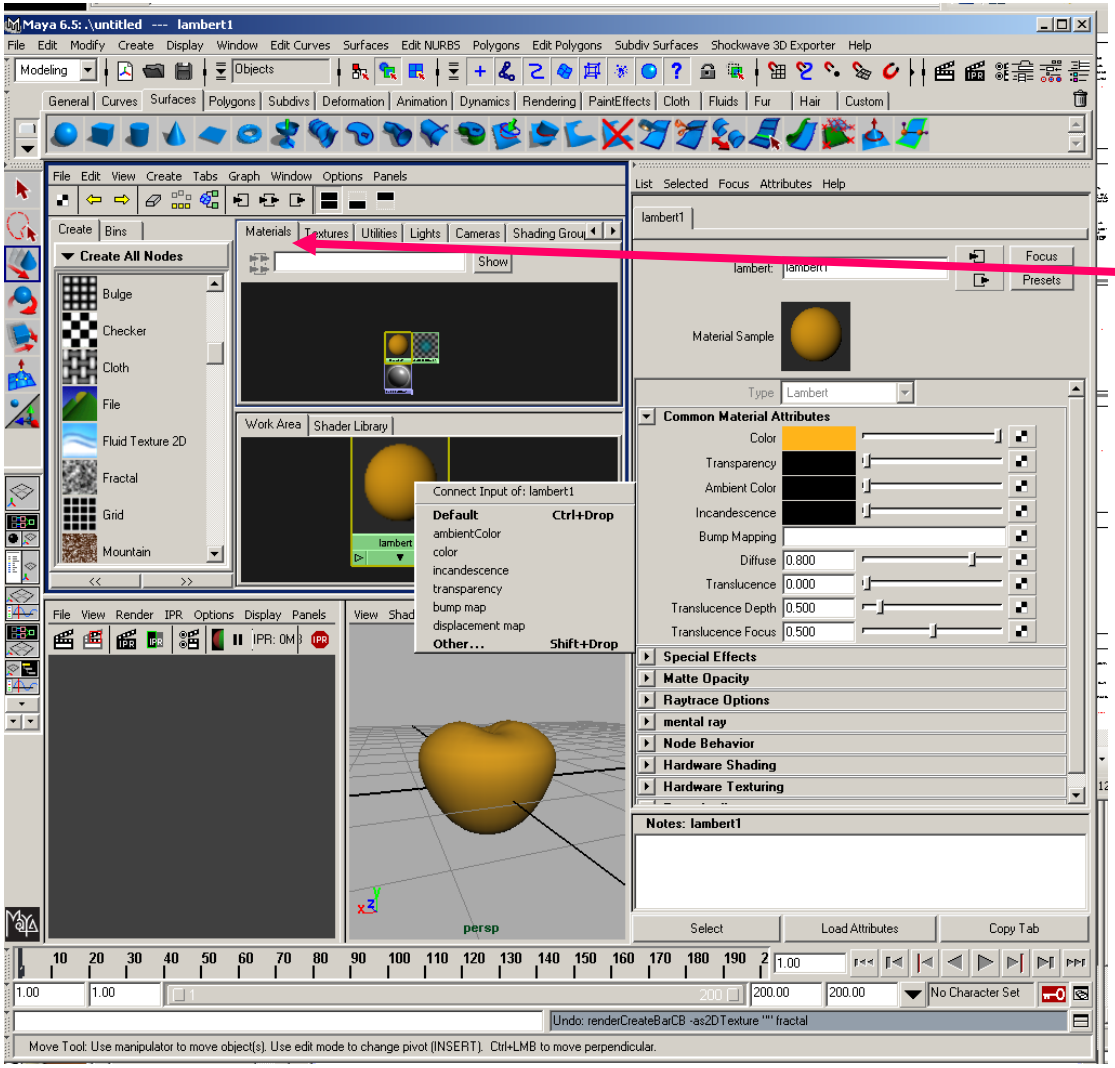
What is the **Hypershade** in Maya 3D?

Manager

- Materials
- Textures
- Lights
- Cameras

Shading Groups in Maya:

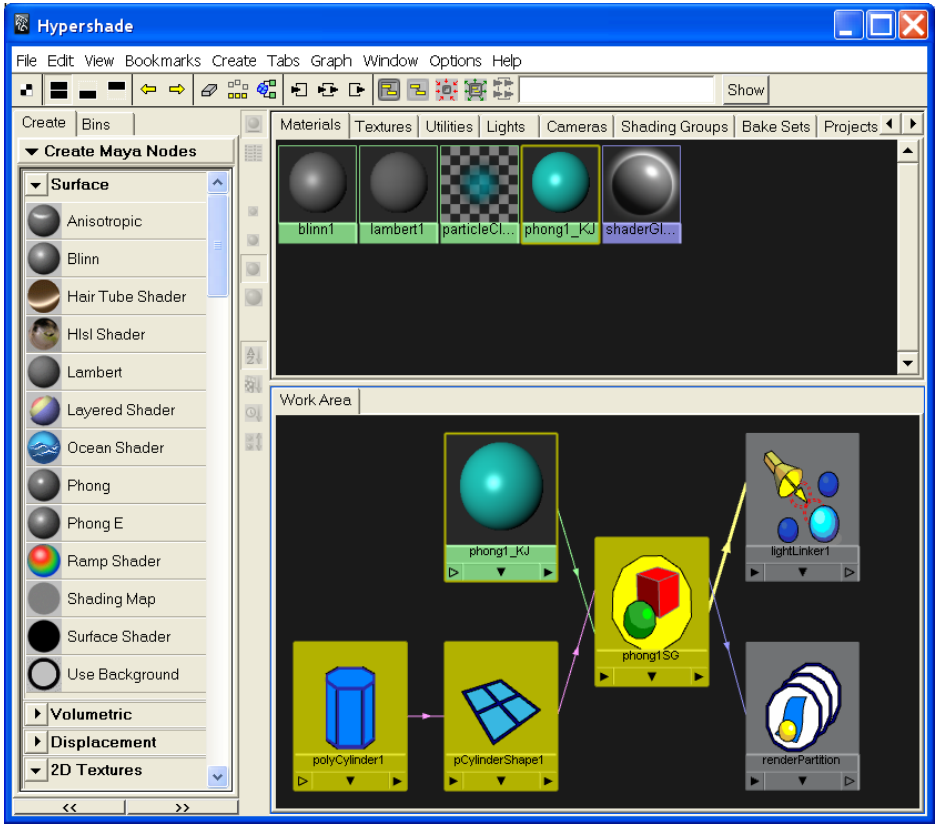
Hypershade



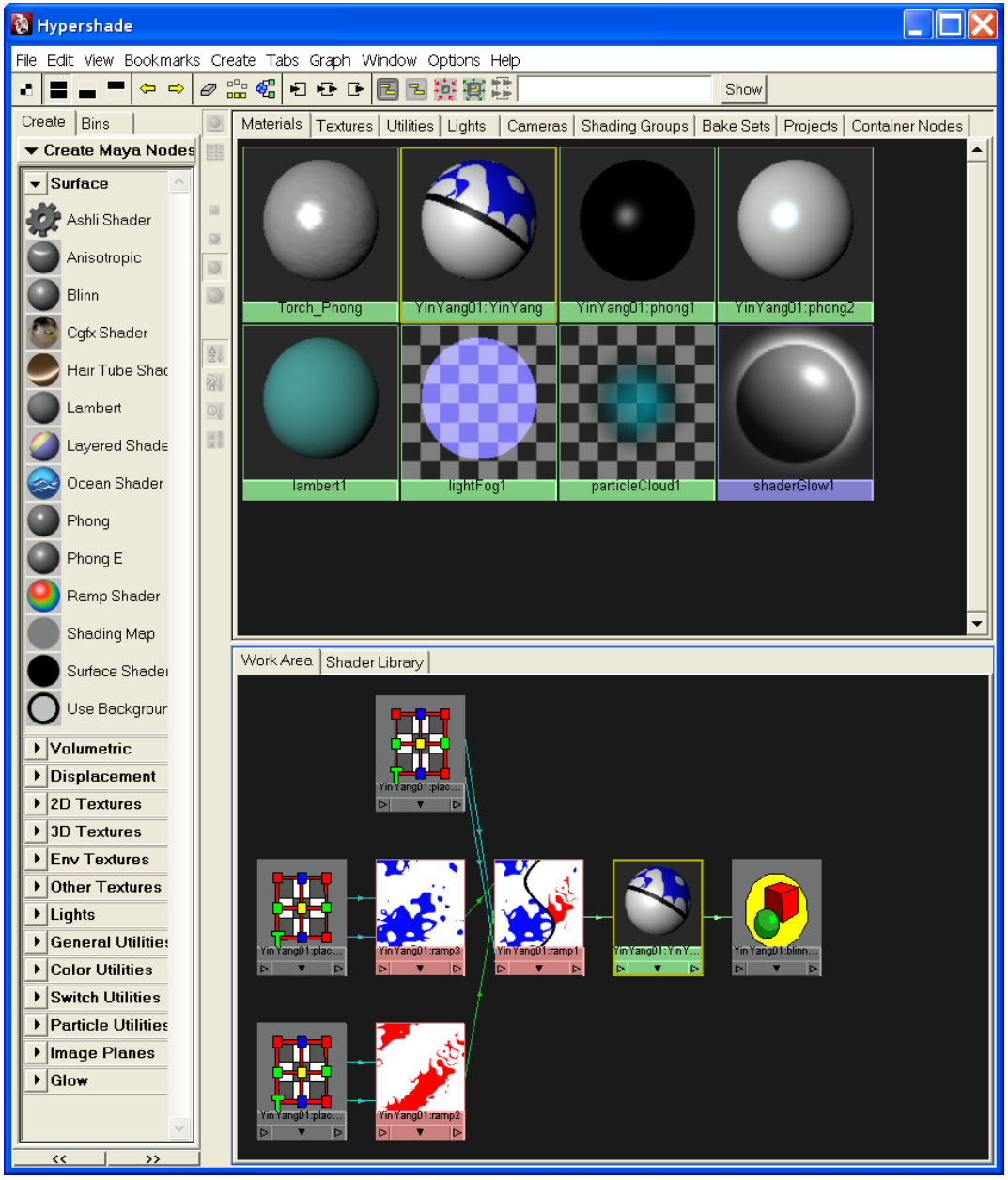
Tab menus

- Materials
- Textures
- Lights
- Cameras

Shader Network



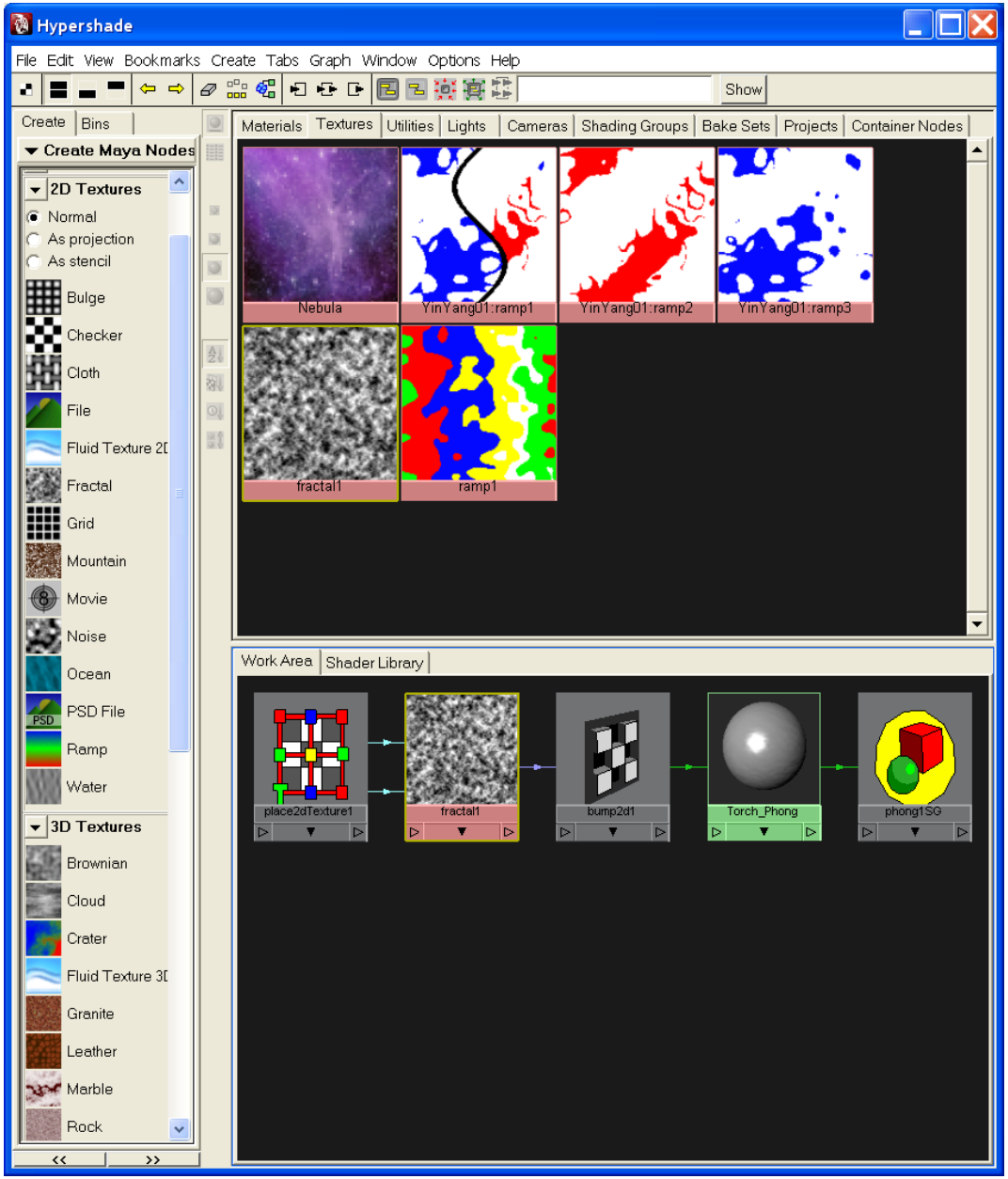
A *shading network* is a collection of connected rendering nodes that defines how colors and textures contribute (usually with lights) to the final look of surfaces (materials). A shading network typically consists of any number of connected rendering nodes plugged into a shading group node.



