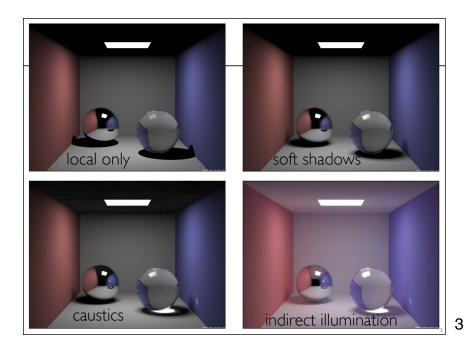
| CS-I | 84: (| Com | puter | Grap | hics |
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| Lecture #16: Global Illumination | Lecture | #16: Global | Illumination |
|----------------------------------|---------|-------------|--------------|
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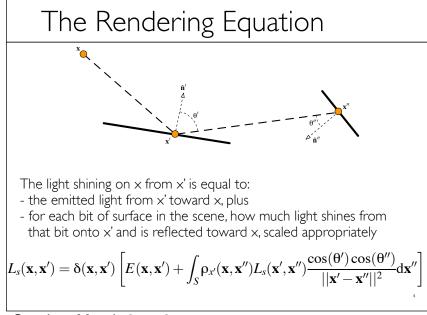
Prof. James O'Brien University of California, Berkeley v2013-5-16-10

| Today | _ |
|------------------------|---|
| | |
| | _ |
| The Rendering Equation | _ |
| Radiosity Method | _ |
| • Photon Mapping | _ |
| Ambient Occlusion | _ |
| | _ |
| | _ |
| | |

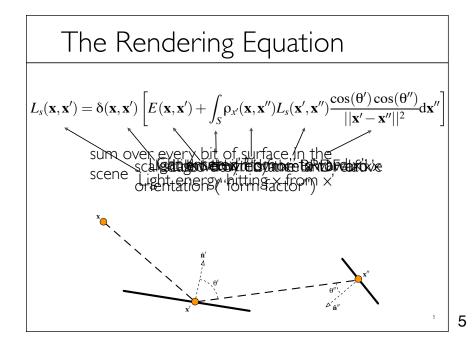
Sunday, March 31, 13



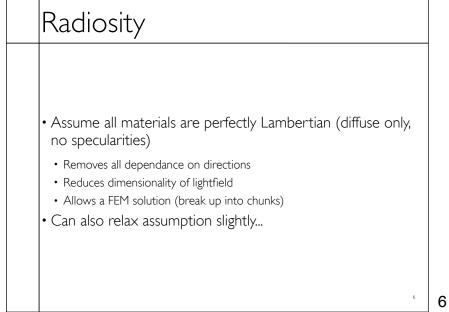




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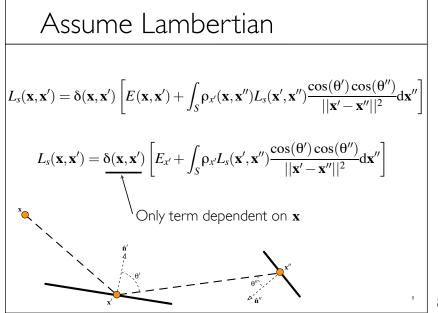




