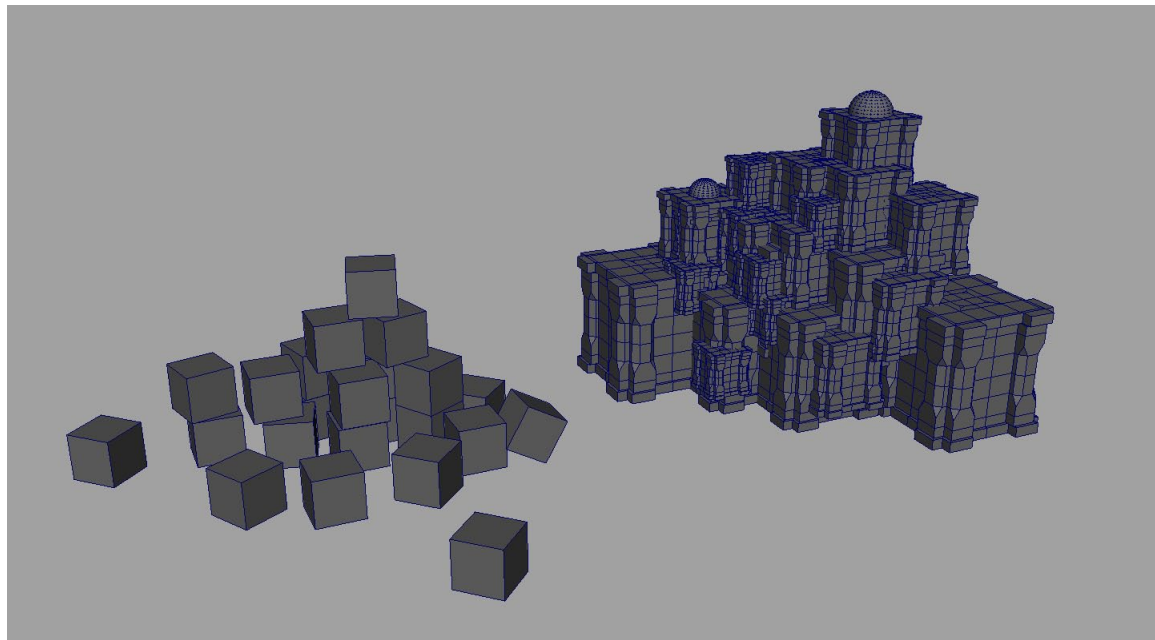




“A” is for Architect—Simple Mass Modeling

One of the first introductions to form and space usually comes at a very early age. As an infant, you might have played with building blocks to help hone your motor skills, assembling them in a row or stacking them to make a simple tower. This is the beginnings of creativity. As we developed, the set of blocks grew to incorporate more curious shapes and primitive forms and then tiny buildings and cities made from rudimentary platforms, posts, beams, ramps, and domes. Little do we know that architecture is about to happen.



Toy Blocks Are the Basis of Form and Space

Overview

This lesson covers the creation and editing of simple primitives and how they can be moved, rotated, scaled, duplicated, and assembled to gain a greater understanding of architectural form and space. The exercises deal with various concepts of pattern, scale, and proportion and explore additive and subtractive forms. Universal design themes will also be covered, including the creation of centralized, linear, radial, clustered and grid forms; space; and planes and plutonic forms.

In this lesson you will learn the following:

- How to set up a scene with preferences
- How to create building blocks from simple primitives
- How to move, rotate and scale objects
- How to split and cut polygons
- How to extrude surfaces
- How to chamfered vertices and bevel edges
- How to assembled forms
- How to assembled space

Getting Started

1. Set preferences

Before you create your polygon architecture, you will need to change some of the default settings to a more suitable environment for this type of work.

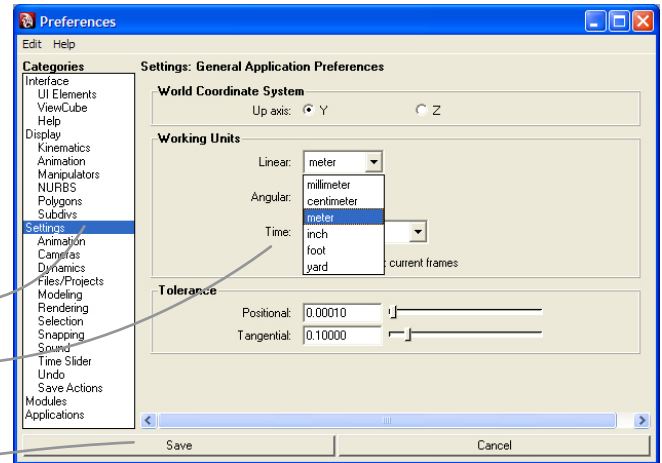
- Select **Window > Settings/Preferences > Preferences**.
The Autodesk® Maya® software user preferences window appears.
- In the Preferences window choose **Categories > Polygons**
- In the Polygon Display settings, set the following:
 - **Border Edges: On**
 - **Edge Width: 4**

This displays border edges more prominently on polygon meshes and helps to identify the edge conditions of any open geometry.

- In **Preferences** window, choose **Categories > Selection**
- In the **Polygon Selection** settings, set the following:
 - **Select faces with: Whole face**

The Whole face setting lets you select polygon faces by clicking on any part of the face rather than on a center dot as with the center setting.

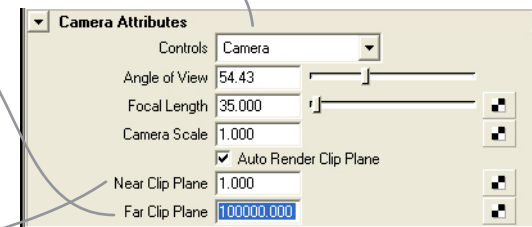
- In **Preferences** window, choose **Categories > Settings**
- In the **Working Units dialog box**, select the **Linear** drop down-menu **choose meter**



Preferences Dialog Box

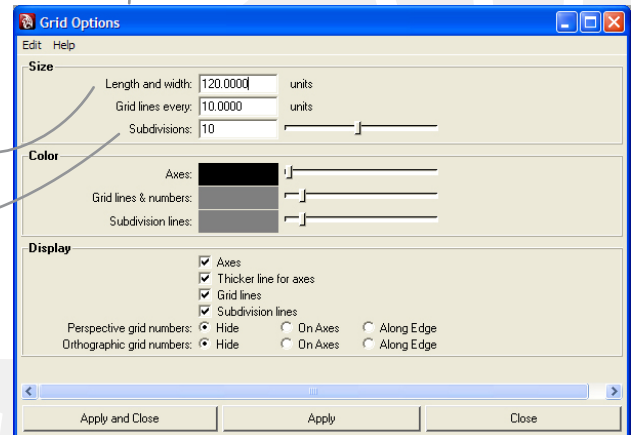
2

- Click the **Save** button to close the settings window
- Open the Outliner and select each camera one at a time: top, side, front, and perspective then change the **Near Clip Plane** to **1** and the **Far Clip Plane** to **100000** for each of them. This will ensure the scene is visible at long and short distances



Camera Attributes

- Select **Create > Polygon Primitives** and turn off the **Interactive Creation** option for primitives
- Select **Display > Grid** and in the **Grid Options** dialog box change the grid size for **length and width** to **120** with the **Gridlines** and **Subdivisions** at **10**



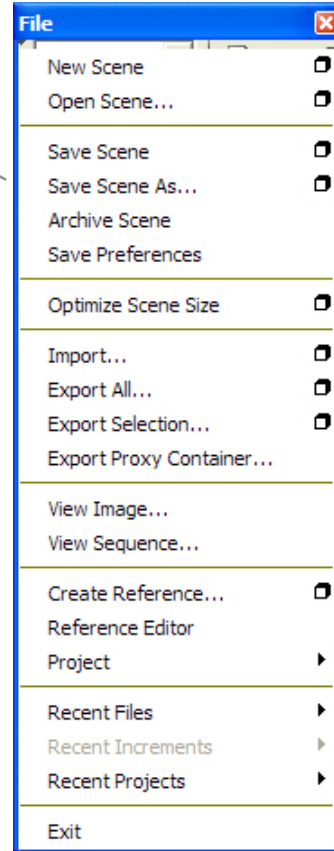
Grid Options Dialog Box

Creating the Building Blocks

Once your workspace is ready, create a new scene and name it.