Materials in Maya

Surfaces

- Blinn,
- Phong
- Lambert
- Etc…



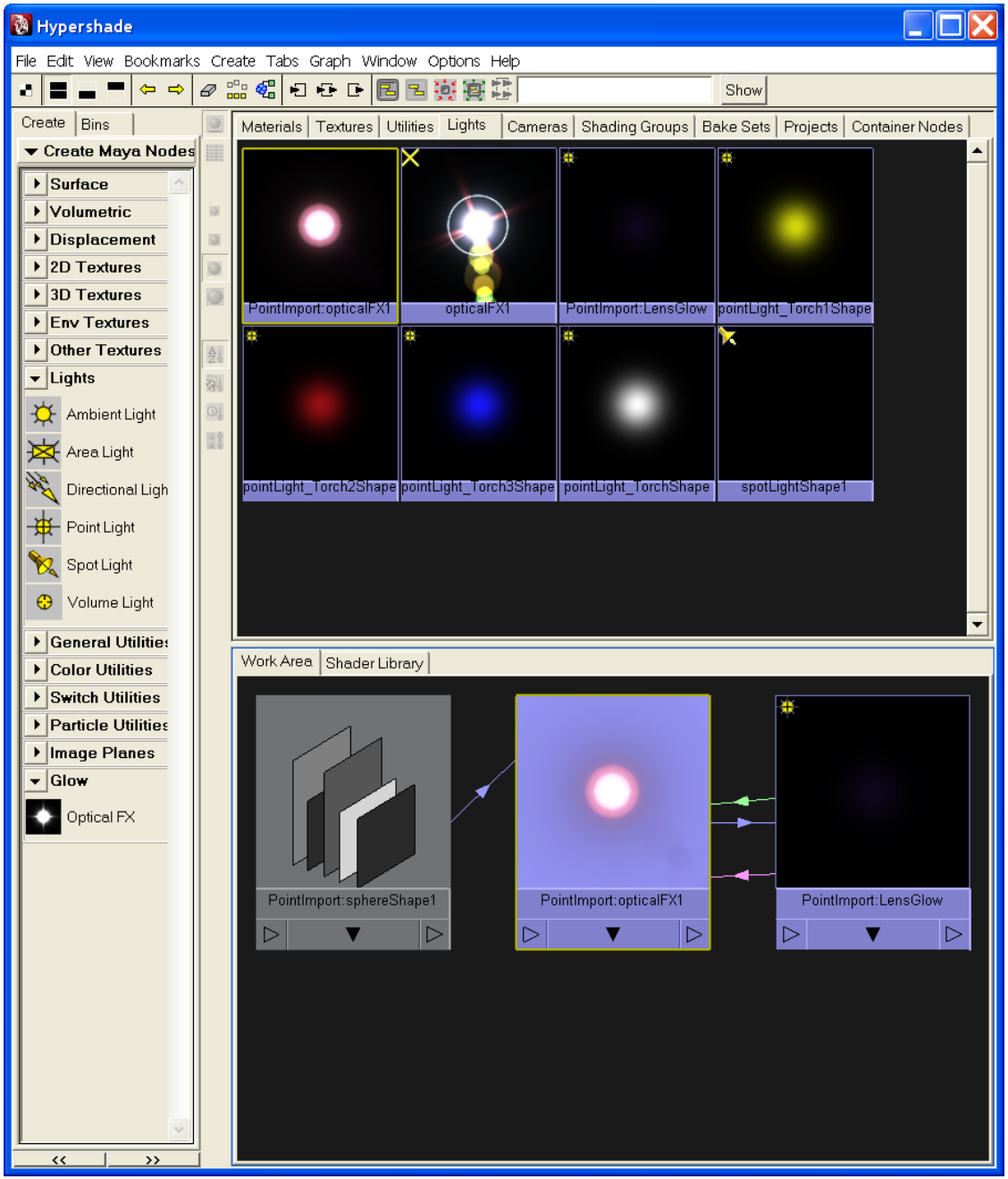
Textures in Maya

2D Textures

- File
- Ramp
- Etc…

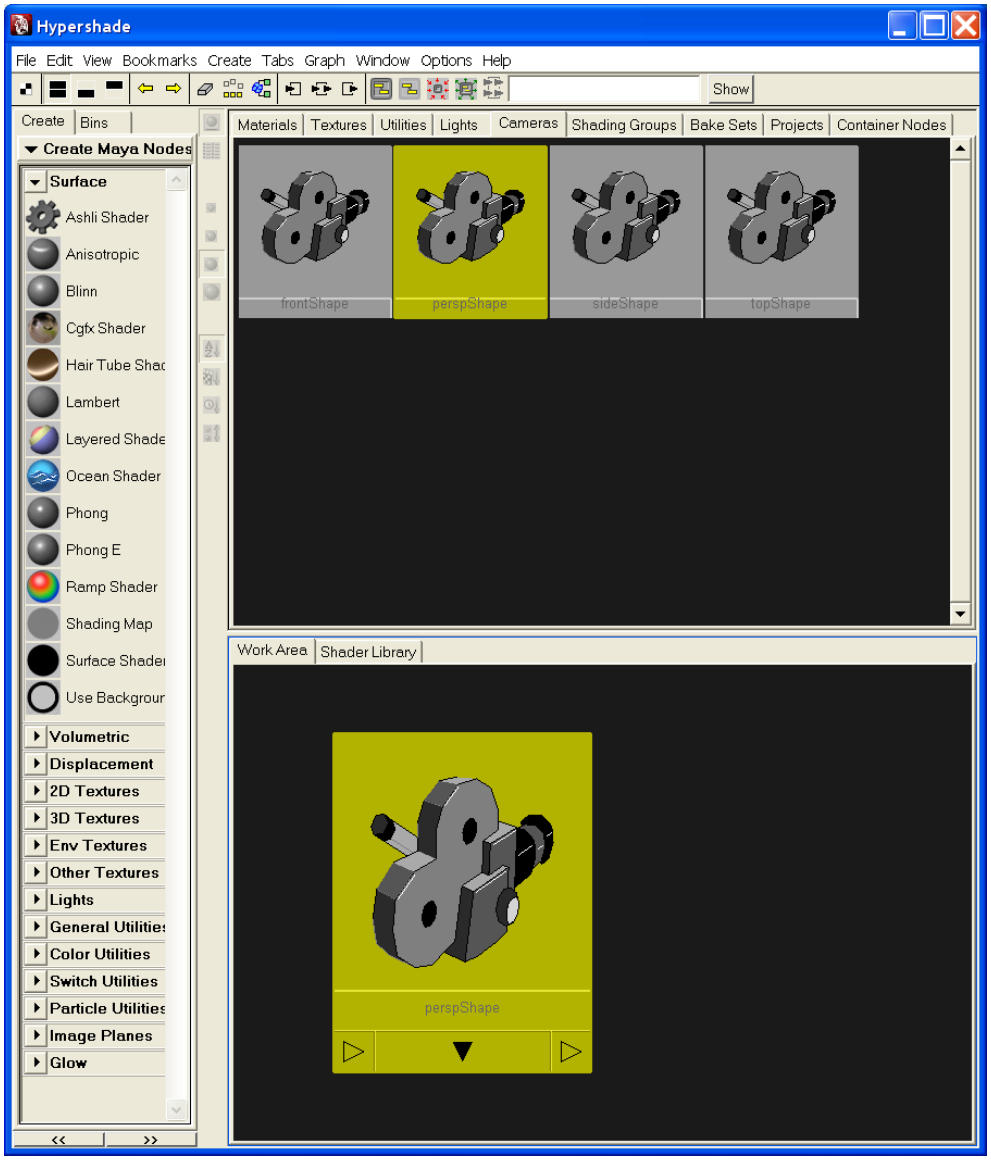
3D Textures

- Cloud
- Marble
- etc



Lights in Maya

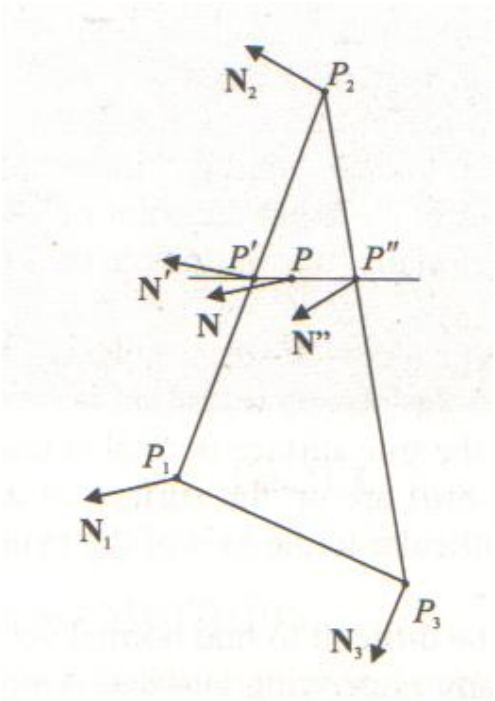
- Ambient light
- Area light
- Spot light
- Directional light
- Volume light
- Point light



Cameras in Maya

- perspective
- front
- side
- top

Mathematical Shading Models



- **Phong**

Shaders

Lambert Material

This material type is the most basic and does not include any attributes for specularity. This makes it perfect for matte surfaces that do not reflect the surrounding environment. The Lambert material type can be transparent and will refract in a Raytrace rendering, but without any specularity, it won't reflect.

Phong Material

This material adds a sharp specular highlight to the Lambert material. The size and intensity of the highlights are controlled by the Cosine Power attribute. This material can also have reflections from either an environment map or Raytraced reflections. The Phong material is good for plastics.

PhongE Material

This material type adds a different kind of specular highlight to the Lambert. The PhongE material includes attributes such as Roughness that controls the softness of the highlight, Whiteness that controls its intensity and Highlight Size.

Blinn Material

Many artists use this material type exclusively because it offers high-quality specular highlights using attributes such as Eccentricity and Specular Roll Off. This material type can be edited to look like a Phong material, which has sharper highlights, in cases where you need better anti-aliasing of highlights during an animation. This material is good for glass and metals.

Anisotropic Material

This material type simulates surfaces which have micro-facet grooves and the specular highlight tends to be perpendicular to the direction of the grooves. Materials such as hair, satin and CDs all have anisotropic highlights.

Shading Map Material

This material type allows you to create custom shading on surfaces. A ramp texture controls the positioning and color of the shading and highlights on the surface. If you want to emphasize the dark areas, simply darken the lower end of the ramp.

Ramp texture

Ramp Shader

This shader gives you extra control over the way color changes with light and the view angle. You can simulate a variety of exotic materials and tweak traditional shading in subtle ways. All the color-related attributes in the Ramp Shader are controlled by ramps.

