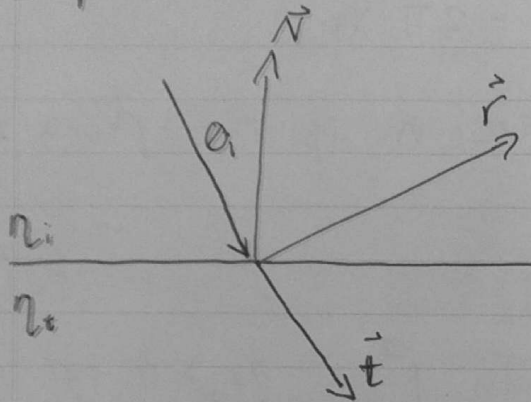


Improvements on Ray Tracing

Path Tracing (Kajiya, 1985)

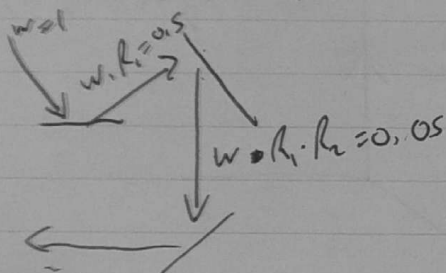
Implementation



compute Fresnel coefficient
 $R \in [0, 1]$

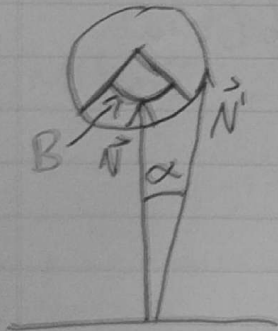
Generate a random number
 $x \in [0, 1]$

If $x < R$ follow \vec{r}
otherwise follow \vec{t}



decrease weight (power) of the
light until we hit a threshold
in which case we stop the ray.

Translucent Materials ("Glossy Transmission")

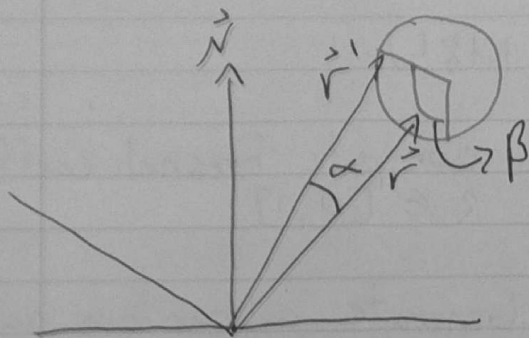


Obtain the perturbed Normal \vec{N}' using:
 $\alpha = \arccos(1 - x_1)^{1/2}$ $B = 2\pi x_2$

