

## Week 3

Boyuan

### Bounding Volume Hierarchy:

#### (a) What it is:

Bounding volume hierarchy uses simple shapes to define the rough outline of objects in 3D. It can also group objects with one bounding box and form a tree structure.

#### (b) How to use it in ray trace

When tracing lights, we traverse every triangle (or mathematical definition of shapes) in the scene and see if it collides with them. In a real scene, there could be hundreds of objects and thousands of triangles. By creating bounding boxes, we can use the simple box to determine if the ray can possibly hit the object within. This can save us great computing power.

### Binary Space Partitioning:

#### (a) What it is:

Binary Space Partitioning is a way to split the space into different rooms by dividing the scene with the plane randomly chosen. We can keep dividing the scene until we run out of polygons. When we are dividing them, we create a binary tree with one set of polygons on one normal direction and the rest on the opposite. In this way, we are able to determine which polygon is closer to the camera. Then we can render them first so we don't waste computing power rendering shapes blocked by others.

#### (b) How to use it in ray trace

Since we are able to determine which polygons are closer to us. We can check the ray trace with them first, if the object is opaque we can stop this run and we will not run into the situation where checking every polygon is necessary since we know this one is the closest one.

#### (c) How are these two data structures different:

Obviously, these are two totally different approach to avoid duplicate computing process. In my opinion without dig deeply into the algorithm, I believe the bounding box is better for moving objects since the cost for moving an object is simply move the bounding box with them, suppose they do not change shapes. The space partition algorithm should works better for static scene since the binary tree allow us to fast traverse them if they remain static.