1. Create a file

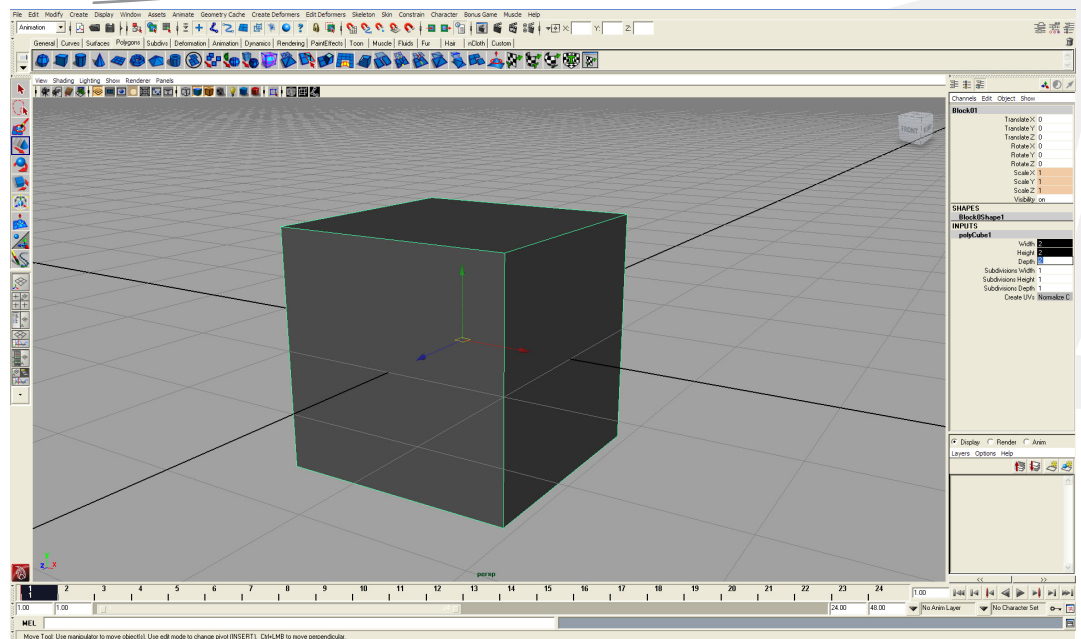
- Select **File > Save Scene As...**
- Name the file *Architecture01_Form_Space_Mine*



File Save Menu

2. Create cube primitive as the building block form

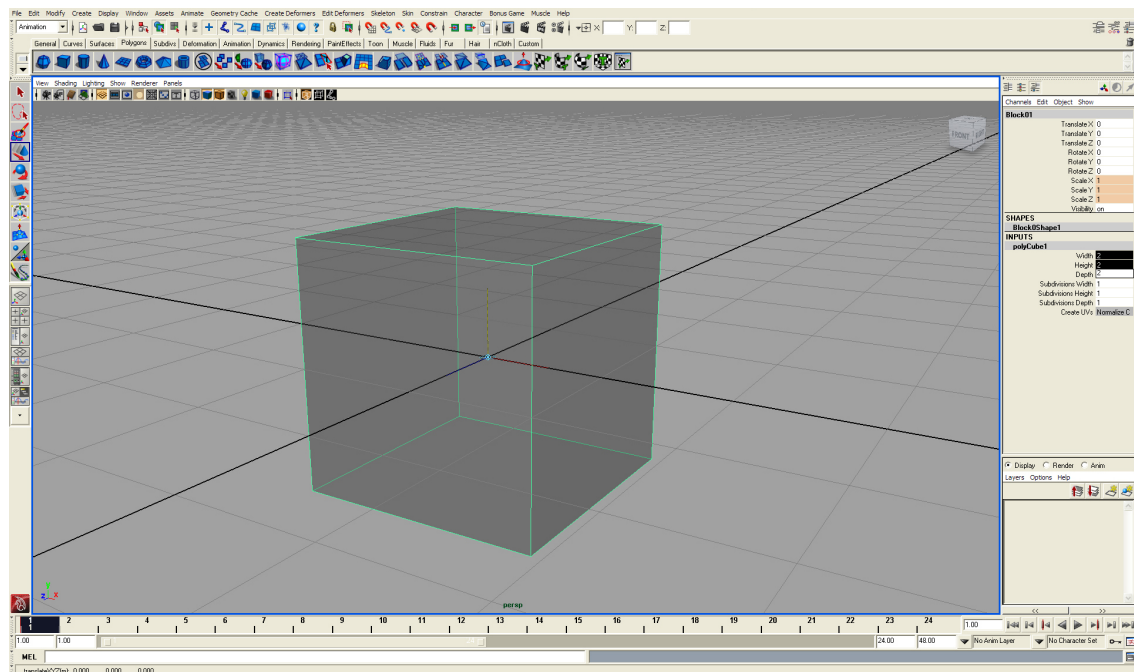
- Ensure you are working in the perspective view
- Select **Create > Polygon Primitives > Cube**
- In the **Channels** dialog box to the right, select the input node **polyCube1** and highlight all three fields by holding down the **Ctrl** key and change the width, height, and depth to 2
- In the **Channels** dialog box rename the mesh *Block01*



3. Adjust pivot for easy movement within the scene

It is always a good practice to position the pivot of an object at the center of its base. By default the pivot of most primitives exist at the center of the volume but having it at the center of the base can be very handy when snapping an object or scaling it.

- Select the new building block *Block01*
- Select the **move tool** (hotkey: W) to enter move mode (this will allow you to see the pivot) (Using the + or - hotkey will scale the manipulator larger or smaller)
- In the **viewport menu** Select **Shading > X-Ray**
See how the pivot sits at the center of the block. This makes it difficult to move precisely on a grid.
- Enter Edit mode for the pivot point by pressing the Insert key



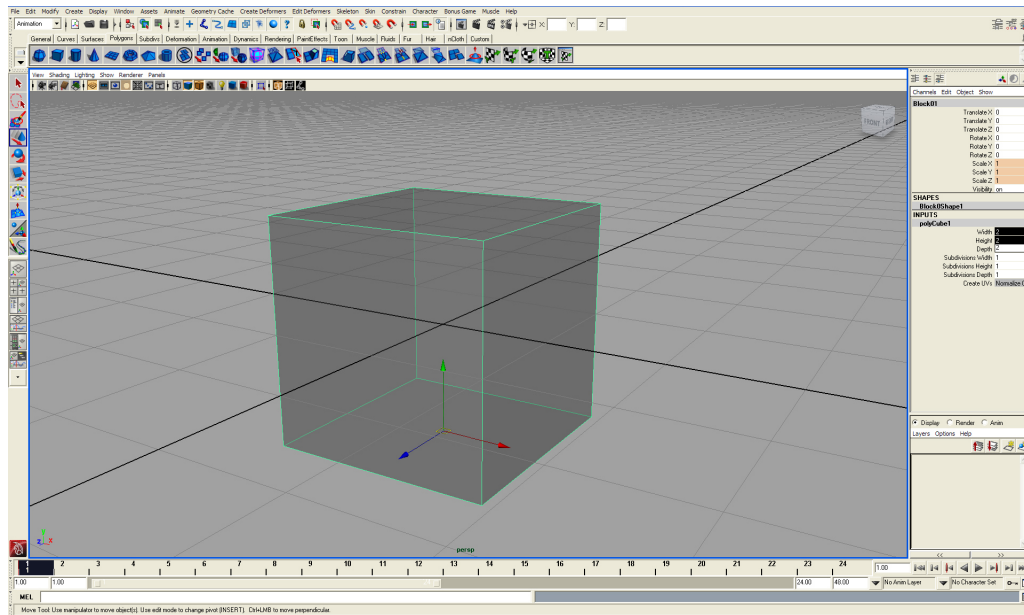
X-Ray Mode and Pivot Adjust Mode On

Tip:



Notice how the manipulator loses its arrows.