where x_1 and x_2 are random
numbers uniformly distributed in $[0, 1]$

Hiboy

"Glossy" Reflection



Obtain perturbed reflected ray \vec{r}' using

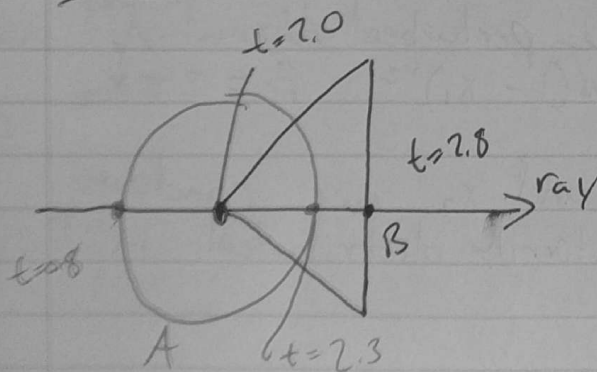
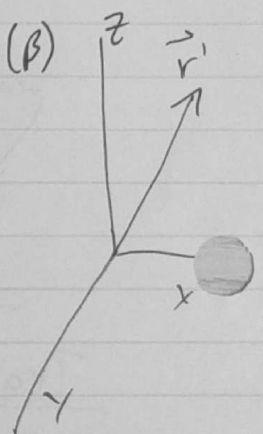
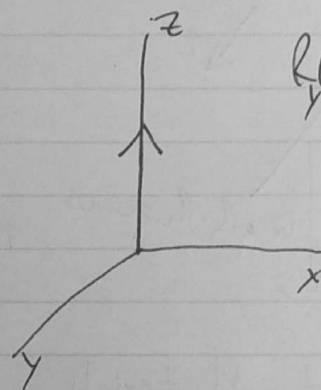
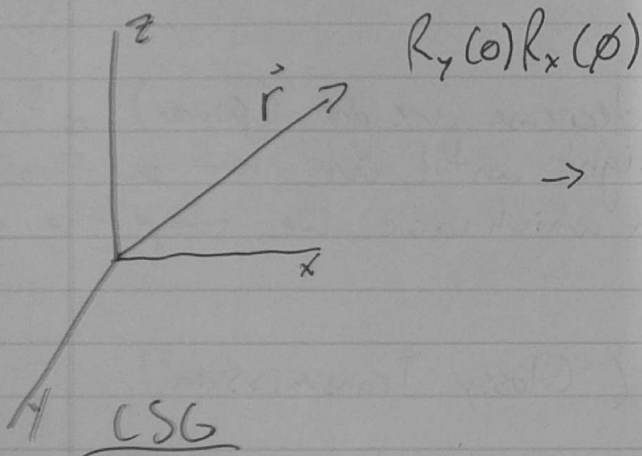
$$\alpha = \arccos(1 - x_1)^{\frac{1}{n+1}}$$

$$\beta = 2\pi x_2$$

Where n is the phong exponent.

n large \rightarrow very gloss
 n small \rightarrow not very glossy

$$R_y(-\theta)R_x(-\phi)$$



$$\text{ray} = a + t(b-a)$$

origin direction

Inside A
 0.8 2.3

Inside B
 2.0 2.8

$A \cup B$

0.8 2.8

$A - B$

0.8 2.0

$A \cap B$

2.0 2.3

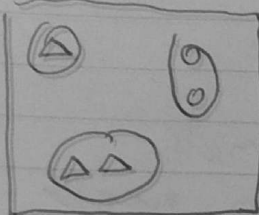
Graphics Raytracing 4

Pg 1

Ray Tracing Acceleration Mechanisms

- Boundary Volumes:

- good for scenes that allow clustering
- not good for scenes having objects with odd shapes.

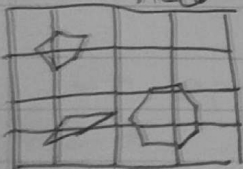


- bound objects by grouping them
- check raytrace on boundary object.

Space Subdivision

- Grid

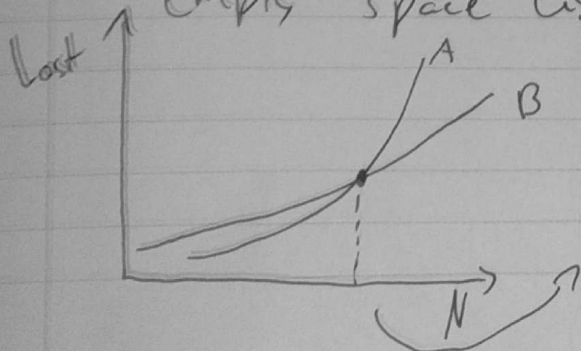
- independent of the nature of the scenes
- good for scenes whose occupancy does vary ~~slightly~~ significantly
- Stepping is faster than tree-based algorithms
- relatively easy to implement
- need to step through empty cells.



- constructing the grid is relatively easy.

- Tree based (Octree)

- good for scenes whose occupancy varies ~~constantly~~ significantly
- Stepping is slower
- we can pass through large quantities of empty space using fewer stepping ~~at~~ operations.



Grid: $C_1 \sqrt[3]{N} \rightarrow 30\% \text{ faster at } N=10^5$

Tree: $C_2 \log N \rightarrow 10\times \text{ harder to implement,}$

Break even point.

Hibroy