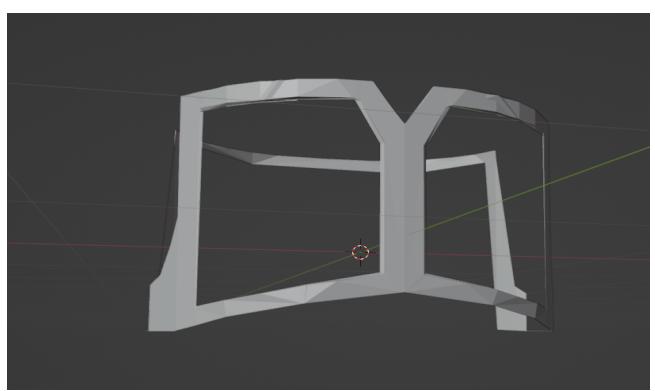
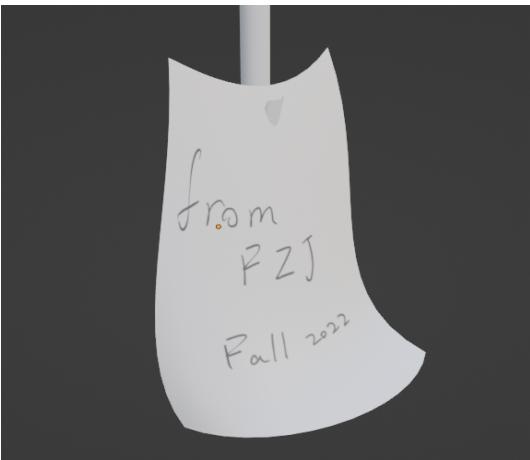
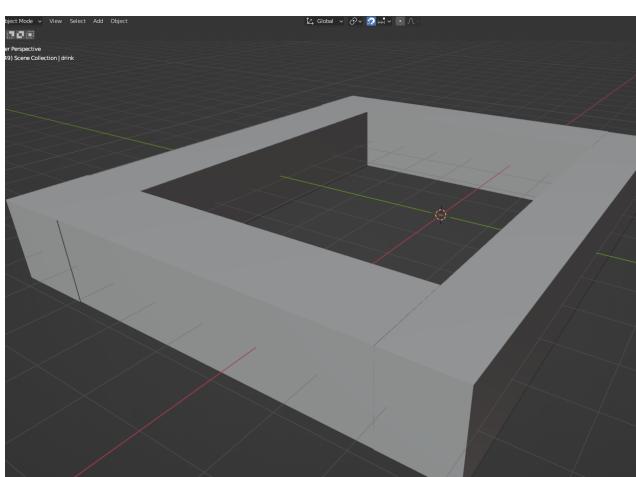
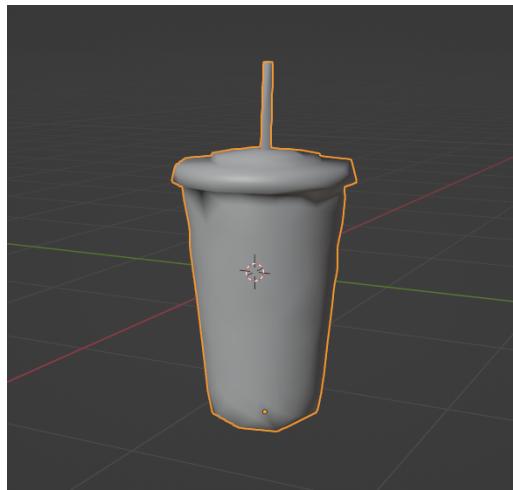


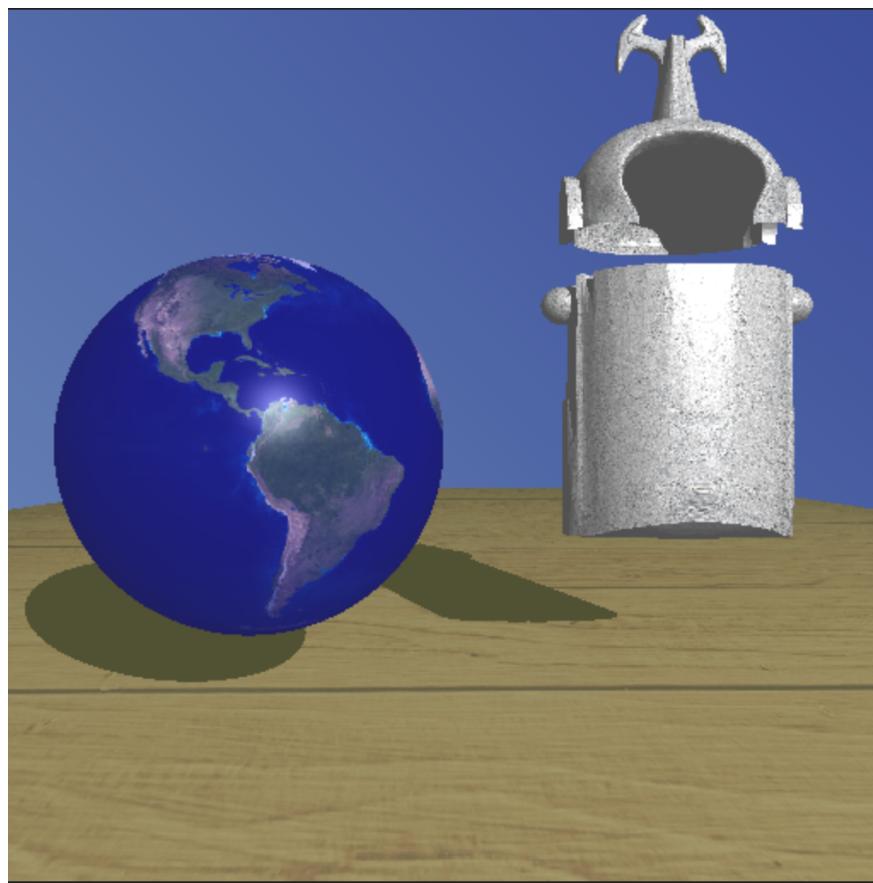
Ray Tracing Portfolio  
Kabutack and Bathhouse  
Zijian Feng  
20819676  
z63feng

<b>1. Objective one - Complex modeling on Kabutack avatar and bathhouse.</b>	<b>3</b>
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# 1. Objective one - Complex modeling on Kabutack avatar and bathhouse.

