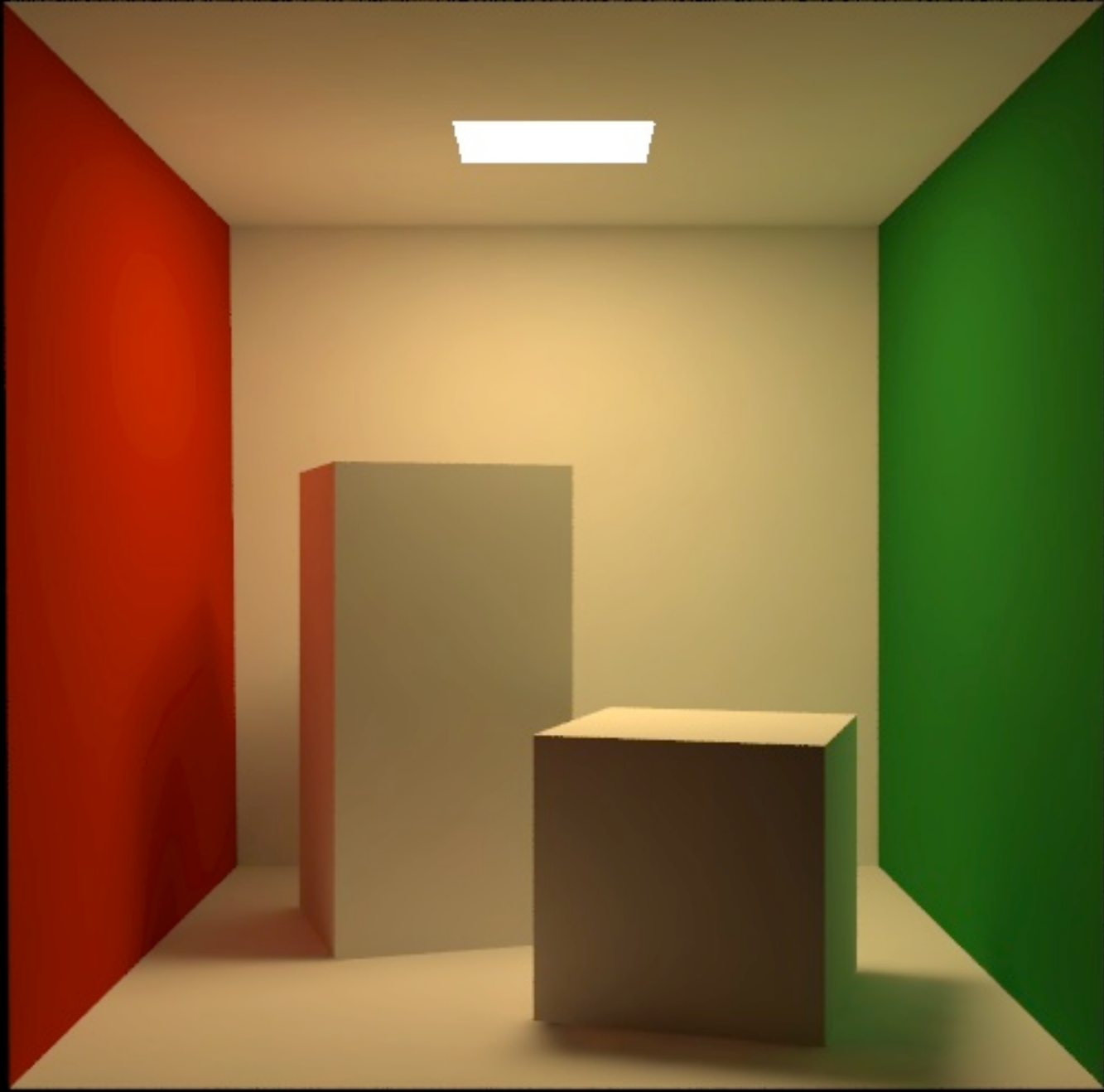
