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# Comparison of EEVEE and Cycles Rendering Performance in Blender 3.5 in the Context of Interactive Visuals for 3D Animation

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**Abstract:** This research aims to compare the performance of two rendering engines, namely EEVEE and Cycles, available in Blender 3.5, in the context of developing interactive visual 3D animation. The rendering engine is a key element in 3D animation production, and the right choice between EEVEE and Cycles can have a significant impact on the final animation result. In this research, we conducted a series of experiments and analyzes to evaluate rendering speed, the quality of the resulting images, and the ability to achieve the visual effects desired by the animator. The results of this research provide deep insight into the strengths and limitations of each rendering engine in interactive 3D animation scenarios. These findings can help animators, game developers, and similar creative professionals make more informed choices when choosing a rendering engine that suits their project needs. Thus, this research contributes to the development of rendering techniques in the growing 3D animation industry.

**Keywords:** Rendering; 3D animation

## Introduction

3D animation is a key element in the entertainment industry, including films, video games, simulations, and more (Ferry et al., 2019). Advances in computer technology have opened the door to the development of increasingly complex (Simamora et al., 2019) and realistic 3D animations, which demand powerful rendering engines (Waskita et al., 2018). In the world of 3D animation, selecting the right rendering engine can impact not only production efficiency but also the visual quality of the result (Zebua et al., 2020).

Blender, as one of the very popular open-source 3D animation software, has been continuously developing and introducing various tools (Daniati, 2020) and rendering engines to help animation creators achieve the desired results (Cahyani, 2020). One of the latest developments is version 3.5, which includes two major rendering engines: EEVEE and Cycles (Lafifa et al., 2023). EEVEE is a real-time rendering engine that stands out for its rendering speed and fast visualization capabilities (Mahendra et al., 2018), while Cycles is a path tracing rendering engine that is known for producing very high image quality (Caesaria et al., 2020).

This research aims to compare the performance of the two rendering engines, namely EEVEE and Cycles, in Blender 3.5 in the context of developing interactive visual 3D animation (Chen et al., 2023). In the context of increasingly fast and interactive 3D animation production (Rajendiran et al., 2018), animators are often faced with the question of which rendering engine best suits the needs of their projects (Rao et al., 2021). Therefore, a performance comparison between EEVEE and Cycles in Blender 3.5 (Peralta et al., 2023) will provide valuable insight into the selection of a rendering

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engine suitable for various animation projects (Echeverri-Jimenez et al., 2021).

This paper will start by outlining the background to the development of rendering engines in the 3D animation industry and the relevance of the performance comparison between EEVEE and Cycles (Karuana et al., 2023). Next, we will explain the methodology used in this study, including the parameters measured and the testing procedures (Dewi et al., 2022). The results of this research will be analyzed and discussed in the context of selecting an appropriate rendering engine for a 3D animation project (Moioli, 2022). Finally, we will summarize our findings and provide an outlook on future developments in rendering technology in 3D animation.

This research has the potential to provide valuable guidance to animation professionals, game developers, and researchers in the selection of a rendering engine that suits their project needs, as well as contribute to a better understanding of the performance of EEVEE and Cycles in Blender 3.5 in the context of interactive visuals for animation 3D.

## Method

*Device and Software Preparation*

Hardware: Operating System: Windows 11 Pro 64-bit; Language: English System Manufacturer: Dell Inc.; System Model: Latitude 5290 BIOS: 1.14.0 (type: UEFI); Processor: Intel(R) Core(TM) i5- 8350U CPU @ 1.70GHz (8 CPUs), ~1.9GHz; Memory: 8192MB RAM Software: Blender 3.5 Prepare the work environment by installing Blender version 3.5 which includes EEVEE and Cycles.

*Initial Data Collection*

Lighting in Blender refers to the way you arrange lighting in an animation or rendering project created with Blender software (Ainiyah et al., 2020). Lighting is very important in creating atmosphere (Jaros et al., 2018), defining shadows, and highlighting objects in a 3D scene (Bhakti et al., 2021).

