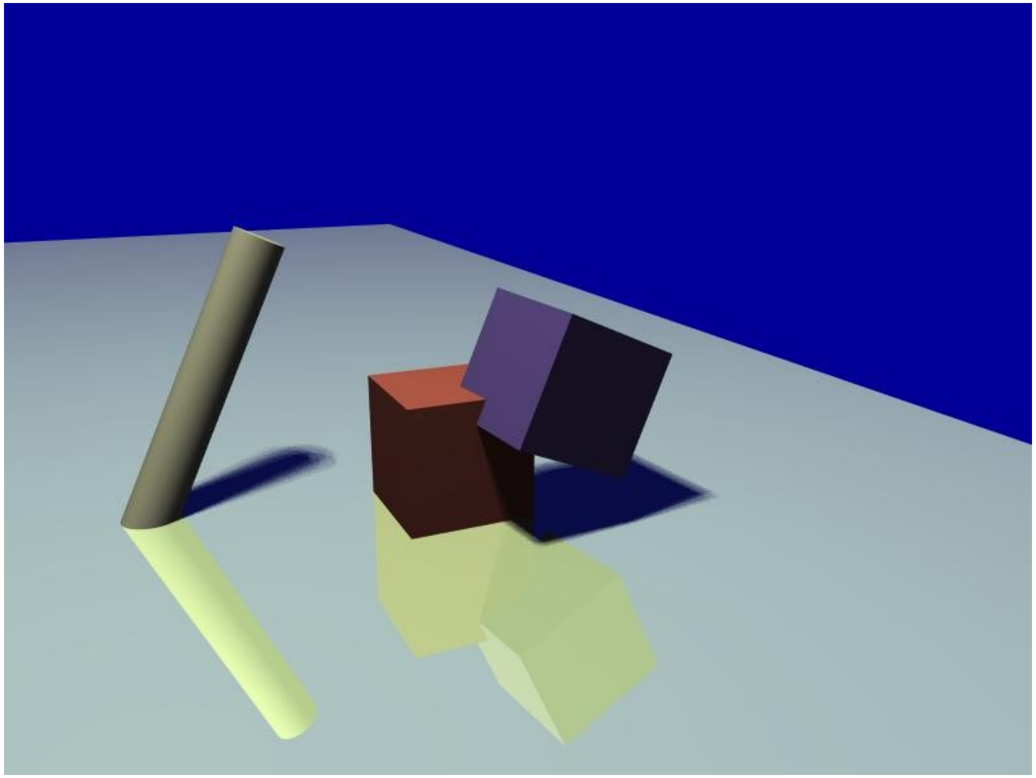
EECS 487

December 4, 2006

- Rodney Ma presentation
- precomputed radiance transfer (cont'd)
- project 5 concepts



support code

- not jot
- written by Prof. Guskov
- command line raytracer:
  srt scene.sce rendering.tga
- “srt” = simple ray tracer
- scene: lights, camera, objects, …
- output: targa image (see spec)

