Post-Rendering Effects

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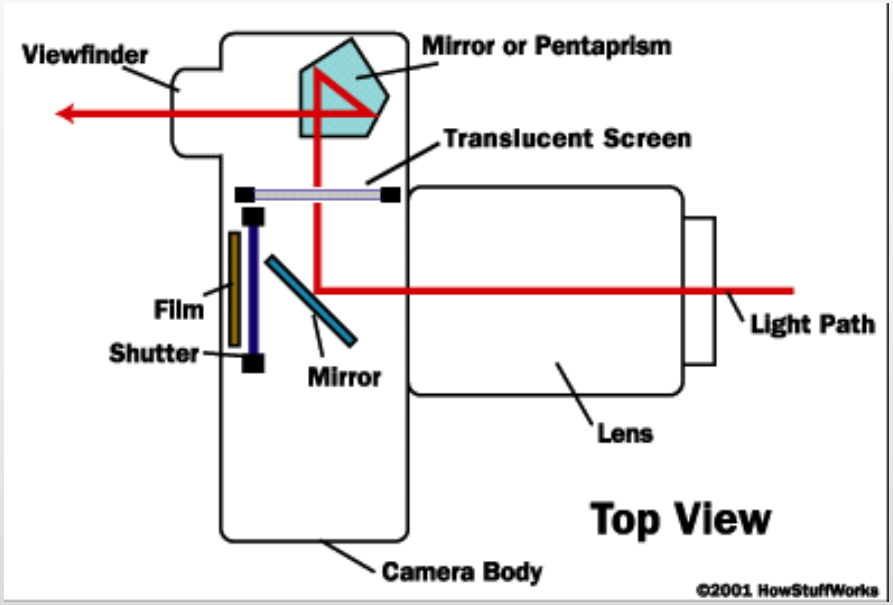
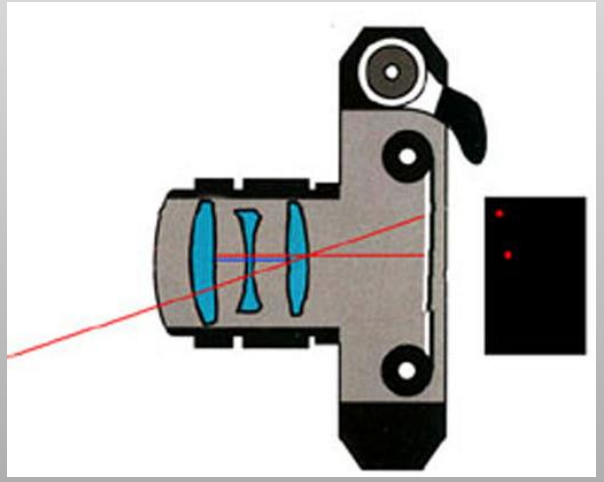
The Problem

- Generating post-rendering effects (**lens flare** and **light bloom**) to simulate the effects produced by a real camera and physical lens system.