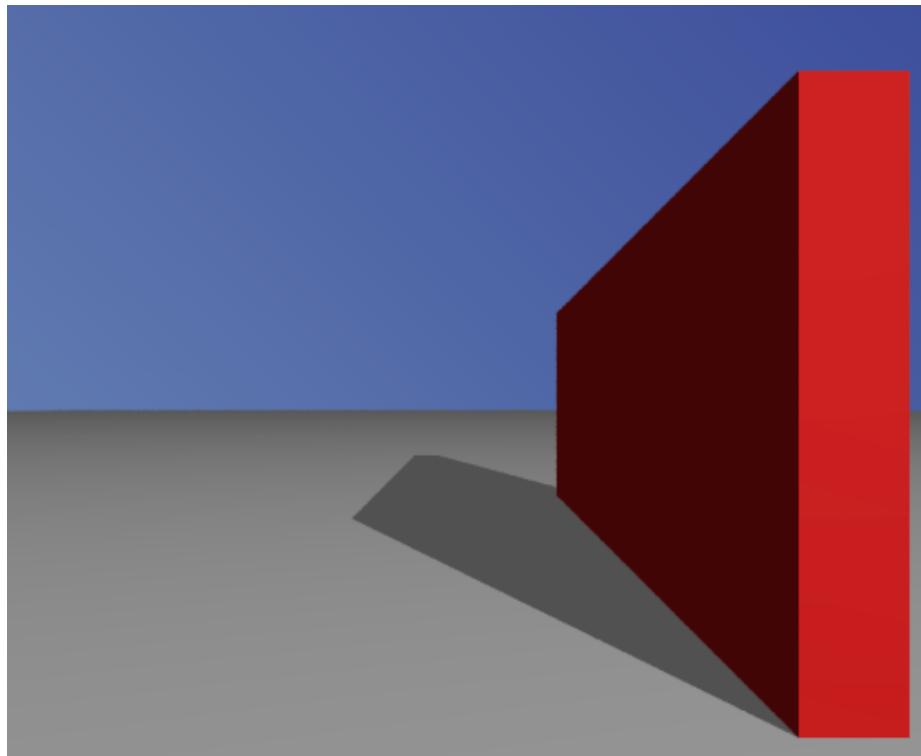


2. Objective two - Texture mapping on environmental objects

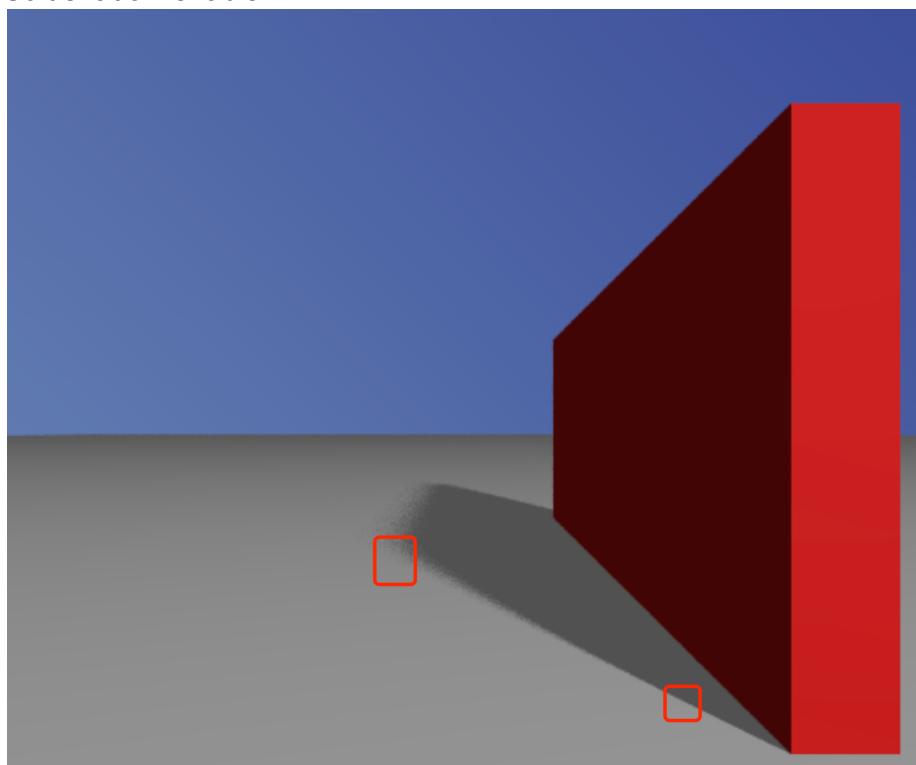


### 3. Objective three - Soft shadow

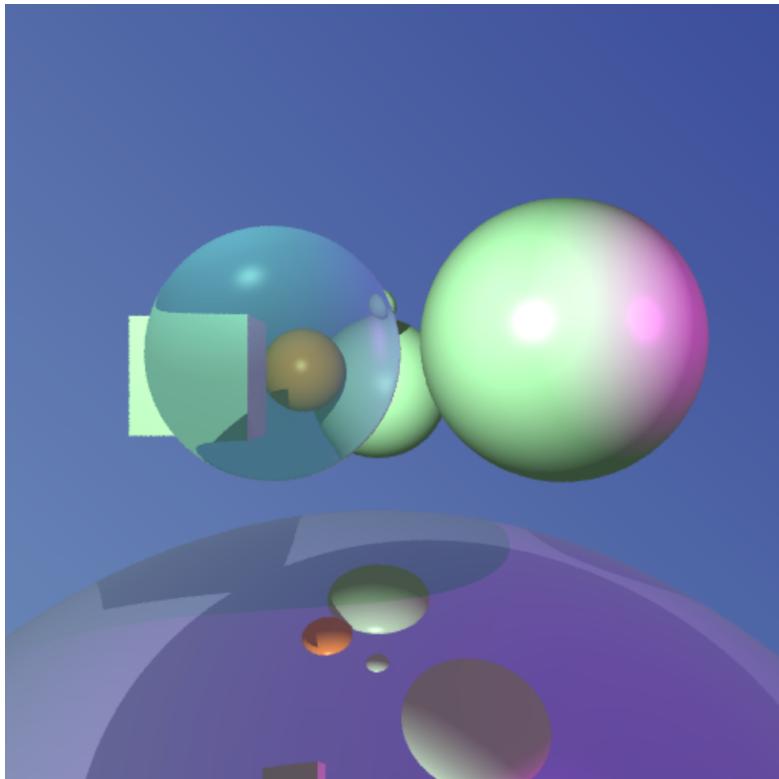
Soft shadow disable



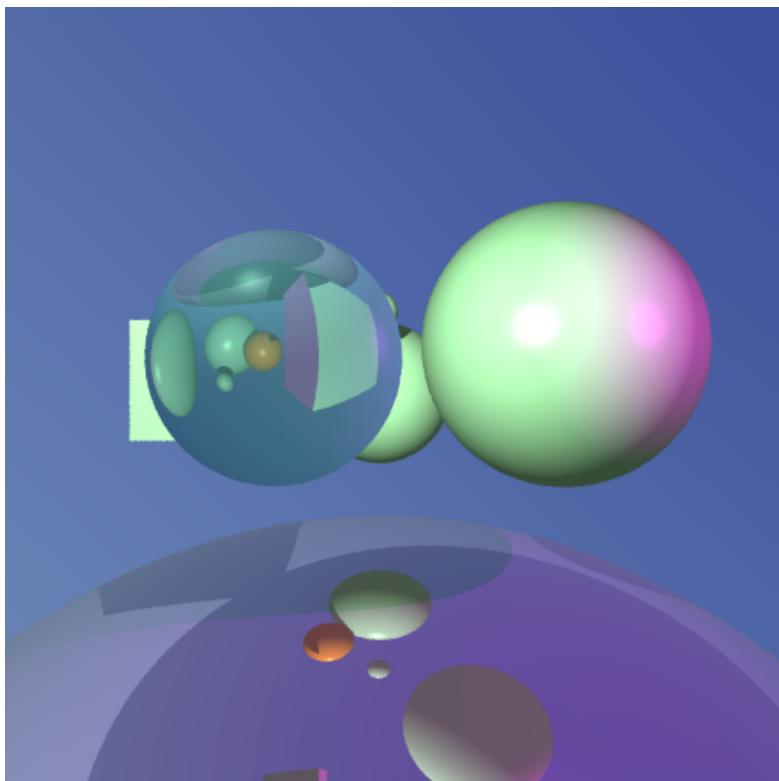
Soft shadow enable



