3D Representation & Geometric Primitives

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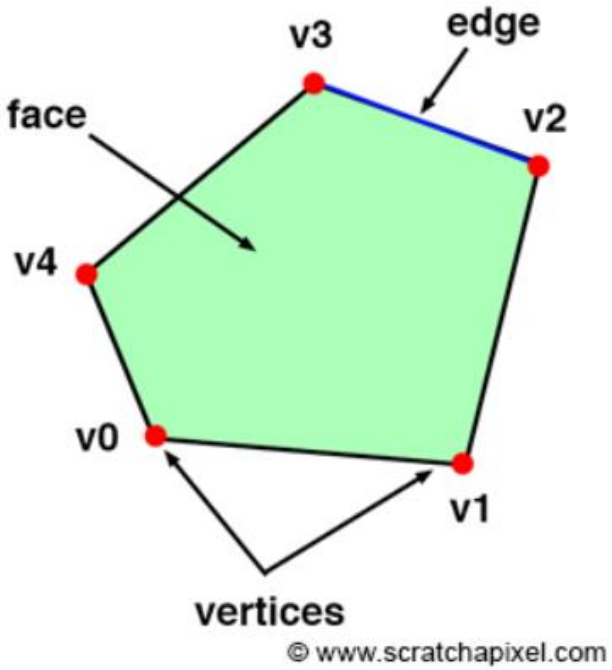
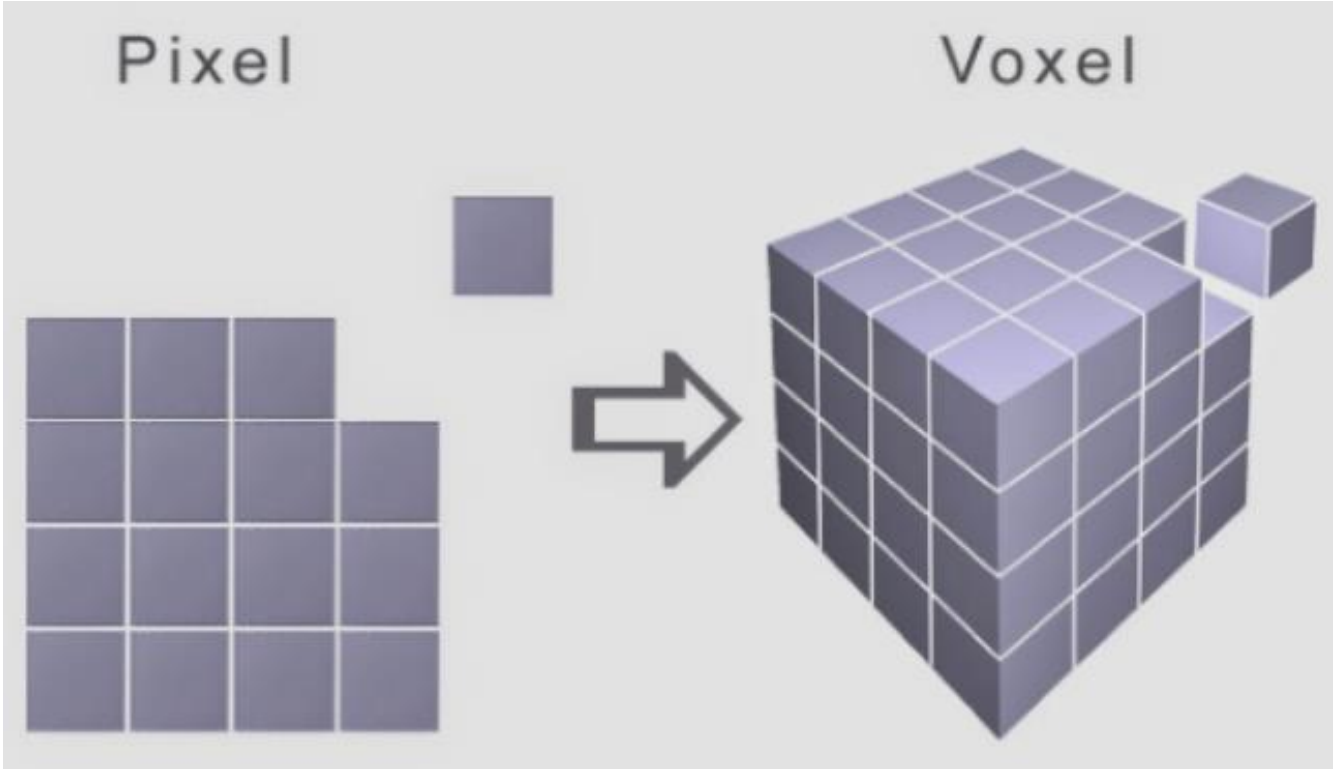
Polygonal meshes

