

In 1980,

Conventional Models uses Phong's model,

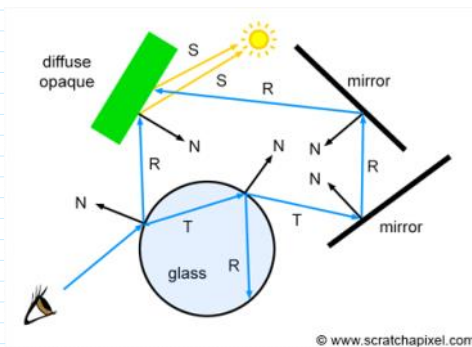
$$I = \underbrace{k_a I_a}_{\text{ambient}} + \underbrace{k_d I_c (L \cdot N)}_{\text{diffuse}} + \underbrace{k_s I_c (R \cdot V)^n}_{\text{specular reflection}}$$

⇒ This model does not account for objects within the scene acting as a light source or for light reflected from object to object

⇒ ambient ✓ diffuse ✓ hurts the quality of specular reflections

Witted Ray-Tracing:-

Different types of rays into a scene:-



Case 1:- Opaque and diffuse → Phong Model

Also cast a ray in the direction of each light source to find if the point is in shadow. (Shadow rays).

Case 2:- Mirror-like surface

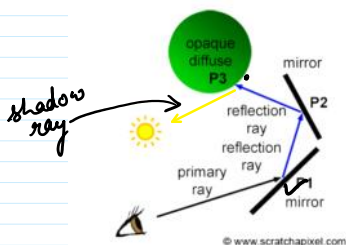


Figure 6: how do we find the color reflected off of the surface of a mirror?

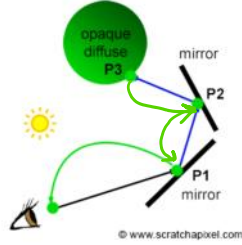


Figure 6: how do we find the color reflected off of the surface of a mirror?

$$I = \underbrace{k_a I_a}_{\text{ambient}} + \underbrace{k_d I_c (L \cdot N)}_{\text{diffuse}} + \text{"Fresnel Reflection Law"}$$

ambient diffuse

Case 3:- Transparent surface

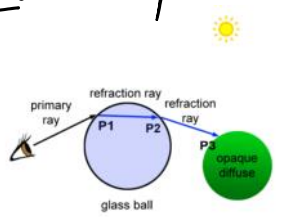


Figure 7: how do we find the color of objects seen through a glass ball?

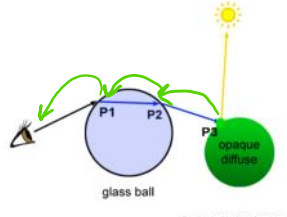


Figure 7: how do we find the color of objects seen through a glass ball?

$$I = \underbrace{k_a I_a}_{\text{ambient}} + \underbrace{k_d I_c(L \cdot N)}_{\text{diffuse}} + \text{"Snell's law"}$$

Recursivity :-

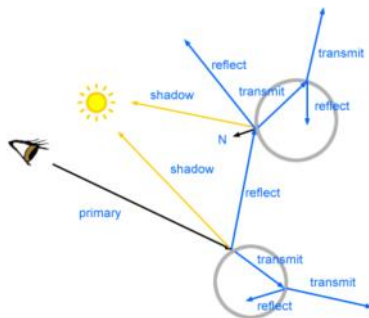


Figure 8: Whitted algorithm is recursive.

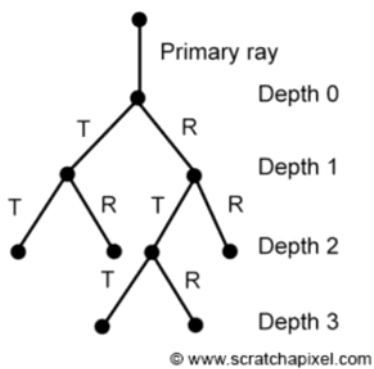


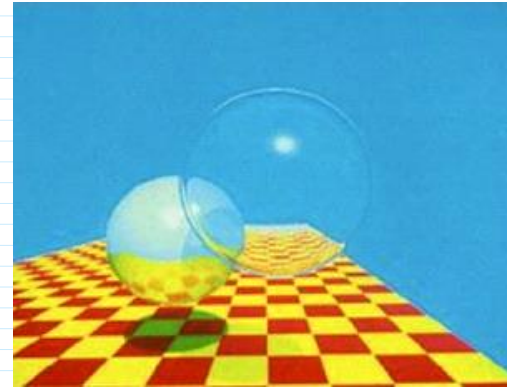
Figure 9: a tree of rays.

PAPER-1 :-

An Improved Illumination Model for Shaded Display

Turner Whitted
Bell Laboratories
Holmdel, New Jersey

To accurately render a two-dimensional image of a three-dimensional scene, global illumination information that affects the intensity of each pixel of the image must be known at the time the intensity is calculated. In a simplified form, this information is stored in a tree of "rays" extending from the viewer to the first surface encountered and from there to other surfaces and to the light sources. A visible surface algorithm creates



480 x 640

74 minutes on VAX-11/780

- Facts :-
- ① Turner owned a numerical analysis company. While doing simulation for a nuclear power industry tracing photons.
 - ② Published in 1980, took 20 more years before ray tracing started to get used for anything else than just research projects, due to high computational cost.