Ocean Shader

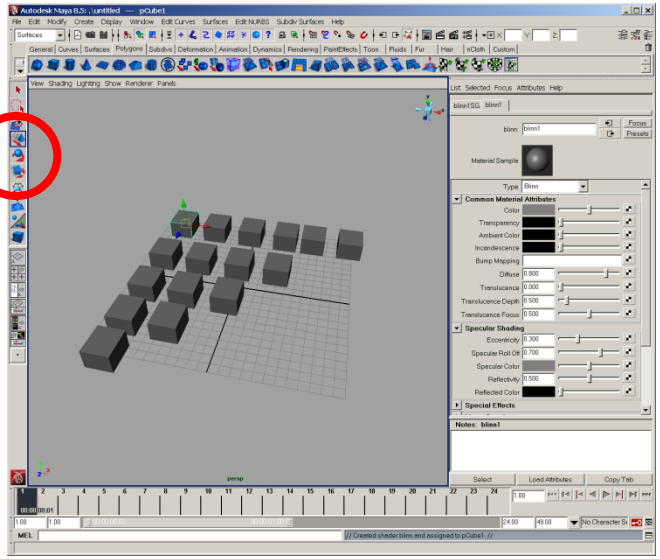
The Ocean shader is a specialized shader with attributes defining realistic waves on large bodies of water. It is usually used through the Fluid Effects > Ocean > Create Ocean command, which automatically creates nodes required to render an ocean.

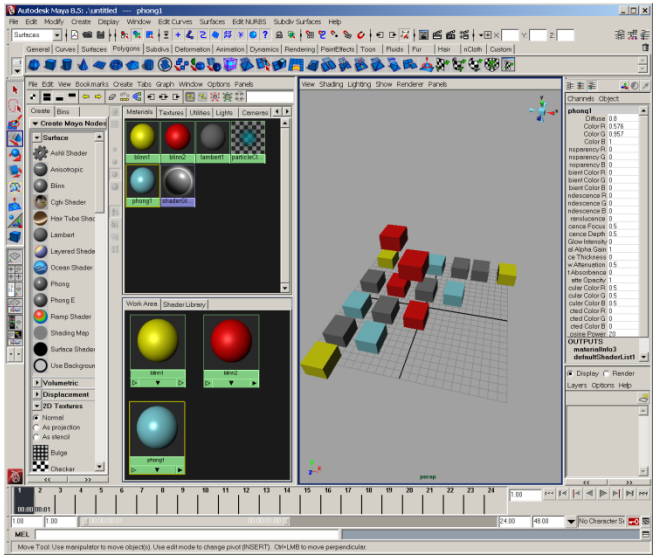
Hair Tube Shader

Hair tube shader simulates a thin tube, where the width of the tube is small enough that local shading effects can be ignored. All shading derives from the view and the tube direction. Because the highlights are spread across the entire tube width, rendering fine hairs does not require as high anti-aliasing levels.

(Autodesk, 2007)

Lab Exercise 1.
Duplicate & Assign Materials to Multiple Objects





1. To create a cube, select **Create > Polygon Primitives > Cube**. Transform the cube through **Move**, **Rotate** and **Scale** tool. By pressing **Ctrl + D**, we can duplicate an object.

2. By pressing ‘5’ (or Shading > Smooth Shade All), we can see the color of the cube.

3. Select any cube. RMB (right mouse button) click and hold. Choose **Assign New Material > select Blinn**. To change curent default color, click the color cell and adjust the color value (HSV or RGB models available).

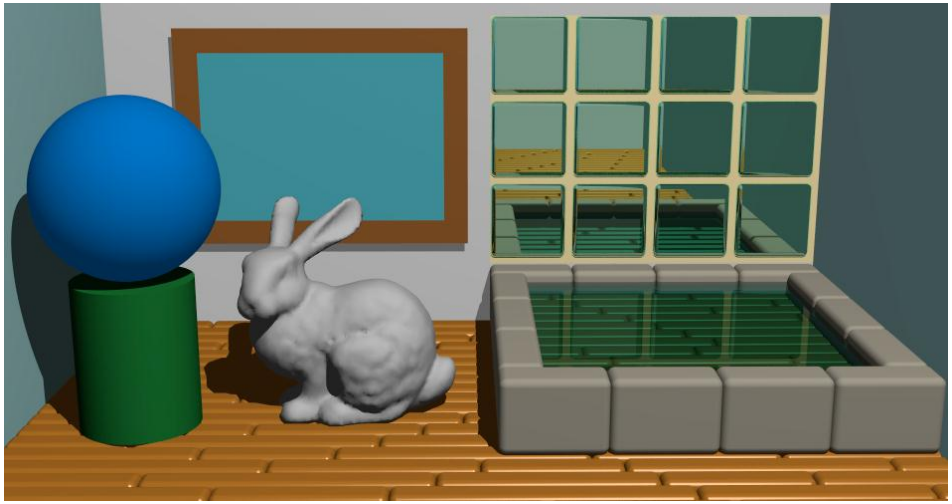
4. Open the **Hypershade** (**Window > Rendering Editors > Hypershade**).

5. To assign different shaders, click **Blinn** icon on the left menu which generates new **Blinn** shader object (**blinn2**). To change the default color, select a couple of cubes to replace into new shader. While the target cubes selected, bring your mouse cursor on the new shader (**blinn2**), click/hold RMB, and select the **Assign Material to Selection.**

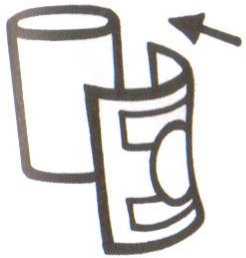
6. To identify certain object(s) with specific shader applied, RMB on any shader object and **Select Objects with Material.** The result shows certain objects highlighted.

7. Render and save your file.

Texture Mapping



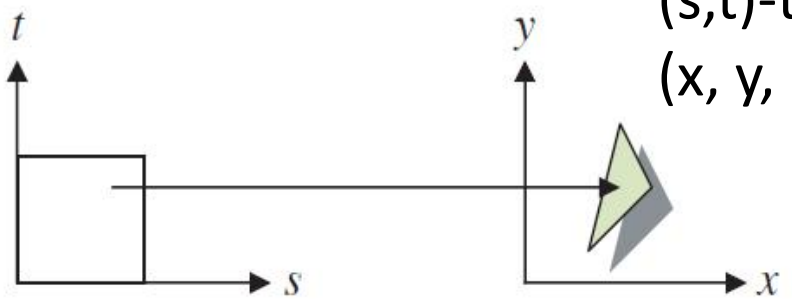
- Wrap image onto 3D geometry
- Applying raster image information to CG geometry
- Add a great detail to enhance realism
- Avoid the need for massive amounts of geometric detail

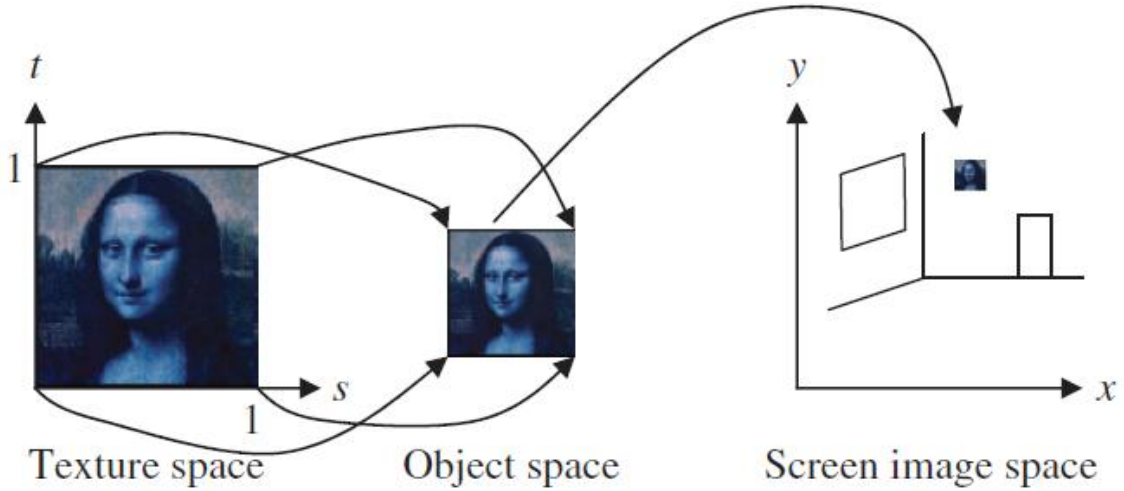


•Source:
(Watt, 1999), (Masson, 2004) & (Park, 2004)

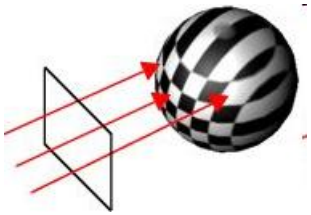
Texel(Texture elements): Array of pixels

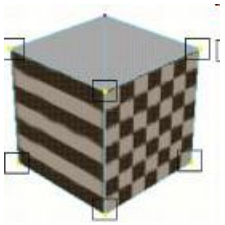
Mapping between
(s,t)-texel space and
(x, y, z)-object surface space



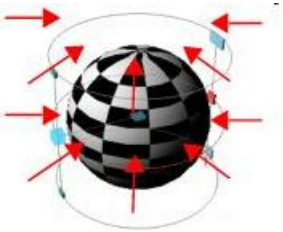


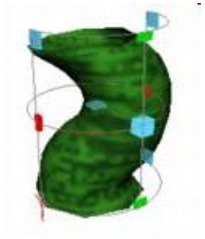
UV Coordinate Space

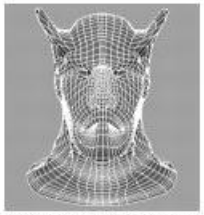


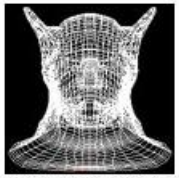


- U and V represent the two axes that lie on the surface.
- N is surface normal axis that points out from the front of the surface.



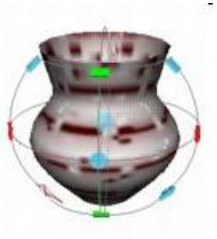


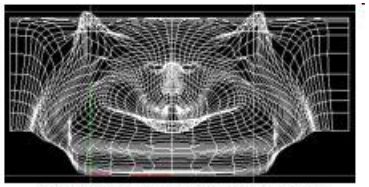




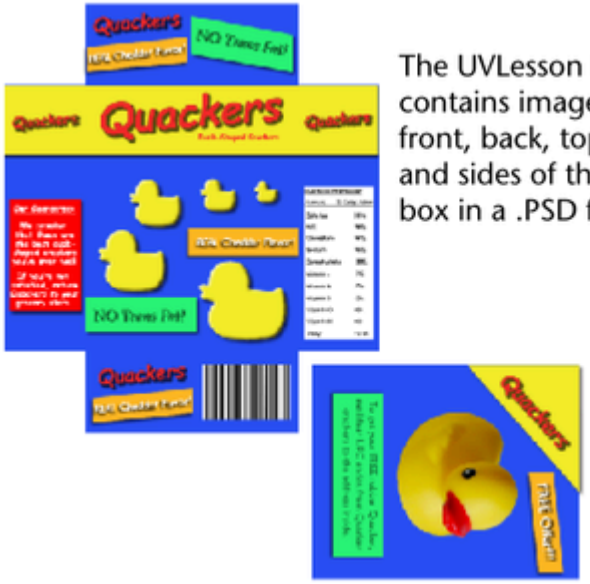
Polygonal character model

Planar Projection produces overlapping and distorted UVs in this example

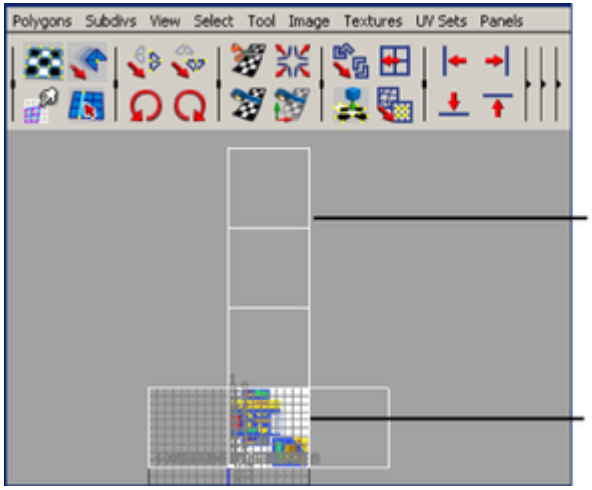




Cylindrical Projection produces UVs that are overlapping and distorted in this example

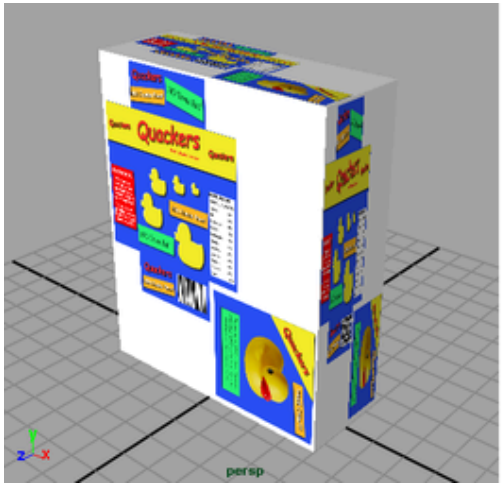


The UVLesson file contains images for the front, back, top, bottom, and sides of the cracker box in a .PSD format file.

