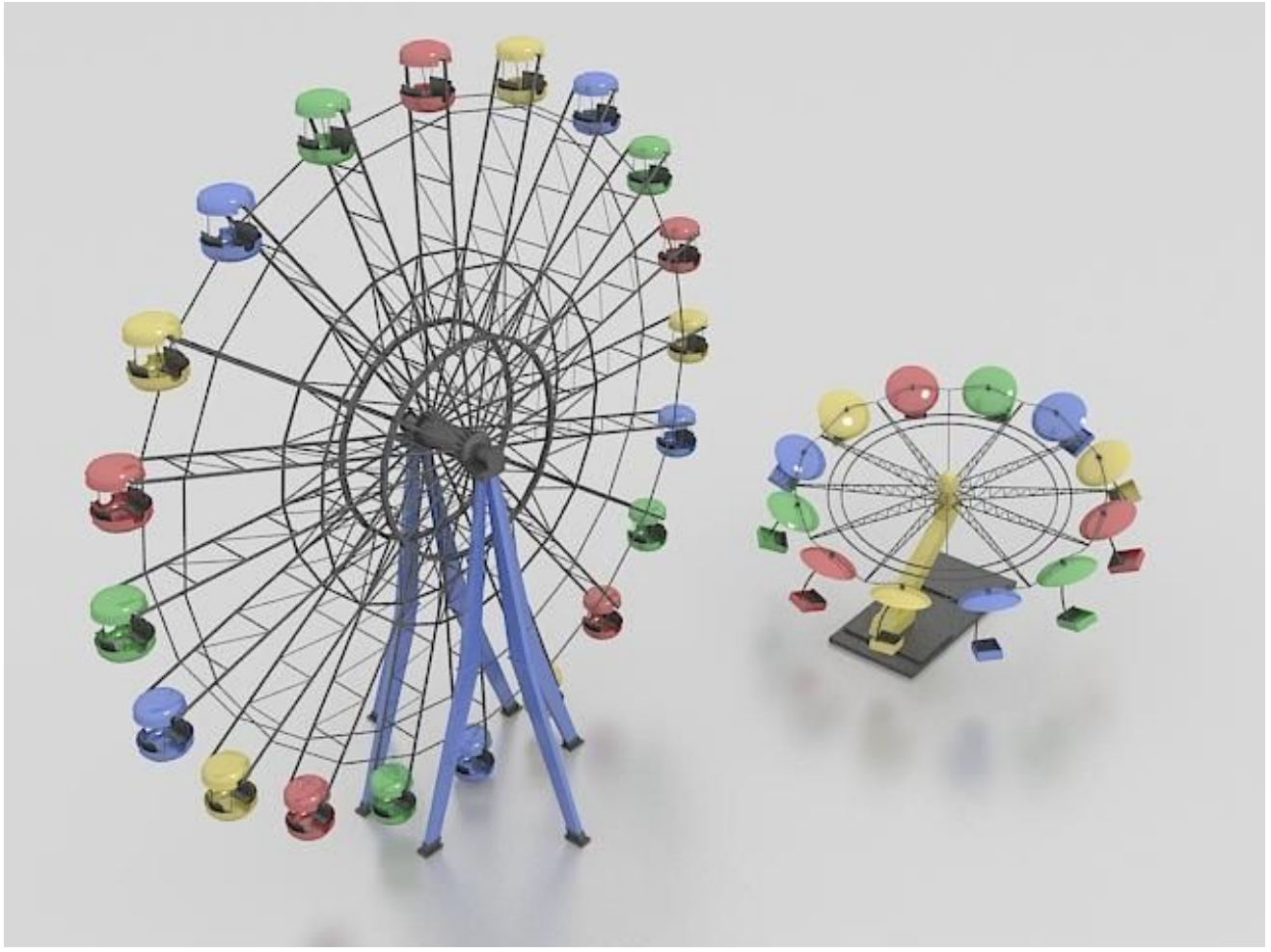
In AA3 we will create a complete functional project that combines several elements taught in class. For this purpose we will use 3 models:



All materials are available with the submission, although here can be found the following sources:

Chicken: https://www.turbosquid.com/FullPreview/Index.cfm/ID/1266316

Trump http://www.denysalmaral.com/2016/11/free-lowpoly-donald-trump-3d-character.html

Ferris Wheel: http://www.cadnav.com/3d-models/model-27862.html

Delivery format:

render.cpp, and all the external files that render.cpp uses (external shaders and .jpg). The gui will take the simplest form possible and allow loading and reloading each exercise. The .pdf with the explanations requested in exercise 3 will not be longer than 1 page.