- It is based on the elementary brick called a polygon(or face)
  - It is a “planar” shape, and it is defined by connecting a series of 3D vertices.
- Polygonal meshes represent the surface of a 3D object



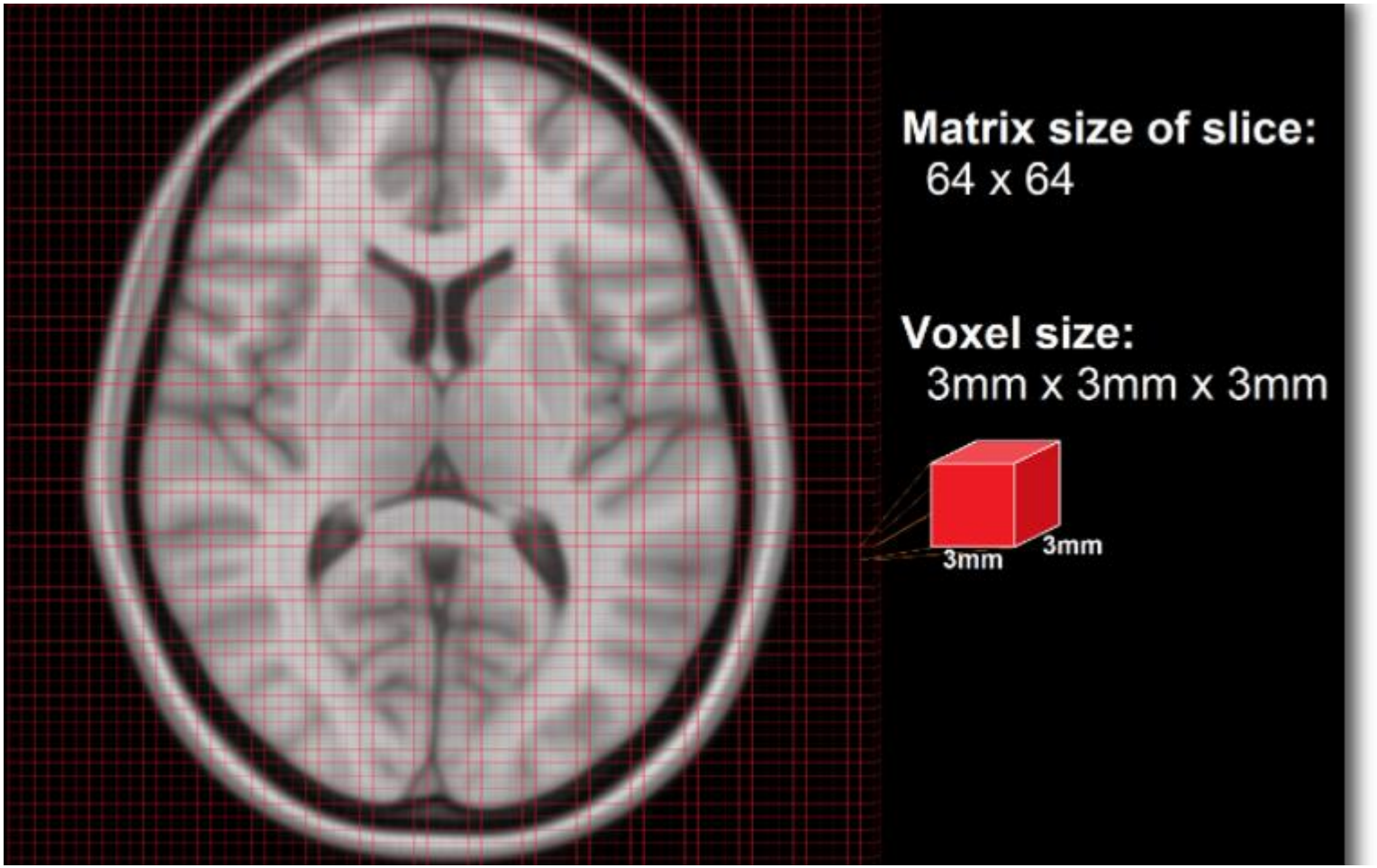
Voxel

