

COSC363: Computer Graphics
Assignment 1
Optical Illusions Art Gallery
(Max. Marks = 20; Due date: 31 Mar 2023)

1. Overview

In this assignment, you will develop an OpenGL program to display a graphics model of an art gallery exhibition space consisting of a few “animated art objects (AAO)”. The AAOs and the model of the art gallery will be designed based on the theme, Optical Illusions.

2. Key Terms:

AAO: An animated art object is simply a three-dimensional model constructed using basic 3D models and primitives. An AAO is displayed using one or more continuous animation sequences.

AAO View: The camera focuses on a single AAO and its animation. If an AAO produces an optical illusion, it should be clearly visible in this view.

Gallery: A 3D model of a room where all AAOs are displayed. For purposes of decoration, a gallery may also contain a few static 3D models.

Gallery View: The camera provides the view of a room containing a spatial arrangement of AAOs. In this view mode, it should be possible to change the view direction and the position of the camera within the room.

3. Task Description

The 3D scene generated by your program should contain models of at least three AAOs and a gallery as described below.

AAO-1 (Max. 3 Marks). This must be an animated model of the Ames Window (https://en.wikipedia.org/wiki/Ames_trapezoid). There are several Youtube videos showing the animation of the Ames Window (search using keyword “Ames Window Illusion”). A shape template of the Ames Window will be provided in the assignment section on Learn.

AAO-2 (Max. 3 Marks). This must be an animated model displaying another optical illusion. Examples of animated optical illusions are scanimation, dual axis illusion, and Moiré patterns.

AAO-3 (Max. 4 Marks). This must be an animated 3D model constructed using a set of basic shapes and primitives. The model should display a combination of at least two independent animation sequences. This model need not produce an optical illusion.

Gallery (Max. 2 Marks): This is a model of a room containing a spatial arrangement of the AAOs. The room must contain a floor plane with a chequered pattern. For extra points, you may add a few decorative elements as given below in “Extra Features” section, to this scene. Please note that it is not required to design supporting structures (such as tables, display stands) for the AAOs.

User interaction (2 Marks): Please use the following keyboard bindings in your program:

| Key | Action |
|-----|-----------------------|
| 1 | AAO-1 View |
| 2 | AAO-2 View |
| 3 | AAO-3 View |
| 0 | Gallery View |
| ← | Camera: Turn left |
| → | Camera: Turn right |
| ↑ | Camera: Move forward |
| ↓ | Camera: Move backward |

Extra features (Max. 4 marks): You can gain up to a maximum of 4 marks by adding the following models or features to the gallery scene. The list given below should not be taken as the only set of features that can be implemented.

- Planar shadows cast by at least one object (0.5 mark).
- A spot light on a moving/rotating object (1 mark). The movement of the spotlight should be clearly visible.
- Physics based (e.g. gravity) animation. Give relevant equations in your report. (1 mark).
- A texture mapped sweep surface (surface of extrusion, revolution) (1 mark). Please provide design details in the report. If the sweep surface is animated by changing the shape of the base curve, you will be given an extra 1 mark.
- A texture mapped triangle strip or quad strip that is not part of a sweep surface (0.5 mark)
- A texture mapped quad showing a static optical illusion (an image) (0.5 mark). Maximum extra marks allowed in this category: 1 mark (corresponding to 2 static illusions).

4. Rendering Quality

In the context of this assignment, rendering quality refers to the visual aesthetic quality of the models and animations displayed by the program. Slow and jittery animations, incorrectly rendered models and shadows, improper movement of the camera, and improper illumination may cause marks to be deducted for poor rendering quality.

You will gain marks only for models/animations that are correctly and clearly displayed on the screen. A particular feature may be implemented correctly in code, but if the

corresponding output is not clearly seen on the screen, you will not receive marks for that feature.

5. Report (Max. marks: 2, Max. number of pages: 4)

The report should include the following:

- A brief description of the scene.
- Screenshots of AAOs and the gallery. You may also include screenshots or descriptions of any important/interesting aspect of the models, images and animations.
- Images of diagrams, sketches used for designing models (e.g. the base curve of a sweep surface).
- Equations if any, used for designing animations.
- A full list of control functions (keyboard, mouse, special keys) defined for interacting with the scene.
- Build commands or instructions for compiling and running the program.
- References to external sources of textures, algorithms, equations etc., used in your work.
- **Important!** The report must contain the following declaration. **Assignment submissions without the declaration will not be accepted.**

Declaration

I declare that this assignment submission represents my own work (except for allowed material provided in the course), and that ideas or extracts from other sources are properly acknowledged in the report. I have not allowed anyone to copy my work with the intention of passing it off as their own work.

Name

Student ID

Date

You may include more than 4 pages in the report, only if absolutely necessary. Please submit your report as a single **PDF** file.

6. Models and Animations

The object models in the scene may be constructed using any of the following methods:

- By transforming and combining a set of (at least three) GLUT/GLU objects such as spheres, cubes, cylinders etc. to form a composite model.
- By using a set of polygonal surfaces comprising of quads and triangles.
- By using surface generation methods such as sweep surfaces, surfaces of revolution etc.

You are not required to design highly complex mesh models for this assignment. Using objects modelled using packages such as Max, Blender, Lightwave, etc., or downloading pre-built mesh models from the Internet will not give you any extra points.

You may use parts of lab code and resources (models, images, image loading functions) provided in the course. Models and animations developed in the lab will give you marks only if significant changes or enhancements have been made to them.

7. Program Development:

- Please do not use source codes of programs from online repositories, tutorials, and books.
- Develop your program in C/C++ language using only OpenGL 2 API. Please do not use OpenGL 4 code (vertex/fragment shaders etc.), or extensions (e.g. ARB, EXT etc.) that are not part of the standard OpenGL API.
- **Please make sure that your program can be compiled and run on CSSE lab machines.**
- Your submission will not be marked for code readability or optimization. However, you are encouraged to prepare well documented and readable code.

8. Timeline

| | |
|--|---------------|
| AAO-1 (Ames Window) | Lab 1, Week 2 |
| AAO-3 (3D Model with animation) | Lab 2, Week 3 |
| AAO-2 (Texture mapping for displaying images/patterns) | Lab 3, Week 4 |
| Gallery (Surface modelling) | Lab 4, Week 5 |
| Assignment help | Lab 5, Week 6 |
| Assignment submission | 31 March |

9. Assignment Submission

Submit electronically (using *Learn*), the source code and all supplementary files (models, images etc.) needed to run the program. Please also submit your report in PDF format. The files should all be packaged together and submitted as a single .zip file.

This is not a group project. Your assignment submission must represent your own individual work. In particular, students are not permitted to share program source code in any way.

10. Miscellaneous

1. Check regularly on the *Learn* system forums for spec updates and clarifications.
2. Standard departmental regulations regarding dishonest practices apply.