#### 4. Objective four - refraction



with index of refraction 0.1

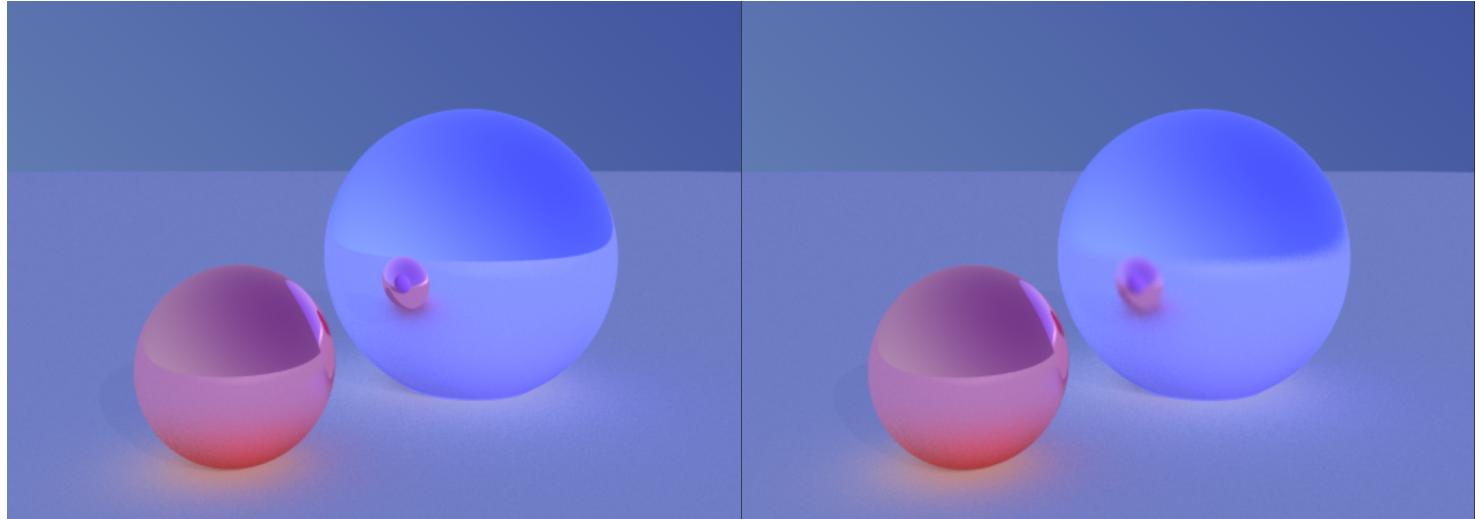


with index of refraction 0.6

## 5. Objective five - Glossy reflection/refraction

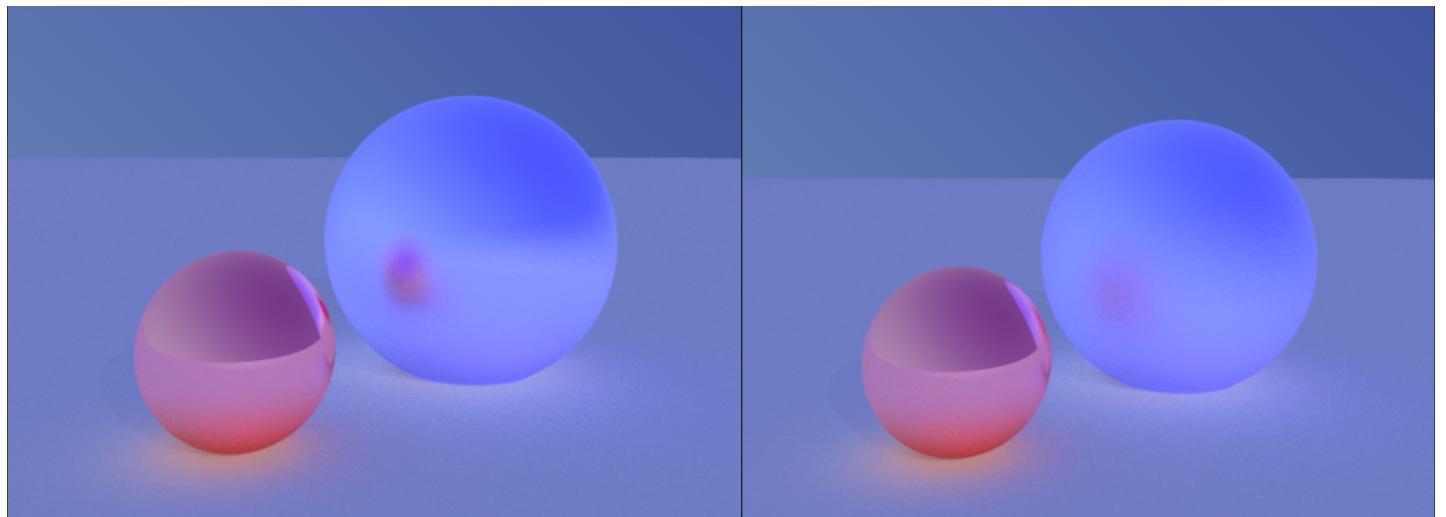
### Glossy Reflection

Donate the index of fuzziness as **m\_fuzz**.



With **m\_fuzz = 0.01**

With **m\_fuzz = 0.1**

