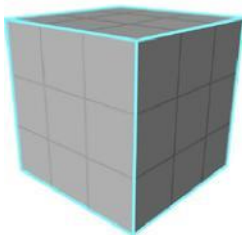# Key 3D Modeling Terms
Beginners Need To Master

Starting your 3D modeling journey is an exciting and rewarding experience. As you begin to learn and practice, there are essential terms you need to know and remember to grow your modeling skills. Use this resource to learn key terms and as a reference when creating your own 3D models.
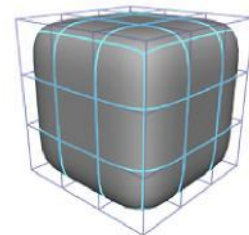
Polygon geometry

A polygon is a three-four sided plane of geometry that makes a face on an object. Polygons are the most commonly used geometry type in 3D. While polygons are commonly used for all types of objects, in order to create very smooth surfaces with polygons means that you'd need to add a lot more geometry than you would with either NURBs or subdivision surfaces.

nUrBs surfaces

NURBS stands for non-uniform rational b-spline (NURBS). NURB splines are curves used to created smooth, minimal surfaces and geometry. NURBS are commonly used for very smooth objects because they don't require as many points to create the same look as polygon geometry would. A NURBS surface always has four sides that are defined by control points.

Subdivision surfaces

Subdivision surfaces, which are sometimes referred to as NURMS (non-uniform rational mesh smooth), are closely related to polygonal geometry. Subdivision surfaces use an algorithm to take polygon geometry and smooth

it automatically. For example, in the image above you can see the polygon cage around the smoothed subdivision surface. You can think of a subdivision surface as a mix of polygonal and NURBs geometry.

Face

When three or more

edges are connected, the face is the filled space between the edges and makes up what is visible on a polygon mesh. Faces are the areas on

your model that gets shading material applied to them.
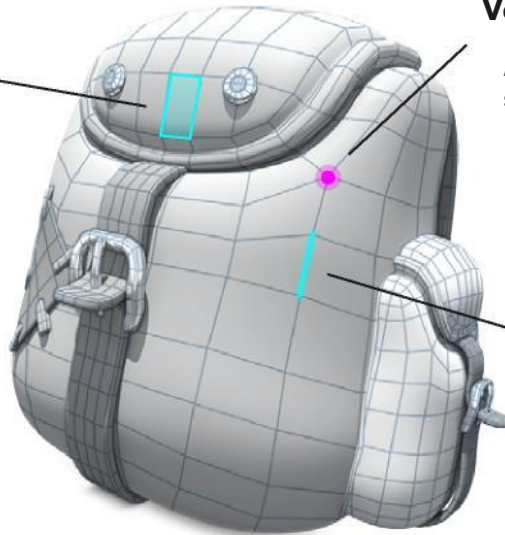
Vertex

A vertex is simply a point in 3D space. Connecting three or more vertices creates a face. These

points can be manipulated to create the desired shape.

Edge

An edge is the line created by connecting two vertices.

Edges can be used to

transform and define the

shape of the model.

TOPOLOGY

To·pol·o·gy : [*tuh*-**pol**-*uh*-jee] : n*oun*

Whatever type of geometry you use it will either be created by NURBs, or points, edges, and faces. The way these components are connected together and the flow around the 3D object is the topology. You can think of topology as the type of polygon faces, the type of vertices and the flow of the edges.
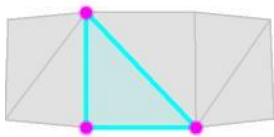
Triangle

A triangle is the simplest polygon that is made up of three sides or edges connected by three vertices, making a three sided face. When modeling, triangles are typically a polygon type often avoided. When creating complex meshes, triangles tend to pose a problem when subdividing geometry to increase resolution, and when a mesh will be deformed or animated.
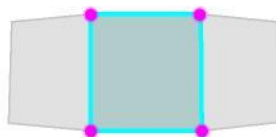
Quad