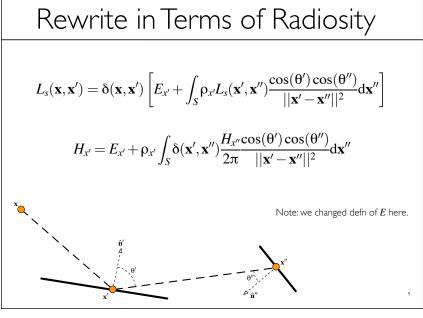




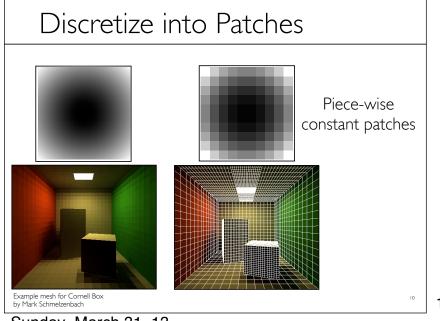










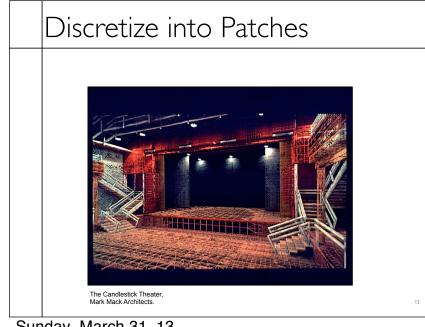




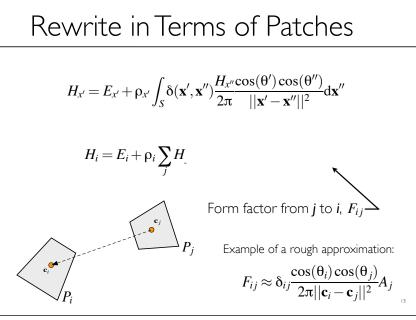
Discretize into Patches



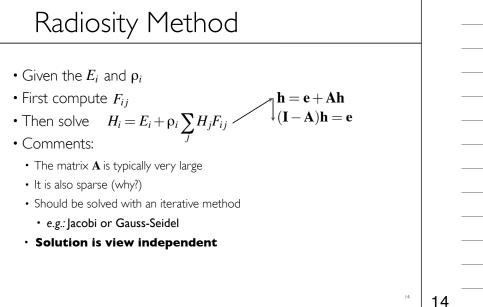








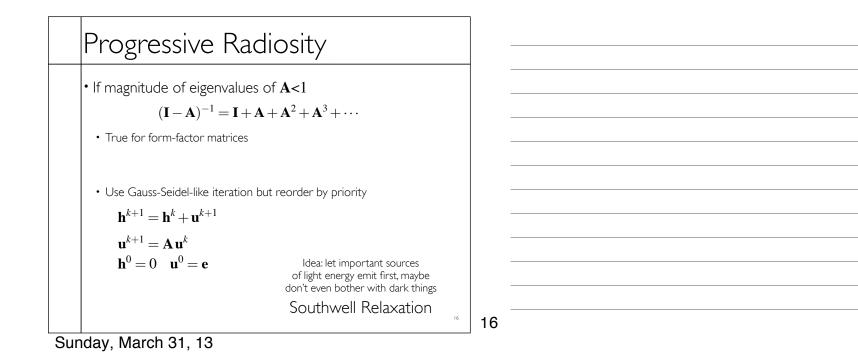




Radiosity Method

- Given the light emitted and surface properties
- First compute F_{ij} , form factors between patches
- Then solve a linear system to balance energy between all patches
- Comments:
 - The system is very large
 - It is also sparse (why?)
- Should be solved with an iterative method
 - e.g.: Jacobi or Gauss-Seidel
- $m \cdot$ Solution is view independent

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Progressive Radiosity





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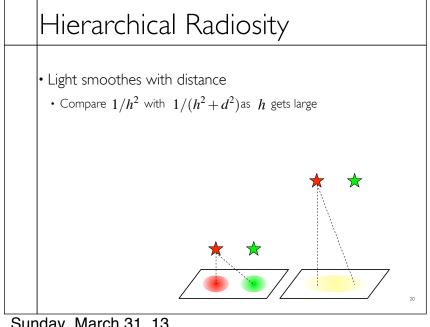


OtherThings

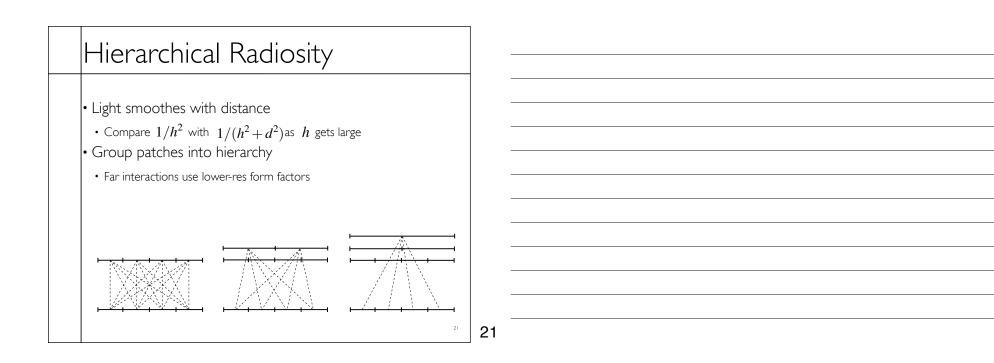
- Each patch will have a constant color
- Smooth solution (e.g. average to vertices)
- No specular reflection
- Add Phong specular term or raytraced specular reflection
- Grid artifacts
- Be clever with grid...