- Snap the pivot to the base of the cube by holding down the **V key** (Snap to Points mode) and click dragging the pivot along the Y-Axis to one of the bottom corners of the cube; this should place the pivot directly at the center spot underneath the cube
- Exit Edit mode for the pivot point by pressing the **Insert key** again



Pivot Moved to Center of Base

5

- Now move the cube onto the grid by holding down the **X key** (Snap to Grids mode) and click dragging the mesh over the origin of the grid
- Save the scene

Now the block is better suited for architectural placement, scaling, and rotation within the scene. Placing the pivot at the center and base of the mesh helps when positioning forms upon a surface and is an excellent practice when creating architectural form.

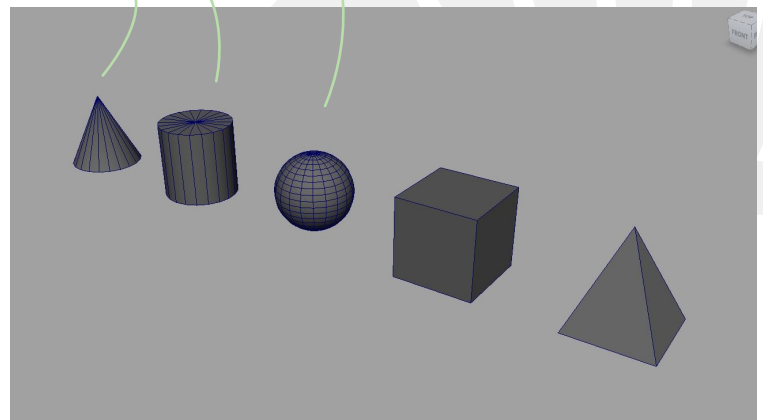
Tip: 

Holding down the **V Key** will let you snap to any vertex in the scene and is extremely helpful when moving objects or adjusting the pivot of an object or group.

4. Create the rest of the primitives

Create the rest of the plutonic forms but using a sphere, cylinder, cone, and pyramid. Make a few duplicates of the cube and make a flat square platform, a post, and a beam. Keep them relatively similar in size.

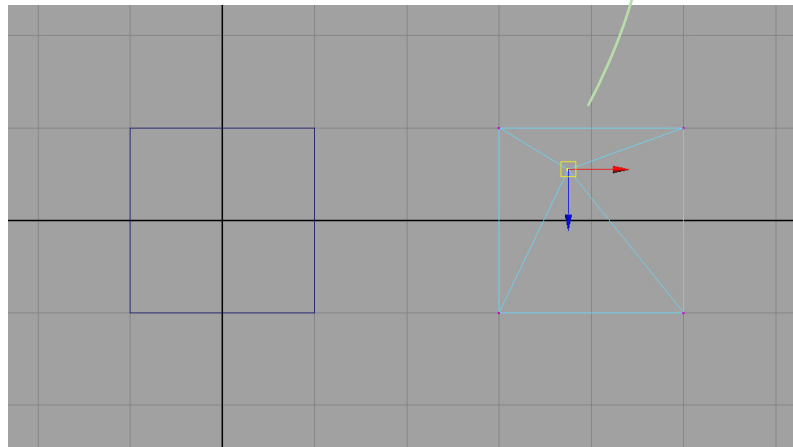
- Select **Create > Polygon Primitives > Sphere**
- Select **Create > Polygon Primitives > Cylinder**
- Select **Create > Polygon Primitives > Cone**



The Plutonic Forms

For the pyramid, duplicate the form and simply collapse the top surface.

- Select Block01 then select **Edit > Duplicate**
- Select top face then select **Edit Mesh > Collapse**
- In the top viewport select the vertex that is off-center, and snap it to the grid by holding down the **X key** (Snap to Grids mode) and click dragging it to the center of the mesh



Pyramid tip adjustment

Creating the Additive and Subtractive Forms

Use new—or copies of—the sphere, cylinder, cone, and pyramid.

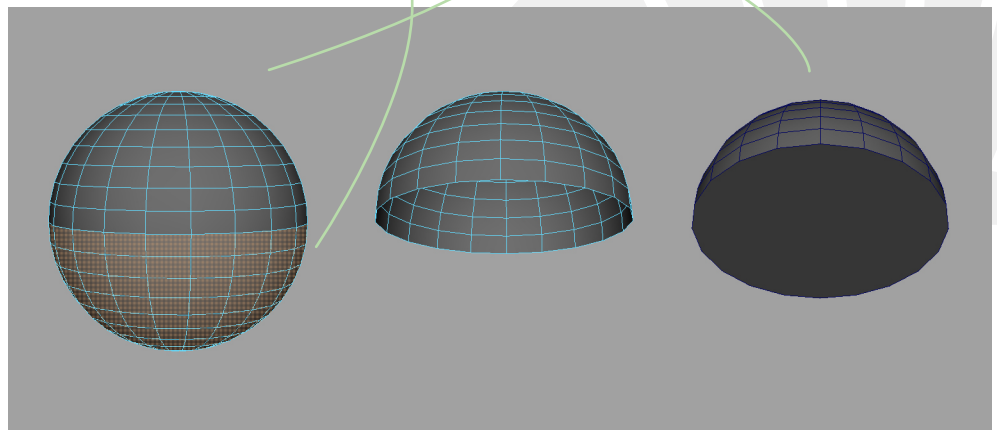
1. Create Subtractive Forms by Deleting Faces

For the sphere, you will simply delete faces and fill in the missing surface.

- Select **Create > Polygon Primitives > Sphere**
- Select the faces of the lower half of the sphere and delete them
- Select **Mesh > Fill Hole** to close the new dome

Tip: 

You can use the Ctrl+D hotkey to duplicate the selected geometry without going into the menu each time.



Sphere Subtractive Form

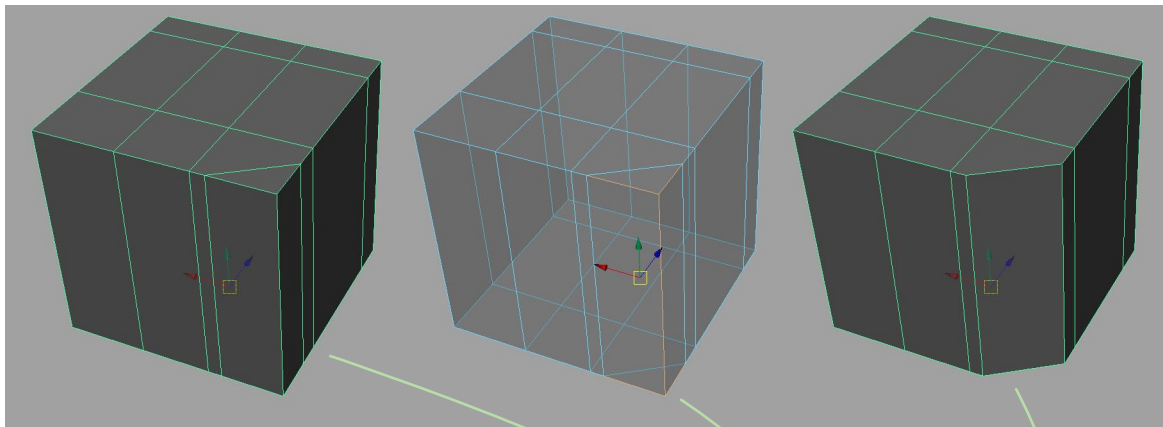
2. Create subtractive forms by deleting edges and vertices

For the cube, you will cut the faces of the object and delete the edges along with the vertices.