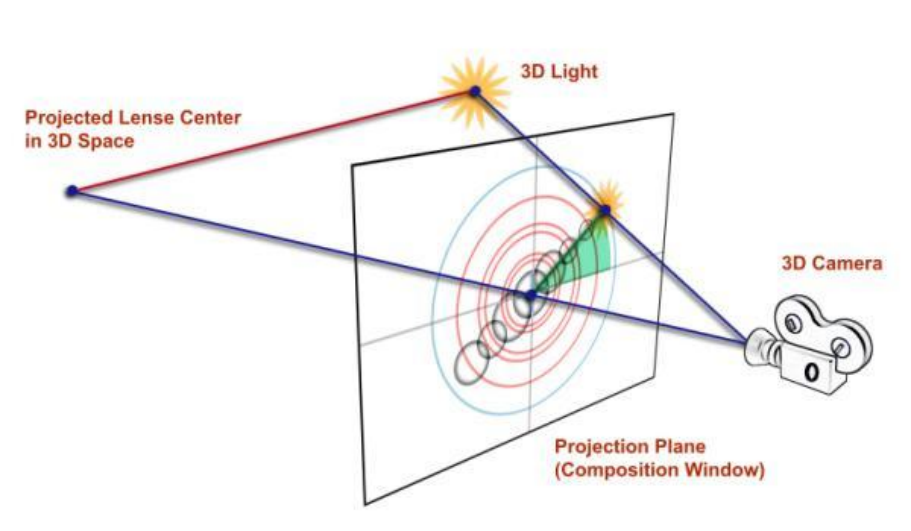
Lens Flare

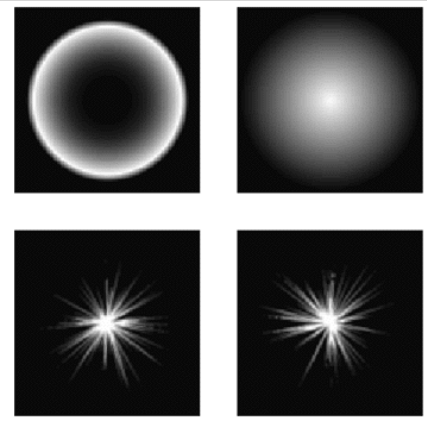
- "Lens flare is the light scattered in lens systems through generally unwanted image formation mechanisms, such as internal reflection and scattering from material inhomogeneities in the lens.“ (Wikipedia)
- Because cameras are built with mirrors inside them, light bounces around and hits places where it shouldn't.