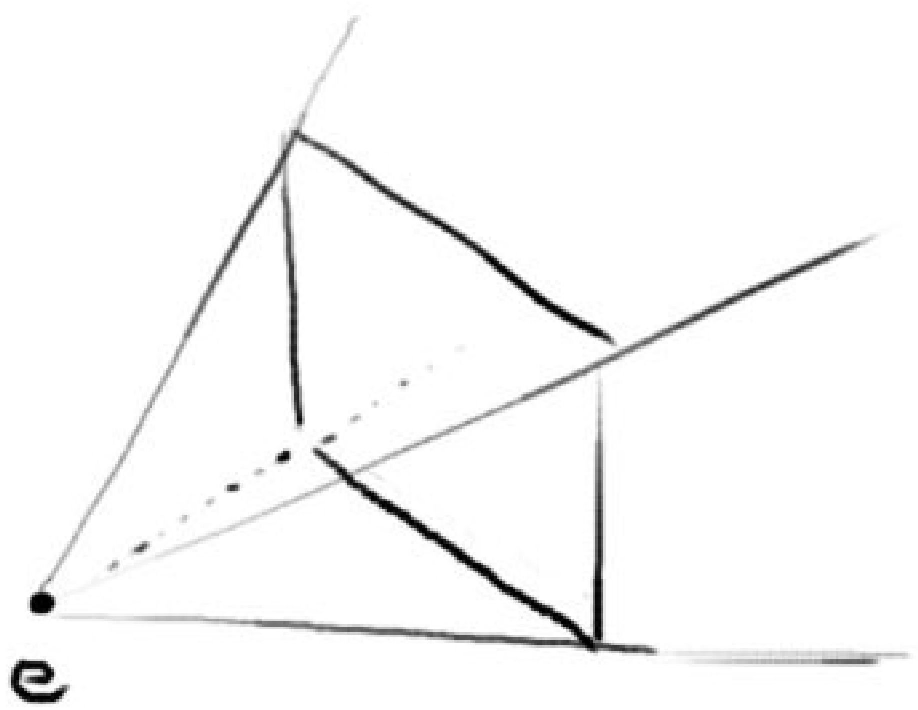
tasks

1. ray generation code
2. shading computations
3. interpolated normals for smooth shading
4. specular reflections
5. cylinder primitive
6. anti-aliasing
7. area lights
8. optimization: bounding sphere test

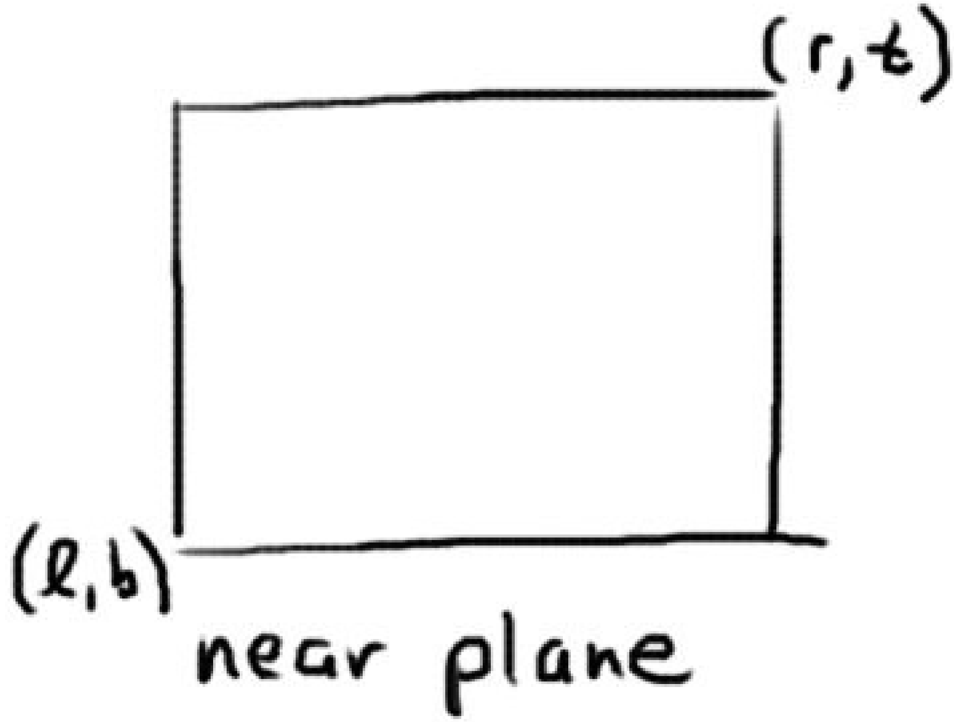
ray generation

- same camera model we've seen before
- parameters:
  e: eye location
  u: unit vector pointing right
  v: unit vector pointing up
  w: unit vector pointing behind us
  rendering window width, height in pixels
  field of view angle (in vertical direction)
  distance to near plane