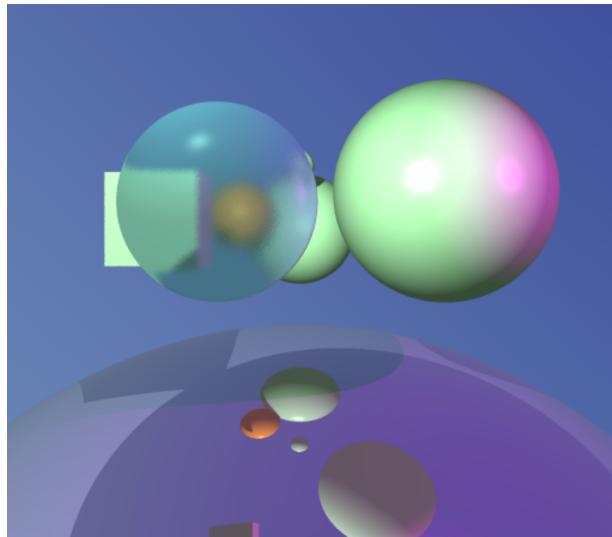


With **m\_fuzz = 0.3**

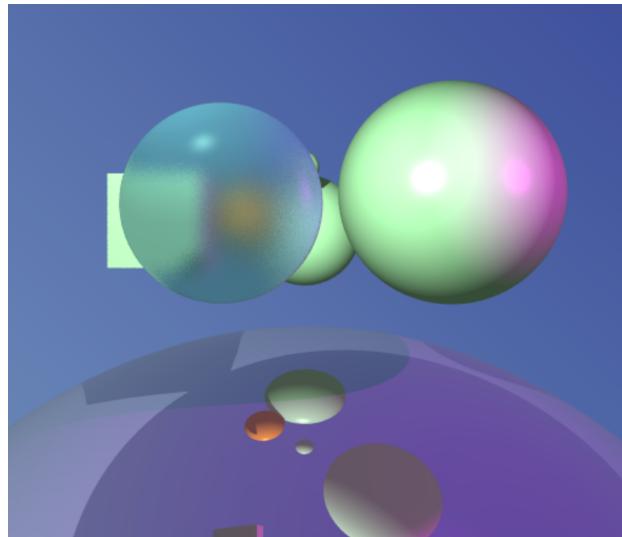
With **m\_fuzz = 0.8**

## Glossy Refraction

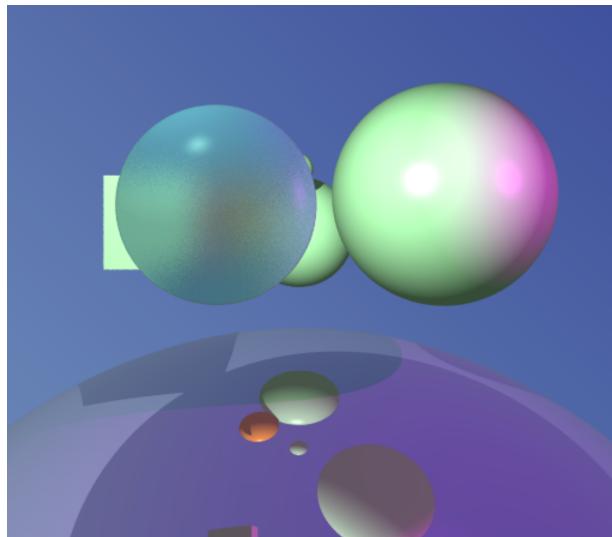
Note that in refraction, a ray will refract twice to display the actual scene. The  $m_{fuzz}$  will be more sensitive compared to the reflections.



