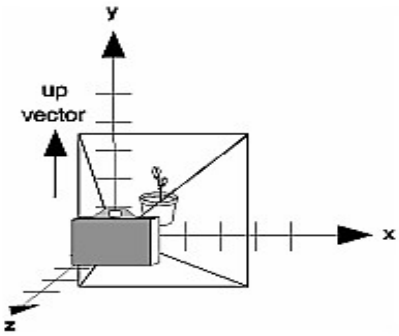
Projection: Orthographic vs. Perspective

In *OpenGL*, the default view volume is a cube with sides of length 2 with the center at the origin. The default projection is Orthogonal and the projection matrix is an identity. The initial 'default' camera frame is centred at the origin with the view direction aligned with the negative Z axis of the world frame



Let get a 3D object (Sphere / Ice-cream) in your *OpenGL* window before we start doing this exercise.

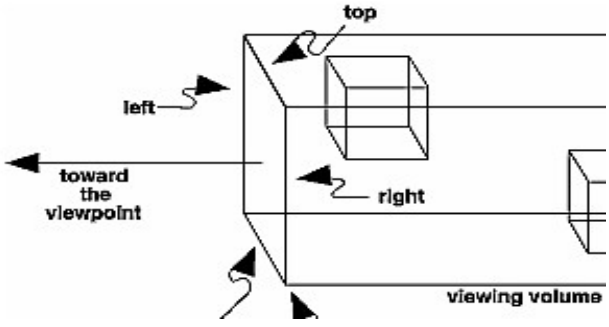
1. Orthographic projection

a) The camera should set up at the beginning and not necessary to call in a `display` function.

b) **`glMatrixMode (GL_PROJECTION)`**
This function tell the *OpenGL* to refer to the projection matrix. You have to put this in the `WinMain` function outside the `while` loop.

c) **`glLoadIdentity()`**
Remember to reset the projection matrix before we start using it.

d) **`glOrtho(left, right, bottom, top, near, far);`**
In ortographic projection, The viewing volume is a rectangular parallelepiped and Objects not scaled with distance. You need to set up the 6 parameters for the cube : left, right, bottom, top, near and far.



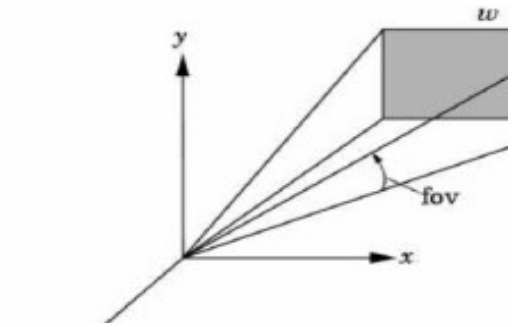
e) Compile and run your code to see the result of orthographic projection. Test with different size of the viewing volume. It is advisable to make the viewing volume symmetric to avoid distortion.

f) Try to translate your object in z axis, you should see the object is still look the same size even when it moves far away.

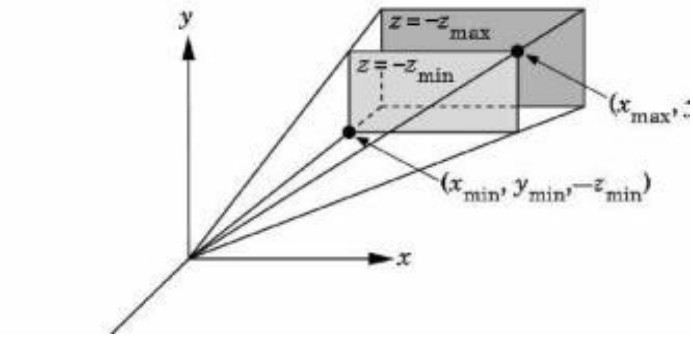
2. Perspective projection

a) Specified and reset the projection matrix.

b) **`gluPerspective(fovy, aspect, near, far);`**
This function will set up the field of view (fovy), the aspect ration (W/H), the near and far plan follow the `glFrustum` for perspective projection.



c) **`glFrustum(xmin, xmax, ymin, ymax, -zmin, -zmax);`**
This function will specified the view frustum for the prespective projection. zmin >0 and zmax >0 because the camera is in the negative z direction.



d) Compile and run your code to see the result of perspective projection. Test with different size of the viewing frustum and fovy.

e) Try to translate your object in z axis, observe the result.

3. Projection handling

- Switch between the view (Orthographic and perspective)
- Set the boundary of your viewing volume when transformation
- Projection / Viewport transformation