Exercise 1. Scene Composition (3 points)

Figure 1: Since the creation of the Big Wheel for the Chicago Fair in 1893, Big wheels or Ferris wheels have a long history as popular attractions (source: wikipedia)

A. Create a set of cubes and make them rotate around a circle, as if they were cabins of a Ferris Wheel. The circle will be centred on the X axis. Visualize them from a camera with a slightly elevated perspective and rotated 30 degrees along the Y axis, relative to the side of the wheel (similar to Figure 1). Make the cubes have their local rotation compensate and cancel the rotation of the circle. As a result, the cabins move along the circle, but their local rotation does not change (i.e., they stay axis aligned), as if they were the cabins of a grand wheel.
Tip: despite it looks like a rotation, it might be simpler to consider the movement of the cabin a displacement around a circle centred on the z axis:

$$pos\,(t) = \left(r * cos\ \left(2\pi ft + \tfrac{2\pi\, i}{N}\right)\ ,\ r * sin\ \left(2\pi ft + \tfrac{2\pi\, i}{N}\right), 0\ \right)$$

Where *t* is time, *r* is the radius of the wheel, *f* is the frequency of rotation and the phase component is determined by *N*, the total number of cabins, and *i*, the cabin number.

B. Replace the cubes standing as cabins with the 3D models indicated. Place the characters of Trump and the chicken in one cabin, facing each other. Place the structural elements of the Ferris wheel model.

Figure 2:A shot counter shot example. See second 35 and second 50: https://www.youtube.com/watch?time_continue=5&v=wM6exo00T5I

C. Place the camera alternating every second between Trump's shoulder and the chicken's side, reproducing a shot reverse-shot scene. If you don't know what is a shot reverse-shot movie scene, here is a description: https://www.premiumbeat.com/blog/cinematic-shot-reverse-shot/ Use figure 2 as reference to adjust your camera positioning. Arrange it in order that, when loading exercise 1, you render the general shot for two seconds, and then move to the shot-countershot. If the exercise 1 is reloaded, the same camera transition occurs, but the movement is not interrupted.

Exercise 2. Lightning and shaders (3 points)

Consider the following lightning scenario: the Moon is illuminating the scene in pale blue. A small Light Bulb between the two models facing each other, slightly elevated, and on the side. The Light Bulb oscillates like a pendulum between -45 and +45 degrees, in a yellow light. Additionally, the Light Bulb only contributes to a specular component.

A. Integrate the dynamic shader loader provided. Make sure you can dynamically reload shaders in the scene, even without recompiling the main project.
B. Render the scene with a toon shader. Use the cube primitive to indicate the Moon and the Light Bulb positions. For the movement of the light bulb, take as a reference figure 3. Make sure that through the interface the intensity of both the moon and of the light bulb sources can be adjusted with a slider that goes between 0 and 1.
C. Implement a contour shading. Make a contour shader which outlines Trump's border. The contour of the 3D characters is thicker than the contour of the cabin or other objects. You are free to implement the contour technique that you want, but the minimum is the contour explained in class.

Figure 3: ln Psycho, a moving light bulb produces a very dramatic effect. See from second 1:06 in: https://www.youtube.com/watch?v=xWHYmNrAFlI

Exercise 3. Advanced rendering (4 points)

In this exercise we want to recreate a vision of a nightmare as experienced from the Trump perspective as in the shot/countershot position of exercise 1.

A. Implement the blur effect with a varying number of frames composited through time (you can apply a sinusoidal to choose the number of frames to composite, between 1 and 4). As a result, as the ferris wheel is rotating and the shot/countershot camera change in place, the blur effect will recreate a "nauseating" sensation. Explain in half a page .pdf how you have implemented it, and the main functions called.

B. On the background of scene B, draw a grid of chickens, each rotating on a random axis. To avoid framerate issues, implement the grid of chickens using instantiation, only one model exists in memory but multiple copies of it are drawn with different transformation parameters. Explain in half a page .pdf how you have implemented it, and the main functions called.