PROJECT REPORT

Computer Graphics (2024-2025)

Assignment 1

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Bachelor of Science

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May 1, 2025

1 Start

Intensity (I) set to 170000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to only 1, light bounces set to 5. There is no indirect lighting and no antialiasing.

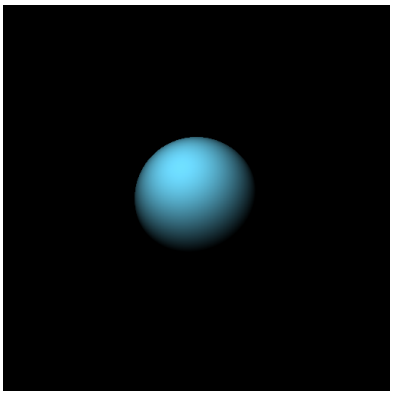

Figure 1: The very start of the lab.

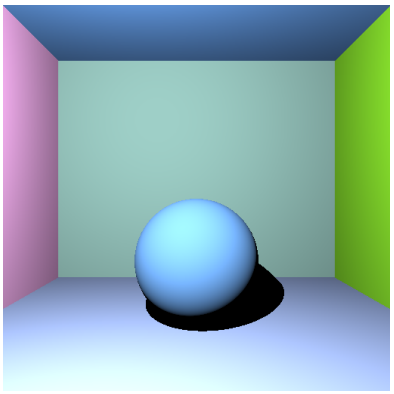

Figure 2: Rendering time (in parallel): 0.15236 seconds

2 Mirroring

Intensity (I) set to 100000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to only 1, light bounces set to 5. There is no indirect lighting and no antialiasing.

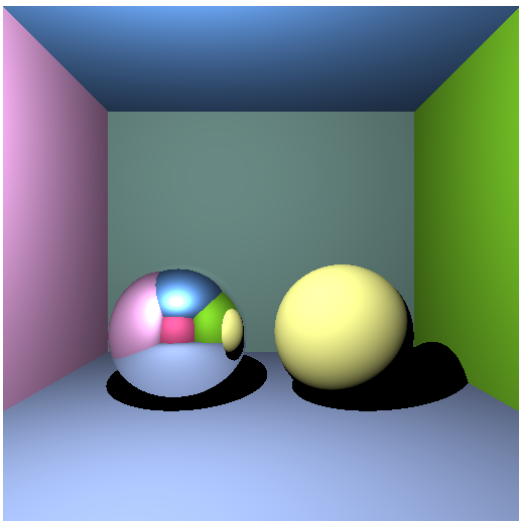

Figure 3: Mirroring.
Rendering time (in parallel): 0.174379 seconds

Intensity (I) set to 140000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 120, light bounces set to 5. In plus, it has indirect lighting and antialiasing.

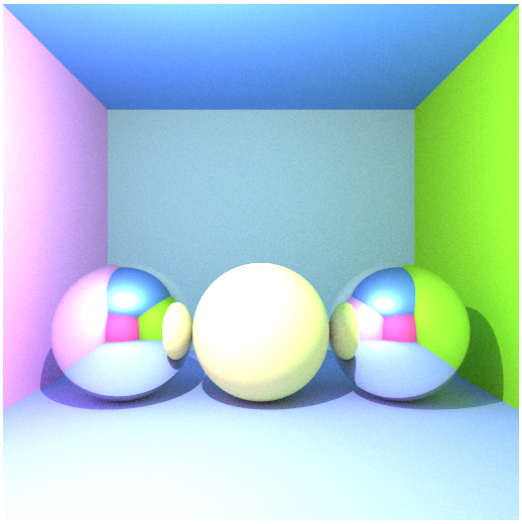

Figure 4: Mirroring.
Rendering time (in parallel): 108.752 seconds

3 Transparency

Intensity (I) set to 200000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 120, light bounces set to 5. In plus, it has indirect lighting and antialiasing.

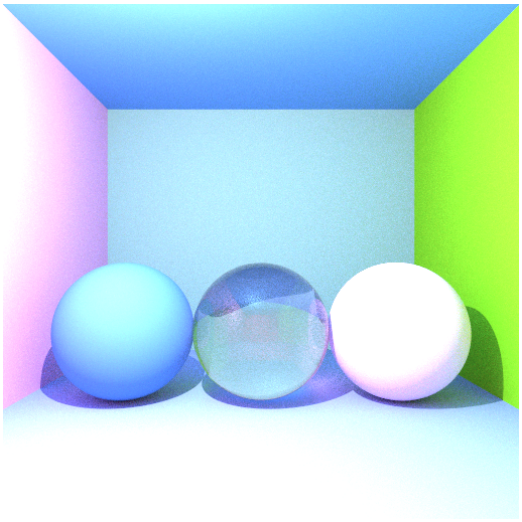

Figure 5: Transparency.
Rendering time (in parallel): 175.857 seconds

4 Motion blur

Intensity (I) set to 200000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 120, light bounces set to 5, moves upwards on the y-axis with a speed of 15 units per time unit. In plus, it has indirect lighting and antialiasing.

