Raytracing

Version 2: Nov 13, 2017

“One algo, we all knew of it, but no one had the guts to publish it.

Because it takes so long to do” [4]

[6]

General Idea

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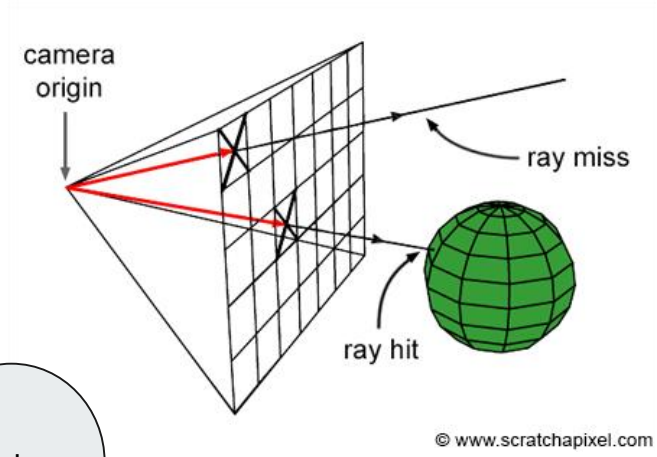
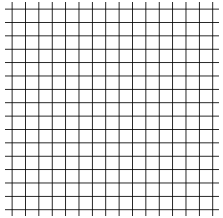
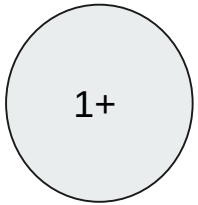


[5]

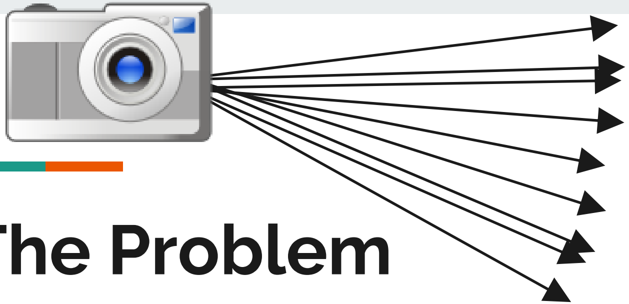
- Imagine a 3D area with types of a things.





- For each pixel, send out a ray originating from the camera, going through that pixel in the screen, and continuing until a certain distance, or the ray intersects an object.

Demo



The Problem

Tons and tons and tons and tons and tons and tons and
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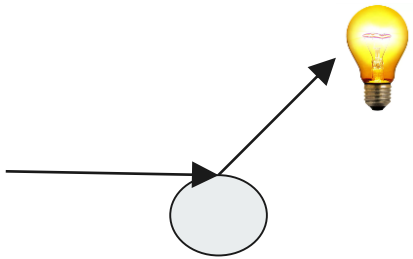
This is very, very expensive computationally

tons and of ***RAYS!***

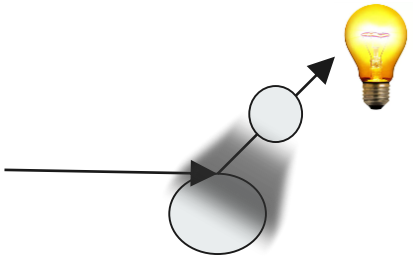
Shadows

Shadows are difficult. Ray tracing however, provides an easy solution to the problem.



No Shadow

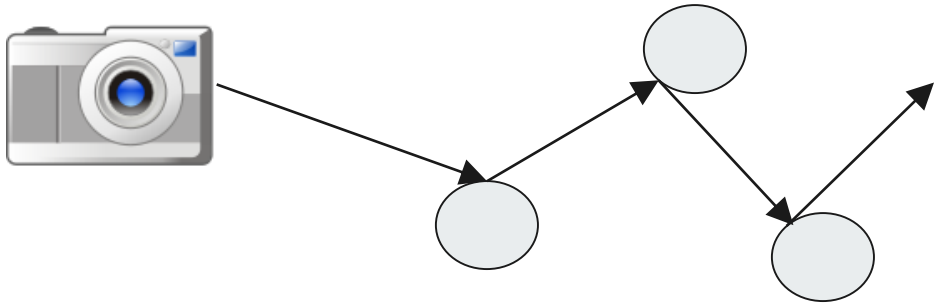
Reflect a ray off the hit object.
Call this a Shadow Ray



Shadow

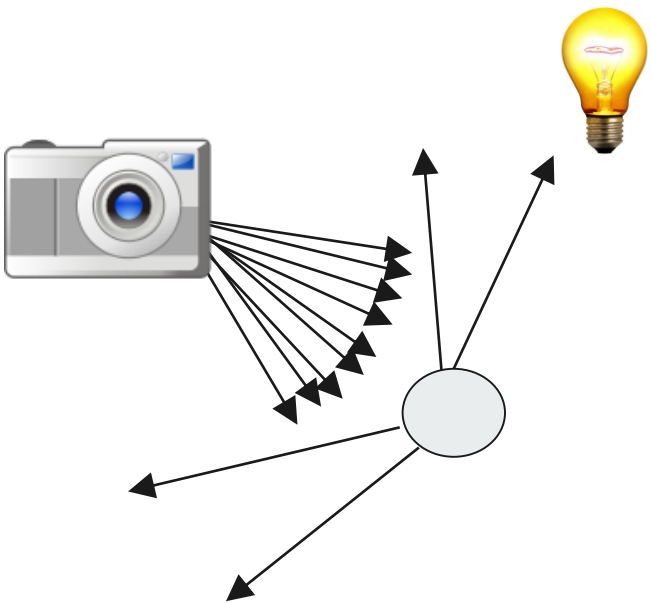
Reflections

Reflections are also difficult. Ray tracing thankfully also provides a solution!