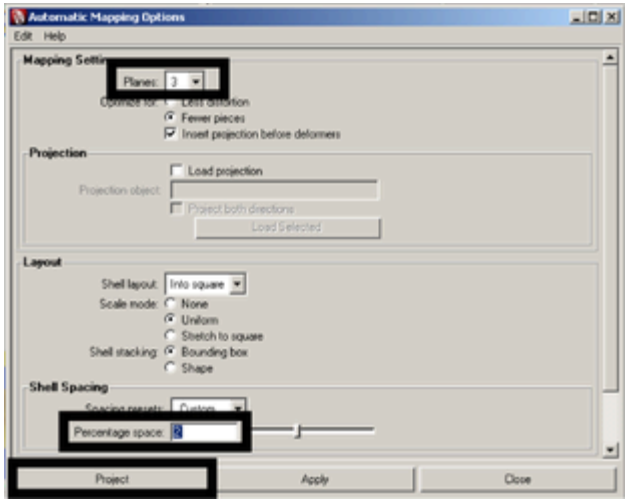


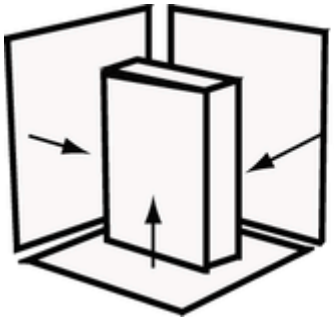
The default UVs for the model extend beyond the texture area (known as the 0 to 1 UV range).

The texture map appears in the 0 to 1 range of the UV Texture Editor.

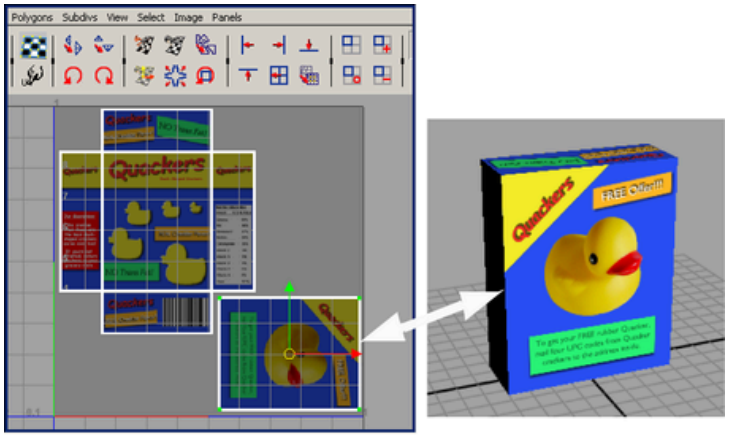


The texture map does not appear correct on the box because the default UVs for the cube primitive don't correlate to the texture map that was supplied.

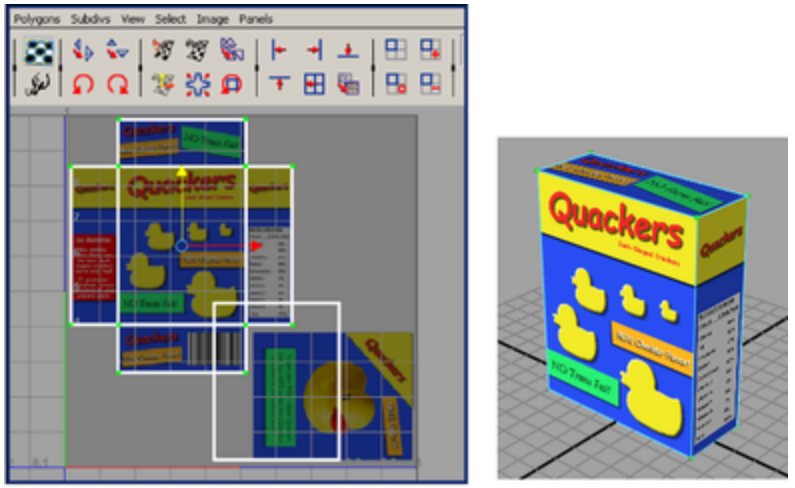




A triplanar UV projection creates UVs based on 3 projection planes.



Repositioning the remaining UV shell to match the texture image repositions the texture map on the back face of the 3D model.

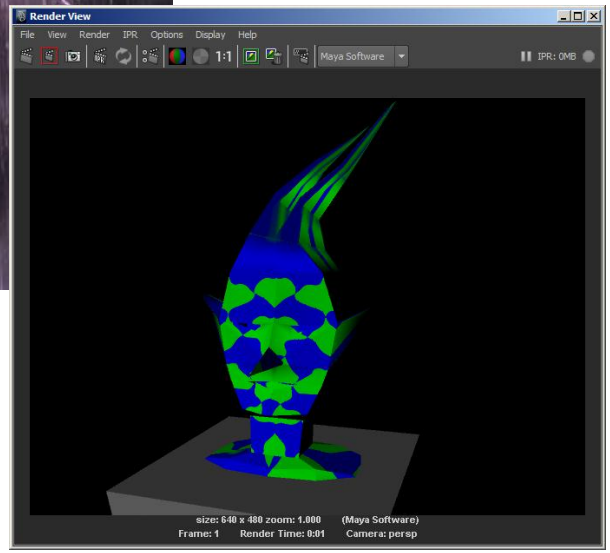


Repositioning the UV shell to match the texture image repositions the texture map on the 3D model.

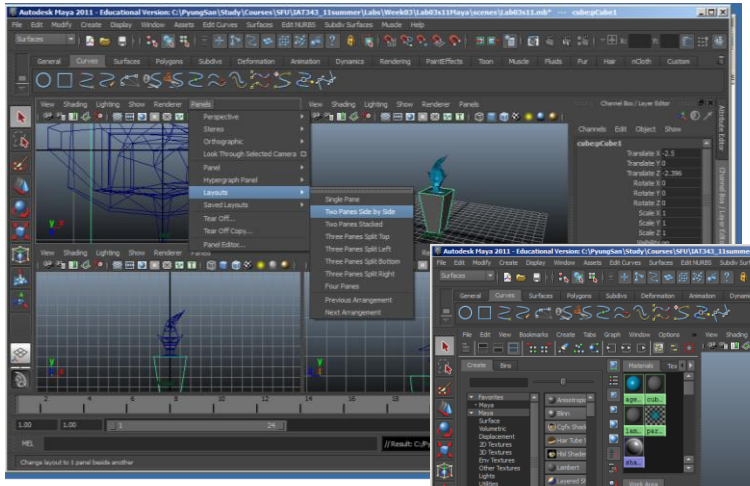
Lab Exercise 2.
Texture Mapping 101

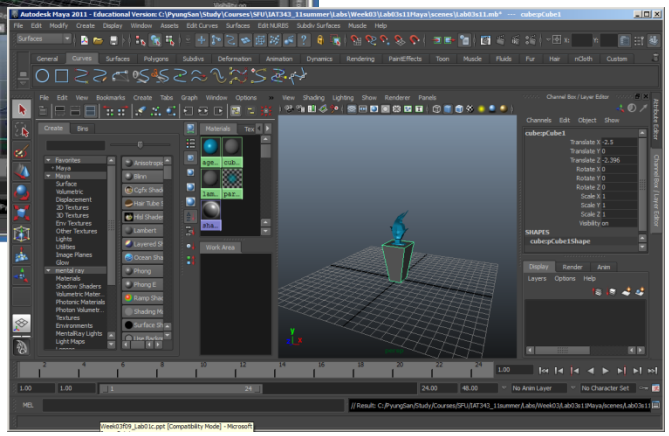
http://www.bigshinyrobot.com/reviews/archives/2799

http://www.gameguru.in/action/2009/17/watchmen-the-end-is-nigh-to-have-voice-overs-by-watchmen-actors/



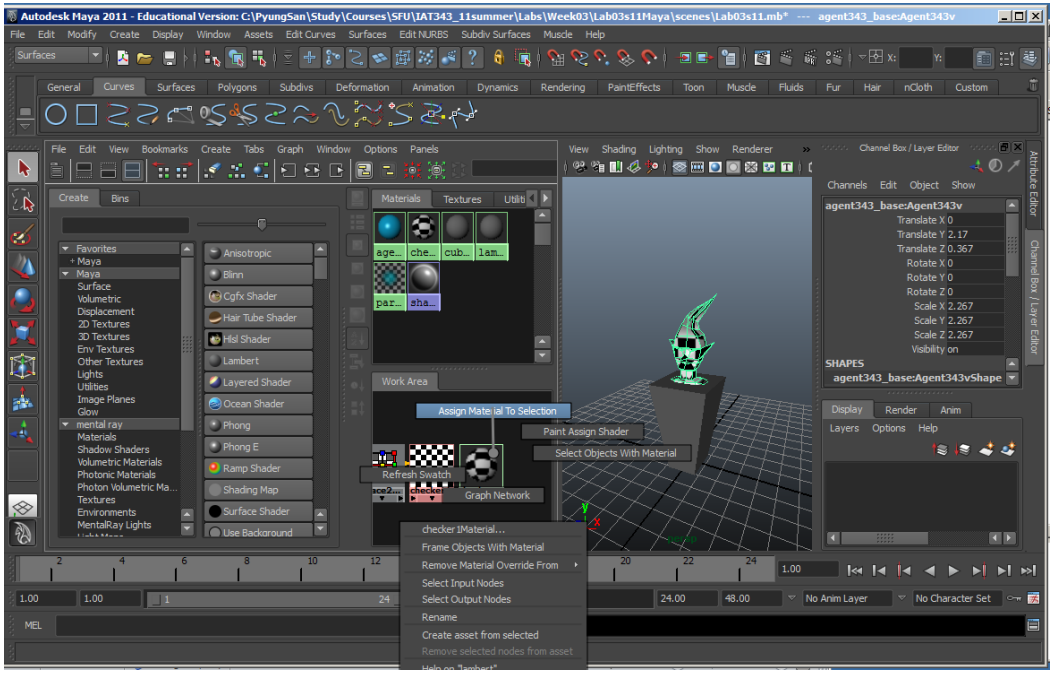
Ex 2. Texturing 101





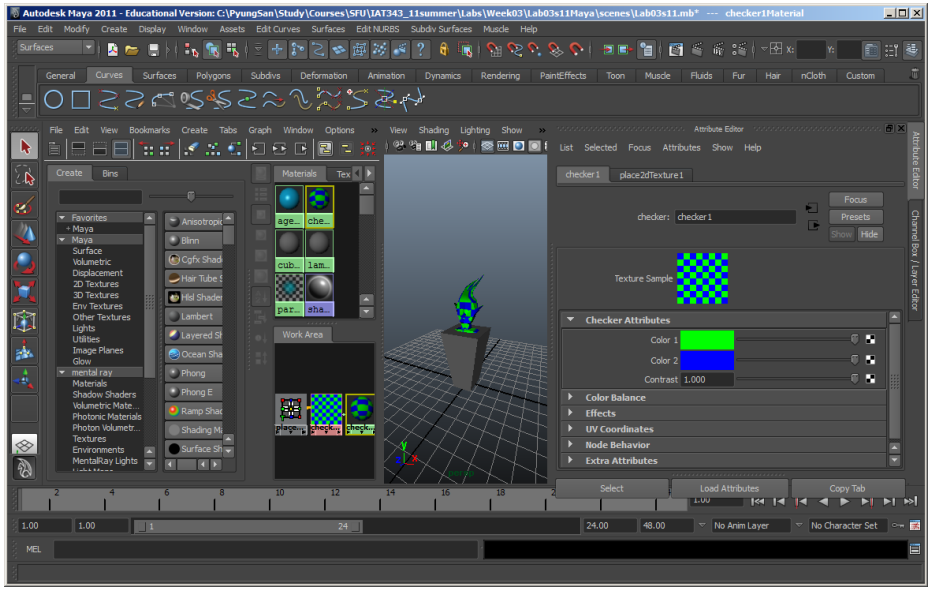
1. To adjust our workflow more into texturing, switch current layout inside any viewport into **Panels > Layouts > Two Panes Side by side** (or **Panels> Saved Layouts > Hypershade/Render/Persp).** Change the left side viewport to Hypershade (**Panels > Panel > Hypershade**)

2. In the bar section of the **Hypershade**, go to **Create > 2D Textures** and select **Checker** function.



3. Before applying any texture, please make it sure whether a target 3D geometry has been selected/highlighted (just click with Left Mouse Button). Inside the **Work Area** of the Hypershade, press/hold Right Mouse Button (RMB) on top of the checker icon and select a function named **Apply Material to a Selection**. To see the effect, press '**6**' to activate **Hardware Texturing**.

4. By double-clicking on the checker node, Maya opens an attribute editor which consists of a number of attributes relate to the checker shader.