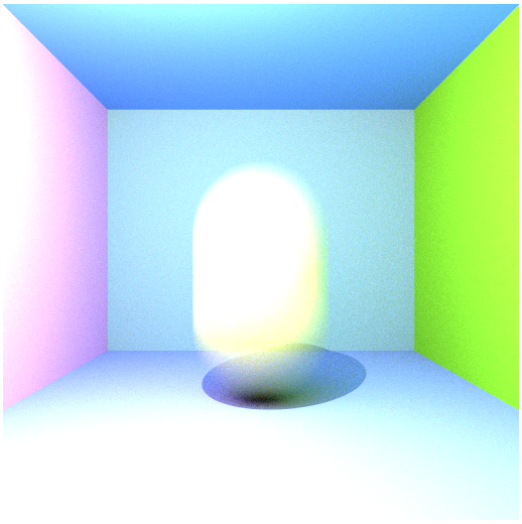

Figure 6: Motion blur.
Rendering time (in parallel): 240.346 seconds

5 Cat - without Bounding Box

Intensity (I) set to 140000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 1, light bounces set to 5. In plus, it has indirect lighting and antialiasing.

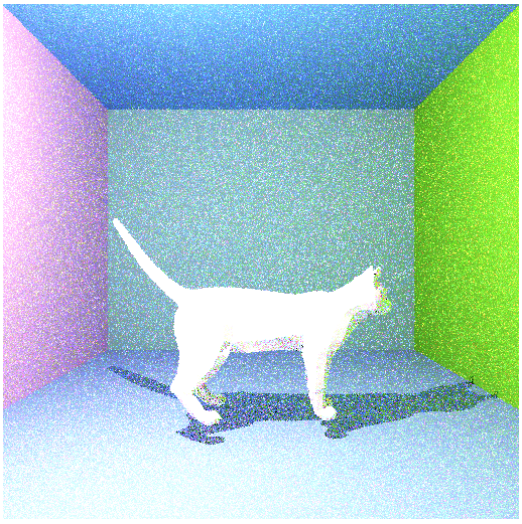

Figure 7: Cat without Bounding Box.
Rendering time (in parallel): 541.217 seconds

6 Cat - with Bounding Box

Intensity (I) set to 100000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 1, light bounces set to 5. In plus, it has indirect lighting and antialiasing.

We see that the BoundingBox improved the rendering time a lot, now taking 1/8 of the previous time.

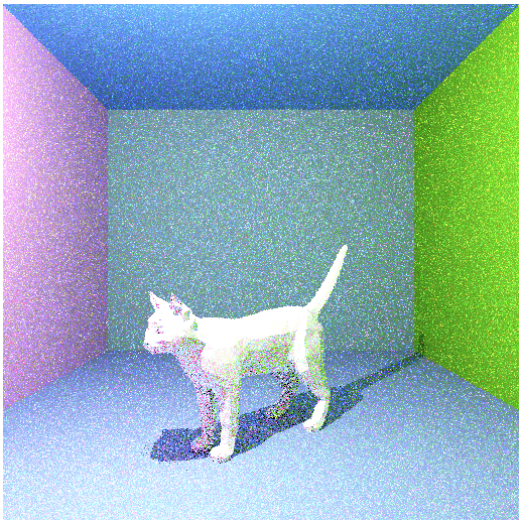

Figure 8: Cat with Bounding Box.
Rendering time (in parallel): 67.3675 seconds

However, for intensity (I) set to 100000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 30, light bounces set to 5. In plus, it has indirect lighting and antialiasing.

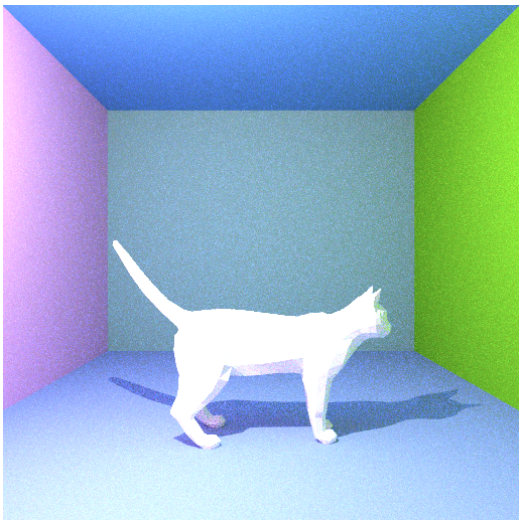

Figure 9: Cat with Bounding Box.
Rendering time (in parallel): 1551.96 seconds

7 Cat - with BVH and Phong interpolation

With BVH, we got an exponentially better rendering time! Here are multiple pictures to illustrate the results. The basic settings remain the same, meaning: intensity (I) set to 80000, image width (W) set to 512, height (H) also to 512, number of rays per pixel set to 1, light bounces set to 5; it has indirect lighting and antialiasing.