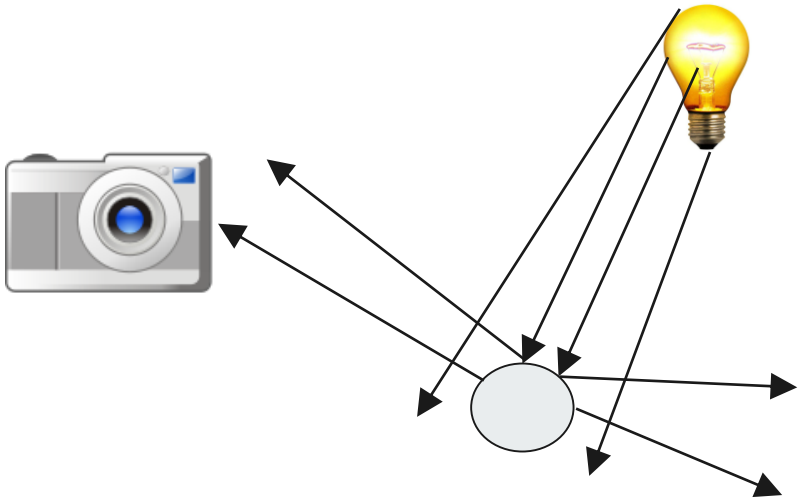


However, much like shadows, this involves sending out many more rays!

Backward vs forward ray tracing



VS



Similar to how we view optics in real life

Just backwards!

History

Overview:

- Rene Descartes (1637)
- Arthur Appel (1968)
- Turner Whitted (1980)
- Robert L. Cook, Thomas Porter, Loren Carpenter (1984)
- James Arvo (1986)
- ...

Rene Descartes

- *Dioptrics* (1637)
- Introduces the core concepts of ray tracing

Arthur Appel

- *Some techniques for shading machine renderings of solids* (1968)
- Applies ray casting techniques to rendering objects

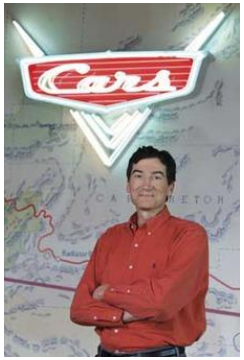
Turner Whitted

- *An Improved Illumination Model for Shaded Display (1980)*
- Introduces recursive ray tracing

Robert L. Cook, Thomas Porter, Loren Carpenter

- *Distributed Ray Tracing (1984)*

Robert L. Cook



Thomas Porter

Loren Carpenter

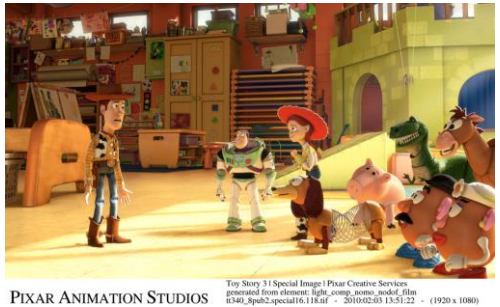
James Arvo

- *Backward Ray Tracing* (1986)

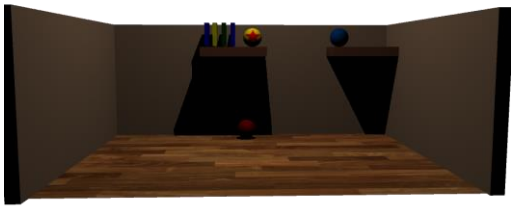
Raytracing in Film

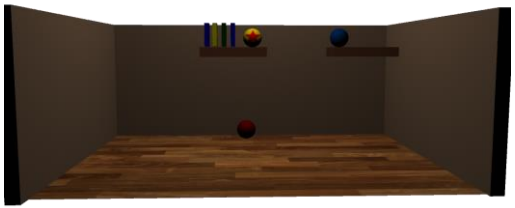
-Global illumination

-Pixar's Photorealistic RenderMan



Raytracing in Autodesk Maya





References (History: Papers)

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  - Cambridge paper discussing Descartes' *Dioptrics*
- http://graphics.stanford.edu/courses/Appel.pdf
  - Appel (paper)
- https://excelsior.asc.ohio-state.edu/~carlson/history/tree/magi.html
  - MAGI (website)
- http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.107.3997&rep=rep1&type=pdf
  - Turner Whitted (paper)

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  - Distributed Ray Tracing (paper)
- https://web.cs.wpi.edu/~matt/courses/cs563/talks/dist_ray/dist.html
  - More on Distributed Ray Tracing and its applications (WPI course page--more understandable than the paper)
- https://pdfs.semanticscholar.org/c088/399ad6dc648647e0e19e01b5485925957681.pdf
  - James Arvo (paper)
- https://graphics.pixar.com/library/HQRenderingCourse/paper.pdf
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  - Robert L. Cook

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