A quad is a polygon made up of four sides or edges that are connected by four vertices, making a four sided face. Quads are the polygon type that you'll want to strive for when creating 3D models. Quads will ensure your mesh has clean topology, and that your model will deform properly when animated.
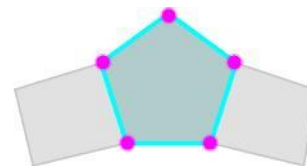
N-gon

An n-gon is a polygon that is made up of five or more sides or edges connected by five or more vertices. It's important to keep in mind an n-gon is typically related to a five sided polygon, but it's not limited to just five sides. An n-gon should always be avoided, they often pose problems at render time, when texturing, and especially when deforming for animation.
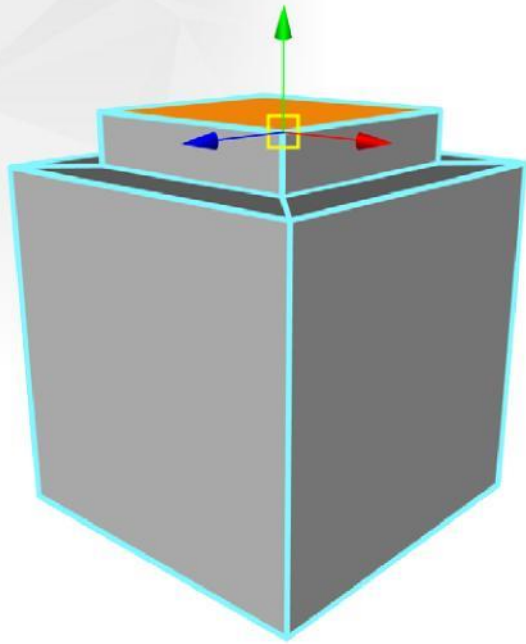
Extrude

Extruding is one of the primary ways of creating additional geometry on a mesh. The extrude command allows you to pull out extra geometry from a face ("polygon" in 3ds Max), edge or vertex.

For instance, you can use the extrude command on the face of a simple cube to pull out the geometry needed to create fingers. These additional extrusions can be edited and manipulated just like any other area of the mesh.

Edge Loop

An Edge Loop is a series of edges connected across a surface, with the last edge meeting the first edge, creating a ring or loop. Edge loops are especially important for maintaining hard edges in a mesh, and also for more organic models.

For example, in order for an arm to deform properly there will need to be edge loops on each side of the elbow joint so there is enough resolution.
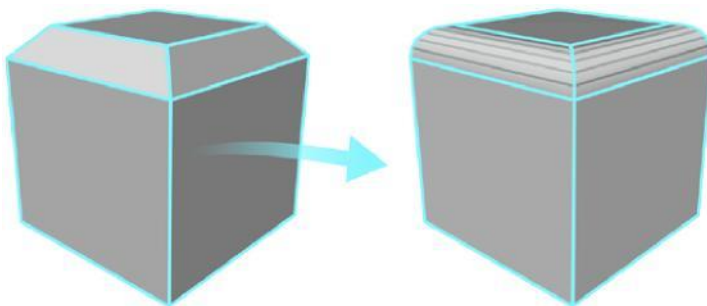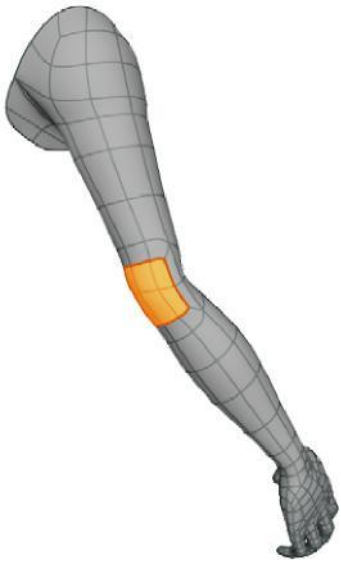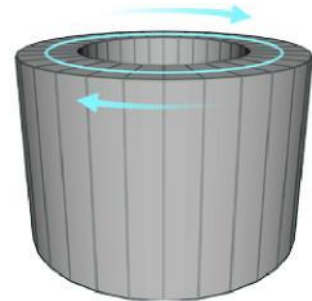
Beveling