ray generation

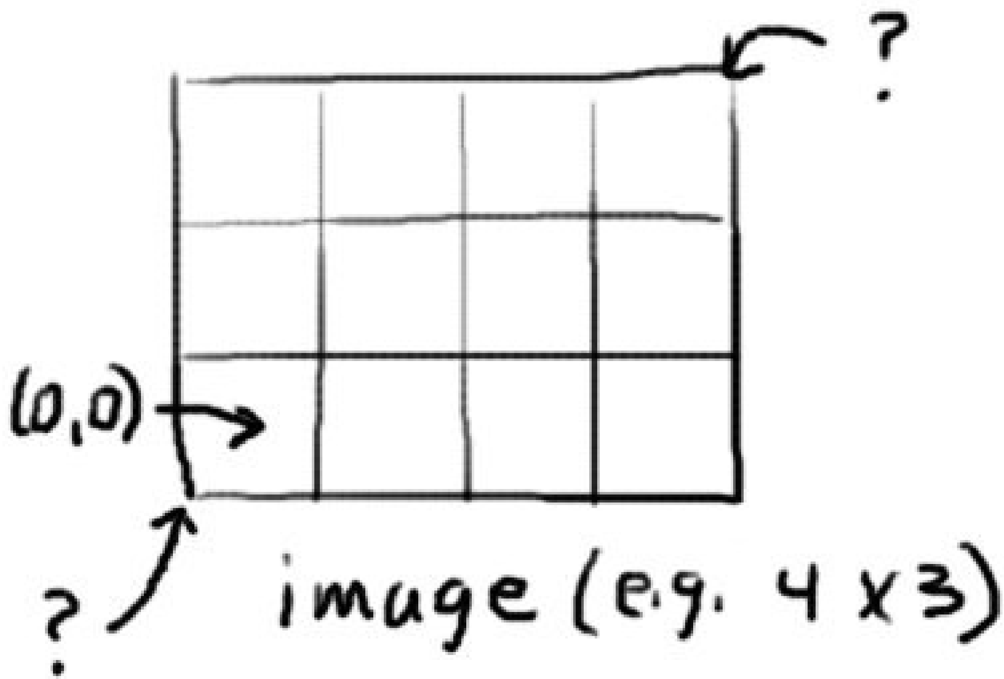


ray generation



- image maps to rectangle in near plane
- assume center of rectangle is (0,0)
- Q: what are (l,b) in terms of (r,t)?

ray generation



- pixel (0,0) is *center* of lower left pixel
- Q: what are coordinates at corners?

ray generation

- convert pixel coordinates (i,j) to (u,v) coordinates describing location on near clipping plane
- e.g. (-½, -½) in pixels maps to (l,b,n) in eye coordinates
  (n = w coordinate of near plane)
- world-space location s is then:
  $\mathbf{s} = \mathbf{e} + \mathbf{u}u + \mathbf{v}v + \mathbf{w}n$
- Q: what is the ray?

ray generation

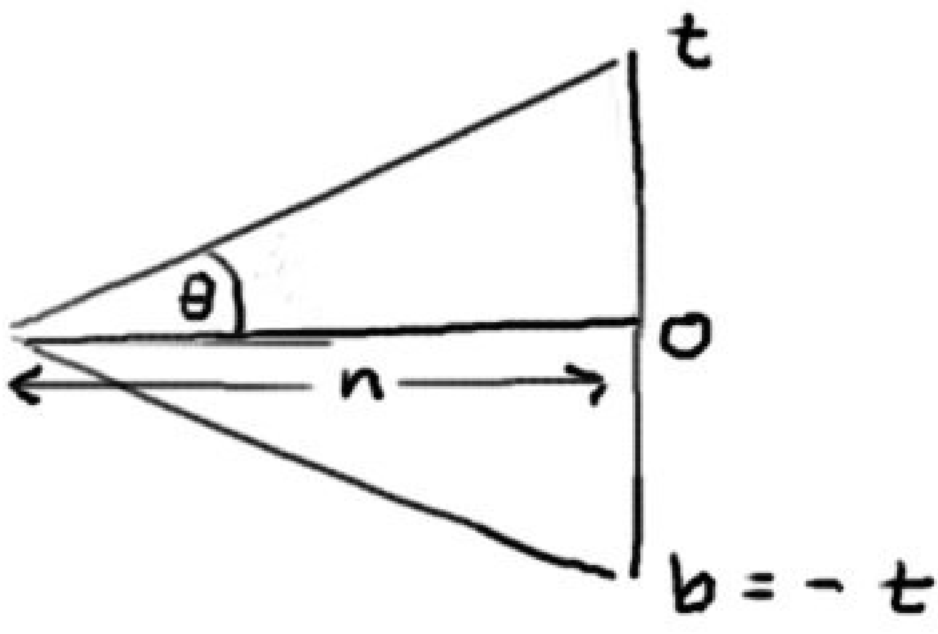
- Q: what is the ray?
- A: $r(t) = \mathbf{e} + t(\mathbf{s} - \mathbf{e})$

ray generation

- Q: how to get l, r, t, b, n, f?