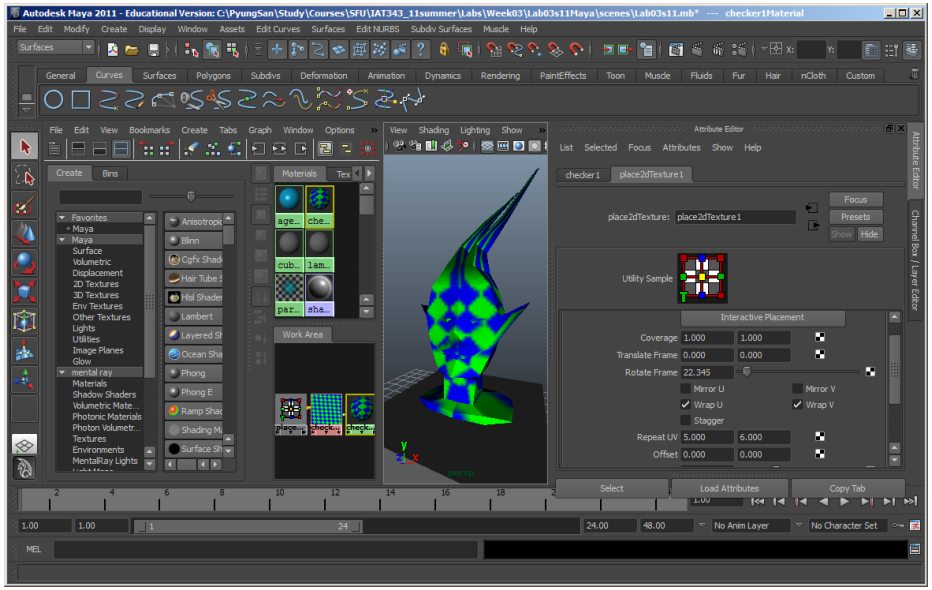


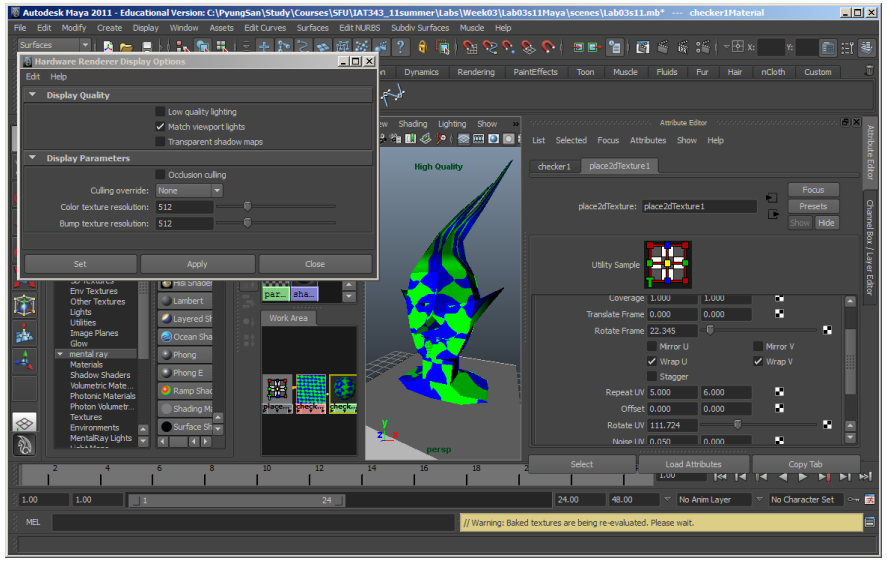
5. To change the current color selection, click on the color cell next to **Color1 (or 2)** attribute.

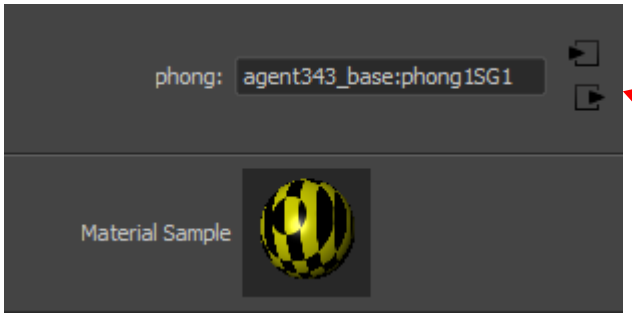
6. To manipulate the current checker pattern, select the tab **place2dTexture1 i**n the Attribute Editor.

7. Change values across different attributes (**Rotate Frame, Repeat UV, Mirror U, Noise** etc.), we can generate an interesting pattern such as noise.

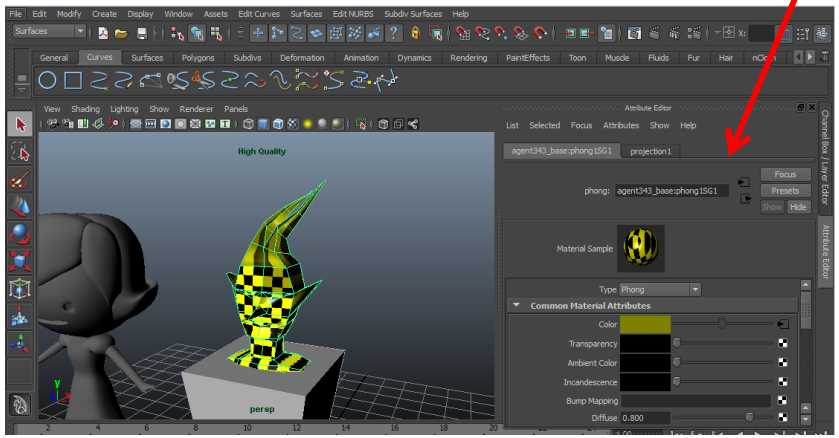
8. Generate an image by pressing **Render the current frame button**. To frame target objects inside the rendered image, turn on **View > Camera Setting > Resolution Gate.** To adjust current view, holding/dragging '**Alt + RMB**' activates precise zoom in/out.