Beveling is the process of chamfering, or creating rounded edges on a mesh. Beveling expands each vertex and edge into a new face. In the real world objects rarely have completely hard edges. Beveling helps to lose some of the computer generated look that comes with 3D modeling.
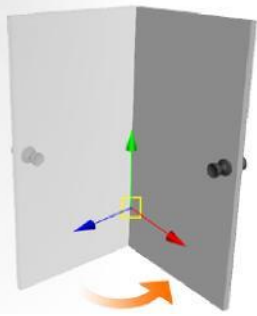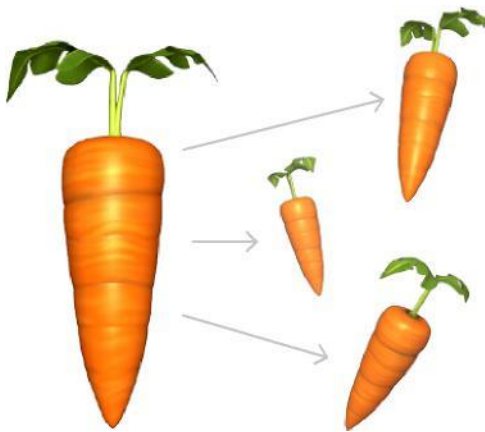
Pivot point

The pivot point is the point on a 3D object where any rotation, scale, or moves that you do will occur from. This pivot point can be moved to any position on the model. For example, placing the pivot point on the hinges of a door will tell the computer where it should rotate from.
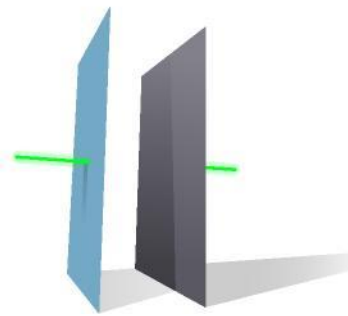
normals

Surface normals are used by your 3D application to determine the direction that light will bounce off of geometry. This is very helpful to get control over how the light reacts to certain materials on your 3D objects.

Instances

When working with a 3D set you will often need to create duplicates of a single object, whether it's hundreds of trees or fence posts. Doing this however can greatly increase render time, because the computer has to calculate all this new geometry. Instead of creating a duplicate of an object, you can create an instance.

Instances are copies of objects that derive all their information from the original object; because of this the computer only has to calculate the geometry for the original object. It's important to keep in mind that you can't edit an instances shape on

its own. If you edit the shape of the original object all of the instances update to reflect that change.

ORIGINAL   INSTANCES

Construction History

While you're working on your 3D models you will likely use a wide range of tools to get the desired result. For example, you may need to extrude many different faces or bevel the edges of the model to create a particular shape. Most 3D applications keep track of all these actions in what is called the construction history. This displays a list of every different tool you've used on your 3D model in the order that you used them.