- It represents a value on a regular grid in three-dimensional space



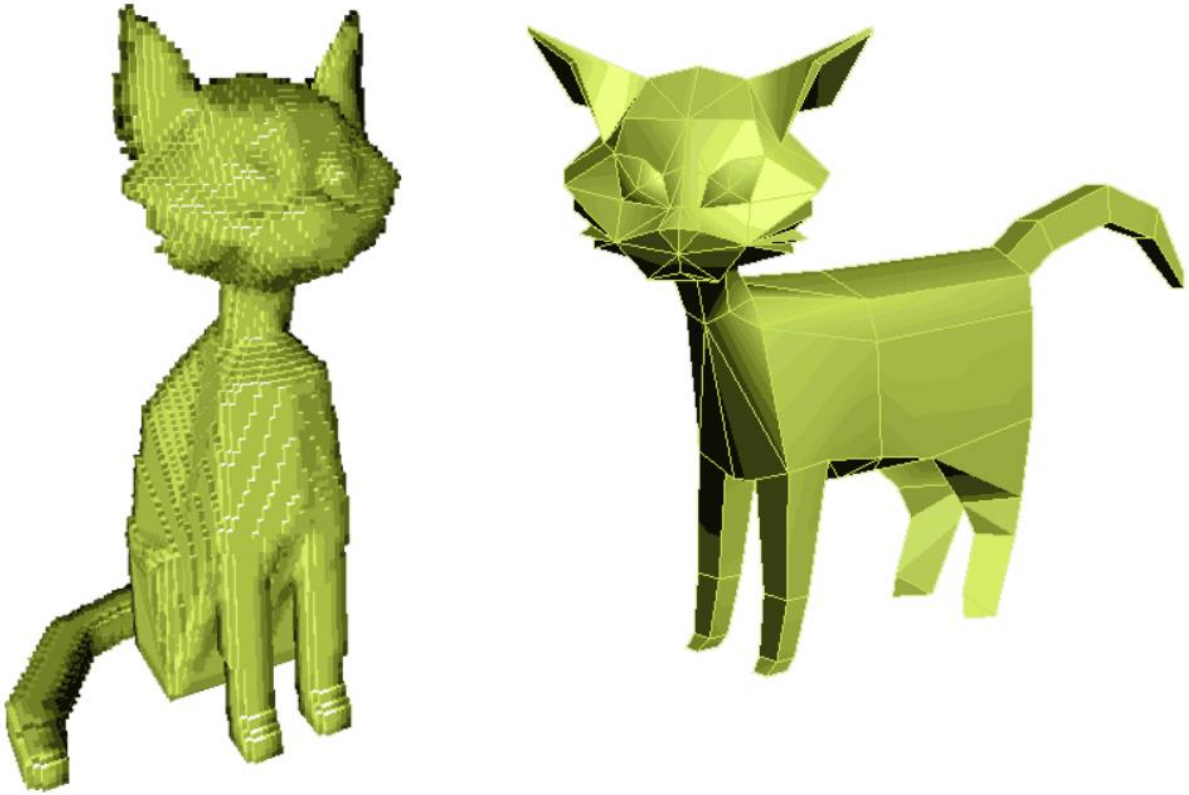
Voxel

- Voxels are frequently used in visualization and analysis of medical and scientific data
  - voxel represents inner part of 3D object



