

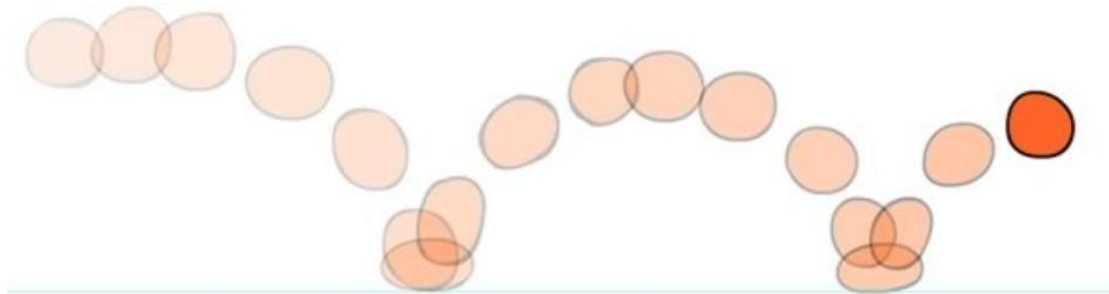
CMSC 435 / 634 Introduction to Computer Graphics

Project Assignment 3: Animation

(Out March 21, Due April 4 2016)

Goal of this project:

The goal of this assignment is to become familiar with the method of creating rigid-body animations. You will create a bouncing circle animation; the bouncing trajectory will be defined by a Bezier spline which controls points can be moved interactively.



Introduction:

In this assignment, you will write an OpenGL program to generate animated motion. This type of motion is very common in games, movies, engineering applications, and many other applications. However, to make an object or a character to move in space, we must do this programmatically using for example Bezier spline to make the motion look realistic and easier to control.

Your code must do the following:

- Define a 2D motion using the Bezier spline;
- Because it is a bouncing motion, you can stitch several cubic Bezier curves together to create this bouncing effect, as we discuss in the lecture.
- (634 only)** Generate physically-correct slow motion when the object is climbing a hill. A simple trick is to add the time step in the Bezier curve calculation to slow down the motion.

Implementation:

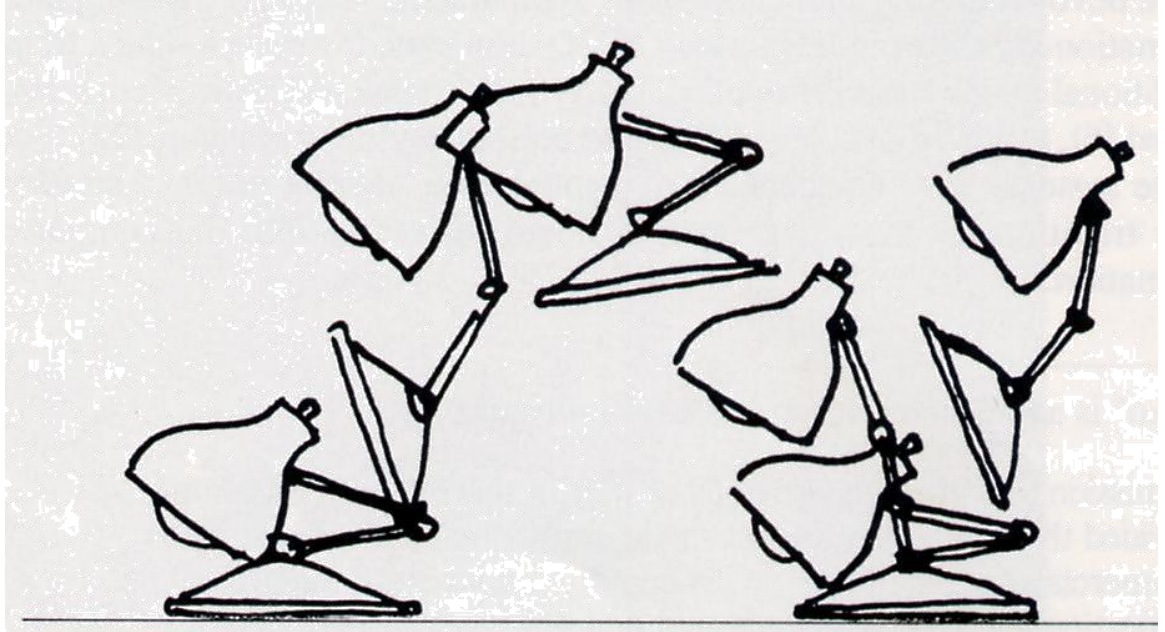
- For defining the 2D motion using the Bezier spline, consider the constraints discussed in the lecture to ensure the continuity of the stitched curve segments.
- You can select any t to define the speed of the movement. Be smart and do not make it too fast – Kevin won't be able to see it otherwise. When the ball is bounced to the ending point, move it back to the first point to resume the motion.

- Draw the control points for your Bezier curve.

Refer to the Dr. Jian Chen lecture on 3/30 for the behavior of control point selection and manipulation. You must implement the same actions as Dr. Chen demo for the selection and manipulation.

Extra credits:

- (435 only)** For 10 points, implement the 634 part to generate slow motions at the beginning of the movement.
- For 30 points, implement the Pixar lamp motion between 41s-42s shown in this video. <https://www.youtube.com/watch?v=DeQlePOb8gM>. Note that this motion is still a rigid motion, but different body parts of the lamp need to be controlled carefully to create the correct positions and angles. The model in the video is 3D. Your code does not need to do that and can just do the 2D motion. It is okay just to use lines and triangles to represent your 2D lamp, as shown in the picture below from the lecture.
- For 30 points, implement the motion above in 3D. The Bezier curve also needs to be manipulated in 3D – try to create your own interaction techniques to move the control points.
- Let the user control the motion trajectory by moving the control points of the Bezier curve. For selecting and manipulating the control points, your code needs to do the following:
 - When the mouse moves, detect the control point to be selected among all control points. Note that we humans are not very good at precise selection. Thus, selecting a point using a mouse can be extremely difficult. To solve this problem, your code can do rough selection: draw a box around each point and use this box as a target of selection (when the mouse cursor falls into a box, the point in the center of the box will be selected.)
 - Once a mouse cursor is within the box during the movement, highlight the point and the wireframe bounding box in yellow; holding the left mouse button should grab the yellow point; Moving the mouse will cause the control point to move; releasing the mouse will confirm the final location of the point. The point and its wireframe bounding box should be in red.
- Any other fancy effects you can think of. Talk to Dr. Jian Chen BEFORE you do the implementation.



What to turn in

Source code only by email to TA. Please do not include any .o files. Please include:

- A README with your handin containing basic information about your design decisions and any known bugs or extra credit;
- How to compile and run your code as if you are telling a colleague that is to continue the development.

Note: Please comment on your code. The better Kevin understands your code, the higher your grade is likely to be.

Enjoy!