

CSE-251: Graphics - Spring 2015:
Assignment 2: Top Shooter

Due: February 17, 5pm.

1 The Problem

In this assignment, we move from 2D to a 3D world. The goal is to make a 3D arcade game to be played with keyboard and mouse controls for the game and changing world parameters. The world consists of a rectangular uneven floor, one end of which is a target. The goal of the game is to hit the target using a spinning top (*Lattu*). (See Figure 1).

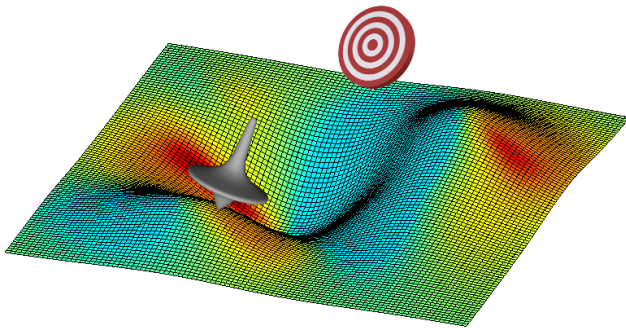


Figure 1: A simplified layout of the arcade game. To goal is to hit the target with a spinning top.

You are standing on one side of the rectangular floor and a target appears at a random position on the opposite side. The goal is to hit the target using a spinning top that is thrown from your side of the floor. The top will move along the uneven floor obeying the laws of physics and could reach the opposite side or get trapped in one of the valleys depending on the direction and velocity of the throw. It can also topple after a certain time. If it hits the target, you get 10 points and a new target appears at a random position on the opposite side. If you miss, you lose a point and can try again. The game starts with 10 points on the score board. The current points should always be displayed in the game window.

In the following sections, the minimum requirements

are mentioned. You may enhance the game as per your liking. It is *your* game.

You should provide a single page quick start guide to those who want to play the game (aka TAs), describing the additional controls (basic controls should be as described below), and additional features.

2 The 3D World

The world consists of an uneven floor with hills and valleys of different heights and depths (see Fig. 1 for a small example). The mesh and color on the floor has been added to make shape of the surface clear to you and is not part of the world). You are standing on one side of the floor and the target appears at the opposite side.

The movement of the top is controlled by the following aspects: The speed, the direction of throw, the surface normal and the spin of the top. The top starts with a specific spin, which slows down as time progresses. As long as the spin is sufficient, the top stays in balance. In addition to the spin, you impart a horizontal velocity (in a specific direction) when you throw the top. At any point, the motion is a result of inertial force in the direction of the current movement, the gravitational force acting downwards and the reaction force from the floor in the direction of surface normal. You may precompute the resultant force of gravity and reaction from the surface at every point before the game starts.

The shape of the top is left to you and could be as simple as two cylinders: one thin long one forming the axis and a large short one forming a wheel around the axis. The only cases of collision are when the top hits the target while in motion and when it topples as the spin stops. If the top reaches the edge of the floor or if it hits the target, the chance is over.

3 Controls and Camera

The left and right arrows are used to control the direction of the throw and the up and down arrows control the speed.

The camera views are defined below:

1. *Player View*: View from the players head position, where one can see most of the floor along with the target.
2. *Top View*: The camera is attached to top of the top and is pointed at the target. The camera moves along with the top, but does not spin.
3. *Overhead View*: Camera is above the world at a fixed position from where you can see the whole floor.
4. *Helicopter Cam*: Here the camera is movable with the mouse in an intuitive manner. Click and drag should change the look angle (yaw and pitch), but the roll angle is always zero. The scroll wheel will move the camera close or away from the scene.
5. *Follow Cam*: A view from a height equal to the height of the top, but at a distance behind the top so that you can see both the terrain and the top as it moves along.

Note that one should be able to switch views, and then control the camera as per their wish.

4 Optional

Another aspect of physics that applies to the throw is whether the top stays on ground or not. This depends on the momentum of the top and the gravitational force. The top may jump over humps if the momentum is sufficient to overcome the gravitational pull, and then it follows the trajectory of a projectile, until it lands.

To make the game more interesting, you may include moving targets or make the surface itself random for each game. Feel free to include additional objects, animations, textures, etc. to make the world more realistic and rich. Additional interesting camera views may also be provided.

5 Submission

You submissions should include your source code, a makefile and a compiled executable. You need to include a readme file that describes any additional information that is needed in compiling/executing you code. Do not use any non-standard libraries.

The submission will be in two stages: The first, due on the 10th should contain at least a crude spinning top (could be any shape) and a simple surface with at least the first three camera positions working and controllable from the keyboard. The world should contain at least a simple hill and valley. You are welcome and advised to do more by this deadline.

The final submission, on Feb. 17th, should contain the final game, the remaining camera views, and the complete world with texture or any other optional items you may choose to add.

6 Grading

You will be graded based on the correctness, modularity, and efficiency of the implementation of the minimum elements described above. This will contribute to 90% of your grade. Remaining 10% will be given based on the improvements that you do over the basic world. In addition, submissions that are found to be exceptional by the graders, will be showcased, and will be awarded extra credits up to 10%.

30% of the grades will be based on the submission on the 10th and the remaining 70%, based on the final submission.