

Gruppe: G4 – BreakfastClub**1) Description of implementation and Effects**

In our scene we have, like in submission 0 described, a small isle with a breakfast table, a streetlight, a jetty, trees and a boat. The breakfast table is full with everything you need for good breakfast (bread, eggs, coffee, tea). We used the different models on our table also to show some of the effects like the Environment Mapping and the smoke. We implemented a day/night cycle. Let us explain all you have to know about our effects:

Special Effects

We have the effects that we specified in submission 0, which are: Bloom, Smoke, EM, HDR, Shadow.

Bloom: The bloom effect can be seen in two different aspects of our scene. At first in the lights of our streetlight. The light is shown quite of the beginning of our camera path. Also on the start of the camera path, the bloom can be seen in the rising sun. The sun starts rising on the day, then the streetlights getting turned off.

Smoke: On our breakfast table we have two coffee cups, there you can see the smoke, because of the hot coffee in there.

EM: On the table, there is also a vase with a flower in it. On the vase you can see the environment mapping. There are two specials in this effect: The first one is, that it shows the whole scene, not just the skybox, you can see this very good in our demo. Second we update the EM, according to the daytime. So you can see at the start of the demo (when attention is on the streetlight) that the vase has another texture than when attention is on the vase during the day.

HDR: We used the exposure from the HDR to support our day/night cycle. So in the night we use a smaller exposure than on the day (linear interpolated).

Shadow: You can see the shadows of the models in the whole scene. The shadow moves according to the daytime and according to our sun-object, which shows the bloom effect.

Water + Reflection + Refraction: We already had the water in our CG game, but we had to change some things (especially because of a wrong reflection), so we also want to mention this effect.

Day/Night Cycle: We thought about implementing atmospheric scattering, but just if there is still time left (you said we don't have to do this). We decided to do a day/night cycle instead of atmospheric scattering, because we can show some of our effects better with this. You can see the day/night cycle in the skybox, the scene starts in the night and changes to day. When the demo ends, it is getting night again (skybox overblending). We also rotate the skybox, so the clouds from the cubemaptexture on the day seems to move over time. We also made a sun object including sunrise and sunset, you can also see this on the demo

(sunrise on the start, sunset on the end). To make that more realistic we used our HDR exposure (darker on the night and brighter on the day). Our streetlight is just turned on in the night, you can hear it with a sound when it gets turned off.

We made sure that you can see all our effects in the demo, but if you want to see anything more detailed you can also use our default Camera.

Camera Path and default Camera

Camera Path: For our camera path we use the calculation of cubic bezier curves and we use the derivation of it as our Front-Vector. We uploaded some of the relevant parts of the scene in Maya and created the curve there. We stored the control points of the curve in a txtfile "controlpoints.txt" (in folder textures) and created a method that reads in the values and stores it in our "pathPoints" vector.

In the camera path we show of course all our effects, but we also tried to make sure you see all important things of the day/night cycle. For example the focus is on the streetlamp (with bloom effect) when it gets turned off and a sound is playing to this time. We also show a part of the sunrise and sunset in the demo. The whole demo starts in the early morning (4:30 am) and ends on the evening (9:30 pm). When the camera path is finished, we rotate the camera once so you can especially see the change in the skymapt textures.

Default Camera: If you push the key "T" the camera path ends and you can use the default camera. If the camera path ends, you cannot go back to the path. You have to end with "ESCAPE" and run it again.

Keys:

W: Forward	E: Right	Q: Up
S: Backward	A: Left	E: Down

Mouse: You can also use mouse to scroll in and out of the scene with the mouse wheel and use it to slue the camera to the left and right.

2) Additional Libraries

- GLEW
 - <http://glew.sourceforge.net/>
- GLFW
 - <http://www.glfw.org/>
- GLM
 - <http://glm.g-truc.net/0.9.7/index.html>
- ASSIMP (modelloader)
 - <http://www.assimp.org/>
- STBI (textures)

- <https://github.com/nothings/stb>
- FMOD (for sound)
 - <https://www.fmod.com/>

We used all this libraries before in our CGUE game. The first four we have from CGUE Wiki “Tips and Tricks”.