Lens Flare: Technique

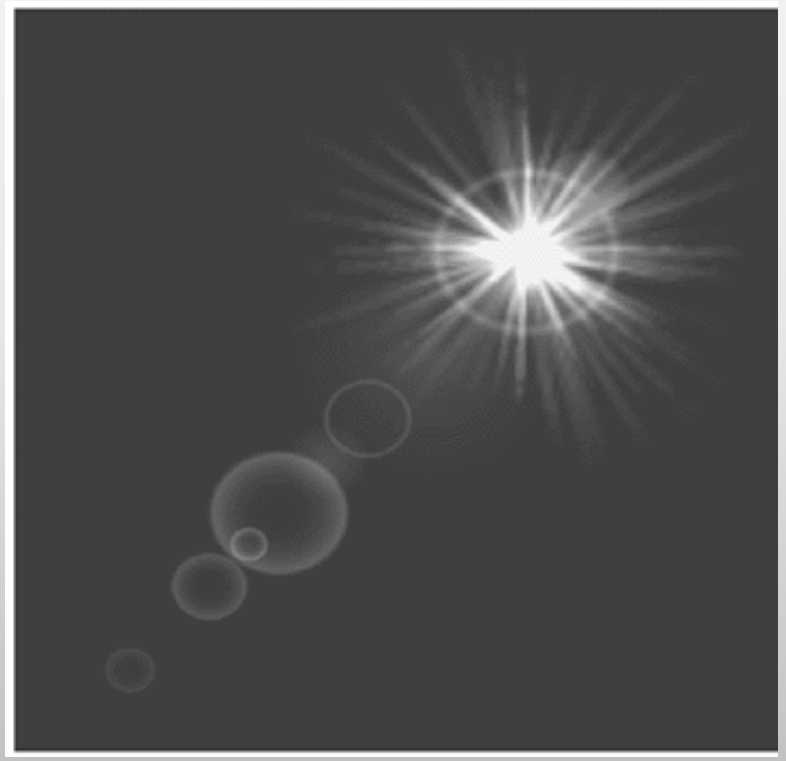




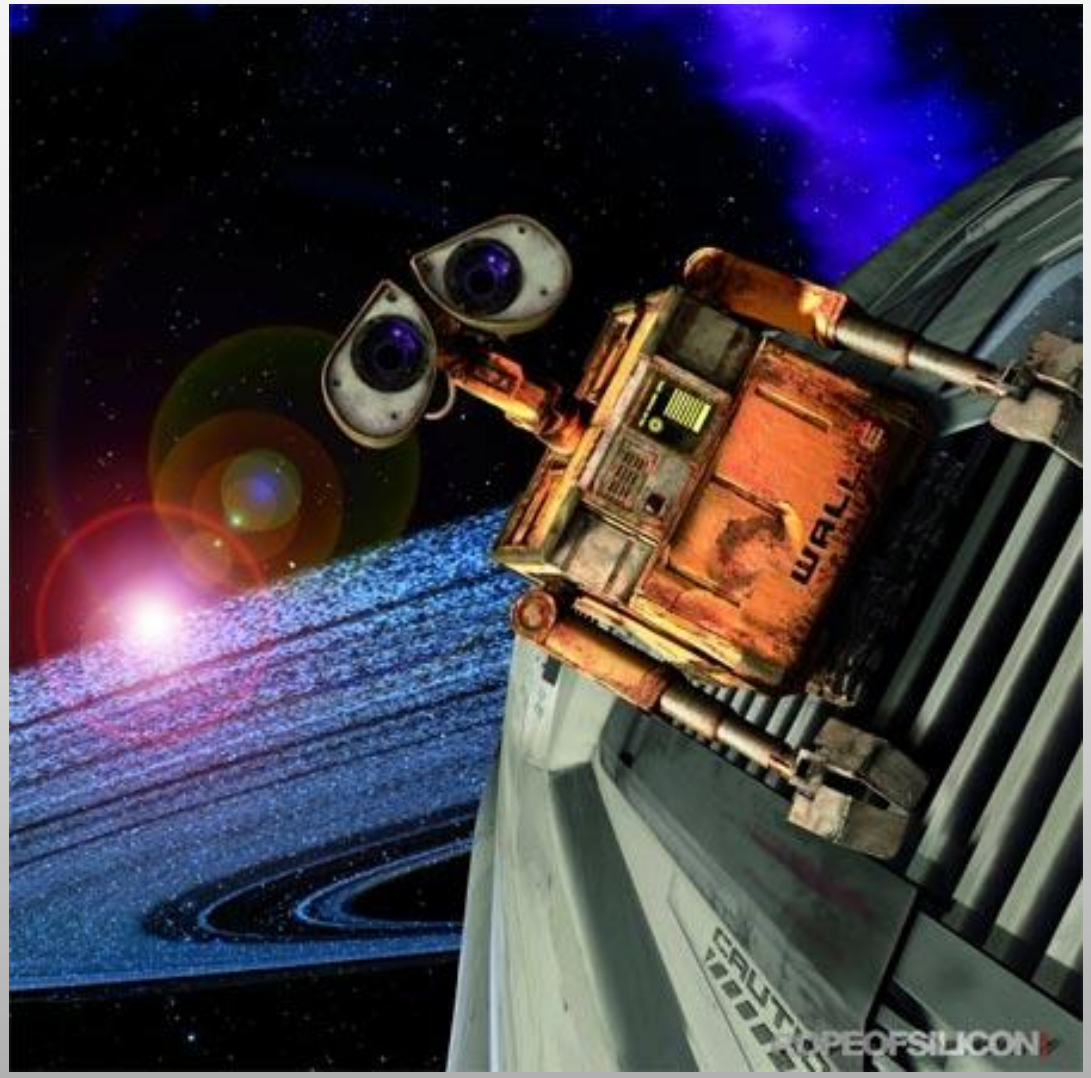
- “Billboards” are usually used in games
- Pre-rendered images are laid out over the image plane
- The position of the light, camera, and the direction of both effect the positions and size of the lens flare.

Lens Flare: Implementation

- Create a new shape
  - Circle
  - Hexagon
- “Lay” that shape on the film
- Render scene normally.



Lens Flare: Example



Light Bloom

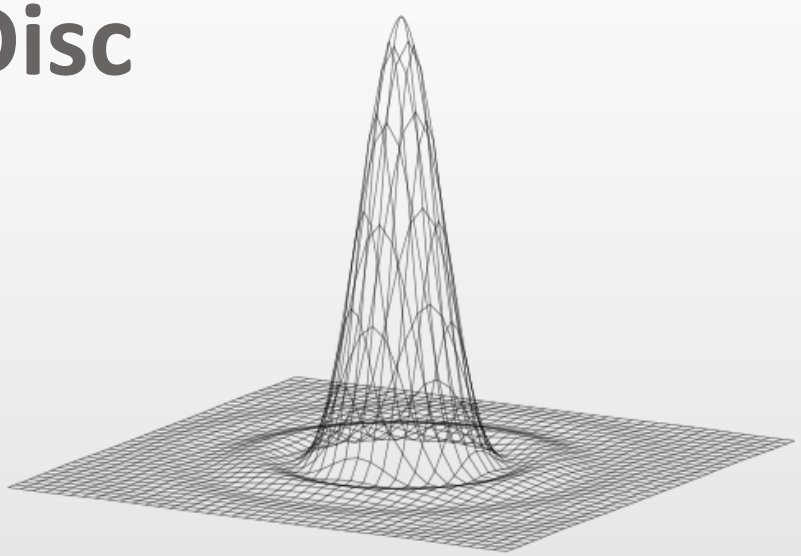
- The physical basis of bloom is that, in the real world, lenses can never focus perfectly.
- “[An] intensely bright light source will cause... the image of the bright light appears to bleed beyond its natural borders.” (Wikipedia)