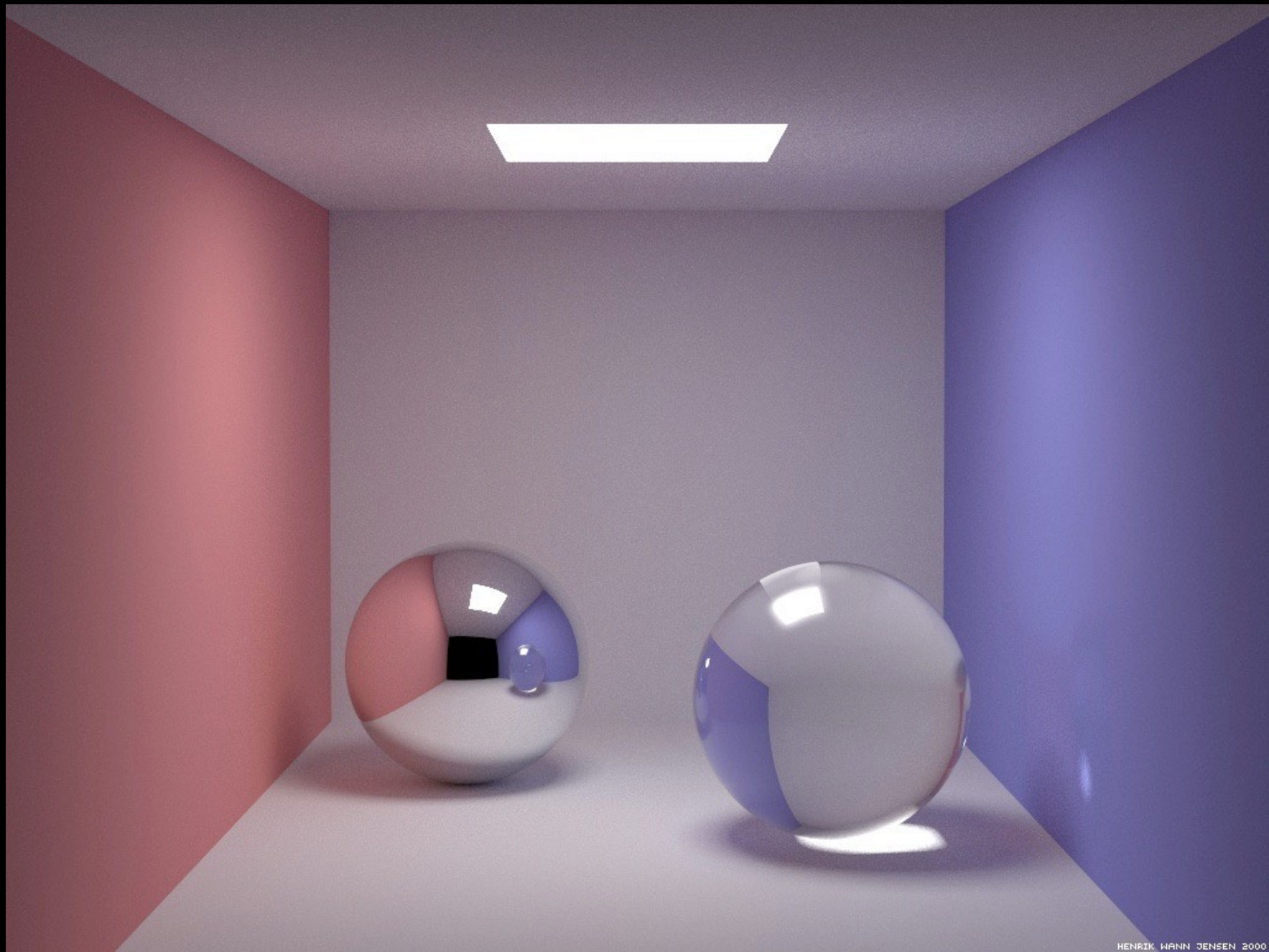