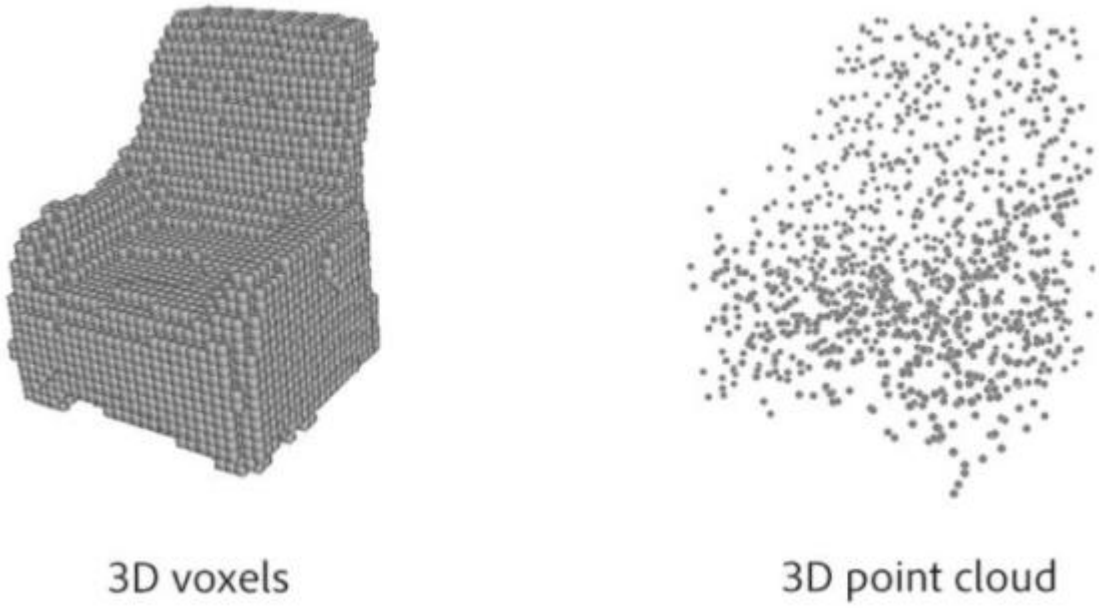
Voxel

- Voxel vs. polygon meshes
  - Usually polygon meshes require less amount of data for 3D representation
  - Modern GPUs are optimized to process polygon meshes rather than voxel