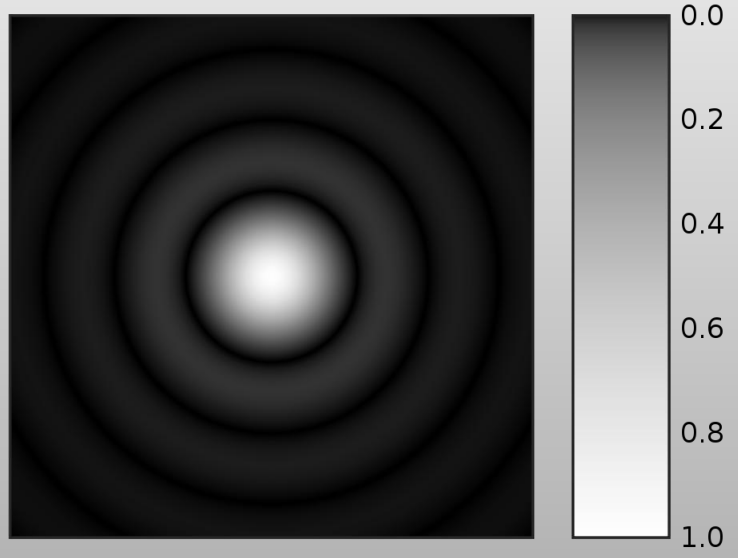
Light Bloom

- When you have a very bright light it seems to bleed around the edges and make it brighter than it should.
- A lens will convolve the image with an Airy disc, which is more noticeable in high contrast areas.

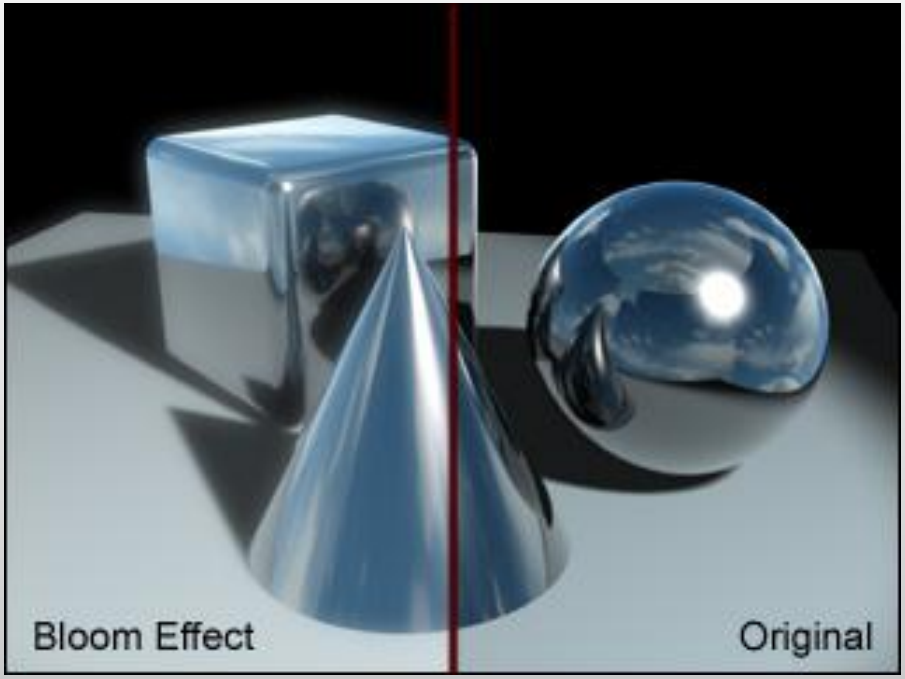
Light Bloom: Airy Disc

- The Airy disc represents the smallest point of light on which a lens can focus.
- When the brightness of different parts of an image varies by a relatively large amount, the tails of the Airy disc become noticeable.





