

# Escape the University

Submission 2 Documentation Document

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# 1 Controls

Key	Function
W/Upper arrow	Move forwards
S/Lower arrow	Move backwards
A/Left arrow	Move left
D/Right arrow	Move right
Left click	interaction
Right click	?
Print	Screenshot
Escape/End	Close game
F1	Help
F2	Toggle FPS and triangle count
F3	Toggle wireframe
F4	Texture-Sampling-Quality: Off/Nearest Neighbor/Bilinear
F5	Mip Mapping-Quality: Off/Nearest Neighbour/Linear
F6	Depth buffer visualization
F7	Toggle pause game
F8	Toggle view frustum culling
F9	Toggle blending
F10	Toggle stencil buffer usage
F11	Fullscreen
Scroll Lock	Toggle bounding volume edges
#	Toggle cam pos/front/right/up values
ß	Toggle light source bounding sphere rendering
Num Enter	Toggle shadow map rendering
Num +	Increase ambient light
Num -	Decrease ambient light

All other keys may have surprises for you.

## 2 Effect Points

Name	Description	Value
Vertex skinning	A complete bone structure is loaded from a model file and assigned to the model according to weighted indices. The skinning is done on the GPU.	2
Deferred Shading	Use the Deferred Shading technique to speed up lighting for many light sources. It uses several render targets and processes light information (shadows etc) in a post process effect (decoupling it from the scenes geometry). Transparency, however, is more difficult to handle	1
Shadow Maps (with PCF)	As presented in the lectures, shadow maps calculate the shadows via rendering the scene from the light source. PCF samples the shadow map several times to improve quality. Make sure to counter all artifacts.	1.5
Summary	-	4.5

For implementation references and explanation see section 8.

### 3 Gameplay

You find yourself in the middle of an university room. You need to get out of the building without being detected. Open the doors and find yourself a way towards the paved floor. Do not open the wrong door, otherwise you encounter a professor and you are busted! This is just a trial run... consider yourself planning your escape for the real experience that will follow. Explore the building, get the floor plane into your head. It will help your real escape in the near future.

### 4 Development Status

Bullet buggy, only partiality collision detection, frustum culling buggy, not much gameplay.

### 5 Camera

The free moving camera is implemented as on the [tutorial on camera from learnOpenGL.com](https://learnopengl.com) with slight modification to suit our needs, e.g. scroll speed, include all depth values on movement etc.

### 6 Moving Objects

- Opening and closing doors.
- Moving character animated with vertex skinning.
- Chairs

### 7 Texture Mapping

- Door + door handle + doorframe
- Lamps and switches
- Table + chairs + Posters + book (shelves)
- Trashbin, student work bench
- Character
- Whole building
- Paved pathwalk outside the building

## 8 Features

- Usage of FBOs, VAOs, VBOs, EBOs, and UBOs as stated in [3].
- Deferred shading from [3], [learnopengl.com deferred shading tutorial](#), and light volumes from [tutorial number 36](#) and [37](#) from [ogldev.atSPACE.co.uk](#) all with changes of our own.
- Point Shadow Mapping with PCF from [learnopengl.com](#) with changes of our own.
- Text rendering on screen with signed distance fields as in [1] with changes of our own.
- Own implemented scene graph and different node type usage.
- [Radar](#) frustum culling from a [lighthouse3d.com tutorial](#) and [2] with a lot of changes. All objects and lights are tested for culling with a scaled bounding sphere all with changes of our own.
- Physics done with [bullet physics](#).
- Automatic minimum collision shape generation from meshes with [VHACD](#).
- Vertex skinning from [drivenbynostalgie.com](#) with changes of our own.

## 9 Simple Lighting and Materials

### 9.1 Light Sources

All objects are now illuminated with blinn phong lighting from a [blinn phong tutorial on learnOpenGL.com](#). Deferred shading from [3], [learnopengl.com deferred shading tutorial](#), and [lighthouse3d.com openGL framebuffer objects](#). Point lights done with the [light casters tutorial on learnOpenGL.com](#). There are currently 10 light-sources in use, distributed among the playfield.

### 9.2 Textures and Blender Models

For creating and as well as modifying our objects, we used Blender 2.78c freely available from <https://www.blender.org/features/2-78/>. All objects (except Animated Female Cyborg) have been reviewed for minimized triangle count. The game contains 155 objects, containing 206.996 triangles (according to Blender).