Point clouds

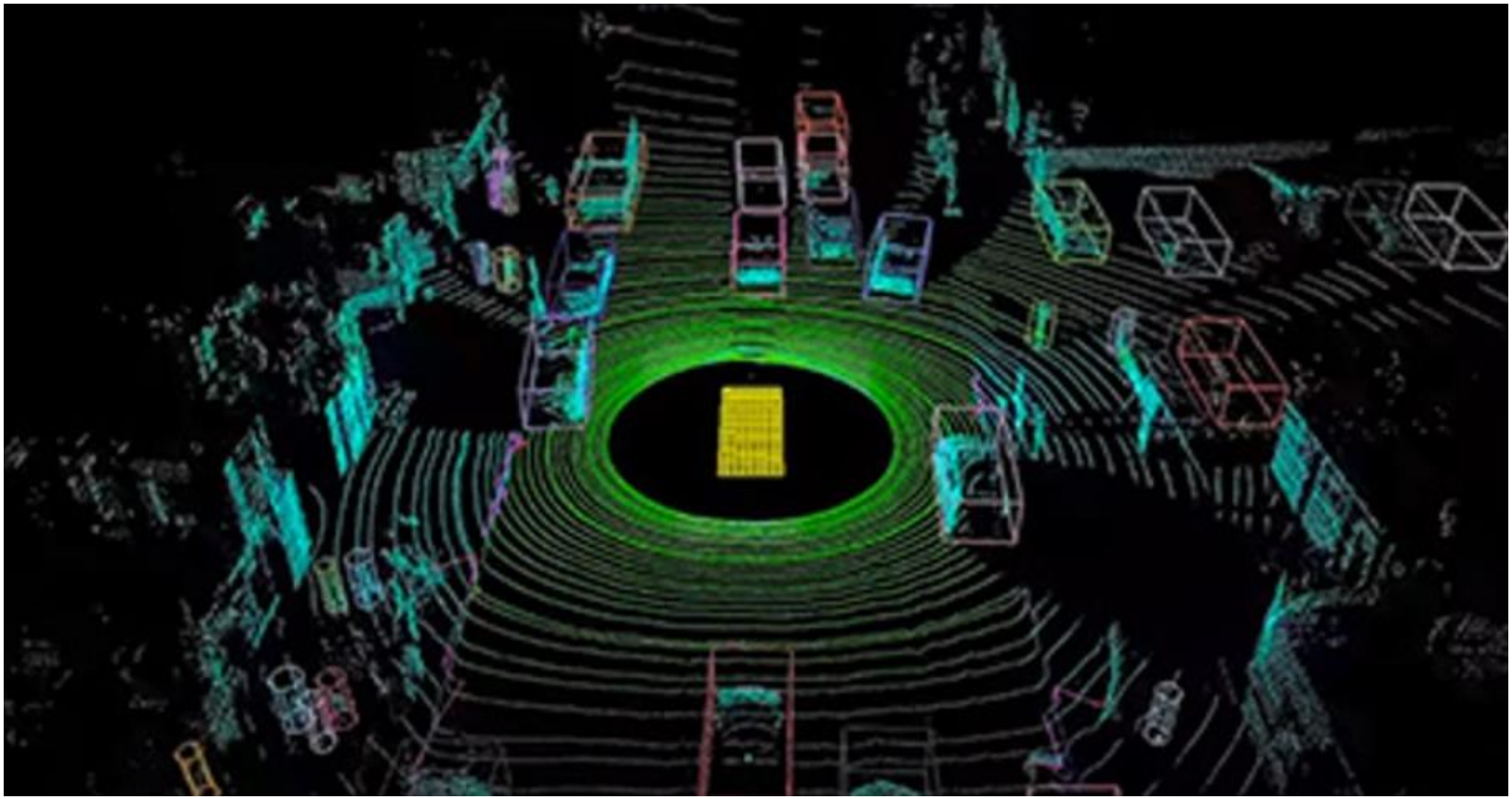
- A point cloud is a set of data points in space
- Each point position has its set of Cartesian coordinates.
- Point clouds rather represent sparse shape of a 3D object



https://research.adobe.com/news/a-papier-mache-approach-to-learning-3d-surface-generation/

Point clouds

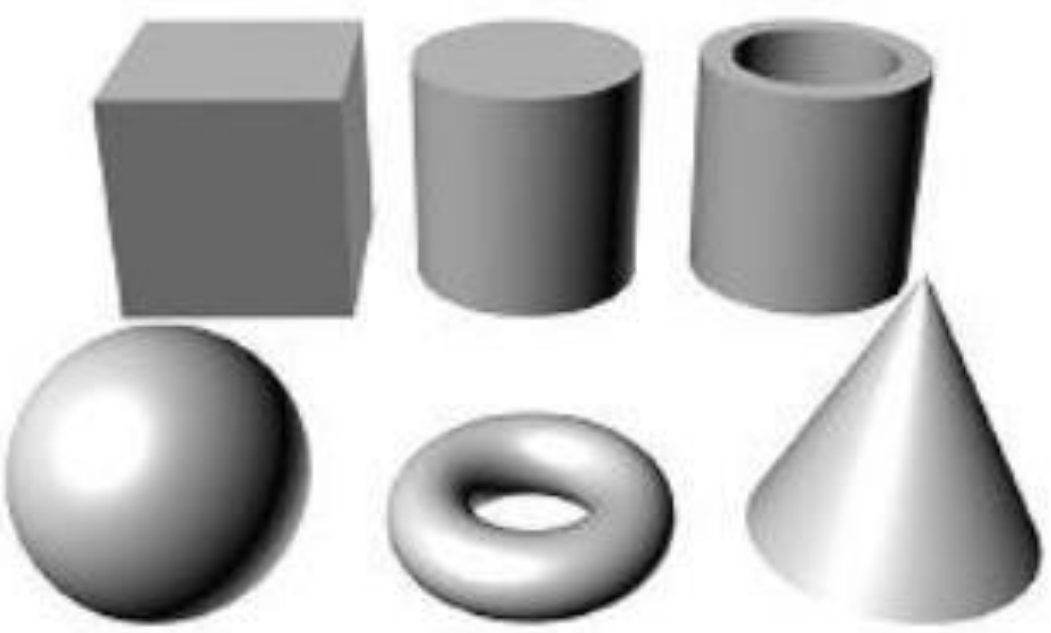
- Currently, point clouds have been drawn attention because of LiDAR and other 3D capturing devices