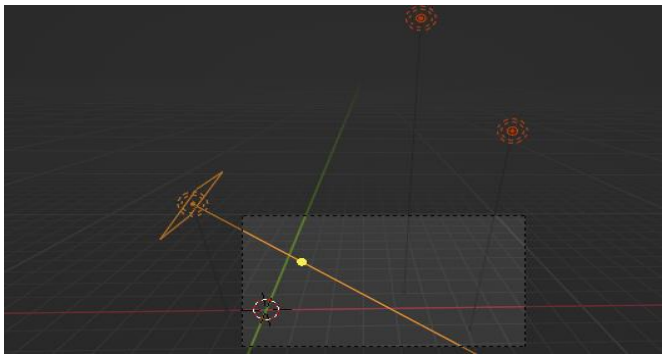

**Figure 1**. Lighting

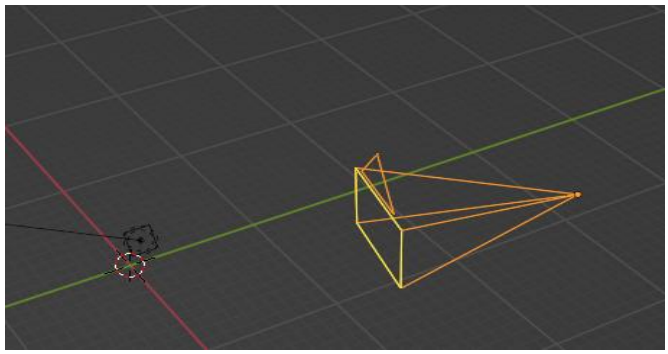

**Figure 2.** Camera

The camera in Blender is an important element in your 3D projects that controls how you view and record scenes created in a 3D environment (Salfina et al., 2021). The camera in Blender functions similarly to a real camera and allows you to adjust the angle of view, focus, composition, etc (Utami et al., 2022).

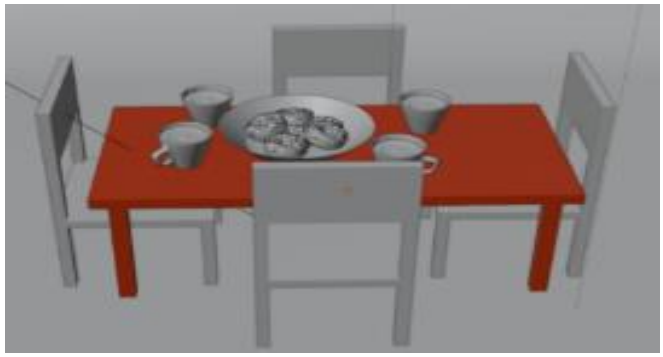

**Figure 3.** Object A

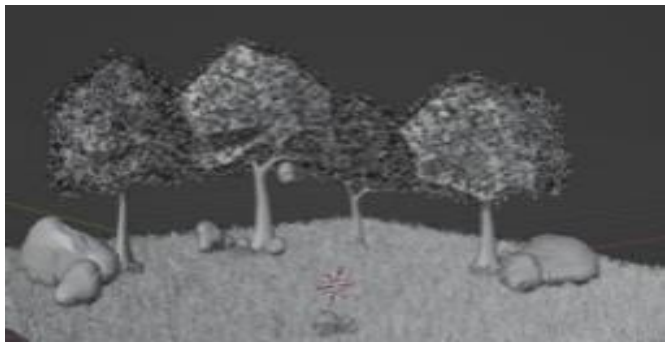

**Figure 4.** Object B

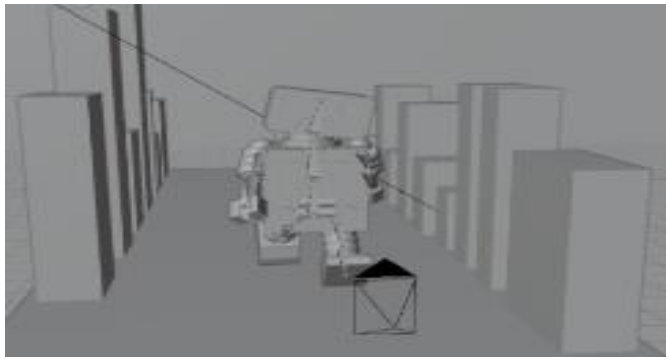

**Figure 5.** Object C

Objects in Blender are the 3D elements that make up the scene or project you create (Amsyar et al., 2023). These objects include a wide variety of elements (Jaros et al., 2019), such as 3D models, lights, cameras, particles, and so on etc (Sari et al., 2023). These objects form the basis of the entire scene or project.