$m_{fuzz} = 0.01$



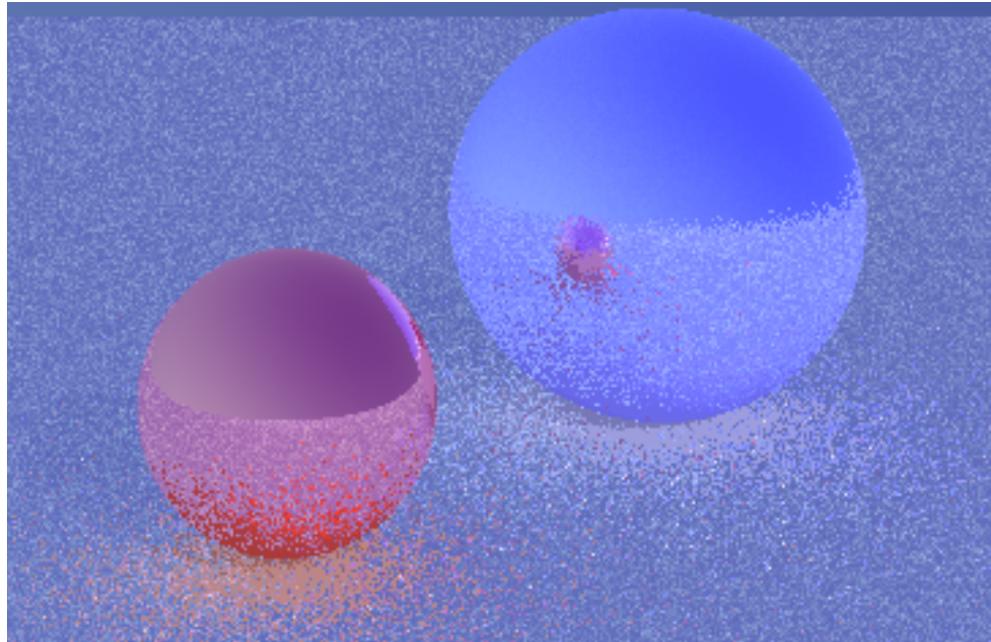
$m_{fuzz} = 0.05$



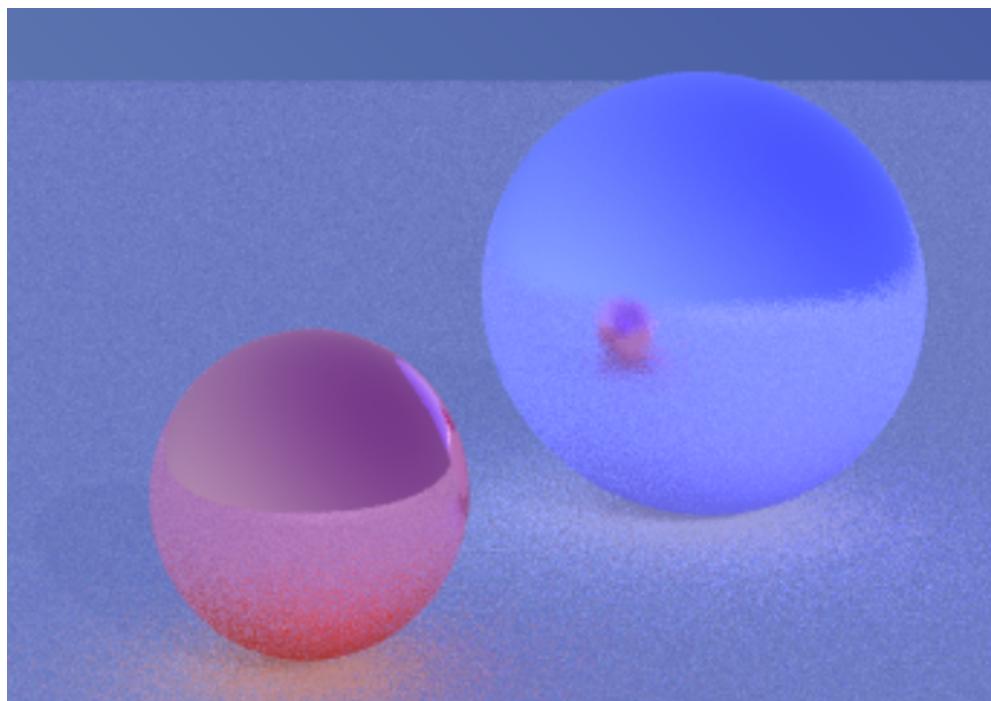
$m_{fuzz} = 0.1$

## 6. Objective six - Super-sampling

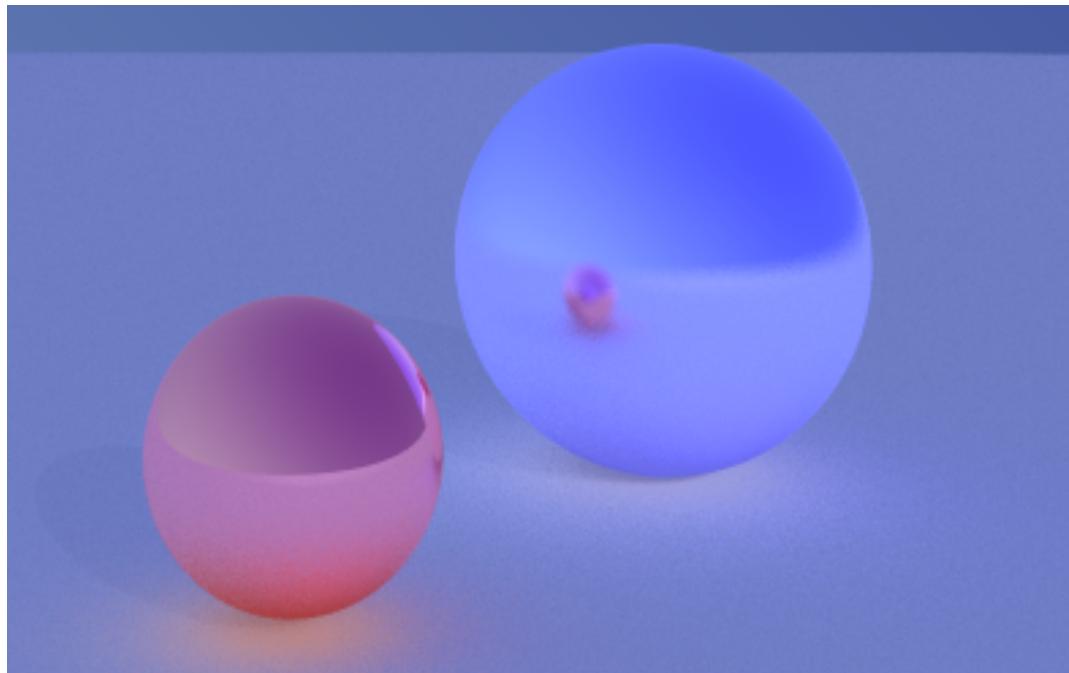
In the Lambertian Model, the ray is generated by a diffuse reflection. It has the uniform probability in every direction. If sampling is not enough, the noise will be more visible than other materials.  
No super-sampling anti-aliasing



10x super-sampling anti-aliasing

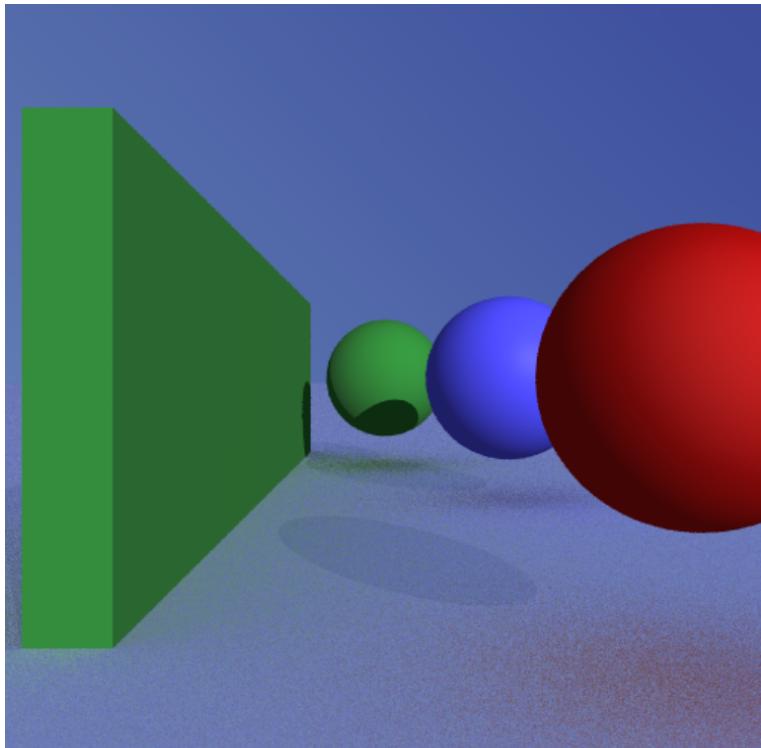


100x super-sampling anti-aliasing

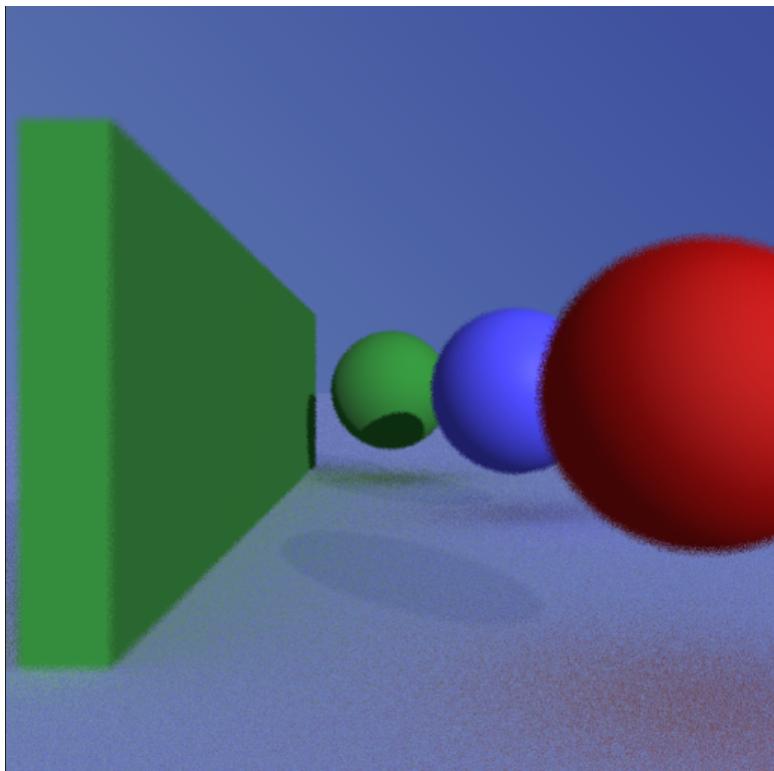


## 7. Objective seven - Simulation of depth of field.

With no DOF



With DOF of 0.2



## 8. Objective eight - Photon mapping

Aborted.

This objective has to be aborted. The reason is that the investigation before the proposal is far from enough. After a further investigation, I found the workload and difficulty is impossible for me to finish in the remaining days. First, it is a completely different ray tracing method. I cannot reuse the ray tracer mechanism in A4 to build the photon map. Second, even if I had done the photon map, I have to write an efficient kb-tree structure to store and query the photons. Third, a mathematical method has to be come up to give the approximation of photons during the rendering. I tried to understand one of them but failed. Lastly, the final effect is not as good as a direct ray tracer if I failed one of the requirements: a large amount of photons which means the structure has to be efficient, a proper approximation and correction during the rendering.