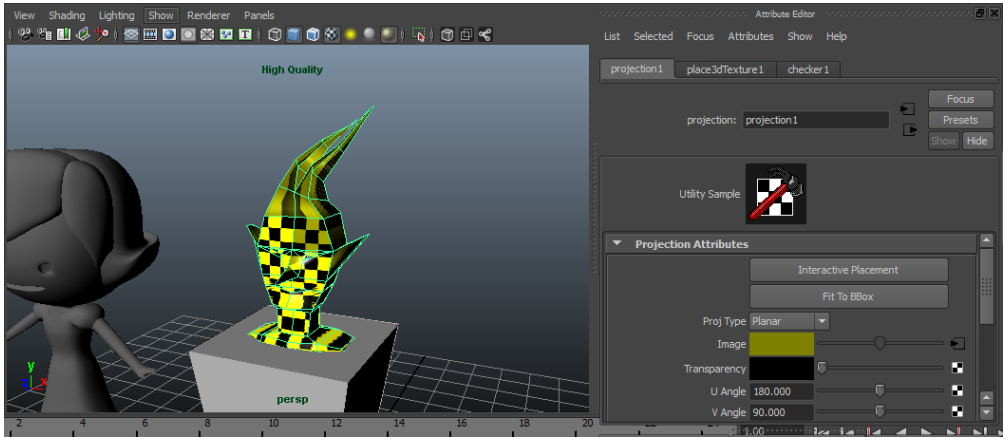


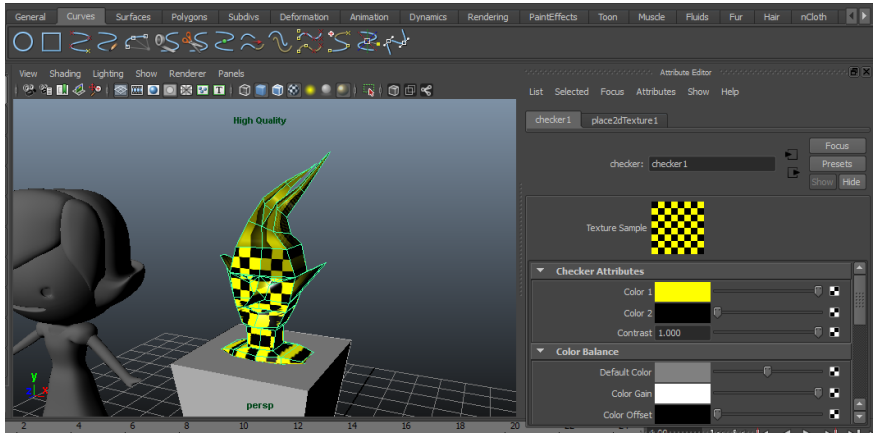


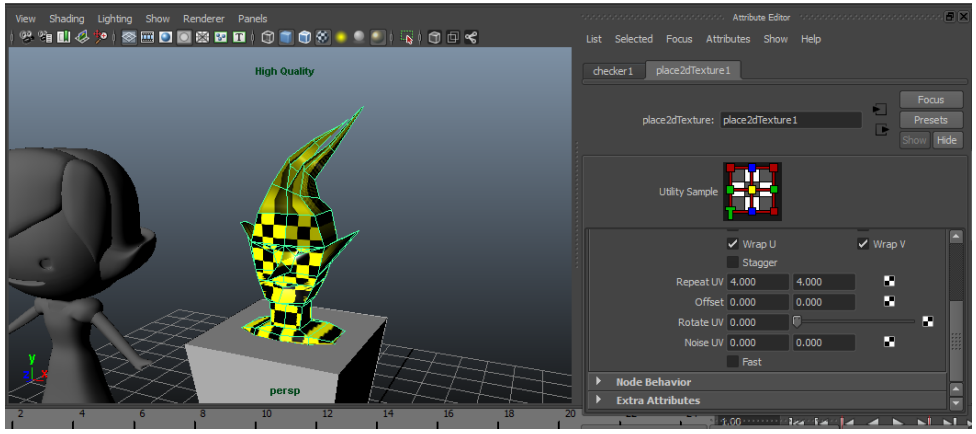


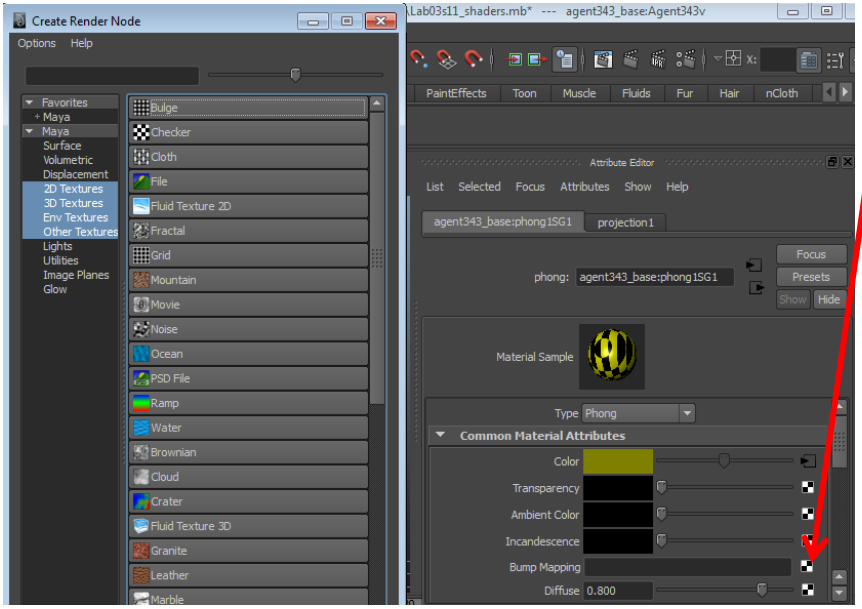
Input connection & output connections









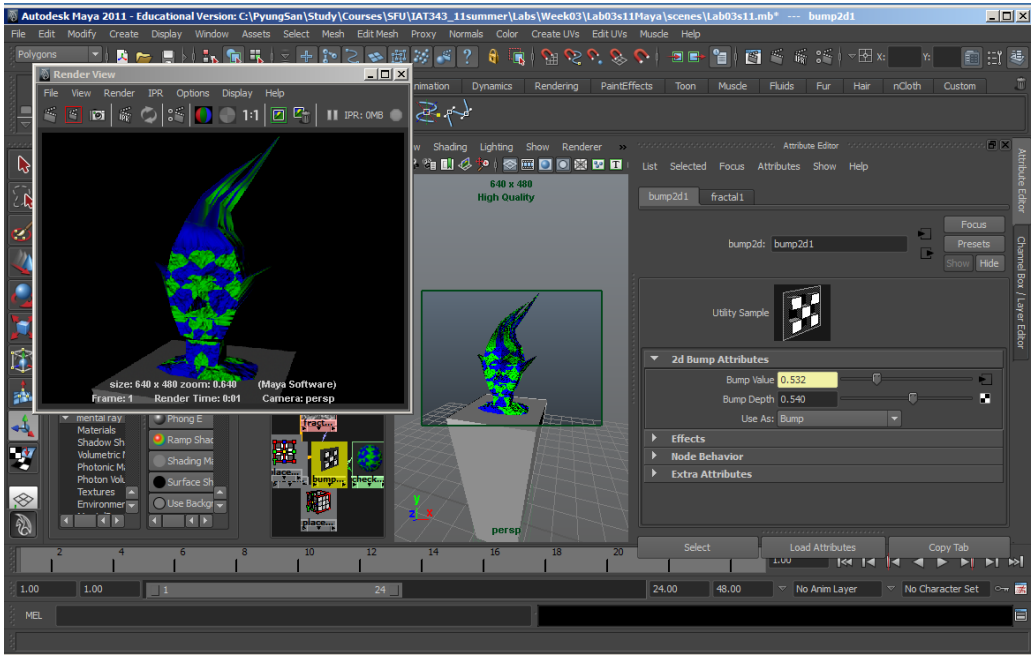


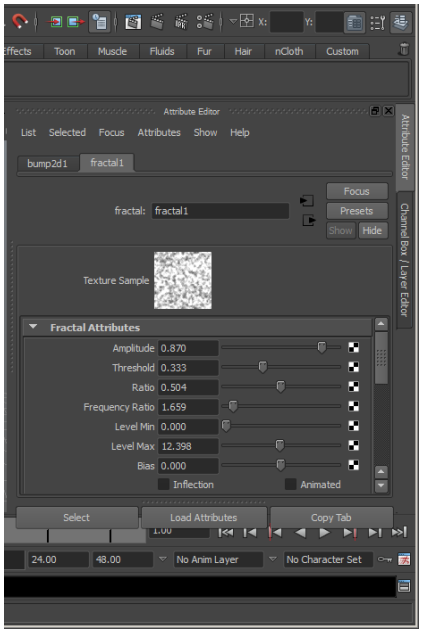
9. Look for **Bump Mapping** attribute. Click the mapping button (tiny checker box) and choose **Fractal** under 2D Textures.

10. Play with different parameter values in **bump2d1** tab and **fractal2** tab.
    - Bump Depth
    - in fractal1 tab, play with different values in Amplitude, Ratio etc.

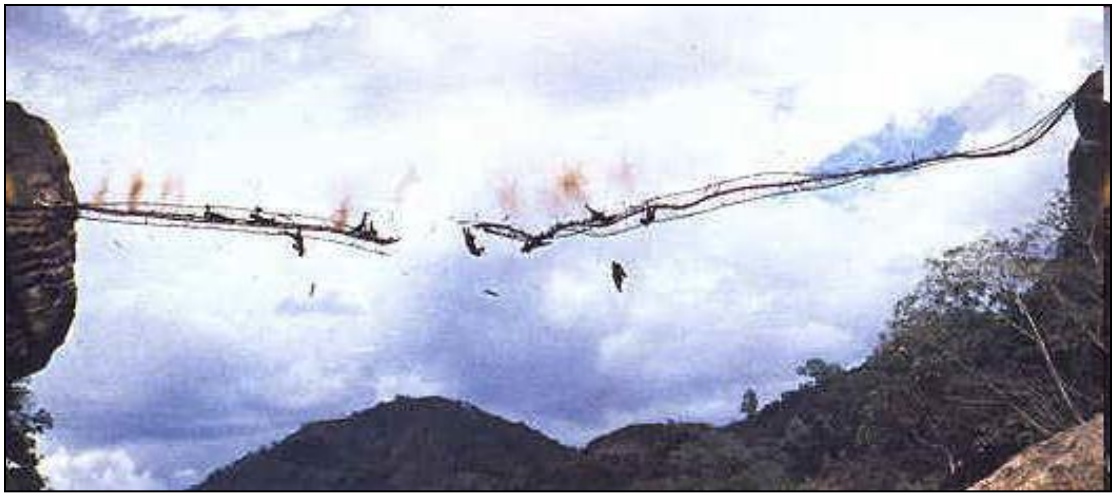
11. Save your work.

12. To increase preview quality, **select Rendrer > High Quality Rendering** Option box in the viewport menu and increase the **Color Texture Resolution** value (i.e., 512).

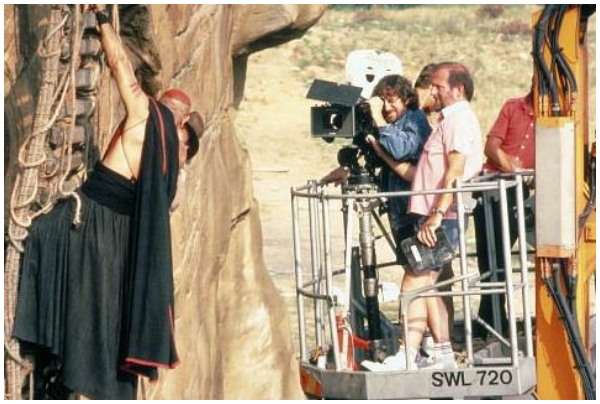




Exercise 3: Set Design
(Castle, Bridge, Cave & Cliff)



Source: Indiana Jones and the Temple of Doom (Paramount Pictures), LucasArts & The Internet Move Database



- **Environment**
  - **Outdoor**
    - » Mountain, desert, ocean
    - » Space, planet
  - **Indoor**
    - » House, school, company building, library, restaurant
  - Microcosm
    - » Inside body

Environment (or Level) Design in Game

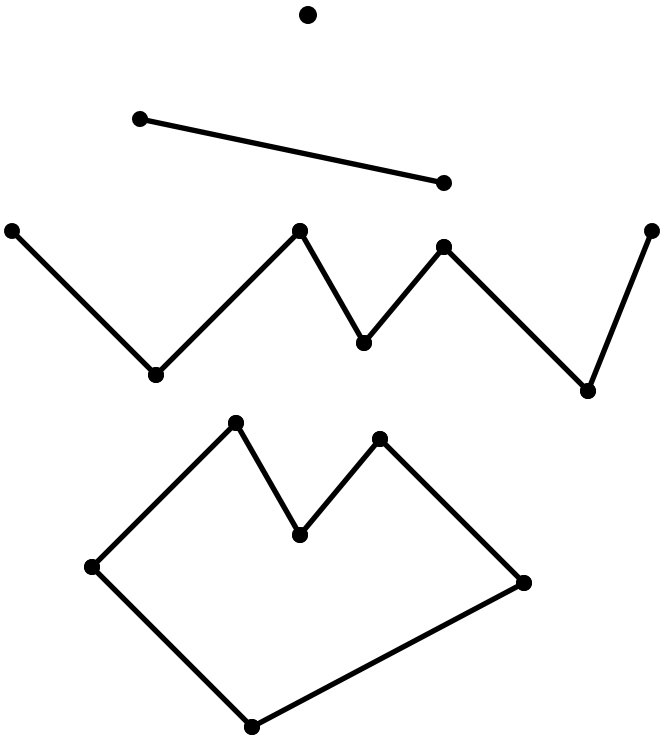
http://en.wikipedia.org/wiki/Main_Page

http://en.wikipedia.org/wiki/Image:The_Great_wall_-_by_Bernard_Goldbach.jpg

http://upload.wikimedia.org/wikipedia/commons/a/a5/Piazza_del_Campo.JPG

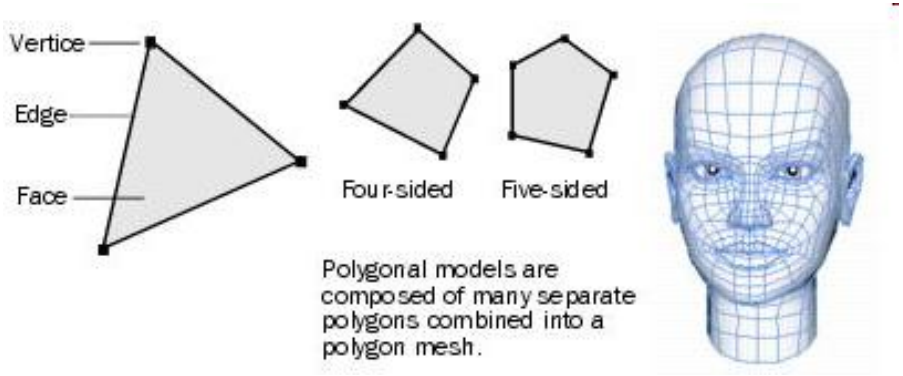
http://en.wikipedia.org/wiki/Main_Page

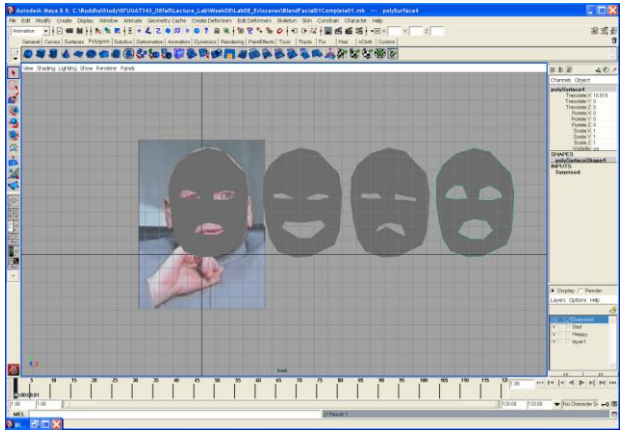
2. Polygon modeling



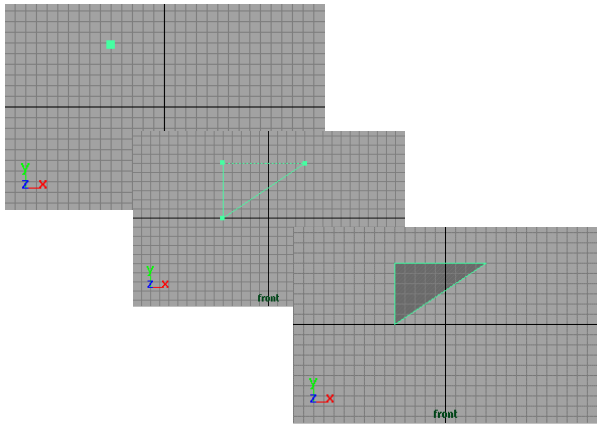
Polygons are straight-sided shapes (3 or more sides), defined by three-dimensional points (vertices) and the straight lines that connect them (edges). The interior region of the polygon is called the *face*. Vertices, edges, and faces are the basic components of polygons. You select and modify polygons using these basic components.

- Simple Geometric Forms
  - Points (Vertex in Maya)
  - Lines (Edge in Maya)
  - Polylines
  - Polygons (Face in Maya)



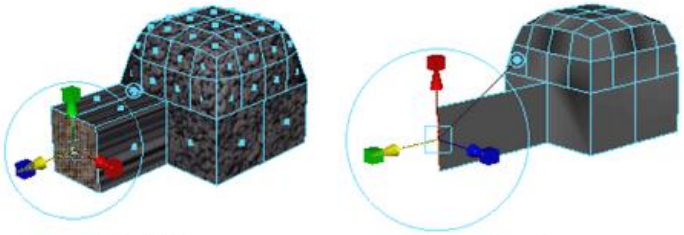


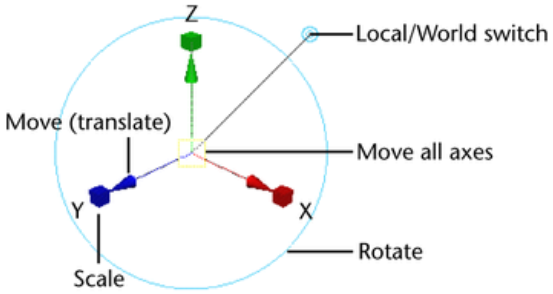
Mesh functions Maya 3D



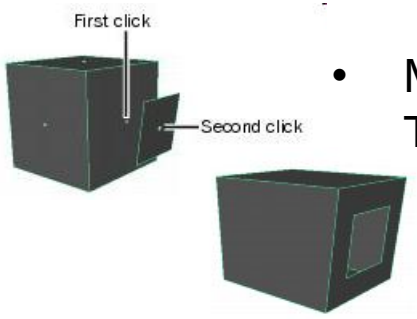
Mesh > Polygon Tool

(User Guide > Modeling > Polygonal Modeling > Polygon selection and creation > Polygon creation >)