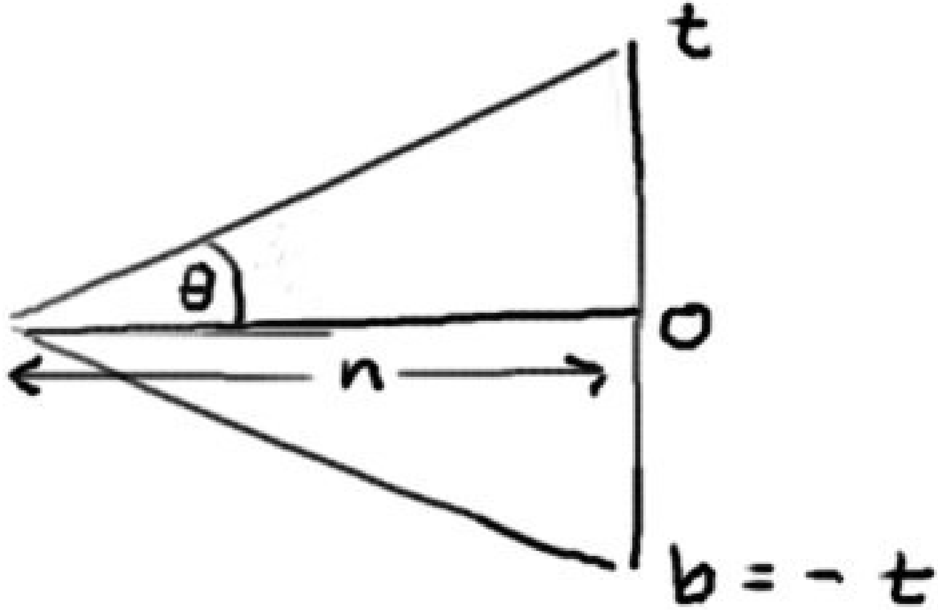
ray generation

- Q: how to get l, r, t, b, n, f?
- A: given n, and fovy
  θ = fovy/2



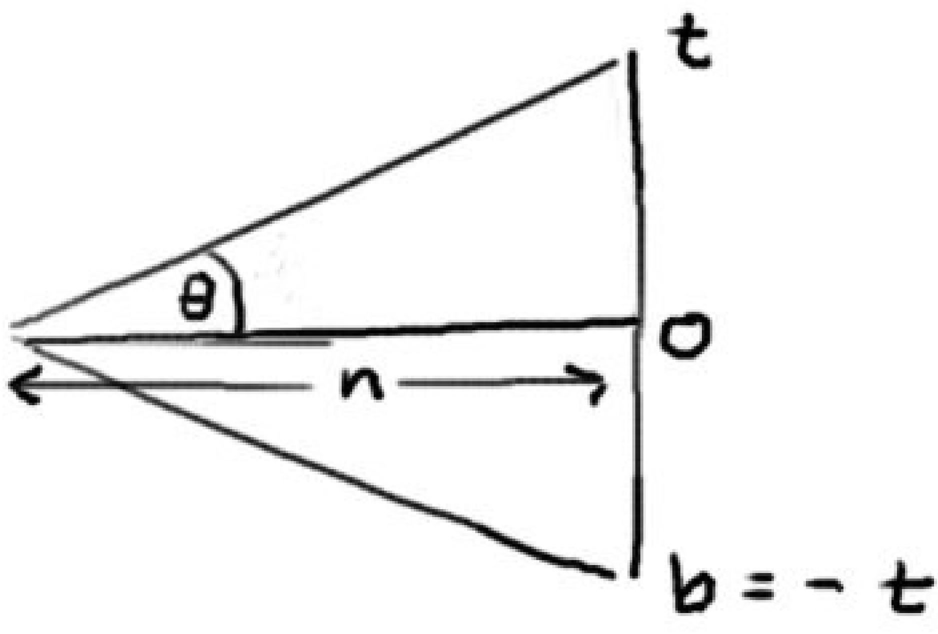
ray generation

- $\tan(\theta) = t/n$
- solve for t



ray generation

- aspect ratio a = image width/height
- r = a*t



shading

```
/// Returns the color from the shading computation using
/// the information in the hitinfo_t structure
/// level is the recursion level
XVecf RayTracerT::Shade(const hitinfo_t& hit, int level) {
  XVecf color(0.0f);

  // Ambient light contribution
  color = hit.m_mat.m_ca*hit.m_mat.m_cr;

  // YOUR CODE HERE
  // shading code here
  // iterate over the lights and collect their contribution
  // make a recursive call to Trace() function to get the reflections


  return color;
}
```

shading

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  // YOUR CODE HERE
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  // make a recursive call to Trace() function to get the reflections

  SceneT::LightCt::const_iterator li;
  for(li=m_scene.BeginLights(); li!=m_scene.EndLights(); ++li) {
     ...
  }
  return color;
}
```

phong shading

- do per pixel normals
  - use barycentric coordinates (provided)
  - return interpolated normal within mesh triangle in `MeshT::Intersect()`
  - if: `m_shade == PHONG_SHADE`

specular reflections

- if max recursion not reached, trace a reflection ray to compute reflected color
- compute illumination seen along reflected array
- combine with base color using material specular value

remaining tasks...

- cylinder primitive
- anti-aliasing
- area lights
- optimization: bounding sphere test