If you need to go back and adjust the settings of a tool you used, you can find it in the construction history. Keep in mind that as your construction history starts to stack up it will slow down your computer, so you will need to delete your construction history periodically.
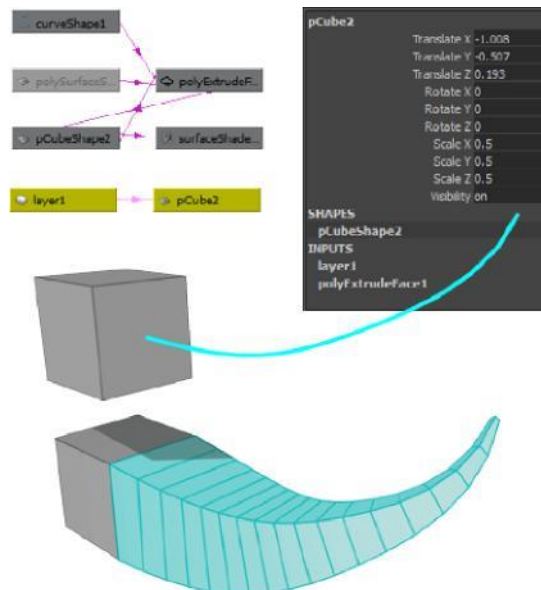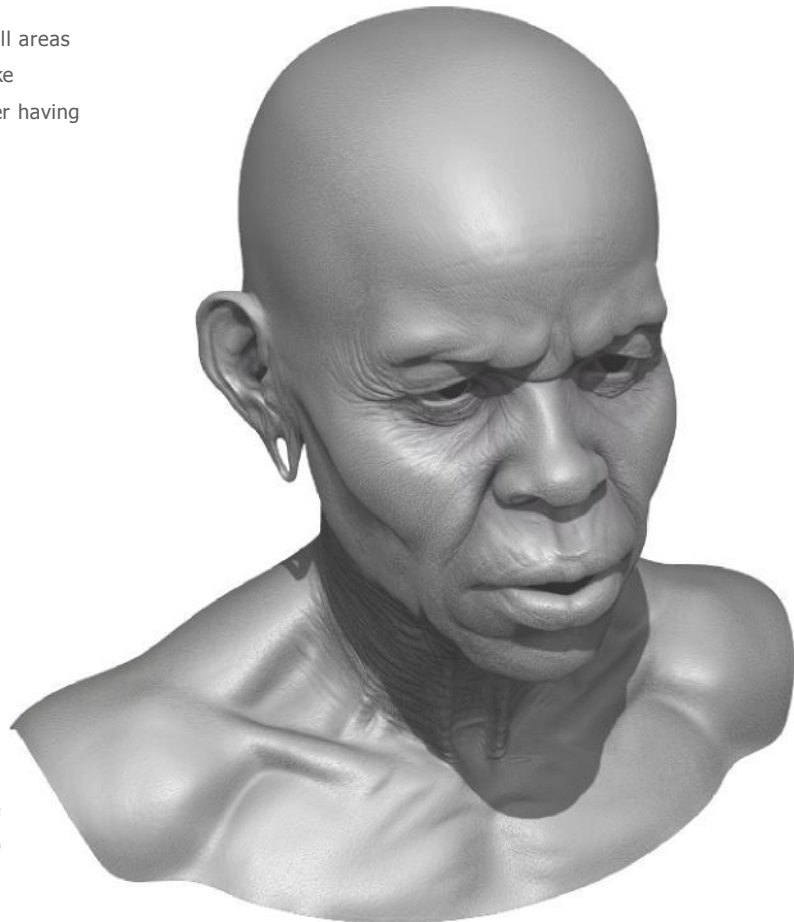
Digital Sculpting

When creating 3D models in an application like Maya the process includes manipulating vertices and edges to get the desired look. While this works, it can be hard to get fine detail that is often required, especially in organic models. Digital sculpting works around this issue by allowing you to create your 3D meshes in much the same way as a traditional sculptor would.

You can interactively push and pull areas of your model, and create details like wrinkles and scratches without ever having to select an edge or vertex.
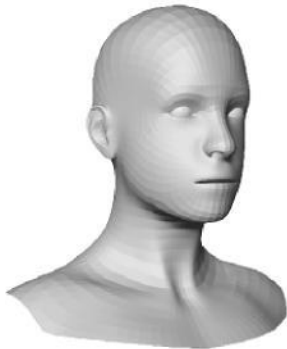
BASE MESH

Often times a modeler will create the low resolution base mesh in a program like Maya, and import that into digital sculpting applications like ZBrush or Mudbox to be able to create those finer details.

HIGH POLYGON MESH