Lab 7 Scale, ScaleOrientation, and Collision

1. Scale
A scaling operation allows you to resize a shape. You can enlarge or decrease the size of a shape in any number of dimensions. The scale factors must be positive. The next figure presents an example.

In Fig 1, the left box is a cube defined using the Box node without any scaling operation. The second is scaled in the X axis by 0.2, the third is scaled in the Y axis also by 0.2, and the fourth is scaled both in the Y and Z axes by 0.2.

**Exercise 1.** Let’s create a VRML world which Fig 1 shows. You can use a default box for the left one.

2. ScaleOrientation
You may wish that the axes to which the scaling operation is applied were not the standard axes. scaleOrientation field allows you to rotate the axes, the scaling factors will be applied to the rotated axes and not to the original axes. The scaleOrientation field specifies a vector which defines the rotation axis, and the angle measure for rotation.

In Fig 2 (a), the left figure shows the axes and a box prior to any geometric transformations. The second shows the effect of the scaleOrientation, a rotation of 45 degrees in the Z axis. The scaleOrientation used was 0 0 1 0.785, the first three values specify a vector, the fourth an angle.

In Fig 2 (b), the cube from the right had a scale of 1.3 in the Y axis which was previously rotated by 45 degrees in the Z axis.

**Exercise 2.** Let’s create a VRML world which Fig 2 (b) shows. You can use a default box for the left one.
3. **Viewer Detection**

The Collision grouping node can be used to turn off collision detection for its children or generate collision events that can be used for animations or sound effects. A collision bounding box can also be specified for a group of objects. This helps improve browser efficiency, by reducing the number of collision detection calculations required. The Collision node’s `collide` field enables and disables collision detection.

**Exercise 3.** You will create a Collision node including an IndexedFaceSet as a following example. What does it happen if `collide` is set to FALSE or TRUE?

```vrml
#VRML V2.0 utf8
# detect collision with an object
DEF Detect Collision {
  collide TRUE
  children [
    Shape {
      appearance Appearance {
        material DEF Mat Material {
          diffuseColor 0.6 0.6 1
          transparency 0
        }
      }
    }
    # Just your basic 1x1x1 meter box but using
    # an IndexedFaceSet and double sided
    geometry IndexedFaceSet {
      solid FALSE
      coord Coordinate {
        point [
          1 1 1, 1 1 -1, 1 -1 1, 1 -1 -1,
          -1 1 1, -1 1 -1, -1 -1 1, -1 -1 -1
        ]
      }
      coordIndex [
        4 0 1 5 -1
        7 3 2 6 -1
        6 2 0 4 -1
        2 3 1 0 -1
        3 7 5 1 -1
        7 6 4 5 -1
      ]
    }
  ]
}
DEF Timer TimeSensor {
  cycleInterval 10
  startTime -1
}
ROUTE Detect.collideTime TO Timer.startTime
ROUTE Timer.fraction_changed TO Mat.transparency
```