https://developer.nvidia.com/blog/webinar-learn-how-nvidia-driveworks-gets-to-the-point-with-lidar-sensor-processing/

Geometric primitives

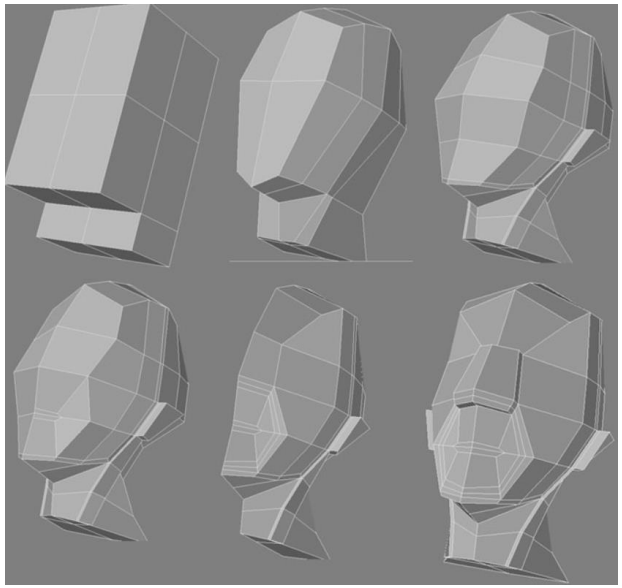
- Geometric primitive is the simplest geometric shape that the system can handle
- Common 3D primitives are cubes, pyramids, cones, spheres, and torus.



https://www.peachpit.com/articles/article.aspx?p=30594&seqNum=5

Box modeling

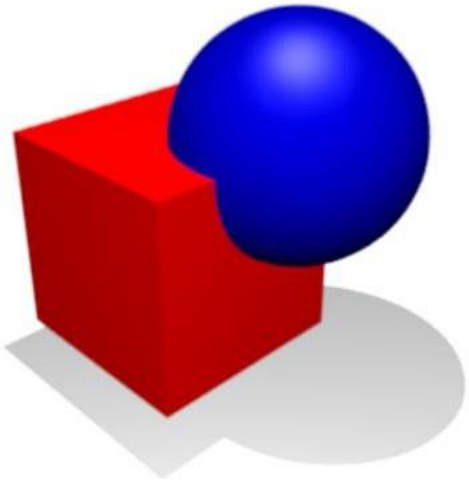
- It is a technique in 3D modeling where a primitive shape (e.g., box, cylinder, and sphere) is used to make the basic shape of the final model.



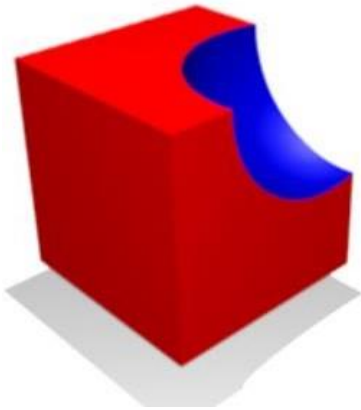
http://www.allen3d.com/mayaboxmodel1.htm

Constructive Solid Geometry

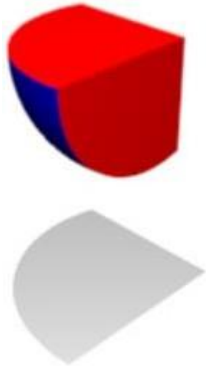
- It is a technique used in solid modeling
- It allows a modeler to create a complex surface or object by using Boolean operators to combine simpler objects



