

ROLL TU SCORE

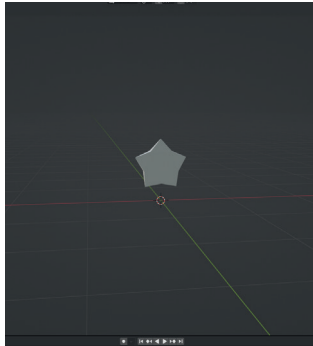
Gameplay Features

3D Geometry (6 Points)

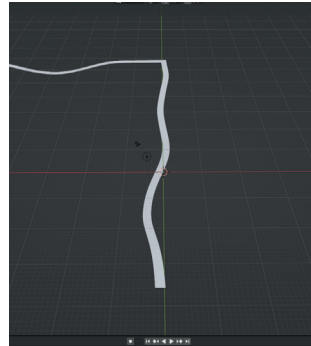
The game includes four external 3D geometries character, platform, tokens and lanes, all imported using assimp. The other objects are created in the Geometry class as basic cubes. All models are made by us using Blender.



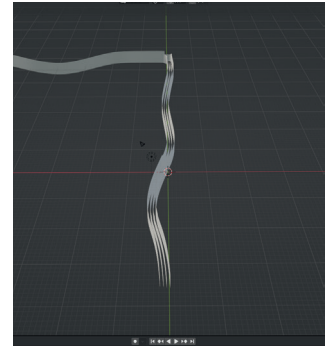
character



token



platform

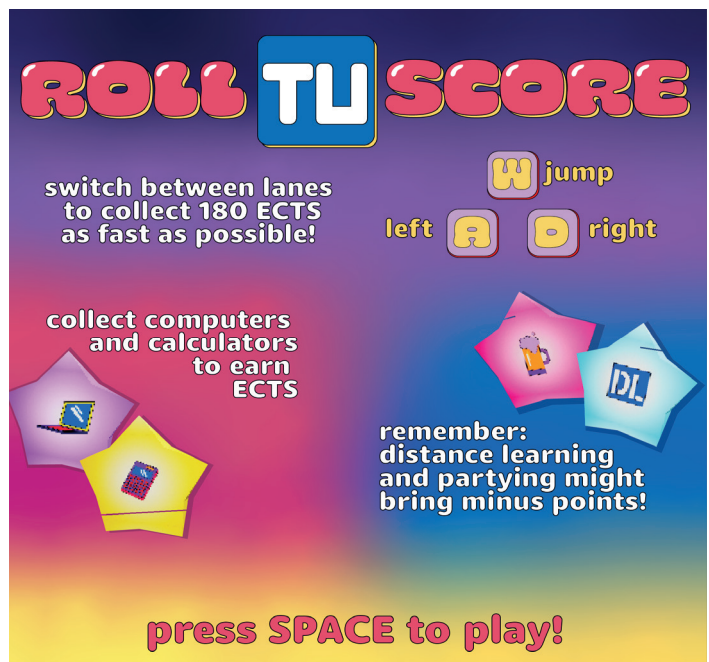
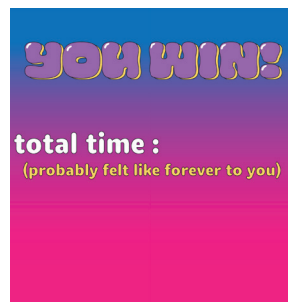
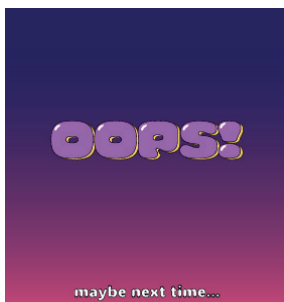


lanes

Lanes object is used as a guideline collision object to help the character object stay in the lane. It's never drawn.

