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Assignment on Virtual Reality and Physically-Based-Simulation - Sheet 1

Due Date 20.11.2023, 23:59 Uhr

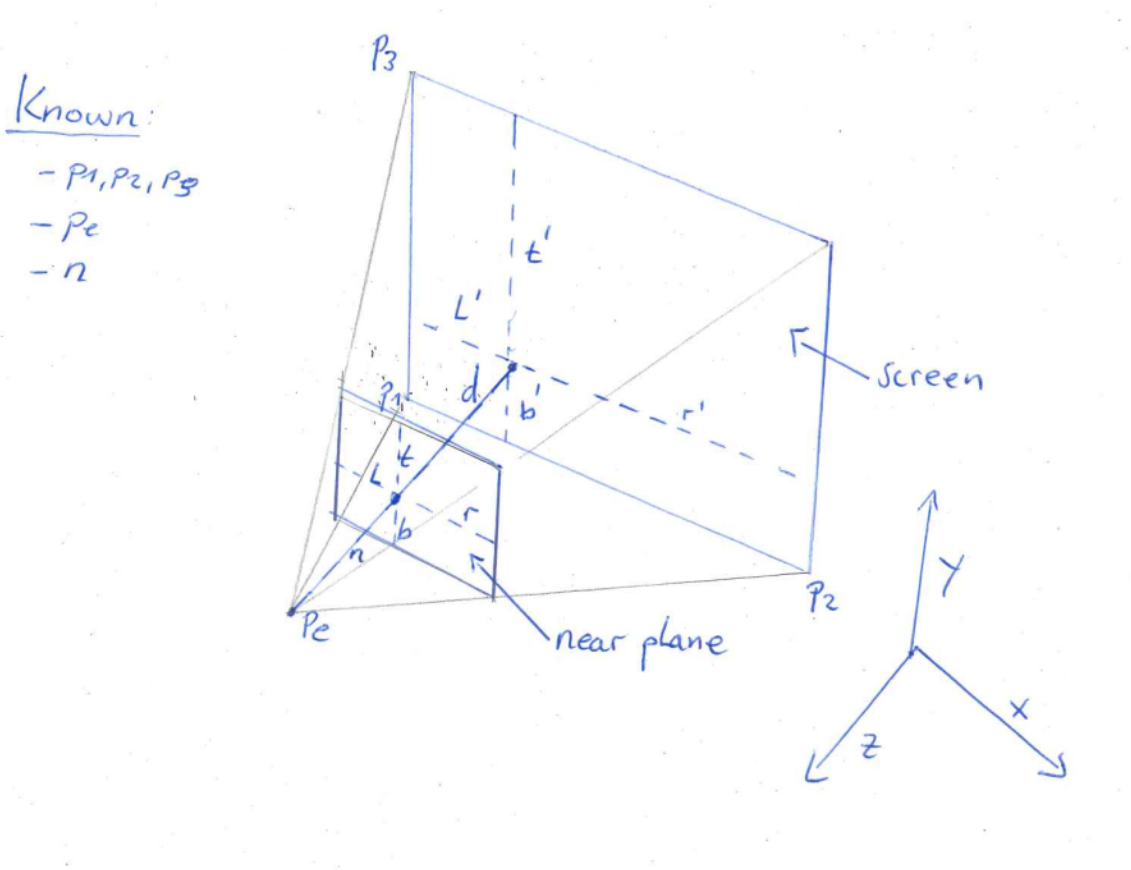

Figure 1: Setup one-eyed moving spectator

Exercise 1 (Fishtank VR, *6 Credits*)

Let us consider the view frustum of a moving spectator in front of a screen. The eye position is changing relative to the screen, so we have to compute the frustum everytime the eye position is changed. For an example see https://www.youtube.com/watch?v=hvrT7FqpPQE. As mentioned in the lecture, the view frustum in OpenGL is set with glfrustum(left,right,bottom,top,near,far). Your task is to find expressions for the above variables for the case of

a) an one eyed spectator (shown in figure 1).

b) for the left eye of a two eyed spectator similar to the lecture.

For the sake of simplicity assume that the observer is looking straight at the the screen (no head rotation). For your calculations assume that the values for the eye position p_e, the screen corners p_1,p_2,p_3 and the distance to the near plane n are given.

Note: For a) it might be the easiest approach to calculate l', r', b', t' and transform them to the near plane.

Exercise 2 (Practical horopter construction, *3 Credits*)

Construct the horopter using real-world building blocks or other cylindrical objects.

Place a subject (e.g., one of your group members) close to a table, such that they look edge-on at the table. Make sure that the background that the subject sees behind the table is as uniform as possible (e.g., white wall). Position one block on the table. Have someone else (the experimenter) place other blocks on the table, *guided by the subject*, such that they all appear to have exactly the same depth as the first block, see to that the subject should always fixate (focus) on the first block while observing other blocks. (This usually requires some iterations, moving the new block back and forth.) The experimenter should try to help the subject such that the experimenter does not influence or bias the subject.

Capture the final setup of the blocks by a photo exactly from the top. Interpolate the block positions by a freeform curve (you can do that very approximately by hand).

Repeat the above experiment with the first block at three different depths (note that differences in these depths should be at least 20 cm, i.e. at 10 cm, 50 cm, and 100 cm).

Exercise 3 (Unreal Materials, *3 Credits*)

In the lecture, we touched on the topic of materials in Unreal Engine. Now, you'll get practical experience with materials by reconstructing the scene shown in figure 2. You can download the scene, which currently has no materials, from our website. Once you've got the scene, here's what you'll need to do:

a) Create two different materials for the two spheres in the scene: One material should make a sphere look rough. The other material should make a sphere look metallic.

b) Create another material that applies the texture *banner/banner_tex* to the flat display surface in the scene.

c) Make the *Hello!* text appear to glow by giving it a material that emits light.

d) Animate the *Hello!* text so that it moves horizontally across the display surface.

Exercise 4 (Unreal VR, *0 Credits*)

In future lessons, we will be using VR. To prepare for this: Set up your Head-Mounted Display (HMD). If you don't have an HMD, please reach out to us to get one. Once your HMD is set up, please run the Unreal Engine VR demo to make sure everything is working correctly.

Figure 2: An example of a finished scene with materials applied.