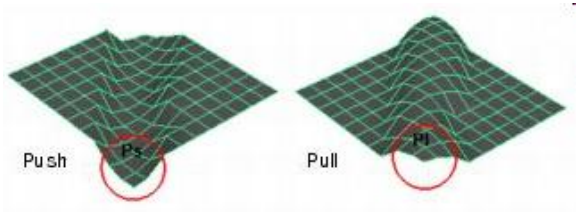




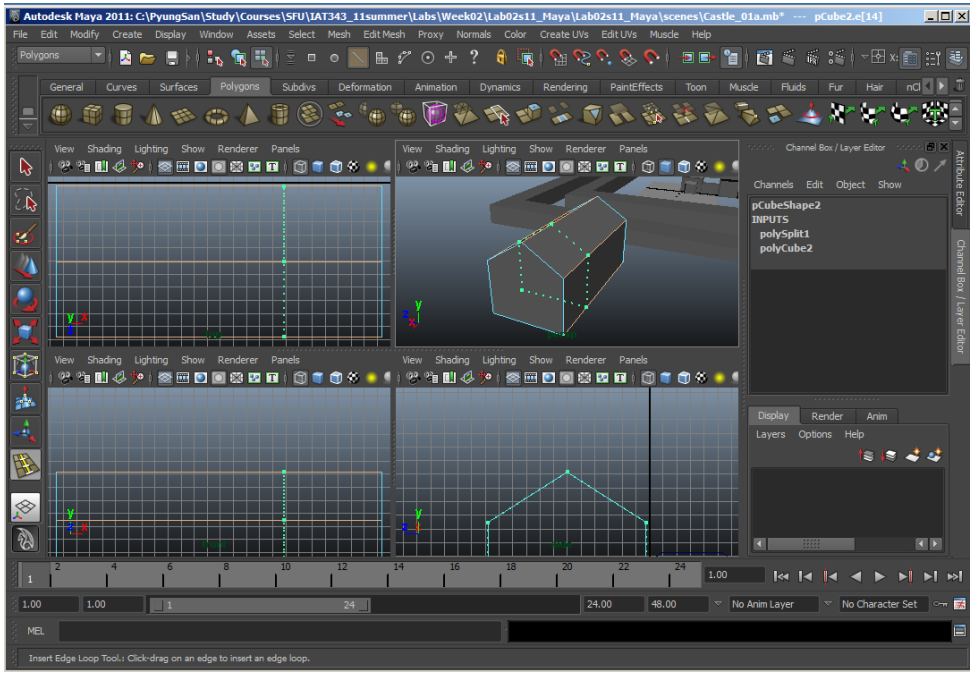
Edit Mesh > Extrude



- Mesh > Make Hole Tool

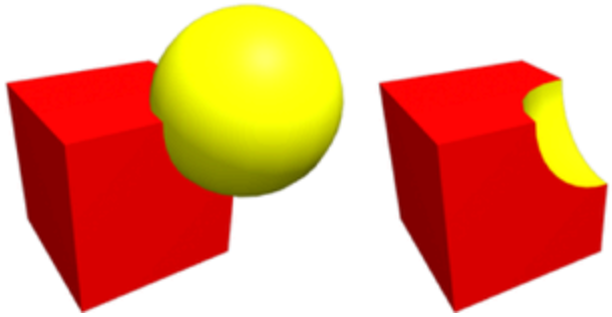


- Mesh > Sculpt Geometry Tool

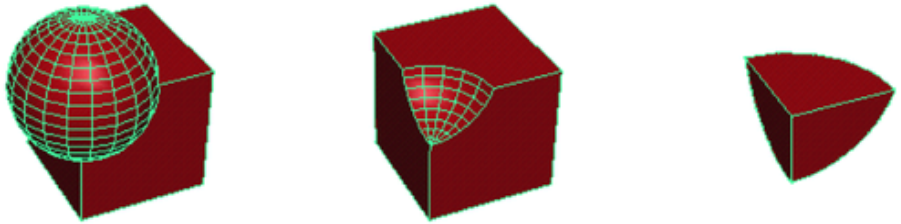


- Edit Mesh > Split Polygon Tool
- Edit Mesh > Insert Edge Loop
- Mesh > Fill hole
- Edit Mesh > Merge (on selected edges)
- Mesh > Extract (on selected faces)
- Keep Faces Together

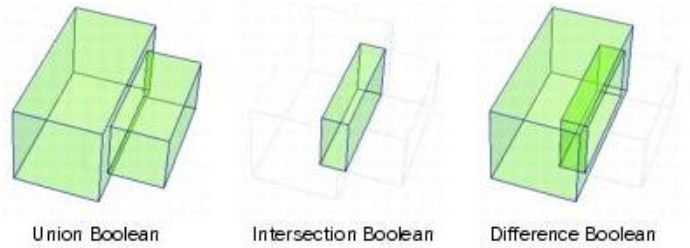
3. Constructive Solid Geometry (CSG)
Boolean algebra **(Mesh > Booleans)**



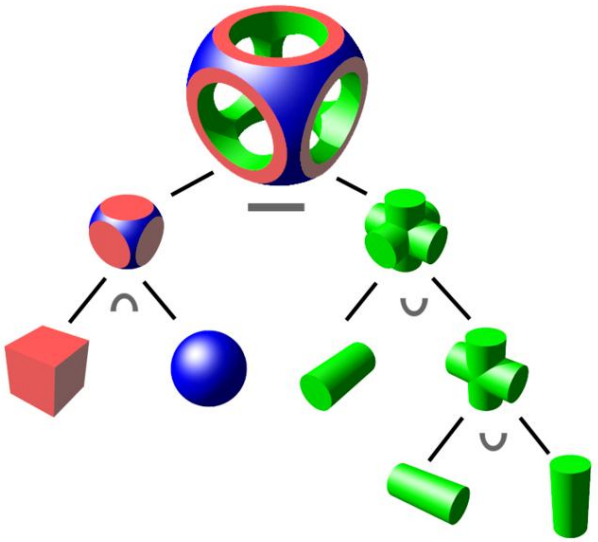
A sphere is used to "carve" the cube using the Difference option.



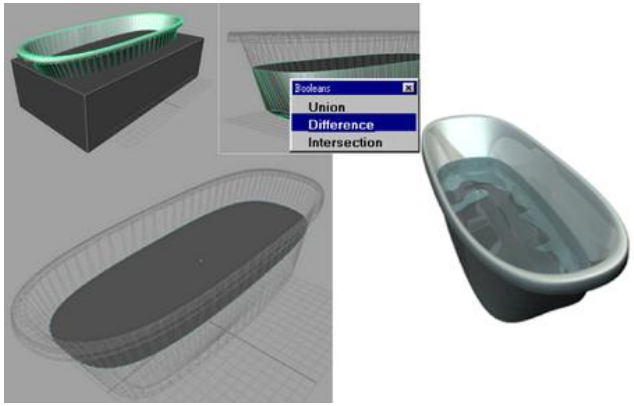
Union Difference Intersection

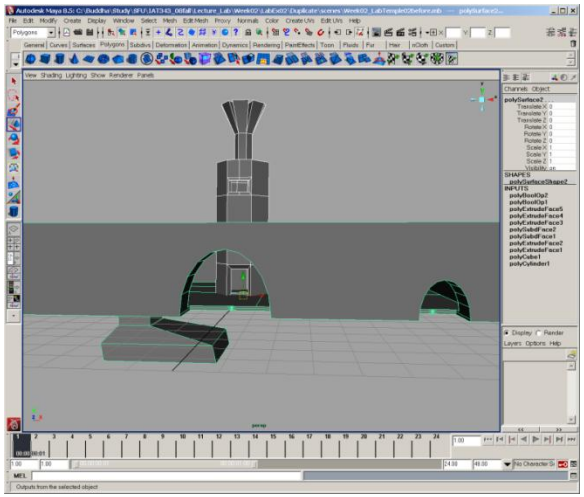


Union Boolean Intersection Boolean Difference Boolean

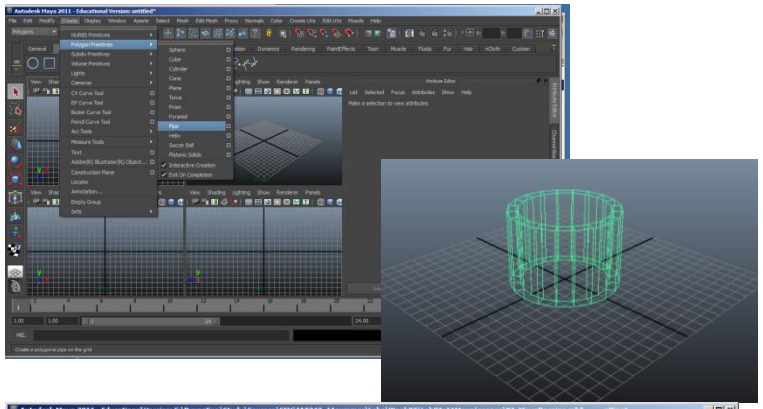


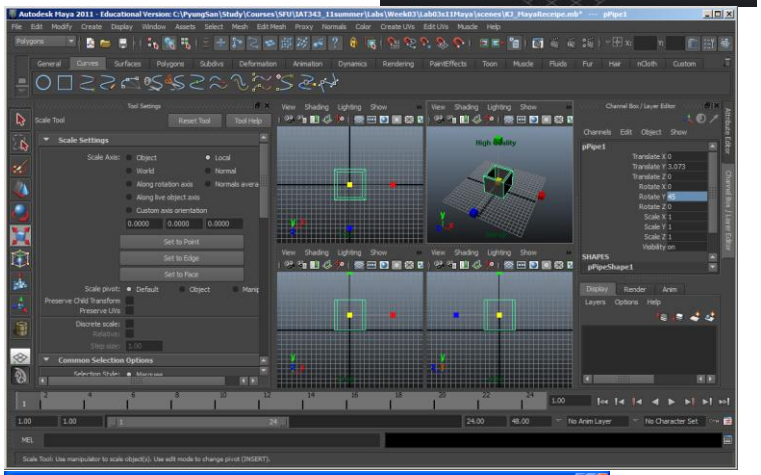
http://commons.wikimedia.org/wiki/File:Csg_tree.png

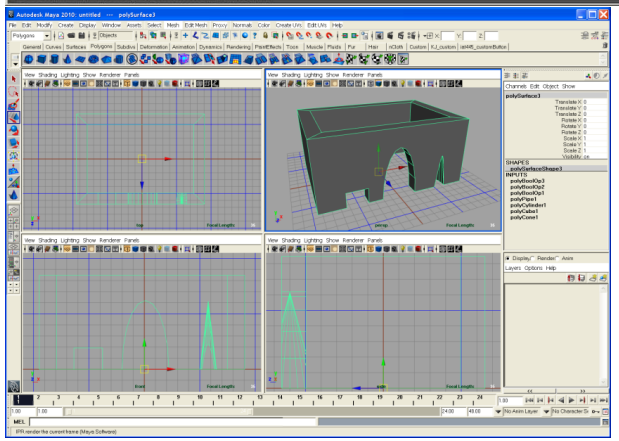




Exercise 3.1 Castle







Use of primitives for the main structure of a castle.

1. First, let's create a castle body. Switch to **Polygons** main menu and look for a function **Create > Polygon Primitives > Pipe**. There are two ways to generate a cube; either turn on **Interactive Creation** option or off (if off, we must assign parameter values in the option box**,** then click on the viewport to generate). This time, use the default option (**Interactive Creation** on) and interactively create a pipe by click and drag the mouse cursor.

2. In the **Channel Box,** click on **polyPipe1** of **INPUTS,** and change the value of Subdivisions Axis (i.e., 4 or 5 for pentagon).

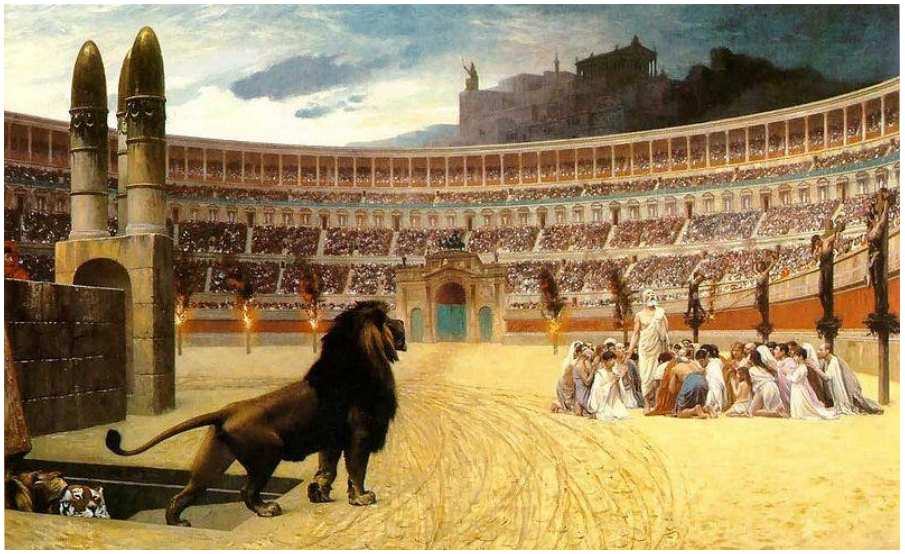
3. Before manipulating the shape (closer look to a castle), let's check the orientation of pivot/center point. Double click on the **Rotation** tool and select different options in **Scale Axis** (i.e., local) to see changes.

