

CPSC 314

Assignment 2: Transformation

Due 11:59PM, February 6th, 2019

1 Introduction

1.1 Getting the Code

Assignment code is hosted on UBC STASH BitBucket, to retrieve it onto your local machine first ensure that you have logged in at least once onto BitBucket:

```
https://stash.ugrad.cs.ubc.ca:8443.
```

Then navigate to the folder on your machine where you intend to keep your assignment code, and run the following command from the terminal or command line:

```
git clone https://stash.ugrad.cs.ubc.ca:8443/scm/cpsc314-2018wt2_students/a2.git
```

1.2 Template

- The file `A2.html` is the launcher of the assignment. Open it in your preferred browser to run the assignment, to get started.
- The file `A2.js` contains the JavaScript code used to set up the scene and the rendering environment. You will need to make minor changes in it to answer the questions.
- The folder `glsl` contains the vertex and fragment shaders for armadillo, bunny, eye, egg and laser. This is where you will do most of your coding.
- The folder `js` contains the required JavaScript libraries. You do not need to change anything here.
- The folder `obj` contains the geometric models loaded in the scene.
- The folder `images` contains the texture images used.

2 Work to be done (100 points)

In this Assignment you will utilize your knowledge of transformations to make things move. First, ensure that you can run the template code in your browser. See instructions in Assignment 1. Study the template to get a sense of how it works.

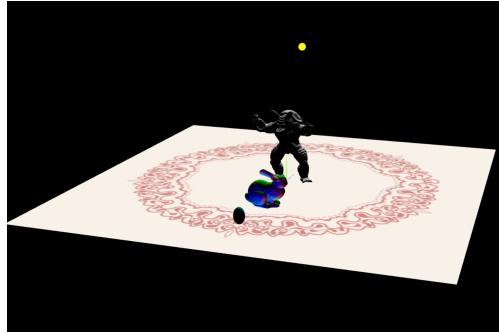


Figure 1: The initial scene of question 1 and 2

Part 1: (70 points) Required Features

The three parts are independent of each other. If you are stuck on one question, you can move on to the next question to get partial marks for Part 1. To switch between different questions, you can press the key '1', '2' or '3', see the codes in `A2.js`.

1. (15 points) Face-off with Armadillo

A dangerous armadillo arrives on the scene, threatening the egg! The armadillo can be moved using the A and D keys. Your task for this question is to rotate the bunny about the vertical ('Y') axis when the armadillo is moving. Make sure it is facing the armadillo, to protect the egg. One way is to create your own **modelMatrix** in the shader in file `bunny.vs.glsl`.

Hint 1: The scaling and translation matrices were already given, you only need to create your own rotation matrix.

(25 points) Armadillo attacks the egg with laser eyes!

In this question, rotate and move the eyes of the armadillo when it moves, to always look at the egg. Make both eyes shoot lasers to the egg (see Figure). To be more specific:

- Attach the provided eyes to the armadillo. First, this requires you to move them along with armadillo. Second, you need to make them orient to look at the egg, as shown in Figure 3. You need to modify `eye.vs.glsl`.
- Create two lasers from the eyes to the egg. You need to create the geometries and shaders by yourself. See code for `laserGeometry` in `A2.js`.

Hint 1: The two lasers can share the same shaders.

Hint 2: The scale of the laser is the distance between the eye and the egg.

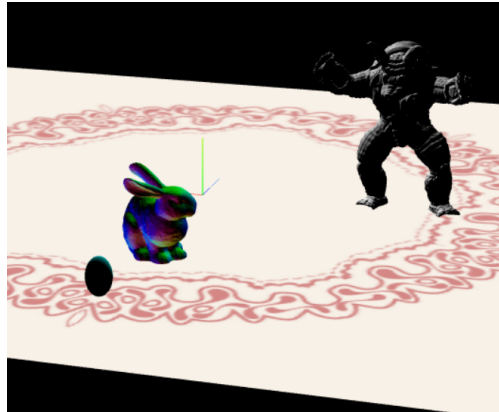
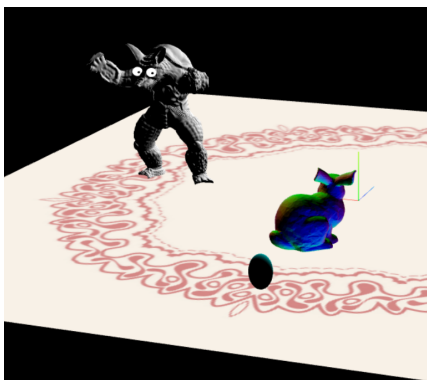
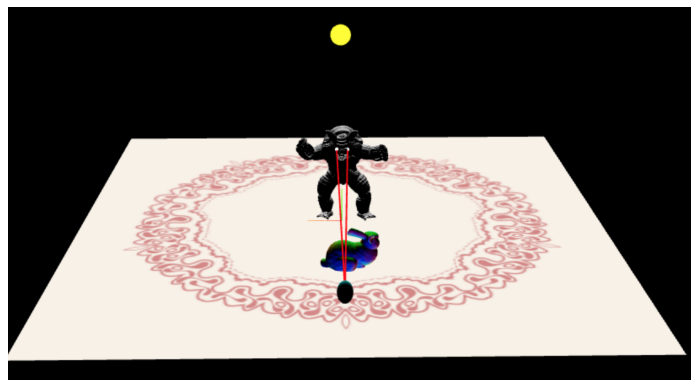


