A Beginner's Guide to 3D Modeling

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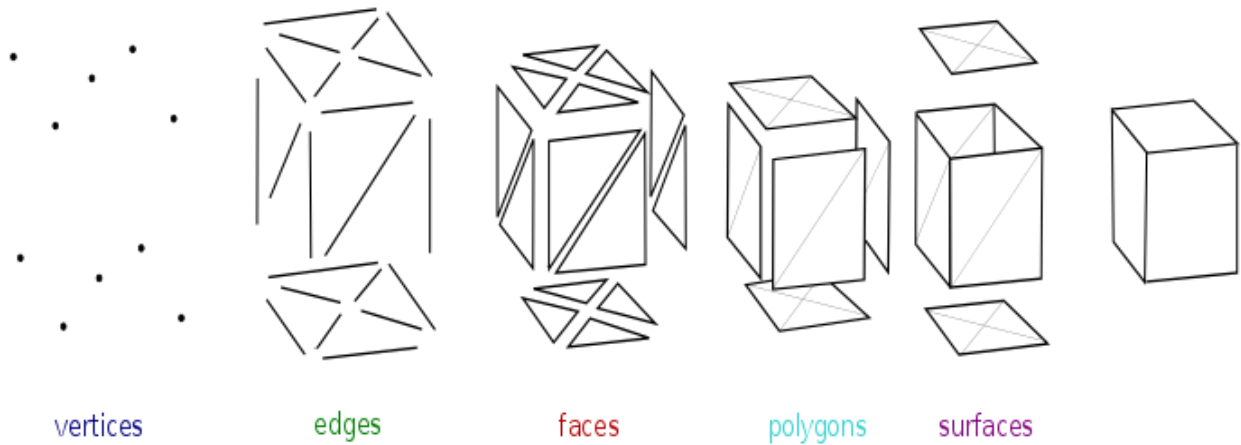
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The Building Blocks of 3D Models

vertices   edges   faces   polygons   surfaces

- **Vertex:** A single point and smallest component
- **Edge:** A straight line that connects two vertices. These define the shape of the model
- **Face:** The mosh basic part of a polygon mesh. It is the space between the edges
- **Polygon:** Any shape that is formed by connecting straight lines. There are different types that depend on the number of sides and the extent of the angles
- **Surfaces:** A group of polygons that appear to form a smooth surface
- **Mesh:** A collection of polygons that are connected along their edges. A 3D object consists of one or more 3D meshes.

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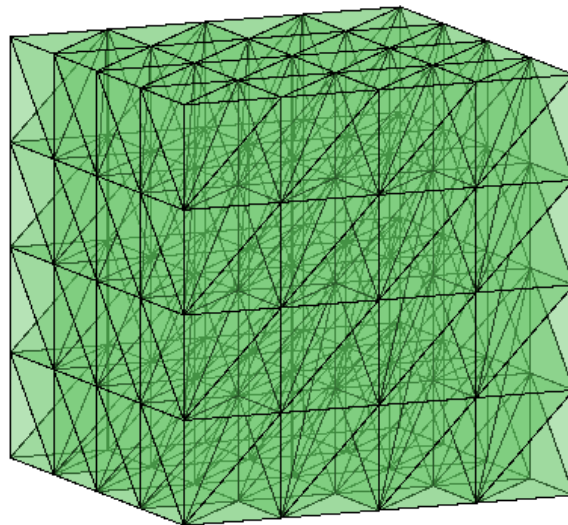
Low Poly Models

Low poly models have a small number of polygons. You can start with creating a model by combining simple shapes to form the object. On the other hand, you can use Blender, to reduce the overall number of polygons used in a model using the 'Decimate' modifier:

www.instructables.com/Creating-Low-Poly-3D-Models-Using-Blender-28/

High Poly Models

High poly polygons have a high poly count and result in more detail. Objects can be created to look more realistic and accurate. Examples of complex objects are buildings, cars, or characters. Using Blender, you can model high-poly models with greater detail using the sculpting tools and techniques.