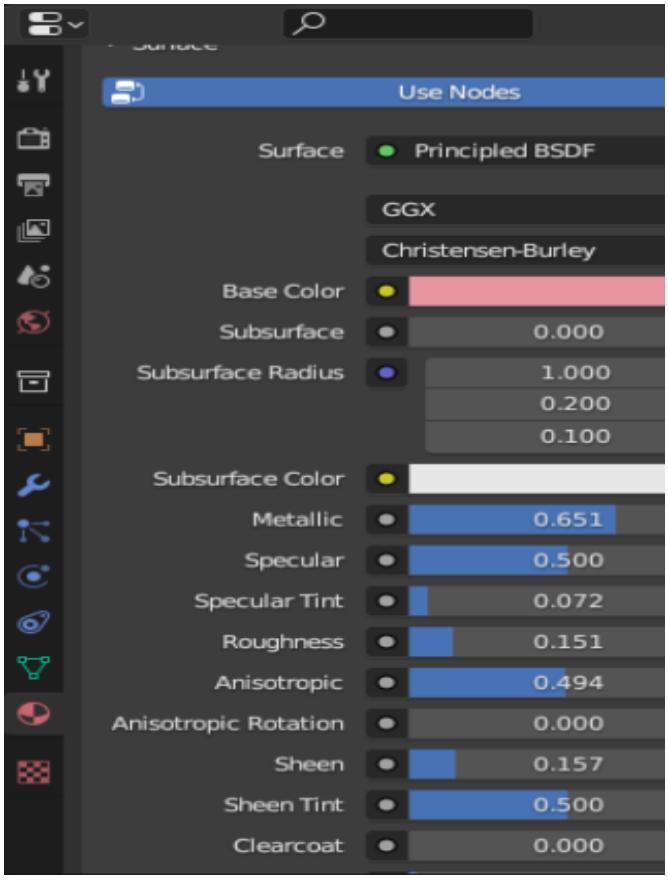


**Figure 6**. Materials

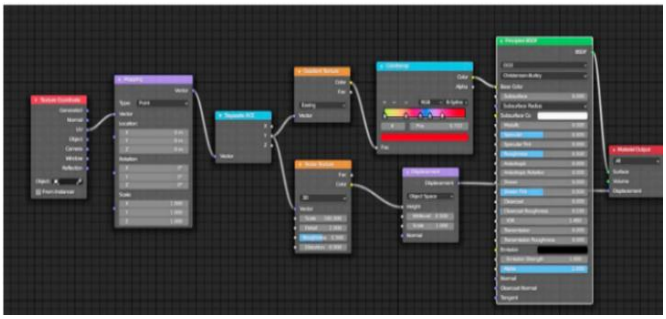

**Figure 7.** Node editor

Materials in Blender are settings that control the appearance of an object's surface in the 3D world (Novianti et al., 2023). In Blender, materials are used to define various encompassing visual properties color, texture (Otao et al., 2017), reflection, shadow, transparency (Jaros et al., 2017), and several other elements that affect the appearance of an object (Bahrun et al., 2023).

Node Editor: The Node Editor is a visual display used to organize and connect nodes. It is mainly used for material editing and compositing in Blende projects.

## Result and Discussion

*Rendering Process*

The rendering process is carried out by selecting the type of rendering engine that will be used and pressing the "Render Image" section in the rendering window or pressing the F12 key on the keyboard. The rendering process on Eevee will immediately display the results without displaying any processes, while the Cycles process uses the Path Tracing integrator, meaning that the image to be rendered looks like a path or paths like the rendering window shown in Figure 8.

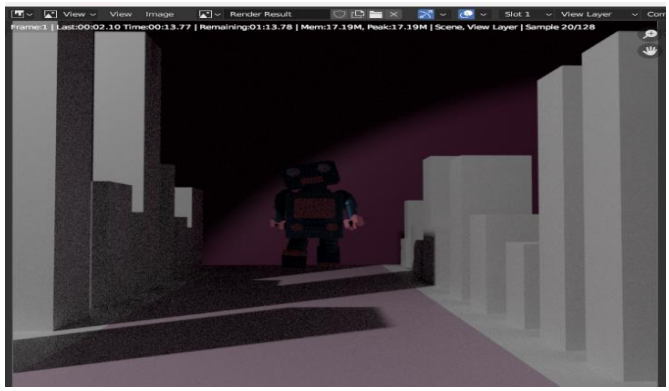

**Figure 8**. Rendering process

The rendering process is the stage where the software converts the 3D models and animations that you have created into images or videos that are ready to be displayed. This is an important stage in 3D animation production and is the final step before you can see the final result of your project.