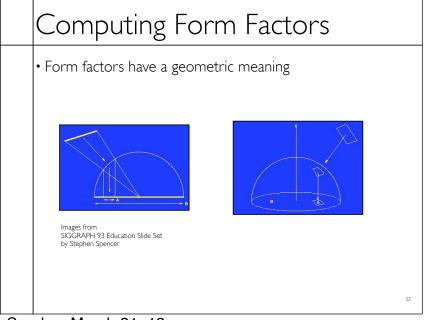
19

19



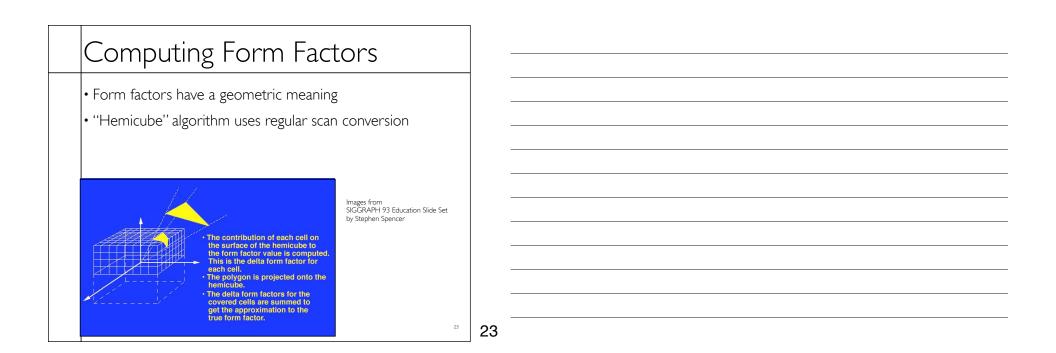




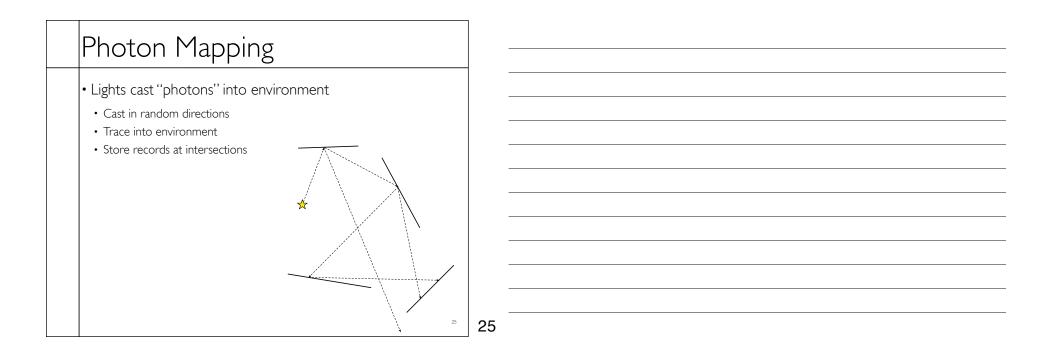


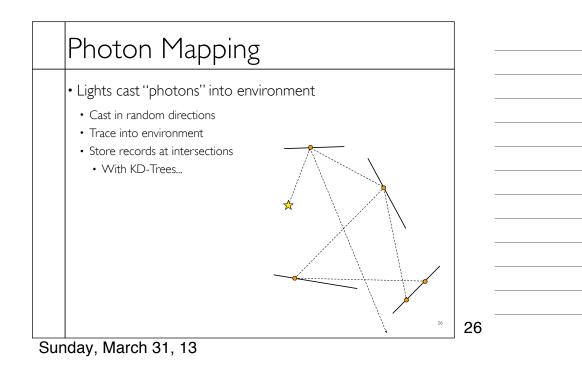


Sunday, March 31, 13



| Computing Form Factors | | | |
|---|----|----|--|
| Form factors have a geometric meaning "Hemicube" algorithm uses regular scan conversion Also computed by ray-based sampling | | | |
| • In practice, computing form factors is the bottleneck | | | |
| | | | |
| day March 31 13 | 24 | 24 | |