- Using the cube in the scene, select **Edit > Duplicate** and create a copy to modify
- Select the new cube and select **Edit Mesh > Cut Faces Tool**
- Subdivide the cube a few times in the top viewport holding down the Shift key to constrain the action in the x and z axis

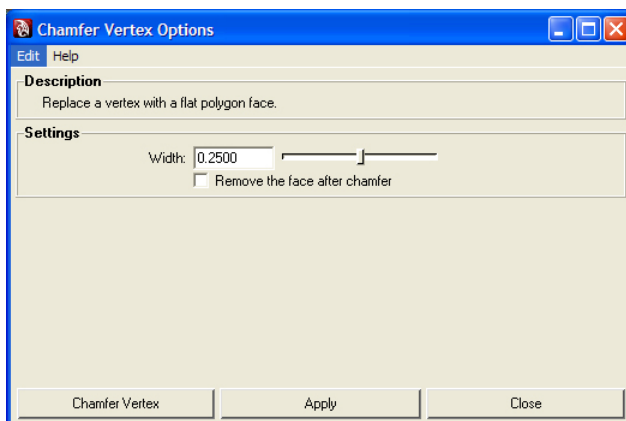
Tip: 

You can use the G hotkey after each operation to use the tool over and over again.



Cube Subtractive Form

- Subdivide the cube in the top viewport at an angle at one of the corners
- Select the edges of the corner
- Select **Edit Mesh > Delete Edger / Vertex** and the entire corner edge will be removed without leaving stay vertices



Chamfer Dialog Box

3. Create subtractive forms by chamfering

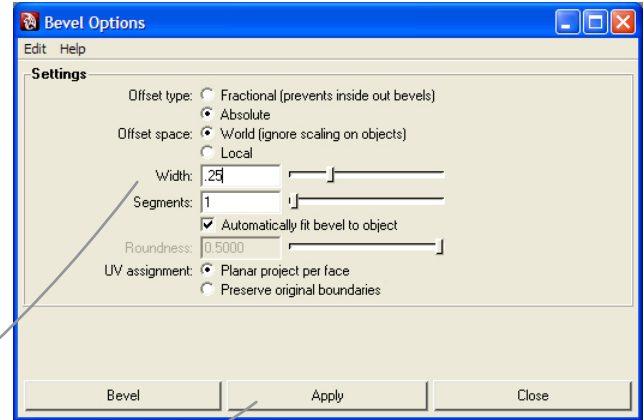
Chamfering vertices is another method to create subtractive forms. Using the cube, you will bevel edges and chamfer vertices of the object to create new forms

- Using the cube in the scene select **Edit > Duplicate** and create a copy to modify
- Select the top four vertices and select **Edit Mesh > Chamfer Vertex Tool Box** and set the width to **0.25**. Be sure to leave the Remove Face After Chamfer box unchecked and press **Apply**
- If the edges of the newly formed object looks awkward, it may be that they are soft; to harden them, select **Normals > Harden Edge**

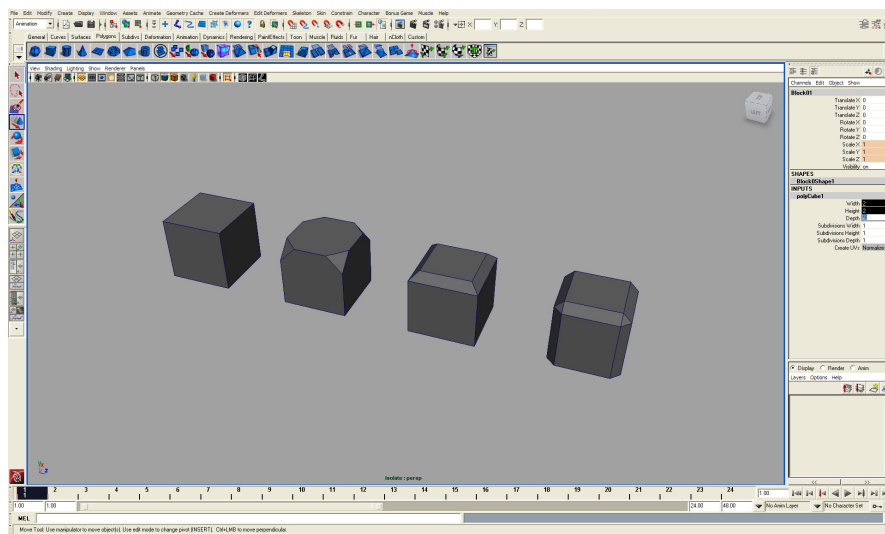
4. Create subtractive forms by beveling

Beveling edges is yet another method to create subtractive forms. Using the cube, you will bevel edges and chamfer vertices of the object to create new forms.

- Using a cube in the scene select **Edit > Duplicate** and create a copy to modify
- Select the top four edges and the side edges and select **Edit Mesh > Bevel Tool Box**
- Set the **Offset type** to **Absolute** and **Offset Space** to **World** with the width at **0.25** and then press **Apply**



Bevel Dialog Box

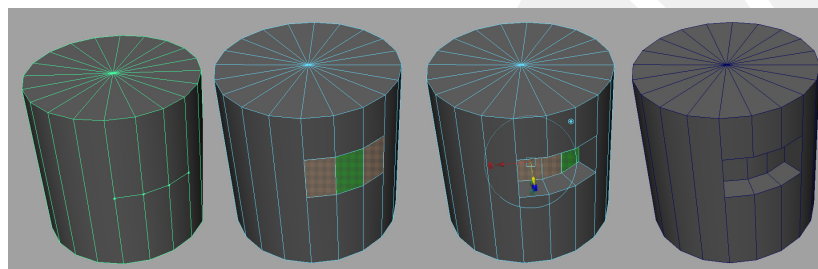


Cubes with Chamfered Vertices and Beveled Edges

5. Create subtractive forms by splitting polygons and extruding

Scaling or extruding parts inward of a pure form is yet another method to create subtractive forms. Using the cylinder, you will subdivide the object and extrude parts inwardly to create new forms.

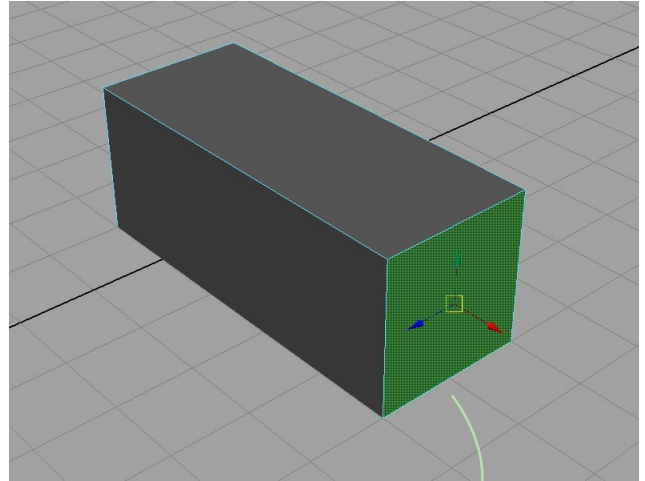
- Duplicate a cylinder in the scene using the **Control + D Hotkey**
- Select the cylinder and then **Edit Mesh > Split Polygon Tool**
- Set the **snapping tolerance** to **100**
- Split the cylinder along the side faces twice to create additional faces
- Select **Edit Mesh > Extrude** and push the faces inward



Cube with Chamfered Vertices and Beveled Edges

Tip:

Continue to create subtractive forms by moving or extruding faces inward to the pure form. You can also use other methods, such as **Control + Right Click** on an Edge and select **Edge Ring Utilities > To Edge Ring and Split** to subdivide objects more quickly.



