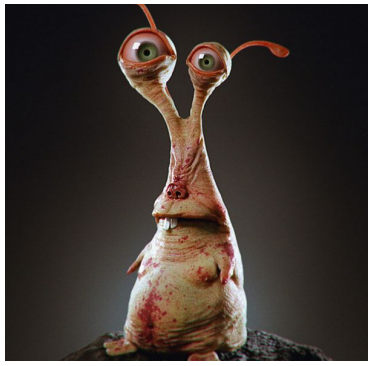
Box Extents

3D Computer Graphics (Lab 12)



Rendering time

Ray tracing is very time-consuming.

For each pixel → or several rays (supersampling)

1. Create a ray from the eye of the camera through the current pixel.
2. For each object in the scene

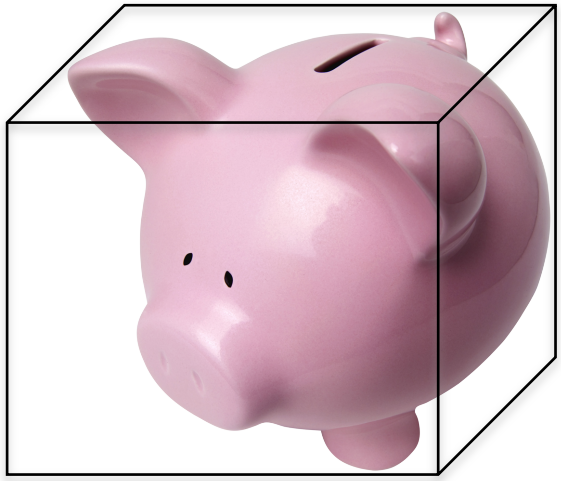
   compute the hitPoints between the current ray and this object.
3. Find the closest hitPoint in front of the camera.
4. Compute the colour of this hitPoint. → shadow feeler, reflected ray
5. Set this colour to the current pixel.

Acceleration techniques are absolutely necessary!

We will implement one popular acceleration technique: extents

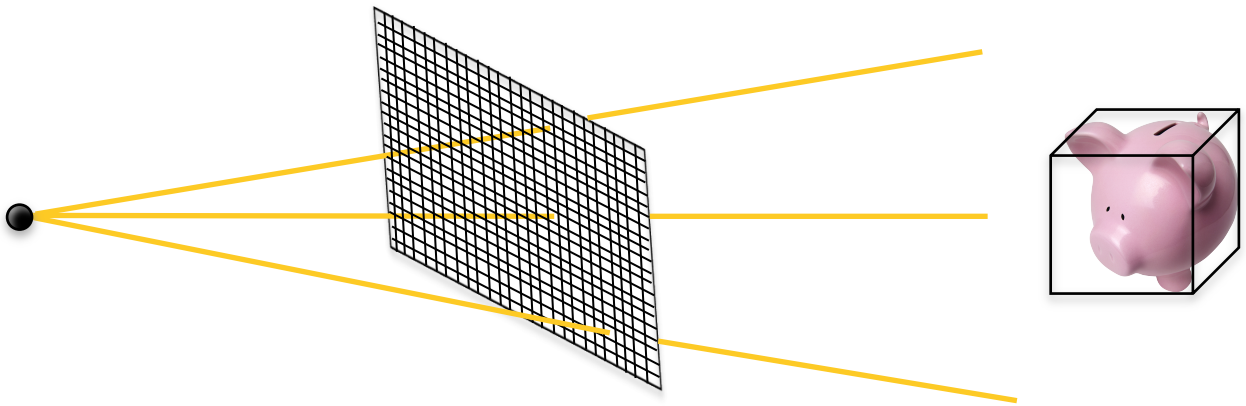
Extents

- An extent of a 3D object is a shape that encloses this 3D object.



- It is very expensive to compute the hitPoints between a ray and the piggy bank.
- If the extent has a simple shape (such as a box), it may be inexpensive to intersect a ray with it.

Idea …



- First intersect each ray with the box extent of the piggy bank. (inexpensive operation)
- If the ray does not hit this box extent, it also misses the piggy bank. So in this case an expensive intersection calculation with the piggy bank can be avoided!

Idea …

- When a ray is tested against the extent, three things can happen:

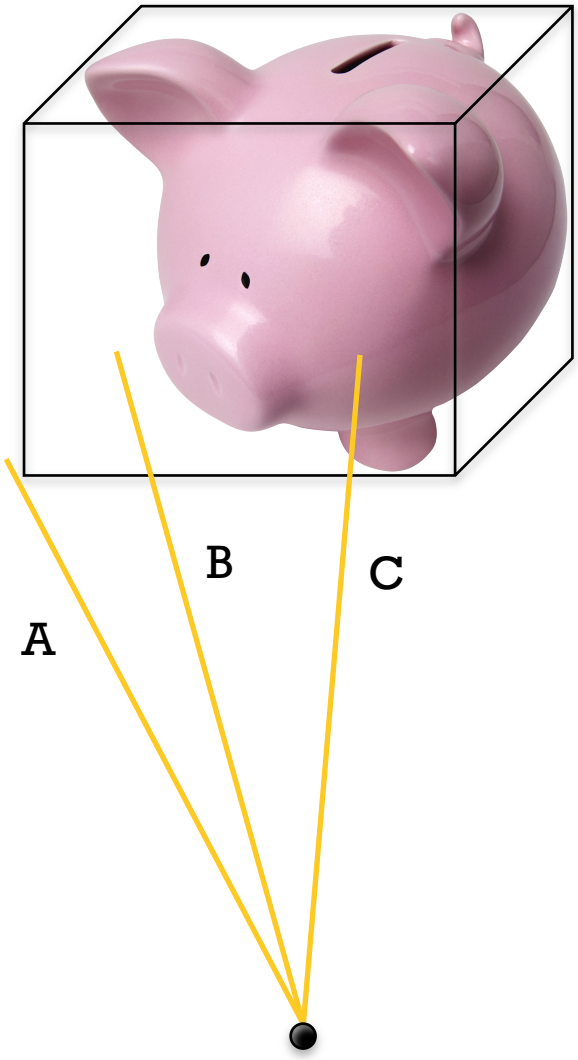
  1) The ray misses the box. Therefore the test against the piggy bank is skipped. *(ray A)*

  2) The ray hits the box, so the full test against the piggy bank is performed, revealing that the ray misses the piggy bank. *(ray B)*

  false alarm

  3) The ray hits the box, so the full test against the piggy bank is performed, revealing that the ray hits the piggy bank. *(ray C)*

- If the cost of the full hit test is much larger than that of the extent test, it is well worth making the extra test for those frequent cases where the ray does miss the extent.



Questions?