Playable (3 Points), Advanced Gameplay (3 Points), Intuitive Controls (2 Points) & Win/Lose Condition (3 Points)

The character can be moved with A, D and W keys. With A and D the character can switch to other lanes and with W it can jump. The goal is to collect the right tokens and avoid the ones with negative points. To avoid unexpected movement caused by user input, it's impossible to move further than the 3 lanes. The game ends (win) when 180 or more ECTS is collected, or the character is at the end of the platform. Total game duration is displayed in case of a win. The user is informed about the game controls and rules at the beginning of the game. Laptop tokens (5) result in 25 points, calculator tokens (10) 15 points, distance learning (5) -10 points, and beer (5) -5 points. The possible positions of the tokens are hard coded and stored in a vector. At the beginning of each game, 25 vectors are chosen from this list randomly. The collected token gets deleted and stops being rendered. The score can never be less than 0.



Min. 60 FPS and Framerate Independence (3 Points)

The game is framerate independent and calculations are done by using dt (delta time) variable.

Intuitive Camera (2 Points)

There are two camera options in the game: The game camera and the debug camera. Debug camera is the same as the one from the ECG course framework. It can be turned on by pressing the F3 key.

The game camera follows the character from behind. In case of a right or left turn the orientation of the camera changes. (laneSwitchAngle). It also rotates when the character is rotating. (Screenshots belong to an earlier version.)



Illumination Model (2 Points)

The game has 3 light sources: One white direct light and two point lights (blue and red) which are used inside cubes as a part of the „bloom“ feature and they rotate and move. Each object has an assigned material and normals. The invisible point light (color value is set to (0,0,0)) is used to give as a parameter of setPerFrameUniforms method when rendering only 2D objects such as the info screen.

Textures (2 Points)

There are 35 different textures in the game. They are all in .dds format and designed by us using Adobe Illustrator and Adobe Photoshop.



Moving Objects (2 Points)

The character is moving on the platform, the normal mapped plate is turning and moving up and down, light cubes are turning around the plate and moving up and down with it. The movement of the character is based on the bullet simulation and other movements are performed manually.

Collision Detection (Basic Physics) (4 Points)

To move the character according to the given path, collision detection of the Bullet Physics is used. Collisions between the character, lanes object and the platform are detected and solved. The collision of tokens and the character is calculated independently of the collisionObjectArray of Bullet, since tokens don't own a rigidBody. The only solver of this collision is the deletion of the token from the token container in case of collision, which means it won't be drawn anymore if the distance between the character and this token is less than 0.5f.

Heads-Up Display (4 Points)

Heads up display on the upper left corner shows the number of collected ECTS during the game. It's imported by using assimp since it has a unique shape. It has a slight glow around it, created by using different alpha values and the blending feature of OpenGL. It can be turned on and off by pressing „H“.

The halfway notice „Almost there“ is a full-screen display data but the texture includes alpha values less than 1. It also helps to distract the player since the inputs will be ignored during the rotation due to the possible complications caused by the change in the axes.



Adjustable Parameters (1 Point)

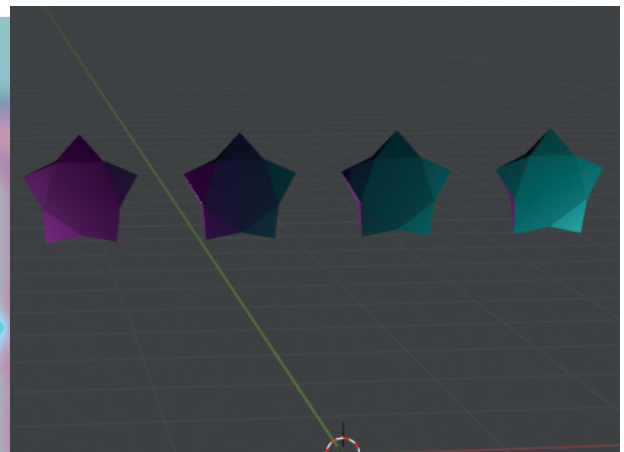
Parameters can be adjusted from the settings file. Additionally, brightness can be adjusted with F3 (+) and F4 (-) keys.