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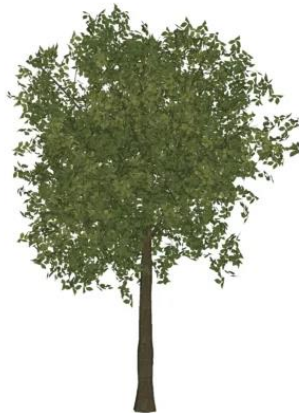
Steps to create a 3D Model

1. **Choose a software!**
   a. TinkerCAD (Recommended for Beginners)
      i. Follow these tutorials to get comfortable with TinkerCAD and it's features and controls: www.tinkercad.com/learn
   b. Blender (Recommended for experienced modelers)
      i. www.youtube.com/watch?v=rN-HMVTB7nk&list=PL_nLm_Ns-0xGd9a_uwIjrhfZx1tcxQmoc
      ii. all3dp.com/2/blender-3d-printing-tutorial/

2. **Choose a subject**
   a. Start simple! A great starting point is creating 3D miniatures like buildings, cars, or animals.

3. **Research & Conceptualize**
   a. Look at examples and references
   b. Sketch it out

4. **Start Simple!**
   a. Start small before tackling complex models
   b. Break down your model into smaller chunks to better manage your project

5. **Check for printability!**
   a. Make sure to check your model for any errors that can cause problems such as verifying the scale and dimensions, fixing gaps, and making sure it is manifold (refer to guide on how to avoid and fix mani-fold edges)

6. **Export, Import, and Slice**
   a. Export your model as a 3D format such as .stl, .3mf, .obj
   b. Import model to ideaMaker and slice!

Remember that practice makes perfect! Keep practicing and getting better to print some awesome models!

Glossary

- **3D:** Three-dimensional. Can be a display, performance, or medium in three dimensions (X-, Y-, and Z-axes).
- **3D object:** Anything that can be represented in 3D space. Geometric objects are good examples of 3D objects, whether they are surfaces, curves, nulls, or polygon meshes.
- **3D rendering:** A final stage in 3D modeling that involves the finalizing of a model. It involves special effects, modifying colors, adding textures, and lighting.
- **3D sculpting:** The process of creating a 3D model through shaping and molding blocks using brushes and other sculpting tools. The process includes pushing, pulling, inching, and pinching.
- **Axis of motion:** A line that an object follows when it's moving in the scene.
- **Axis of rotation:** A line that a 3D object in the scene rotates around.
- **Back face of culling:** A technique that checks the orientation of a triangle and removes those facing away from the camera.
- **Beveling:** The process of removing sharp edges in a model to give it a realistic look and enhance its appearance.
- **Boolean:** A mathematical system used to express the connection between things. It's used in 3D modeling to add, subtract, and do other operations.
- **Boolean operations:** A technique that uses two objects to create another object. The objects must be overlapping.
- **CAD:** An acronym for computer aided design.
- **Edges:** Formed by two vertices joined together, edges are used to transform 3D models.
- **Extrude:** Adding a third dimension to a two-dimensional shape to create a 3D object.
- **Faces:** It's formed through a connection of three or more edges.
- **Geometry:** This vertex data results in the actual 3D model.
- **Materials:** Includes colors and textures assigned to 3D models to make them more real-looking. It has different kinds of properties depending on the rendering mode being used.
- **Mesh:** A 3D model that's made of triangular polygons. Polygons consist of edges, faces, and vertices that determine how the shape of an object looks.
- **Polygonal modeling:** 3D modeling objects by using polygons to make rough estimates of surfaces. In polygon modeling, vertices, edges, and faces are all worked on.
- **Rapid prototyping:** The entire process of creating a 3D model using 3D modeling techniques and printing it using a 3D printer.
- **Texture:** The image applied to a 3D object as a part of a material.
- **Topology:** This is how polygons are organized and connected.
- **Vertices:** A point in a 3D space. When several vertices are combined with edges, it forms a polygon.