Comparison



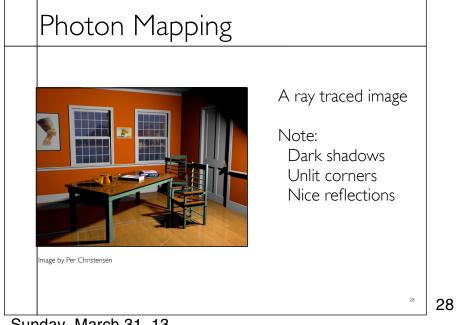


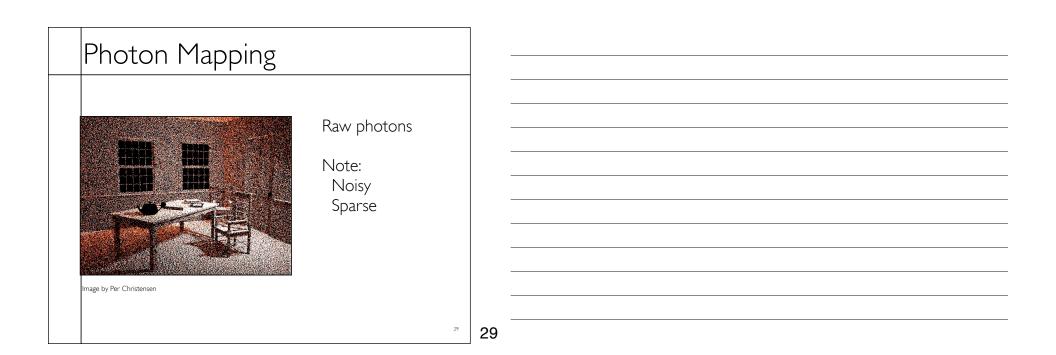
Ray Tracing

Ray Tracing w/ Photon Map

Catherine Bendebury and Jonathan Michaels CS 184 Spring 2005

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| | Photon Mapping | | | |
|---|----------------|--|----|--|
| 1 | | Interpolated Photons Note: Still noisy Biased | 30 | |

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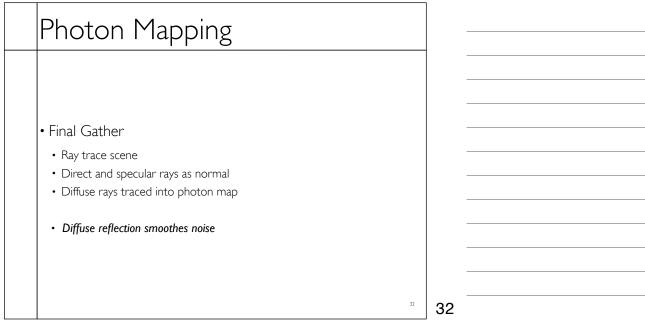
Photon Mapping



Image by Per Christensen

Interpolated Photons (multiplied by diffuse)

Note: Still noisy Biased



Photon Mapping



Image by Per Christensen

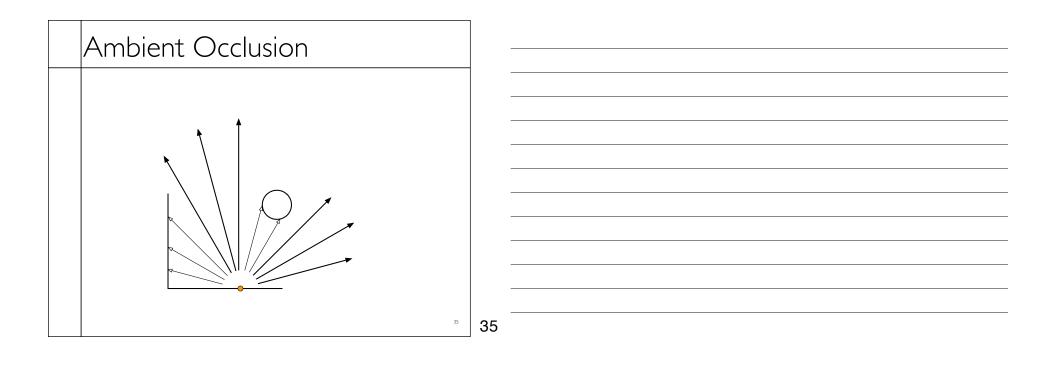
Final Image

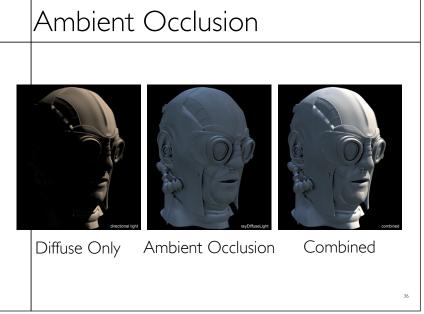
Note: Not noisy Nice lighting Reflections May still be biased

Final gather often bottleneck...

33 33

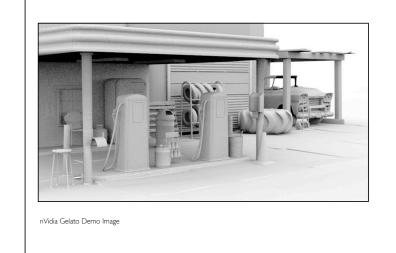
| Ambient Occlusion | |
|---|---|
| A "hack" to create more realistic ambient illumination cheaply | |
| • Assume light from everywhere is partially blocked by local objects | |
| At a point on the surface cast rays at random Ambient term is proportional to percent of rays that hit nothing Weight average by cosine of angle with normal Take into account how far before occluded | |
| 3 | 4 |







Ambient Occlusion



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