4. To make a wall facing the front camera view, rotate 45 degree on the Y axis (could type under **pPipe1)**.

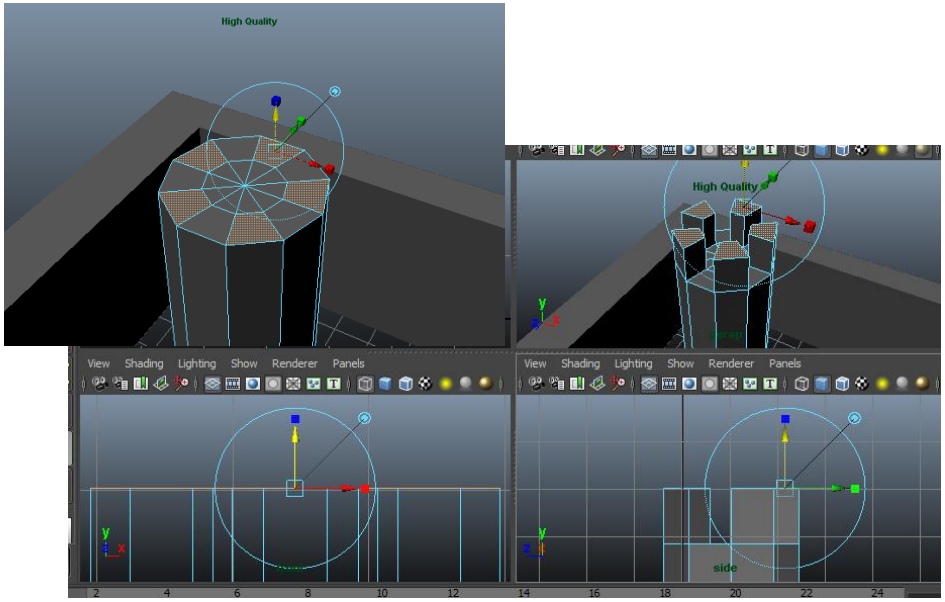
5. Using the **Boolean** operation, we can make an entrance by subtracting a cylinder from the cube. To make an entrance, first create a cylinder (**Create > Polygon Primitives > Cylinder** in the front view. Scale it on different axis to look more like a door. To subtract the cylinder from the body, select the castle body first, then **Shift** select the cylinder. Apply **Mesh > Boolean > Difference.**

6. Add other primitives and apply Boolean operation whether it works to generate more entrances.

Can we make multiple entrances similar to coliseum in an efficient way (e.g. duplication)?



http://en.wikipedia.org/wiki/Colosseum

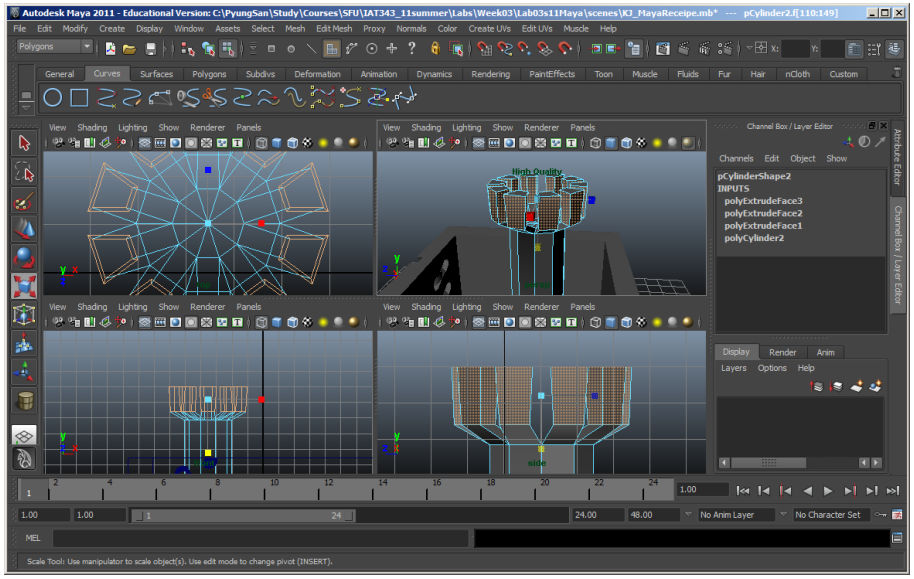


7. Create a new cylinder for a tower. Changes parameters in the **polyCylinderX under INPUTS.** Reduce the **Subdivisions Axis** to 10 and increase **Subdivisions Caps** to 2.

8. To extrude faces, select multiple faces on the cap while holding **Shift** to add selection. To subtract, hold Ctrl key.

9. Apply **Edit Mesh > Extrude.** To extrude on the positive Y axis, drag the blue arrow up. We can also apply scaling through a small colored cube. Scale down uniformly by click/hold down the center cube.

10. Either turn on or off **Keep Faces Together** option under **Edit Mesh, Extrude** functions brings a different results.

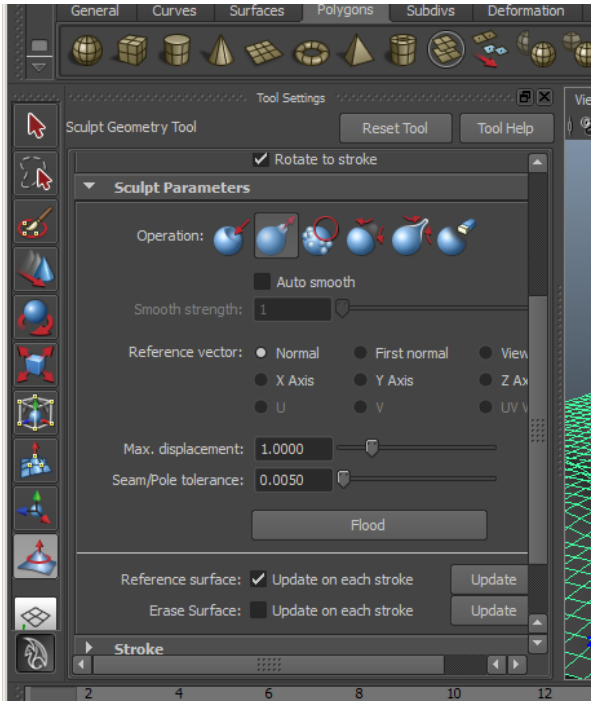


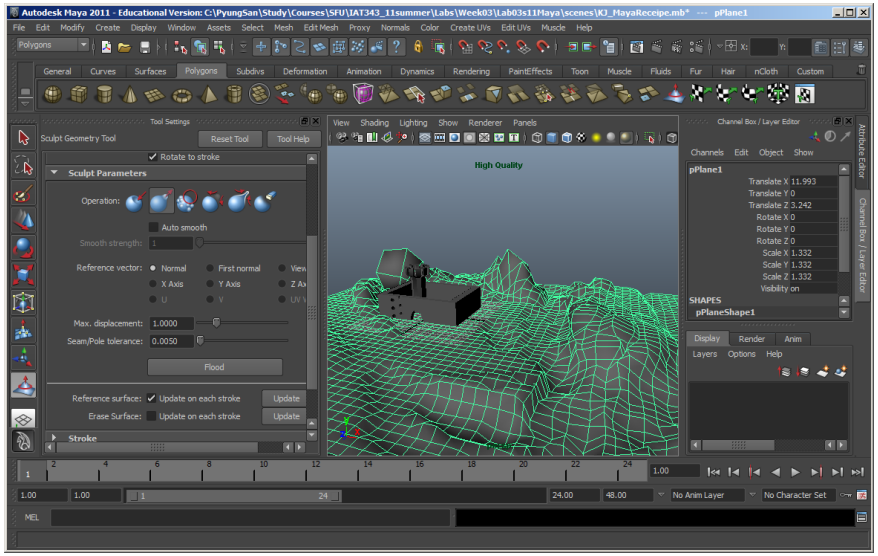
11. Transformation can be done through the standard Move, Rotate and Scale tool on the left UI (shortcut ‘W, E, or R’)

12. To redo the last activity, press ‘G’: shortcut.

13. Switch to different viewports , select different faces and manipulate the tower shape.

Exercise 3.2: Polygon & Surface Modeling (Bridge & Cliff)





Step 1: Create a ground plane and cliffs

1. Zoom out the current scene and draw a plane using the **Top** viewport (**Create > Polygon Primitives > Planes)**. Hold and drag the mouse to adjust the size.

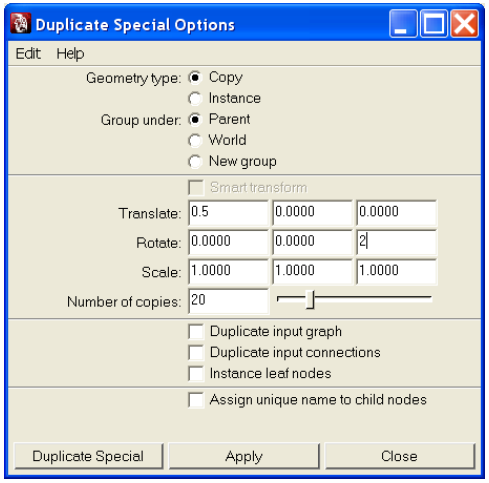
2. To add more divisions, edit the attributes of the plane in the **Channel Box** (**Display > UI elements > Channel Box/Layer Editor**).

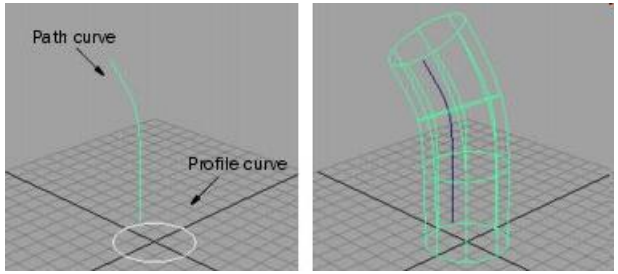
3. From the Channel Box's **INPUTS** section, type 20 in the **Subdivision Width** and **Subdivision Height**.

4. Rename **pPlane1** to *ground*.

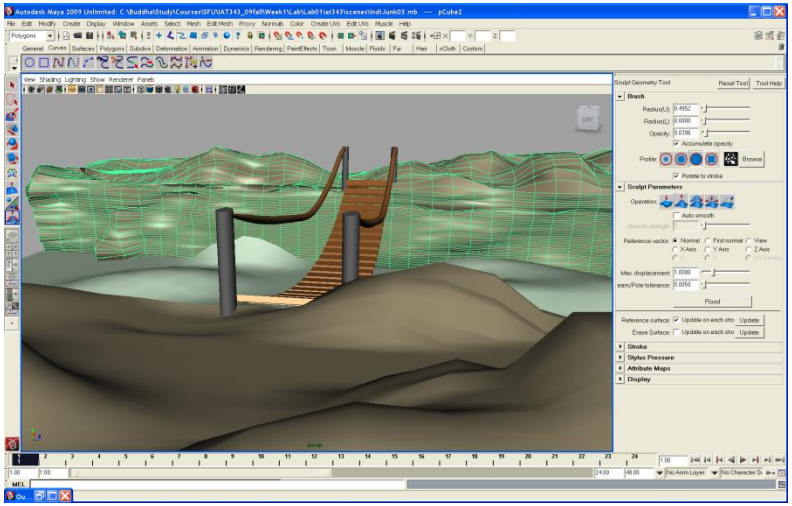
5. To make the ground more realistic having bumpiness, manipulate the surface by applying **Mesh > Sculpt Geometry.** The cursor changes to a brush icon. By brushing on the object, the shape can be easily manipulated. Play with different **Sculpt Parameter** settings such as **Brush Radius**.

6. To make a cliff or the lower ground level where river flows, use the **Push** operation on selected faces.





Surface > Extrude



Step 2: Create a bridge

8. By duplicating a cube, a bridge can be built. Create a cube and adjust the position. Go to **Edit > Duplicate Special Option Box**. Change some parameters (**Number of copies, Rotate, Translate**). Each box next to **Translate, Rotate and Scale** indicates X, Y and Z values. Click **Apply**.

9. To reposition the bridge, apply grouping (**Edit > Group**) to move as a group rather than an individual piece. Rename it from **group1** to **Bridge** on the **Channel Box.** Using the Manipulator tool (scale, move & rotate) , adjust its location. If it is necessary to change the center of the group reposition to the center, apply **Modify > Center Pivot**.

10. Browse other primitive objects (i.e., cylinder) and create more objects to complete the bridge.

11. A rope can be generated by combining a circle and a curve through **Surface > Extrude** function. Create a small circle (as a profile) and a curve (as a path). Select the profile object first and Shift select the path. Apply **Surface > Extrude**.

12. Duplicate these objects and finalize the bridge.

13. Save this file.