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Using Blender for 3D Modeling of Public Buildings

Daniel Petrov[1], Georgi Hristov[1,2*]

[1]Second English Language School „Thomas Jefferson", 26 Trayanova Vrata St., Sofia 1408, Strelbishte Residential Complex,
[2]Sofia University "St. Kliment Ohridski", 15 Tsar Osvoboditel Blvd., Sofia 1504

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ABSTRACT

This report examines the use of Blender as a tool for 3D modelling of public buildings, with a focus on its practical application through the creation of a digital model of the school I attend. The project aims to demonstrate Blender's capabilities for precise and visually appealing representation of real architectural structures. Throughout the process, fundamental techniques of modelling, texturing, and lighting were applied, contributing to a realistic and detailed visualization. The project shows how professional-quality 3D models can be created using free and accessible software, which may be applied in educational contexts, as well as in planning, reconstruction, or virtual tours of public buildings. Moreover, Blender is free and open-source software, constantly evolving thanks to its large community of developers and users. It supports a wide range of tools - from modeling and rendering to Python scripting - making it a flexible choice for both educational and professional projects.

Keywords: blender, 3D modelling, public buildings, open-source software.

INTRODUCTION

This report presents a practical study of using Blender to create a realistic 3D model of the Second English Language High School "Thomas Jefferson" in Sofia. The project demonstrates a compact, repeatable workflow - gathering reference materials, block-modelling for correct proportions, adding details with efficient topology, applying UVs and PBR (physically based rendering) materials, and rendering with Cycles. Blender was chosen because it is free, open-source, and supports the modelling, shading, animation, and export tools needed for educational and professional architectural visualization. The report also highlights practical solutions to common challenges (measurement gaps, texture alignment, polygon optimization) and outlines how the resulting model can be used for presentations, virtual tours, or further urban-context work.

EXPERIMENTAL

The report outlines the steps, tools, and modifiers used to create a 3D model of a school

**Correspondence to: Georgi Hristov, Second English Language School „Thomas Jefferson", Trayanova Vrata Street, Sofia 1408, Strelbishte Residential Complex, and Sofia University "St. Kliment Ohridski", 15 Tsar Osvoboditel Blvd., Sofia 1504, e-mail: georgi.hristov@2els.com*

building. During the development process, several challenges arose, which were resolved using a variety of methods.

Building the model required solid knowledge of Blender's tools and techniques for practical work. To achieve this, different learning materials, analytical resources, and the official Blender documentation were used.

For larger architectural projects, it is considered good practice to follow an organized workflow:

1. Gathering reference materials (plans, facades, photographs)
2. Block modeling to establish proportions
3. Detailing and optimization (reducing unnecessary polygons)
4. UV unwrapping and material setup
5. Final rendering and export

This workflow saves time and helps avoid frequent restarts when working with complex scenes.

RESULTS AND DISCUSSION

This report provides a detailed description of the tools used to create the 3D model of the building of the Second English Language High School "Thomas Jefferson" (Fig. 1). The model was created using the free and widely accessible 3D modelling software Blender.

Modelling tools

- Grab (g): Basic command for moving objects or their faces, edges, and vertices. Useful for

Fig. 1. 3D model of the school building (Second English Language High School "Thomas Jefferson," Sofia).

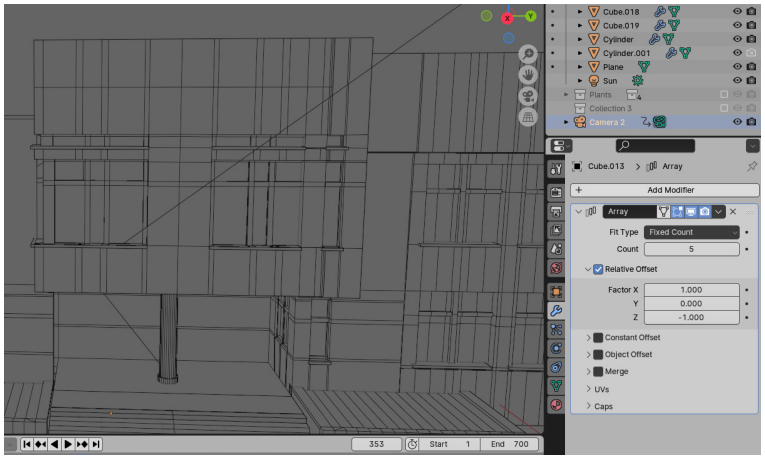

Fig. 2. Blender workspace while modeling the school façade and windows.

composing elements in a scene.

- Scale (s): Changes the size of an object. Extensively used in this project to regulate proportions of various elements.
- Extrude (e): Extends or indents the selected face of an object.
- Loop cut (ctrl+r): Adds edges to objects, making editing easier. In this project, mainly used for windows, combined with *Extrude* to create window depth (Fig. 2).
- Mirror: Modifier that creates mirrored copies of objects, saving time when working with symmetrical structures. Used for windows and trash bins in front of the building (Fig. 1).
- Array: Modifier that duplicates objects multiple times with adjustable spacing. Used for columns (Fig. 1), stairs (Fig. 3), and repeated window sections.
- Boolean: Allows one object to cut into another. Used to create a circular hole in the wall by applying a cylinder and subtracting its volume.
- Solidify: Thickens object surfaces. Applied to the trash bins after removing their top face.
- Shade smooth: Smooths objects, making them less sharp. Used for bins and the wall opening.