As a consequence, I have to abort this objective but still I want everyone to know that I tried.

## 9. Objective nine - Multithreading rendering

Configuration:

Machine: z63feng@gl47

Graph: final.lua, 512x384,

Super-sampling: OFF

Soft shadow: OFF

No multi-threading: 53 seconds.

```
rendering... (50000, 196608) 45.78%
rendering... (100000, 196608) 50.86%
rendering... (110000, 196608) 55.95%
rendering... (120000, 196608) 61.04%
rendering... (130000, 196608) 66.12%
rendering... (140000, 196608) 71.21%
rendering... (150000, 196608) 76.29%
rendering... (160000, 196608) 81.38%
rendering... (170000, 196608) 86.47%
rendering... (180000, 196608) 91.55%
rendering... (190000, 196608) 96.64%
Time consumption: 53 sec.
z63feng@gl47:~/cs488/A5/Assets$
```

2 threads rendering: 33 seconds.

```
F22: Calling A5_Render(
    SceneNode:[name:scene, id:0]
    Image(width:512, height:384)
    eye: vec3(0.000000, 2.000000, 0.000000)
    view: vec3(0.000000, -0.300000, -1.000000)
    up: vec3(0.000000, 1.000000, 0.000000)
    fovy: 50
    ambient: vec3(0.400000, 0.400000, 0.400000)
    lights{
        L[vec3(0.800000, 0.800000, 0.800000)
        , 27.000000), 1, 0, 0]
    }
)
main() : creating thread, ranged from 0 98303
main() : creating thread, ranged from 98304 196607
rendering... (100000, 196608) 50.86%
Time consumption: 33 sec.
z63feng@gl47:~/cs488/A5/Assets$
```

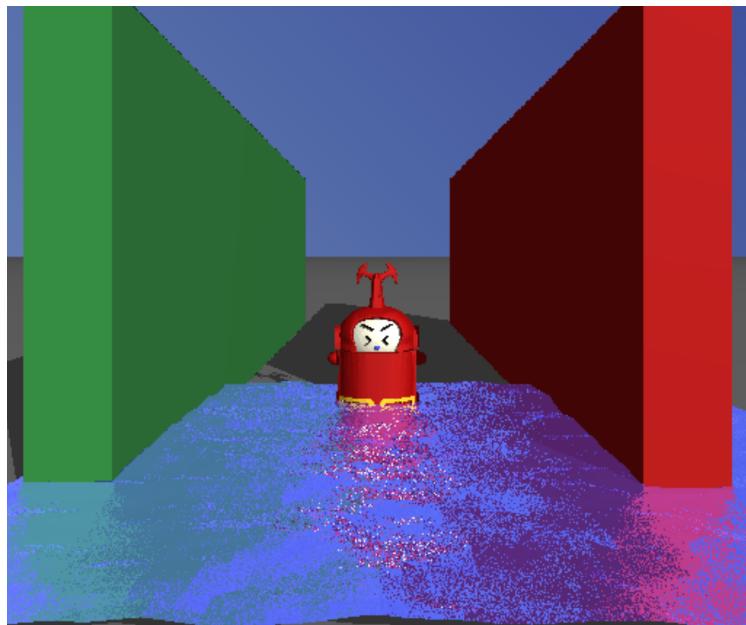
4 threads rendering: 25 seconds.

```
F22: Calling A5_Render(
    SceneNode:[name:scene, id:0]
    Image(width:512, height:384)
    eye: vec3(0.000000, 2.000000, 0.000000)
    view: vec3(0.000000, -0.300000, -1.000000)
    up: vec3(0.000000, 1.000000, 0.000000)
    fovy: 50
    ambient: vec3(0.400000, 0.400000, 0.400000)
    lights{
        L[vec3(0.800000, 0.800000, 0.800000)
, 27.000000), 1, 0, 0]
    }
)
main() : creating thread, ranged from 0 49151
main() : creating thread, ranged from 49152 98303
main() : creating thread, ranged from 98304 147455
main() : creating thread, ranged from 147456 196607
rendering... (100000, 196608) 50.86%
Time consumption: 25 sec.
```

8 threads rendering: 15 seconds.

```
F22: Calling A5_Render(
    SceneNode:[name:scene, id:0]
    Image(width:512, height:384)
    eye: vec3(0.000000, 2.000000, 0.000000)
    view: vec3(0.000000, -0.300000, -1.000000)
    up: vec3(0.000000, 1.000000, 0.000000)
    fovy: 50
    ambient: vec3(0.400000, 0.400000, 0.400000)
    lights{
        L[vec3(0.800000, 0.800000, 0.800000), ve
, 27.000000), 1, 0, 0]
    }
)
main() : creating thread, ranged from 0 24575
main() : creating thread, ranged from 24576 49151
main() : creating thread, ranged from 49152 73727
main() : creating thread, ranged from 73728 98303
main() : creating thread, ranged from 98304 122879
main() : creating thread, ranged from 122880 147455
main() : creating thread, ranged from 147456 172031
main() : creating thread, ranged from 172032 196607
rendering... (100000, 196608) 50.86%
Time consumption: 15 sec.
z63feng@gl47:~/cs488/A5/Assets$ █
```