Path Tracing

Images for CS6630 lecture



Cornell PCG

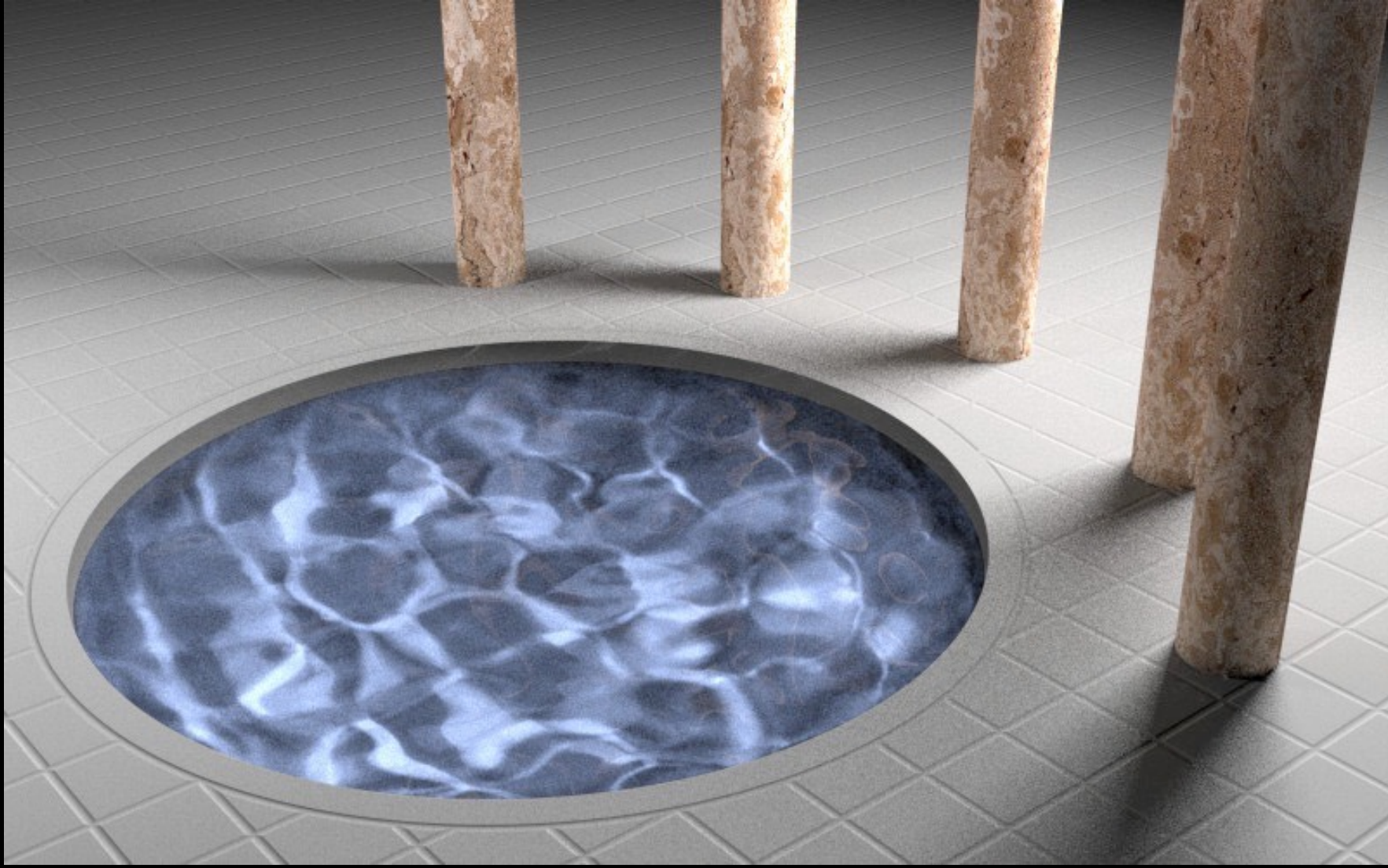


HENRIK WANN JENSEN 2000

Henrik Wann Jensen



Veach & Guibas 1994



Veach & Guibas 1997



Kajiya-style path tracing, version 0:

rayRadianceEst(x, ω):

$y = \text{traceRay}(x, \omega)$

return emittedRadiance($y, -\omega$) + reflectedRadianceEst($y, -\omega$)

reflectedRadianceEst(x, ω_r):

$\omega_i = \text{uniformRandomPSA}(n(x))$

return $\pi * \text{brdf}(x, \omega_i, \omega_r) * \text{rayRadianceEst}(x, \omega_i)$

Kajiya-style path tracing, version 0.5:

rayRadianceEst(x, ω):

$y = \text{traceRay}(x, \omega)$

 return emittedRadiance($y, -\omega$) + reflectedRadianceEst($y, -\omega$)

reflectedRadianceEst(x, ω_r):

 if random() < survivalProbability:

$\omega_i = \text{uniformRandomPSA}(n(x))$

 return $\pi * \text{brdf}(x, \omega_i, \omega_r) * \text{rayRadianceEst}(x, \omega_i) / \text{survivalProbability}$

 else

 return 0

Kajiya-style path tracing, version 0.75:

rayRadianceEst(x, ω):

