

# Forward vs Deferred Rendering

- [Pros and Cons](#)

# Pros and Cons

- **Forward Rendering:**

- Renders each object individually, one by one, during each pass.
- Lighting calculations performed in the same pass as geometry and material shading calculations.

- **Deferred Rendering:**

- Renders geometry and material properties into intermediate buffers (G-buffer) first.
- Lighting calculations performed in a separate pass using information stored in the G-buffer.

## Lighting Calculations:

- **Forward Rendering:**

- Lighting calculations performed per-pixel during rendering of each object.
- Can be computationally expensive for scenes with many lights and complex shading effects.

- **Deferred Rendering:**

- Lighting calculations performed per-pixel after rendering all objects into the G-buffer.
- Allows more efficient lighting calculations, independent of the number of objects in the scene.

## Number of Lights:

- **Forward Rendering:**

- Limited by the number of lights that can be efficiently rendered in a single pass.
- May result in performance bottlenecks and increased rendering times for scenes with many lights.

- **Deferred Rendering:**

- Efficiently handles scenes with many lights, as lighting calculations are decoupled from the number of objects.
- Well-suited for scenes with complex lighting setups and dynamic lights.

## Memory Usage:

- **Forward Rendering:**

- Requires storing per-pixel information in the framebuffer during each pass.
- Can lead to higher memory usage, especially for scenes with many objects and lights.

- **Deferred Rendering:**

- Requires storing geometry and material properties in the G-buffer.

- Memory requirements for the G-buffer can be significant for scenes with high-resolution textures or complex materials.

## Transparency and Post-Processing Effects:

- **Forward Rendering:**

- Handles transparency and post-processing effects more naturally.
- Lighting calculations are performed per-pixel during rendering of each object.

- **Deferred Rendering:**

- Can struggle with transparency and post-processing effects.
- These effects typically require access to per-pixel information that may not be available in the G-buffer.