## 10. Objective ten - Final Scene

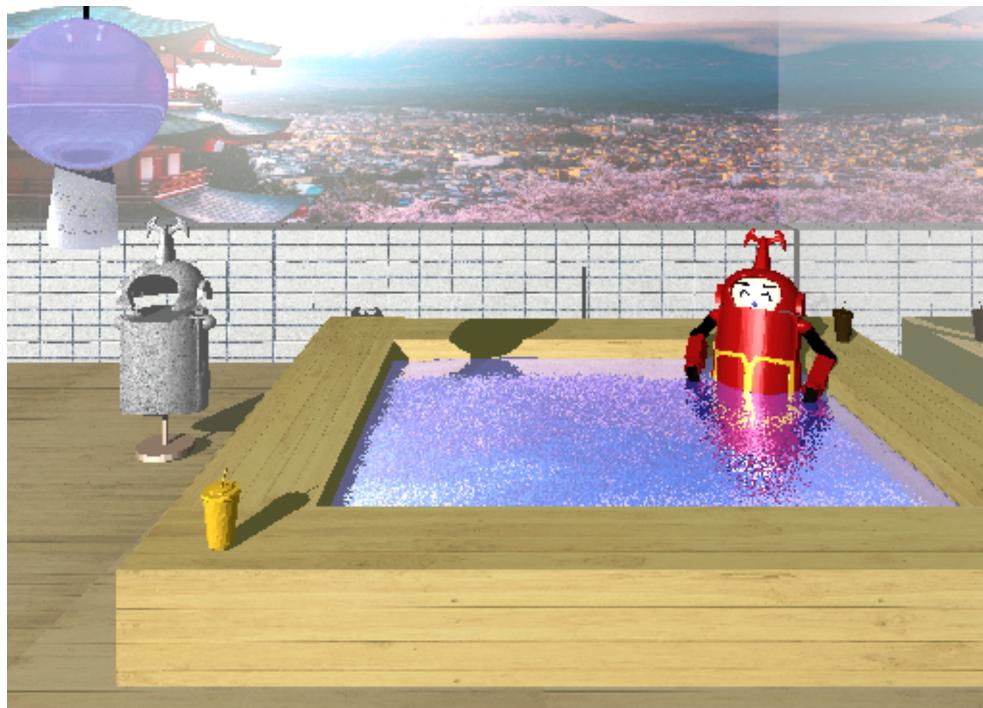


Try to render water.



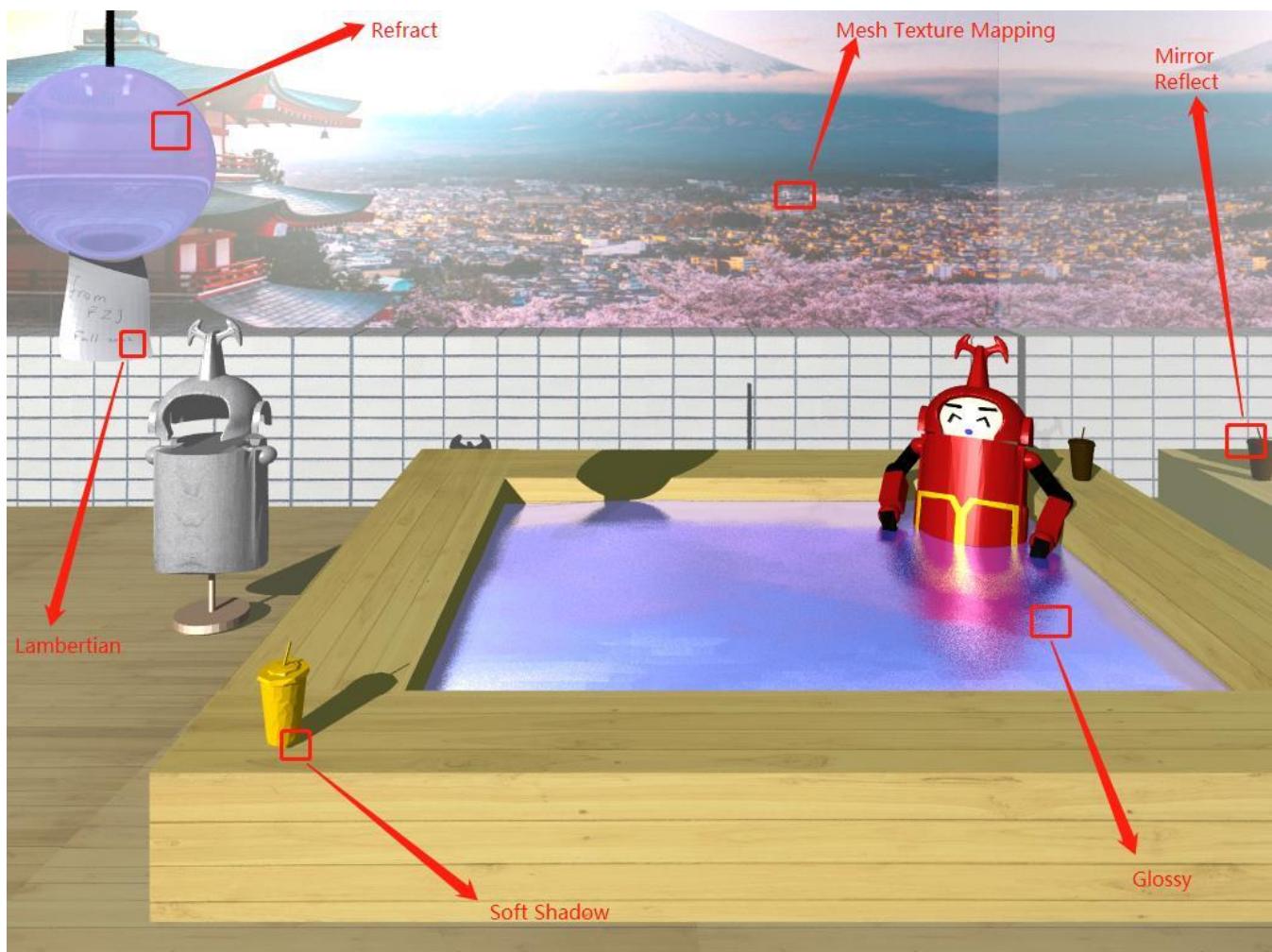
First draft

With environments added.



Final scene.





## 11. Special Thanks to YangWC's Blog.