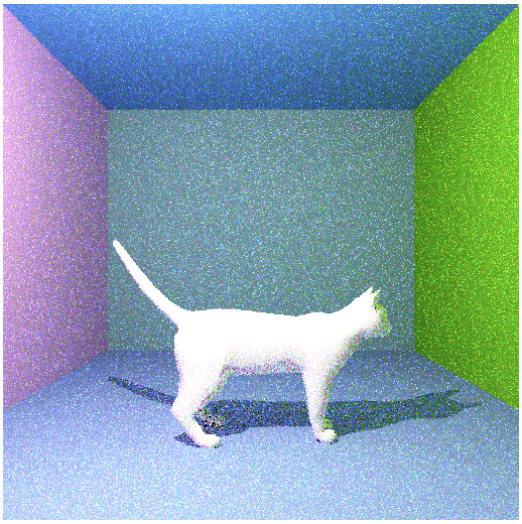

Figure 10: Cat with BVH and Phong.
Rendering time (in parallel): 26.1473 seconds

With 30 rays per pixel:

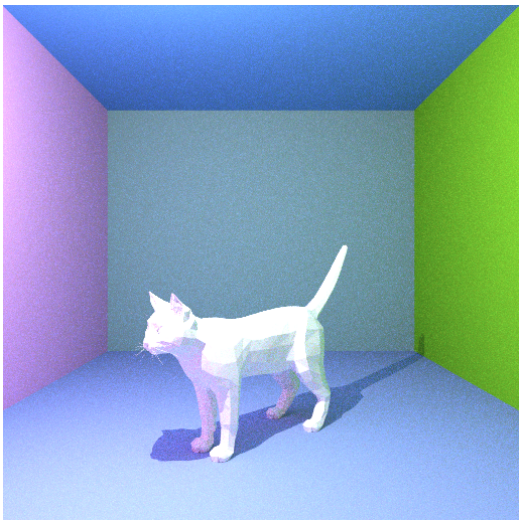

Figure 11: Cat with BVH no Phong.
Rendering time (in parallel): 195.423 seconds

With Phong interpolation and 10 rays per pixel:

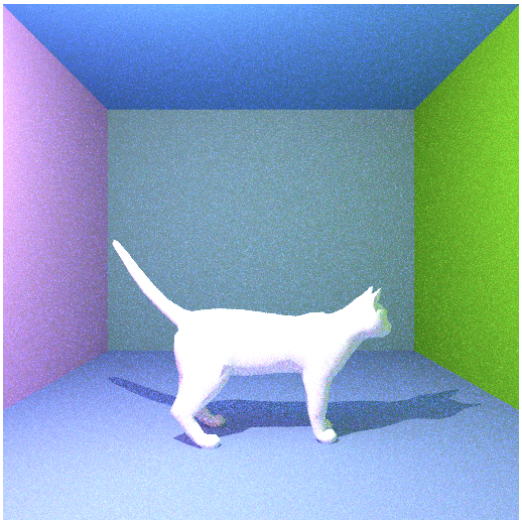

Figure 12: Cat with BVH and Phong.
Rendering time (in parallel): 383.302 seconds

8 Comments

We see that the rendering time is not that small despite the BVH. This is also due to my slow machine. However, BVH and the BoundingBox decreased exponentially the rendering time, resulting in a much faster result, hence the code is good.

9 Acknowledgments

During the first part of this project, while we were still at the beginning, I was working with Leal Koksal. However, this meant just exchanging brief ideas. For the transparency part, a BX24 friend, Yassine Turki, helped me correct the formulas, since I had some mistakes, resulting in an image that was not similar to the one in the lecture notes. For the BoundingBox I got some intuition from Moreira Machado, who also helped me debug the BVH (which was almost entirely written as specified in the lecture notes). Despite their help, my code is fully written by me, although in these respective parts, it might follow the logic that they also probably used. AI was used only for a better understanding of the lecture notes, for debugging when I was stuck for too long, and for C++ type system constraint errors.