- If not explicitly declared otherwise, textures have been taken from <https://lva.cg.tuwien.ac.at/textures/> or painted by ourself (single color textures mostly).
- Trash bin from <https://www.blendswap.com/blends/view/81654> under fulfillment of stating the corresponding author *miguelromero* <https://www.blendswap.com/user/miguelromero>. Model has been slightly adjusted for texturing.
- Brushed metal for Trash bin from [https://www.sketchuptextureclub.com/public/texture\\_d/0010-stainless-brushed-metal-texture-hr.jpg](https://www.sketchuptextureclub.com/public/texture_d/0010-stainless-brushed-metal-texture-hr.jpg) in compliance to <https://www.sketchuptextureclub.com/terms-of-use>.
- The garden table model as well as its textures have been taken from the freely available download-package (after sign-up with email) from the website <http://www.chocofur.com/>. It has been modified in order to have the correct display behaviour in OpenGL as well as a reduced triangle load.

- The textures for the doors & door frames are also from the previously mentioned download package. The model was designed by ourselves.
- White roughcast texture for Walls from <https://freestocktextures.com/texture/seamless-roughcast-wall,812.html>.
- Key from <https://www.cgtrader.com/free-3d-models/household/other/worn-key> in respect to editorial / non-commercial license.
- Book inside a shelf in respect to editorial / non-commercial license from <https://www.cgtrader.com/free-3d-models/furniture/cabinets-storage/bookshelf>.
- University chair from <https://www.cgtrader.com/free-3d-models/furniture-set/other/university-portfolio> in respect to the general license. Model has been modified and is therefore not distributed in the way it has been downloaded.
- Table in respect to the general license from <https://www.cgtrader.com/free-3d-models/architectural-details/decoration/wood-table-13cac5a4-f11f-4b36-9a77-af84a5f4c914>. Model has been modified and is therefore not distributed in the way it has been downloaded.
- Flowerpot from <http://archive3d.net/?a=download&id=e9325e5e#>. In agreement to point “4. This model may be freely modified or elaborated.” of Archive3D.net
- Office chair from <https://resources.blogscopia.com/2010/04/22/office-chair-download/> adapted and used in compliance with the Creative Commons 3.0 Unported license.
- School bench from <https://www.cgtrader.com/3d-models/interior/office/school-desk-206e>. Model has been purchased and is used in compliance with the Royalty Free License.
- We Want You - Poster with some adaptations from <https://free3d.com/3d-model/poster-quotwe-want-youquot-88757.html>.
- Laptop from with a modified texture from <https://free3d.com/download-page.php?url=notebook-low-poly-version-57341>.
- Animated Female Cyborg from <https://www.dropbox.com/s/mimglhfvlqdnelf/pers.zip?dl=0> mentioned in <https://github.com/leonardo98/TexturedAssimp3DAnimationsOpenGL>. Upon request, the question of the source of the model <https://www.mixamo.com> was answered and is therefore compliant with the announcement of <https://community.mixamo.com/hc/en-us/community/posts/206715697-Mixamo-is-free->.
- Books-on-a-shelf from <https://www.blendswap.com/blends/view/75450> under fulfillment of stating the corresponding author *Archemi* <https://www.blendswap.com/user/archemi>. Model has been slightly adjusted for texturing.

## 10 Additional Libraries

- [GLFW](#)
- [GLEW](#)
- [DevIL](#)
- [irrKlang](#)

- [GLM](#)
- [Assimp](#)
- [Bullet Physics](#)
- [VHACD](#)

## 11 Sounds

If not stated below the sounds were recorded by the authors of this document.

- [EAT - Oh Mom Elevator Mix](#) with an [Attribution-Share Alike 3.0 United States License](#)
- [TMHECTOR\\_-\\_16\\_-\\_The\\_Elevator](#) with an [Creative Commons Attribution 3.0 License](#)
- [The last ones by Jahzzar](#) with an [Attribution-ShareAlike 3.0 International License](#).

## References

- [1] Chris Green. Improved alpha-tested magnification for vector textures and special effects. In *ACM SIGGRAPH 2007 Courses*, SIGGRAPH '07, pages 9–18, New York, NY, USA, 2007. ACM.
- [2] Kim Pallister. *Game Programming Gems 5*, volume 5. Hingham, Mass., Charles River Media, 2005.
- [3] Graham Sellers, Richard S. Wright Jr., and Nicholas Haemel. *OpenGL SuperBible, Comprehensive Tutorial and Reference*, volume 7. Addison Wesley, 2016.