# Simple Collision Detection

1. Show two particles (spheres).
2. User can auto step or manually step.
3. User can check a box to change one to an axis aligned box.
4. User can control the mass of both particles with a slider, and particle sizes correctly proportionally to the mass.
5. Display the separating and normal velocity vectors.
   1. Use intuitive and intelligent colors.
6. User can click a button to cause a collision.
   1. After a collision, do the following:
   2. Stop simulation
   3. Hide all of the velocity vectors.
   4. Assume the particles are penetrating about .25
      1. Be sure to use values that are believable, and be sure your particles are large enough that the user can easily see what happens. You will have to make them very large in order for the vectors to display in a meaningful way.
   5. Display the vectors in in which both particles will be *moved* on the next frame, but don’t move them until the next frame (when the user manually steps).
   6. When the user manually steps to the next frame, move the particles apart against the contact normal. Be sure to consider the mass of each particle. Keep the velocity vectors hidden, and maintain the position movement vectors. Be sure to use a different color for the position movement vectors than that of the original velocity vectors.
   7. All other frames after this one display the velocity vectors and hides the position movement vectors until the next time the user clicks the collision button.

Questions:

1. What is interpenetration?
   1. The amount 2 objects are embedded inside of each other.
2. What is the difference between the physics simulator vs. the collision detector?
   1. The collision detector only reports collisions, it doesn’t actually do anything. It is up to the physics simulator to respond appropriately to reported collisions (among other things).
3. When a collision is present, why must we *change the position* and the velocity of the particles?
   1. If you don’t change the position as well as the velocity; then if the two objects were interpenetrating enough then only a change in velocity will not move them out of each other, so on the next frame another collision may be detected. When this happens in succession, the particles appear glued together because they are constantly being moved away from and back towards each other.
4. Which system is responsible for indicating how far two particles have collided?
   1. The collision detector
5. Which system is responsible for resolving the distance two particles have collided?
   1. The physics simulator
6. What is the process of resolving two interpenetrating objects?
7. How do we make this process believable?
   1. Make the amount each particle is moved relative to the particle’s mass.