Toon Shading- Perception of textures

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Aiming for grade A-B.
Blog: `https://malinjam.github.io/DH2323-Toon-Shader/`

1 Background

1.1 Toon Shading

Rendering in computer graphics refers to the process of generating an image using software programs from a model. In this project, our focus is on Toon Shading (or Cel Shading), a non-photorealistic rendering technique that gives a mesh a cartoonish appearance and a hand-drawn feel in the final render. This technique has been used in the animation industry for years and has been applied in video games. Conventional Toon Shading utilises the orientation of a 1D texture in relation to a light source to determine the colour of a given area [1]. This is done by extending the Lambertian shading model and thereby deciding the colour of an area. This style of shading renders every surface location with full accuracy, thereby allowing even small shape features to be rendered by the shader. Toon Shading is also view-independent, and thus is unable to render metallic or plastic materials that rely on view-dependent highlights.

The concept of creating a Toon Shader for experimenting with various surfaces originated from a prior project (Fig. 1) completed in the Computer Graphics and Interaction course (DH2323) at KTH that unfortunately is not available anymore, as well as from previous works, which are listed below in the Previous work section.
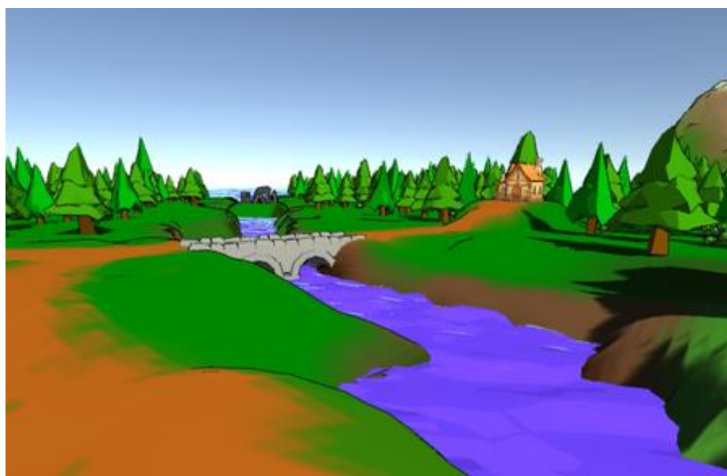

Figure 1: Toon Shader used for rendering a scenery. `https://www.kth.se/social/course/DH2323/page/dgi16-project-blogs/`

1.2 Previous work

Toon Shader made using Unity engine 2018.3:
https://roystan.net/articles/toon-shader/
Cel Shading/Toon Shading on Glass and Metal Objects [2]:
https://github.com/Unchained112/CelShadingProject_ComputerGraphics-Interaction https://www.cs.rpi.edu/~cutler/classes/advancedgraphics/S12/final_projects/hutchins_kim.pdf

2 Problem

The main problem is to create our own Toon Shader for a 3D object in Unity/Blender where we could test to see how different materials are rendered and if people perceive them us such (maybe plastic, metal).

3 Implementation

To begin, our focus will be on implementing a basic Toon Shader on a simple shape, such as a sphere, with a single material or texture applied.

Once we have a functioning Toon Shader, we may explore applying it to spheres with diverse materials and textures.

To visualize the project, we will use Unity/Blender for rendering, lighting, and loading models into a scene. We will create Unity scripts to implement the Toon Shader and spheres with varying textures.

To evaluate our work we will conduct a perceptual study where participants evaluate our results using a survey (probably through Google).

3.1 Specification ideas

These will change over time but initially we suggest these specifications:

- opacity

- reflectiveness

- light

- albedo

- shadows

4 Extensions

Some possible extensions could be:

- Offer users the ability to adjust certain parameters in the Toon Shader.

- Apply the Toon Shader to other 3D objects.

- Conduct a more detailed perceptual study.

References

[1] Pascal Barla, Joëlle Thollot, and Lee Markosian. "X-Toon: An Extended Toon Shader." In: *Proceedings of the 4th International Symposium on Non-Photorealistic Animation and Rendering*. NPAR '06. Annecy, France: Association for Computing Machinery, 2006, 127–132. ISBN: 1595933573. DOI: 10.1145/1124728.1124749. URL: https://doi.org/10.1145/1124728.1124749.

[2]   Bosen Cheng. *Cel Shading / Toon Shading on Glass and Metal Objects.* `https : / / github . com / Unchained112 / CelShadingProject _ ComputerGraphics - Interaction`. [Online; accessed 24-April-2023]. 2021.