$y = \text{traceRay}(x, \omega)$

 return emittedRadiance($y, -\omega$) + reflectedRadianceEst($y, -\omega$)

reflectedRadianceEst(x, ω_r):

 if random() < survivalProbability:

$\omega_i, \text{pdf} = \text{brdfSample}(x, n(x))$

 return brdf(x, ω_i, ω_r) * rayRadianceEst(x, ω_i) / (pdf * survivalProbability)

 else

 return 0

Kajiya-style path tracing, version 1.0:

rayRadianceEst(x, ω):

```
y = traceRay(x,  $\omega$ )  
return emittedRadiance(y,  $-\omega$ )  
    + reflectedRadianceEst(y,  $-\omega$ )
```

directRadianceEst(x, ω_r):

```
 $\omega_i, pdf = \text{luminaireSample}(x, n(x))$   
y = traceRay(x,  $\omega_i$ )  
return brdf(x,  $\omega_i, \omega_r$ )  
    * emittedRadiance(y,  $-\omega_i$ ) / pdf
```

reflectedRadianceEst(x, ω_r):

```
return directRadianceEst(x,  $\omega_r$ )  
    + indirectRadianceEst(x,  $\omega_r$ )
```

indirectRadianceEst(x, ω_r):

```
if random() < survivalProbability:  
     $\omega_i, pdf = \text{brdfSample}(x, n(x))$   
    y = traceRay(x,  $\omega_i$ )  
    return brdf(x,  $\omega_i, \omega_r$ )  
        * reflectedRadianceEst(y,  $-\omega_i$ )  
        / (pdf * survivalProbability)  
else:  
    return 0
```

Kajiya-style path tracing, version 1.0m:

directRadianceEst(x, ω_r):

```
 $\omega_l$ , pll = luminaireSample(x, n(x))
pbl = brdfPDF( $\omega_l$ )
 $\omega_b$ , pbb = brdfSample(x, n(x))
plb = luminairePDF( $\omega_b$ )
yl = traceRay(x,  $\omega_l$ )
yb = traceRay(x,  $\omega_b$ )
fl = brdf(x,  $\omega_l$ ,  $\omega_r$ )
    * emittedRadiance(yl,  $-\omega_l$ )
fb = brdf(x,  $\omega_b$ ,  $\omega_r$ )
    * emittedRadiance(yb,  $-\omega_b$ )
return fl / (pll + pbl) + fb / (plb + pbb)
```

reflectedRadianceEst(x, ω_r):

```
return directRadianceEst(x,  $\omega_r$ )
    + indirectRadianceEst(x,  $\omega_r$ )
```

indirectRadianceEst(x, ω_r):

```
if random() < survivalProbability:
     $\omega_i$ , pdf = brdfSample(x, n(x))
    y = traceRay(x,  $\omega_i$ )
    return brdf(x,  $\omega_i$ ,  $\omega_r$ )
        * reflectedRadianceEst(y,  $-\omega_i$ )
        / (pdf * survivalProbability)
else:
    return 0
```

Kajiya-style path tracing, version 1.1:

reflectedRadianceEst(x , ω_r):

```
 $\omega_l$ ,  $p_{ll}$  = luminaireSample( $x$ ,  $n(x)$ )  
 $p_{bl}$  = brdfPDF( $\omega_l$ )  
 $\omega_b$ ,  $p_{bb}$  = brdfSample( $x$ ,  $n(x)$ )  
 $p_{lb}$  = luminairePDF( $\omega_b$ )  
 $y_l$  = traceRay( $x$ ,  $\omega_l$ )  
 $y_b$  = traceRay( $x$ ,  $\omega_b$ )  
 $f_l$  = brdf( $x$ ,  $\omega_l$ ,  $\omega_r$ )  
    * emittedRadiance( $y_l$ ,  $-\omega_l$ )  
 $f_b$  = brdf( $x$ ,  $\omega_b$ ,  $\omega_r$ )  
    * emittedRadiance( $y_b$ ,  $-\omega_b$ )  
 $reflRad$  =  $f_l / (p_{ll} + p_{bl}) + f_b / (p_{lb} + p_{bb})$   
if random() < survivalProbability:  
     $reflRad$  += brdf( $x$ ,  $\omega_b$ ,  $\omega_r$ ) /  $p_{bb}$   
        * reflectedRadianceEst( $y_b$ ,  $-\omega_b$ )  
        / survivalProbability  
return  $reflRad$ 
```