Using the Grid to Snap Movement of Faces

6. Create additive forms by combining objects

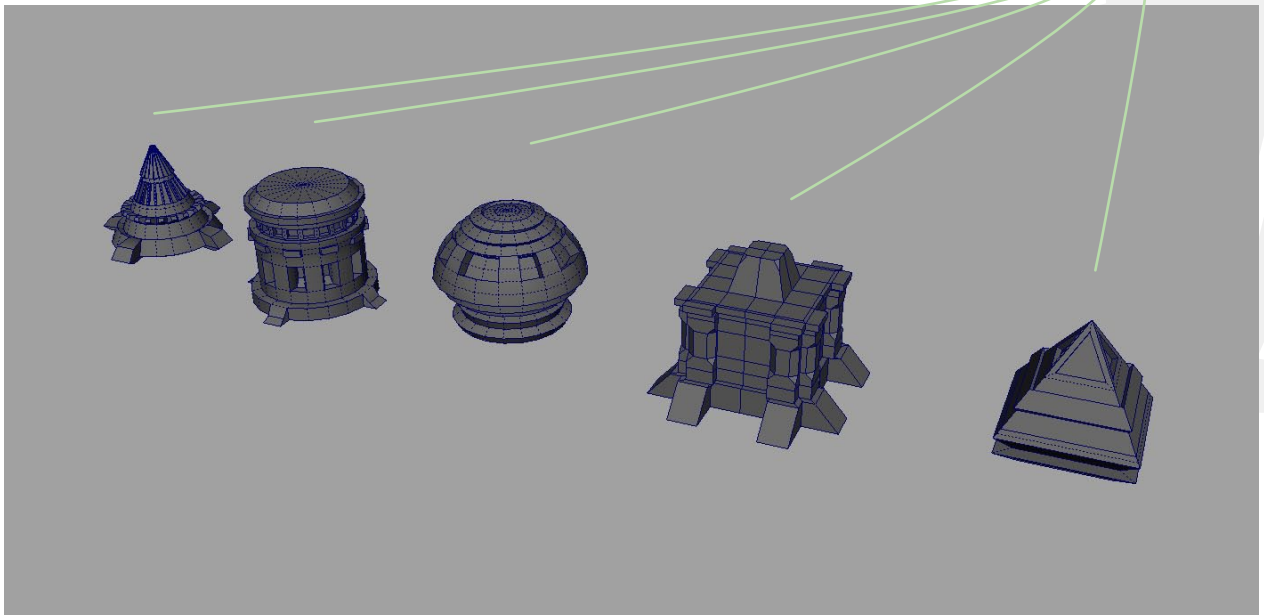
Additive forms are much easier as they simply require extruding faces outward from the form or combining various simple forms into a more substantial form.

- Duplicate a cube in the scene using the **Control + D** Hotkey
- Select a face and move it in the scene while holding down the **X** Key; you will find that you can scale cubes while keeping them on the grid. This makes it very easy to create forms and align them.
- Subdivide the cube using the various methods, and extrude single or groups of faces to create an additive form
- Duplicate some of the cubes and other primitives in the scene, and scale some of them to different sizes vertically and horizontally
- If you decide to use more than one object to achieve this, you should assemble them together and select **Mesh > Combine** to create a new additive form

Assembling the Building Blocks

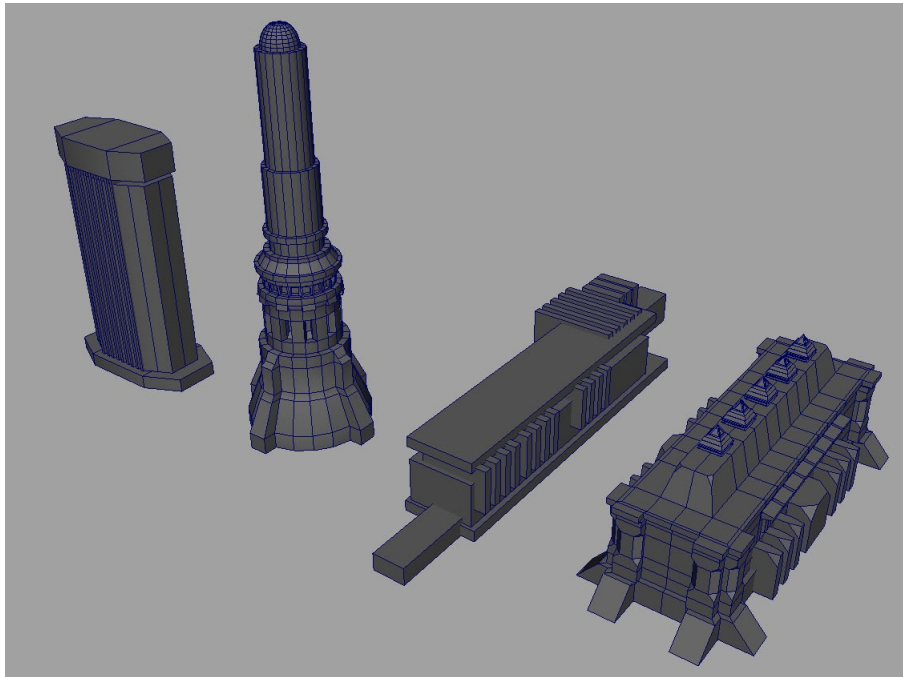
Through simple Tools and Methods like Scale, Duplicate, Move, Polygon Face Cut, Split Polygon, and Combine you can really get a lot of curious forms. Select Face and Edge Loops or Rings to extrude or split to offer you more and more choices while you try to create the following fundamental architectural forms:

1. Create centralized forms



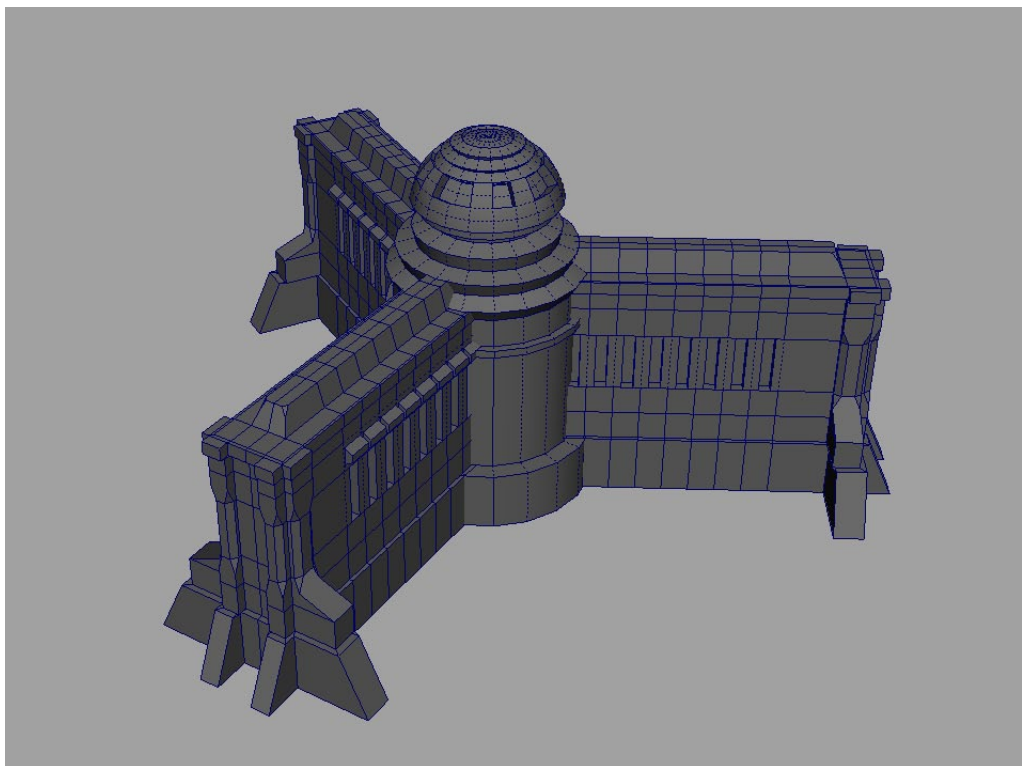
Centralized Forms

2. Create linear forms



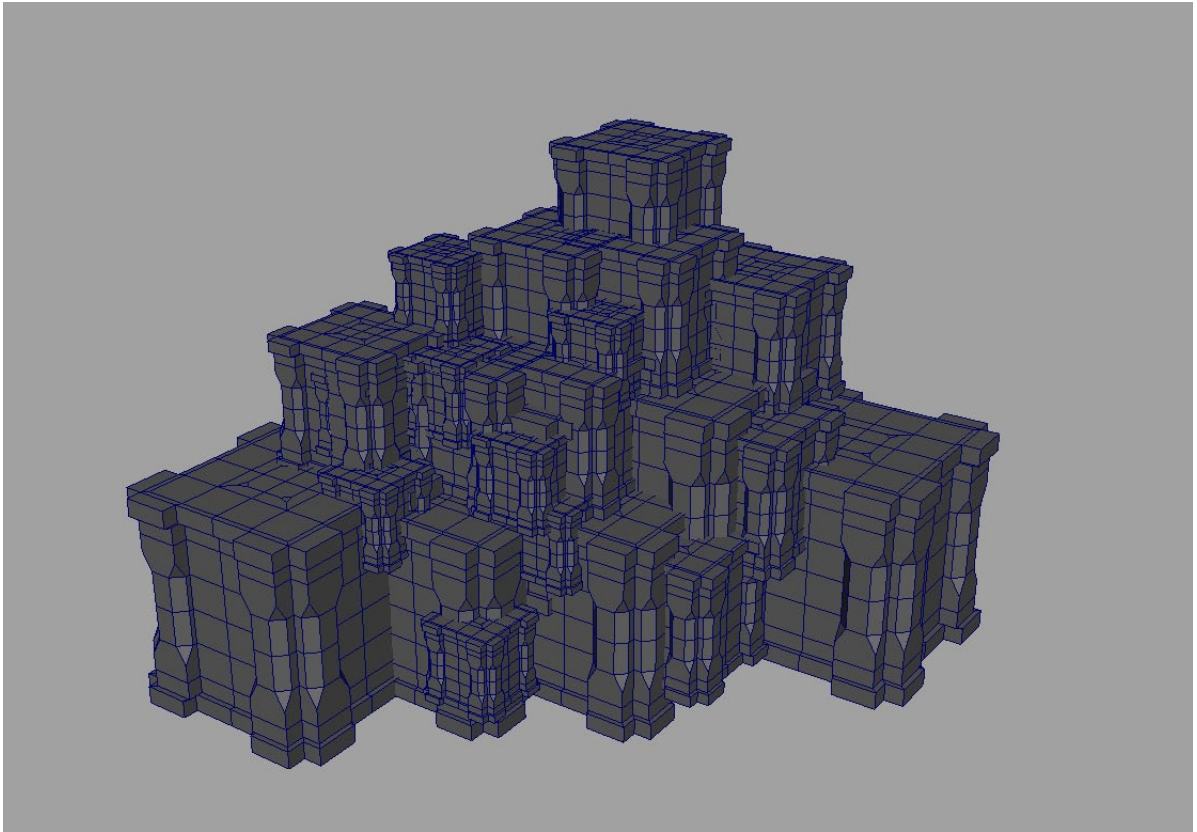
Linear Forms

3. Create radial forms



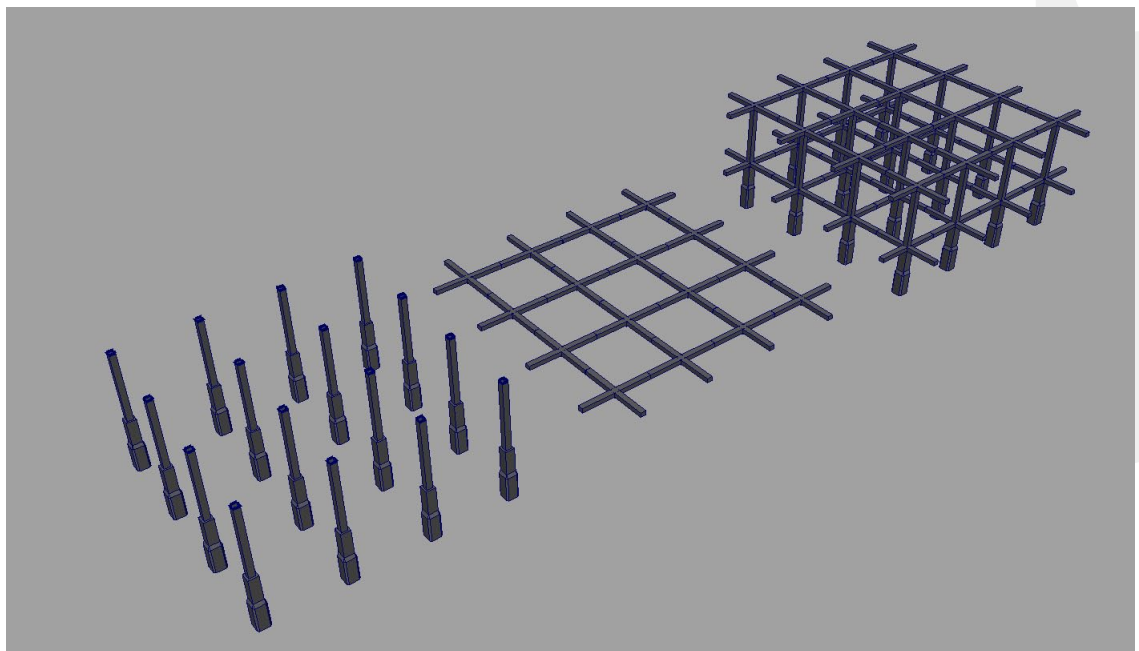
Radial Form

4. Create cluster forms



Clustered Form

5. Create grid forms



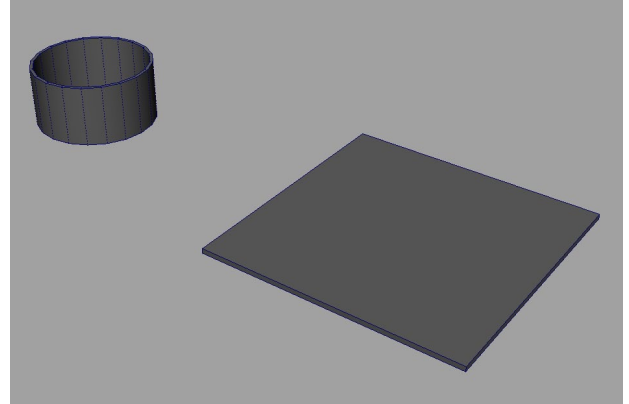
Grid Form

Defining Space

Defining space simply involves the use of a plane or repeating elements to create ideas of closure. Columns work well when spaced evenly in enclosing a space.