**Tabel 1.** Experimental Works

| Animation project | Aspect evaluated qualitative | Eevee results | Results cycles |
|---|---|---|---|
| Object 1 | Lighting | Faster and less realistic | Smoother and more diffuse |
| | Shadow | Produces sharper shadows | Softer shadows |
| | Color | Provides more natural and realistic colors | Produces brighter and brighter colors |
| | Clarity | The results may lack Sharpness and detail | Higher clarity and Finer details |
| Object 2 | Lighting | Looks realistic | Looks less realistic |

| Animation project | Aspect evaluated qualitative | Eevee results | Results cycles |
|---|---|---|---|
| | Shadow | Soft shadow | Softer shadows |
| | Color | Provides more natural and realistic colors | Produces brighter colors |
| | Clarity | The results are clear | Higher clarity and finer details. |
| | Lighting | Less realistic | Smoother lighting Blends |
| Object 3 | Shadow | Produces sharper shadows | Softer shadows Looks real |
| | Color | Provides realistic colors | Produces even more realistic colors |
| | Clarity | The result is soft | Higher clarity and finer detail |
| Object animation | Evaluated quantitative aspects of | Eevee results | Cycles results |
| Object 1 | Rendering time | 00:14 | 03:59 |
| | File size | 2.01 mb | 2.80 mb |
| Object 2 | Rendering time | 00:17 | 01:38 |
| | File size | 2.92 mb | 4.51 mb |
| Object 3 | Rendering time | 00:03 | 01:26 |
| | File size | 672 kb | 1.12 mb |

*Render Results of Eevee and Cycles*

Figures 9 and 10 are object 1 rendered using the Evee rendering engine and the right using cycles rendering engine. The Cycles engine produces Evee renders in less realistic lighting while the cycles are smoother and more diffuse, in terms of shadows the Evee render produces sharper shadows while the cycles shadows are less sharp and less detail, softer shadows, in terms of Color the evee render produces more natural and realistic colors while cycles produces brighter colors, in terms of Clarity the evee render produces the results perhaps less sharp and detailed whereas the cycles render produces higher clarity and finer details.

**Figure 9.** Object 1 rendered by evee

**Figure 10.** Object 1 rendered by cycles

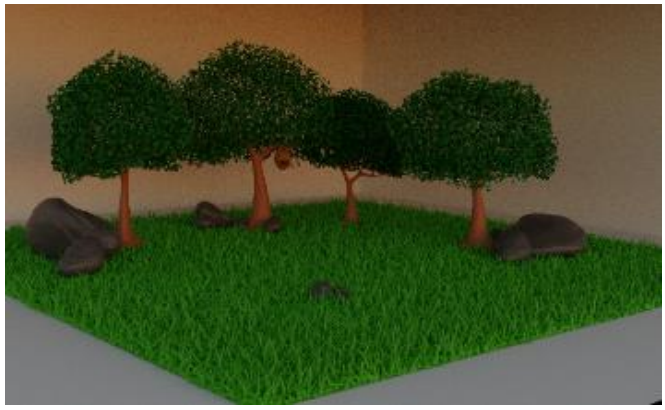

**Figure 11.** Object 2 rendered by evee

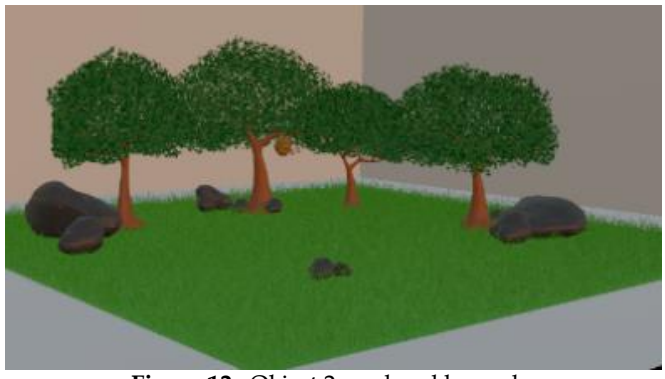

**Figure 12.** Object 2 rendered by cycles

Figures 11 and 12 are object 2 rendered using Evee rendering and the image on the right uses the Cycles rendering engine. The Evee cycles engine in terms of lighting produces Darker, the same as experiment 1, less realistic, while using the Cycles rendering engine in terms of lighting produces the same as the experiment. object 1's lighting is smoother, rendering object 2's image using Evee rendering in terms of shadows produces soft shadows, while using render cycle produces softer shadows, while in terms of color rendering using Evee rendering produces more natural and realistic colors while using rendering cycles produce brighter colors,

whereas in terms of clarity rendering using evee the results are less clear while rendering using rendering cycles produces higher clarity and detail which is smooth smoother.

**Figure 13.** Object 3 rendered by evee

**Figure 14.** Object 3 rendered by evee

## Conclusion

From research that has been carried out, the speed of a rendering engine using Evee is faster than using a cycles rendering engine. The factors that influence rendering speed include the number of objects, the amount of light used, the level of shadow intensity, material, and texture. As for the file size produced by the Evee rendering engine, it is smaller than using the Cycles rendering engine. As for the image quality, Cycles Evee seems more realistic, soft and rendering using Cycles gets bright, bright image quality.

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**Conflicts of Interest**
The authors declare no conflict of interest.

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