Light Bloom: Implementation

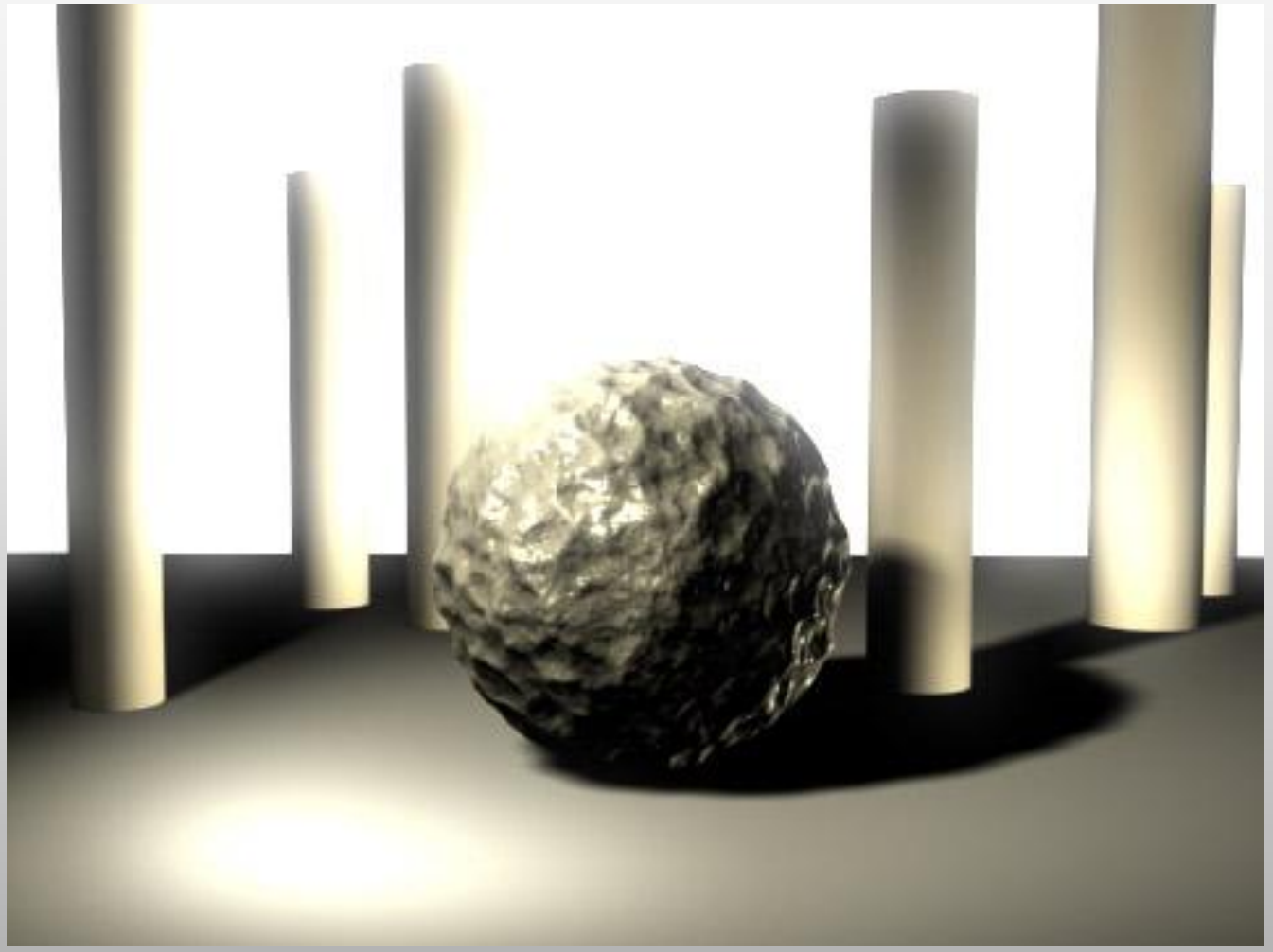


- Create a grayscale image of the rendered scene
- Apply a bright pass filter to find brightest areas
- Blur those pixels with their neighbors with a Gaussian blur
- Add image onto rendered scene

Light Bloom: Implementation

- Gaussian blur can be used to simulate the Airy disc in a less than perfect lens.

Light Bloom: Example



Light Bloom: Example

Why have all these?

- Because it gives a scene a much more "real" appearance, because lens flare happens in real life.
- Because the goal is to create images / movies that appear lifelike, if these effects are not in place, it can appear odd to the viewer.

Risks

- Finding the correct algorithms
  - Found various examples (Ray tracers, games, etc.)
- Porting the algorithms from XNA, etc. into our ray tracer.
  - Most are math based, so the code should transfer fairly easy
- Getting circle/hexagon collision to work.
  - Build it off a square, then worry about circle.
- Errors in the design / redesign
  - Doing our homework

Links you might like to see

Lens Flare

- GameDev.Net
  - http://www.gamedev.net/reference/articles/article813.asp
  - http://www.gamedev.net/reference/articles/article874.asp
- Visual
  - http://library.creativecow.net/articles/mylenium/lens_flare.php
- Code example
  - http://www.3dmuve.com/ (search “lens flare”)

Light Bloom

- Bloom Description
  - http://www.neilblevins.com/cg_education/specular_bloom/specular_bloom.htm
- Bloom Code Example (HDR)
  - http://www.ogre3d.org/wiki/index.php/Faking_HDR
- XNA Bloom example
  - http://www.xnainfo.com/content.php?content=28#bloom

Questions?