1. Create a plane and pipe

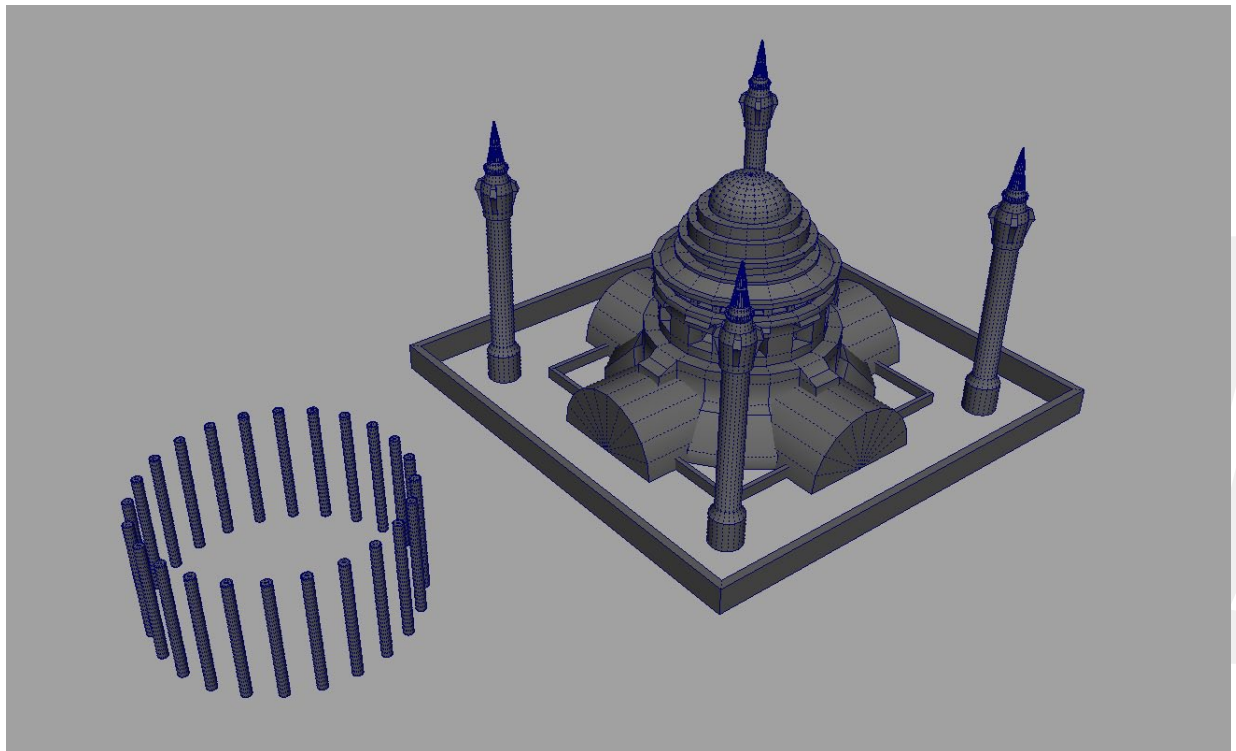
- Select **Create > Polygon Primitives > Plane**
- Input length and width of **4**
- Extrude the plane by 0.05 to create a ground surface with a bit of thickness
- Duplicate the plane and rotate it so that it becomes a wall
- Select **Create > Polygon Primitives > Pipe**
- Input a thickness of 0.05



Pipe and Plane

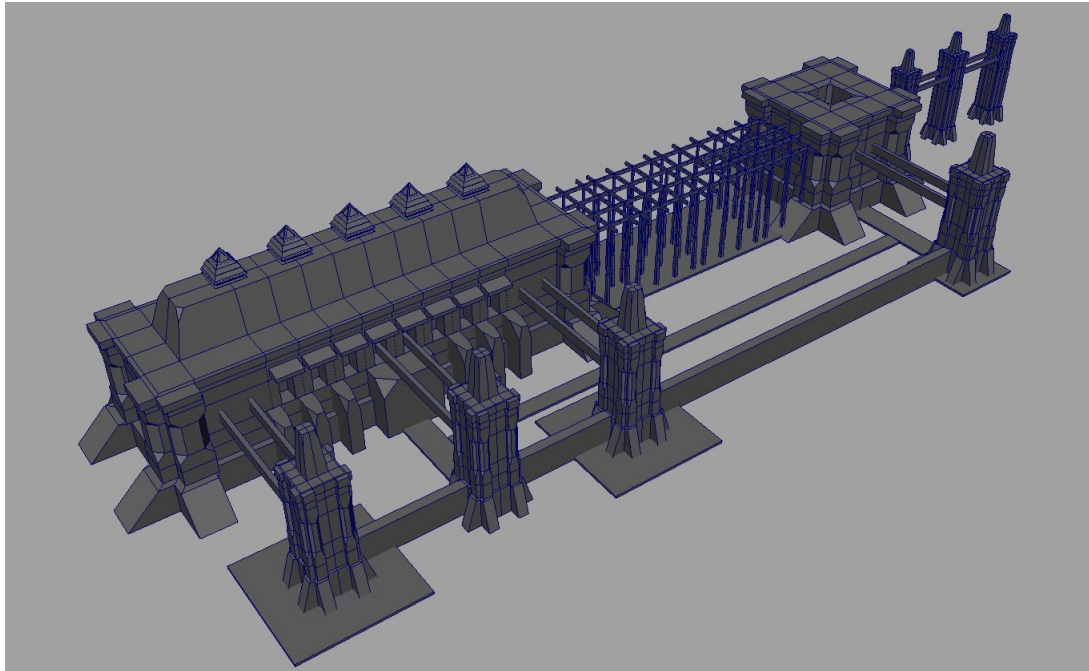
Spatial themes can easily be explored now by assembling various walls, ceiling, or floors to create the following fundamental architectural spaces:

2. Create centralized space



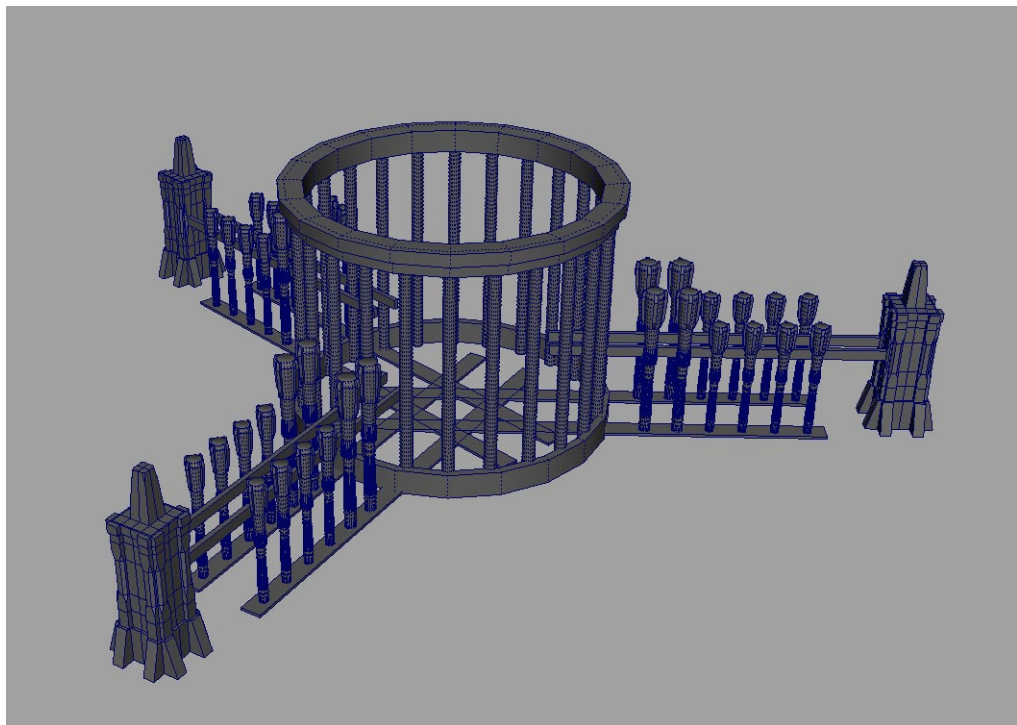
Centralized Space

3. Create linear space



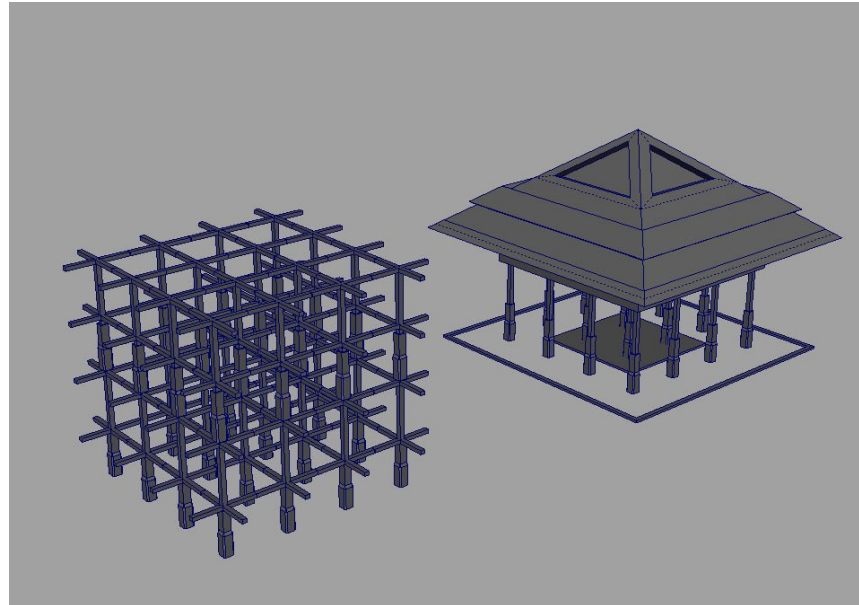
Linear Space

4. Create radial space

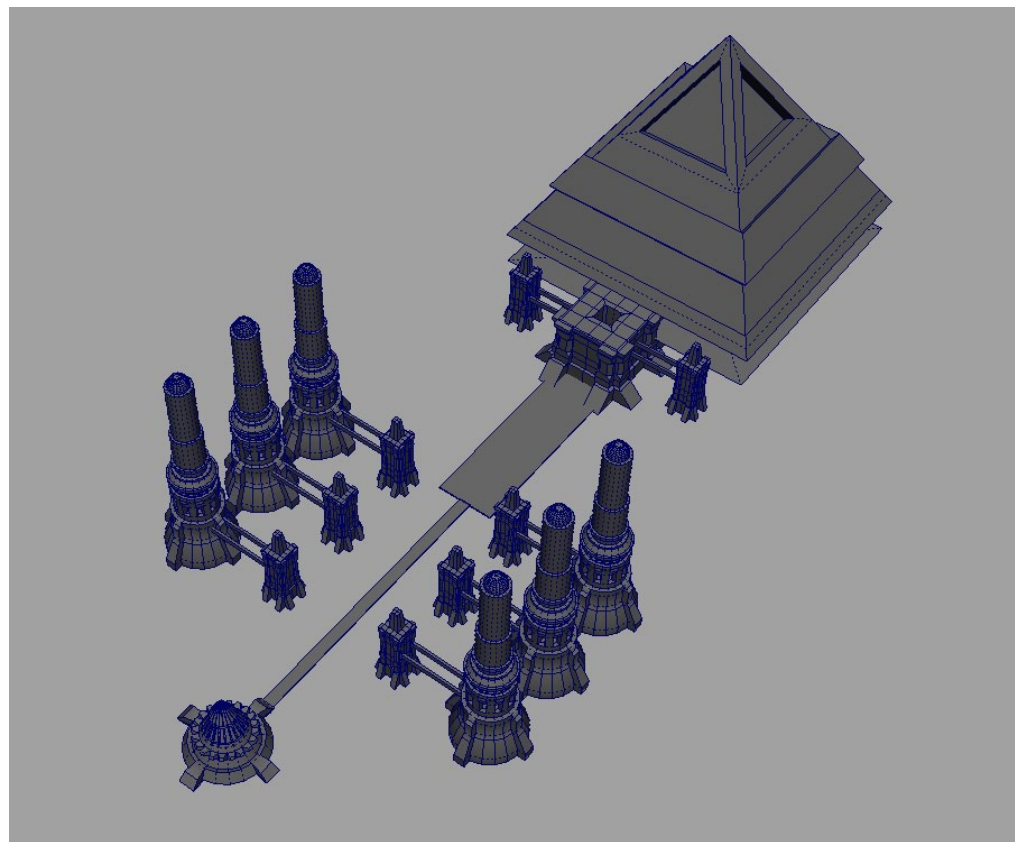


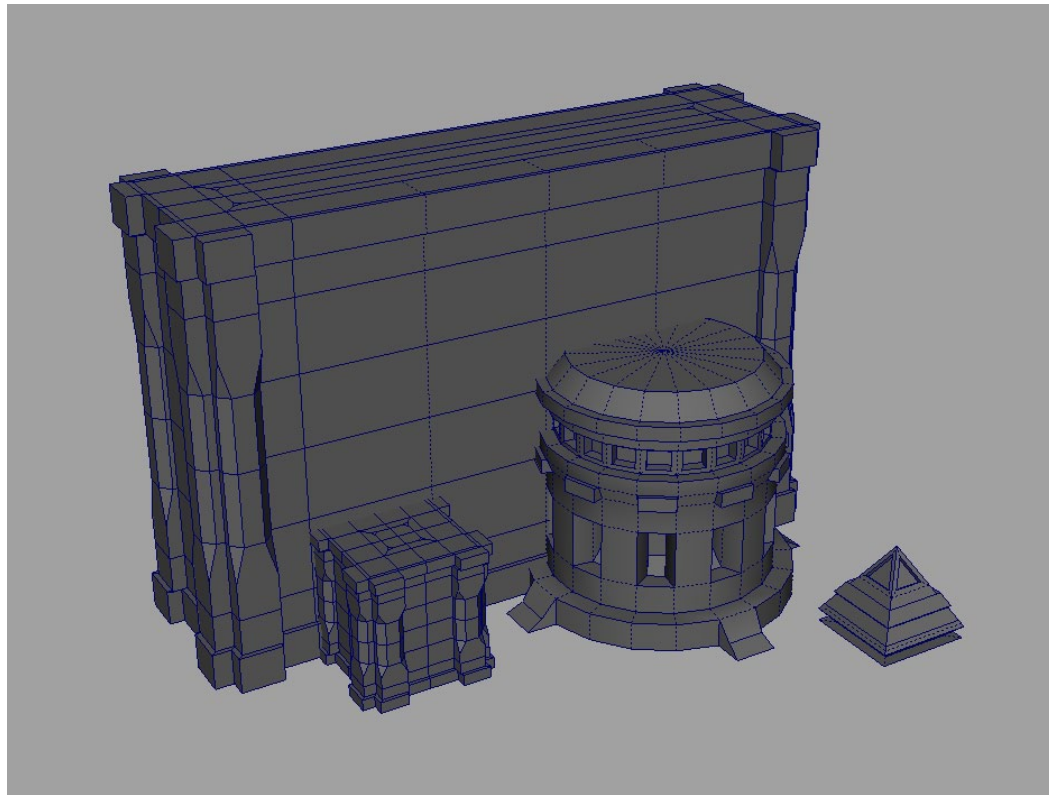
Radial Space

5. Create grid space

*Grid Space*

You can create symmetry through spacing and mirroring elements or explore ideas about axis by setting up a linear space that ends at a structure. You can even make a datum.

*Axis Through Symmetry*



Datum

Concepts Explored

- Pattern, Scale and Proportion
- Subtractive and Additive forms
- Architectural themes of Form
- Architectural themes of Space
- Orders of Space and Form

After the Exercise

This exercise provided you with the essential tools and procedures to create form and space. It is easy to see that by practicing these techniques you will be able to create almost any type of architecture. Remember that selecting rings and loops of edges and faces is a powerful method that allows you to subdivide an object quickly before you extrude. Master this skill and you will be able to mass modeling quickly.

The fundamental forms and space will be invaluable when considering types or styles of architecture. Using the additional files provided with this exercise will help you to continue thinking about how these architectural themes have been used throughout historical form and space.

Historical.ma provided for further exploration of architectural form and space.