Figure 2: Question 1.1. Rotate the bunny to face the armadillo.



(a) Attach the eyes to armadillo and make them always orient to the bunny's eggs.



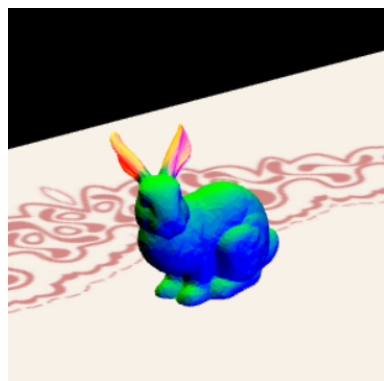
(b) Generate two lasers from the eyes to the egg.

Figure 3: Question 1.2

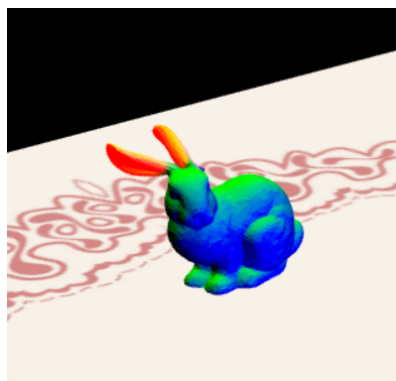
2. (30 points) Shake

Next, make the bunny shake its ears around the y-axis. The first step is to segment the two ears, i.e., identify the vertices that belong to the ears. Then you will have three coordinate frames, one for each ear, one Head frame that initially will be perfectly aligned. The Head frame is fixed to the body, while the Ear frames are fixed to the bunny's ears. The template provides the origins for the two Ear frames. More details:

- (a) The first task is to segment the ears, which means you have to determine if a specific vertex is part of an Ear or not. One way is by checking whether the vertex is on one side of a plane through the origin of the ear frame. You can do this by computing the angle between displacement vector of the vertex in the ear frame, and the plane normal in the same frame.
- (b) For shaking ears, you must rotate each of the two ears of the bunny relative to the Head. The angle of rotation should be controllable using the 'Z' key; holding the key down should move the ears in a cyclic manner.



(a) Segmentation for the two ears.



(b) Deformation of the ears when holding the key.

Figure 4: Question 1.3

Don't panic if some significant artifacts pop up around the boundary between the head and ear for larger rotations. You should modify `shake_bunny.vs.glsl` for both tasks.

Hint 1: Use dot product to compute the angle difference.

Hint 2: You may want to create a rotation matrix for each Ear frame.

Part 2: (30 points) Creative License

For this part we want to see what you can do. In order to get a good mark on the creative parts, you need to complete at least two of the suggested features listed below. Show your TA which feature you did when grading. You will also need to create your feature, which should be of a similar complexity to the previous tasks. If you have any doubts, check with a prof or TA. Some possible suggestions might be:

- Similar to Question 1 of Part 1, also translate the bunny to always stay between the egg and armadillo.
- add movement for the egg which will also lead the movement of the laser
- shake the armadillo's head or hands, similar to Question 1.3
- change the laser's behavior using the keyboard.

Bonus marks may be given at the discretion of the marker for particularly noteworthy explorations.

2.1 Hand-in Instructions

You do not have to hand in any printed code. Create a `README.txt` file that includes your name, student number, and login ID, and any information you would like to pass on to the marker. Create a folder called "a2" under your "cs314" directory. Within this directory have two subdirectories named "part1," and "part2", and put all the source files,

your makefile, and your README.txt file for each part in the respective folder. Do not use further sub-directories. The assignment should be handed in with the exact command:

```
handin cs314 a2
```