3) Links/References of the Effects

Most things about how we have implemented the effects we already wrote above, so here are some links and further information’s.

Bloom:

- Slides Echtzeitgraphik 2016 - ScreenSpace Effects
- <https://software.intel.com/en-us/articles/compute-shader-hdr-and-bloom>

HDR: Implementing of HDR was easy because we did Bloom before and used the same shaders. We weren’t sure how we can show this effect in our scene, that’s why we made the day/night rhythm. We use small exposure in the night and big exposure on the day.

- Slides Echtzeitgraphik 2016 – ScreenSpace Effects
- <https://developer.nvidia.com/sites/default/files/akamai/gameworks/hdr/UHDCOLORFORGAMES.PDF>

Smoke: We have some problems with this effect. The reference we wanted to use was not really good so we used this instead:

- <http://www.opengl-tutorial.org/intermediate-tutorials/billboards-particles/billboards/>
- <http://www.opengl-tutorial.org/intermediate-tutorials/billboards-particles/particles-instancing/>

Shadow Mapping: We change the shadow over time, so the shadow is always correct (according to the sun objects).

- <http://www.opengl-tutorial.org/intermediate-tutorials/tutorial-16-shadow-mapping/>

Environment Mapping: We first did EM just for the skybox, then we changed so we can see the whole scene in the EM. We take the pictures of EM not every renderloop because it would cost too much performance and is unnecessary because the environment around don’t change so often. We just call the renderEnvironment method when the skybox changes because of the daytime.

- http://developer.download.nvidia.com/CgTutorial/cg_tutorial_chapter07.html
- Buch „Real-Time Rendering“ – Kapitel 8.4. „Environment Mapping“
- Special EM (for Scene EM):
https://www.youtube.com/watch?v=IW_iqrtJORc&list=PLRIWtICgwaX0u7Rf9zkZhLoLuZVfUksDP&index=52

Day/Night Cycle: We didn't use much tutorial for this. The sunrise and sunset are made by our own. We used a tutorial that shows how you can switch between two different cubemaptextures.

- <https://www.youtube.com/watch?v=rqx9IDLKV28&index=28&list=PLRIWtICgwaX0u7Rf9zkZhLoLuZVfUksDP>

4) Models

We made the most of the models by our own in Maya.

Models we build our self: Jetty (Steg), Table, chairs, knives, spoon, napkins, egg, egg cup, different plates, coffee cups, water glasses, teapot, trivet, light, bulbs from streetlight

Models from internet: Trees, grass, boat, streetlamp, breadbasket, pastries, vase, flower

We improved some of the internet models a little bit in Maya.

Source of internet models:

<https://www.cgtrader.com/3d-models> || <https://archive3d.net> || <https://free3d.com>

5) Graphics Card

AMD (Vislab) and NVIDIA (on our Laptops)

6) Other information's

60FPS: We always tried to get better performance but we really have many effects so our FPS are exactly 60. We always just render the models, which are really important and necessary for this part. We also changed all texture sizes and made it as small as we can. A big problem for the performance is the water-effect. It is rendered every loop in main TWICE to get correct reflection and refraction. We know this costs lot of performance but the water looks so good, so we wanted to keep and improve it.

Sounds: We use a background song, it's the theme song from the film "Breakfast club". We use a sound when the streetlight gets turned off.

Run from VS 2015

We worked on our laptops with VS 2013. We tried to build the project in Vislab, but there was a problem because of the upgrade to VS 2015.

We found a solution for this, described in this article:

<https://social.msdn.microsoft.com/Forums/vstudio/en-US/5150eeec-4427-440f-ab19-aecb26113d31/updated-to-vs-2015-and-now-get-unresolved-external-errors?forum=vcgeneral> .

Just for the case you want to run it from VS and not the .exe file you have to add this library to the additional libraries: **legacy_stdio_definitions.lib**