Welcome to Our Cannon Simulator!

**Developers:** **Engine Provided By:**

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**Controls:**

W / S: Increase/Decrease Yaw Angle (X-Axis) of Cannon

A / D: Increase/Decrease Pitch Angle (Y-Axis) of Cannon

(Hold and Release) Space: Fire Cannonball

*Note: The Longer you hold Space the Stronger the Cannon Force (Limited to a Maximum)*

*You can only fire once a cannonball has finished its trajectory. (A.K.A. Wait until the ball hits the ground)*

R: Reset all Target Boxes to New Starting Position

**Purpose of Simulation:**

Our simulation provides the capability to fire a cannon with relatively realistic Newtonian physics at Target Boxes. When hit Target Boxes will be pushed from their floating position and fall to the ground. They will then slide on the ground and slow to a stop due to friction. The cannonball will bounce off the target box and fall to the ground as well. When it reaches the ground, it will be reset back to the Canon’s chamber ready to be fired again. This game provides fun target practice game while demonstrating the following concepts:

* Collision Detection:
  + The ball and boxes know when they collide with each other.
  + The boxes fall to the ground a slide on the floor.
  + The ball hits the ground and is reset to the cannon’s chamber
* Newtonian Physics
  + The ball and boxes have mass
  + The cannon imparts a force on the cannonball
  + All objects are affected equally by gravity
  + The ball and Target boxes transfer motion when collided
  + The boxes experience friction when they slide on the floor
* Spatial Optimization
  + The scene is divided into segments through Oct Trees
  + Each instance knows what Octant it exists through individualizes Octant IDs
  + The Oct Tree knows to automatically subdivide based on object density
  + The Oct Tree Regenerates its subdivision and origin based on the changing state of the scene.

I hope you enjoy our simulation!