Effects

Lightmap using Separate Textures (8 Points)

The tokens in the game are assigned with for different baked textures. The shader has another mode to draw these, where the baked texture is multiplied by the diffuse texture of each token. The textures are baked and exported using Blender. Each token has a different type of shading depending on its placement against the two light sources (bluePointLight and redPointLight) which are also used to implement the bloom effect.

```
if(mode==2){
    vec4 diffuseColor = texture(diffuseTexture, vert.uv);
    vec4 bakedColor = texture(secondTexture,vert.uv);
    vec3 result=((diffuseColor * bakedColor).rgb)*8 + vec3(userDefinedBrightness,userDefinedBrightness,userDefinedBrightness);
    color=vec4(result.rgb,1.0);
    brightColor = vec4(0.0, 0.0, 0.0, 1.0) ;
```



Hierarchical Animation (4 Points)

The wheels are rotating when the huge roller skate is passing by. They are spinning in two different directions depending on the movement of the roller skate (left or right).



Environment Map (8 Points)

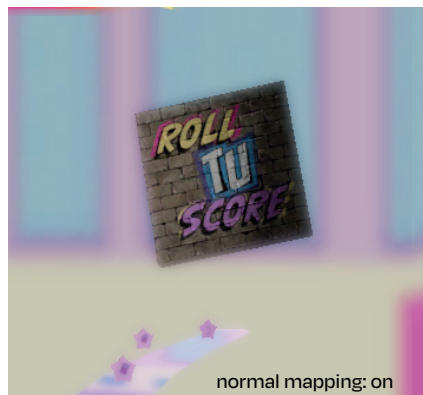
Environment map is implemented with the help of a learnOpenGL article. The platform has a larger reflection coefficient and the lightmap can be observed on the platform.

Bloom/Glow (8 Points)

Bloom feature is added by creating light cubes that are filled with a diffuse color only and placing point lights according to their positions. Rest of the scene is slightly blurred by using Gaussian blur and objects with larger reflectivity coefficients also partially glow when the lights are hitting them from shorter distances with particular angles. The amount of glow can be increased by setting the exposure variable to a smaller value. For the sake of playability and presentation of other features, it was set to 1.0f. An article of learnOpenGL is used as a guideline.

Simple Normal Mapping (4 Points)

The turning picture has an assigned normal map which is created with Adobe Photoshop. The effect can be turned on/off by pressing „N“ on the keyboard. The original texture and normal map is taken from learnopengl. Another light source is added to the game to increase the visibility of the normal map. It's also rotating around all axis slowly to help observation of reflections as normal map features.



Additional Libraries and References

Foundation, B. (2022) blender.org - Home of the Blender project - Free and Open 3D Creation Software, blender.org. Available at: <https://www.blender.org/> (Accessed: 27 April 2022).

The Asset-Importer-Lib Documentation — Asset-Importer-Lib December 2020 documentation (2022). Available at: <https://assimp-docs.readthedocs.io/en/v5.1.0/> (Accessed: 27 April 2022).

LearnOpenGL - Assimp (2022). Available at: <https://learnopengl.com/Model-Loading/Assimp> (Accessed: 27 April 2022).

Bullet Real-Time Physics Simulation | Home of Bullet and PyBullet: physics simulation for games, visual effects, robotics and reinforcement learning. (2022). Available at: <https://pybullet.org/wordpress/> (Accessed: 27 April 2022).

Branchenführende Software für Vektorgrafiken | Adobe Illustrator (2022). Available at: <https://www.adobe.com/at/products/illustrator.html> (Accessed: 27 April 2022).

LearnOpenGL - Cubemaps (2022). Available at: <https://learnopengl.com/Advanced-OpenGL/Cubemaps> (Accessed: 27 April 2022)

LearnOpenGL - Normal Mapping (2022). Available at: <https://learnopengl.com/Advanced-Lighting/Normal-Mapping> (Accessed: 13 June 2022).

LearnOpenGL - Bloom (2022). Available at: <https://learnopengl.com/Advanced-Lighting/Bloom> (Accessed: 13 June 2022).

LearnOpenGL - Blending (2022). Available at: <https://learnopengl.com/Advanced-OpenGL/Blending> (Accessed: 13 June 2022).

Adobe Photoshop | Software für Bildbearbeitung und Design (2022). Available at: <https://www.adobe.com/at/products/photoshop.html> (Accessed: 13 June 2022).