Tools for colouring and textures

- Colouring: Applied through the "Material" panel. Multiple colors were added to objects by creating new materials, selecting the relevant faces, and using the "assign" button (Fig. 4).
- Textures: Pre-downloaded textures were imported via the *Shading* workspace. Using "Principled BSDF" and the shortcut *shift+ctrl+t* (requires "Node Wrangler" add-on), textures were automatically linked. If placement was off, adjustments were made in *UV Editing*.

Blender supports both raster and procedural textures. Procedural materials (node-based) are especially useful for architecture, offering flexibility for parameters such as roughness, reflectivity, or wear. A PBR workflow with albedo, normal, roughness, and ambient occlusion maps was also used for realistic results.

Animation tools

The camera was set at an initial position and saved with the *I* key in the Timeline. After adjusting to a second position and repeating the process, the camera was animated to move smoothly between the two points.

A second camera was added. To combine them, markers were used (*M* key > "Marker > Bind Camera to Markers"). The second camera was then animated in the same way (Fig. 5).

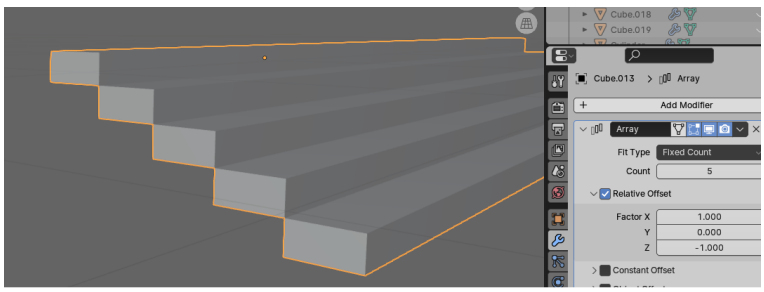

Fig. 3. Creation of the stairs at the school entrance.

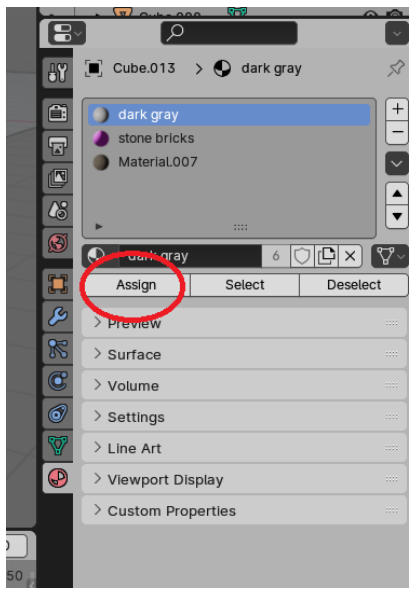

Fig. 4. Applying the "assign" setting.

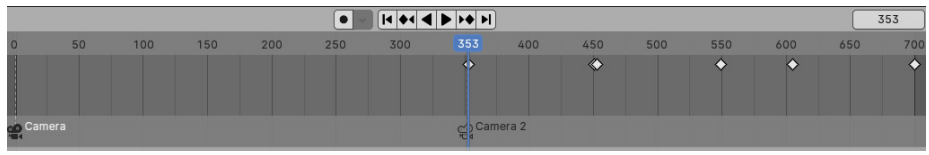

Fig. 5. Camera animation process.

Rendering

Blender offers two main render engines:

- Cycles (path tracing) for photorealistic images
- Eevee (real-time) for faster previews

For this project, Cycles was used to achieve higher-quality results.

Blender also supports third-party render engines (e.g., LuxCore, Renderman), providing additional flexibility if required.

Future applications

- Architectural visualization: Public building models in Blender help architects present ideas convincingly to clients, investors, or institutions.
- Urban planning: Realistic 3D models allow integration into city environments, including sunlight and shadow simulations at different times of day or year.
- Virtual reality: Blender models can be exported into VR environments for immersive walkthroughs.
- Restoration: Blender can digitally reconstruct historical buildings that are damaged or destroyed.
- Photogrammetry & LiDAR: Integration with tools like Agisoft Metashape enables quick base model creation from real photos or scans.

Blender also supports standardized formats (FBX, OBJ, glTF), allowing easy use across platforms.

Practical tips and optimization

For large scenes, efficient practices include:

1. Organizing objects into Collections.
2. Using low-poly models and instancing for repeated elements.
3. Optimizing textures (lower resolution for previews).
4. Working with proxy models during editing.
5. Saving the project file frequently.

CONCLUSIONS

This report presents a detailed overview of the tools and modifiers used in Blender to create a realistic 3D model of the Second English Language High School “Thomas Jefferson” in Sofia. Challenges that arose during the process were resolved using the described methods. Additionally, the report highlights the wide range of applications of Blender in modelling public buildings and the advantages such models bring to education, planning, and visualization.

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