Union: Merger of two objects into one

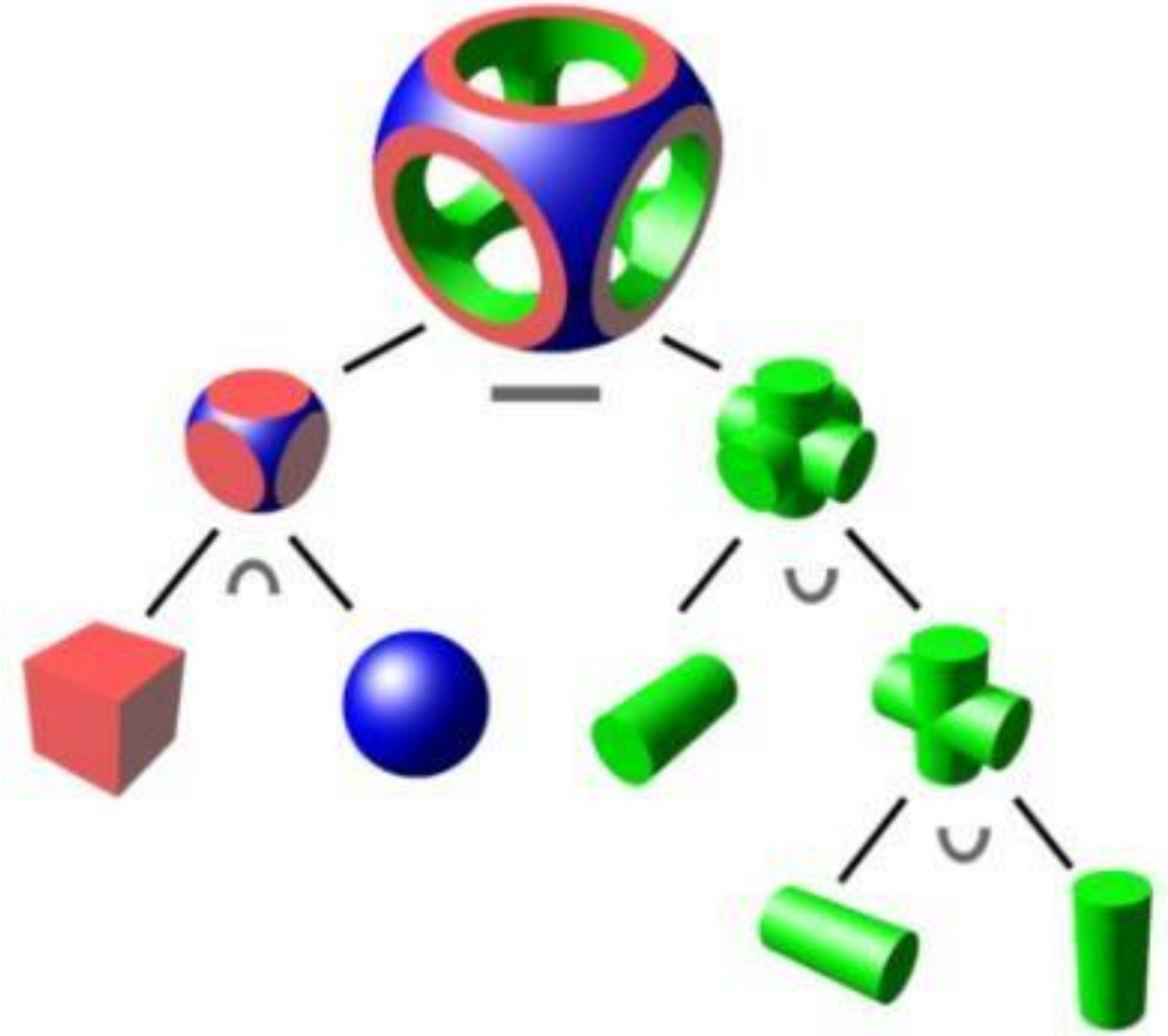


Difference: Subtraction of one object from another



Intersection: Portion common to both objects

Constructive Solid Geometry



https://en.wikipedia.org/wiki/Constructive_solid_geometry